

DuoMAGTM

MAGNETIC | STIMULATION

rTMS Software - User Manual



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DuoMAG rTMS Software User Manual
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Part I

Safety and other information

Safety

 	Instructions for use DuoMAG TMS DM004-IFU (IFU) is a separate manual, which provides all the information necessary for the safe use of the device DuoMAG TMS. Please read all warnings and cautions in the Instructions for use (IFU). To avoid injury, damage, or loss DuoMAG TMS data, follow these safety measures during the operation and maintenance of the system. In this manual can be certain WARNING or CAUTION, but despite that, this manual does not replace Instructions for use (IFU) from the perspective of ensuring patient safety and operation.
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Customer Responsibilities

This product and its components will perform reliably only when the operation, maintenance, and storage follow the Instructions for use (IFU). The defective product must not be used. Parts that are damaged, missing, or clearly worn, should be immediately replaced with original spare parts that were manufactured, supplied, or approved by DEYMED Diagnostic s.r.o.

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Additional documents

Additional documents including the Instructions for use (IFU) can be obtained from:

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Part II

Functional documentation by screens

Description of all functionalities of the SW with respect to its position in the user interface (UI). UI is divided into screens. Each screen is designed to help users fulfill its purpose.

1 SW initialization screen

Switch on the Magnetic Stimulator as described in the Instructions for use document in the chapter Turning on and operating the Magnetic Stimulator. In addition, start the control PC by pressing the power button. After the operating system starts, SW is started automatically. The SW starts with a starting sequence that consists of the five following steps:

1. Application Initialization,
2. Loading Configuration,
3. Loading the patient's Database,
4. Check if EMG Adapter is connected,
5. Magnetic Stimulator connection check.

Correct completion of each step is indicated by a checked checkbox.



Figure 1: SW Initialization screen.

1 Initialization check described above.

1.1 SW Initialization

Particularly, if the SW initialization fails then SW is unable to load properly. The SW initialization includes:

- the first access to the logging file,
- initialization of default configurations,
- checking the presence of the configuration file.

1.2 Loading Configuration

Configuration files are loaded and checked for their correctness. And a presence of audio files is verified in this step. If the configuration load fails, then the default configuration is loaded.

1.3 Loading Patient Database

SW tries to connect to the database file, and if it fails, the dialog pops-up. It asks whether to create a new database file or not. If the new database file is created, the system tries to import data from the database of the 1.3 version if the upgrade was made.

If the patient database is unavailable, the checkbox is not checked. Then the only possibility user has is to change the system configuration but only in case when the login is not required. Login requires a database to be valid and connected.

1.4 Adapter Connection

Attempt to connect adapter and EMG headbox is made for a maximum of 15 seconds. After that time, the adapter is considered as disconnected. However, the adapter and EMG headbox can be connected later when needed. The system will recognize it and the battery indicator will appear.

1.5 Stimulator Connection

Finally, the stimulator is connected, and configuration codes are validated. It is required to have a stimulator connected in this step so the SW can check the validity of configuration codes.

1.6 Login form

If the system is configured to require login during its startup, then the login form is displayed after the initialization procedure.

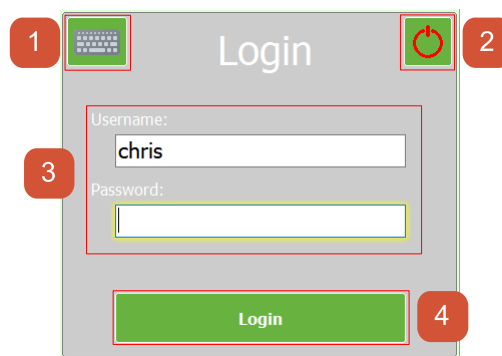


Figure 2: Login Form with shutdown button.

- 1 On-screen keyboard button that turns displays/hides on-screen keyboard at the bottom of the dialog.
- 2 Shutdown button. The dialog with three options for *cancel*, *shutdown*, and *restart* pops-up by clicking this button.
- 3 User credentials fields. The username is case insensitive alphanumeric only, but the password can be filled with any character and is case sensitive. Both fields are limited to a maximum of 64 characters.
- 4 Login button. After clicking this button, the system verifies User credentials, and if they are correct, the patient database is displayed.

2 Patient Database

The *Patient List* screen is the first screen visible when the user logs into the DuoMAG rTMS Control PC. The *Patient List* screen serves several purposes. Firstly, it is the main screen from which another screens could be accessed. Secondly, patient and session information are managed here as well. Both touch-screen and mouse may be used for navigation.

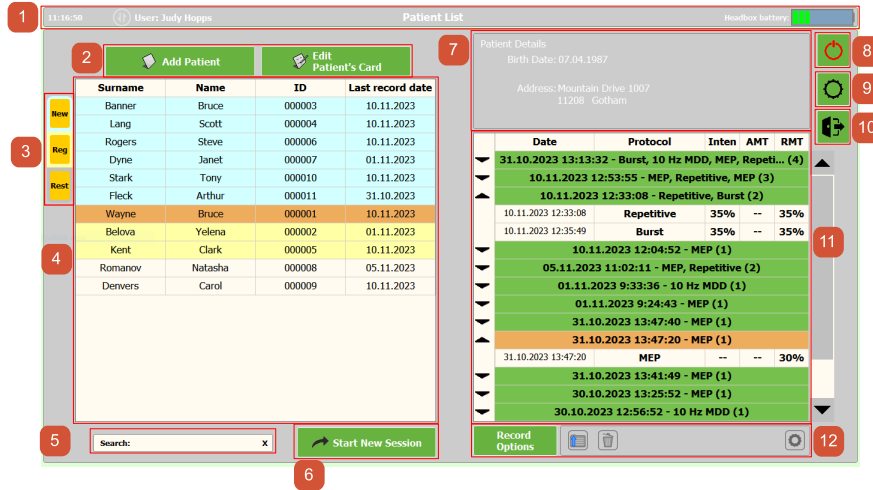


Figure 3: Patient List screen.

- 1 Information line. Is consisted of the current time, connection to remote database (if connected), user name (if the user is logged in), and screen name. A break reason of the selected protocol is visible on the right if the protocol is unfinished. If a hfeadbox is connected, a battery indicator is displayed in the right corner (if the battery is fully charged, then the indicator is not displayed).
- 2 *Add/Edit* patient buttons for opening a dialog for changing patient's information. (see sec. 2.3)
- 3 Patient filter that determines what types of patients are shown on the patient table. There are three types of patients recognized by the system - new, regular, and the rest. This component is visible only if the patient type detection is enabled in the configuration. (see sec. 2.2)
- 4 Patient table. The list contains surname, first name, ID, and last session date. Listed patients are filtered by the patient filter and search text. (see sec. 2.2)
- 5 *Search* bar. Typing on the keyboard fill this bar. Clicking on this field opens/closes the touch keyboard when enabled in settings. (see sec. 2.2)
- 6 Button to start a new session. The dialog with session step configuration pops-up after this button is clicked.
- 7 Additional information about the selected patient in the patient table, such as date of birth and address, is listed. (see sec. 2.4)
- 8 Shutdown button pops-up a dialog with three buttons *OK* (for system shutdown), *Cancel*, and *Restart* (for SW restart). (see sec. 2.1)
- 9 Configuration button. Three options are displayed to access the *System Configuration* (see sec. 5), the *Protocol Setup* (see sec. 6), or the *User Management* (see sec. 7). Displayed options are based on the current user privileges.
- 10 Logout button. This button allows the user to log out. If login is required, the user login form is displayed. Otherwise, the default user is activated.
- 11 The session table includes expandable sessions, allowing users to view individual session steps that were performed. (see sec. 2.4)
- 12 Session record option panel with a button to show all available options for the selected record on the left. The configuration button of the quick options is on the right, and the quick option buttons are in-between. Displayed record options are based on the selected record. (see sec. 2.5)

2.1 Exit the SW and turn off the computer

The shutdown button allows the user to shut down the DuoMAG Touch-screen Interface. However, this shutdown procedure does not turn off the stimulator unit. The stimulator must be switched off separately (for more information, see Instruction of use of Magnetic Stimulator).

2.2 Patient list

The patient list shows all patients stored in the system. Patients are identified by the First and Last Name, Patient ID, and Last record date on the patient table.

You can sort listed patients by first name, last name, and ID by clicking a particular column header cell. Patients can be filtered using the search bar.

The *Search* text shows the data entered when searching the patient database. You can write a string by a connected keyboard or a touchscreen keyboard. The last character is deleted by backspace, and the whole string is erased by clicking the X symbol in the searched text field or by pressing the delete button. If the on-screen keyboard is enabled in the *System Configuration*, click on the search field in order to open/close it at the bottom of the patient table.

Additionally, it is possible to show/hide patients by their types that are recognized by the system as new, regular, or rest. This option is made available by the patient filter setting. Patient filter colors match colors shown in the table with respect to the patient types.

The patient selected in the table is highlighted in orange color. His/her information is shown in the selected patient information area, and performed sessions with the patient are shown in the session table.

2.3 Add/Edit Patient

After the *Add Patient* button is clicked, a dialog where patient details can be filled is displayed. The available field for patient information is divided into two parts as follows:

Standard Patient Data:

- Surname** with a maximum of 35 characters;
- First name** with a maximum of 25 characters;
- ID** with a maximum of 15 alphanumerical characters editable only during creation;
- Street** with a maximum of 80 characters;
- City** with a maximum of 50 characters;
- ZIP code** with a maximum of 10 characters;
- Phone** with a maximum of 22 characters;
- Date of birth;**
- Height** in cm;
- Weight** in kg;
- Sex** as a one of Male, Female, or Empty;
- Laterality** as a one of Left, Right, or Empty;

Medical data:

- Insurance** with a maximum of 10 characters;
- Diagnosis** abbreviated as Dg.;
- Medication;**
- Physician** with a maximum of 60 characters.

All patient data inputs are for therapist information only and has no influence on the stimulator.

Dialog for edition of the patient data differs in the following details: ID field is not editable, a current motor threshold of the patient is displayed if it is set, and buttons for deletion and report creation are added. Deletion of the patient requires additional confirmation and is final. No deleted data recovery is possible after the user confirms deletion. The patient report consists of patient information and a list of all performed sessions and steps with their results.

To jump the cursor between each field for fast data entry, use the TAB button on your keyboard. You can make quick entries of information without using the mouse. The active field is highlighted by a yellow rectangle, as shown in Figure 4 with the physician field.

The form is titled "Patient Card" and is divided into several sections. The "Patient" section includes fields for Surname (Wayne), Name (Bruce), ID (000001), Address (Mountain Drive 1007, Gotham, 11208, 654897235), Birth Date (7/4/1967), Height (188 cm), Weight (95 kg), Sex (Male), and Handedness (Right). The "Info" section includes Insurance (Allstate), Medication (MDO), and Physician (Brown, MD). A "Resting Motor Threshold (RMT): 35%" field is highlighted with a red box. At the bottom, there are buttons for "Report", "Delete Patient", "OK", and "Cancel". Red numbered callouts (1-6) point to specific fields and buttons.

Figure 4: Patient card editing form.

- 1 ID field that can only be changed when the patient is being added. And the ID must be unique for the patient in a given database.
- 2 List of set motor thresholds of the patient is available only during patient edition. Displayed values depend on the motor threshold mode configuration.
- 3 *Delete Patient* button deletes all the data of the selected patient. The *Patient Card*, as well as all the session data, are permanently removed.
- 4 *Report* button for creating a report of patient's performed sessions. Shwon *Report settings* dialog is the same as session report configuration form (see sec. 3.3) but do not contain MEP report selection and protocol type button. See sections 8 and 8.3 for more details about the content of the PDF report.
- 5 *OK* button that confirms changes and writes a new or edited patient to the database and then closes the dialog.
- 6 *Cancel* button that closes the dialog, so all performed changes are lost.

2.4 Session table

The patient details and session history window area displays the selected patient's data as entered in the *Patient's Card* together with all of the previous sessions of this particular patient. The displayed information consists of the date of the session, the type of session, used stimulation intensity, and the current Motor Threshold. The *Motor Threshold type* is preset in the *System Configuration* screen. For more information on the Motor Threshold, see The Motor Threshold Mode part of this guide (see item 13 in sec. 5). When a session is grayed (not black), it indicates that the protocol was interrupted. Information about who and what stopped the session is indicated on the top bar of the *Patient List* screen.

One or more items can be selected in the session list. Based on the selection, fast record option buttons are displayed (see sec. 2.5). If the interrupted session step is selected, then the reason for the interruption is shown in the information line above the table.

Rows of the table are either session or session steps when the session row is expanded. The session row can be expanded/collapsed by clicking on the particular row.

2.5 Record Options

The *Record Options* button opens the list of available options for the selection in the session table. The list of features changes depending on whether a MEP or Therapy session is selected. When a Therapy session or more rows are selected, only the *Delete Session* option is available. Available features in MEP are:

Open session details loads the selected session in the session details screen. If the session step is selected, then this session step is selected by default in the loaded session details screen.

Export to Matlab generates a text file and saves it to the selected destination. The file can be loaded into Matlab as the predefined structure in the workspace.

Export to Brain Vision generates three files and saves them to the selected destination. These files can be loaded into the software supporting the Brain Vision format.

Export to ASCII generates a text file and saves it to the selected destination. The file contains the data and comments explaining the file structure.

Export to GDT is available if the GDT function is permitted. Exports the data to the GDT with preset parameters (see item 6 in sec. 5.2)

Delete Record deletes one or more selected records. The session is deleted after deleting all of its session steps.

The *Record Quick Tools* tab is located below the session list of the selected patient. The tab content changes if MEP or Therapy session is selected similarly as *Record Options*. The *Record Quick Tools* settings button on the right side of the tab allows the user to preset which features should be visible on the tab.

3 Session Details screen

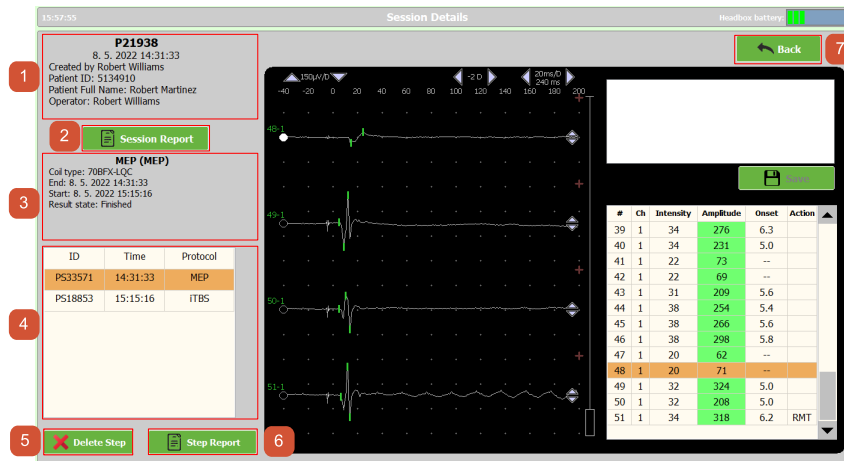


Figure 5: Session detail screen - session options.

- 1 Session information that contains session ID (automatically generated), date and time of the session beginning, user name of the operator, ID of the patient.
- 2 Button to create a report of the whole session. The session report configuration form (see sec. 3.3) pops-up. See section 8.4 for more details about report content.
- 3 Session step information contains session step name, code, description, coil type, date and time of start and end, as well as result state. If the GDT is enabled, information whether the step should be exported to GDT or not is displayed.
- 4 Table of all session steps performed during the session. The table contains three columns: The first contains the automatically generated step ID, the second shows starting time, and the final third column contains performed procedure step name, i.e., MEP or protocol name. As long as there are more procedure steps than displayed, a scroll bar is displayed on the right side of the table.
- 5 *Delete Record* button for deleting selected step. Deletion has to be confirmed in the displayed dialog.
- 6 Button to create a report of selected session step. The session report configuration form (see sec. 3.3) pops-up. See section 8.5 for more details about report content.
- 7 Navigation button that are used for returning to the patient database screen (see sec. 2). When a note was modified and not saved, a dialog is shown to choose whether changes should be saved or not.

3.1 Protocol session step

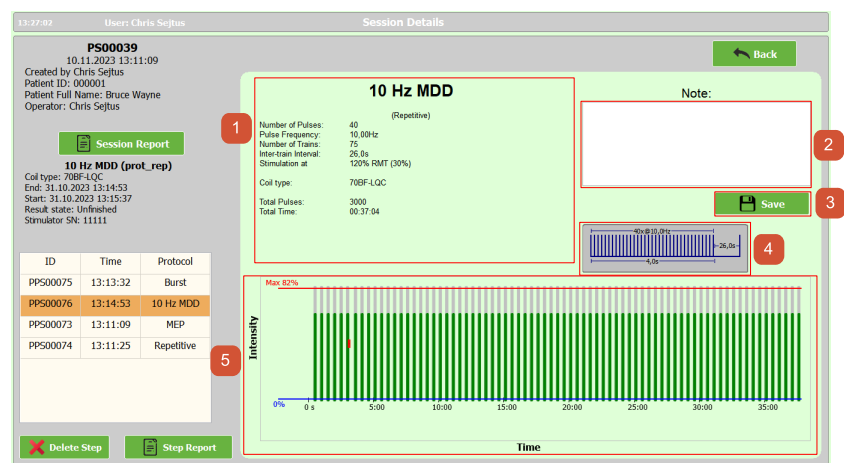


Figure 6: Session detail screen - protocol step.

- 1 Performed protocol configuration and information containing parameters of the protocol, coil type, total number of pulses, and total time.
- 2 Note field for writing or editing notes to the session step. No text formatting options are available. If the text exceeds the size of the note area, then the scroll-bar is displayed on the right side.
- 3 *Save* note button that saves changes made in the note field.
- 4 Protocol pulse timing overview.
- 5 Protocol process visualization that contains performed pulses (green bars), undelivered pulses (yellow bars), and pauses during protocol (red lines). You can zoom this visualization. In a sufficient level of zoom, pause reason text is displayed.

3.2 MEP session step

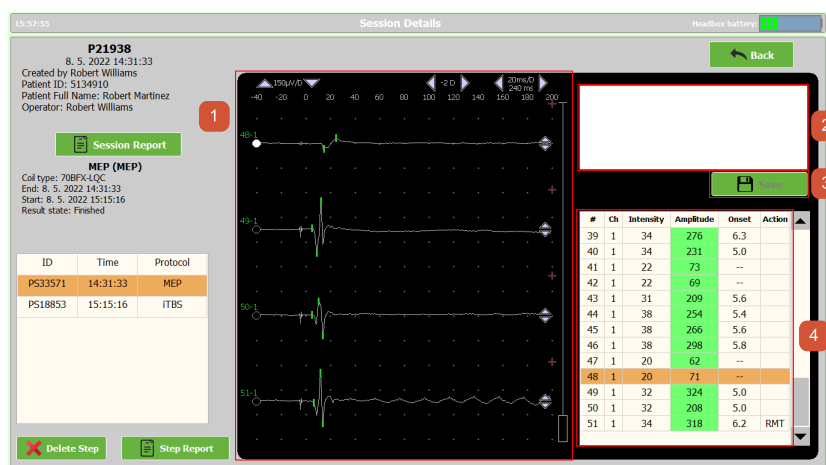


Figure 7: Session detail screen - MEP step.

- 1 Recorded MEP history. A track is selected by clicking on a circle left from a record. When it is selected, the matching row is selected in the table (no. 4 below),
- 2 Note field for writing or editing notes to the session step. Same as in 3.1.
- 3 *Save* note button that saves changes made in note field. Same as in 3.1.
- 4 MEP summary table that contains values of measurement for each MEP recording. When there are more rows than can be displayed, the scroll bar is displayed on the right side. The table has 6 columns:

contains the order number of the pulse.

Ch is a number of the headbox channel.

Intensity is a magnetic stimulator intensity of delivered pulse in the percentage of maximal stimulation output.

Amplitude is the p-p value in μV as difference between markers A- and A+.

Onset is a latency of MEP in ms. It is the time between the stimulus and marker I.

Action column shows where the MT has been set. Pulse after which the MT was set is marked as RMT or AMT based on the set MT type.

3.3 Session report configuration form

Figure 8: Session report configuration.

- 1 Control buttons that determines what report filename parts are present or not. Button session type is visible only when the report of the session step is being produced.
- 2 Current report filename preview. The filename is in the form of {Report type}[_{session type}][_ {patient ID}][_ {surname}-{first-name}][_ {birthday in it the format YYYYMMDD}][_ {current date in the format YYMMDD}]-{current time in the format hhmmss}.pdf. Four parts might be switched on/off as per paragraph above.
- 3 Selection of how many last recorded MEPs will be reported in detail in the final document. The button on the bottom defines if struck through traces should or should not be included in the report. Each recording in the report contains latency, p-p amplitude, intensity, and MEP images.
- 4 *Continue* button that opens standard directory selection dialog. When the directory is chosen, then the report is generated there with the name defined by options described above. While the report is being generated and saved, the report progress dialog (see fig. 9) is shown.
- 5 *Cancel* button that aborts report creation and closes the session report configuration form.

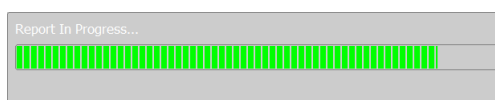


Figure 9: Report progress dialog.

4 Session screen

A new session is started when the first session step is selected.

4.1 Next session step selection form

Click the *Start New Session* button on the *Patient List* screen or the *Next Session Step* button on the session screen to start either MEP or protocol stimulation session step.

4.1.1 Next session step - MEP

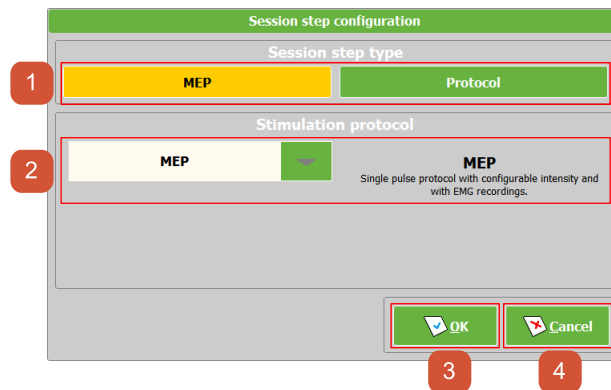


Figure 10: Session step selection - MEP.

- 1 Selection of the session step type. Two options are available: The first is *MEP* for MEP recording and MT determination. The second is *Protocol* where configured protocols can be selected (see sec. 4.1.2 for more details).
- 2 When using one stimulator, this is an unchangeable part. However, when the pair pulse is enabled, there is an expandable list of configured MEP protocols on the left and the selected MEP protocol description on the right.
- 3 *OK* button that confirms the selection and starts the appropriate session step along with the session itself if it was not started yet.
- 4 *Cancel* button closes this dialog without starting the new session or next session step.

4.1.2 Next session step - protocol

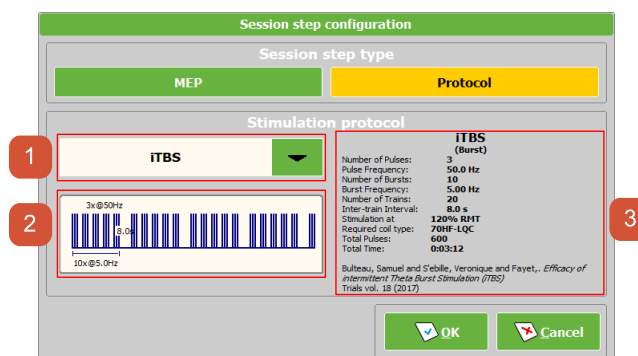


Figure 11: Session step selection - protocol stimulation.

- 1 Expandable list of configured protocols of the system in the *Protocol Setup* screen. List contains all available protocols on a particular system (see sec. 6). The list matches the list shown in the *Protocol Setup* screen.
- 2 Selected protocol pulse timing overview.
- 3 Technical description of the selected protocol.

4.1.3 Safety warning dialog

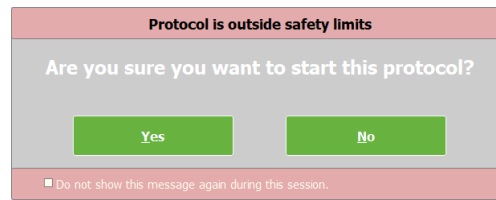


Figure 12: Safety limit warning dialog.

If the *Repetitive* or *Burst* protocol does not meet the safety requirements defined by Wasserman [4] or Rossi [3], then the safety warning dialog pops-up (see fig. 12). If the checkbox is checked before confirmation, this dialog does not pop-up during the session anymore.

4.2 MEP stimulation

(see sec. 4.1 for start up instructions)



Figure 13: MEP session step screen where MT is determined.

- 1 Patient information - ID, full name in quotes, and Diagnosis if it is filled.
- 2 Headbox battery indicator that is always visible during therapy (it is not displayed only if it is fully charged).
- 3 EMG recording area consisting of the following parts:
 - (a) **Live EMG** window contains a compressed and detailed signal for which individual sensitivity and time scale can be set. Additionally, the NOTCH filter (i.e., power grid filter) can be turned ON or OFF, and root mean square computation can be turned ON or OFF. The window of RMS can not be changed at this screen but it can be configured in the *Advanced System Configuration* (see sec. 5.2).
 - (b) **Last MEP** recorded is stored in the window below the live EMG signal. Here sensitivity and time scale can be changed. When the stimulation is performed, latency (I) and amplitude (A-, A+) markers are automatically detected and set. Some of them might be automatically not set if the signal is not clear.
 - (c) **MEP history** contains other MEPs recorded during a given session. The sensitivity of individual MEP can be set by the arrow on the right side. When circles on the left side are clicked, the recorded MEP is selected, and amplitude and onset are shown in the table for the selected recording (no. 6 below). The last recorded MEP is moved to the end of the history when the next stimulus is delivered.

- 4 Navigation buttons to start a next session step or end the current session. The *Next Session Step* button opens a dialog for choosing the next step (see sec. 4.1) where the protocol step type is selected by default. The *Exit Session* button opens the ending dialog.
- 5 Coil information window with coil type and bar displaying coil temperature. Placebo coil types are displayed as non-placebo variants to hide such information for blind studies. If the coil type is not visible, connected HW does not send such information. The coil temperature level shows a bar that grows from left to right and changes colors from green over yellow to red. If the bar is empty, the coil is completely cooled.
- 6 MEP information table with a button to delete all MEP history. The table has as many rows as many channels are active. The data about selected MEP are displayed consisting of onset in milliseconds, p-p amplitude in μV , and intensity in % of MSO. After a new MEP is recorded, it is automatically selected, and measures based on markers are displayed in the table.
- 7 Counter of pulses that were performed with the same intensity and which exceeded the set value of the p-p amplitude. The number at right is growing with each stimulation with the same intensity. The number at left is growing if the p-p amplitude of the current pulse is higher than the set threshold. When the intensity is changed, then the counter is hidden and starts counting again if other stimulations are performed with the same intensity.
- 8 Intensity control where the current intensity can be monitored at the right bottom corner. *Set RMT* and *Set AMT* are shown at the top based on the configured MT mode. After the pulse is delivered, buttons for setting RMT or AMT are shown.¹ Pressing the button sets the MT of the current patient to the intensity of the last pulse delivered. Set buttons are hidden when the intensity is changed.
- 9 Calibration control window is visible only if the MT mode contains AMT.
- 10 Stimulation control buttons. The upper button enables/disables stimulator. When the stimulator is enabled, it can be charged to configured intensity. Otherwise, the stimulator is in a stand-by mode in which it can not be charged. The lower button triggers the HW to deliver a pulse to check for the patient MEP response in order to find the MT. This button is enabled only if the stimulator is enabled and charged to displayed intensity.
- 11 Intensity control components consist of up and down arrows to change the intensity by 1% and a bar that visually displays intensity. Stimulation intensity can be modified by both mouse and touch screen.

4.3 Protocol stimulation

(see sec. 4.1 for start up instructions)

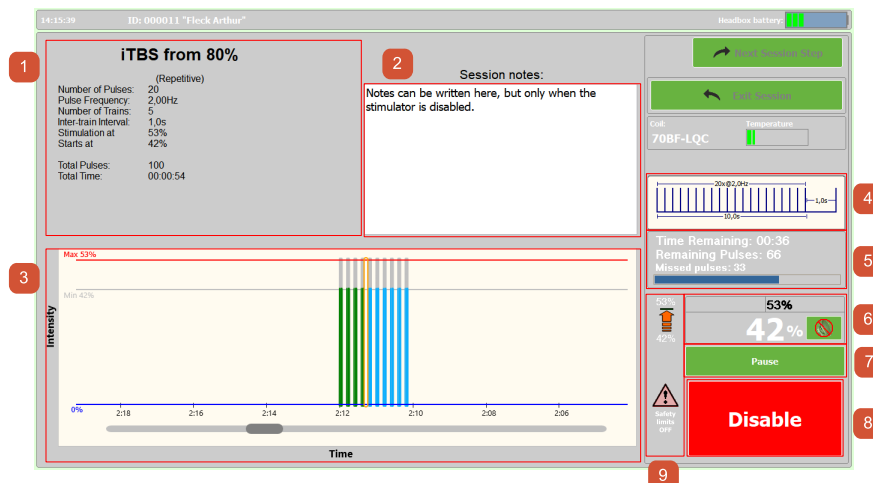


Figure 14: Protocol stimulation step screen.

- 1 Information about the protocol that was selected for current session step.
- 2 Plain text field for recording notes. Text can not be modified when the stimulator is enabled. When the text is longer than displayed, a scroll bar is shown on the right side. No formatting is possible.

¹Set AMT button is shown only if RMS signal was calibrated.

- 3** Protocol animation. Before the protocol starts and during pause, all pulses could be browsed in the animation. When the protocol is in progress, animation automatically moves with the window, so the current time marker is always visible. The window supports the following functionalities:
- Move** changes currently displayed time by using the bar under the pulses, clicking the mouse and moving left and right, or swiping pulses left and right.
- Zoom** via the two-finger gesture or by clicking by mouse and moving up and down.
- Current time marker** shows the current time in the context of the protocol. It is a rounded rectangle with an orange color that appears at the protocol's start. It goes from left to right as the protocol proceeds.
- Pulse colors** are based on the state of the pulse. Gray pulses marks times when the pulse is going to be delivered. Blue pulses highlight the level of intensity that is going to be delivered. Green and yellow pulses highlight level of intensity that was successfully and unsuccessfully delivered, respectively.
- Note:** Undelivered pulses are checked after the delivery attempt. Therefore, even an undelivered pulse is marked as delivered at first.
- Minimum** intensity level is shown when protocol intensity can vary during the protocol delivery.
- Maximal** intensity level is always shown as a top intensity in the animation.
- 4** Selected protocol pulse timing overview. Same as in the *Protocol Setup* screen (see sec. 6.2) and protocol *Next Session Step* dialog (see sec. 4.1.2).
- 5** Live protocol information panel consisting of:
- remaining time,
 - remaining pulse count,
 - missed pulses count when at least one pulse had not been delivered,
 - a bar that shows remaining time visually (filled at the beginning and moving to the left while the protocol is progressing).
- 6** Intensity control containing: Current AMT and RMT based on the threshold that determines final stimulation intensity of the selected protocol. Configured percentage of MT of selected protocol. Current intensity of the stimulation. When the stimulator is enabled, current intensity has to match the intensity displayed on the stimulator. Button for enabling/disabling audio warning before the train is displayed to the right of the current intensity.
- 7** *Start/Pause/Continue* button used for starting/pausing/resuming the current protocol. This button is enabled when the stimulator is enabled and charged to given intensity. When the protocol is finished, this button is not visible.
- 8** *Enable/Disable* button for enabling/disabling the stimulator. The stimulator can be charged to given intensity, and the protocol can be started when the stimulator is enabled. *Next Session Step* and *Exit Session* buttons are enabled when the stimulator is disabled. The stimulator is discharged, and protocol can not be started or continued when the stimulator is disabled.
- 9** Additional information area that may contain:
- Safety warning icon when the safety limits were exceeded.
 - Upper and lower bound of intensity in which the intensity can be changed during protocol which supports manual intensity change.

4.4 Pair pulse stimulation

(see sec. 4.1 for start up instructions)

There are three types of screens for the pair pulse stimulation based on the configuration of particular protocol. If the protocol is configured as repetitive then the same screen as in the section 4.3 is displayed. When a MEP session with EMG is configured then the screen is similar to the screen described in section 4.2 but there are a few differences which are described below.

4.4.1 Pair pulse MEP with EMG

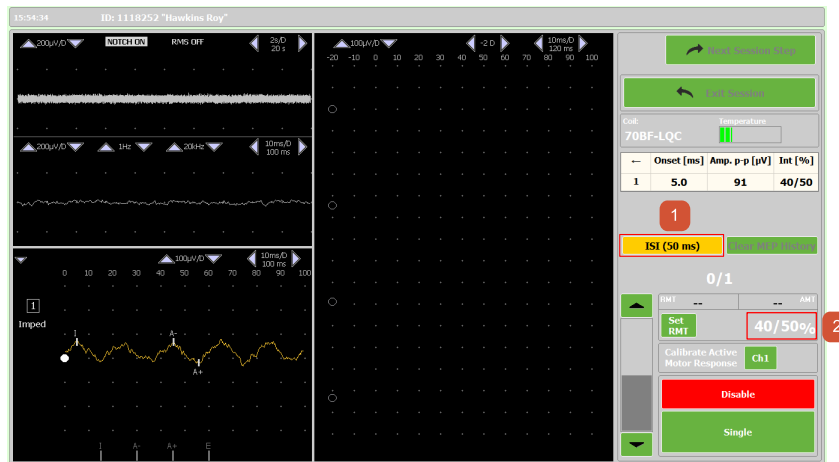


Figure 15: Pair pulse stimulation with EMG.

- 1 Button that displays the ISI value. When the ISI change is enabled in the current pair pulse MEP protocol (see sec. 6.2.4), then this button can be enabled. If this button is enabled, the ISI value may be changed by the wheel on the coil wand.
- 2 Intensities on both stimulators are displayed. Default intensities and their ratio are defined by the pair pulse configuration (see sec. 6.2.4) in the *Protocol Setup*. The first intensity is the intensity of the stimulator A, and the second is the intensity of the stimulator B.

4.4.2 PairPulse MEP without EMG

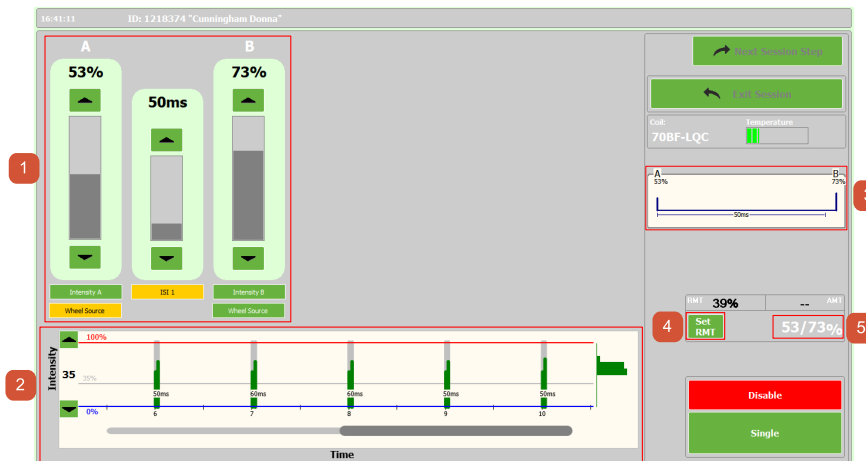


Figure 16: Pair pulse stimulation screen without EMG and with options to configure intensities and ISI of pulses.

- 1 Panel with control for parameters of the dual stimulation, including the following:
 - Stimulator intensity is visible for both stimulators A and B as an MSO percentage and a bar. Moving with the bar changes the intensity. Similarly, up and down buttons lower and raise the intensity by 1%.
 - ISI is displayed between the intensities of stimulators, and it can also be configured by the bar and arrows.

- Coil wheel target buttons (Intensity A, ISI 1, Intensity B) define which stimulation parameter is changed by the movement of the coil wheel.
 - Coil Control buttons define from which stimulator the wheel data are read. This functionality is only applied for more coil usage without the coil coupler.
- 2** Pulse visualization. On the left, highlighted intensity may be configured. On the right, there is a histogram of all pulses delivered during the session step. Between, the visualization of stimuli is depicted. Height of green bars represents stimulation intensity and the distance ISI value, which is also displayed as a text. There is a scrollbar displayed on the bottom when the stimuli does not fit to the current size of the visualization.
- 3** Visualization of configured pulse sequence.
- 4** Button for setting RMT for current patient. Value of RMT is based on the first stimulator's intensity.
- 5** Intensities on both stimulators are displayed. The first intensity is the intensity of stimulator A, and the second is the intensity of stimulator B.

5 System Configuration

The *System Configuration* dialog may be accessed through the configuration button in the *Patient Database* screen.

5.1 Basic configuration

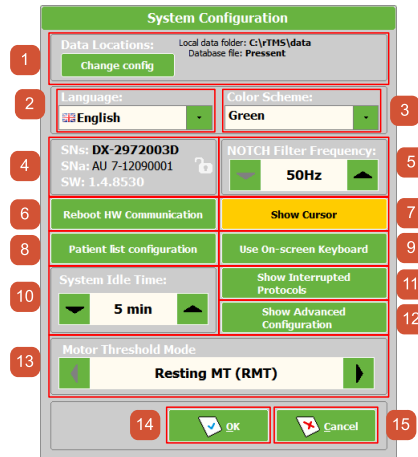


Figure 17: System Configuration dialog without advanced options.

- 1 *Data Locations* displays configured local and remote data location. There is a button *Change config* for accessing configuration dialog for data sources (see sec. 5.3).
- 2 *Language* can be set as one of the following: Čeština, English, Francais, Deutsch, Polski, Slovenčina, and Español. Application of change of this field requires a restart of the SW.
- 3 *Color Scheme* can be set as *Blue*, *Green*, and *Grey*. *Grey* is high contrast theme.
- 4 Serial nuber panel displays the following:

SNs is an SN of the connected stimulator. A little lock on the right can be used to lock the SN. If the SN is locked, the configuration code for the stimulator is verified even without the stimulator. However, only the stimulator with a given SN can be used by such a system.

SNa is an SN of the connected EMG adapter. A little lock on the right can be used to lock the SN. If the SN is locked, the EMG adapter with another SN is not accepted by the SW.

SW shows the current version of the software.
- 5 The *NOTCH Filter Frequency* defines the frequency of electrical grid: European 50Hz or Americans 60Hz.
- 6 The *Reboot HW Communication* button restarts connections between the SW and all HW devices.
- 7 The *Show Cursor* button shows or hides the cursor of a mouse that hovers over the rTMS software.
- 8 The *Patient List Configuration* button shows the dialog for patient list configuration (see sec. 5.4).
- 9 The *Use On-screen Keyboard* button enables or disables the use of the on-screen keyboard. When the on-screen keyboard is enabled, a keyboard is displayed in dialogues with textual input.
- 10 The *System Idle Time* defines a time when the stimulator is automatically disabled if the stimulator was enabled and no pulse has been delivered. Also, if the SW does not register any action from the user for this period, logged user is logged out. In the case of the default user, the screen returns to the patient database screen. Therefore, after this time of inactivity, all active procedures are ended, and all current changes in configuration are lost. Its value can be set to one of the following values: 2, 5, 10, 15, 30, 60 min.
- 11 *Show Interrupted Protocols* is a button that shows all unfinished protocol steps when inactive. Consequently, sessions with unfinished steps only are also hidden.

- 12 The *Show Advanced Configuration* button enlarges and shrinks this dialog with advanced configuration panels (see sec. 5.2).
- 13 The *Motor Threshold Mode* defines what type or types of motor threshold (MT) are available on this system. There are three options possible *Resting MT*, *Active MT*, or *Resting + Active MT*.
- 14 The *OK* button closes the dialog and saves the changes. If any change requires a restart of the SW, then a confirmation dialog pops-up.
- 15 The *Cancel* button closes the dialog without saving changes.

5.2 Advanced configuration

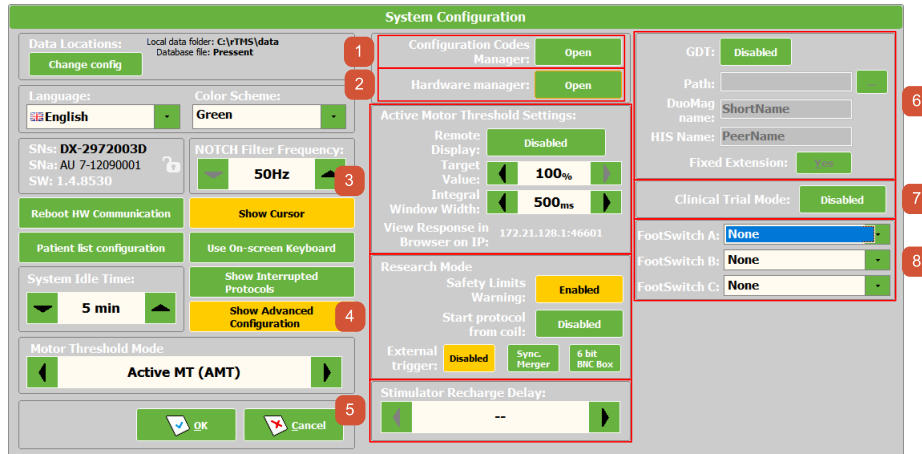


Figure 18: System Configuration dialog with advanced options.

- 1 The *Configuration Codes Manager* allows a user to insert and remove configuration codes of the software (see sec. 5.5). This option is always visible.
- 2 The *Hardware Manager* is a dialog for configuration of serial numbers of the stimulators connected to the system (see sec. 5.6).
- 3 The *Active Motor Threshold Settings* contains configuration for the local HTTP server that the SW provides for showing information on other devices via any internet browser. This option is visible only when the *Motor Threshold Mode* (see sec. 5) contains *Active MT*.

Remote Display starts or stops the HTTP server.

Target Value determines the percentage of calibration value that is targeted. Possible values are in the range from 0% to 100%.

Integral Window Width determines the integration window used to compute the root mean square (RMS) of the signal. Values from 1 to 2000 ms.

View Response in Browser on IP shows the IP and a port on which the HTTP server is accessible if it is active.

- 4 *Research Mode* contains additional functionalities that are implemented for research purposes. It is activated by code.

Safety Limits Warning is an option for enabling or disabling a safety warning during the startup of an individual procedure step when the limits are being exceeded.

Start protocol from coil is enabled for starting protocol by the coil button. Otherwise, it is required to use the start button in the SW.

External trigger is applied when additional device is being used for triggering the pulses during MEP or starting protocol. There are two options available. *Sync. merger* provides external device to trigger stimulator and record MEP simultaneously. *6 bit BNC box* enables SW to process input TTL signal to the adapter. Therefore, stimulation by this trigger is not immediate but delayed approximately by 30 to 100 ms.

- 5 *Stimulator Recharge Delay* is used to dim artifact in MEP signal made by stimulator charging procedure that is started immediately after each stimulus by default. This option is only applied for MEP recordings. Notice that it would not be possible to deliver pulses as close as usual because the stimulator is going to be recharged after specified delay. Values can be set in range from 0 to 600ms with 50ms step. This feature has to be allowed by configuration code.
- 6 *GDT* could be configured to communicate with other hospital systems. GDT communicates via the shared folder defined by path parameter. rTMS software creates files in the folder with output format AB.E, where A and B are *DuoMag* and *HIS* names respectively and E is an extension, these parts are generated by the configuration described below. This feature has to be allowed by configuration code. Whenever the *GDT* is enabled, all records has option for their GDT export.
- Path** is a folder used for GDT communication. The path can be selected by standard folder selection windows when the three-dots button is clicked.
- DuoMag Name** is a part A of the filename of GDT messages.
- HIS Name** is a part B of the filename of GDT messages.
- Fixed Extension** determines if the file extension is always fixed as *.gdt* (select *Yes*) or is an increasing number padded by zeros to the size of 3 (select *No*).
- 7 *Clinical Trial Mode* should be enabled for clinical trials that are not used on human subjects. This option changes the term “patient” with the more general term “subject”. This feature has to be allowed by configuration code.
- 8 Footswitch options may be configured to control some parts of the stimulation workflow via the three-pedal footswitch provided by manufacturer. This feature has to be allowed by configuration code.

5.3 Data source configuration

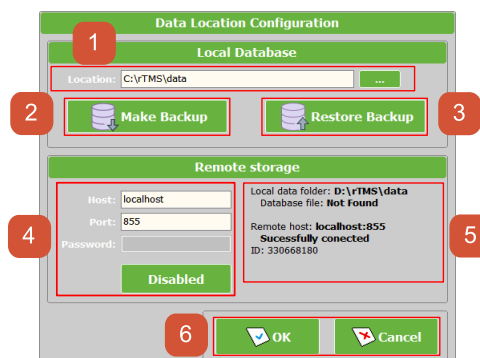


Figure 19: Data location configuration dialog.

- 1 *Location* containing local database is configured directly by typing location or by standard open dialog displayed after clicking on the button with three-dots. Application of change of this field requires a restart of the SW.
- 2 *Make Backup* button opens standard save dialog for specification of the output file name and location. After the dialog is confirmed the backup file is created.
- 3 Local database may be restored from the backup file. However, the restoration is allowed only when the current database contains no stored records.
- 4 *Remote storage* location is specified by the host and port specification. A password is required for connecting to the remote storage. Also, remote storage usage can be enabled or disabled.
- 5 Presence of the configured local database and connection to the remote storage are validated. The result is displayed with the local system ID that is used for connection to the remote storage.
- 6 Dialog escape buttons that close the dialog. Changes made are saved when the *OK* button is clicked in this dialog and then also in the system configuration dialog. The *Cancel* button closes the dialog without saving any changes.

5.4 Patient list configuration

The *Patient List Configuration* dialog can be accessed via the *Patient list configuration* button in the *System Configuration* (see sec. 5).

Figure 20: Patient list configuration.

- 1 *Default* defined default state of the patient filter based on the patient type, i.e., one of *New*, *Regular*, and *Rest*.
- 2 The *Regular Patients* panel contains options for configuration of regular patient filter and background color of their row. The system marks the patient as regular if he/she has at least *minimal repetition number* (2-6) of consecutive sessions started in a shorter period than the *maximal time between therapies* (from 3 days up to 1 year). The latest session has to be sooner than the maximal interval between them. The *Regular* patient type is preferred before the *New* patient type.
- 3 The *New Patients* panel contains option for configuration of new patient filter and background color of their row. The system marks the patient as new if the creation of the patient or the first therapy was sooner than the selected value (from 3 days up to 6 months). The regular patient assignment is preferred over a new patient. Patients that do not meet any of the two criteria above are marked as *Rest*.
- 4 The *Show Patient type* enables or disables the use of the filter that distinguishes above described three types of patients based on their attendance.
- 5 *Sort by Patient type* enables or disables a sort by patient type option where new patients are displayed first, then regular patients and rest patients are at the end of the table. This option is applied only when *Show Patient Type* is enabled.
- 6 *Default patient sorting* is a default column by which the patient table is sorted. The column can be changed by clicking to the header of a column in the patient database screen (see sec. 2). Three possibilities are available: *Surname*, *Name*, and *ID*. The sort option is applied for patients within each type if the patient types are enabled.

5.5 Configuration codes form

The *Configuration codes* form is opened by the *Open* button in the *Configuration Codes Manager* panel that is a part of the advanced configurations (see sec. 5.2).

ID	Code	Expiration	State
1	1LRHCEEVT2ABNA4QM15I2XR2M6	Unlimited	Connected
2	PAA7X3R52AAGC39CABVH4SLN34	Expired	Connected
3	1WUQJIUJHUUICBTQC8HNB775TA	Unlimited	No HW
4	THKXRF1MA38K6RULGQRIRFW78H	Unlimited	PC

Note: XT100;

Buttons: Add, Delete, Up, Down, OK, Cancel

Figure 21: Configuration codes form.

- 1 Table containing configuration codes. It has 4 coluns and a scrollbar. The first column is the code sequence number. The second column is the code itself which consists of high caps alphanumerical string. The third column shows the remaining expiration time. Fourth column summarizes the state of the code. Three values are available: *Connected* if the HW required for the code is detected; *PC* if the code is assigned to the current PC; *No HW* if required HW is not detected. In addition, the font of the first row of active code assigned to the connected stimulator is green. Similarly, the font of all codes for a given PC is red.
- 2 Field for a note for the selected code in the table above. By default, the note contains information about types of the stimulators that are enabled by the code.
- 3 *Add* and *Delete* button for adding a new code or deletion of the selected code. The *Add* button allows the user to insert a new code (see fig. 23). The *Delete* button shows a dialog for confirmation of deletion of the selected code.
- 4 The *Up/Down* button moves the selected code up/down in the list. It is required to have the main code as the first. Additional codes could be added for more functionality or for more devices connection to the same SW instance.
- 5 Dialog escape buttons that close the dialog. The *OK* button saves performed changes and prompts dialog for SW restart if any change requires SW restart (see fig. 22). The *Cancel* button closes the dialog without saving any changes.

Configuration Codes Changed

Changes will apply after application restart.

Restart application now?

Yes No

Figure 22: Configuration code changed dialog. Pressing *Yes* performs restart of the SW, *No* closes the dialog without saving and restarting.

Set new configuration code:

OK Cancel

Figure 23: New configuration code dialog. *Cancel* closes the dialog without adding code. *OK*, or pressing Enter key inserts new code to the end of the list.

5.6 Stimulator layout selection form

Figure 24: Stimulator Layout selection form.

- 1 Selection of the stimulator type. Visible options are based on configuration codes.
- 2 List of connected and configured devices. Connected devices starts with their SNs, and then in the bracket are configured layouts. Configured but not connected devices starts with the configured layout specification. *Refresh* button reloads the list.
- 3 Stimulator SN selection and a button that enables the automatic SN assigning for any stimulator that is connected to the system.
- 4 Each layout may be enabled or disabled. Stimulators of a layout would not be connected if the layout is disabled.
- 5 The *Signal Layout* button starts the signalization procedure that sets the intensity of each stimulator configured in the selected layout to 3% for 5 seconds. When the stimulator is connected, its SN is displayed with a green background. Otherwise, the background is gray.
- 6 Dialog escape buttons that close the dialog. The *OK* button saves the performed changes. The *Cancel* button closes the dialog without saving any changes.

6 Protocol Setup screen

The *Protocol Setup* screen is accessed through the configuration button in the *Patient Database* screen.



Figure 25: Protocol setup screen - main options.

- 1 Button to show protocols' setups. (see sec. 6.2)
- 2 Button to show display and audio setup. (see sec. 6.1)
- 3 *Back* button that returns the view to the patient database screen. A confirmation dialog pops-up when the changes in the setup were made and not saved.

6.1 Display and audio setup

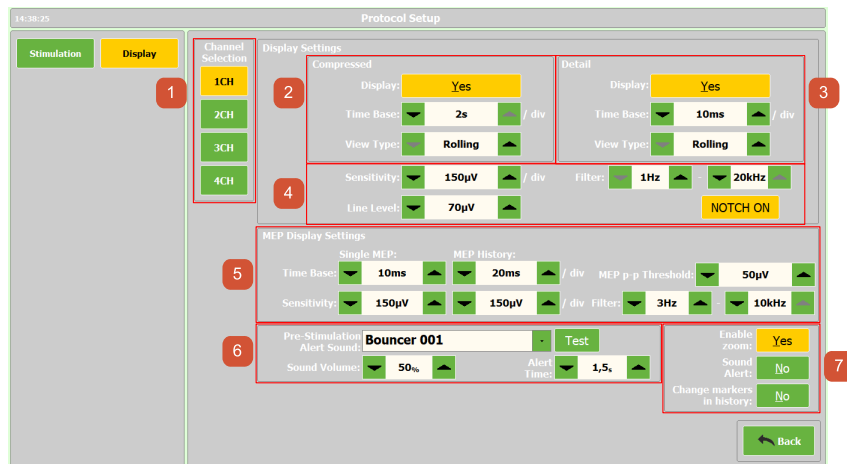


Figure 26: Display and audio setup.

- 1 Selection of active EMG channels by buttons that are orange if selected. Two or four channels are available based on the active code.
- 2 Configuration of a compressed EMG signal. (see sec. 6.1.1)
- 3 Configuration of a detailed EMG signal. (see sec. 6.1.1)
- 4 Shared configuration by both compressed and detailed EMG signal. (see sec. 6.1.1)
- 5 Configuration of MEP signals sensitivity, time scale, filters, etc. (see sec. 6.1.2)
- 6 Configuration of audio warning for protocol stimulation. (see sec. 6.1.3)
- 7 Additional options:

Enable zoom allows the user to enlarge the selected signal window to full screen. Double-tap/click on the selected window to enlarge it. Double-tap/click again to get back to the standard layout.

Sound Alert enables sound audio alerts before train during the protocol stimulation.

Change markers in history allows user to change position of markers in the MEP history window.

6.1.1 EMG signal configuration

Both parts of detail and compressed EMG signal can be configured as follows:

- Show/Hide the signal, time base configuration, and view type selection.
- *Timebase* can be set to values from 50ms to 2s and 1ms to 100ms per division for compressed and detailed signals, respectively.
- There are three types of views: *Rolling*, *Over-Write*, and *Stack*. When the *Rolling* signal type is used, the signal moves in windows from right to left. *Over-write* mode makes the signal static where new data rewrites the old ones. *Stack* mode writes new data from left to right. And when the data reaches the right border, the data are deleted, and writing starts from the beginning again.

The same values of sensitivity, line level, and filter could be configured for both compressed and detailed EMG signals. Sensitivity can be set from $10\mu V$ to $10mV$. Line level can be either disabled (value “-”) or set to value in the range $200nV$ to $30mV$. Two lines in a signal windows are displayed on a given level on both positive and negative sides when the line level is set. These lines can be used as a reference for signal monitoring. Note that lines are not visible if sensitivity settings make it out of the displayed signal range.

NOTCH filter can be enabled by default which is the preferred option. The additional bandpass filter can be configured by setting upper and lower frequencies from 1Hz to 300Hz and from 500Hz to 20kHz, respectively.

6.1.2 MEP signal configuration

Markers can be added and moved in the last recorded MEP signal view. Further, we refer to this view as Single MEP. After the next MEP is recorded, its signal is shown in the Single MEP, and the previous MEP is moved to the MEP History, where all other MEPs are displayed.

Time Base can be set for both Single MEP and MEP History in the same range of 1ms to 50ms per division.

Sensitivities for both Single MEP and MEP History can be set in the range $20\mu V$ to $1.5mV$ and $500nV$ to $1.5mV$, respectively.

MEP p-p (peak to peak) *Threshold* can be set in interval of $10\mu V$ to $300\mu V$. This threshold is used to determine which p-p values are considered successful MEPs. Such p-p values are then highlighted in tables with recorded MEPs.

Band pass *filter* of both Single MEP and MEP History, where the lower bound is from 0Hz (DC) to 100Hz and the upper bound is from 500Hz to 10KHz, can be set.

6.1.3 Audio warning configuration

The Pre-Stim alert lets the patient know that stimulation is about to occur. The settings below can be set:

- *Pre-Stimulation Alert Sound*: Choose from a large list of sounds for the alert;
- *Alert Time*: Indicates the amount of time before the next stimulation;
- *Sound Volume*: Sets the volume for the alert.

The *Test* button allows the user to try out the current sound settings.

6.2 Protocol Setup

The *Protocol Setup* consists of list with available protocols (see sec. 6.2.1) and configurations of individual protocols (see sec. 6.2.2, 6.2.3, 6.2.4).

6.2.1 Protocol list

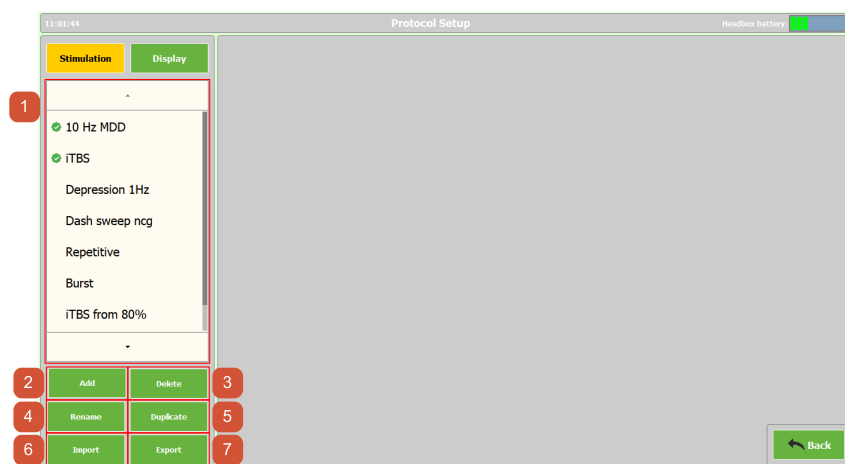


Figure 27: Protocol list.

- 1 List of available protocols' names. At the top and bottom there are arrows to move the protocol list up and down. You can also use scroll bar at the right side of the list. Protocols that has the same parameters as protocols approved for the clinical use are marked by a green symbol.
- 2 Add protocol button displays a dialog with the text field for a new protocol name (see fig. 28). The new name of the protocol can not be the same as some already listed because protocol names must stay unique.
- 3 Delete protocol button. It is required to confirm deletion.
- 4 Rename protocol button that allows you to change the protocol name using similar dialog as shown in Figure 28. The protocol name has to be unique.
- 5 Duplicate protocol button creates a copy of the selected protocol. New protocol name contain a number in brackets as a suffix of its name.
- 6 Import protocol button is used to import protocol from the file (extension rTMS). This functionality enables moving protocols from one device to another or for backuping protocols.
- 7 Export protocol button exports the selected protocol to the file (extension rTMS). This functionality enables moving protocols from one device to another or restoring protocols from backup.

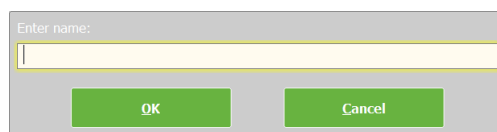


Figure 28: New protocol name dialog.

6.2.2 Repetitive Stimulation

Two mechanisms can limit values that can be configured. Firstly, the maximal frequency of two consecutive pulses is limited by your device. If you have connected MP and XT simulators, please, be aware that the MP simulator is not designed to deliver repetitive and burst stimulation. Secondly, you may choose to limit your protocol with respect to published Wassermann safety limits [4].

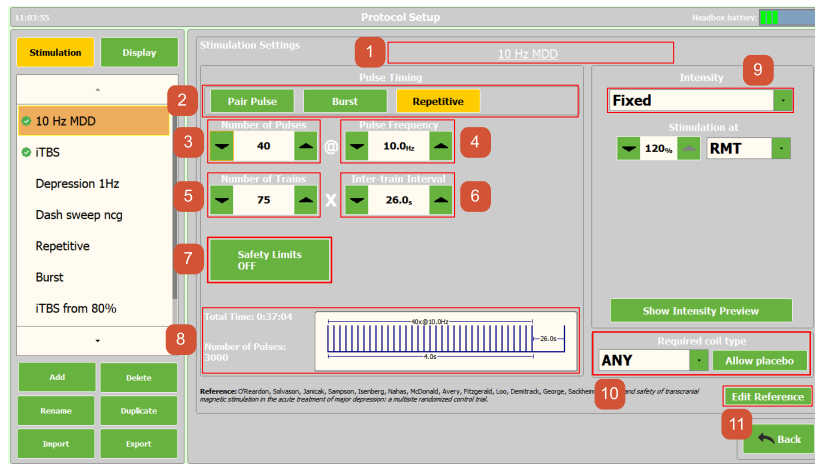


Figure 29: Repetitive protocol configuration.

- 1 Protocol name.
- 2 Type of protocol pulse timing.
- 3 Number of pulses delivered during one train cycle. Values range is 2-3000.
- 4 Pulse frequency inside the train measured in Hertz (stimulations per second). Values range is 0.1-100Hz with step 0.1Hz.
- 5 Number of trains is the number of repeating batches in which the pulses are delivered. Values range is 1-200.
- 6 Inter train interval sets the time delay, in seconds, at the end of each train before the next train starts. This interval also gives the coil time to cool down during intensive stimulation. Values range is 1-300s with step 0.1s.
- 7 When the *Safety Limits* button is enabled, all the parameters of the *Repetitive* protocol are limited, so the final protocol meets the safety limits described in the Wassermann Safety guidelines [4]. If the button is disabled, the parameters are limited only by the system technical capabilities. Even with the button disabled, if the protocol does not meet the safety limits, the user is still warned when attempting to start the protocol (see sec. 4.3 and 4.1.3).
- 8 Stimulation Protocol Preview shows a total time, the total number of pulses, and a protocol pulse timing overview to help the user recognize the protocol design. This graphical representation shows only single train in the protocol. All following trains are the same.
- 9 Type of the intensity control selection (see sec. 6.2.5).
- 10 It is possible to select a specific type of coil that is required for the given protocol, so if the protocol is started with a different type, then a warning dialog is displayed. If there is no specific coil for the protocol, option *ANY* can be selected. Function *Allow placebo* is used for allowing also placebo variant of the selected coil type for the protocol delivery.
- 11 *Add/Edit* a reference button that opens the protocol reference dialog (see sec. 6.2.7). The reference is then displayed in the space left from this button.

6.2.3 Burst Protocol

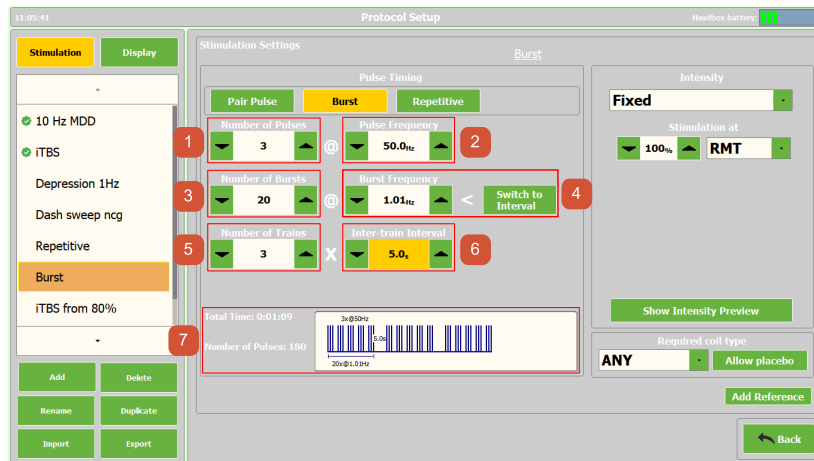


Figure 30: Burst protocol configuration.

- 1 *Number of pulses* delivered in one burst. Values in the range 2-6.
- 2 *Pulse frequency*. Values are in the range 0.1-100Hz.
- 3 *Number of Bursts*. Values are in the range 1-500.
- 4 *Burst Frequency* or *Interval*. The minimum frequency and a maximal interval is 0.05Hz and 20s. Other bounds are determined by the length and frequency of pulses in burst and the frequency limit of the given device. For example, using stimulator XT100 for 3 pulses with a frequency 50Hz leads to a maximal frequency of 14.29Hz and minimal interval of 0.01s.
- 5 *Number of trains* is a repetition number of batches in which the pulses are delivered.
- 6 *Inter-train Interval* sets the time delay, in seconds, at the end of each train before the next train starts. This interval also gives the coil time to cool down during intensive stimulation.
- 7 Stimulation Protocol Preview shows a total time, the total number of pulses, and a graphical representation of the protocol to help the user recognize the protocol design. At least one burst is shown, but the whole train is shown only if it fits into the displayed area.

6.2.4 Pair pulse stimulation

Configuration of the pair pulse stimulation is available only if it is allowed by a configuration code.

Note that using synchronous pulses changes pulse characteristics such as intensity and pulse width by the multiplication factor of $\sqrt{2} \approx 1.41$.

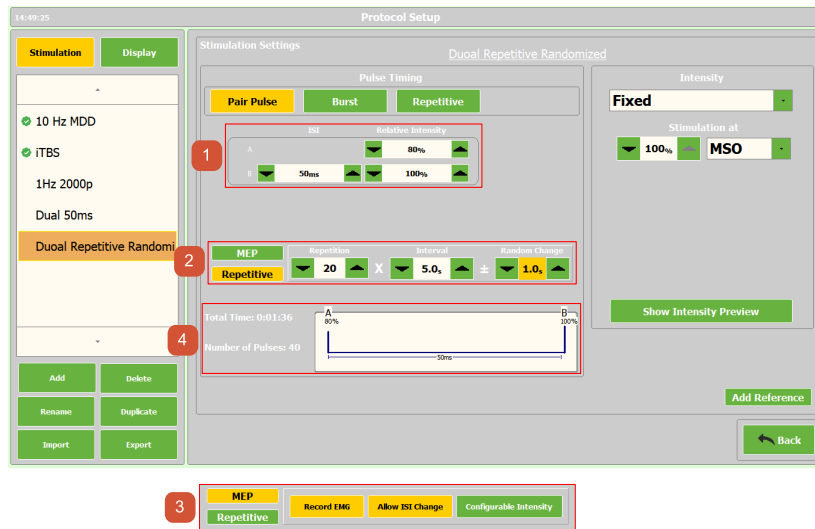


Figure 31: Pair pulse stimulation configuration.

- 1 Configuration two consequential pulses. Two main parameters are an inter-stimulus interval (ISI) and intensity. ISI may be configured from 1 to 600ms. In addition, it is possible to set ISI to zero for a synchronous pulse. The relative intensity refers to the configuration of the percentual value of the stimulation intensity based on the protocol intensity configured in the right panel.
- 2 Here repetitive stimulation can be configured by setting a number of repetitions, the time interval between pair stimulation, and random change in the interval. Random intervals are generated before stimulation from a uniform distribution.
- 3 Alternatively to repetitive stimulation, MEP stimulation can be configured. There are just three switches that can be enabled or disabled. *Record EMG* allows recording EMG during the MEP stimulation. It requires EMG HW to be connected. The *Allow ISI Change* button may enable ISI change during the session step. And finally, *Configurable Intensity* allows the user to change intensity independently on each stimulator.
- 4 Stimulation Protocol Preview shows the total time, the total number of pulses, and a graphical representation of the protocol to help the user recognize the protocol design. At least one burst is shown, but the whole train is shown only if it fits into the displayed area.

6.2.5 Intensity control types

Other than *Fixed* intensity types have to be allowed by configuration code. There are three types of intensities: magnetic stimulator output (MSO), active motor threshold (AMT), and resting motor threshold (RMT). MSO must be activated by the code. Displayed AMT and RMT options depends on motor threshold mode configured in the *System Configuration* (see sec. 5).

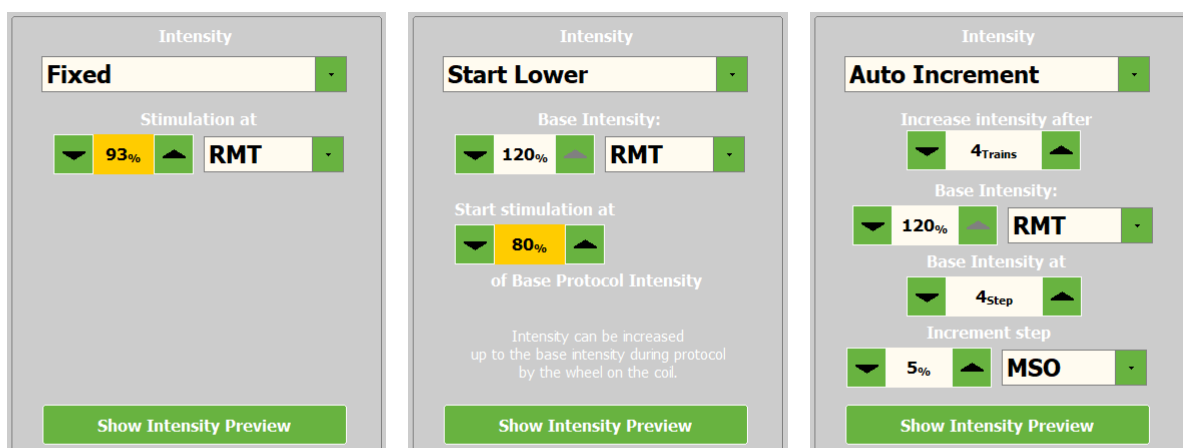


Figure 32: Possible intensity control types.

Fixed intensity allows the configuration of stimulation intensity in the percentage of patient's AMT or RMT or in the exact percentage of MSO.

Start Lower uses fixed intensity as a base and allows the operator to start protocol at a lower intensity and adjust the intensity manually by the coil wheel during the stimulation.

Auto Increment is an experimental intensity control type. This type allows automatic increasing or decreasing of stimulation intensity during the protocol stimulation. A change of intensity is made after a certain number of trains are finished. Increment step intensity is configured, and based intensity is placed in some increment step.

In addition, the **Show Intensity Preview** button opens the protocol preview dialog (see sec. 6.2.6 for more details).

6.2.6 Protocol Preview Form

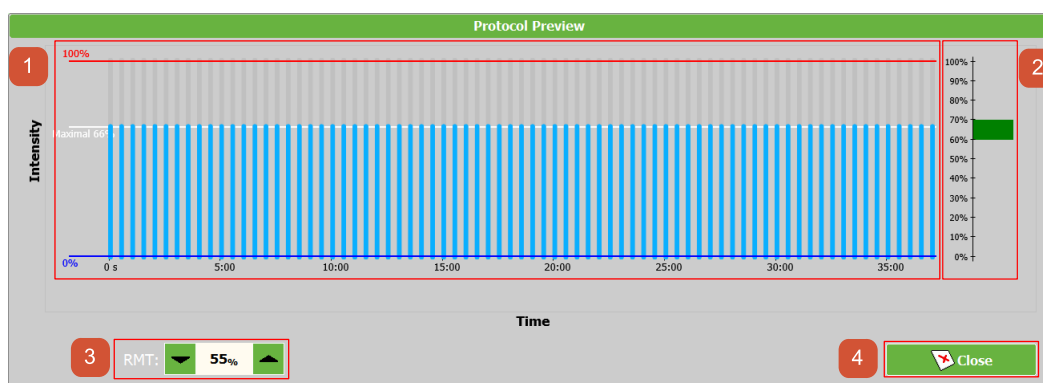


Figure 33: Protocol Preview Form.

- 1 Visualization of the whole protocol. This window is interactive and can be zoomed in and out by touch gestures. Similarly, holding the left mouse button and moving up and down performs zoom in and out. Expected stimulation intensity is shown as a level of blue bars in gray bar, which represents stimulation. Moving displayed pulses left and right is possible via the gesture or mouse.
- 2 Histogram for the expected intensity of pulses delivered during the protocol.
- 3 Motor threshold intensity in MSO can be adjusted to see the final intensity of the protocol for a given threshold value. The displayed type depends on the intensity type set in the protocol setup screen. If it is already set MSO, then this field is not visible.
- 4 *Close* button closes the preview.

6.2.7 Protocol reference dialog

There are three fields available to be filled. These fields are then printed into the report and shown in the *Protocol Setups* for the selected protocol. Reference is not stored with each session. Therefore, it is possible to add a reference to the protocol later if needed, and by doing so, make reports to contain the reference. Stimulated protocols and stored references are paired by the protocol name.

Figure 34: Protocol Reference Editor dialog.

Title of the reference.

Author or authors of the reference.

Source of the reference.

Delete button deletes opened reference after confirmation in a dialog. This button is not visible when adding a new reference.

OK button saves made changes and closes the dialog. The situation when all fields are empty is equivalent to deleting the reference.

Cancel button closes a dialog without saving changes.

6.2.8 Approved protocols only mode

Configuration code of the SW can enable the approved protocols only mode in which only list of approved protocols is available and can not be modified. This mode is suitable for restricting users to use only scientifically proven protocols.

Approved protocols may differ for individual customers based on the local regulatory requirements and the time they were uploaded into the system. Updates of the SW may change the approved protocols list. List of currently approved protocols is in Table 1.

Table 1: List of approved protocols [1, 2].

Protocol name	Train configuration				Inter train interval	Train num.	Intensity
	Pulse num.	Pulse freq.	Burst num.	Burst freq.			
iTBS	3	50 Hz	10	5 Hz	8 s	20	120% of RMT
10 Hz MDD	40	10 Hz	x	x	26 s	75	120% of RMT

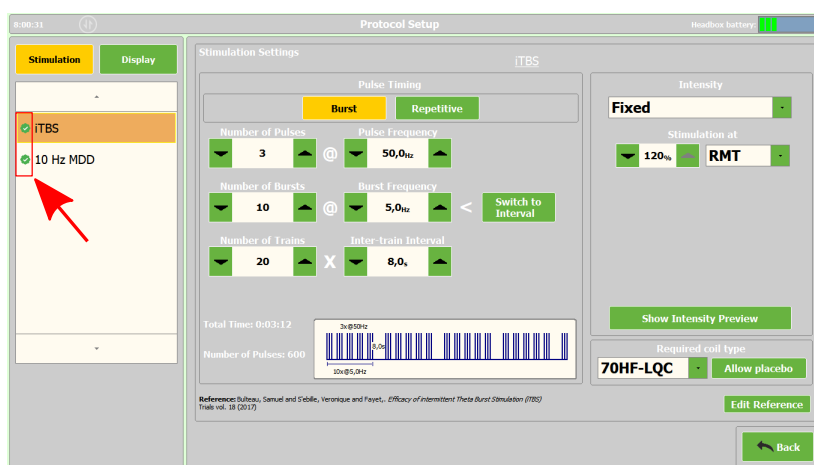


Figure 35: Approved protocols only mode. Approved protocols are marked by a green symbol.

7 User Management

The *User Management* screen may be accessed through the configuration button in the patient database screen.

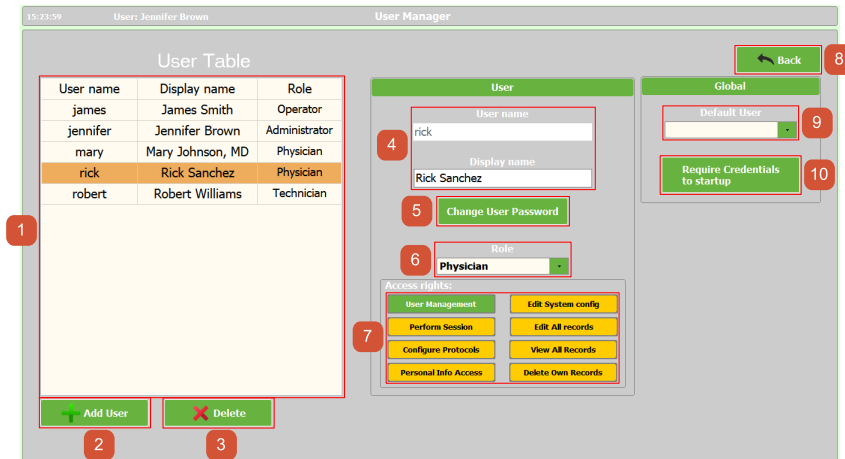


Figure 36: Repetitive protocol configuration.

- 1 Table of active users. It has three columns with user name, displayed name, and assigned role.
- 2 The *Add User* button shows a dialog where a new user name can be written. And after its confirmation, new user with the name is created. There can not be two users with the same name. The user is activated when the user name of a nonactive user is inserted.
- 3 The *Delete* button that deactivates selected users in the table of active users. The user is never deleted entirely, so that the username can be displayed in the session history. Non-active users can not log in to the system.
- 4 *User name* for login can not be changed and the name is displayed by the system in the top bar, session details, reports, etc.
- 5 *Add/Change User Password* button that pops-up the password change dialog (see sec. 7.1). A new password has to be repeated to be successfully set.
- 6 *Role* selection defines type of the selected user. By selecting a role, access rights are changed with respect to the selected role (see sec. 7.3). If a role is selected and access rights differ from default rights, then the role is marked with an asterisk at the end of its name.
- 7 Controls where individual access rights can be enabled or disabled for the selected user. When the role is selected, access rights that do not match the user role are marked by the red border of its button. (see sec. 7.2)
- 8 Navigation button returns the view to the patient database screen (see sec. 2).
- 9 Here default user name may be selected. The list of available values is updated based on active users of the system.
- 10 Button that defines if login is required after startup or if default user should be used instead of the logged user.

7.1 Password change

Bellow, a dialog for creating and changing user's password is displayed. This dialog has maximal input size of 64 UTF-8 characters.

Figure 37: Dialog for creating and changing user's password.

7.2 Access rights

User Management allows a user to access the user management screen where he/she can manage user accounts and configure login behavior.

Perform session allows a user to perform a session with a selected patient. If it is not allowed, then the user is unable to deliver any pulse, and the user has no access to the session screen (see sec. 4).

Configure Protocols allows a user to change protocol settings and default display configuration in the *Protocol Setup* screen (see sec. 6).

Personal Info Access allows a user to see patients in the patient database. If it is not allowed, then all patients not created by the logged user are collapsed into the one anonymous user with no details.

Edit System config allows a user to change the *System Configuration* (see sec. 5). If it is not allowed, then *Advanced Configurations* are not shown in the dialog, and *OK* button is not visible.

Edit All records allows a user to manage all records, i.e., delete them, change their notes. Otherwise, only records performed by a logged-in user can be managed.

View All Records allows a user to see all records. Otherwise, only records performed by the logged user are shown.

Delete Own Records allows a user to delete only his/her records of performed therapies.

Note that for all visible records, it is possible to generate a report in PDF and make an export if they are enabled.

7.3 User roles

User roles names are based on the current language settings. However, if you change language settings, already assigned roles would not be changed. A list of available roles follows. We strongly recommend not allowing any user full access rights. But rather make two users where one is Administrator just for managing user accounts, and the other is a physician with all other rights.

None role is not defined. Option for user-defined access rights that do not match any predefined role. Default option.

Administrator can only manage user accounts.

Operator can perform sessions, edit and view all records, and have access to personal information. The operator is a person who delivers most of the procedures however is not responsible for the configuration of the system and protocols.

Technician can configure protocol, access personal information, edit system configuration, edit all records and delete only own records. A technician is a person who configures and maintains the system but does not perform therapies.

Physician can do almost anything in terms of performing procedures and configuration, but he is not allowed to manage users.

Full Access is a role that grants complete control of the system to a given user.

8 Report content

Generated reports are saved to PDF files. They are not intended to be edited.

8.1 Report header

The first page of each report contains a header with patient information.

Figure 38: Report first-page header.

- 1 Type of the report. One of patient, session, MEP, protocol.
- 2 Patient card.
- 3 Stimulator identification depends on the connected stimulator.
- 4 Counts of performed sessions and step types.
- 5 Date and time when the report was created.
- 6 Current patient's RMT and AMT based on MT mode set in the *System Configuration*.

8.2 Report footer

Figure 39: Report page footer applied for all pages.

- 1 Date of the report creation. Formatting is based on the OS local configuration.
- 2 Original name of the report file.
- 3 Page number with total number of pages of the report.

8.3 Patient report

Patient report content consists of list of performed session with the patient. Each session is reported as follows.

Step ID	Date & Time	Protocol Type	Stimulation Protocol Name	Coil type	Operator	Result
1	2. 5. 2022 4:24:31	MEP	MEP	70BFX-LQC	Robert Williams	
2	2. 5. 2022 5:12:53	Repetitive	10 Hz MDD	70BFX-LQC	Robert Williams	Protocol finished
3	2. 5. 2022 5:21:42	Repetitive	10 Hz MDD	70BF-COOL	Robert Williams	Protocol finished
4	2. 5. 2022 5:30:47	Repetitive	DASH SWEEP NCG	70BF-COOL	Robert Williams	Protocol finished

Figure 40: Printed session information in patient report.

- 1 Session ID.
- 2 General session details:

1. Unique identification is a unique ID of the session.
2. Displayed name of the user who performed the session is displayed.
3. Date and time when the session was created, i.e., started.

- 3 Table of performed steps in the session.

Step ID is the order number of the session.

Date & Time when the session step started.

Protocol Type refers to the type of the pulse delivery MEP, PairPulse, Repetitive, or Burst.

Stimulation Protocol type is a Code of the stimulation protocol.

Coil type is a type of used coil to deliver individual session steps.

Operator refers to display name of the user that performed the session step.

Result contains additional information about a result of the protocol. This value depends on the protocol type:

- For MEP, it contains what type (AMT or RMT) and what intensity of MT was set.
- For Repetitive and Burst, it contains how the protocol ends, i.e., successfully or terminated prematurely.

8.4 Session report

The session report contains general session details and performed session step reports (see sec. 8.5).

8.5 Session Step report

At first, session step identification is printed - session UID, step ID, session type, date and time of the session step start and end, coil type used. Then the navigation protocol is printed if the navigation was used. Finally, the number of pulses delivered and the result (finished/unfinished) are printed.

8.5.1 MEP stimulation step report

MEP report contains the table with measured values in recorded MEPs, and at the end, individual MEP tracks as images. The number of the last listed pulses is defined during report creation (see sec. 3.3).

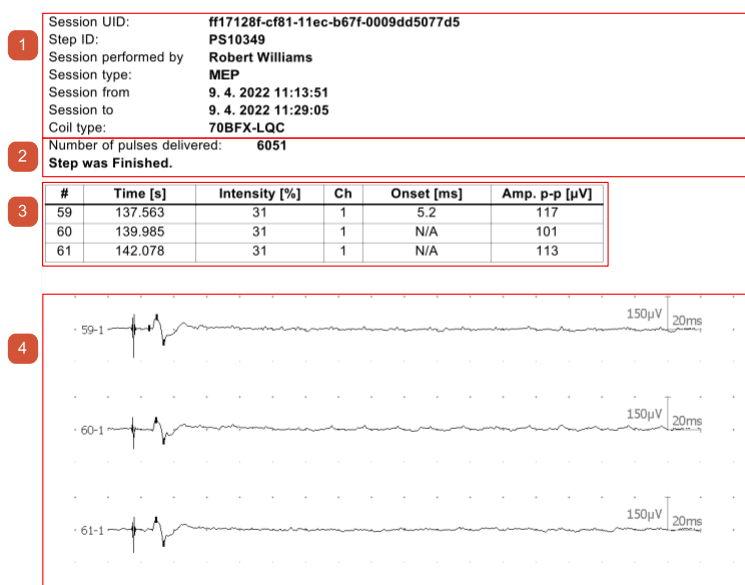


Figure 41: Printed session information in patient report.

- 1 Session step information includes session UID, step ID, name of the user that performed the step, session type (MEP in this case), beginning and end of the step, and used stimulator SN and coil type. The user is not printed when the default user was signed in during the therapy.
- 2 Summary of delivered pulses and result of the session step.
- 3 Table of individual pulse measures. The table contains the following 6 columns:
 - # is a sequence number of the pulse in the session step.
 - Time [s] is a column with a time from the session step beginning in seconds.
 - Intensity refers to the MSO intensity used to deliver a pulse.
 - Ch column contains a number of channel on EMG device measured.
 - Onset [ms] is a latency measured in ms. The value is *N/A* if the marker for latency (*I*) is not set.
 - Amp. p-p [μV] is a p-p amplitude measured in μV . The value is *N/A* if one or both markers for amplitude (*A+* and *A-*) are not set.
- 4 Recorded signals printed as images.

8.5.2 Protocol stimulation step report

1

Session UID: 2928B657-406D-4E17-AA2B-42658CA60063
 Step ID: PPS00015
 Session type: Burst
 Session from: 9. 5. 2022 13:24:28
 Session to: 9. 5. 2022 13:28:41
 Coil type: 50BF

2

Number of pulses delivered: 600
 Step was Finished.

3

Protocol Name: ITBS from 80%
Reference
 Author: Bulteau, Samuel and S'ebille, Veronique and Fayet,
 Title: Efficacy of intermittent Theta Burst Stimulation (iTBS)
 Source: Trials vol. 18 (2017)
 Protocol Type: Burst
 Number of Pulses: 3
 Pulse Frequency: 50.00Hz
 Number of Bursts: 10
 Burst Frequency: 5.00Hz
 Number of Trains: 20
 Inter-train Interval: 8.0s
 Base Intensity: 120% RMT
 Starts at 96% RMT
 Total Pulses: 600
 Total Time: 0:03:12

4

Protocol events

Time	Remaining	Event	Description
0:01:36	300	Pause	Paused by Operator - coil control button
0:02:12	300	Continue	Paused for 0:00:35
0:03:49	0	Finished	
0:04:12	0	Protocol End	

Figure 42: Printed session information in patient report.

- 1 Session step information includes session UID, step ID, name of the user that performed the step, session type (Burst in this case), beginning and end of the step, and used stimulator SN and coil type. The user is not printed when the default user was signed in during the therapy.
- 2 Summary of delivered pulses and result of the session step.
- 3 Protocol description including name, technical specification, reference to the related article if defined, and protocol summary.
- 4 Protocol events table with the following columns:

Time column is the time from the first sent pulse.

Remaining is the number of remaining pulses at the event time.

Event column shows what event was encountered at a given moment of the protocol. Events are the following:

Pause,

Continue,

Undelivered when some pulse or pulses were not delivered,

Finished when the protocol runs to its end,

Protocol End when the user leaves the session step.

Description is an event's further specification.

Pause: Reason for the pause initialization.

Continue: Length of the pause.

Undelivered: How many pulses were not delivered.

Finished: Nothing.

Protocol End: Protocol's end reason.

9 Navigation between screens

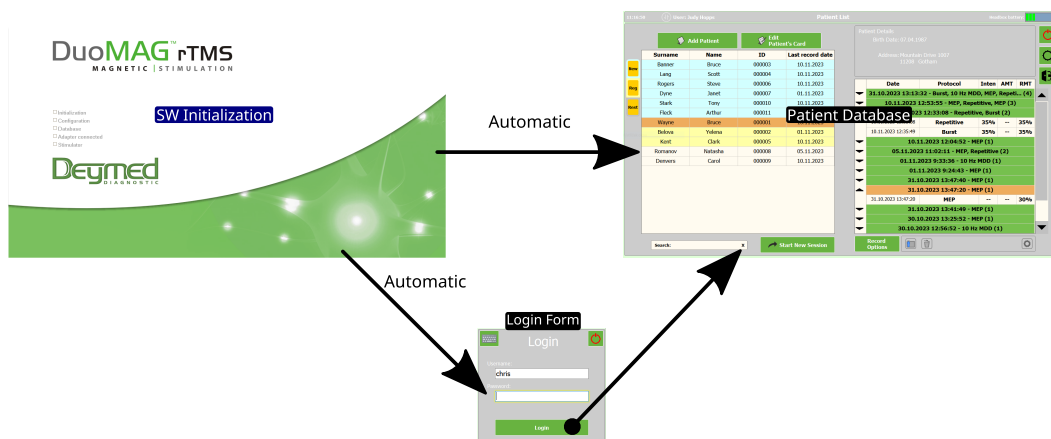


Figure 43: SW Initialization screen navigation options.

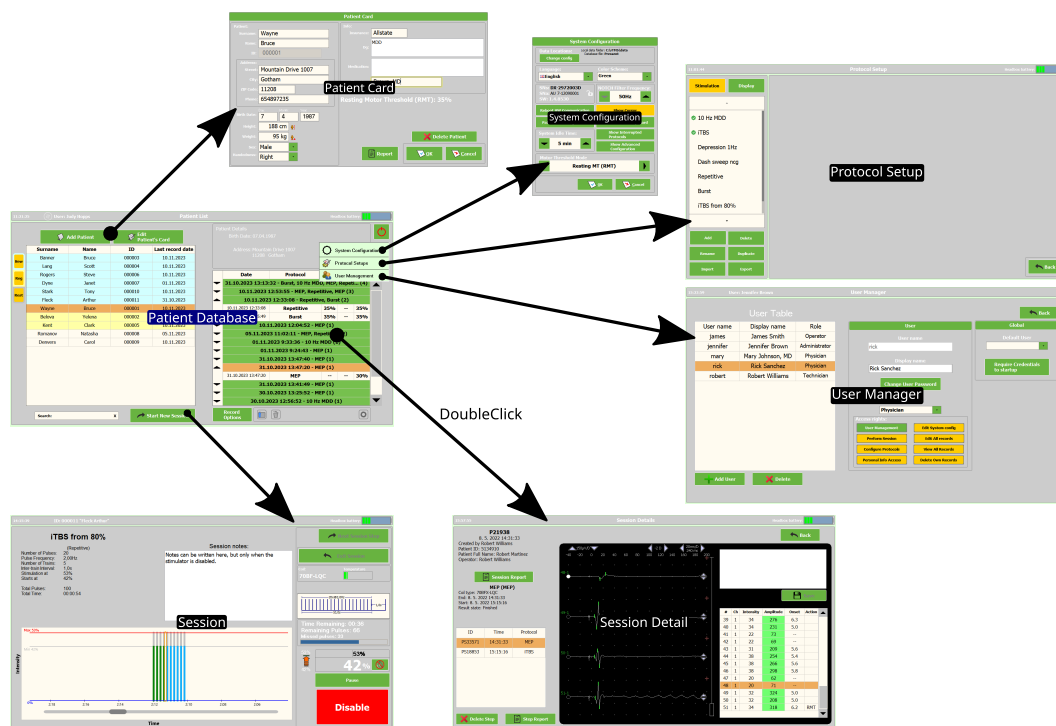
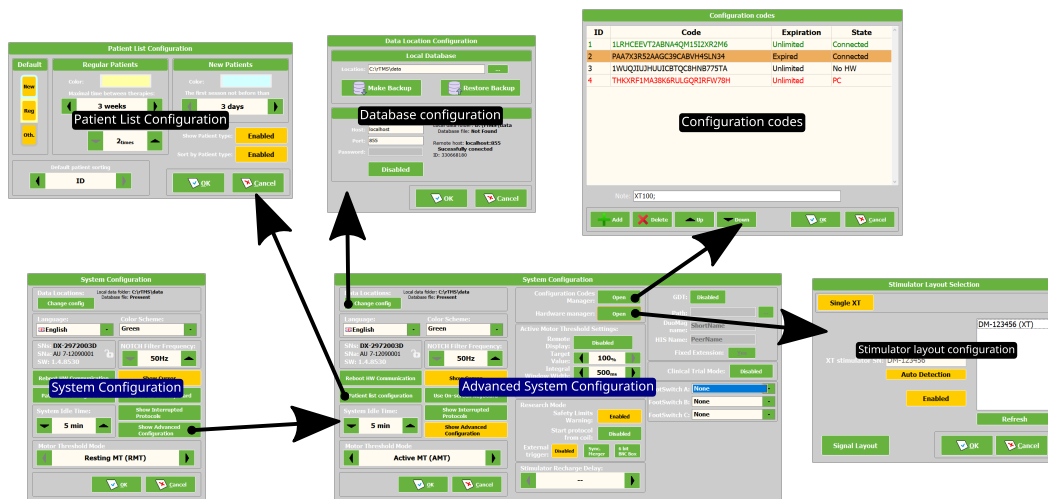


Figure 44: Patient database screen navigation options.



Part III

Common use cases

10 Standard session

10.1 Adding new patient

1. In the *Patient List* screen, click on the *Add Patient* button.

2. Edit fields that you need. Make sure that the *ID* is filled. See section 2.3 for more information about field restrictions.

3. Press the *OK* button in the right bottom corner.
4. A new patient has been created and it is selected.

What could go wrong?

Firstly, the patient ID needs to be unique because of that if you press the *OK* button in step 3 and the ID is already in the database, an informative dialog is shown (see fig. 46).

Secondly, the birthdate is also validated when you try to confirm the dialog. If it is not valid (e.g. 31.2.XXXX or XX.XX.1800), then another informative dialog (see fig. 47) pops-up.

Figure 46: A dialog that is opened when the patient ID with some ID is in the database.

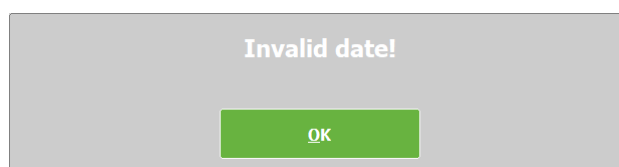
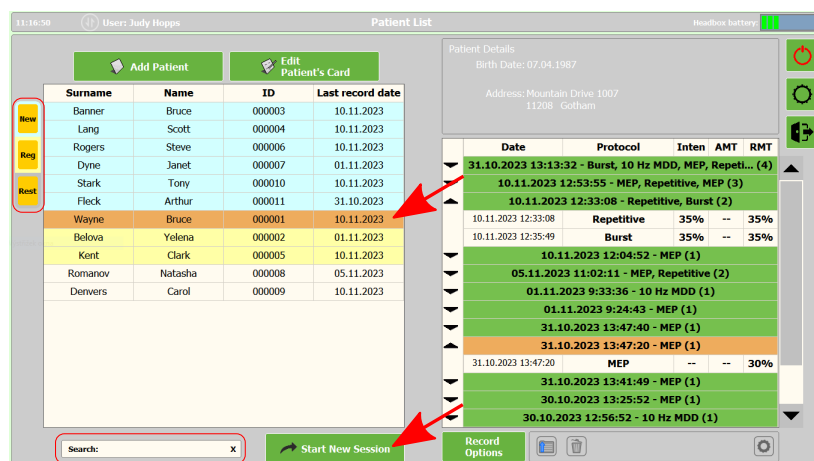


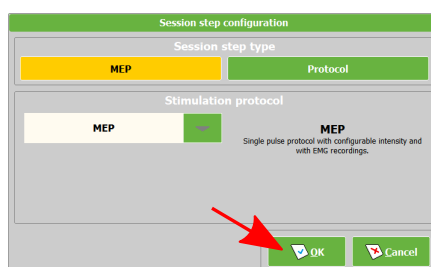
Figure 47: A dialog that pops-up when the date on the patient card is invalid.

10.2 MT determination (MEP recording)

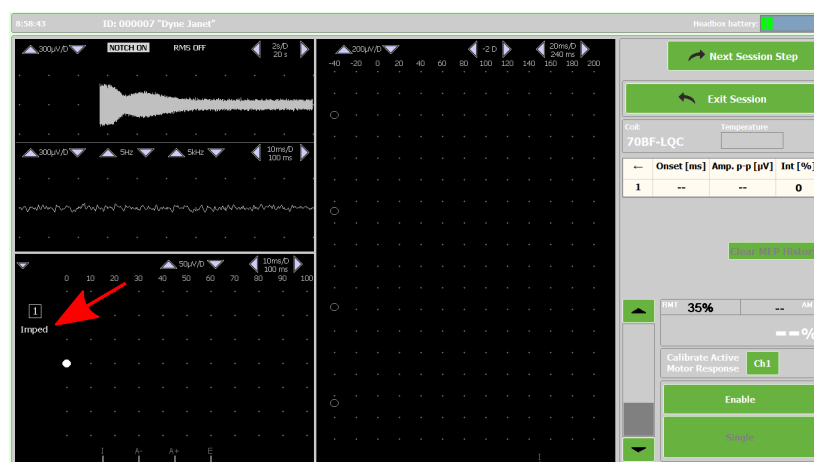
1. Select a patient by selecting a particular row in a patient table and click the *Start New Session* button. Optionally, use search or other filtering options to find the desired patient faster.



2. Confirm *MEP* stimulation selection by clicking the *OK* button. (*MEP* session step is selected by default).



3. Optionally, check the impedance by pressing *Imped*.



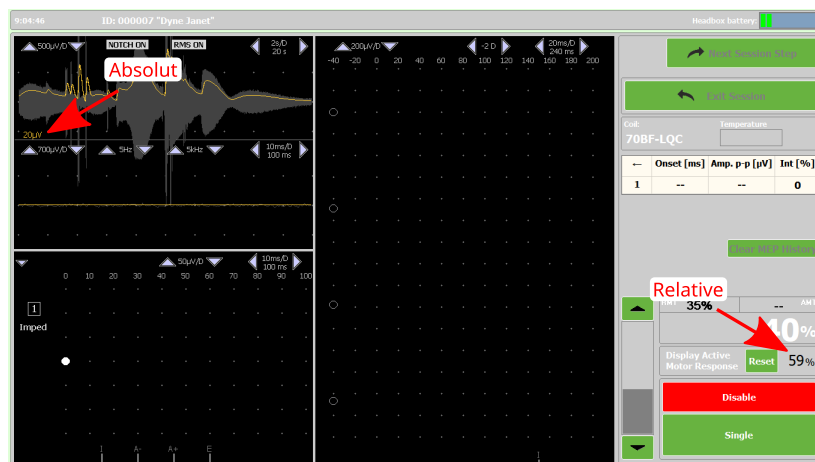
4. For AMT, calibrate the desired channel while the patient activates the measured muscle.
5. *Enable* the stimulator.



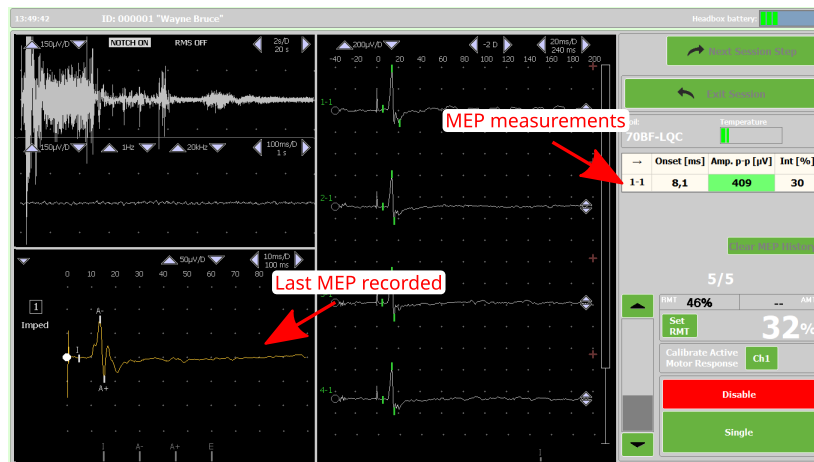
6. Adjust stimulation intensity in the SW or by the coil wheel.



7. For AMT, check relative and absolute response levels. The absolute response level is visible only if RMS is ON.



8. Deliver a pulse by clicking the coil button or the *Single* button at the bottom right corner of the SW.
9. Check response. Optionally, markers in the last MEP record may be adjusted.



10. Repeat from step 6 until you find MT. Usually, it means that exactly 5 of the last 10 pulses have desired response on the same stimulation intensity.
11. Set MT by clicking the *Set AMT* or *Set RMT* button.
12. *Disable* the stimulator.



13. Done. MT for the current patient is set. Optionally, you may continue to protocol stimulation (see 10.3).

What could go wrong?

EMG signal is affected by surrounding noise which can be turned down by filters. The electrical grid is the most common noise source in the EMG signal. The NOTCH filter is designed to remove such noise (see fig. 48 where the surrounding noise is recorded with disabled NOTCH filter). In addition, the SW provides upper and lower bound filters for additional noise control (see sec. 6.1).

HW issues are reported during the session in the red dialog in the middle of the screen (see fig. 49). Temperature warnings are the most common and may be resolved by waiting until the device is cooled down. With connection issues, you should check a particular connection and try another cable if possible. If the above mentioned persists or for other issues, try to reboot the system. Finally, when the reboot does not help, or the issue persists, contact the distributor or manufacturer.

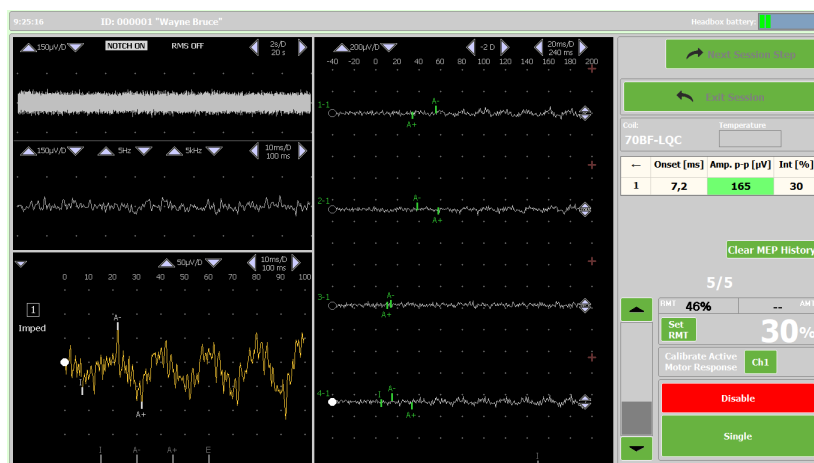


Figure 48: MEP recording power line noise with NOTCH filter disabled.

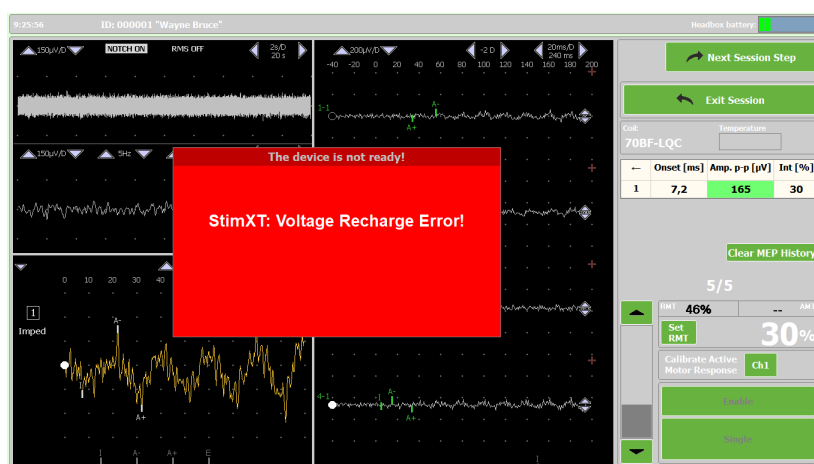
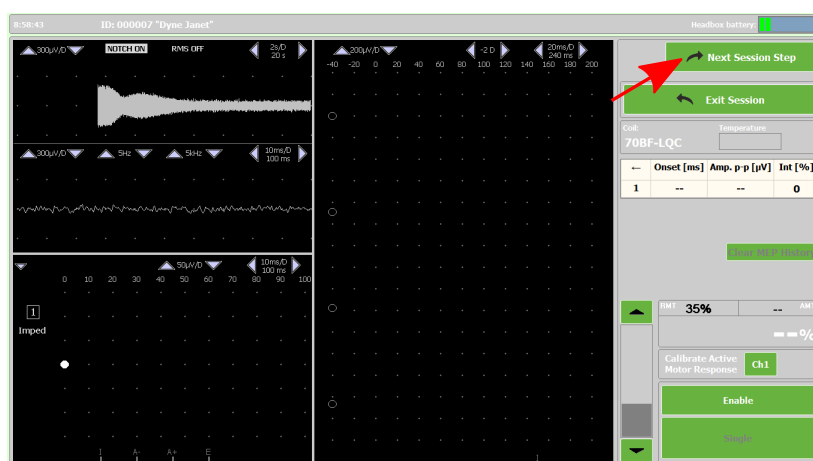


Figure 49: HW issue during the session.

10.3 Protocol stimulation

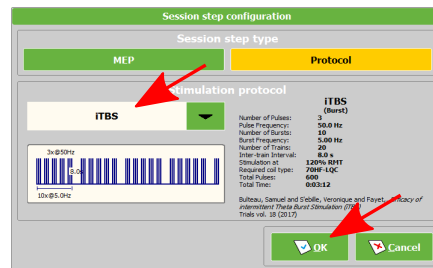
We recommend performing MT determination before any protocol stimulation. Therefore, this process assumes that you have performed MT determination and you want to continue to the next step of the session. If, for whatever reason, you want to start protocol stimulation without MT determination, it is possible by selecting the patient and starting the protocol stimulation step as in step 2 in this use case.

1. Select the *Next Session Step* option.

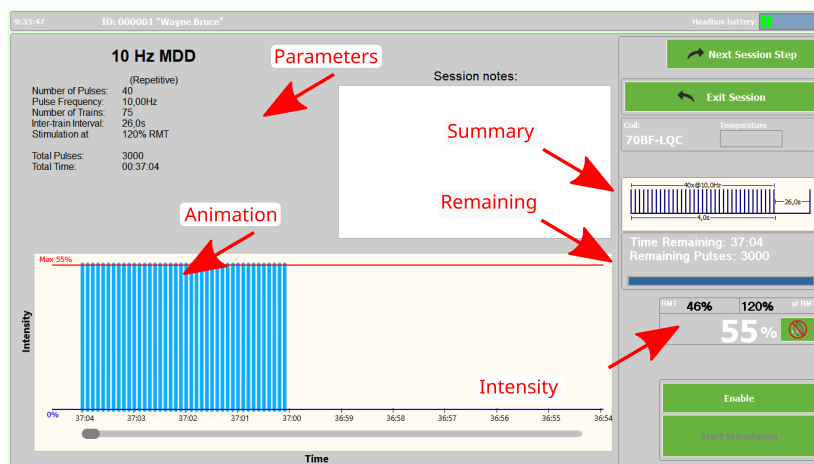


- Choose a protocol that you want to perform by name and confirm your selection by clicking the **OK** button . (*Protocol* stimulation step is selected by default)

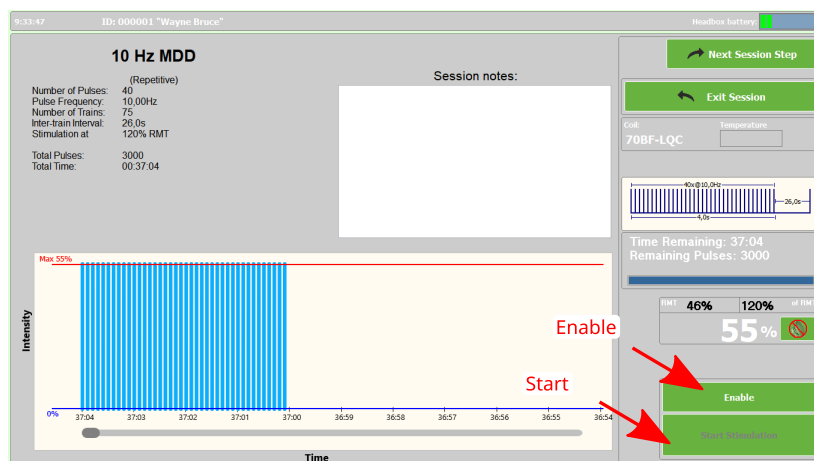
Note: If the protocol intensity is relative to AMT or RMT, it is possible to start such protocol only when the selected patient has configured MT. Otherwise, you must perform the *MEP* step first and configure the MT.



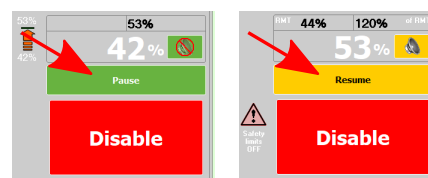
- Check the protocol configuration. We encourage users to check protocol configuration each time before it is delivered to avoid delivering potentially misconfigured protocol.



- Enable the stimulator.
- Start the protocol.



- Optionally, the protocol can be paused and continued. The pause may be initialized by the coil button, but the pressing button in the SW is required for continuation.



7. Wait until the protocol ends and monitor the patient during the stimulation.
8. Write additional notes when needed and when the protocol is paused.
9. Leave the session by pressing the *Exit Session* button.



What could go wrong?

Coil overheating is the most common protocol stimulation issue. It can be caused by HW issues or by HW and environment limitations. Even coil with the cooling system has its limitations. The coil may overheat during protocols with extensive stimulation and high intensities (65% and more). If you are experiencing coil overheats regularly, lowering the room temperature and turning the liquid cooling system ON about 5 min before the therapy might help.

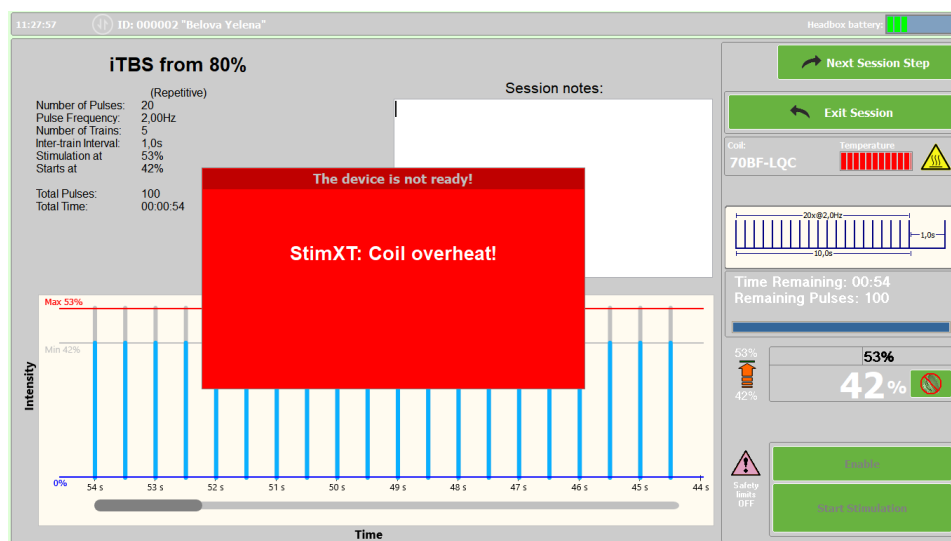
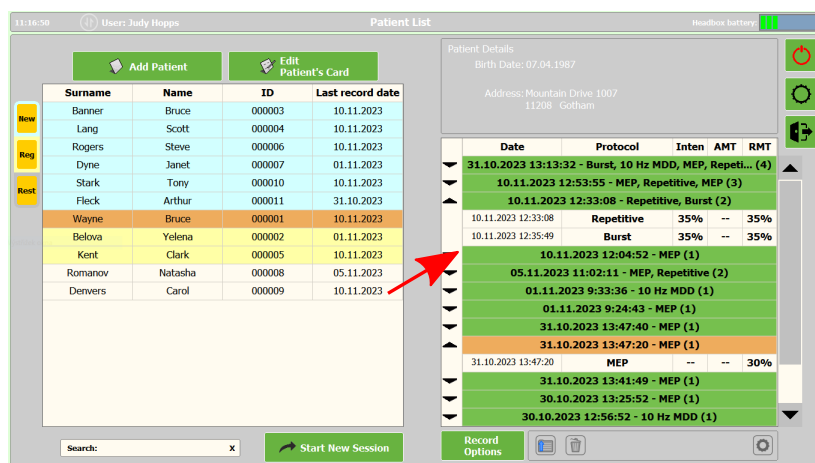


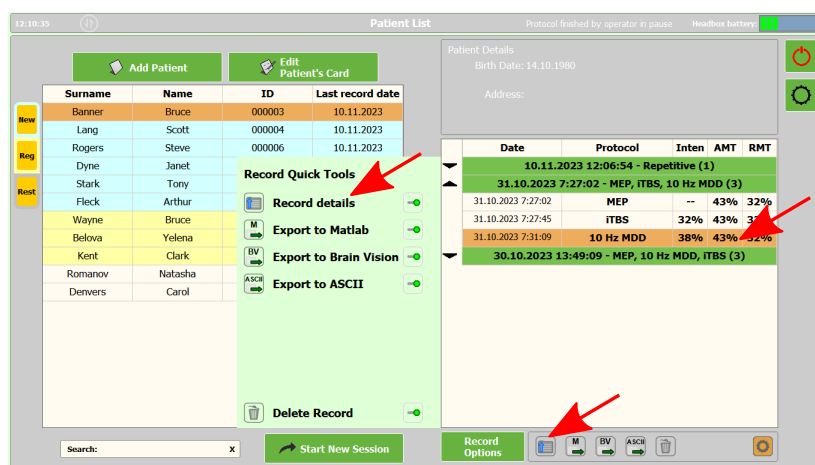
Figure 50: HW issue during the session.

10.4 Review performed session and write additional notes

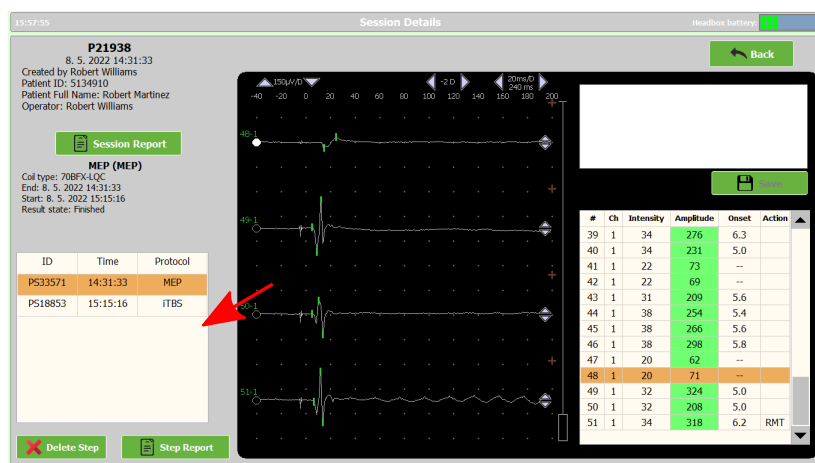
1. Select a patient by selecting a particular row in a patient table. Optionally, use search or other filtering options to find the desired patient faster.
2. Find the session in the patient's record table.



3. Open details by double click or tap. You may also click on the show details option. By doing so, the *Session Details* screen (see sec. 3) is opened.

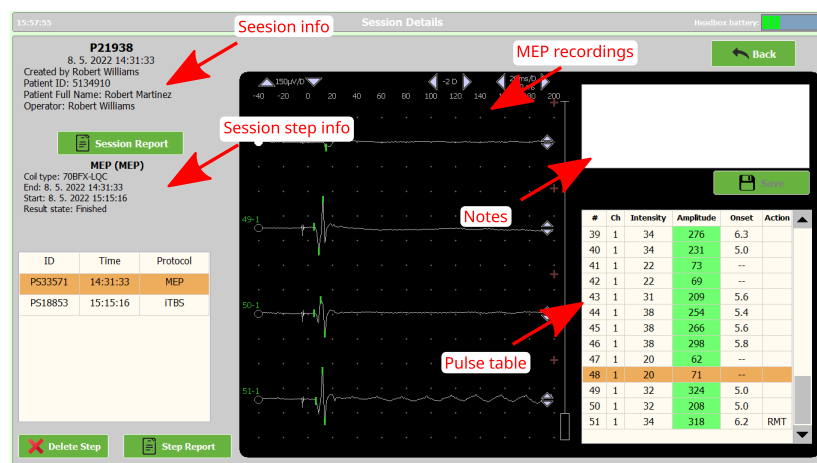


4. Select session step.

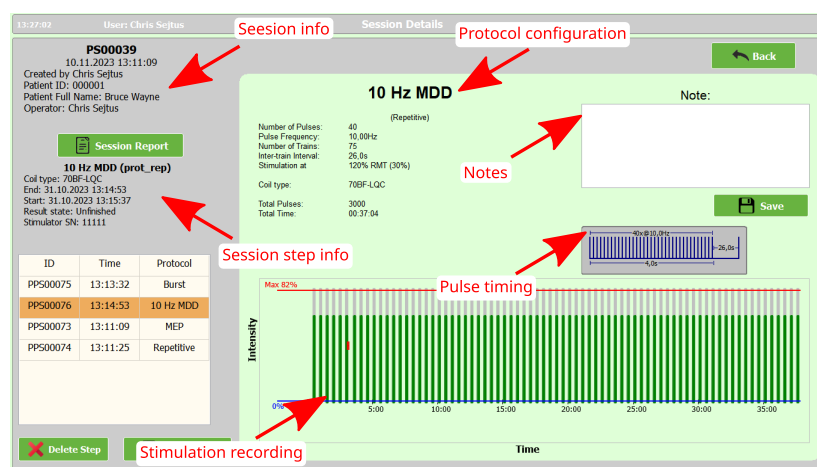


5. Review information.

(a) MEP stimulation



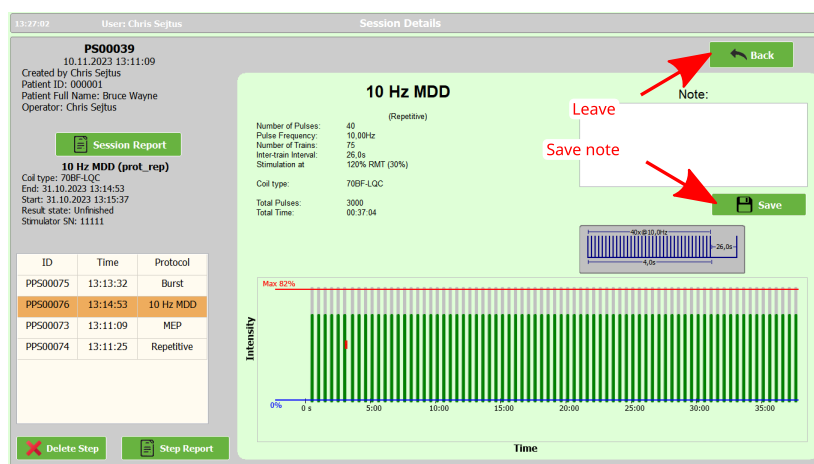
(b) Protocol stimulation



6. Write an additional note to the note field shown in the figures above.

7. Save the note with the *Save* button.

8. Leave the *Session Details* screen by pressing the *Back* button.



What could go wrong?

MEP recordings are stored in separate files. The dialog (see fig. 51) pops-up if this file is not accessible and such recording is selected.

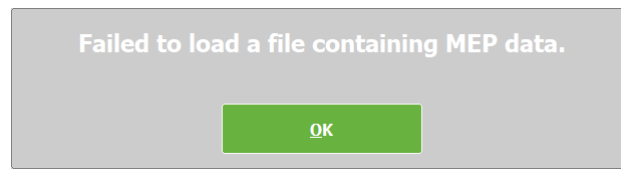
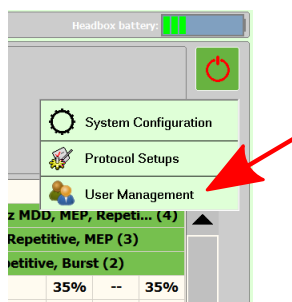
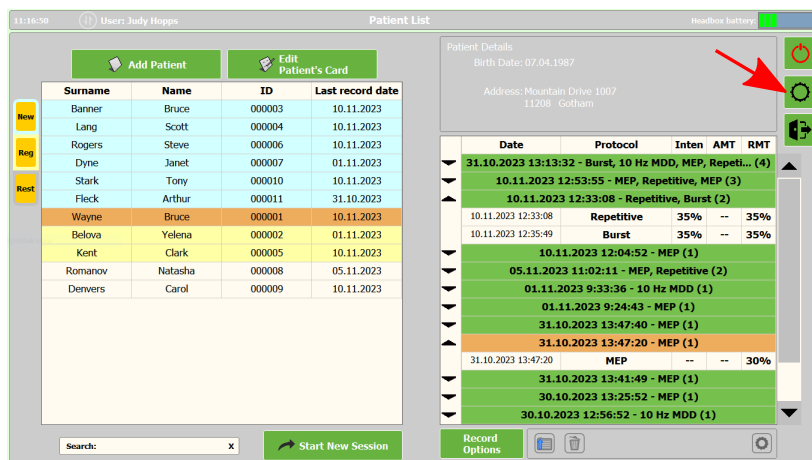


Figure 51: A dialog that pops-up when the recording file is not accessible.

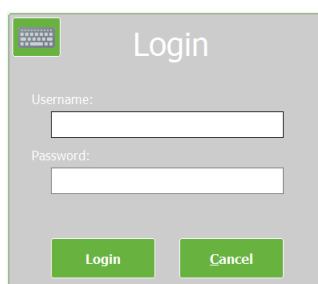
11 Adding new user

If login is required on the system to access the patient database, the following first two steps are swapped.

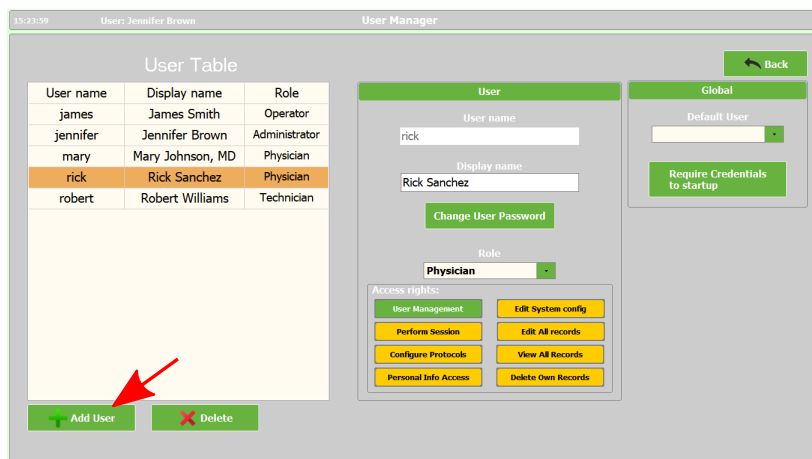
1. Open the *User Manager* screen (see sec. 7) by clicking the configuration button and selecting the *User Management* option.



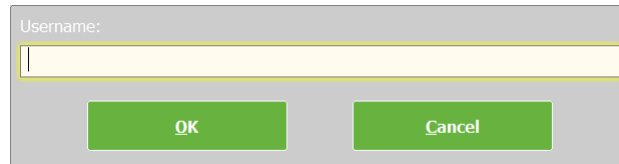
2. Login as a user with user management permissions.



3. Press the *Add User* button.

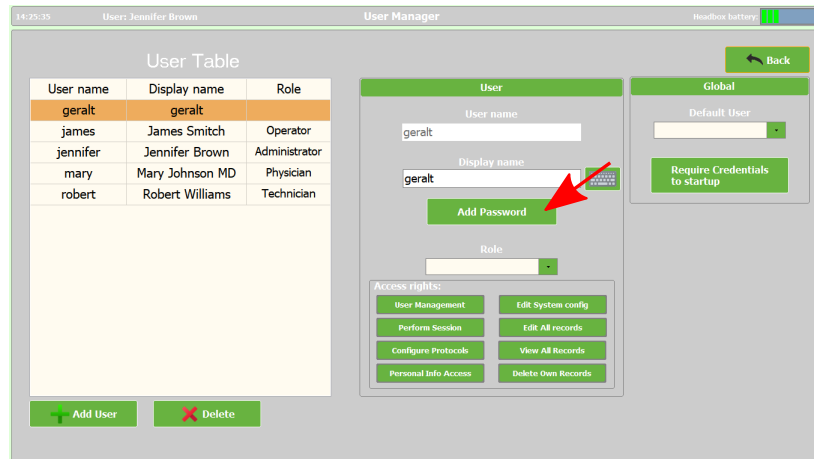


4. Insert the user name of a new user and press the *OK* button.



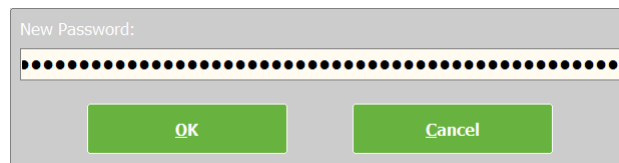
A dialog box with a title bar. It contains a text input field labeled "Username:" and two buttons: "OK" and "Cancel".

5. Add and confirm the password of the user.

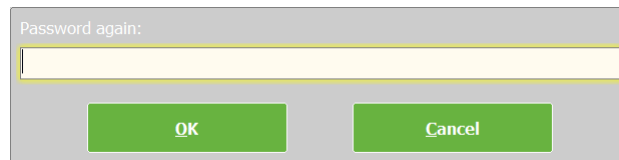


The "User Manager" interface shows a "User Table" on the left and a "User" configuration panel on the right. The "User" panel has fields for "User name" (geralt), "Display name" (geralt), and "Role" (Operator). A red arrow points to the "Add Password" button. The "Global" panel shows "Default User" and "Require Credentials to startup".

User name	Display name	Role
geralt	geralt	Operator
james	James Smith	Administrator
jennifer	Jennifer Brown	Physician
mary	Mary Johnson MD	Technician
robert	Robert Williams	

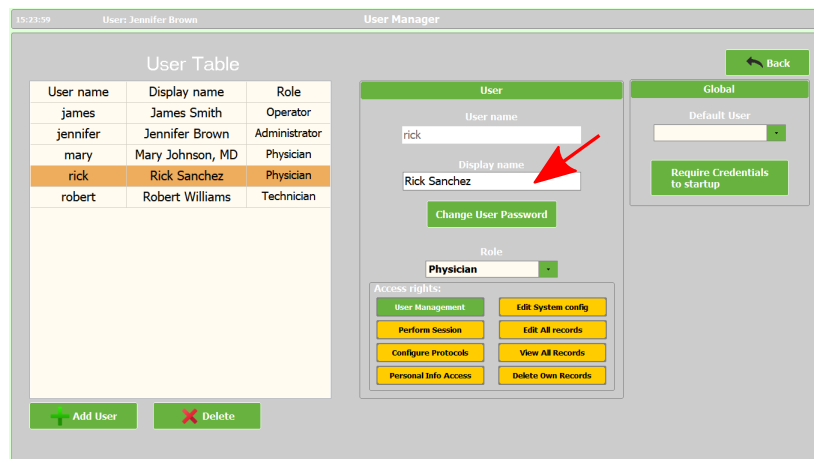


A dialog box with a title bar. It contains a password input field labeled "New Password:" and two buttons: "OK" and "Cancel".



A dialog box with a title bar. It contains a password input field labeled "Password again:" and two buttons: "OK" and "Cancel".

6. Change the *Display Name* of the user to his/her full name.



The "User Manager" interface shows the "User" configuration panel with "User name" (rick), "Display name" (Rick Sanchez), and "Role" (Physician). A red arrow points to the "Display name" field. The "Global" panel shows "Default User" and "Require Credentials to startup".

User name	Display name	Role
james	James Smith	Operator
jennifer	Jennifer Brown	Administrator
mary	Mary Johnson, MD	Physician
rick	Rick Sanchez	Physician
robert	Robert Williams	Technician

7. Change the *Role* and/or individual permissions of user to your needs. The rule for least permissions should be applied (see sec. 7.2 and 7.3 for more information about access rights and roles, respectively).

15:23:59 User: Jennifer Brown User Manager

User Table

User name	Display name	Role
james	James Smith	Operator
jennifer	Jennifer Brown	Administrator
mary	Mary Johnson, MD	Physician
rick	Rick Sanchez	Physician
robert	Robert Williams	Technician

User

User name: rick

Display name: Rick Sanchez

Change User Password

Role: **Physician**

Access rights:

- User Management
- Edit System config
- Perform Session
- Edit All records
- Configure Protocols
- View All Records
- Personal Info Access
- Delete Own Records

Global

Default User: [dropdown]

Require Credentials to startup

Back

Add User Delete

8. Leave the *User Manager* screen.

15:23:59 User: Jennifer Brown User Manager

User Table

User name	Display name	Role
james	James Smith	Operator
jennifer	Jennifer Brown	Administrator
mary	Mary Johnson, MD	Physician
rick	Rick Sanchez	Physician
robert	Robert Williams	Technician

User

User name: rick

Display name: Rick Sanchez

Change User Password

Role: **Physician**

Access rights:

- User Management
- Edit System config
- Perform Session
- Edit All records
- Configure Protocols
- View All Records
- Personal Info Access
- Delete Own Records

Global

Default User: [dropdown]

Require Credentials to startup

Back

Add User Delete

What could go wrong?

The user that you sign in step 2 doesn't have user management permissions. When that happens, an informative dialog (see fig. 52) is shown. If you accidentally log in as a user without permissions needed, then you have to log out first by pressing the logout button in the *Patient List* screen and after that log in as the user with needed permissions.

Sorry, you do not have required permissions.

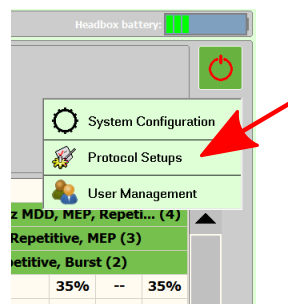
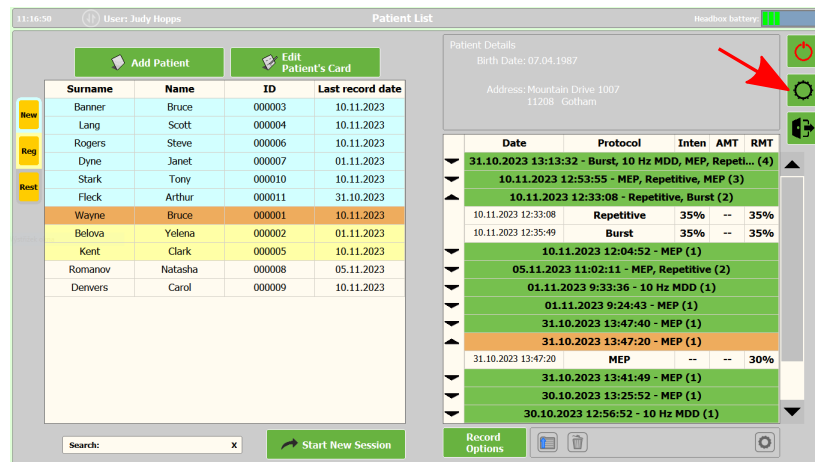
OK

Figure 52: A dialog that pops-up when the user doesn't have user management rights.

12 Protocol setup

12.1 New Stimulation protocol setup

1. Open the *Protocol Setup* screen (see sec. 6).



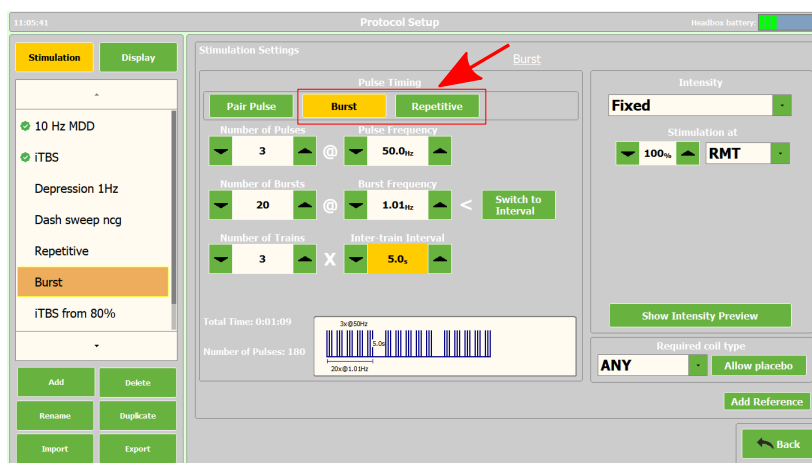
2. Create a new protocol.



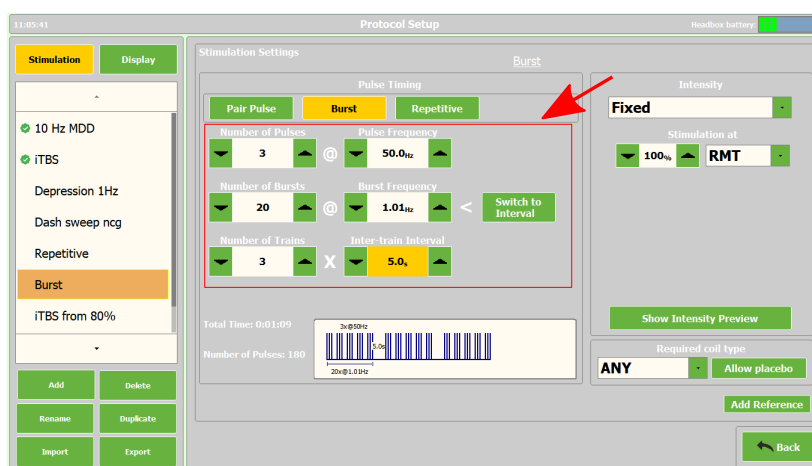
3. Insert the new protocol's name.

This is a dialog box for entering a protocol name. It has a text input field with the placeholder 'Enter name:'. Below the input field are two buttons: 'OK' and 'Cancel'.

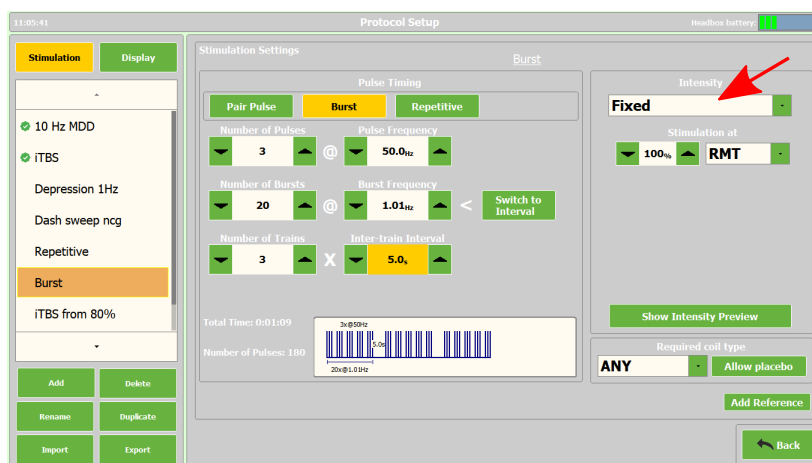
4. Select a protocol type (*Burst* with high-frequency bursts or *Repetitive*).



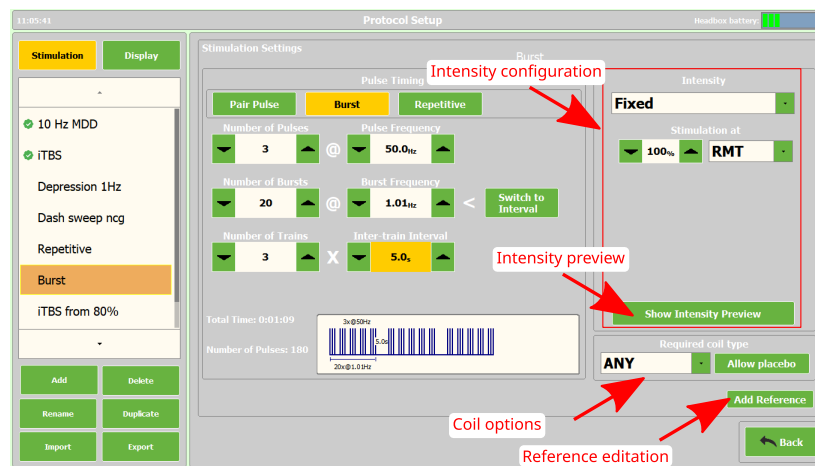
5. Configure pulse timing (see sec. 6.2.3 and 6.2.2 for burst and repetitive protocol setups, respectively).



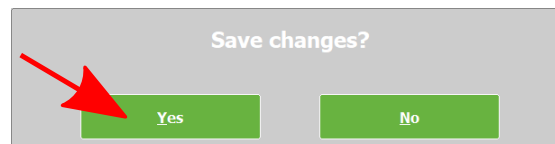
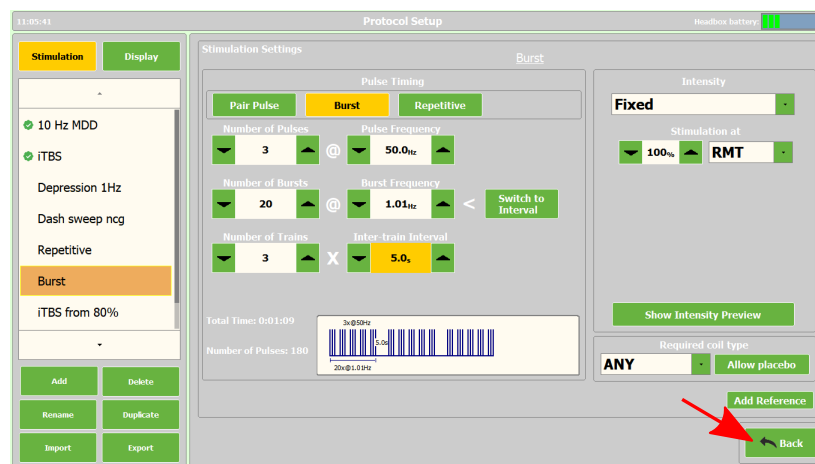
6. Select intensity policy. Displayed options are based on your configuration code, but at least the *Fixed* option is available in all cases.



7. Configure intensity.
8. Optionally, see the intensity preview (see sec. 6.2.6).
9. Optionally, edit the protocol's reference (see sec. 6.2.7).

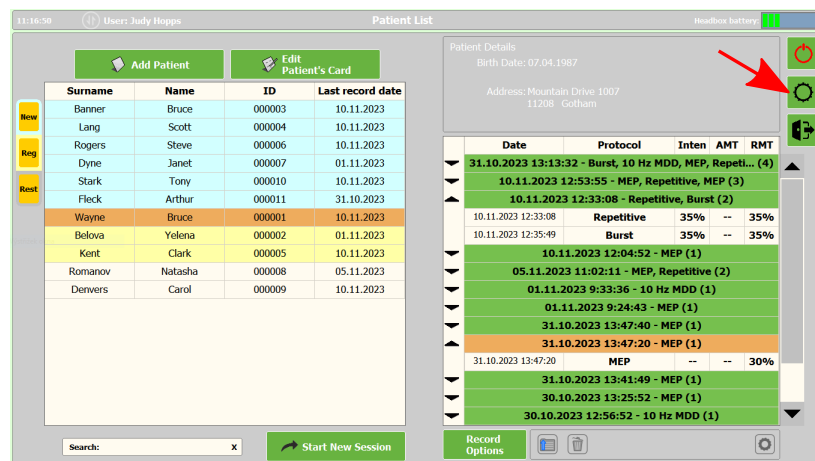


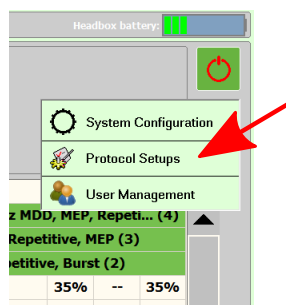
10. Save changes.



12.2 Changing MEP default configuration

1. Open the *Protocol Setup* screen (see sec. 6.2).

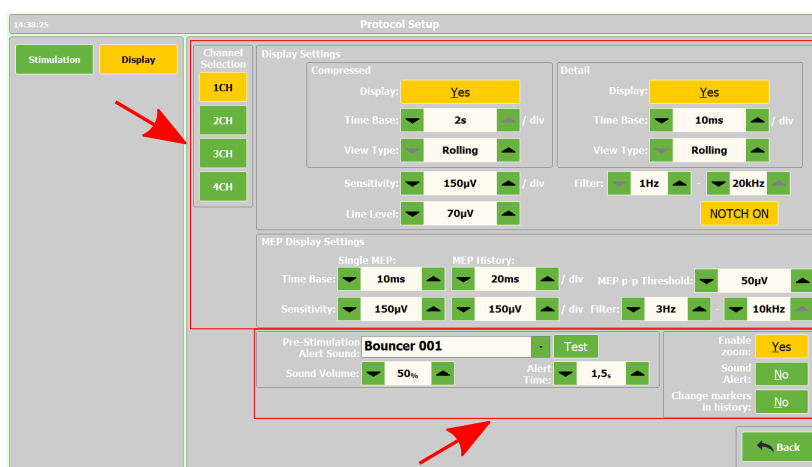




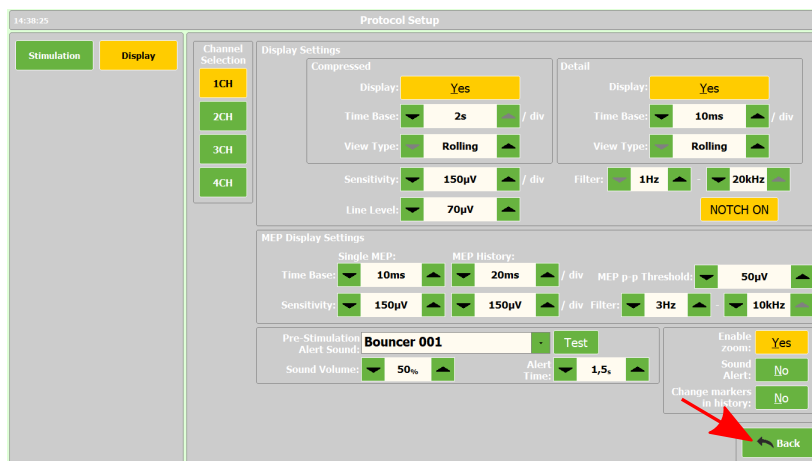
2. Open display and audio configuration (see sec. 6.1) by pressing the *Display* button.

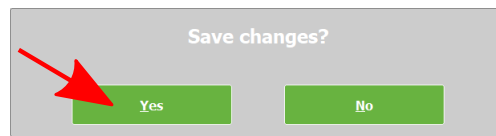


3. Configure MEP options (see sec. 6.1.1).



4. Save changes.

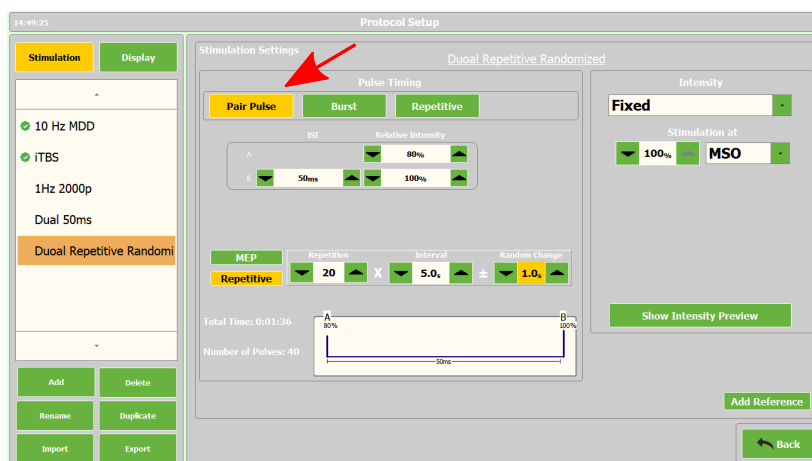




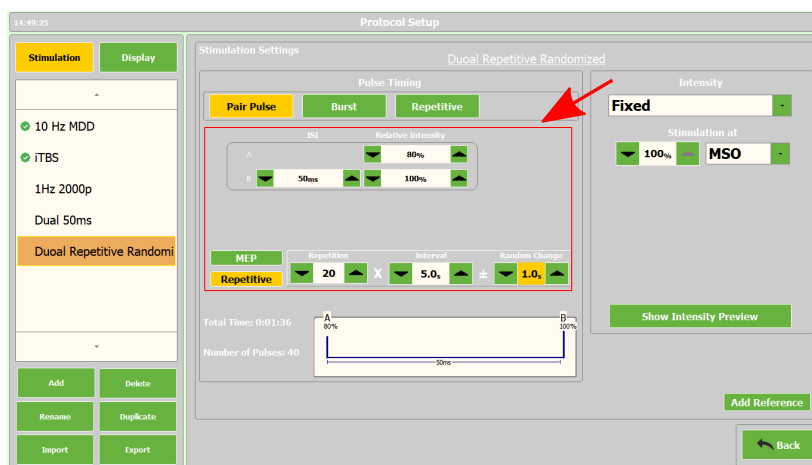
13 MP Dual

13.1 Protocol setup

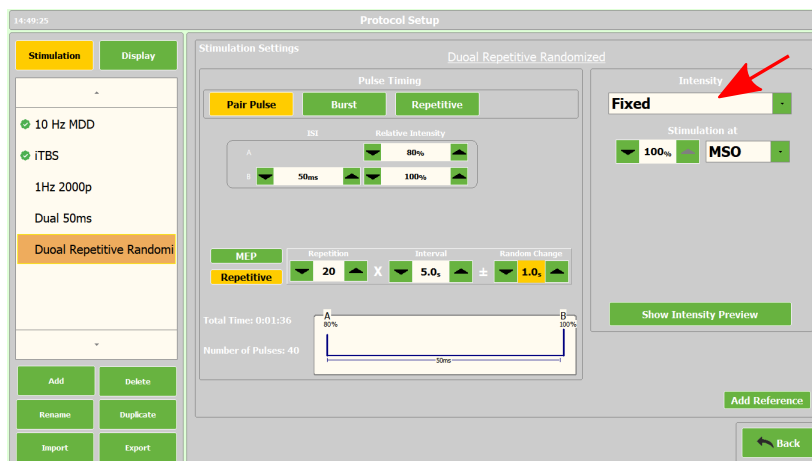
1. Open the *Protocol Setup* screen (see sec. 6).
2. Create a new protocol.
3. Insert the new protocol's name.
4. Select a protocol type (*Pair pulse*).



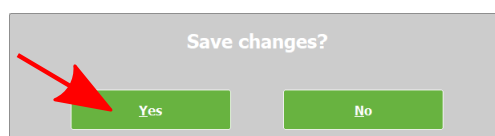
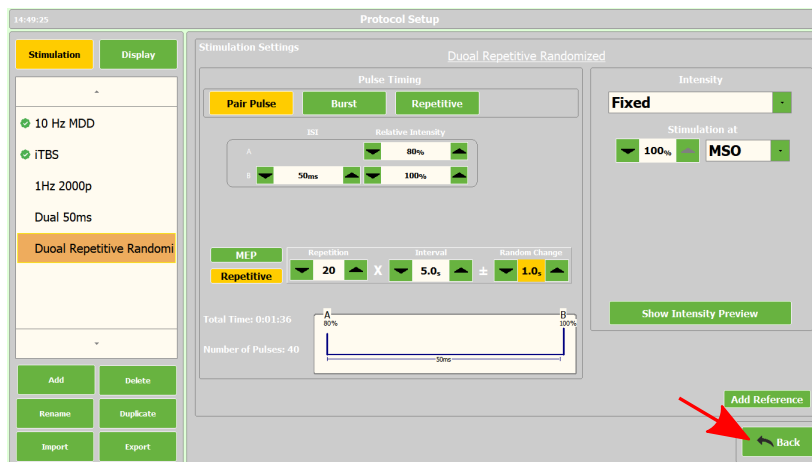
5. Configure *Pair pulse* stimulation (see sec. 4.4). You can configure either *MEP* stimulation or *Repetitive* stimulation.



6. For repetitive stimulation, select the intensity policy. Displayed options are based on your configuration code, but at least the *Fixed* option is available in all cases.



7. Save changes.

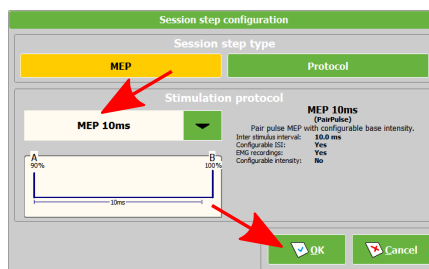


13.2 Dual pulse MEP with EMG

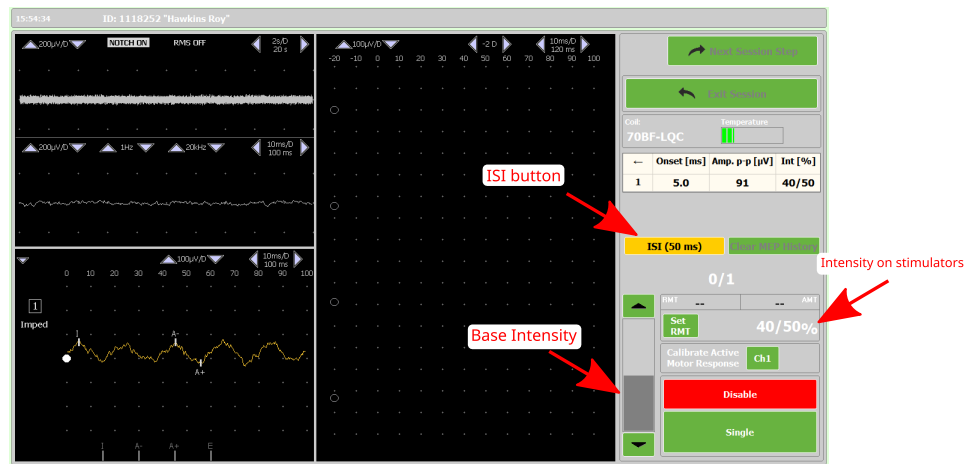
In this use case we describe the dual pulse stimulation with EMG recordings. It is also possible to stimulate without EMG or alternatively deliver a protocol consisting of pair pulses.

Further, some steps are shortened and without a thorough explanation (see sec. 10.2 and 10.3, that describe the pulse delivery with one stimulator).

1. Select a patient.
2. Select desired protocol from the list of preconfigured MEP stimulations (protocol with enabled EMG recordings). Then press *OK*.



3. Optionally, check the impedance by pressing the *Imped.*
4. Enable stimulators by pressing *Enable* button.
5. Adjust base stimulation intensity in SW or by the coil wheel. Intensity on the stimulators is computed from the base intensity and is displayed on the screen.
6. Adjust ISI value by enabling the *ISI* button and then moving with coil wheel.



7. Deliver a pulse by clicking the coil button or the *Single* button at the bottom right corner of the SW.
8. Check the response. Optionally, markers in the last MEP record may be adjusted.
9. Repeat from step 5 as many times you want.
10. *Disable* the stimulator.

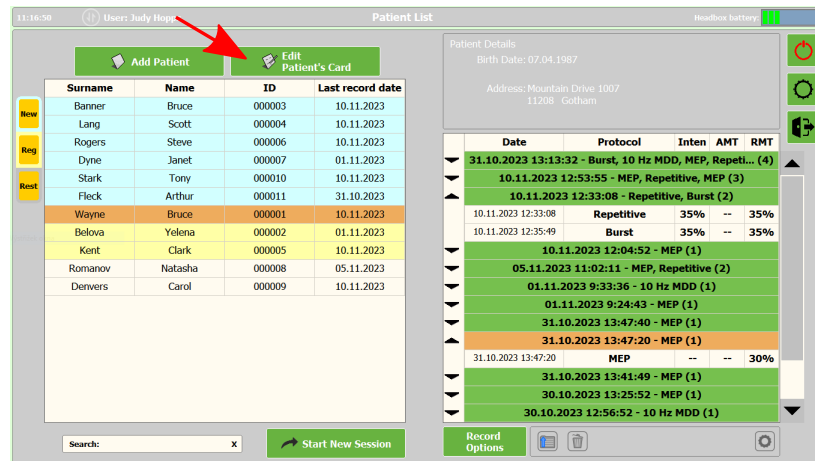
What could go wrong?

In step 2, if you do not see a list of preconfigured MEP when you click on the name or the down arrow, you should check if you have configured at least one protocol as pair pulse with MEP.

14 Report creation

14.1 Patient

1. Select a patient by selecting a particular row in a patient table. Optionally, use search or other filtering options to find the desired patient faster.
2. Open the *Patient Card* dialog (see sec. 2.3).



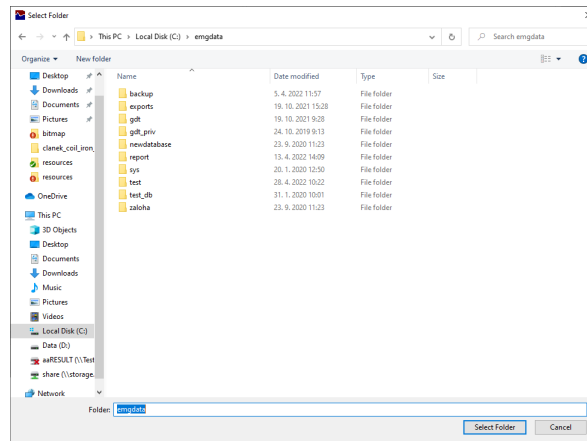
3. Select the *Report* creation option.

The screenshot shows the 'Patient Card' dialog. It contains fields for Patient information (Surname: Wayne, Name: Bruce, ID: 000001), Address (Street: Mountain Drive 1007, City: Gotham, ZIP Code: 11208, Phone: 654897235), Birth Date (7/4/1987), Height (188 cm), Weight (95 kg), Sex (Male), and Handedness (Right). There are also fields for Insurance (Allstate), Dg (MDD), Medication, and Physician (Brown, MD). A red arrow points to the 'Report' button at the bottom right.

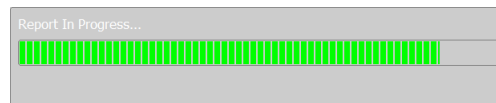
4. Configure the report filename and press the *Continue*.

The screenshot shows the 'Report settings' dialog. It has a section 'Choose parts of the filename:' with three buttons: 'Subject ID', 'Subject Full Name', and 'Subject Birth date'. Below these, there's a preview of the filename: 'Patient_000001_3527257_220505-125332.pdf'. A red arrow points to the 'Continue' button at the bottom.

5. Choose a directory where the report file should be created.



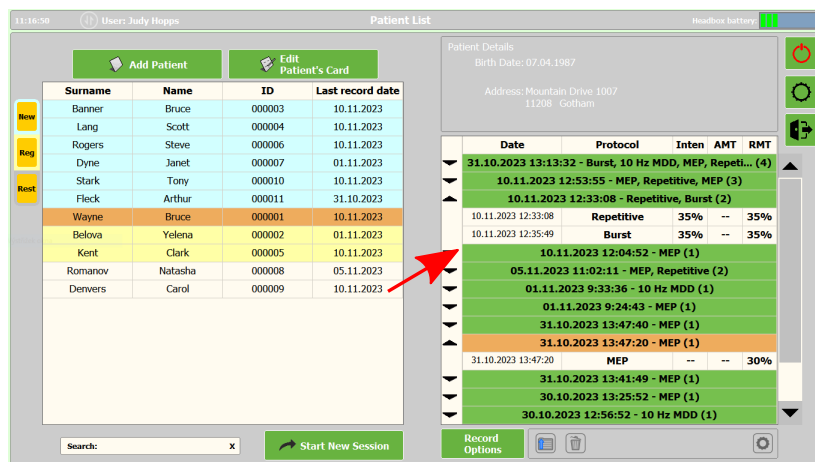
6. Wait until the report is finished.



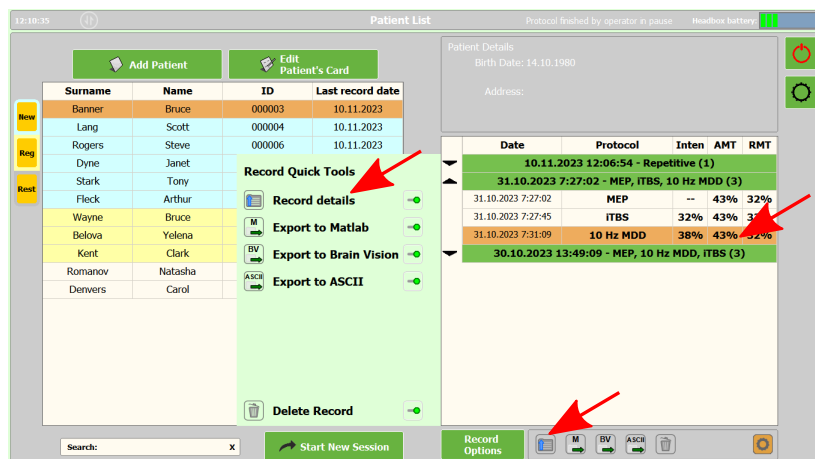
7. It is done when the progress bar dialog is closed.

14.2 Session

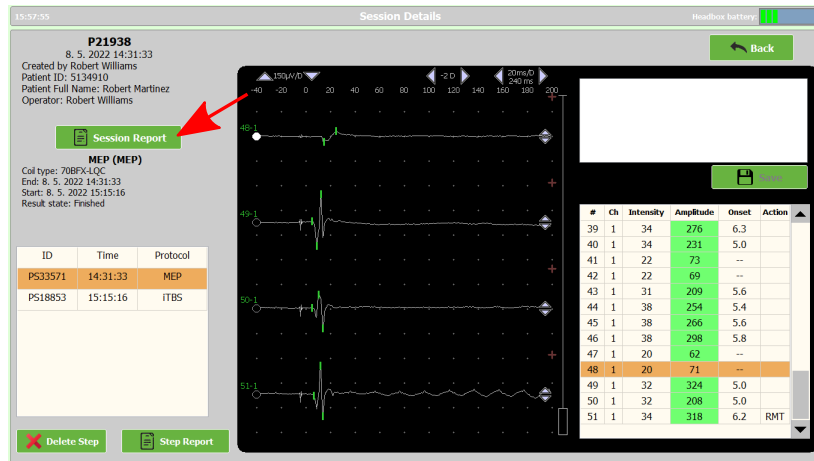
1. Select a patient by selecting a particular row in a patient table. Optionally, use search or other filtering options to find the desired patient faster.
2. Find the session in the patient's record table.



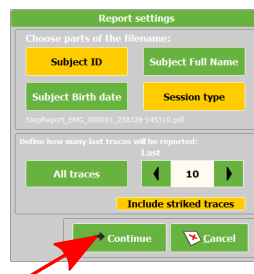
3. Open details by double click or tapping. You may also click on the show details option. By doing so, the *Session Details* screen (see 3) is opened.



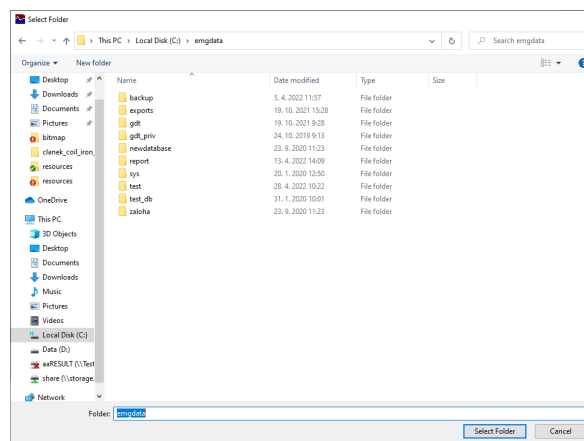
4. Select the *Report* creation option.



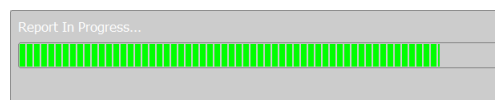
5. Configure report filename and number of the last MEP records included for each MEP session step. And then press the *Continue* button.



6. Choose a directory where the report file should be created.



7. Wait until it is finished.



8. It is done when the progress bar dialog is closed.

Abbreviations

AMT Active motor threshold

RMT Resting motor threshold

MT Motor threshold

MEP Motor evoked potential

MSO Magnetic stimulator output

EMG Electromyography

ID Identification

UI User interface

SN Serial number

GDT Gerätedatentransfer. Medical data format to transfer data among medical devices and software systems used in Germany.

HL7 Health Level 7 is a set of clinical standards and messaging formats that provide a framework for the management, integration, exchange, and retrieval of electronic information across different healthcare systems.

RMS The root mean square. In our context, it is used dominantly during the AMT determination process.

TTL Transistor-Transistor Logic

TMS Transcranial magnetic stimulation.

HW Hardware

p-p Peak to peak value is a distance between two peak markers (A+ and A-) in the y axis of recorded signal measured in Volts.

0-p Zero to peak. Same as previous but measured from zero to one peak.

ISI Inter stimulus interval

Litrature

References

- [1] Samuel Bulteau, Veronique Sébille, Guillemette Fayet, Veronique Thomas-Ollivier, Thibault Deschamps, Annabelle Bonnin-Rivalland, Edouard Laforgue, Anne Pichot, Pierre Valrivière, Elisabeth Auffray-Calvier, et al. Efficacy of intermittent theta burst stimulation (itbs) and 10-hz high-frequency repetitive transcranial magnetic stimulation (rtms) in treatment-resistant unipolar depression: study protocol for a randomised controlled trial. *Trials*, 18:1–10, 2017.
- [2] John P OâReardon, H Brent Solvason, Philip G Janicak, Shirlene Sampson, Keith E Isenberg, Ziad Nahas, William M McDonald, David Avery, Paul B Fitzgerald, Colleen Loo, et al. Efficacy and safety of transcranial magnetic stimulation in the acute treatment of major depression: a multisite randomized controlled trial. *Biological psychiatry*, 62(11):1208–1216, 2007.
- [3] Simone Rossi, Mark Hallett, Paolo M Rossini, Alvaro Pascual-Leone, Safety of TMS Consensus Group, et al. Safety, ethical considerations, and application guidelines for the use of transcranial magnetic stimulation in clinical practice and research. *Clinical neurophysiology*, 120(12):2008–2039, 2009.
- [4] Eric M Wassermann. Risk and safety of repetitive transcranial magnetic stimulation: report and suggested guidelines from the international workshop on the safety of repetitive transcranial magnetic stimulation, june 5–7, 1996. *Electroencephalography and Clinical Neurophysiology/Evoked Potentials Section*, 108(1):1–16, 1998.