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# Overview

The Trackit software is designed to work with Lifelines' Amplifiers and the optional Lifelines Photic Stimulator. Trackit Software V2.8.1 onwards supports the Trackit Mk2, Trackit Mk3, Trackit T4A, Trackit T4, Trackit Sleepwalker (Mk2 and Mk3) and the R40 EEG Amplifier\*.

The software provides the following functions:

- Define signal types: create labels to attach to inputs
- Attach the desired signal type (label) to the recording input
- Create a recording montage and download it to the amplifier
- Perform a calibration of the inputs
- Perform an impedance check on the inputs
- View ongoing signals and adjust display parameters such as chart speed and display sensitivity
- Start and stop a recording session. The software supports Ambulatory recordings, Dual Recordings and PC-only recordings.
- Open and review EEG recordings (EDF and BDF format)
- Synchronised video recordings
- Dual video cameras, Review in Acquire (with video)
- Password-protected Lockscreen
- File Manager (for end of study file operations)
- Lifelines Photic Stimulator support
- Hyperventilate activation.

Three versions of the Trackit software are available:

- **Trackit:** This provides the configure to connect to Lifelines amplifiers, initiate an ambulatory recording and the review functionality to review the recording.
- **Trackit Plus:** This provides the same functionality as Trackit with the additional of PC and Dual recordings.
- **Trackit Plus with Video:** This provides the same functionality as Trackit Plus and introduces synchronized video acquisition and recording using USB cameras. The EEG amplifiers provide time sync information to the video file to ensure accuracy down to the nearest frame: essential to correlate behavioural and physiological information. During playback the recorded video is synchronised to the recorded EEG data.

*\*The Trackit Mk1 is not supported in V2.8.1 onwards.*

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3. All programs offering auto-update features, including Windows, should be set to manual or automatic if desired but at a time when the system is not being used.
4. Adopt formal departmental or organisational procedures to ensure the integrity and safe operation of the medical equipment and supporting systems.

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# 1 Introduction

## 1.1 General description

The Trackit software is designed to work with Lifelines' Amplifiers and with the optional Lifelines Photic Stimulator. Trackit Software V2.8.1 onwards supports the Trackit Mk2, Trackit Mk3, Trackit T4A, Trackit T4, Trackit Sleepwalker (Mk2 and Mk3) and the R40 EEG Amplifier.

The software is supported on Microsoft Windows XP, Windows Vista and Windows 7, Windows 8.1 and Windows 10. The USB drivers will be found on the CD. After connecting the Amplifier to the PC for the first time, at the Windows prompt, browse to the folder *CD Drive:\USB Drivers*. From there Windows will find the correct drivers for the version of Windows being used.

The software provides the following functions:

- Define signal types: create labels to attach to inputs
- Attach the desired signal type (label) to the recording input
- Create a recording montage and download it to the amplifier
- Perform a calibration of the inputs
- Perform an impedance check on the inputs
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## 2 Installation

### 2.1 Trackit Software Installation

The Trackit software is available on the included CD/USB disk or on the Lifelines FTP site. A readme file describes installation. The latest software is 2.8.4.7 and supports all available Lifelines Amplifiers. Check with your distributor or Lifelines if a newer version of software is available.

Before installing the Trackit Plus Software, please remove any previous versions of Trackit Plus from the PC. Any user-defined custom montages, signal definitions and amplifier setups are retained and are available after installing the latest version.

**NOTE:** The Trackit software should be installed before connecting the Trackit amplifier to the PC.

There are 3 variants of Trackit Software: Trackit, Trackit Plus and Trackit Plus with Video. Each variant is located in a separate folder on the CD (or installation setup folder)

Run the Trackit Installer (Install.exe), located in the Trackit Installation folder. The Installer screen, as shown below will be displayed. Press the "Install" button to start the installation. Follow the on-screen prompts to complete the installation. The installation will install the Trackit software and the required USB driver.

When installation is complete, a shortcut will be placed in the Start menu (Start-> Programs-> Trackit-> Trackit).



### 2.2 Video Codec Installation

If the Trackit software is to be used with Video, a separate installation is required to install the required video encoding and playback tools. Version 2.8.1.18 onwards introduces support for recording H264 MP4 videos. Trackit Plus software supports two H264 encoders: X264 and FFDSHOW. For all other video formats, the XVID video codec is the preferred codec. The installation files for all the codecs and video tools can be located in the "Trackit Video Codecs and MP4 Setup" folder (located in the "Misc" folder on the CD or other installation media).

For H264 (MP4) video support, install the following software:

- X264vfw
- FFDSHOW
- GDCL-MPEG4 Codec
- LAV Filters.

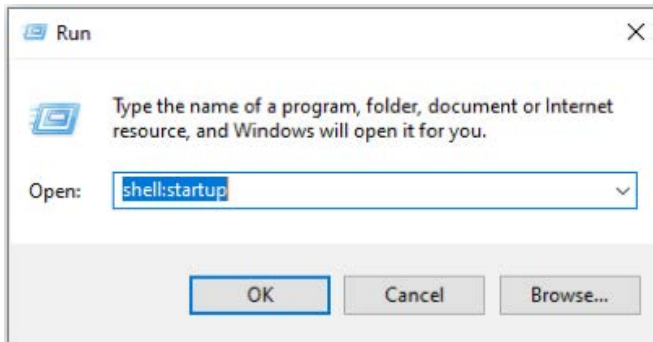
For XVID codec use, run the Xvid setup file, located in the codec folder, mentioned above. The latest installation file can also be downloaded from <https://www.xvid.com/download/>.

For all video tools, run the installation and follow the on-screen instructions to complete the installation.

## 2.3 Launch on Windows Startup

The Trackit software can be set to launch automatically when Windows® starts. In order to do this, place a shortcut to the Trackit application in the Windows start up folder, as follows:

1. Place a Shortcut to the Trackit application on the Desktop
2. Press “Windows (⊞)+R” to open the ‘Run’ window. Type **shell:startup** and press enter. This will open the startup folder for the current Windows user.



3. Copy the Trackit shortcut from the desktop to the Startup folder.

**NOTE:** This step is required if the Auto Recording Resume feature is required.

## 2.4 Set the Recordings Folder

The default recording folder is set to C:\Program Files(x86)\Trackit\Trackit Recordings. This can be changed by the user to a more user accessible location (such as the user's Documents folder). See Section 3.2.2.1.3 for details.

## 2.5 Software Registration

The Trackit Plus Software needs to be registered within 30 days of installation or program features become limited. The registration process requires that the user sends a signature string and Lifelines responds with a registration key, as shown (right).

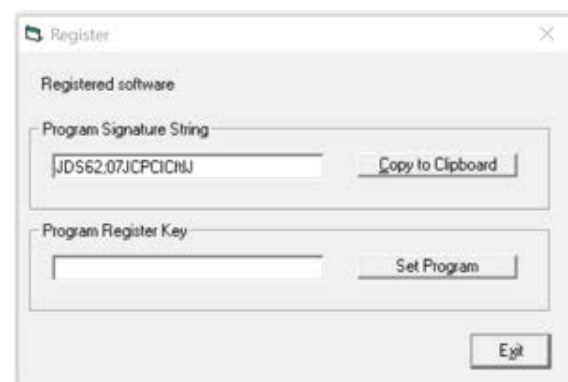


Figure 1: Program Registration

## 3 Getting Started

### 3.1 Overview

The Trackit Software can be launched from the Windows Start menu (Start-> Programs-> Trackit-> Trackit).

The Trackit software has four menu options: File, Home, Settings and Help. Each option provides a Microsoft® style "ribbon" toolbar (see Figure 2 - Figure 6). The default view is the 'Home' ribbon.



Figure 2: File Toolbar

#### Key

- |                              |                          |                                 |
|------------------------------|--------------------------|---------------------------------|
| 1 Open EEG file (for review) | 4 Close all review files | 8 Video Resume                  |
| 2 Open EEG videos            | 5 View Events File       | 9 Print Keyboard Event Template |
| 3 Refresh playback files     | 6 Measurement Graticule  | 10 Exit Software                |
|                              | 7 Prints Screen          |                                 |

- Open all files. This brings up a dialog to open edf or bdf files for review.
- Open EEG Videos. This brings up the Trackit Video Player and a dialog to open video files.
- Refresh playback files. For situations where the currently recording file is also open for review, this command updates the review with the latest acquired data.
- Close all. Closes all files.
- Event List. This operates the same as the Event List button in the Home menu.
- Measure Graticule. This operates the same as the Measure Graticule button in the Home menu.
- Print Screen. This brings up the standard print dialog window and allows the screen to be printed.
- Video Resume. This allows a video recording to be resumed after an interruption. *Refer to Section 3.2.1.*
- Print Template.

This command allows the printing of a keyboard overlay which shows the mapping of Events to Function keys to be produced. This shows each event with its currently set description against the associated Function key.

Two slider controls allow for the sizing and setting an F4-F5 gap to suit different keyboards.

The display window is as follows (Figure 3 below).

- Exit

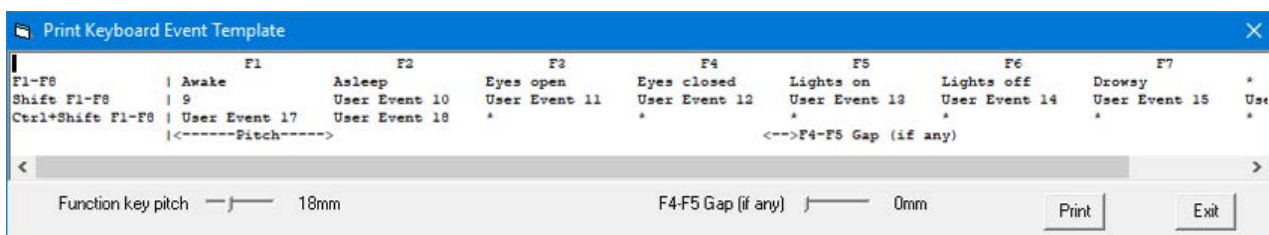


Figure 3: Print Keyboard Template

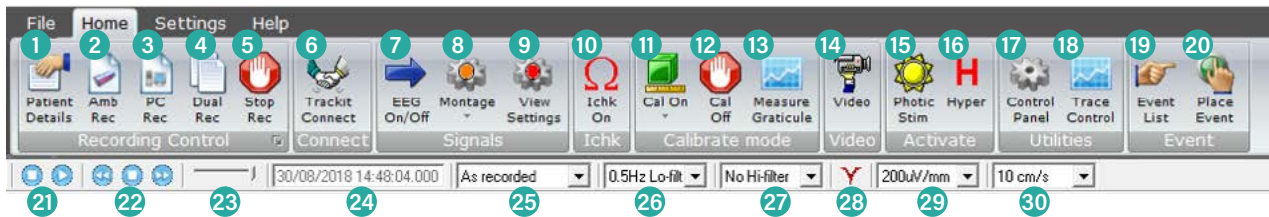


Figure 4: Home Toolbar

**Key**

1 Patient Details	8 Montage Editor/ Montage Select	15 Photic Stimulation	23 Chart speed
2 New Ambulatory Recording	9 View Settings/Hookup	16 Hyperventilation	24 Playback time
3 New PC Recording	10 Impedance Check On	17 Trackit Control Panel*	25 Montage selection
4 New Dual Recording	11 Calibration On/Amplitude	18 Trace control	26 Lo-filter selection
5 Stop Recording	12 Calibration Off	19 Get Trackit Events	27 Hi-filter selection
6 Trackit Connect	13 Measurement Graticule	20 Place Manual Event	28 Notch Filter On/Off
7 EEG Signal Trace On/Off	14 Videometry (optional)	21 Playback: Stop / Start	29 Vertical sensitivity
		22 Paging: Back/Stop/Forward	30 Chart speed

1. Patient Details. *For details refer to Section 6.2.1.*

2. New Ambulatory Recording  
Initiates a new ambulatory recording on the recorder.

3. New PC Recording

Initiates a new PC recording. For Trackit this is a standard 16-bit edf file. For R-40 and T4 and T4A it is a standard 24-bit bdf file. For these new devices, multiple files are supported.

During a PC recording, if the recorder cable is detached or the wireless goes out of range, the file continues to be recorded contiguously, with zero data, and all channels displayed in red, simultaneously with a flashing 'Disconnected' message. When the recorder is reconnected or comes back into range, PC recording resumes. This feature also works if the recorder has been switched off during the disconnected period. The host ensures that it is the correct recording device and has the correct setup in it.

4. New Dual Recording

Initiates a new dual recording (PC and ambulatory). Note that with a dual recording with video, an extra option is presented to enable synchronisation of the video to either the ambulatory file or the PC file (*refer to Section 6.3.3*).

5. Stop Recording. Stops the ambulatory recording and/or the PC recording.

6. Trackit Connect. Opens the Connection dialog box to connect to an amplifier.

7. EEG On/Off. Turns on or off live streaming of EEG signals.

8. Montage Editor/Montage Select.

This launches the Montage Editor as detailed in *Section 4.3*. There is also a drop down list to directly access all available montages.

9. View Settings/hookup. Provides a view of the amplifier hookup. *Refer to Section 4.2.3.*

10. Impedance Check On. Initiates Impedance Check. *For details refer to Section 4.6.*

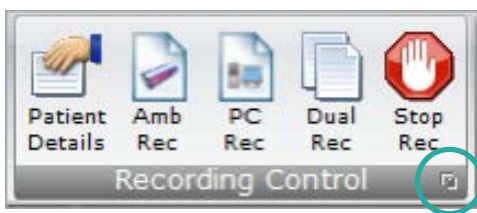
11. Calibration On.

Turns on Calibration mode. Refer to *Section 4.5*. For the R-40, T4 and T4A additional levels are available:

- 8mV
- 2mV
- 500µV
- 125µV

12. Calibration Off.
13. Measurement Graticule. This display a measurement grid over the signals area which is calibrated for the currently set display sensitivity and chart speed and also takes account of screen size.
14. Video. This initiates a video synchronised recording. *For details refer to Section 3.2.1.*
15. Photic Stimulation. This initiates a photic stimulation session. *For details refer to Section 9.*
16. Hyperventilation. This initiates a hyperventilation session. *For details refer to Section 10.*
17. Trackit Control panel. This displays the Trackit Control panel. *For details refer to Section 5.*

**NOTE:** The Trackit Control Panel can also be accessed by clicking on the 'expand' arrow at the bottom right of the Recording Control group, as below.



18. Trace Control. This brings up a dropdown list which allows control over the number of signals displayed, if less than the total number in the setup. Also available is a page up and page down facility as well as superimpose all. *Refer to Section 4.4.*
19. Get Trackit Events.
 

This command reads all the events stored in the Recorder and displays them in a window. *Refer to Section 8.4* for details. Double clicking on any event brings up a page of EEG starting at the event time.
20. Place Event.
  - This allows the placing of events during a recording or at Review time into an existing recording. A list of available Events and their descriptions is displayed as well a Manual Event and a Free Text event. *Refer to Section 8.3* for more details.
  - User Events. This brings up a window which allows the User-configurable event descriptions to be edited. The window also shows the fixed recorder internal events and also the Function key quick access assignment. *Refer to Section 8.3.2.*
21. Playback Stop/Start. This scrolls through the playback file a second at a time.
22. Page back/Stop/Forward. This pages back through the playback file taking account of the screen width and the Chart Speed setting.
23. Paging Speed slider. This slider controls the playback paging speed.
24. Playback time. This is the current playback time at the vertical cursor position.
25. Montage selection.
26. Lo-filter selection.
27. Hi-filter selection.
28. Notch filter On/off. This applies a display filter to the traces to attenuate 50 or 60Hz mains interference. The mains frequency is set in Options.
29. Display sensitivity.
30. Chart speed.

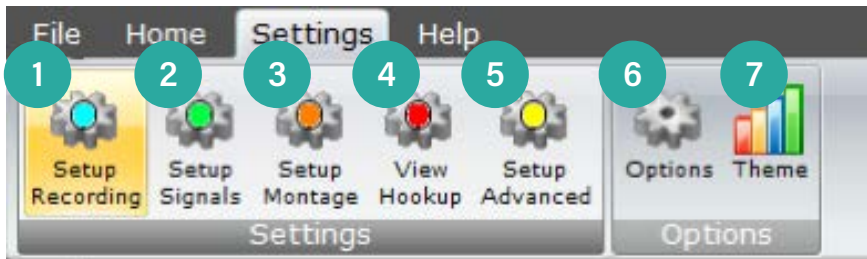


Figure 5: Settings Toolbar

### Key

- |                   |                         |                                  |
|-------------------|-------------------------|----------------------------------|
| 1 Recording Setup | 4 View Amplifier Hookup | 6 Trackit Software Setup options |
| 2 Signal Setup    | 5 Advanced Settings     | 7 Application colour theme       |
| 3 Montage Setup   |                         |                                  |

1. Setup Recording. Refer to Section 4.2.2.
2. Setup Signals. Refer to Section 4.2.1.
3. Setup Montage. Refer to Section 4.3.
4. View Settings/Hookup. Refer to Section 4.2.3.
5. Setup Advanced. Refer to Section 5.4.2.
6. Options. Refer to Section 3.2.2.
7. Themes. This allows setting the desired colour scheme for the Trackit program.

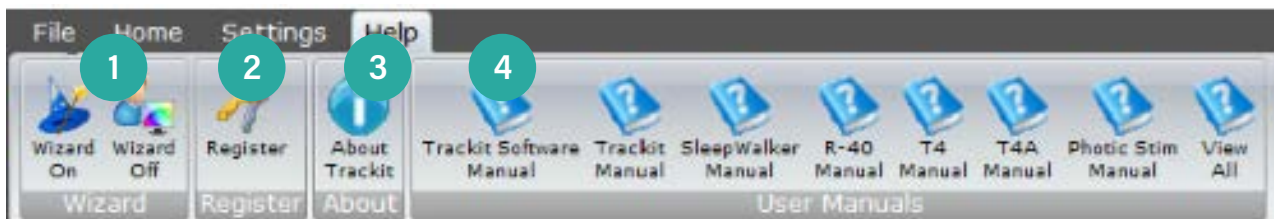


Figure 6: Help Toolbar

### Key

- 1 Wizard On/Off. The wizard guides the user through the Ambulatory recording setup when starting the Trackit software. Refer to Section 6.2.4.
- 2 Software registration. Refer to Section 2.5.
- 3 Trackit Software Version information.
- 4 User manuals for Trackit Software and various Trackit amplifiers and Lifelines products (manuals are included with the software installation).



## 3.2 Setup

### 3.2.1 Video Setup

The Video setup allows the user to setup a USB camera for synchronised video recording. The Trackit Plus Software provides the following features for video recordings.

- Support for multiple video capture codecs including MPEG-4.
- Selectable frame rates and video compression
- Selectable video resolution.
- User definable video file length to provide increased security and more manageable files for copying over a network. It also allows video files with no interesting findings to be easily deleted thus reducing the amount of data.
- Time, date and patient ID stamp on the video

With a USB camera connected to the PC, click the video icon on the Home toolbar. This displays the video preview window, as shown in Figure 7. Click on the setup icon to display the five setup tabs.



Figure 7 Trackit video preview

## Video tab

The Video tab allows the camera, the picture size and frame rate to be selected. If an excessively large picture size is inadvertently selected, the setup tabs can become inaccessible off-screen thus making re-sizing impossible. Under these circumstances the Setup button has a dropdown option which can be used to reset the video resolution.



- **Camera**

This allows selection of the camera. The dropdown list displays all available cameras. Additional camera-specific settings can be accessed by clicking on the icon next to the camera selection list.

- **Input**

For video devices that support different inputs, this dropdown displays them and allows selection.

- **Size**

This selection and dropdown displays all the available video resolutions for the video device selected. The icon brings up the properties window which allows the frame rate to be selected.

- **Show time**

If checked this embeds the date/time into the video.

- **Show name**

If checked this embeds the Patient ID into the video.

- **Motion detect and sensitivity**

This allows motion to be detected in the live video, with a sensitivity adjustment. A message will be displayed in the video if triggered.

All these settings are saved when the window is closed and restored when re-opened

## Audio tab

The Audio tab allows an optional microphone to be selected.

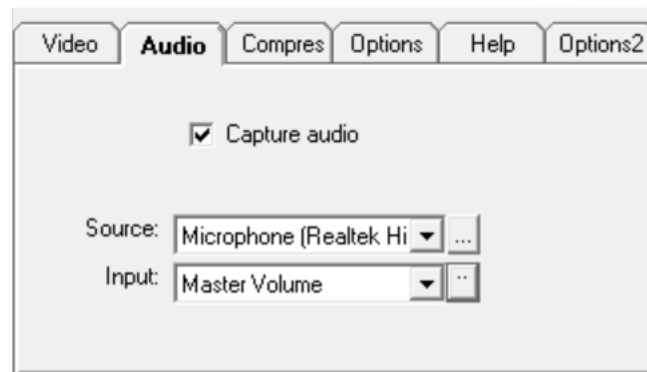
- **Capture audio**

When checked this enables recording audio with the video.

- **Source**

This dropdown list displays the audio source devices. The icon brings up an audio settings dialogue which enables mono/stereo, 8/16 bit resolution and bit rate to be selected.

**NOTE:** The higher audio quality settings will result in larger video files.



- **Input**

This selection and dropdown list displays available inputs for the device selected. Clicking on the Input Settings button provides the option to set the input level of the microphone.

**NOTE:** When an H.264 (MP4) video codec is selected, the "Capture audio" option is enabled and greyed out since MP4 files always include audio. If audio is not required in the video recording, disable the microphone (or set the level to zero) in the Input settings.

All these settings are saved when the window is closed and restored when re-opened.

## Compress tab

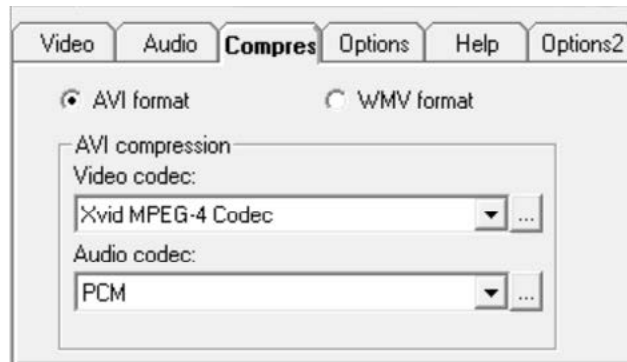
The Compress tab allows the compression codec to be selected.

For recording H.264 (MP4) video, select either **ffdshow Video Encoder** or **x264fvw - H.264/ MPEG-4 AVC codec**.

For AVI files, the recommended video codec is **XVID MPEG-4 Codec**.

See Section 2.2 for installation details.

The recommended audio codec, for MP4 and AVI files, is **PCM**.



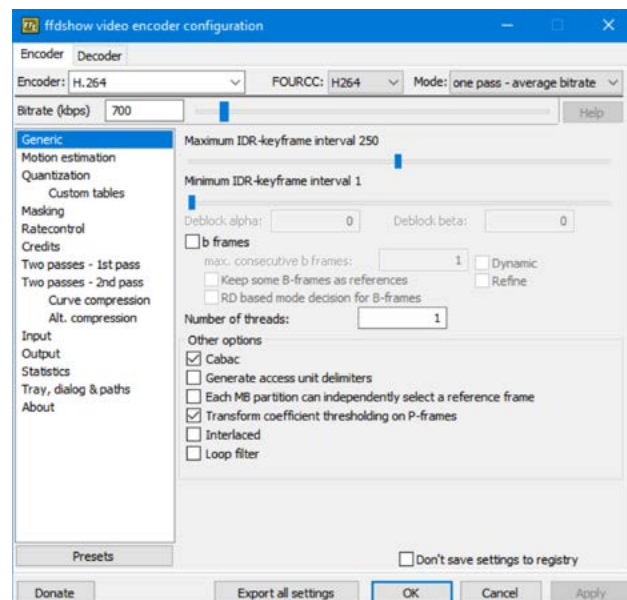
## Ffdshow setup option

For recording mp4 videos, ffdshow is the preferred codec. Be sure to install the GDCL-MPEG4Codec and LAVFilters-0.69 as well.

Once installed, ensure that the Encoder is set to H.264 as shown below.

To do this, in the installation folder is the file 'ffdshowTrackit.reg' which when double-clicked will set the registry settings to appropriate values.

To do this manually, use the Windows program 'VFW configuration', and set as below..

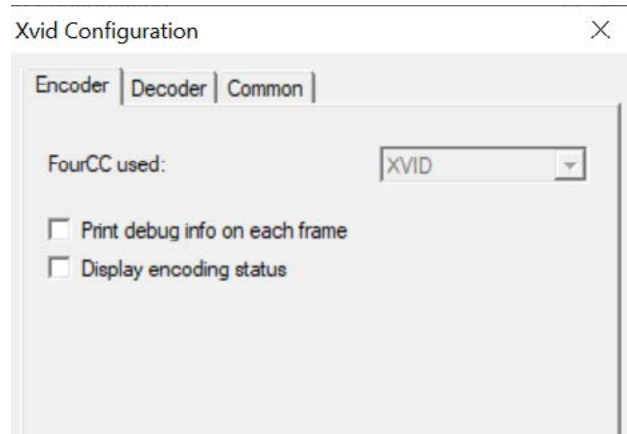


## XVID MPEG-4 Codec Configuration

Clicking on the **...** button next to the video codec selection brings up the XVID codec settings. Click on the "Other Options" button to bring up a second screen.

Under the "Encoder" tab, make sure both checkboxes are **unticked**, as shown below.

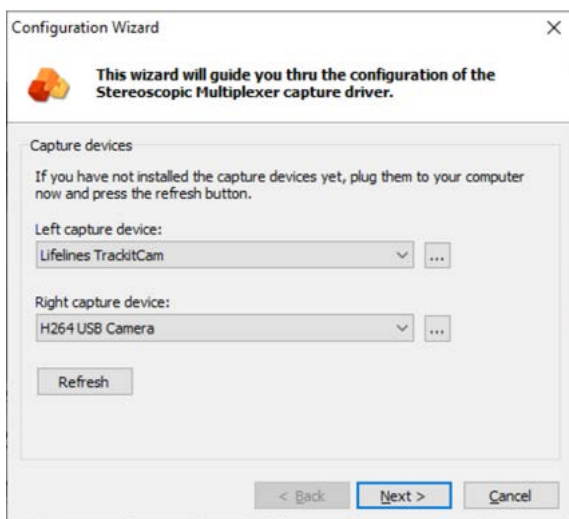
All other encoder options can be set as default.



## Dual Video Cameras

Simultaneous dual camera recording is supported in the Trackit Plus program, and the driver StereoscopicMultiplexer needs to be installed. Once installed, open the program and run the Configuration Wizard to set up the 2 cameras and their resolutions. The preferred dual camera solution is two TrackitCam devices. It is essential to keep the resolutions which are common to both cameras. Running the Wizard normally only needs doing once, however access is provided if necessary from the Trackit Plus program. The Trackit program presents the two cameras side by side, thus doubling the horizontal resolution but retaining the vertical resolution. A single video file is recorded. All other recording parameters remain unchanged including the mp4 and avi compression codecs. The synchronisation files are recorded as for a single camera.

Playback of dual camera videos behaves the same as for a single camera, but with the two cameras shown side-by-side. EEG synchronisation occurs automatically as for a single camera.



Once set, the dual camera Stereoscopic Multiplexer will automatically appear in the drop down list of cameras in the Trackit Plus program. Once selected, this will display the two cameras as show below:

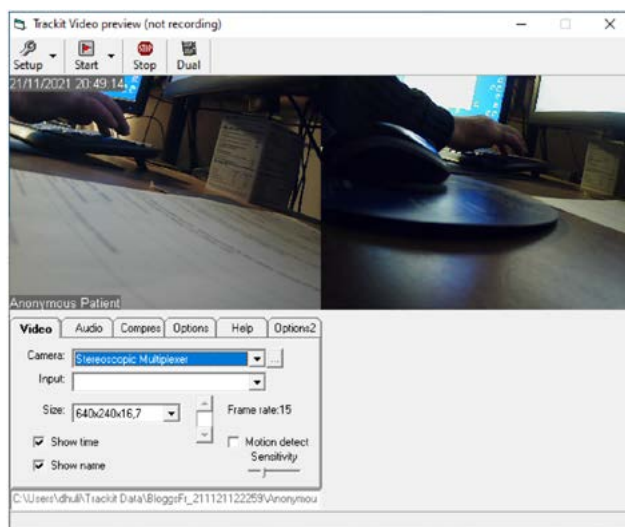


Figure 8: Stereoscopic Multiplexer

## Options tab

The Options tab allows various options to be selected as shown below.

Video can automatically resume after an interruption and will use only the original camera.

Video file segment size can be selected or disabled. This allows for smaller video files to be recorded. For continuous recording, always ensure the "Auto Restart" option is selected. This allows the video to start a new file segment automatically.



- **Transparent overlay**

If show date/time and Patient ID are enabled, this option sets the background of the text to transparent (so the video shows through). Otherwise the background is grey and non-transparent.

- **Only reconnect with original Video device**

If Video Resume is enabled, this option only allows reconnection to the original video camera at the point of resume.

- **Allow Video Resume mode**

This option allows video recording to resume after the program or PC has been shut down.

- **And auto-start video recording.**

If the above option is set, this option sets video recording on immediately after a resume condition.

- **Flip H**

This option flips the video horizontally.

- **Flip V**

This option flips the video vertically.

- **Unlock PW**

This option requires that a password is required to unlock the controls after recording is started. The default password is set as the Recording ID.

- **Video file segment limits**

These options allow potentially very large video files to be split into manageable segments.

- Time  
The video is split into separate files of a specified time each.
- Size  
The video is split into separate files of a specified size each.
- Auto restart  
If checked, subsequent segments are automatically started.
- Total time limit  
The total video recording time is limited to a specified time.

All these settings are saved when the window is closed and restored when re-opened

### Help tab

The Help tab provides a single large button which the patient can use to start and stop the recording. When the start button is pressed, the button changes to a Stop button.

If either of the stop options in "Option2" tab are selected, a second Stop button appears. This allows the user to stop and exit the Trackit Plus software or stop and shutdown the PC.



Lock controls prevents access to the setup settings. It is reset from the Setup dropdown menu.

### Options2 tab

The Options 2 tab provides two options for additional actions when stopping a video recording. Either the Trackit software application will be closed or the PC will be shut down. Selecting either option will add a second Stop button to the Help tab, as shown above.



## 3.2.2 PC Setup

### 3.2.2.1. PC Options

The Options window can be accessed by pressing the "Options" button on the Settings toolbar. These options allow customisation of the Trackit software and recording options. The standard installation will have all the necessary options configured by default.

#### 3.2.2.1.1. Options | Tab 1

The Options panel Tab 1 contains general settings which are described below.

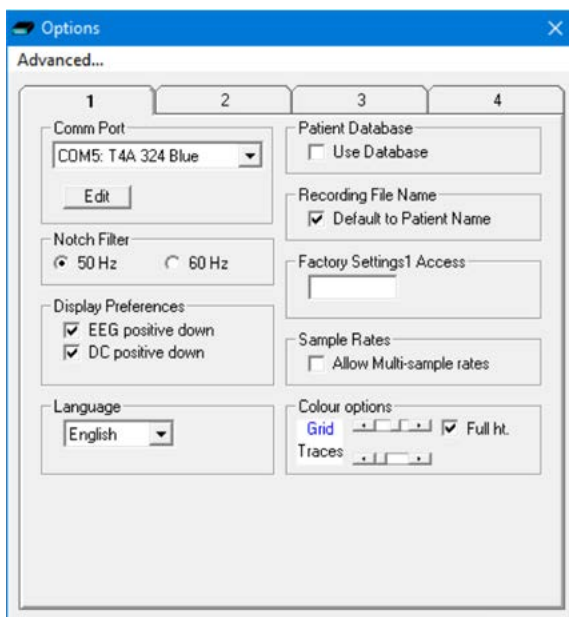


Figure 9: Options Tab 1

**Comm Port:** Assign a name to the Bluetooth Comm port.

**NOTE:** To specify that the Comm port is a Bluetooth connection, include the word "blue" in the name.

**Notch Filter:** Set the frequency to match the local AC supply.

**Display Preferences:** Select whether EEG or DC signals are inverted

**Language:** Application language selection

**Patient Database:** Select to use a patient database (Microsoft Access database)

**Recording File Name:** Select to use the Patient name as the recording file name. When unticked, the recorded file name will be set to "Anonymous".

**Factory Setting Access:** Access to amplifier factory settings (factory use only).

**Sample Rates: Allow Multi-sample rates (Trackit Mk3 only).** Set this option to allow the Mk3 amplifier to record with multiple sample rates (provided the amplifier is configured with this feature).

**Colour Options:** Changes the colour of the trace lines and grid lines

### 3.2.2.1.2. Options | Tab 2

The display of the 2nd video window is an option as set in Options, as shown below (3rd frame) *Disable video in review in acquire*. This avoids the confusion of having two video windows showing simultaneously.

*PC Resume in Dual mode copies all events into 1st tvx file*. In a Dual recording study, if the PC is shut down for any reason and a Resume is in operation at next switch on, events created in the 2nd segment of recording are additionally saved in the 1st tvx event file.

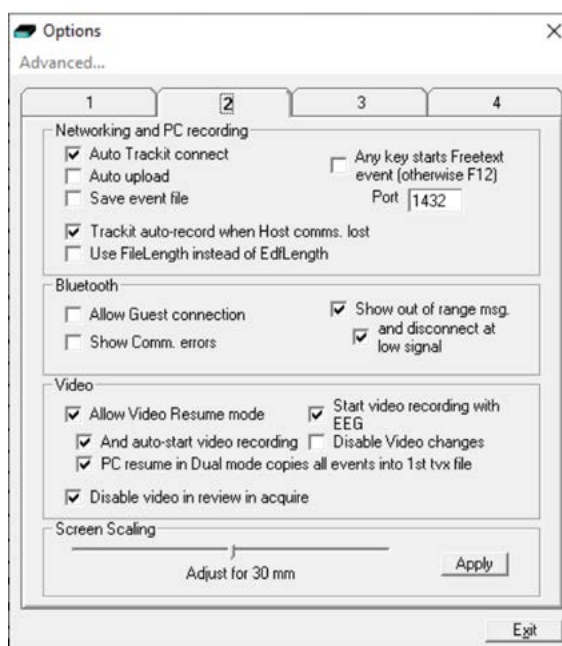


Figure 10: Options Tab 2

### Networking and PC recording Options

- **Auto Trackit\* connect.** If ticked this will cause the application to attempt to reconnect to the designated amplifier after a disconnect. The disconnect can be loss of Bluetooth link or unplugged cable etc.

**NOTE:** A manual disconnect will stop the Autoconnect connection attempts. Autoconnect starts after the first manual connection.

- **Auto upload.** When ticked, the application will automatically upload the Amplifier's setup immediately after a connection is established. It is only enabled if 'Auto Trackit Connect' is enabled. **Trackit Mk3 only.**
- **Save Event File.** If ticked this will cause the application to automatically upload the Trackit's event file immediately after a connection is established and save it in a temporary file called TempEve1.tev in the default application path. This file can be viewed or emailed out at a later time with or without the Trackit connected. It is only enabled if Auto Trackit Connect and Autoupload are enabled. **Trackit Mk3 only.**
- **Port.** This is the port number that the application uses for its TCP networking connection. For the client, this designates the local port to send data from. For the server, this is the local port to listen on.
- **Any key starts Freetext Event (otherwise F12).** When checked, pressing any key during a recording starts a "Freetext Event". When unchecked, the user must press F12 to start a "Freetext" event. See Section 7.1 for more details on Freetext events.
- **Trackit\* auto-record when Host comms. lost.** When ticked the Amplifier will automatically start recording when the Host communication is lost if a PC recording is active. This feature is most useful with a wireless Bluetooth connection, but it will work for any type of connection. If there is already a file on the amplifier's disk, then certain rules will apply to avoid overwriting valid data. *Refer to Section 6.2.3 for more details.*
- **Use File Length instead of EDF Length.** This a playback feature and if ticked, the file length is used instead of the EDF length parameter embedded in the EDF header. This is used if there are partial records in the EDF/BDF file.

\*Amplifier name may vary depending on which amplifier is connected.



### Bluetooth Options

- **Allow Guest connection.** If ticked this will allow the application to become a Bluetooth GUEST. Before actual connection the application will listen on the connection to ascertain whether a MASTER is already in control of the designated Trackit. In these situations, the new application becomes a GUEST connection if allowed. Note that this option concerns the application only. There are other options that configure the Trackit and the Bluetooth module as regards GUEST connections (see below). **Applicable to Trackit Mk3 only.**
- **Show Comm. errors.** This allows any Comm. errors to be displayed on the main screen status bar below the Patient ID. This applies to all connections, whether direct, USB or Bluetooth. It can be useful when assessing signal quality.
- **Show out of range msg.** This allows an "Amplifier Out of Range" message to be displayed on the graph screen when the amplifier is out of Bluetooth range. This can be helpful to alert the patient to move closer to the recording PC.
  - **and disconnect at low signal.** When selected, the software will disconnect from the amplifier if the Bluetooth signal quality is low. The software shall reconnect to the amplifier when the Bluetooth signal strength has improved.

### Video

- **Allow Video Resume mode.** This allows Video synchronised recordings to be resumed after the PC has been powered off.
  - **And auto start video recording.** This allows the video to automatically start recording after a Video Resume has occurred.
- **Start Video recordings with EEG.** When checked, the video recording will start automatically, when the EEG recording starts. When unchecked, the user needs to start the video recording manually, after starting the EEG recording.
- **Disable Video changes.** This disables the Video settings. This prevents any unintended changes to the video setup.

### Screen Scaling

This Slider Bar allows the screen size to be set so that the Chart Speed for the traces exactly matches the cm/s selected. To use, adjust the slider so that it is 30mm from the left hand end.

## 3.2.2.1.3. Options | Tab 3

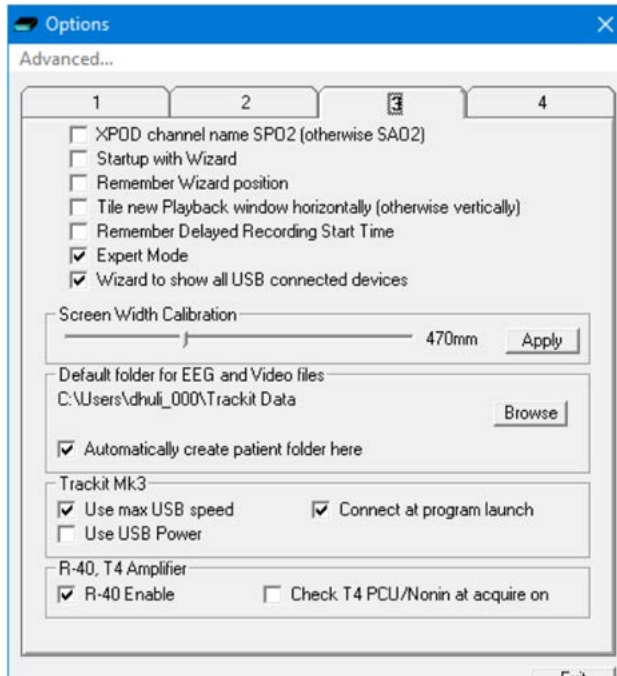


Figure 11: Options Tab 3

- XPOD channel name SPO2 (otherwise SAO2).** This option allows the XPOD channel name to be either SPO2 or SAO2. This is because some playback software requires a specific label to enable recognition. **Not applicable to Trackit T4A.**
  - Startup with Wizard.** If checked, the Trackit program will next start with the Wizard.
  - Remember Wizard position.** If checked, the last Wizard window position will be remembered and recalled. Otherwise it will appear centrally.
  - Tile new Playback window horizontally (otherwise vertically).** When checked, the playback window will be tiled horizontally and displayed below the recording window.
  - Remember Delayed Recording Start Time.** When selected, the Delayed Start time, set in the Wizard, is retained and not reset to zero.
  - Expert Mode.** Selecting this option removes some of the confirmation steps when setting up a new recording. This allows for a quicker recording setup.
  - Wizard to show all USB Connected Devices.** By default, the Recording Wizard shows the first available amplifier. When this option is set, the Recording Wizard will show all available amplifiers.
  - Screen Width Calibration.** This allows the program to be calibrated to the screen width. Set this value to the measured width of the screen.
  - Default folder for EEG and Video files.** This allows the program to always record EEG and/or video files to the same default folder. Use Browse to find and/or create the default folder for recordings.
- NOTE:** This is set to C:\Programs Files (x86)\Trackit by default. This should be changed after installing the application.
- Automatically create patient folder here.** If checked, the program will automatically create a patient folder in the default recording folder set above without any user intervention. If not set, the user chooses where to save the recording using the standard save file dialogue window.
  - Use max USB speed.** Normally this would be checked. Can be used to only allow a slower speed to overcome connection problems (**Trackit Mk3 only**).
  - Use USB Power.** Normally checked. Can be used to stop the Trackit using USB power and use its batteries instead (**Trackit Mk3 only**).
  - Connect at program launch.** If checked, the program will automatically connect to the amplifier at launch. The last used connection type (Bluetooth or USB) will be used to attempt reconnection. **Applies to all amplifiers.**
  - R40 Enable.** Enables use for new 24-bit EEG amplifiers (including R40, T4 and T4A). This is normally checked by default.
  - Check T4 PCU/Nonin at acquire on.** When ticked, the software shall check that the T4 PCU matches the setup used (24/8 PCU or 64/4 PCU) when a recording is started. The software shall also check that the Nonin SpO2 monitor isn't being used with too many channels (**Trackit T4 only**)

## 3.2.2.1.4. Options | Tab 4

- CPU Usage Monitor during Dual or PC recording**  
 This setting allows a configurable CPU usage limit to mark an event in the recording. Such an event is useful for diagnosis when an abnormally high CPU load causes issues with the recording.
- Detect video errors.**  
 During video recording, the program will attempt to detect video errors and automatically recover.
- Constant Frame Rate (CFR) Video Settings**  
 This setting is for the video camera and determines if Auto Exposure is used or not. When On, the camera can automatically adjust its frame rate to compensate for low light levels. This can effect video/EEG synchronisation, so an option is provided to disable this and instead fix the frame rate.
- Enable Multiple Instances of the Program**  
 If enabled, multiple instances of the program are enabled. This is not normally required, since the program supports simultaneous review in acquire.
- Enable Dual Camera Video**  
 When selected, allows dual video camera support. Otherwise, only a single camera is allowed.
- Lockscreen unlock password**  
 Allows setting a custom Lockscreen unlock password. Note that there is a default hidden password of 'lifelinesXX', where XX is the numeric current day of the month, e.g. 3 or 24 etc. This password always works.

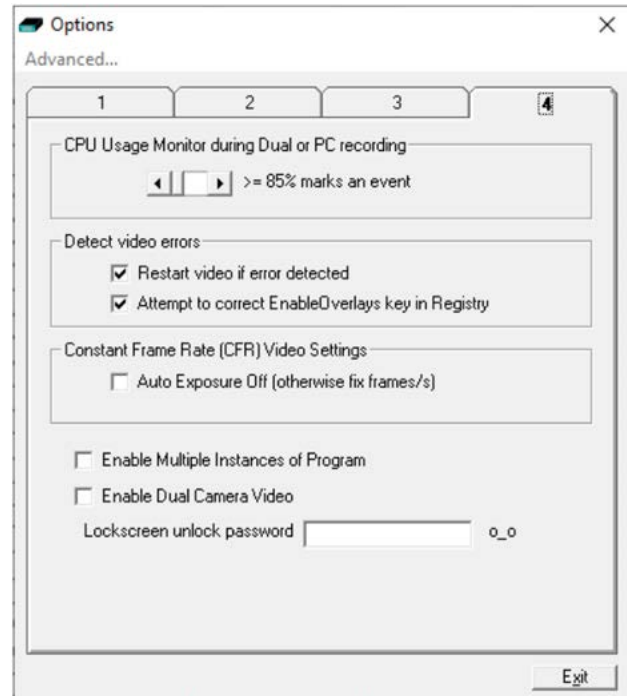


Figure 12: Options Tab 4

## 4 Basic Operation

### 4.1 Connecting the amplifier

The Trackit application software will normally connect automatically to the Amplifier as soon as it is plugged in to the computer via the USB cable (See "Trackit Auto Connect" option in Section 3.2.2.1.1).

To connect manually:

1. Open the Trackit Connect dialog box (Figure 11) by clicking on the Connect icon in the Home toolbar (Figure 4) or the Connect button in the Control Panel (Figure 27).

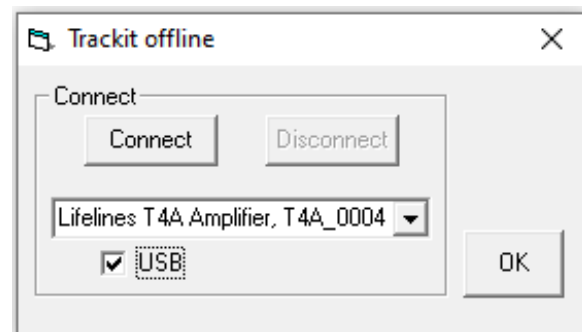
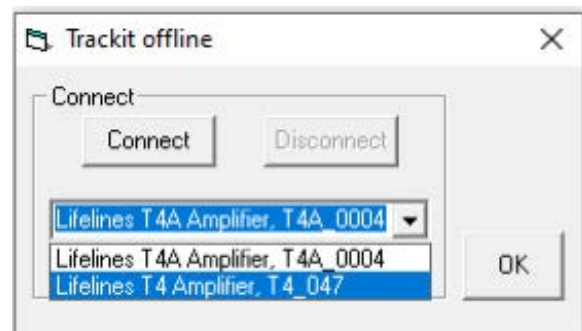


Figure 13: Connect Dialog Box

2. To connect via USB,
  - a. Check that the amplifier USB cable is connected properly.
  - b. Select the "USB" checkbox. The name and serial number of the amplifier will appear in the dropdown list. If multiple Amplifiers are connected to the computer, this dropdown will list all the connected amplifiers, as shown (right).
  - c. Select the correct amplifier (check the amplifier's serial number) and click on the Connect button.



3. To connect via Bluetooth:
  - a. Switch on the Trackit Amplifier and enable Bluetooth (if required). Ensure that the amplifier has been paired to the computer first (refer to the "Appendix 3" for information on Bluetooth pairing).
  - b. Untick the "USB" checkbox and select the correct COM port from the drop down list (see "Appendix 3").
  - c. Click on the Connect button
4. Once connected, Click OK to close the Connect dialog box.

Once connected, the Trackit software status bar (at the bottom of the screen) shows 'Online (USB) [Trackit] - Tx\_xxxx' (for USB connection) or 'Online (COM Port name) [Trackit]' (for Bluetooth connection) (Trackit will be replaced with the connected amplifier name and Tx\_xxxx will be replaced with the amplifier's serial number).

The Status bar also displays the current setup parameters loaded onto the amplifier.

## 4.2 Amplifier Setup

### 4.2.1 Defining Input Signals

An input signal needs to be defined before it can be mapped to an amplifier input. Defining signals is usually only done once or very occasionally. Signal definitions are stored in a "Signal Library" file. The Trackit Plus software is supplied with pre-defined set of signals, which should suit most applications, hence it may only be necessary to add signals types for polygraphic recordings (airflow, respiration, etc.).

The defined input signals are independent of the amplifier and can be used on any amplifier with the available input types (EEG, AC, DC, etc.).

The Trackit and R40 EEG amplifiers are supplied with a default set of signals which are match the signal definitions in the Trackit Software.

If for any reason the signals have not been created, it is necessary to define all the signals (labels) that are to be used for a montage creation. The signal editor allows the creation of up to 256 distinct signals ranging from the standard 10/20 EEG signals such as FP1, O2, to Respiration, Pulse and other polygraphy inputs.

To define a signal:

- 1 Select on the "Setup Signals" icon in the Settings toolbar.
- 2 Click the View all signals tab in the Signal editor dialog box.



Signal Editor (Library = SignalsB)

Open Save Exit

View all signals							Signal editor			
Ref	Name	Type	Units	Sensitivity	Transducer	Notes	DigMin	DigMax	Pl ▲	
1	Fp1	Eeg	uV	Master	AgAgCl		-32768	32767		
2	Fp2	Eeg	uV	Master	AgAgCl		-32768	32767		
3	F7	Eeg	uV	Master	AgAgCl		-32768	32767		
4	F3	Eeg	uV	Master	AgAgCl		-32768	32767		
5	Fz	Eeg	uV	Master	AgAgCl		-32768	32767		
6	F4	Eeg	uV	Master	AgAgCl		-32768	32767		
7	F8	Eeg	uV	Master	AgAgCl		-32768	32767		
8	T3	Eeg	uV	Master	AgAgCl		-32768	32767		
9	C3	Eeg	uV	Master	AgAgCl		-32768	32767		
10	Cz	Eeg	uV	Master	AgAgCl		-32768	32767		
11	C4	Eeg	uV	Master	AgAgCl		-32768	32767		
12	T4	Eeg	uV	Master	AgAgCl		-32768	32767		
13	T5	Eeg	uV	Master	AgAgCl		-32768	32767		
14	P3	Eeg	uV	Master	AgAgCl		-32768	32767		
15	P4	Eeg	uV	Master	AgAgCl		-32768	32767		
16	Pz	Eeg	uV	Master	AgAgCl		-32768	32767		
17	T6	Eeg	uV	Master	AgAgCl		-32768	32767		
18	O1	Eeg	uV	Master	AgAgCl		-32768	32767		
19	O2	Eeg	uV	Master	AgAgCl		-32768	32767		
20	Oz	Eeg	uV	Master	AgAgCl		-32768	32767		

Figure 14: Signal List

- Double click on the signal you want to edit. This brings up the Signal editor tab, allowing you to create a relevant signal or label to be entered into the signal list.

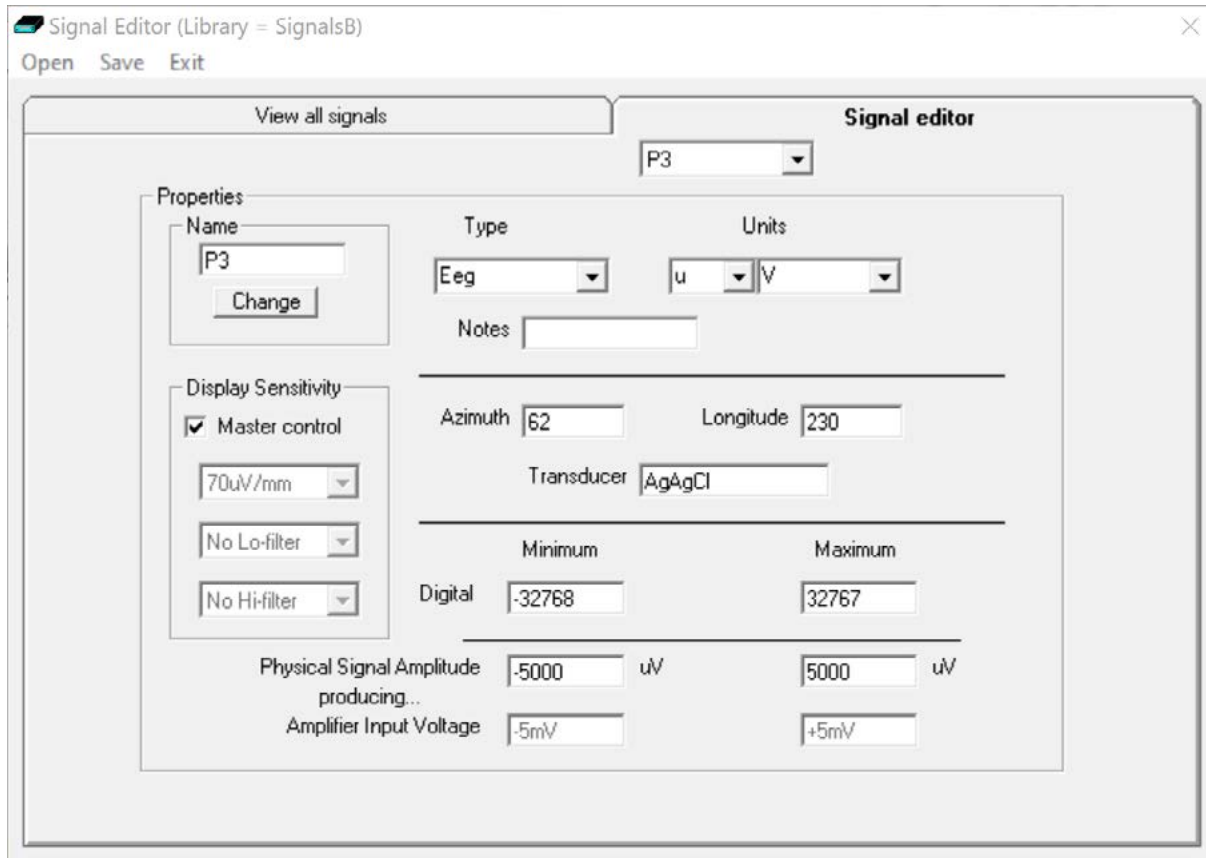


Figure 15: Signal Editing Tool

- Type in the Signal name (e.g. Fp1).

**NOTE:** For EEG signals the Signal name is case sensitive.

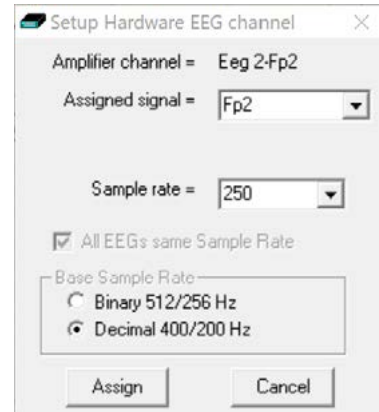
- Select a signal type from the drop down list (EEG, ECG, EMG, AC, DC, etc.).
- Click on the Change button. The signal is now entered into the list under the View all signals tab.
- If the signal is not an EEG signal, it may be necessary to insert a display sensitivity value by unchecking the Master control check box.
- The Signals will be saved in a Signals "Library" file (\*.sl3 file).

Signals that have been defined with their own independent sensitivities appear in red in the trace display. Further editing and changes to these sensitivity values in the trace display will be saved back into the signal library.

### 4.2.2 Setting up the Amplifier Inputs and Recording channels

Defining inputs, recording channels and montage is usually only done once per setup type. This entire setup can then be saved and recalled for future use. To open a saved setup or to create a new setup, proceed as follows:

- 1 Select the "Setup Recording" icon on the Settings toolbar. This opens the tabbed Setup Recording dialog.
- 2 If a pre-saved setup is available then this can be opened directly from the Open menu option (within the Setup Recording dialog box), and the rest of this section can be skipped. Setups are saved in a \*.tsu file. If a new setup is being created, proceed as follows:



#### Setting Amplifier Input Channels

- 3 Under the "Amplifier Channels" tab, select the desired amplifier or PCU checkbox ("T4A", "R40/T4-68/T4-32", "NicOne PCU" or "10/20 Clickon"). This will update the channel list with the available channels on the Amplifier. The channel names will also be updated to show the EEG 10-20 mapping on the amplifier's patient connection unit. If none of the checkboxes are ticked, this will default to a 24/8 setup with unassigned channels, as per the Mk2 or Mk3. Note, if the amplifier is online (connected), the checkbox will automatically be ticked and greyed out.

Figure 16: Channel Setup

- 4 Select the signals (labels) to be attached to the physical inputs.

For example, EEG input 1 may require the label Fp1 and so on according to the standard 10/20 nomenclature.

Double click the channel name and select the relevant signal label from the Setup Hardware EEG channel dialog (Figure 14). The order of the signal labels in the pull down list is the same as the order of the signals in the signal list defined using the signal editing tool.

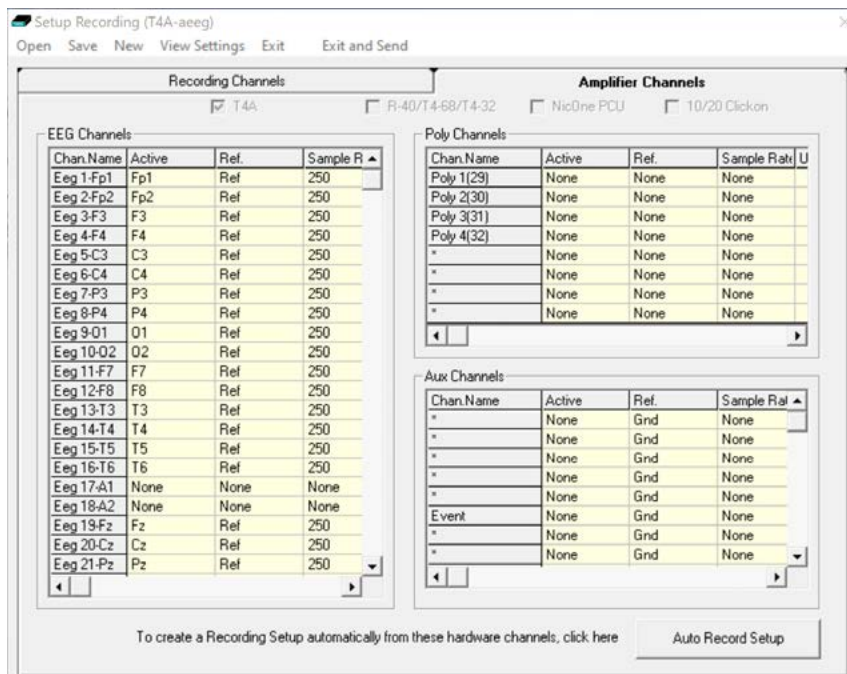


Figure 17: Setup Recording dialog

The Lifelines' EEG Amplifier range supports the following channels.

Amplifier	EEG	Poly	Aux (High level DC)	Event	Nonin SaO2	Heart Rate	Pulse Wave	Trigger Input	Light Sensor	Sample Counter	Total
Mk2/Mk3 <sup>#</sup>	12 – 32	0 – 8	4	1	1	-	-	-	-	-	18 – 46
R40	32	8	2	1	1	1	1	1	-	1	48
R40 (24)	24	4	2	1	1	1	1	1	-	1	36
T4-32	24	8	1	1	1	1	1	1	1	1	40
T4-64	64	4	1	1	1	1	1	1	1	1	76
T4A	28	4	-	1	-	-	-	1	1	1	36

<sup>#</sup>The number of EEG and poly channels in a Trackit Mk3 will depend on its configuration. This is expressed as EEG/Poly. For example, a "T24/8" has 24 EEG channels and 8 poly channels.

- Non-EEG channels include:
  - **Aux:** High level DC input
  - **Event:** Remote patient event thumb switch
  - **SaO2, Heart rate & Pulse wave** (provided by Nonin module)
  - **Trip I/P:** Trigger input signal (requires special USB cable)
  - **Light sensor I/P:** Ambient light sensor on front panel of the amplifier
  - **Sample:** Special channel which records the EEG sample number.

Channels marked with an asterisk (\*) on the "Setup recording" window are not used on the selected amplifier. Configuring these channels will have no effect on the amplifier.

**Poly Channels:** these inputs can be set to either referential (EEG mode), bipolar AC or bipolar DC. They are ideal for polygraphic signals such as respiration, airflow, EKG, body position (DC mode) etc.

To calibrate a DC Poly input to reflect a required unit of scale for a given voltage input use the signal editor (see Section 4.2.1). Select the appropriate units, e.g. %, or mm Hg, and enter the Physical Signal Amplitude required to generate the Amplifier Input Voltage.

To use the recording channel order defined in Amplifier setup, click on "**Auto Record Setup**" button in the Setup Recording dialog box. This sets up the recording channels in the same order as the amplifier channels. You can then skip the step of defining the recording channels (Section 4.2.4).



### 4.2.3 View Electrode Setup

To view the signals mapped onto the amplifier inputs, click on View Settings in the Menu Bar to display the Electrode Hookup visualisations, as shown in Figure 16 and Figure 18. The Electrode Hookup display shows all the currently available amplifier and PCU options. The allocated channels in the Recording Setup are shown against the appropriate hardware connector on the selected amplifier or PCU type. Click on the appropriate tab to access the specific type. All the types and visualisations are shown below.

The electrode hookup screen can also be viewed by clicking on the "View Settings" button on either the Home Toolbar or the Settings Toolbar.



Any of the Amplifier or PCU visualisations with the channel assignments can be printed by pressing the "Print" button, located below the visualisation.

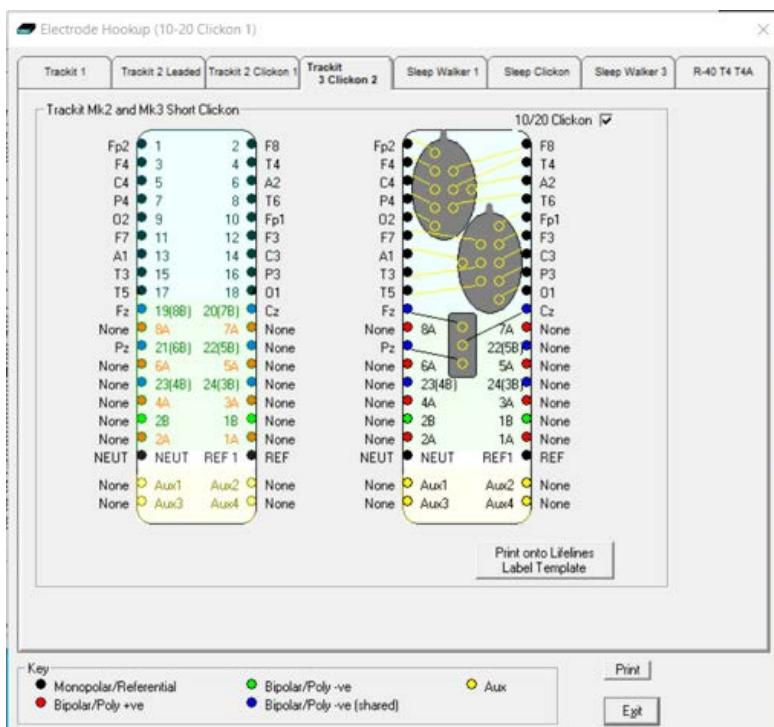


Figure 18: Electrode Hookup - Trackit Mk2 and Trackit Mk3

Figure 16 shows the electrode hookup for the Trackit Mk2 and Trackit Mk3. If the 10/20 Clickon PCU is being used, select the 10/20 Clickon checkbox, which will bring up the display of this PCU alongside the standard PCU.

Clicking on the Print onto Lifelines Label Template command allows the current Recording Setup to be printed onto a custom Lifelines Label which is stuck directly onto the PCU. The command brings up a window which allows vertical and horizontal offsets to be adjusted depending on the particular printer (see Figure 17).



Figure 19: Print on Label Template

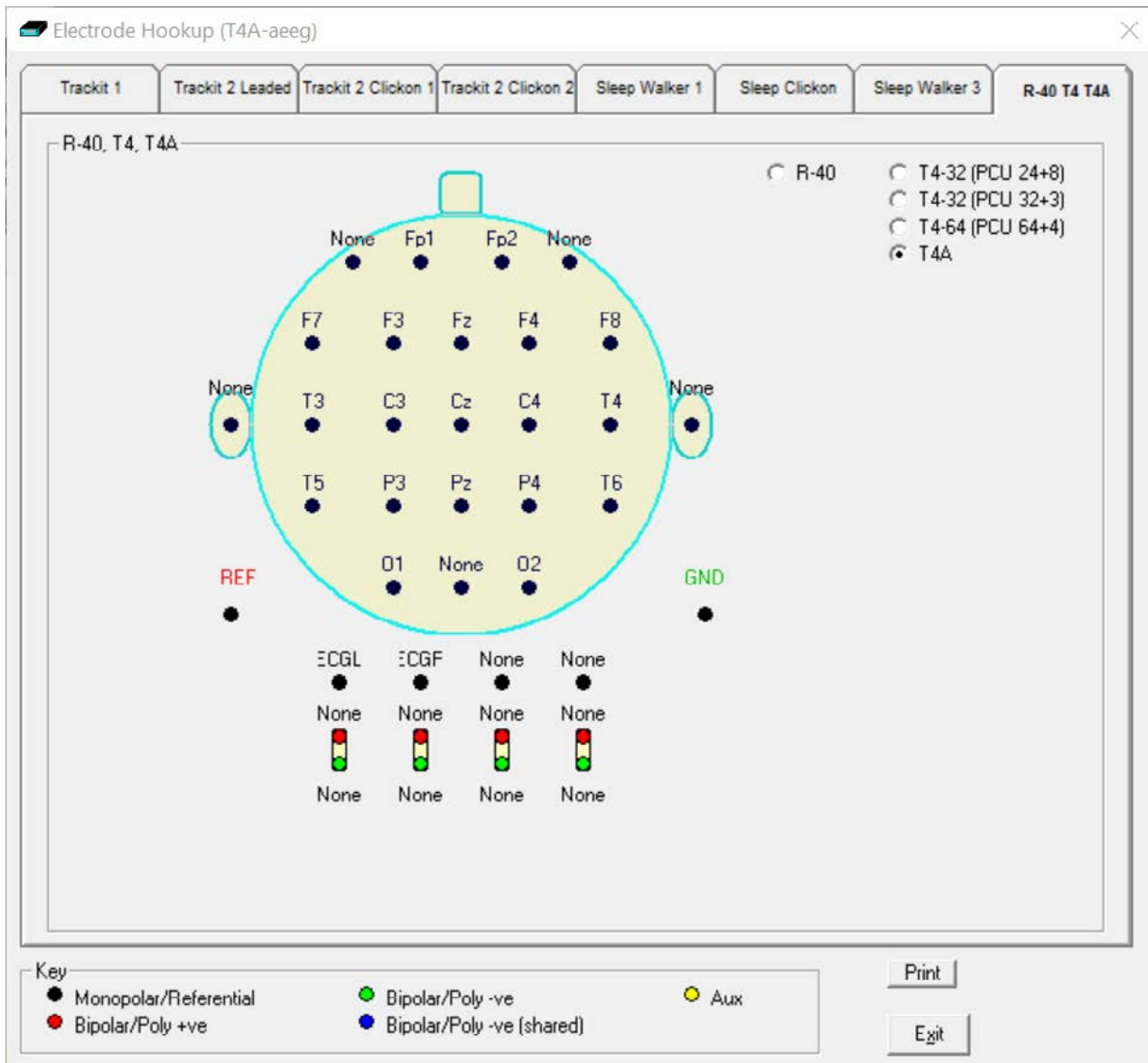


Figure 20: Electrode hookup – Trackit T4A

### 4.2.4 Define the recording channels

The Recording Channels tab allows the user to setup a Recording Montage. The Recording Montage defines which amplifier input channels will be recorded to the memory card or PC and the order in which they will be recorded.

This step can usually be skipped, since the **Auto Record Setup** button will copy the defined amplifier inputs from the previous step into the list of recording channels and in the same order as the inputs channels.

However, you can define and save recording montages for specific recording needs, and recall them for future usage.

Creating a montage follows the same principle as the signal creation and input definition tool: click on the channel number to define the active and reference label of choice.

An example of a recording montage is shown below. Information about recording data rate and recording time is displayed. If an amplifier is connected, press the **“Refresh”** button to update this information with the fitted memory card capacity.

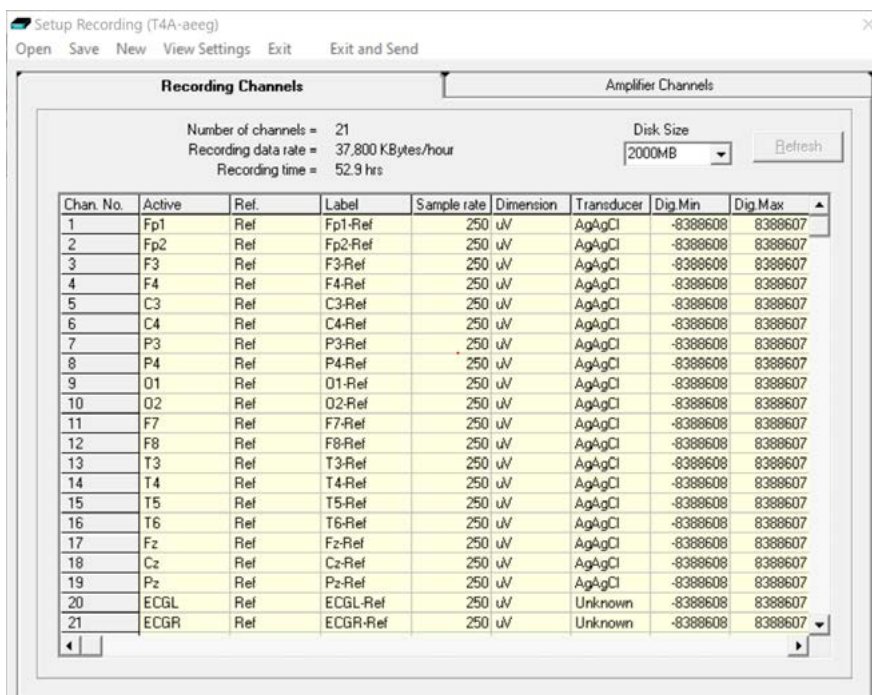
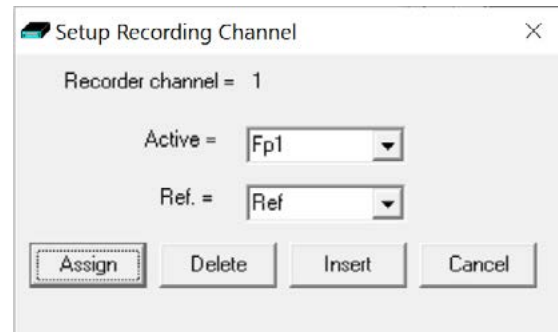


Figure 21: Recording Channel editing

When the Amplifier inputs and recording configuration have been completed, the setup can be saved (in a \*.tsu file). If the EEG amplifier is connected and online, the new setup can be sent to the amplifier by selecting the **“Exit and Send”** menu option. If the amplifier is not connected, the Setup Recording dialog will close, but the setup would not have been sent to the amplifier.

**NOTE:** If the Setup file (\*.tsu) is to be copied to another PC, the corresponding Signal library (\*.sl3 file) must be copied with the setup file. If the signal library is not copied with the setup, any new signals which are not in the default library will not be correctly displayed on the Montage editor.

### 4.3 Montage Editor

The Montage Editor is accessed by clicking on the "Montage" button on the Home toolbar or on "Setup Montage" button on the Settings toolbar. This displays the Montage Editor as shown in Figure 21, below.



The Montage Editor allows the setting up of 16 user montages and the As-recorded montage. The Montage Editor shows the location of the signals on the brain. Refer to Section 4.2.1 for details on defining the signal location.

The 16 user montages are fully definable and can have the following parameters set for each channel:



1. Active channel name. This is either chosen from the dropdown list representing the current Signal Library signals, selected on the brain image, or typed in directly.
2. Ref. channel name. This is either chosen from the dropdown list representing the current Signal Library signals (including Ref and Gnd), selected on the brain image, or typed in directly.
3. Channel On or Off. If off, the channel label is greyed out and no trace is displayed.
4. Master or Special Control. If Special, then the Sensitivity, Low Filter and High Filter can be set.

**NOTE:** the As-recorded montage can only have its channel on/off and channel master/special control edited (and if special, the channel sensitivity and filters).

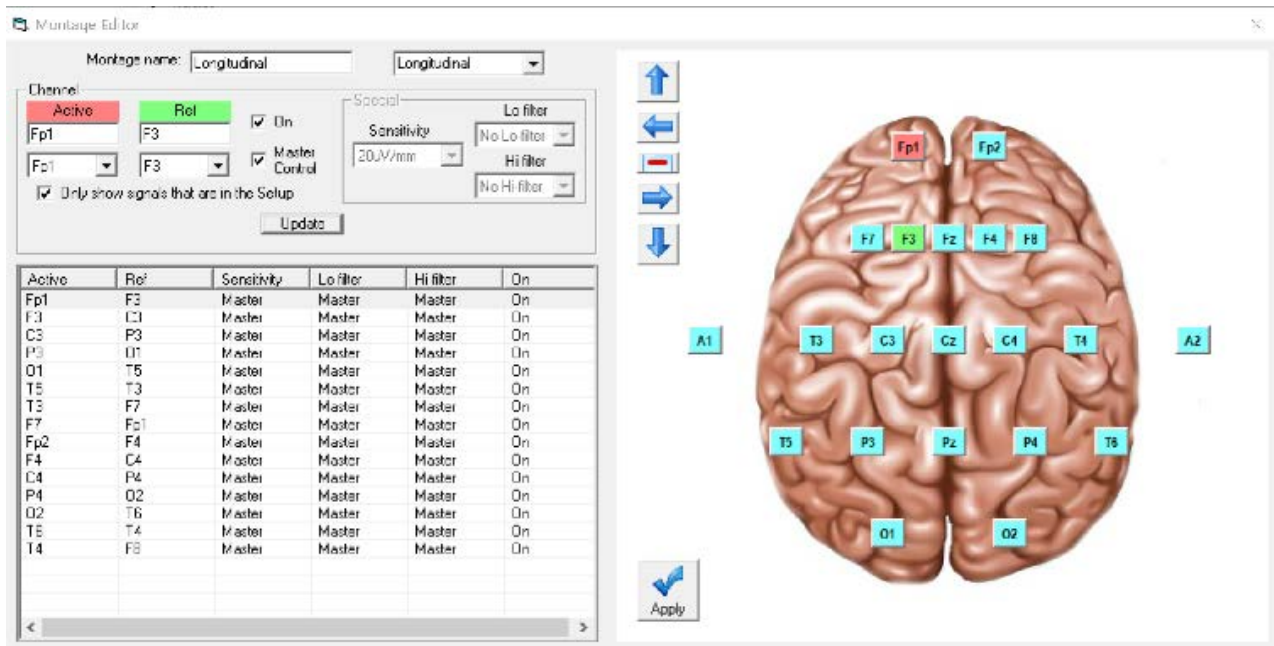


Figure 22: Montage Editor

To change an Active or Ref channel on the brain image;

1. Select the designed channel on the list (or add/insert a new channel).
2. Click on the current Active or Ref signal on the brain (Active signal is coloured Red, Ref signal is coloured green),
3. Click on an unused signal. The selected signal shall change to the appropriate colour. If the desired signal is in use (coloured red or green), this signal must be unassigned first.
4. Click Apply

Additional controls are provided to allow:



(Up) Selects the previous channel on the list



(Remove) This removes the currently selected channel.



(Down) Selects the next channel on the list



(Insert) This inserts a channel above the currently selected channel.



(Append) This adds a channel to the end of the Montage list.



(Update) Copies the current settings into the currently selected channel.

Montage name – User input for custom montage name.

If anything is changed, an option is presented to save all changes to disk or not. If not saved, changes are only temporary.

**NOTE:** Some of the montage parameters can be changed outside the Montage Editor, by clicking on a channel label to bring up the Channel Information window. These changes are only temporary (although you can save them later by subsequently going into the Montage Editor).

### 4.4 View EEG Signal Traces

To view the EEG signal traces at any time, whether recording or not, click on the "EEG On/Off" icon in the Home toolbar.

When you do this, one of the following things occur:

- If the amplifier is connected to the PC, and has been sent a valid recording setup, the traces appear wiping from left to right across the display.
- If the amplifier has not been sent a setup from the PC, the system asks for the recording setup held in the amplifier before displaying the traces.

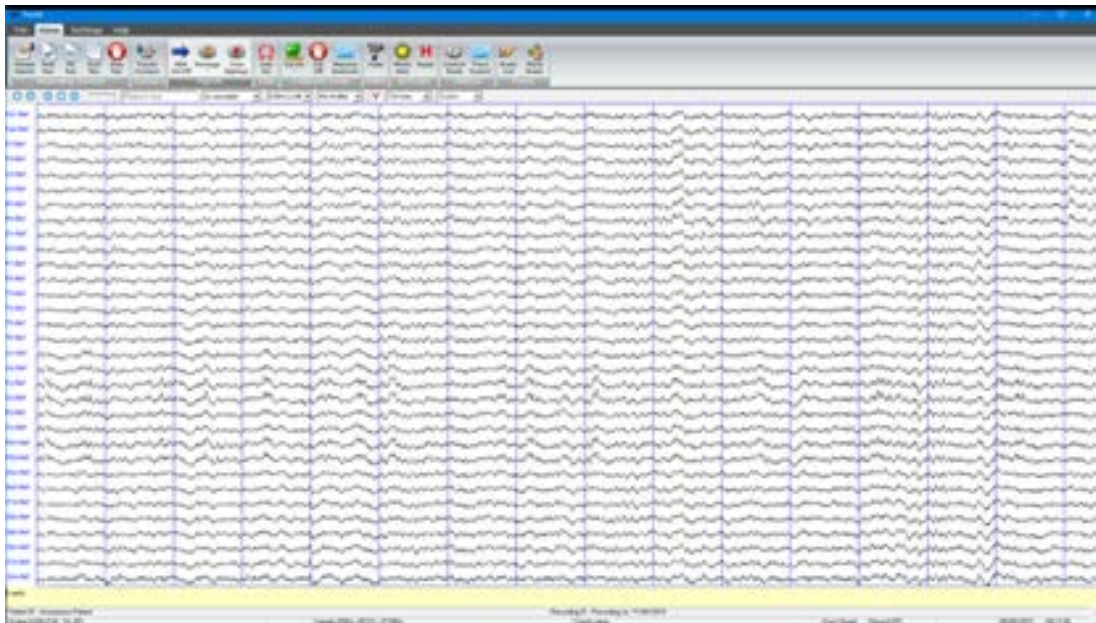
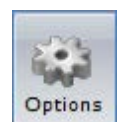


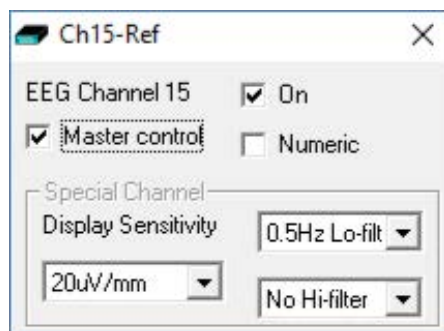
Figure 23: EEG Signal trace display

**Notch filter:** to set a notch filter, open the Trackit 'Options' window from the Settings toolbar. Notch filters are either 50Hz or 60Hz depending on where the system is to be used (USA 60Hz; Europe 50Hz). See Section 3.2.2.1.1



To activate the notch filter, click on the Notch Filter icon in the Trackit toolbar.

**Sensitivity, Chart speed, Notch Filter and Hi/Lo filters:** as is often the case when viewing a live trace display, the sensitivity, chart speed and filters need be adjusted for optimal viewing. Use the drop down lists on the toolbar (see Figure 4).



To adjust the display parameters for an individual channel, click on the channel label on the left of the graph. This displays a dialog box for that channel, with a checkbox for master control, trace On or Off, and Numeric. Click on Numeric if you want the numeric value displayed under the label. This can be useful when for displaying units such as mmHg or degrees C.

When a channel is under individual channel control the label is depicted in red. When display of that channel is turned off, the label is greyed out.

Figure 24: Adjust display parameters

**Number of displayed traces**



The "Trace Control" icon provides the ability to adjust the number of displayed traces to 1, 4, 8, 12, 16, 24, 32 or all traces.

**NOTE:** This feature is not available while recording to the PC.

When the number of displayed traces is less than the total number of recording channels, the "Trace Page Down" and "Trace Page Up" functions will cycle through all the available traces.

The 'Superimpose On/Off' option (under the Trace Control menu) will superimpose all the traces on top of each other. This is useful when checking DC offset and noise measurements.

**Trace measurement**

Use the "Measurement Graticule" button to display a measurement grid on the EEG traces. This provides a method for measuring the amplitude of the traces. The scale of the measurement graticule will change with the sensitivity and chart speed settings.



**4.5 Calibration Check**



To perform a Calibration check, whether recording or not, click on the Cal On icon on the 'Home' toolbar. Calibration check is turned off by pressing the 'Cal Off' icon.

Calibration check will start the acquisition and ongoing traces if not already active. A calibration square wave will be produced for each channel and displayed on the screen. During a calibration check, EEG is not recorded and the calibration check waveform replaces the EEG waveform in the recording.

The calibration waveform for the Trackit Mk3 is a 0.5mV p-p square wave @ 1Hz. This is not configurable.

The calibration waveform for the R40, T4 and T4A is configurable. The default waveform is an 8mVp-p square wave @ 1 Hz. The amplitude can be set to 8mV, 2mV, 500µV and 125µV by clicking on the down arrow on the 'Cal On' icon.

**4.6 Impedance Check**



An Impedance check can be performed on the EEG inputs, whether recording is active or not. To perform an Impedance Check click on the 'Ichk On' icon on the Home toolbar. This will start the Impedance Check on the amplifier and the Impedance Check panel will be displayed (Figure 24).

If recording has started, the impedance check is displayed on the trace display with an Impedance Check event.

The impedance check works via pass/fail threshold selection. Impedance values above the selected threshold (fail) are displayed on an orange background. Values below (pass) are displayed on a green background. Impedance Check is not performed on channels configured in bipolar mode and a value will not be displayed for these channels. The threshold can be set to 2kΩ, 5kΩ, 10kΩ, 20kΩ or 50kΩ on the Impedance Check panel.

Clicking on 'Exit' will stop the Impedance check on the amplifier.

For T4A, T4 and R40, the impedance of the Reference Electrode can be measured and displayed by clicking on the buttons as above.

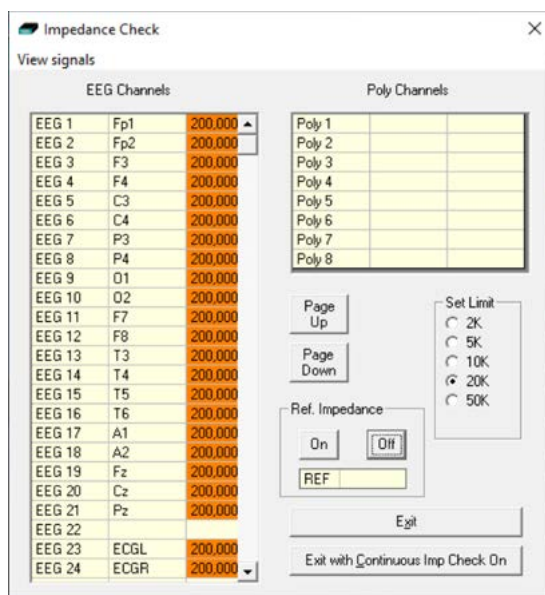


Figure 25: Impedance check

**Continuous Impedance Check (R40, T4 & T4A)**

Clicking on “Exit with Continuous Imp Check On” will close the Impedance check panel but leave the amplifier in Impedance check mode. The ongoing trace display will resume and the channel names of the channels which exceed the set limit will flash orange (see Figure 25).

Continuous Impedance Check can be cancelled by starting or stopping Ongoing EEG traces (EEG On/Off).

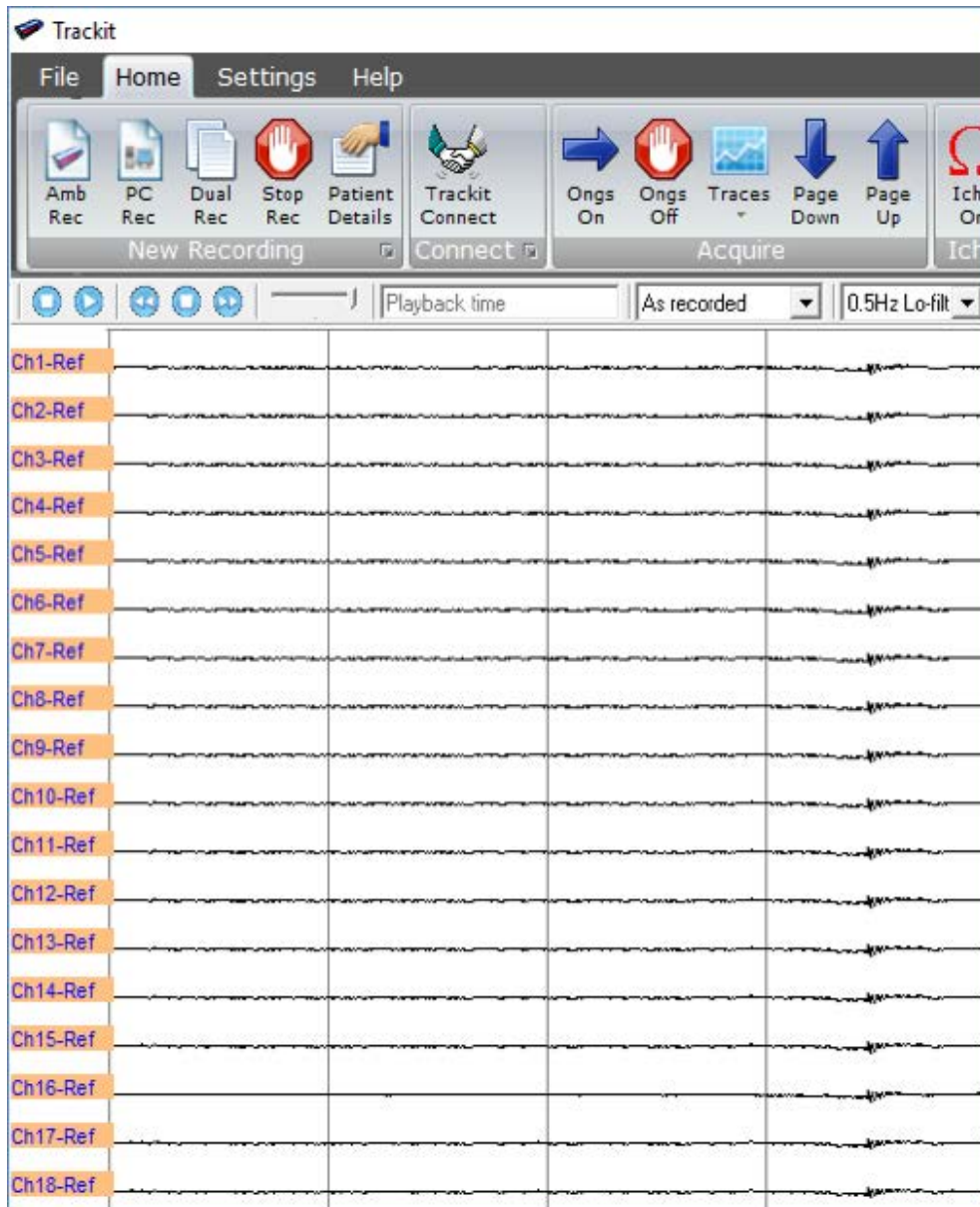


Figure 26: Continuous Impedance Check



## 5 Trackit Control Panel

The Trackit Control Panel shows the status of the connected Trackit amplifier and provides quick access to the common functions (“Connect”, “Disconnect”, “Send Setup” and “Setup Recording”).

The Trackit Control Panel can be accessed by clicking on the “Control Panel” Icon in the Home Toolbar or clicking the “expand” arrow of the “Recording control” panel (See Figure 4).

The Status section provides status information about the connected amplifier. This shows whether the SD (or CF) card is present or not and the operating and recording status of the device. These parameters are detailed below.

**NOTE:** The name of the Control panel and Status box will show “Trackit” by default and when disconnected. Once connected to an amplifier, these names will be updated to the name of the amp. For Example “T4A Control Panel”

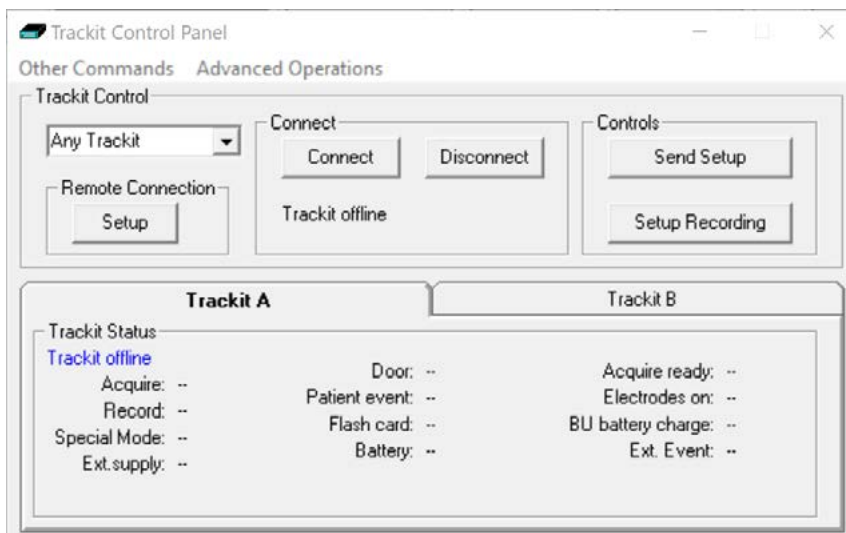


Figure 27: Trackit Control Panel (Amplifier Disconnected)

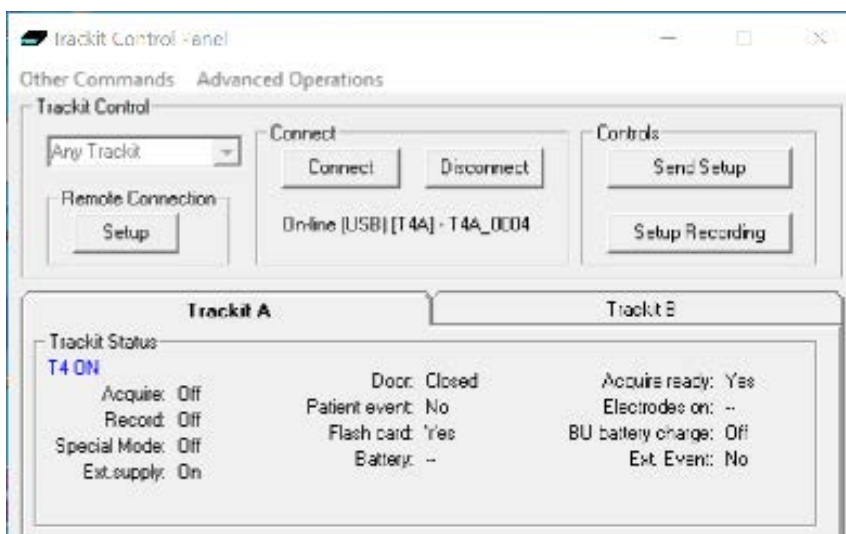


Figure 28: Trackit Control Panel (Amplifier connected)

## 5.1 Check Amplifier status

The Control Panel can be used to check whether the amplifier is online and setup correctly. The "Trackit A" tab of the Control Panel gives you the following status information for the amplifier:

<b>Acquire - on or off</b>	Shows whether the amplifier is acquiring or not.
<b>Record - on or off</b>	Shows whether or not the amplifier is recording data to its internal memory card.
<b>Special Mode - on or off</b>	Shows whether a special recording mode (timed recording) has been configured
<b>Door</b>	Shows whether the battery compartment door is open or closed (only applicable to the T4A and Trackit Mk3).
<b>Patient event</b>	Shows that the patient event marker has been activated.
<b>Flash card</b>	Shows whether the memory (SD or CF) card is present.
<b>Ext. Supply</b>	Shows whether the amplifier is connected to an external supply (USB source) or running on batteries.
<b>Battery</b>	Shows if the amplifier is running off batteries.
<b>Acquire ready</b>	Shows that a valid recording setup has been loaded into the amplifier.
<b>BU Battery Charge</b>	Shows whether the backup battery is being charged.
<b>Ext Event</b>	Shows that the remote patient event marker (via the External Event connector) has been activated
<b>Electrodes On</b>	Not used.

Further status information is available on the second tab ("Trackit B"). This includes the amplifier's time, Battery capacity, Recording time and the memory card's total and remaining capacity in (Megabytes (MB)) (see Figure 28).

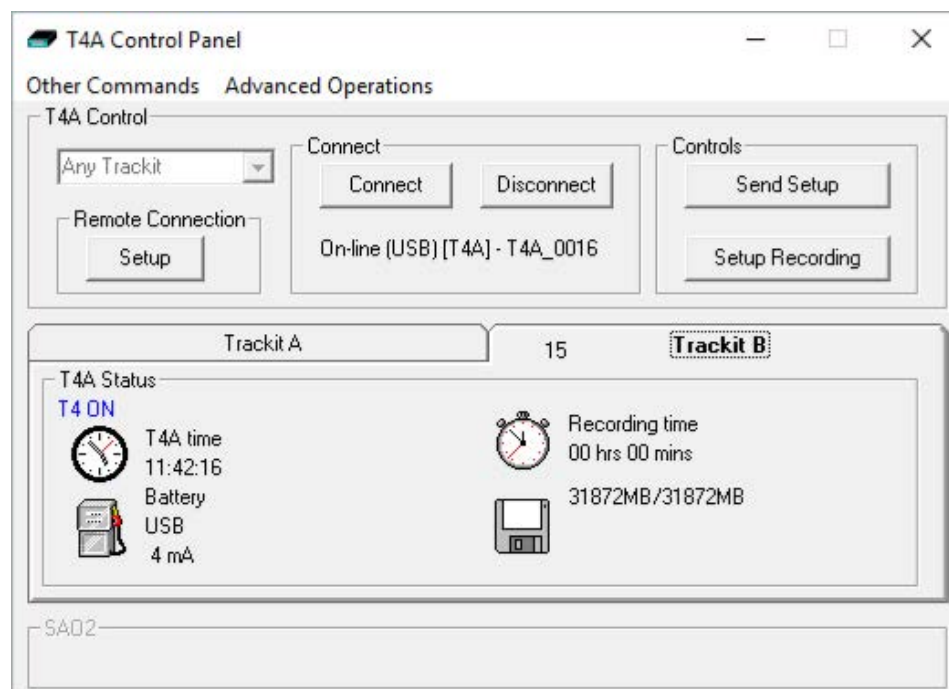


Figure 29: Trackit Control Panel "Status B"

## 5.2 Connect

The Trackit Control panel provides a Connect and Disconnect button to connect to the amplifier. See *Section 4.1 for further details on connecting the amplifier*. Once connected, the amplifier's name is shown under the two buttons.

## 5.3 Controls

The Trackit Control Panel includes two control buttons: "Send Setup" and "Setup Recording".

Clicking on the "Send Setup" button will send the last opened recording setup file to the Trackit. See *Section 4.2 for details on setting up a Recording protocol*.

The "Setup Recording" button will open the "Recording Control" panel. This allows the user to select the type of recording, and to start and stop an ambulatory (amplifier only) recording. See *Section 6.3 for more details*.

## 5.4 Menu Options

The Trackit Control panel has two menu options: "Other Commands" and "Advanced Operations".

### 5.4.1 Other Commands

By default, these options are greyed out as they are not available to the typical user and only available during factory testing.

Other Commands duplicates some of the controls on the home toolbar and recording control. There are also miscellaneous controls for:

**Set Trackit Time/Date:** if the amplifier is not recording, this manually sets the amplifier's time and date to that of the PC. Note: this function is normally done automatically when recording is started.

**Get Trackit Setup:** this manually retrieves the setup from the amplifier's memory and overwrites the currently loaded setup on the PC. Note: this function is normally done automatically whenever the software detects a mismatch between the amplifier's setup and the PC setup.

**Quiet On: (Trackit MK3 only)** if a host PC is connected, this temporarily disables the warning beep if the battery door is opened while the Trackit Mk3 is turned on. It is automatically re-enabled after the PC is disconnected.

**Quiet Off: (Trackit MK3 only)** if a host PC is connected, this re-enables the warning beep if the battery door is opened while the Trackit Mk3 is turned on.

## 5.4.2 Advanced Operations

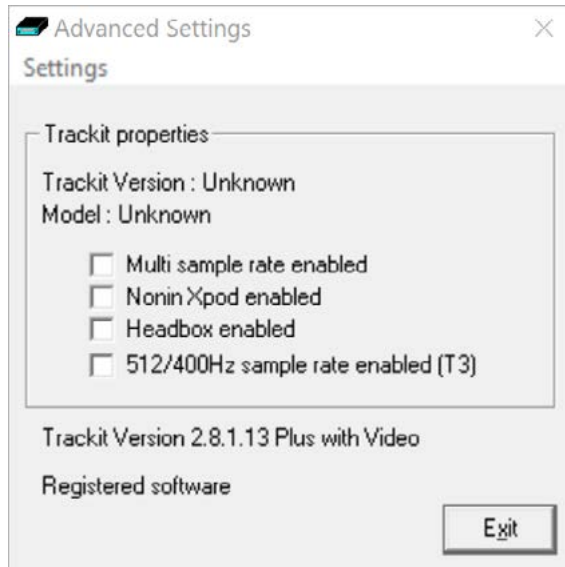


Figure 30: Advanced Settings

The Advanced Settings panel displays information about the amplifier such as firmware, model and configuration. This display also shows which features, if applicable, are enabled on the amplifier.

The Settings menu provides options for setting the amplifiers default settings, viewing the memory card status, enabling / disabling the backup battery charger and switching off the amplifier. Access to the factory settings and amplifier Configuration restricted by password access. Factory settings include compensation of DC offsets.

**NOTE:** This screen can also be accessed from the "Setup Advanced" option in the Settings toolbar.

To see the available options under Advanced Operations:

- 1 Open on the Trackit Control Panel.
- 2 Click on Advanced Operations.
- 3 Click on Settings.

### 5.4.2.1. Set Trackit Defaults

[> Advanced Operations > Settings > Set Trackit Defaults]

The Trackit Defaults provides configurable options for the Trackit and R40 amplifiers as well as the Bluetooth configuration. The Trackit Default options are detailed in **Appendix 1**.



Please read the manual carefully before changing or updating the Trackit Defaults.

### 5.4.2.2. Get Card Info

[> Advanced Operations > Settings > Get Card Info]

Selecting Get Card Info opens a dialog showing the current status of the flash card, including the file name and any error codes ('Disk OK' is displayed to indicate a properly functioning card). Should any problem occur with the flash card, copy and paste this dialog and send it to your Lifelines distributor.

In the Disk utilities menu there is Disk format and Disk R/W functions.

Disk Format (CF Cards only – Trackit Mk2 & Trackit Mk3)

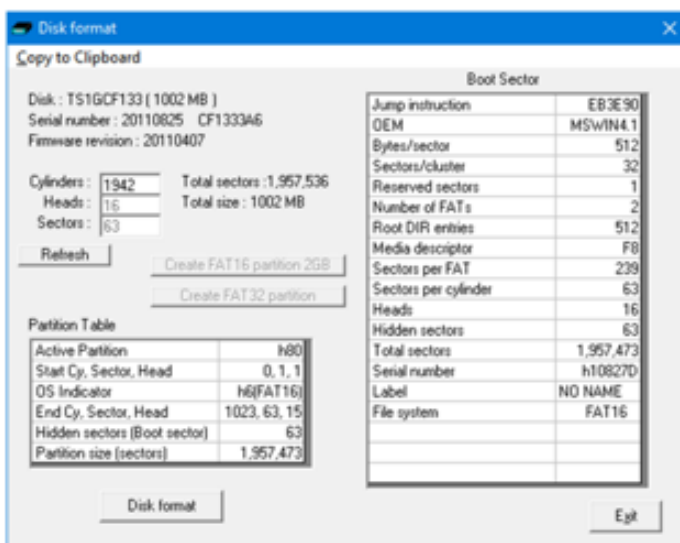


Figure 31: Disk Format

This allows for formatting of the Compact Flash (CF) memory card in the recorder in situ, without having to remove it. All the partition and boot parameters are automatically calculated and shown in this window, depending on the card size, and sent to the recorder for it to accomplish the format. FAT16 and FAT32 partitions are supported as well as the creation of a FAT16 partition on a large (>2GB) memory card.

**NOTE:** The R40, T4 and T4A do not support card formatting. The SD card should be formatted on a PC using the recommended SD card formatting software (<https://www.sdcard.org/downloads/formatter/>).

### Disk R/W

This brings up a window that allows individual sectors of the memory card in the recorder to be read, edited and written back to the recorder. This is mainly for diagnostic purposes, and is password protected (password can be obtained from Lifelines).

### 5.4.2.3. Factory Settings

[> *Advanced Operations* > *Settings* > *Factory Settings*]

Factory settings are protected by a password (via Options in the Settings toolbar). Only trained support staff should have access to factory settings. The password can be obtained from Lifelines.

Factory settings also provide a means to compensate for any DC offsets that may be present on any of the recording inputs. The DC offsets are saved in the amplifier's non-volatile memory.

### 5.4.2.4. Configuration

[> *Advanced Operations* > *Settings* > *Configuration*]

Configuration gives access to the amplifier's factory configuration. The code displayed can be copied and emailed to Lifelines for an activation code to be sent back.

### 5.4.2.5. Backup battery charge ON / OFF

[> *Advanced Operations* > *Settings* > *Backup battery charge ON*]

[> *Advanced Operations* > *Settings* > *Backup battery charge OFF*]

These commands will turn the backup battery charger on and off.

### 5.4.2.6. Trackit OFF

[> *Advanced Operations* > *Settings* > *Trackit OFF*]

Turns the amplifier off.

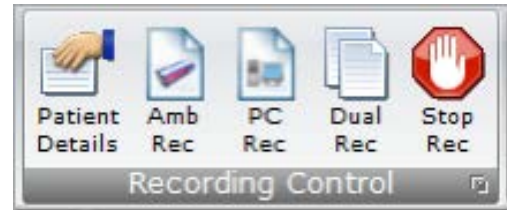
**NOTE:** Communication to the host PC will be lost.

## 6 Recording a new study

### 6.1 Overview

The Trackit Plus software performs three types of recordings:

- **Ambulatory Recording** – EEG data and Events are stored on the SD/ CF card in the amplifier.
- **PC recording** – EEG data and Events are stored on the computer, in the recording folder.
- **Dual recording** – EEG data and Events are stored on the SD/ CF card in the amplifier and on the computer.



All recording types can be recorded with or without video. When recording with video, the recorded video files are stored in the recording folder with the EEG and Event files.

The following steps are the same for all three types of recordings. An Ambulatory recording has additional options for starting a recording. *This is detailed in Section 6.3.*

### 6.2 Starting a Recording

Before a recording can be started, the following needs to be set up first:

1. The required signals need to be defined (*see Section 4.2.1*).
2. Recording channels and montage needs to be set up (*see Section 4.2.2*).
3. If a videometry recording is to be used, the video needs to be set up (*See Section 3.2.1*)
4. The recording folder to store the recorded files needs to be set. This defaults to "C:\Program Files (x86)\Trackit\Trackit Recordings". (*See Section 3.2.2.1.3*)

The preliminary steps are usually only required once. The recording setup can be saved and recalled for future use. Once set up, the Video setting will remain the same for all recordings and do not need to be set up for each recording.

#### 6.2.1 Patient Details

1. Click on "Patient Details" in the 'Home' Toolbar.
2. Enter the patient name and Recording ID into the "Patient Details" dialog box (Figure 31). This information is saved with the recording setup for download to the recorder in a future recording.

**NOTE:** It is possible to configure the system to use a patient database instead of the simple dialog shown in Figure 31.

 A dialog box titled "Patient Details" with a close button (X) in the top right corner. It contains three text input fields: "Last Name:" with the value "Anonymous", "First Name:" with the value "Patient", and "Middle Name:" which is empty. Below these is a label "Recording ID" followed by a text input field containing "Recording no.1". At the bottom are "Cancel" and "OK" buttons.

Figure 32: New Patient dialog

The database allows you to enter more extensive information about the patient and recording, and save it for future reference.

To use the Patient Database instead of the simple patient dialog shown in Figure 31, set this option in the PC setup (Section 3.2.2.1).

- Once the patient details have been entered, click "OK".

#### NOTE: Anonymising Patient Data

The Patient's full name (first, middle and last name) and Recording ID will be included in the recorded EEG data files in plain text. If this is not desired and/or to protect personally identifiable patient data when files are shared, key information should be anonymised or otherwise locally encoded. (for example, "Anonymous", as shown in Figure 31).

Figure 33: New Patient database

## 6.2.2 Recording Mini-Wizards

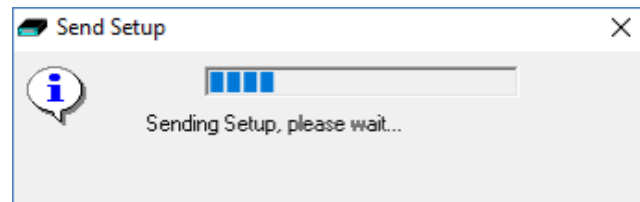
- Select either the "Amb Rec", "PC Rec" or "Dual Rec" button from the Home toolbar.

**NOTE:** If the patient details have not been entered beforehand, the Patient Details window (Figure 31 or Figure 32) will appear first.

- The "Open Setup" dialogue box will appear; select the Recording setup file (as described in Section 4.2.2) and click "Open". To bypass this step and use the setup loaded on the Trackit Amplifier, close this dialog box by clicking the 'X' in the top right hand corner.
- The "Trackit Connect" dialog box will appear next. If the Trackit has not already been connected to the PC, connect via USB or Bluetooth (as described in Section 4.1) and click 'OK'. If the Trackit is already connected, then just click 'OK'



4. The new setup will be sent to the amplifier (if required). A warning will appear if this is not successful.
5. The next dialog box confirms if video is to be recorded? Select 'Yes' if doing a videometry recording.



6.
  - 6.1. For PC recordings, the recording shall start and the EEG traces shall be displayed on the screen
  - 6.2. For Dual or Ambulatory recordings, the Recording Control panel (Figure 33) will appear
    - 6.2.1. Select the Record mode (default mode is 'Immediate').
    - 6.2.2. Enter the desired file name for the recording file name.
    - 6.2.3. Confirm the SD card is ready by clicking "Check disk"
    - 6.2.4. Click Start to start the recording.
    - 6.2.5. The recording configuration will be sent to the amplifier. This may take a few seconds as the amplifier may need to prepare the SD card.
    - 6.2.6. The Recording Control panel will close if the recording started successfully.
    - 6.2.7. Once the amplifier has started recording, the PC recording will start (if performing a dual recording).

Refer to Section 6.3 for a description for recording options in the Recording Control panel.

7. After the recording has started, the following actions can be performed:
  - 7.1. View EEG Signal Traces (see Section 4.4)
  - 7.2. Perform a Calibration check (see Section 4.5)
  - 7.3. Perform an Impedance Check (see Section 4.6)

### 6.2.3 Auto Record

The Trackit and R40 amplifiers support auto record functionality, where the amplifier will automatically start recording to the memory card in certain scenarios. The scenarios are:

- **Auto-record on Comms lost.** The Amplifier will automatically start recording when the Host communication is lost if a PC recording is active. This feature is most useful with a wireless Bluetooth connection, but it will work for any type of connection. All amplifiers (Trackit Mk3, T4, T4A and R40) support this function. This function is enabled in the PC options (see Section 3.2.2.1.2).
- **Auto-record after restore setup at power-on. (Trackit Mk3 only).** When enabled, the Trackit Mk3 continues recording at power-on if it was recording the last time it was powered off, using the recalled Setup and Patient Name and Recording ID, but only if it has been powered off for 15 minutes or less. If the Trackit Mk3 has been powered off for longer than 15 minutes, then the Patient Name and Recording ID are overwritten with defaults (the current Setup remains). This function is enabled in the Trackit Defaults (see Appendix 1).

Refer to the Trackit Defaults setup in Appendix 1 for additional options for Auto Record.

If there is already a file on the amplifier's disk, then the following rules will apply, depending on the amplifier:

#### Trackit T4, T4A and R40:

1. If the BDF file name on the SD card does not match the filename set by the Trackit software, the file will be deleted.
2. If the file name matches then the patient ID in the file header is checked to make sure it matches the ID set by the software. If it does not, then the files will be deleted.
3. If the patient ID does match, the files will not be deleted off the SD card and a new BDF file will be written to the card.

**Trackit Mk3:**

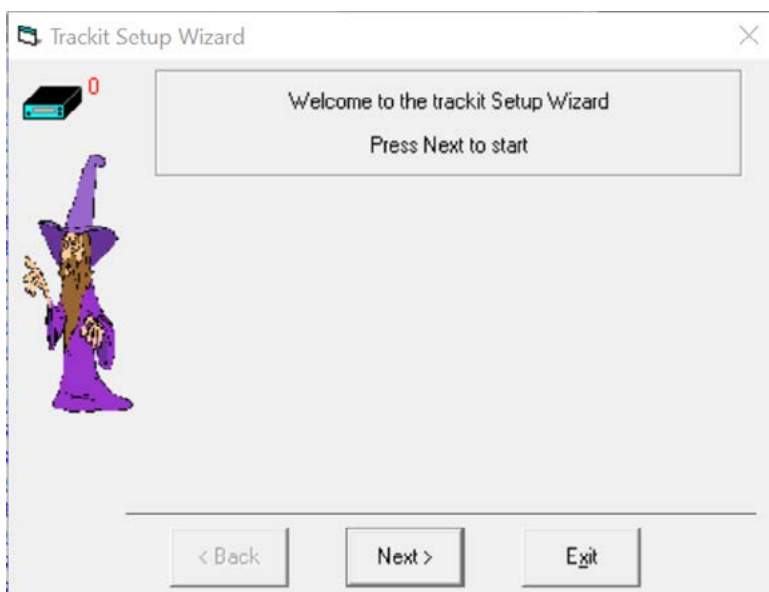
1. The Trackit Mk3 will not overwrite a file less than 24 hours old
2. The Trackit Mk3 will append new data, if enabled, to a file on the flash card is less than 24 hours old and if the Patient Name, ID, recording setup and all other details are identical to its current setup
3. The Trackit Mk3 will overwrite data on the flash card, if enabled, if the data on the card is more than 24 hours old.
4. The Trackit Mk3 will write new data to a blank flash card, if enabled.

**6.2.4 Trackit Recording Setup Wizard**

A Setup Wizard is available which some users may prefer as a simplified method to setup and start an "Ambulatory only" recording. It is enabled via the Help menu and appears the next time (and every time, until disabled) the Trackit software is invoked.

The Setup Wizard can also be used to stop the Ambulatory recording.

**NOTE:** This wizard cannot be used to start Dual or PC recordings.



The Wizard can be dismissed at any time by using the top right close button: setup and control can then continue using the normal Trackit software. Exit from the Wizard exits the Trackit software.

### 6.3 Recording Control Panel (Amplifier recording)

The Recording Control panel provides additional options when recording to the memory card on the amplifier. These options are not applicable when performing a PC recording. Click on the 'Setup Recording' button in the Trackit Control Panel (Figure 27) to open the Recording Control dialog box (Figure 33). The Recording Control panel is also displayed when starting an ambulatory or a Dual recording.

The patient's name and the default file name for the recording are displayed. The default file name can be changed to a custom filename (up to 8 characters in length). The recording ID can be changed in this window. The Patient ID cannot be changed. To change the Patient ID, refer to Section 6.2.1.

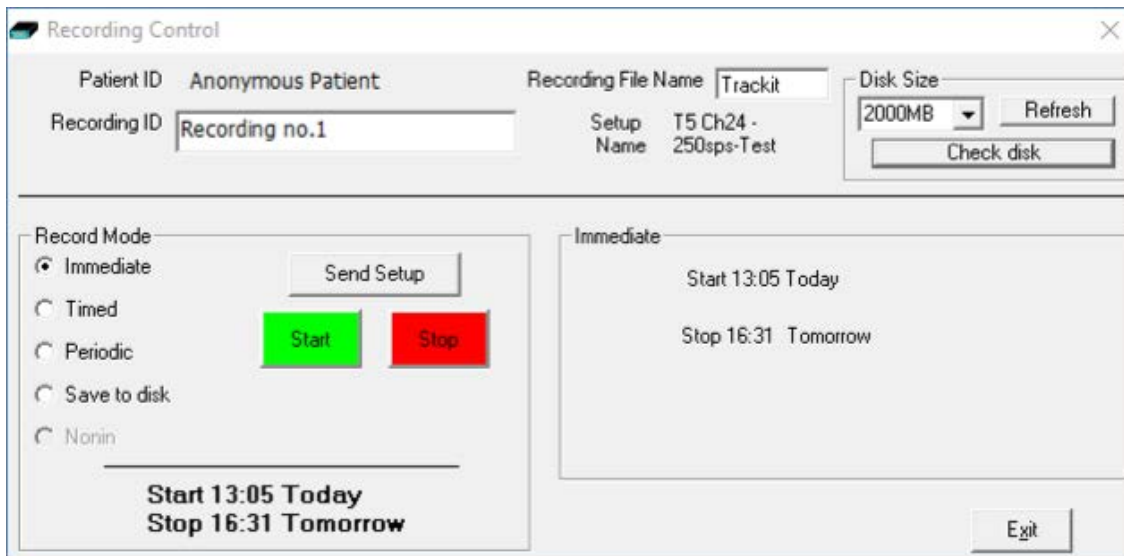


Figure 34: Recording Control panel (non videometry recording)

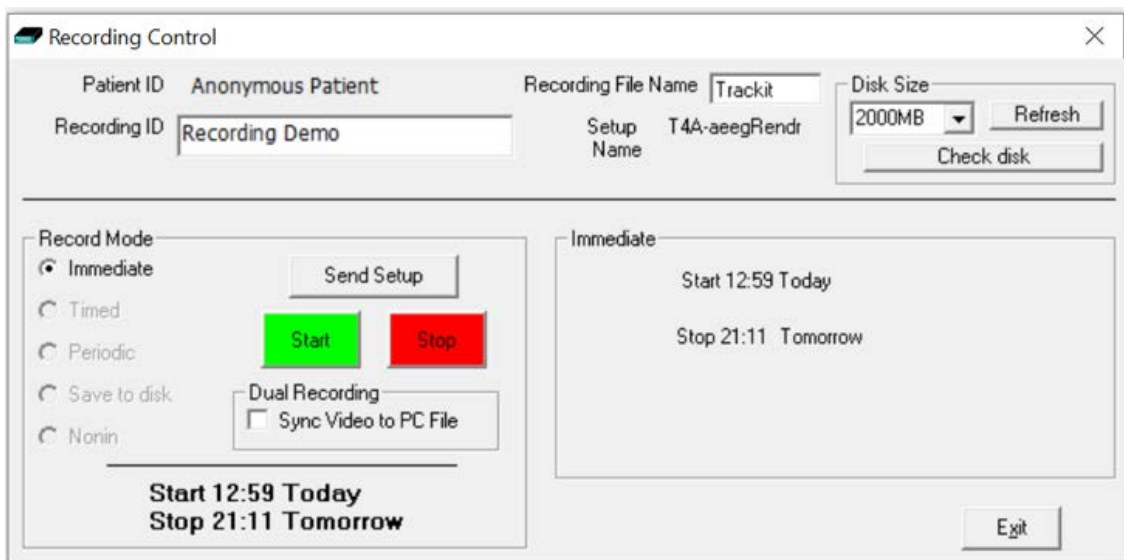


Figure 35: Recording Control panel (Videometry recording)

### 6.3.1 Default file names

To make the recording file name the same as the patient name:

- 1 Choose 'Options' from the Settings toolbar (see Section 3.2.2.1).
- 2 Put a checkmark by "Default to Patient Name" option.
- 3 Click on Exit.

### 6.3.2 Recording modes

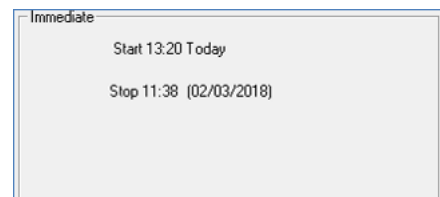
There are multiple ways to start an ambulatory and Dual recording:

- Immediate
- Timed
- Periodic
- Save to Disk
- Nonin

**NOTE:** When starting a recording with video, the only option is "Immediate". All other options are greyed out as shown in Figure 34.

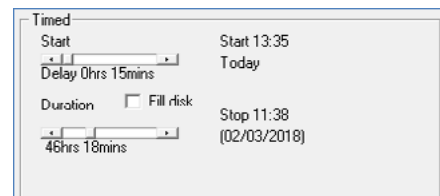
**Immediate:** the recording starts as soon as the Start button is pressed (Figure 33). Recording finishes when the Trackit is turned off, when the disk is full or when the recording is stopped.

- 1 Under Record Mode, choose Immediate.
- 2 Click the Send Setup button, then the Start button



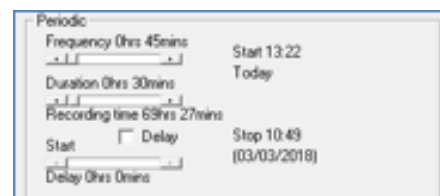
**Timed:** The Trackit EEG amplifier records for a specified period of time.

- 1 Under Record Mode, choose Timed.
- 2 In the Recording Control dialog box, set a start time to start the recording, using the Start slider.
- 3 Either put a checkmark by 'Fill Disk', or use the Duration slider to set the recording duration.
- 4 Click the Send Setup button, then the Start button.



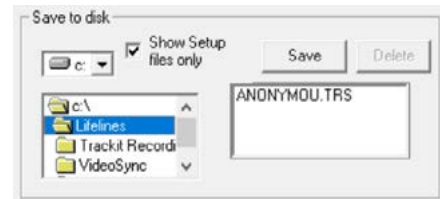
**Periodic: (Trackit Mk3 only)** The Trackit Amplifier records for specified periods of time at a defined interval (e.g. for periods of 30 minutes, with a 45-minute interval):

- 1 Under Record Mode, choose Periodic.
- 2 Use the frequency and duration sliders to define the length of the recording period, and the interval between periods.
- 3 For a delayed start (e.g. in an MSLT study), put a checkmark by the Delay box, and use the Start slider to set a start time for the recording.
- 4 Click the Send Setup button, then the Start button.



**Save to disk:** A setup is created, then saved on the flash card for use in a later recording. This is particularly useful for home sleep recordings where the patient can switch on the recorder (and so start the recording) just before going to bed.

- 1 Create a setup in the normal way, with patient name and recording channels.
- 2 Place the flash card in the flash card reader in the host PC.
- 3 Under Record Mode, choose Save to disk. The setup is saved on the flash card as a \*.trs (trackit recording setup) file. The name of the setup file is the patient's last name.



**Nonin: (Trackit Mk3 only)** Recording starts as soon as the Nonin SaO2 probe is connected and attached.

### 6.3.3 Dual Recording

**Sync Video with PC File:** When performing a dual recording with video, the video will be synchronised to the Amplifier recording by default. To synchronise the video to the PC recording, tick the **"Sync Video with PC File"** checkbox.

## 6.4 Ending a Recording

A recording can be stopped using the following steps:

- Connect the amplifier to the Trackit Plus software if it is not already connected.
- Press the "Stop Rec" button on the Home toolbar.
- A confirmation message box will be displayed, confirming you want to stop the recording. Press "Yes" to confirm.
- If a Dual recording is in progress, two messages boxes will be displayed when the "Stop Rec" button is pressed; one confirming that the amplifier should stop recording and one confirming that the PC should stop recording. Press "Yes" for both messages to stop the Dual recording



## 6.5 File Manager

At the end of a recording, the File Manager window and dialogue is displayed.

The File Manager automatically collects all the relevant associated files for a study and assembles them into appropriate folders on the PC. This makes it much easier for local review and/or the upload of files for remote review to take place. It works for the following recording types:

- Ambulatory (amplifier) recordings with or without video
- PC recordings with or without video
- Dual recordings with or without video

The File Manager automatically assembles files on the PC as follows:

### Ambulatory Recording folder

for example: SmithJoh\_220311134555

The File Manager assembles the ambulatory files, Events files and all video and synchronisation files in this folder.

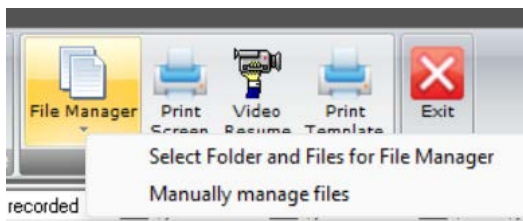
### PC Recording folder, with the [PCFiles] identifier

for example: SmithJoh\_220311134555[PCFiles]

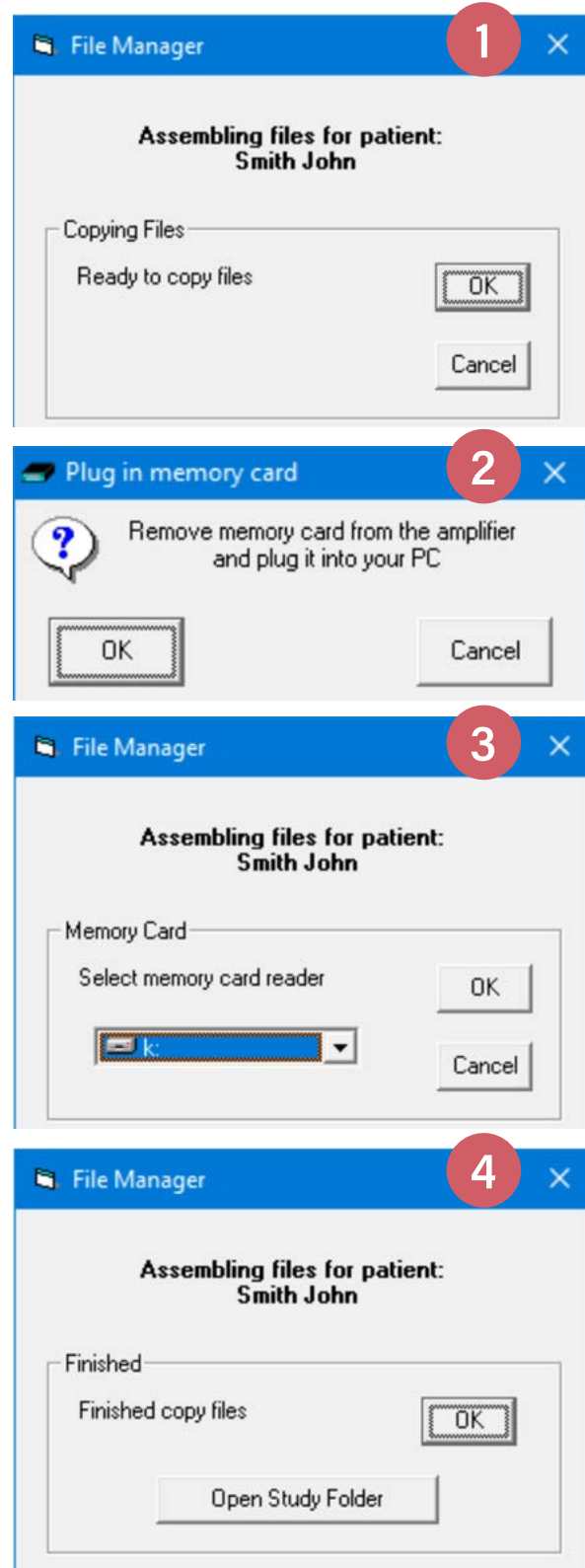
The File Manager assembles the PC files into this folder.

**NOTE:** the File Manager can be launched from the main File tab as well as automatically at Stop Recording. The options available here are as follows:

- Proceed as above for the last patient recording
- Or via the drop down list:
  - Select folder and files for File Manager
  - Manually manage files



Following Stop Recording, the File Manager steps are as follows:



## 6.6 Lockscreen

During a recording, a Lockscreen can be invoked to disable options available to the patient.

It is available from the main Home tab right-hand side as follows:



The special display and limited features available to the patient are as shown below:

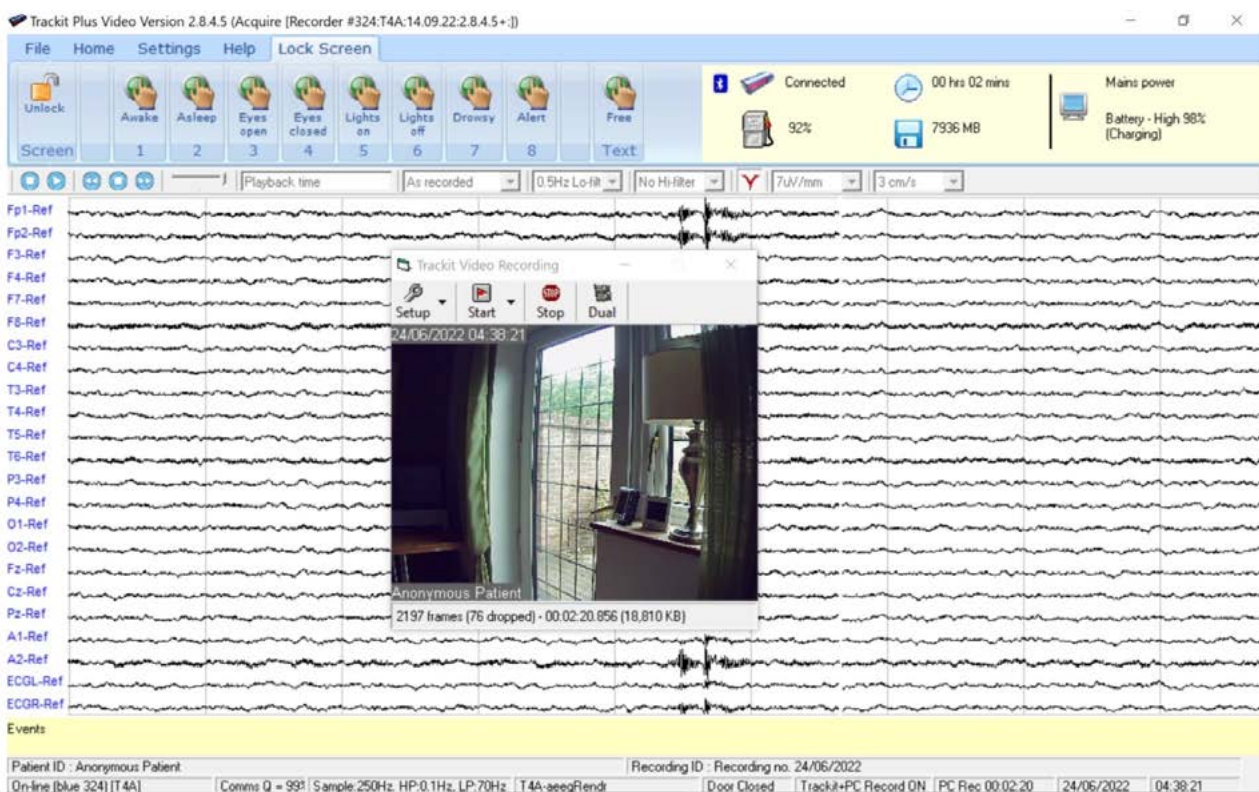


Figure 36: Lockscreen

- Full-size display – minimize and exit disabled
- Eight configurable patient events
- Free-text event
- Status panel – top right in ribbon area:
  - a Connection status with Bluetooth marker
  - b Battery capacity remaining
  - c Recording time
  - d Recording MB on the memory card remaining
  - e Tablet mains or battery power
  - f. Tablet battery capacity remaining and charging status if on mains
- Video window - moveable but with all controls disabled, minimize and exit disabled
- All other controls, menus and ribbon items disabled
- Information in bottom status bars and top caption bar still available
- All the usual auto-reconnect Bluetooth features, video segments etc. work as before
- The EEG will scroll across if turned on before the lockscreen
- Password required to unlock (refer Options)

# Review and Playback

Trackit recordings are stored in either 16-bit EDF format (for Trackit Mk3) or 24-bit BDF format (for R40, Trackit T4 and Trackit T4A). These files are readable in all EDF and BDF-compatible EEG browsers. In a compatible browser, the patient's name and recording ID are displayed in the test properties. The recordings are identified with a user-definable 8-character file name with either an '.EDF' extension (Trackit Mk3) or a '.BDF' extension (R40, T4, T4A).

As an alternative to the Trackit Plus software which offers basic playback features, any EDF-compatible viewer can be used to read the EEG files recorded by the amplifier. The viewer must be BDF compatible to read the 24-bit EEG files recording using the R40, T4 or T4A.

Lifelines currently recommends:

- Trackit Plus Software
- Persyst Insight EEG
- Lifelines iEEG
- StratusEEG

## 6.7 Retrieving Recorded files

To review a recording, the recorded EEG data files, event files and video files must be located in the same folder, as follows:

- **PC Recording:** All the recorded files (EEG, Event and Video) are saved in a subfolder in the "Recording folder". The subfolder is identified using the patients' name and a date stamp. The recording can be opened directly from this folder.
- **Ambulatory recording:** The CF / SD card should be removed from the amplifier and connected to a card reader on the PC. All the files on the card should be copied to the PC, as follows:
  - **Non-videometry recording:** Since there are no video files, the EEG and event files can be copied to a folder of the user's choice.
  - **Videometry recording:** The video files are stored in a subfolder in the "Recording folder". The subfolder is identified using the patients' name and a date stamp. Copy all the files from the card to this folder.
- **Dual Recording:** A Dual recording provides two sets of EEG and Events files and one set of video files. The user should choose which recording should be viewed with the video files.
  - **PC recording:** The PC recording can be opened directly from the recording folder.
  - **Ambulatory Recording:**
    1. Locate the PC recording's EEG files (with extension .EDF or BDF) and Event files (with extension .TEV) and move these files to a subfolder or alternate location.
    2. Copy the EEG files (\*.EDF/\*.BDF) and Event files (\*.TEV) from the CF/SD card on the amplifier to the recording folder. The ambulatory recording can then be opened with the recorded video.

**NOTE:** The Extended Event file (.TVX) can be opened with the Ambulatory files. This provides user events captured during the recording.

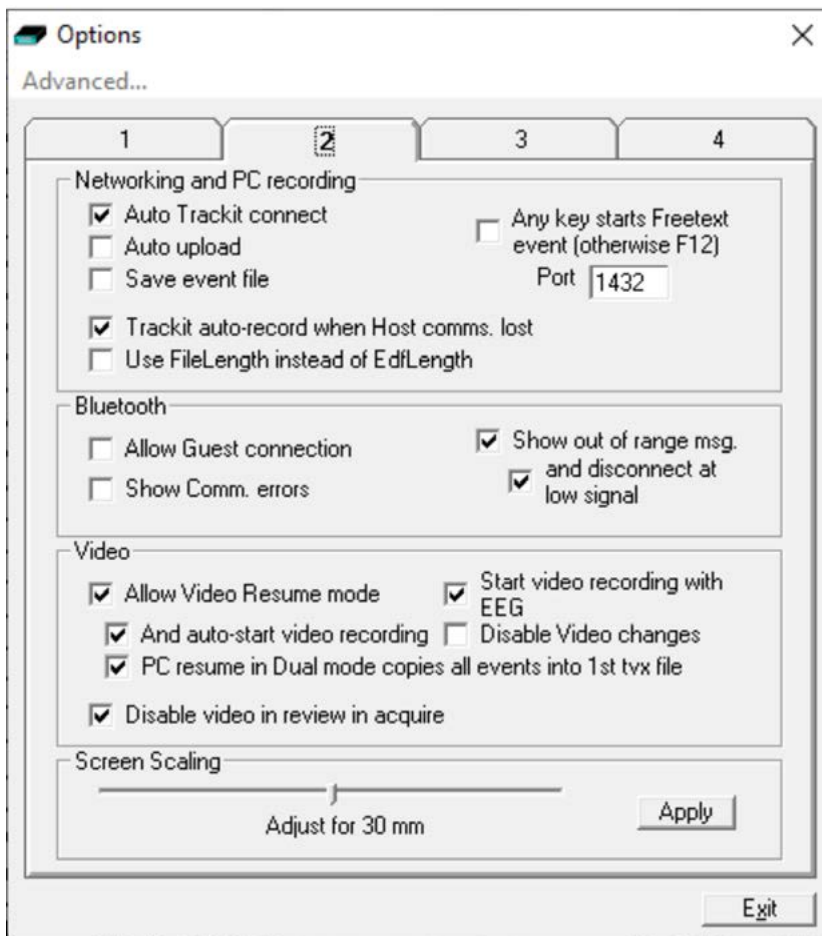


## 6.8 Opening a recording

Once the files have been retrieved from the amplifier (if applicable), the recording can be opened for review in the Trackit Plus application.

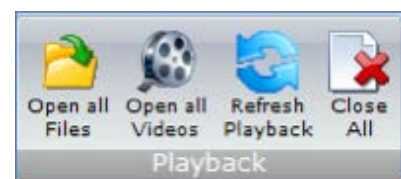
If currently recording to the PC, it is possible to open this file for simultaneous playback and review, whilst displaying the live traces. This will open the current EDF/BDF file, all video files and the current Events list.

The display of the 2nd video window is an option as set in Options, as shown below (3rd frame) *Disable video in review in acquire*:



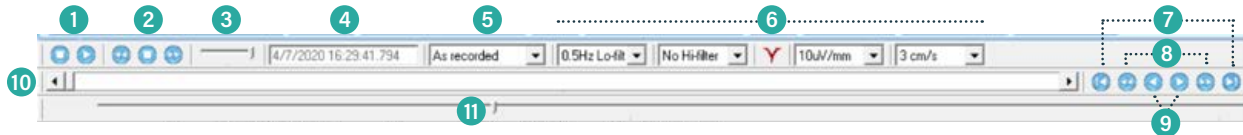
Playback occurs in the normal way. The 2nd playback window is titled "Trackit Review" and can be set to tile horizontally or vertically (as set in Options). It is also possible to launch a second instance of the Trackit software and review the PC file.

Click the 'Open all files' button on the File toolbar to playback a recording and browse to the folder and file required. This will open the EDF/BDF file and any associated files.

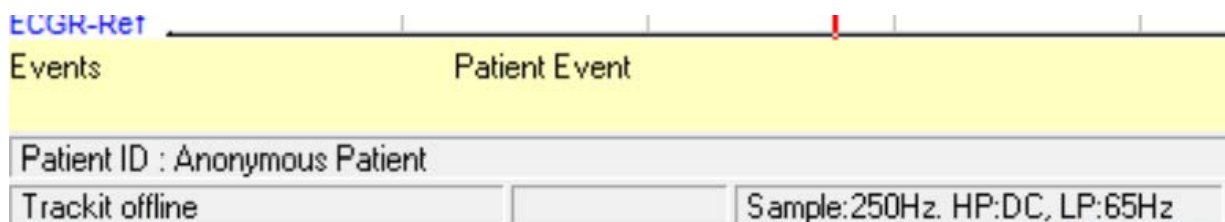


## 6.9 Reviewing an EEG Recording

The Review commands are located below the Menu options, as shown below.



1. Play start stop. This scrolls the data across the screen.
2. Page back, stop and forward. This pages the data a screen at a time.
3. Playback speed. This sliders sets the paging speed.
4. Date and time. This window shows the current date and time at the cursor position in the playback file.
5. Montage selection. This dropdown list allows the selection of a display montage.
6. The lo-filter, hi-filter, notch filter, sensitivity and chartspeed are available during review and operate the same as in acquire, as detailed above.
7. Start and End of file.
8. Page back and forwards.
9. Previous second and next second.
10. Horizontal scroll bar. This sets the current playback position in the file, with the traces and Date and time window updating appropriately.
11. Cursor and slider bar. This moves the cursor across the screen, with a display of the current position.
  - Clicking on the traces area to the left of centre moves the playback time one second earlier.
  - Clicking on the trace area to the right of centre moves the playback time one second forwards.
  - The Patient ID and Recording ID are displayed in the status bar, below the trace area. These are set from the playback file.
  - Along the bottom of the window, above the Status Bar, is a yellow area where the events are displayed corresponding to the current playback position and traces above. By right clicking in this area events can be placed. Right clicking on an existing event allows it to be deleted. Refer to Section 8.





## 6.10 Reviewing an EEG Recording with Video

If video was recorded with the EEG recording, the associated video is opened with the EEG recording and is displayed on the top of the EEG data in a moveable window as shown in Figure 36. This video data is time-synchronised to the EEG data. Audio is played as well if recorded with the video.

**NOTE:** The video files and video sync (\*.tvs) files must be in the same folder as the EEG recording. Refer to Section 7.1.

The video window appearance and available features are as follows:

- The video and audio are replayed time-synchronised with the EEG data. Moving the video or the EEG automatically moves the EEG or video respectively to synchronise them.
- The date/time and the Patient ID embedded into the video is displayed as shown.
- The date/time and current frame number as read from the video file is shown in the status area at the bottom of the window.

### Video Controls

- Settings. This expands the bottom of the video window to display three tabs as shown:
  - Properties: displays parameters for the currently opened file as shown in Figure 36.
  - Other Files: displays a list of all other video files associated with the recording.
  - Advanced: allows synchronisation to be turned on or off.
- Open. This brings up a standard open file dialogue to allow the browsing and selection of a file.
- Zoom. This allows a video zoom to be applied. Settings are ½, 1, 1½ and 2 times.
- Playback speed. This allows video playback speed to be adjusted. Settings are ½, 1, 1½ and 2 times.
- Audio mute.
- File start and finish. Jumps the video to the start or finish of the current file.
- Step back and forward. Step back or forwards through the file one frame at a time.
- Play start and stop. Plays through the video file at the currently set playback speed.
- Horizontal scroll bar. This allows setting the current video playback position.



Figure 38: Video Playback

## 7 Events

### 7.1 Overview

The Trackit Plus Software and the Trackit EEG amplifiers support various events types as shown below.

- 56 Automatic events (hardware events, photic start/stop, video start/stop etc.)
- 40 user-configurable events
- Free-text events entered during acquisition

During a recording, events are recorded to the PC and the memory card on the amplifier.

The Trackit EEG amplifiers store automatically generated events and patient events in a file "filename.TEV". These are the events listed in Table 1, list key 0.

If the recording session is being recorded to the PC (PC or Dual modes) then further sets of event markers are available, see Event Keys #1, #2, #3 & #4 in Table 1, below. These events are stored in "filename.TVX". These PC-initiated events are driven either automatically when a PC-controlled event occurs, or off the function keys. See section 8.2 for a description of the user-configuration events.

See section 8.3 for a description of the triggering of the event markers.

Event List Key	Event No.	Contents	Type	Size	Size	Mapping
0	0	No event	Fixed	16 x 16	256	Auto
	1	Stop recording	Fixed			Auto
	2	Start recording	Fixed			Auto
	3	Door Open	Fixed			Auto
	4	Door Closed	Fixed			Auto
	5	Host On	Fixed			Auto
	6	Host Off	Fixed			Auto
	7	Low Battery	Fixed			Auto
	8	OK Battery	Fixed			Auto
	9	Imp.CheckMode	Fixed			Auto
	10	Calibrate Mode	Fixed			Auto
	11	Normal Mode	Fixed			Auto
	12	Electrodes on	Fixed			Auto
	13	Electrodes off	Fixed			Auto
	14	Patient Event	Fixed			Auto
15	External Event	Fixed	Auto			
1	16	Awake #	User-config	16 x 16	256	F1
	17	Asleep #	User-config			F2
	18	Eyes open #	User-config			F3
	19	Eyes closed #	User-config			F4
	20	Lights on #	User-config			F5
	21	Lights off #	User-config			F6
	22	Drowsy #	User-config			F7
	23	Alert #	User-config			F8
	24	Photic start	Fixed			Auto
	25	Photic stop	Fixed			Auto
	26	HV start	Fixed			Auto
	27	HV >>	Fixed			Auto
	28	HV stop	Fixed			Auto
	29	Post HV start	Fixed			Auto
	30	Post HV >>	Fixed			Auto
	31	Post HV stop	Fixed			Auto
2	32	Video start	Fixed	32 x 32	1024	Auto
	33	Video stop				Auto
	34	Video movement				Auto
	35	Trackit connect				Auto
	36	Trackit disconnect				Auto
	37 - 63	Reserved			Auto	
3	64 - 95	?	User-config			Shift F1-8 Ctrl+Shift F1-8
4	96 - 159	?	User-config (free-text)	64 x 64	4096	F12

Table 1: Event Mapping

## 7.2 User-Configurable Events

The User-configurable events allow the user to log custom events during a recording. Eight events have been pre-assigned to the F1-F8 keys, as shown in Table 1. The user-configurable events should be edited and setup before acquisition. These are automatically saved and restored by the program. For ease of entry during acquisition, 24 of these events are mapped to the keyboard F1- F8 keys, Shift F1 – F8 and Control + Shift F1 – F8 keys.

Clicking on the “Place Event” button on the Home toolbar brings up the Events menu. The “Edit Events” menu option will bring up the “User events” window which allows the user-configurable events to be edited as shown below. If the system is recording, selecting an event marks it in the recording. If not recording, selecting an event allows it to be edited. Right clicking an event allows its description to be edited. During a recording, editing of event descriptions is inhibited, if the event has been used, otherwise it can be edited.

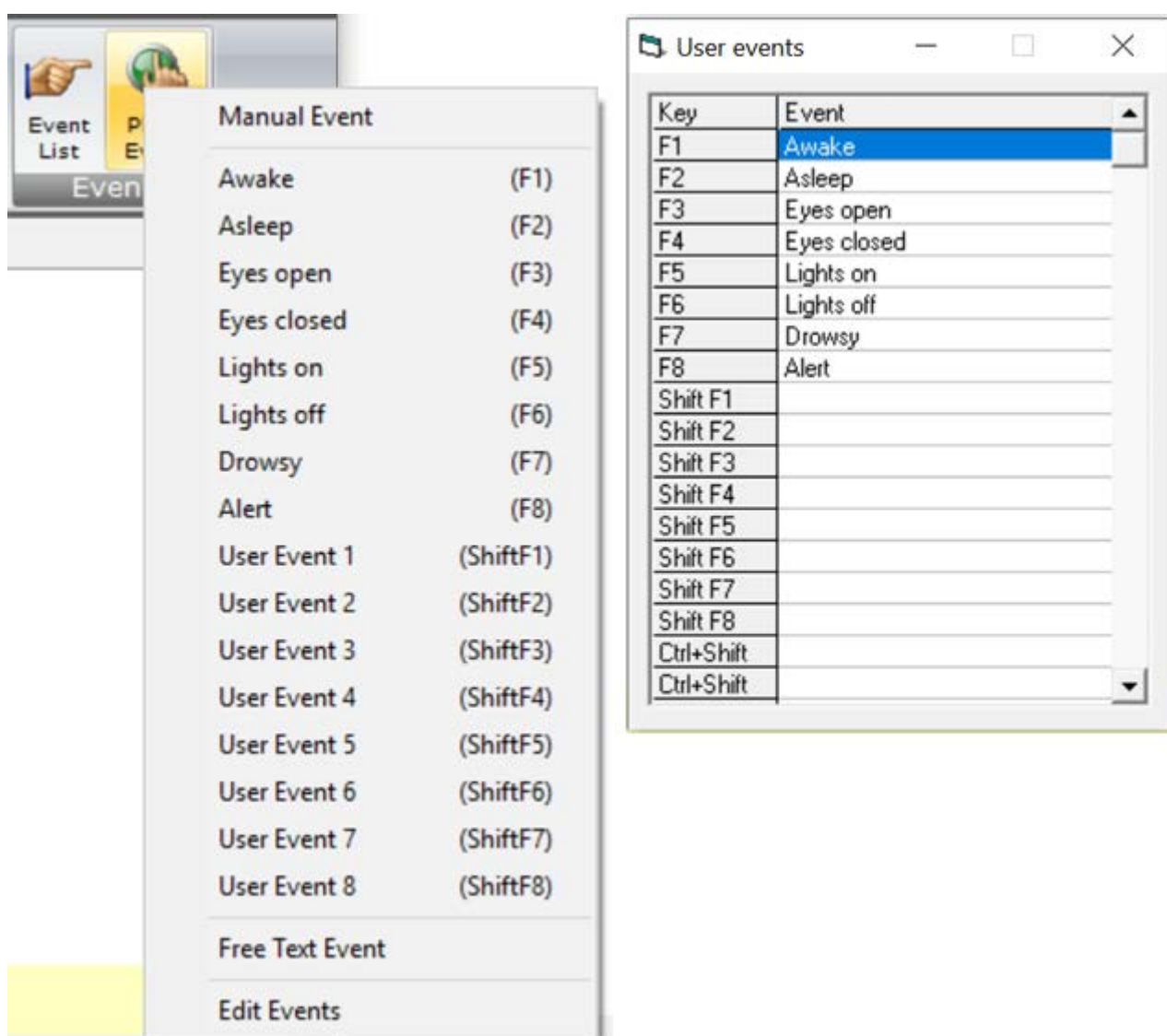


Figure 39: User Events

The "Print Template" button in the File Toolbar brings up an option to print an events template for overlaying on the keyboard. Facilities are provided to scale the printout to fit different size keyboards.

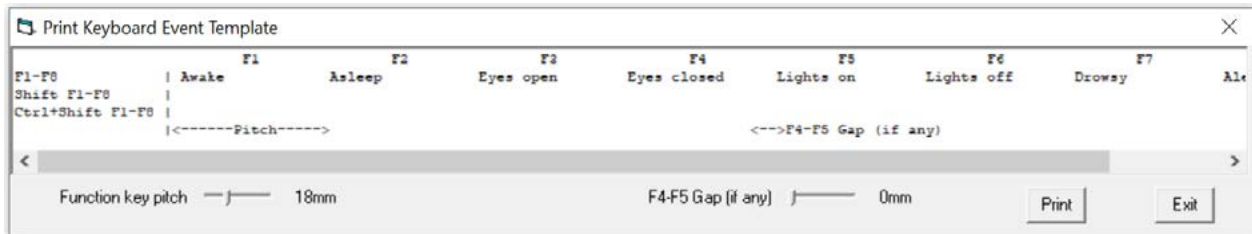


Figure 40: Events Template setup

## 7.3 Events Marking

Events can be placed during a recording or at Review time into an existing recording. Events are logged to the TEV and TVX event files as described below.



### 7.3.1 Fixed Events

Fixed events are logged automatically when a system event occurs (see Table 1: Event Mapping). The exception to this rule is Patient Events and External Events.

- **Patient Event:** A patient event is logged when the patient presses the event button on the Trackit Amplifier (not applicable to the R40).
- **External Event:** An External Event is logged either when the user places a "Manual event" from the Trackit Plus Software or when the patient presses the remote event pushbutton (connected via the 3.5mm jack on the amplifier). To place a Manual Event, press the "Place Event" button on the Home toolbar and select "Manual Event" from the menu (see [Figure 37](#)).

There are several additional automatic events recorded with a study apart from those specified previously. These are as follows:

- **Battery capacity at the start of the recording.** The actual % capacity of the battery is read from the amplifier and added as an event at the start of the recording.
- **Enter the Lockscreen** will record an event and its time.
- **Exit the Lockscreen** will record an event and its time. The period between the Enter and Exit Lockscreen events is the time spent in the Lockscreen and the next Enter event gives the time out of the Lockscreen.
- **Enter Review** will record an event and its time.
- **Exit Review** will record an event and its time. The period between the Enter and Exit Review events is the time spent in Review.

### 7.3.2 User Events

To place a user event during a recording, either use the keyboard shortcut keys (F1- F8 keys, Shift F1 – F8 or Control + Shift F1 – F8 keys.) or use the "Place Event" button on the Home toolbar and select the required event from the menu (see [Figure 37](#)).

See [Section 8.2](#) for details on configuring User Events

### 7.3.3 Free Text Event

During a recording, pressing the F12 keyboard key allows a free-text event to be created. The event is recorded at the time F12 is pressed and a window is displayed (Figure 39) allowing the entry of descriptive text which can be entered at the user's leisure. During this time all the other types of events can be activated.

Free-text events can be triggered using any keyboard key instead of F12. To enable this feature, set this option in the PC setup (see Section 3.2.2.1.2).

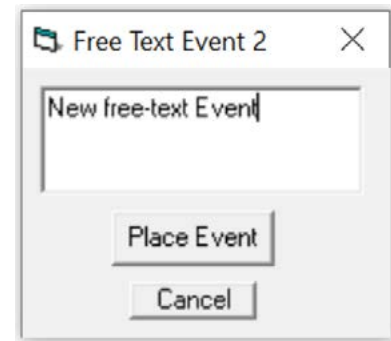


Figure 41: Free-text Event

## 7.4 Viewing Events

Events can be viewed while a recording is ongoing and while reviewing a recording. Events are displayed on the EEG graph at the point in time when the event occurred. The description of the event is shown in the yellow status bar at the bottom of the graph screen.

To view the full list of recorded events in the recording, click on the "Events List" icon in the Home toolbar.

During Review, an event can be placed in the reviewed EEG recording either by using the "Place Event" button, as described in Section 8.3 or by right clicking in the yellow events display area at the point of interest. This brings up a list of events and the selected event is placed at the mouse position. An existing event can be deleted by right clicking it. If using the "Place Event" button to place an event, the event is placed at the current cursor position.

Events are displayed in the Event viewer (Figure 40) with a description and time. The event list allows the user not only to see when events took place, but to also view the data behind those events. Double clicking on an event in the list jumps to that point in the recording.

The events may be sorted alphabetically by clicking on the 'Event' heading in the list. This is convenient for grouping all event types together, e.g. Photoc. Clicking on the 'Time' heading sorts the events back into chronological time.

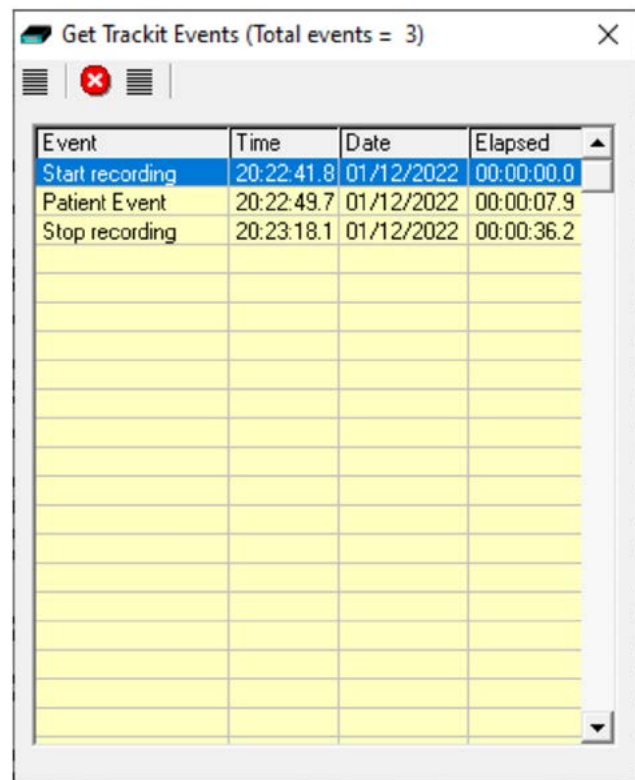


Figure 42: Event Viewer



# 8 Photic Stimulation

An optional Lifelines Photic Stimulator is available which can be used with the EEG Amplifiers to assess patient photosensitivity in EEG studies. For a detailed description of operation, connection and specifications please refer to the separate documentation "Lifelines Photic User Manual".

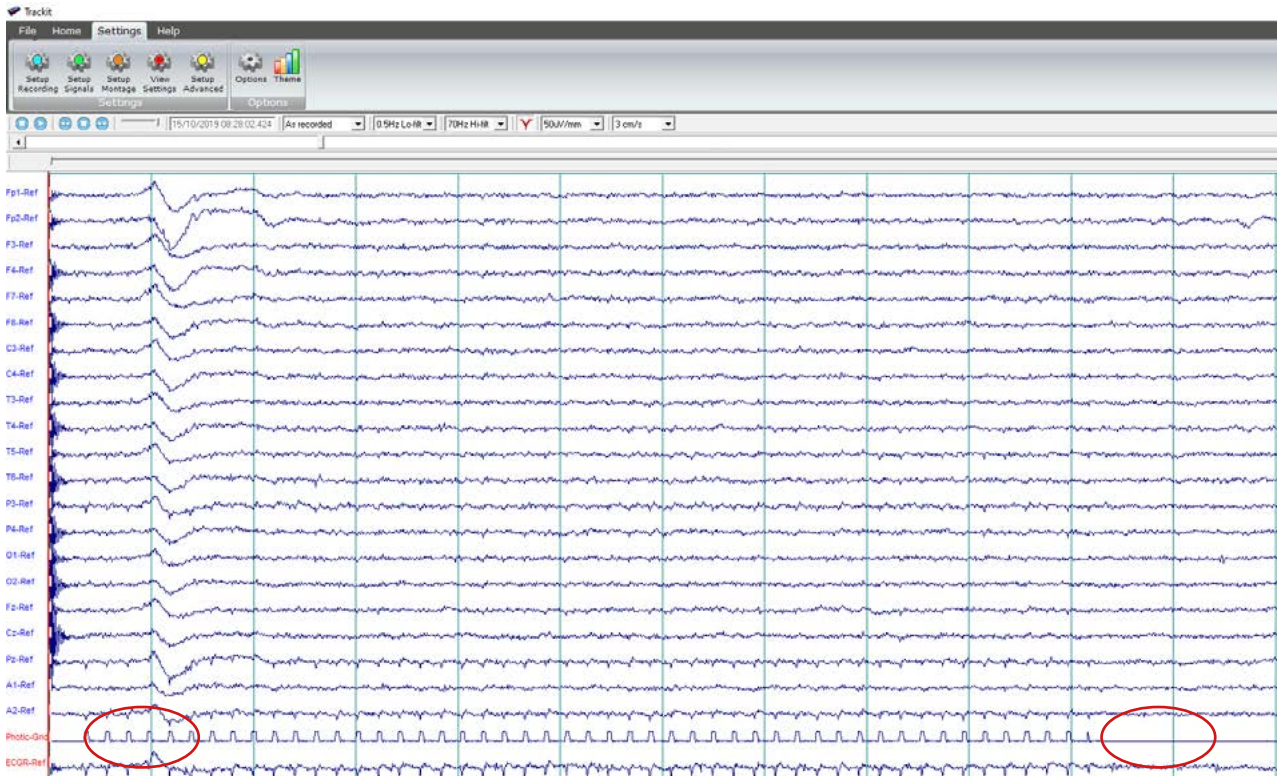
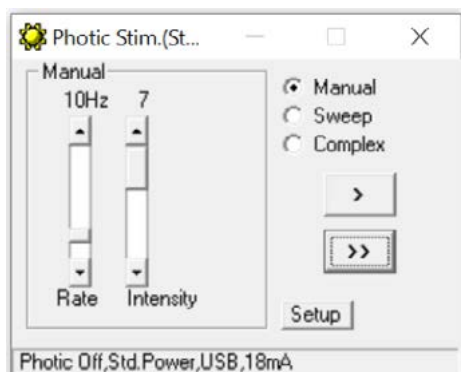


Figure 43: Photic Stimulation

Click on the Photic Stimulation icon in the home toolbar to bring up the Photic Stimulation control panel, shown below.



The Photic Control panel, shown in Figure 42, allows single, manual, sweep and complex sequences of Photic stimulation to be produced. Photic start/stop events are recorded as shown in Figure 41. By using the Trigger output from the Photic Stimulator and connecting to an Aux input (for Trackit Mk3, R40 & T4) or the a polygraphic channel input (on T4A), the actual Photic flash 'ticks' are produced in the recording as shown in Figure 41.

Photic Events (Photic start, Photic stop and Photic frequency changes) are stored in the Events file during a recording (see Section 8).

Figure 44: Photic Stimulation control window

**NOTE:** to setup a suitable Photic trigger signal definition, for displaying in the EEG montage (as shown in Figure 41), open the Signal library as described in Section 4.2.1 and define a signal with a name "Photic", set it to type DC, units mV and Physical Signal Amplitude of +/- 1000mV/V. Set the sensitivity to non-master and 10mV/mm (as shown in Figure 43).

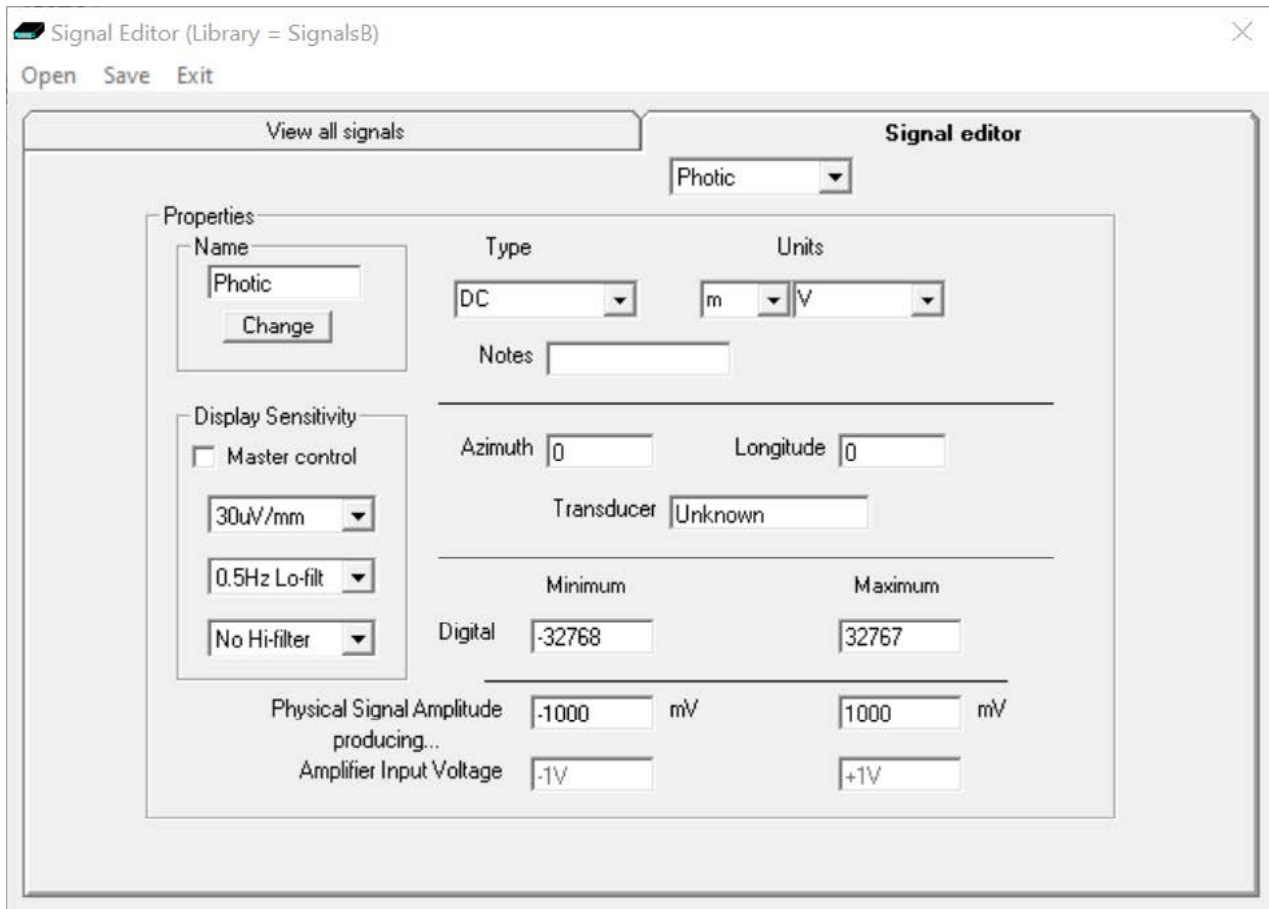


Figure 45: Photic trigger signal definition

## 9 Hyperventilation

A method of timing and marking a Hyperventilation and post-Hyperventilation activation sequence is provided in the Trackit Plus software.

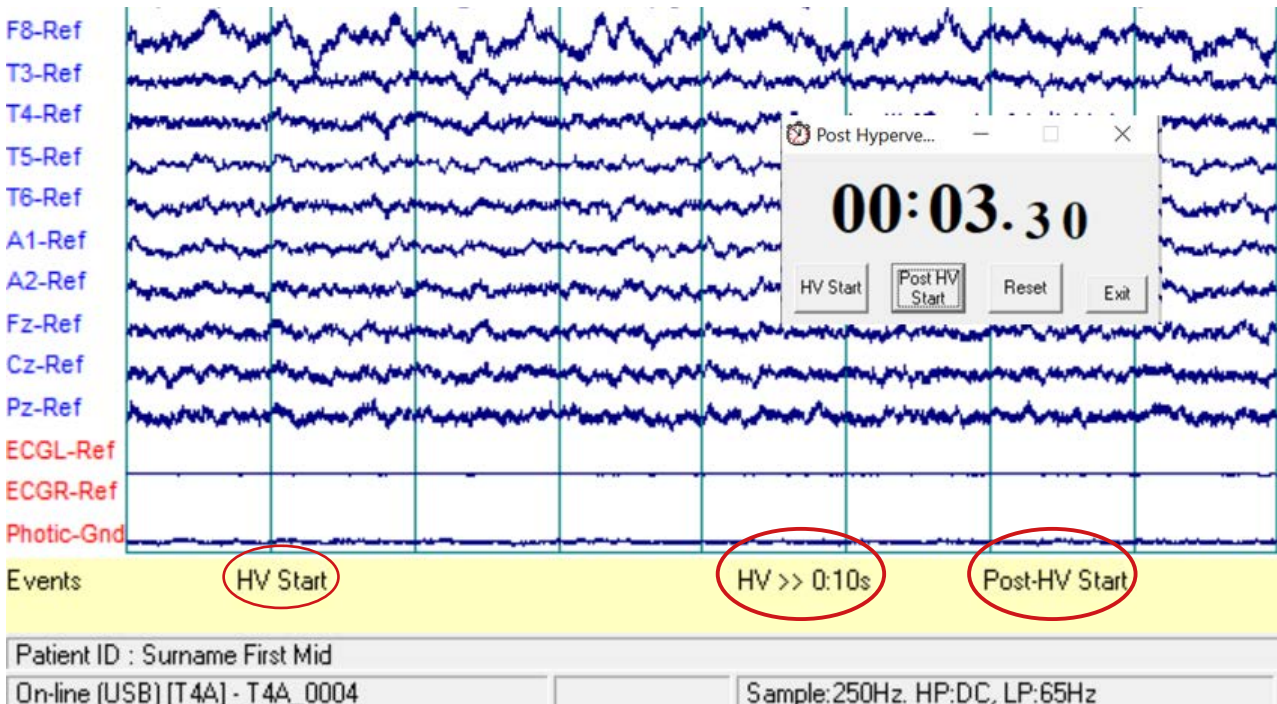
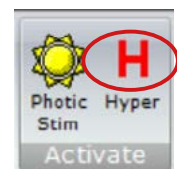


Figure 46: Hyperventilation

Click on the Hyperventilation icon (“Hyper”) on the Home toolbar to bring up the control window as shown in Figure 45.



This provides a digital timer, which is used as follows:

- Click on HV Start to start the HV period and the timer starts running. An ‘HV Start’ event is recorded.
- Thereafter an ‘HV >> mm:ss s’ event is automatically generated every 10 seconds.
- Click on Post HV Start to start the post HV period. A ‘Post HV Start’ event is recorded.
- Thereafter a ‘Post HV >> mm:ss s’ event is automatically generated every 10 seconds.
- Click on Reset or Exit to end the hyperventilate activation.

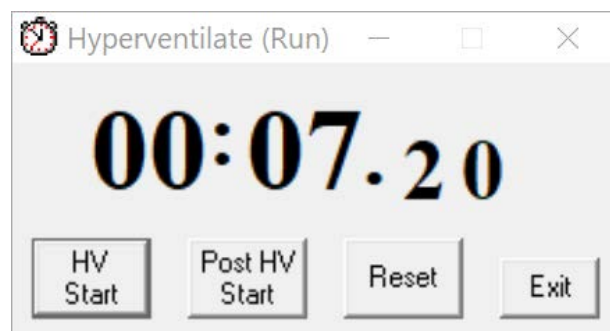



Figure 47: Hyperventilation control window

**NOTE:** The Post HV Start will not work unless HV is in progress. Likewise, HV Start will not work if Post HV is in progress.

# Appendix 1: Trackit Amplifier Setup

[> Advanced Operations > Settings > Set Trackit Defaults]


Please read the manual carefully before changing or updating the Trackit Defaults.

## Trackit Defaults Tab 1

This menu item activates a control dialog that adjusts how the amplifier behaves during a recording. These options may not be applicable to all the amplifiers. See Figure 46 and Table 2, overleaf.

To save new defaults to Amplifier, press 'Send these values to Trackit', followed by 'Save current values'

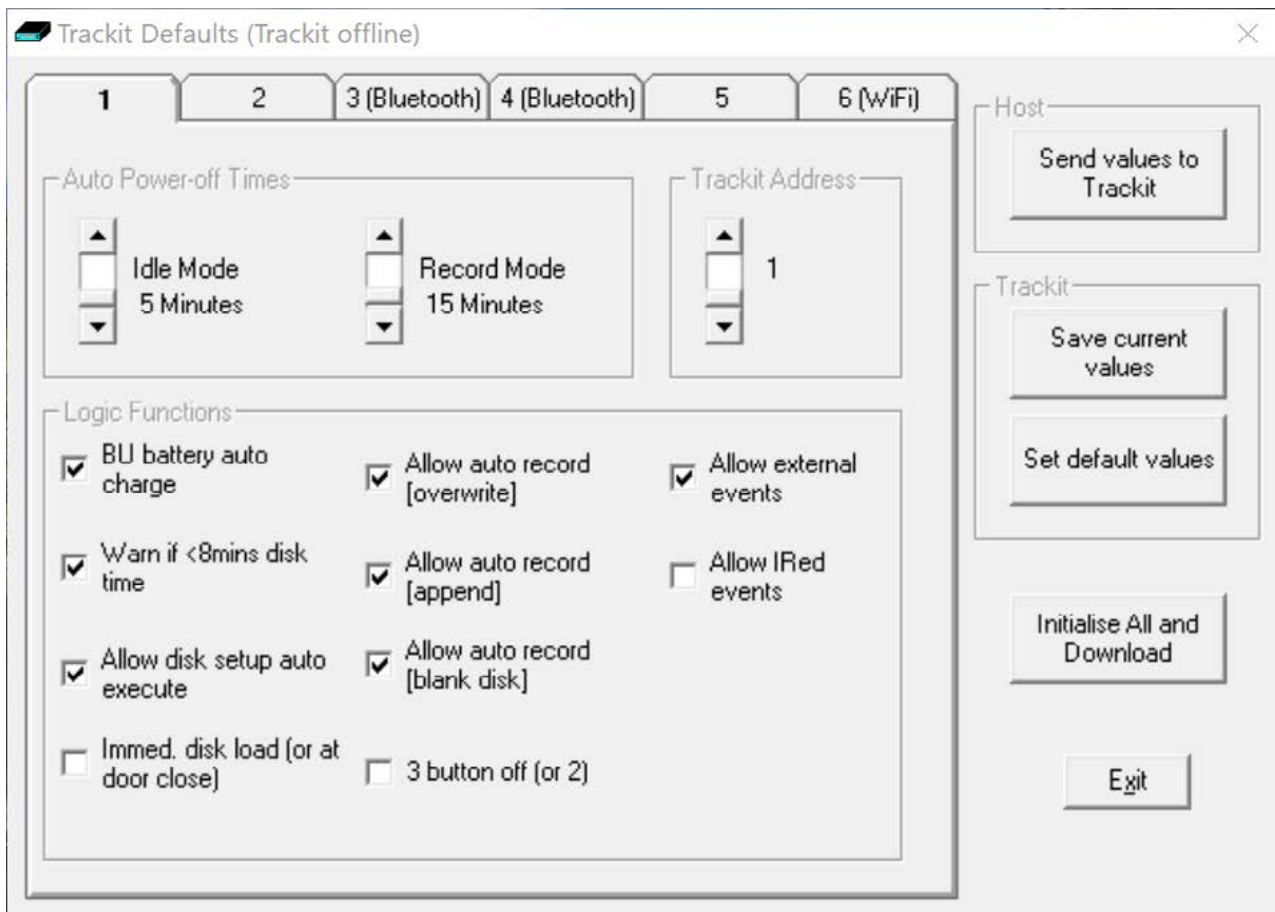


Figure 48: Defaults Tab 1

Option	Description	Applicable Amplifier			
		Mk2/ Mk3	T4A	T4	R40/ R40(24)
<b>Idle Mode</b>	The amplifier turns itself off after a defined period when not connected to a PC.	●	●	●	●
<b>Record Mode</b>	The amplifier turns itself off after a defined period after having recorded. The amplifier waits for a defined period for a card to be reinserted to append to an existing file which is <24 hours old. Otherwise it starts a new recording on a blank card. 60 minutes is enough for a user to remove a card, read it and reinsert it to continue recording until the card is full.	●	X	X	X
<b>Trackit* Address:</b>	Sets the serial address of the amplifier if a simple serial network is configured with several Trackits connected to one PC.	●	X	X	X
<b>BU battery auto charge:</b>	Enables fast charging of the backup battery when the amplifier is connected to USB or USB power bank.	●	●	●	●
<b>Warn if &lt;8 mins card time:</b>	The Amplifier starts beeping when the card has room for only another 8 minutes of recording.	●	●	●	●
<b>Allow disk setup auto execute:</b>	Allows a setup to be stored onto a flash card for a recording to start automatically only when the Trackit Mk3 is switched on. See Section 6.3.2	●	X	X	X
<b>Allow auto record (overwrite):</b>	When this box is checked the Trackit Mk3 automatically overwrites any data on a card inserted during a recording (e.g. when changing cards during a recording).	●	X	X	X
<b>Allow auto record (append)</b>	If a card is inserted with a file which has the same patient name and is less than 24 hours old, Trackit Mk3 appends to rather than overwrites the data. This is a very useful feature if a recording is interrupted, say for a quick review of the data. Trackit Mk3 waits in record mode, and when the card is reinserted it carries on recording to the existing file on the card.	●	X	X	X
<b>Allow auto record (blank card)</b>	Check the box if you routinely want recordings to take place over several blank cards. This is a very useful feature if a recording over several days is required.	●	X	X	X
<b>Allow external events</b>	An external event marker can be attached to the Aux. port.  <b>NOTE:</b> The T4, T4A and R40 have dedicated External Event input and this feature is not required.	●	X	X	X
<b>Allow IRed events:</b>	Not used – legacy option for Trackit Mk1. Unchecked by default.	X	X	X	X
<b>Immed. card load (or at door close):</b>	Off by default, allowing the card to be loaded only when the rear door is shut. Leave this box unchecked if you want to make recordings over several cards on a regular basis.	●	X	X	X
<b>3 button Off (or 2):</b>	Not used – legacy option for Trackit Mk1. Unchecked by default	X	X	X	X

Table 2: Trackit Amplifier Defaults

All new amplifiers have all their applicable logic functions, except Immed. card load and 3 button Off, enabled by default.

To update the logic functions of the amplifier when changes are made, click on **“Send values to Trackit”**, followed by **“Save current values”**. This saves the values in the Amplifier's non-volatile memory. See Figure 46, on previous page.

**NOTE: Trackit Mk2 and Mk3 only – If you want to enable auto-start from flash card or append features, make sure all the checkboxes in Trackit Defaults are checked.**

## Trackit Defaults Tab 2

Additional setup parameters are accessed via tab 2 of Defaults panel, as shown in Figure 47 below.

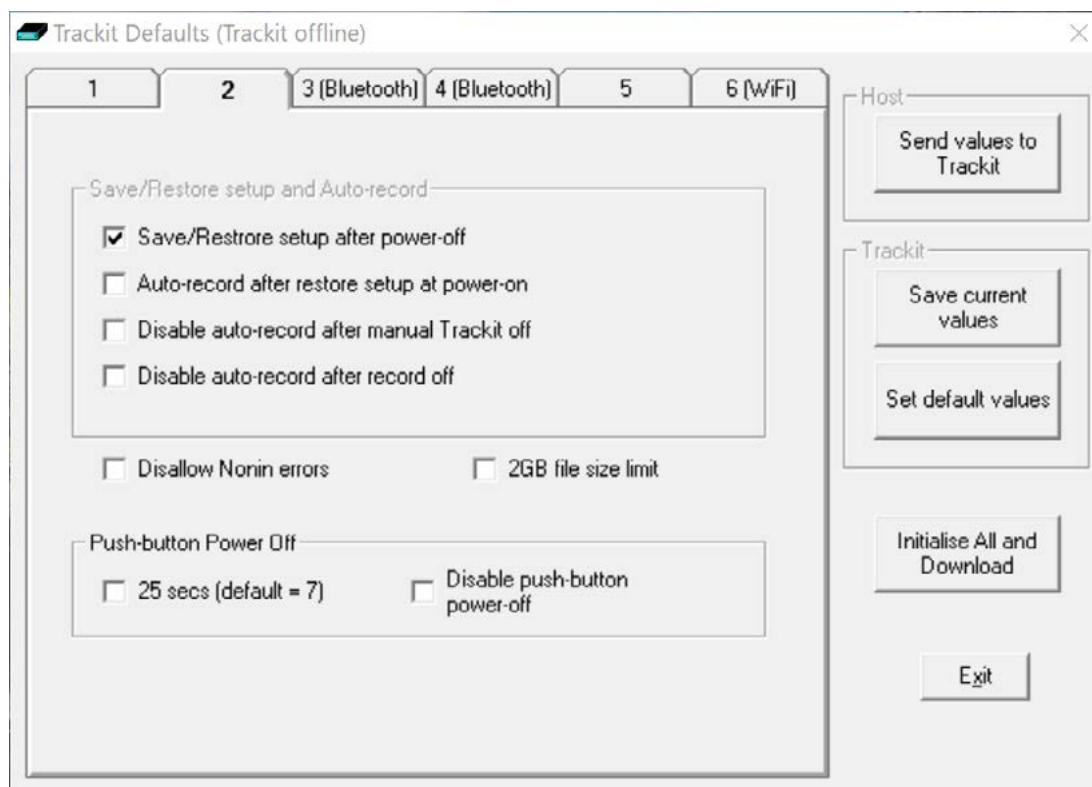


Figure 49: Defaults Tab 2

### Save/Restore setup and Auto-record

The amplifier is able to save its entire Setup before powering off. When next powered on, this Setup can be restored.

- **Save/Restore setup after power-off.** When checked, this enables the Amplifier to save the entire Setup including Patient Name and Recording ID after power-off and recall it at power-on. Note that the Patient Name and Recording ID are only retained for 15 minutes after power-off (refer below).
- **Auto-record after restore setup at power-on (Trackit Mk3 only).** When checked, this enables the Trackit Mk3 to continue recording if it was recording the last time it was powered off, using the recalled Setup and Patient Name and Recording ID, but only if it has been powered off for 15 minutes or less. If the Trackit Mk3 has been powered off for longer than 15 minutes, then the Patient Name and Recording ID are overwritten with defaults (the current Setup remains).

**NOTE:** The parameter above must also be checked to use this feature.

- **Disable auto-record after manual Trackit off.** When checked, this causes a potential Auto-record situation to be cancelled whenever the amplifier is powered off either from its own front panel pushbutton or from the Host.
- **Disable auto-record after record off.** When checked, this causes a potential Auto-record situation to be cancelled whenever the Hosts instructs the amplifier to stop recording.

See Section 6.2 for further information on Auto Record.

## Disallow Nonin Errors

Normally, the SaO2 data stored to the memory card is set to an invalid value (127) to mark any of the following Nonin errors:

1. Sensor disconnected
2. Out of track
3. Low perfusion
4. Marginal perfusion
5. Bad pulse

Errors 1 and 2 are serious and do cause invalid data. However, short term errors 3 to 5 are not so serious and the Nonin device is still able to produce meaningful data. The available option is as follows:

- **Disallow Nonin Errors.**

When checked, all errors 1 – 5 produce invalid data (127).

When unchecked, it is only errors 1 and 2 which cause the data to be marked as invalid, otherwise the Nonin data is unmodified.

## 2GB File size limit

When checked, the maximum recording file size to the memory card will be 2GB. When unchecked the maximum recording file size will be 4GB.

## Push Button Power-Off

Sets the required time to hold the event button to power off the amplifier. The default is 7 seconds. This can be changed to 25 seconds. Alternatively, the Push button Power-off function can be disabled altogether.

## Trackit Defaults Tab 3 and Tab 4 – Bluetooth setup

Tab 3 contains Bluetooth options and a Backup (BU) Battery charging option, as shown in Figure 48 below. Tab 4 provides additional Bluetooth setup options.

Refer to **Appendix 2** (Advanced Bluetooth Setup) for details of Tab 3 and 4.

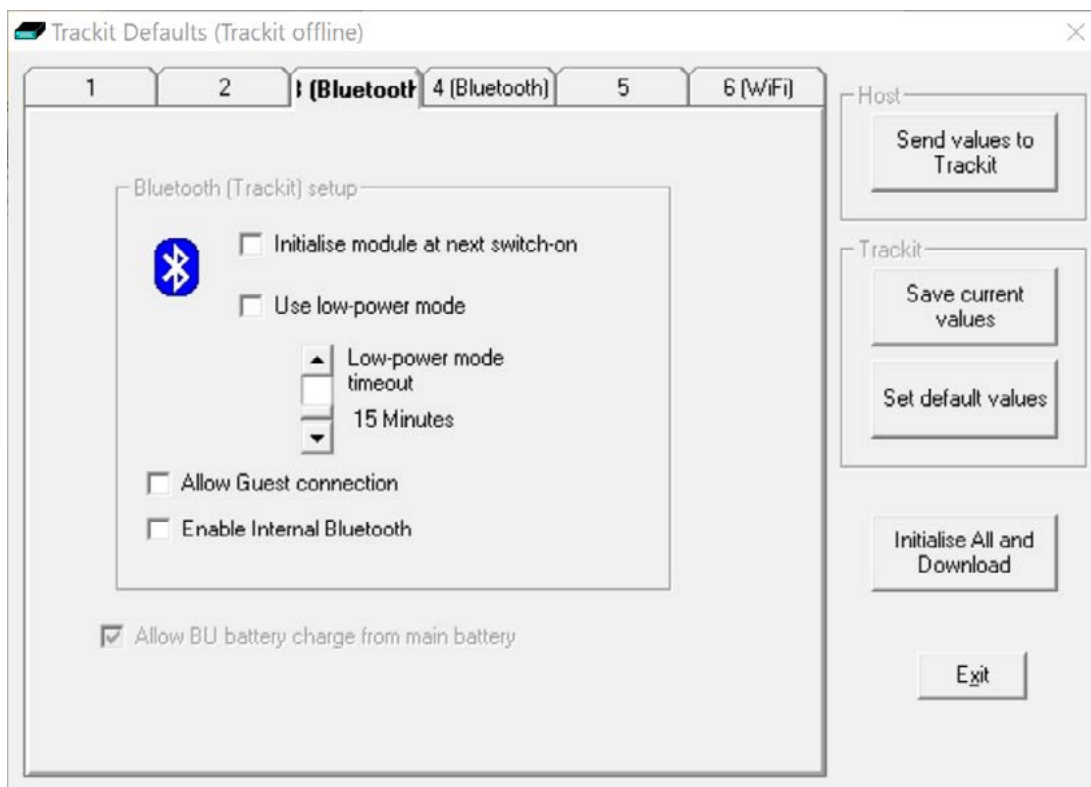


Figure 50: Defaults Tab 3 – Bluetooth

### General

**Allow BU battery charge from main battery. (Trackit Mk2 and Mk3 only)** This option allows the amplifier to recharge the internal backup (BU) battery from the main battery when operated wirelessly.

The Trackit Mk3 only ever charges its backup battery once at switch-on and only after a 10 minute rest period (in case the Trackit is switched on and off repeatedly in quick succession). Additionally, the Trackit will only use power from its main batteries if they are within 75 – 100% of their capacity, i.e. fresh batteries. Furthermore, the Trackit will only charge its backup battery for a period of 10 minutes. All this means that the back-up battery will receive a 5% charge at every Trackit switch-on at the expense of a 0.5% drop in main battery capacity (assuming a single alkaline battery – it will obviously be proportionately less of a reduction for more main batteries).

It is important that the backup battery is charged because it provides power to the amplifier's internal clock/calendar chip and also provides power to enable the amplifier to continue recording for a short while during main battery replacement. All amplifiers (Mk3, T4, T4A & R40) will charge the internal battery when connected over USB.

This option does not apply to the T4A as the T4A will always recharge the backup battery from the Main battery packs.

This option can be disabled if the amplifier regularly connected over USB. Also note that it is possible to manually initiate a backup battery charge sequence (see Section 5.4.2.5).



## Trackit Defaults Tab 5 – R40, T4 and T4A Options

Tab 5 provides additional options specific to the R40, Trackit T4 and Trackit T4A

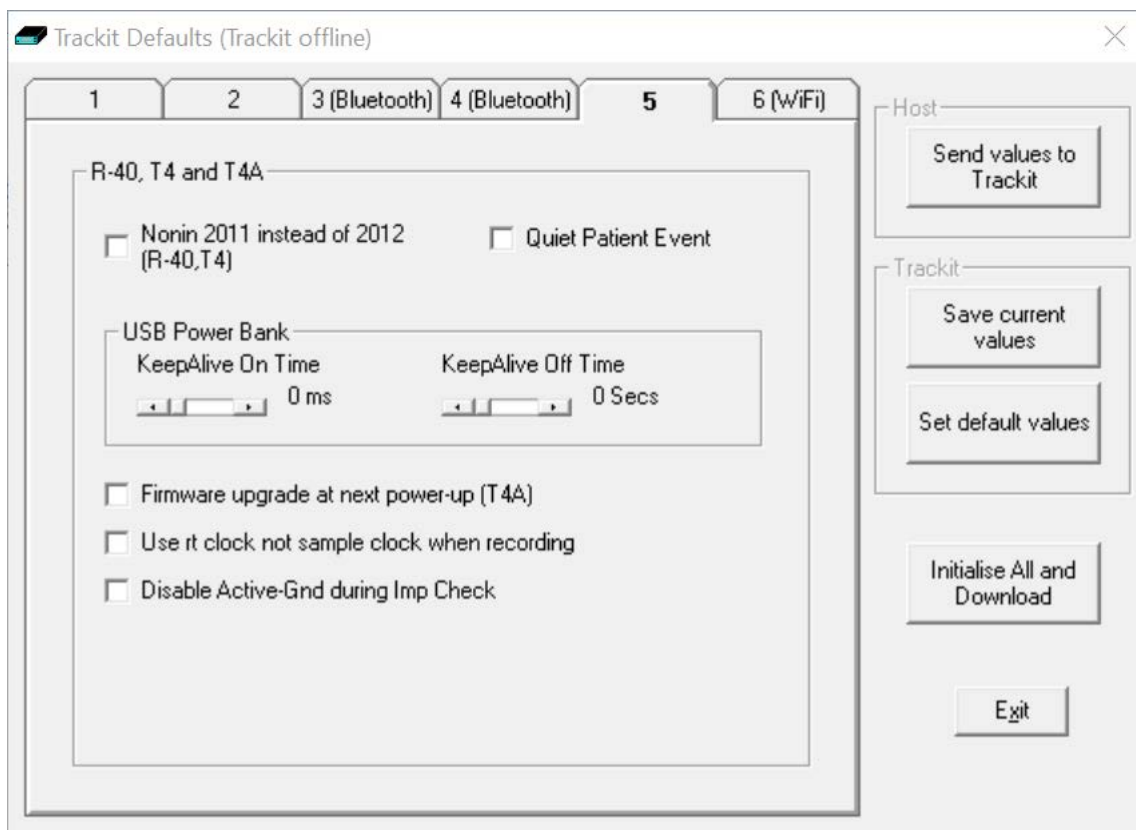


Figure 51: Defaults Tab 5 – R40, T4 and T4A options

- **Nonin 2011 instead of 2012 (R-40 and T4 only).** Set if option if the Nonin 2011 pulse oximeter is connected, instead of the standard Nonin 2012.
- **Quiet Patient Event.** This option disables the audible beep when the remote patient event pushbutton is pressed.

**NOTE:** This only applies to the remote pushbutton event and not to the pushbutton on the amplifier.

- **USB Power Bank.** The R40, T4 and T4A can be powered from approved USB power banks (Lifelines part numbers 1581 & 1582). The power banks automatically switch off when the connected amplifier is idle (not acquiring or recording). To prevent the power bank from automatically switching off, the amplifier can periodically send a pulse to the power bank to keep it switched on. The two options below allow to the user to adjust the on and off time of this pulse to ensure the power bank stays switched.
  - **KeepAlive On Time.** This can be set from 0 – 2000ms. Typical value is 300ms. Setting this to 0 will disable the Keep Alive function.
  - **KeepAlive Off Time This can be set from 0 – 240s.** Typical value is 10 Sec. Setting this to 0 will disable the Keep Alive function.

- **Firmware Upgrade at next power-up (T4A).** Setting this option will instruct the T4A to perform a firmware upgrade on its next power up. Refer to separate document – “Trackit T4A Firmware Upgrade Procedure” for more details.
- **Use rt clock not sample clock when recording (R40, T4 and T4A only).** The R40, T4 and T4A amplifiers use independent clock sources for sampling EEG data and for the real time (rt) clock. These two clock sources may have different tolerances which could lead to problem synchronising events with video and EEG data. To avoid synchronisation errors between recording events (marked with the Real time clock value) and the EEG data (which uses the sample clock), these amplifiers will adjust the Real time clock to be in sync with the sample clock. Setting this option will disable the adjustment to the real time clock.
- **Disable Active-Gnd during Imp Check.** The amplifiers use an Active Ground (Driven Right Leg) feature which improves the CMRR performance. During impedance check, the Active Ground can influence the impedance values, especially when there are unconnected electrodes. To overcome this problem, the user can disable the Active-Ground during Impedance check by setting this option.

**NOTE:** This does not change the settings for normal EEG data acquisition, where Active Ground is always used.

After selecting the required options, press “Send values to Trackit” to store the new settings. This should be done before moving to the next tab.

## Trackit Defaults Tab 6 – Wifi

Tab 5 provides Wifi setup options. These are only applicable to the R40 and Trackit T4 amplifiers which are fitted with the WiFi module.

Refer to “*Appendix 3: Wireless*” for more details.

## Appendix 2: Advanced Bluetooth Setup (Mk3, T4 and R40 only)

### Trackit Default Options Tab 3- Bluetooth setup

Tab 3 contains the first set of Bluetooth options as shown in Figure 50 below.

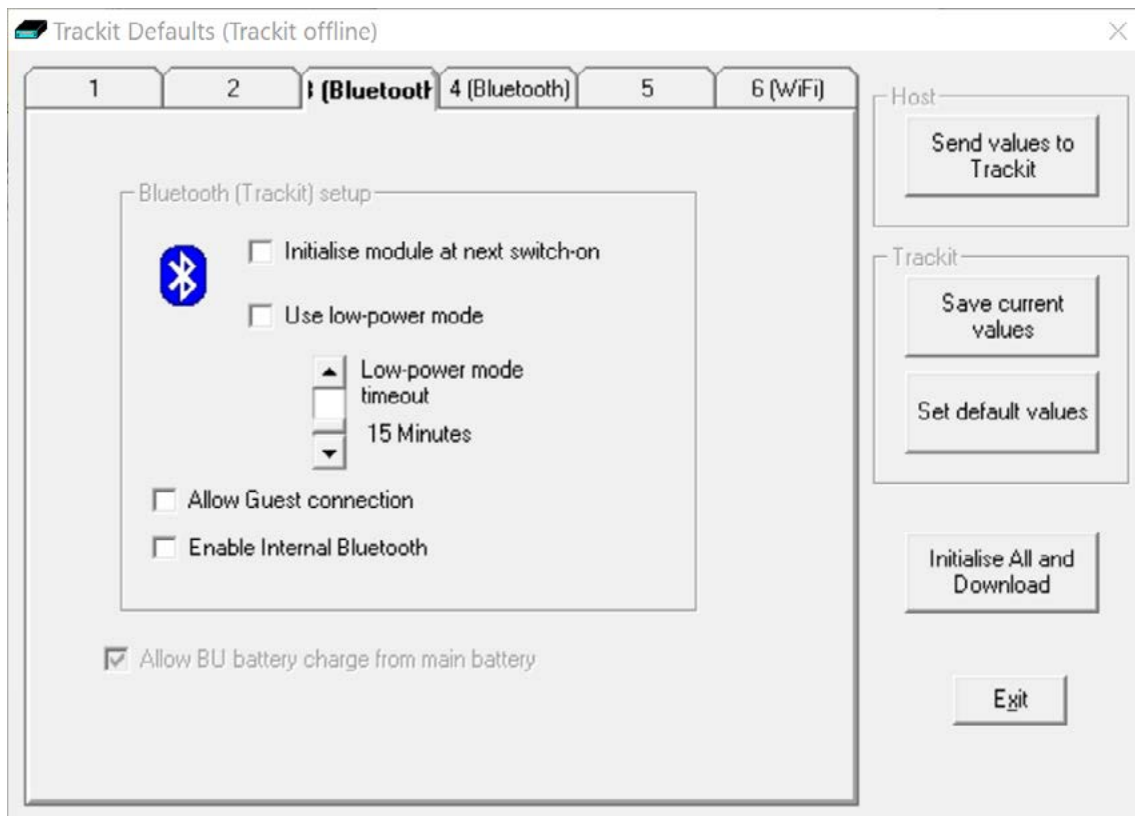


Figure 52: Defaults Tab 3 - Bluetooth

### Bluetooth (Trackit<sup>#</sup>) setup

*# Name depends on connected amplifier.*

**NOTE:** This setup applies to Trackit Mk2, Mk3, T4 and R40 amplifiers fitted with Bluetooth.

**NOTE:** This setup does not apply to the Trackit T4A.

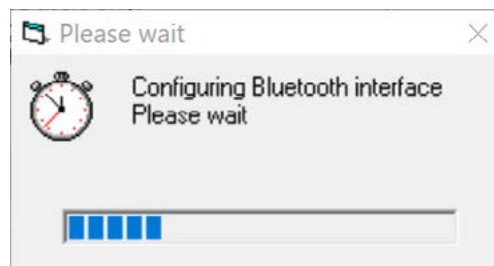
- **Initialise module at next switch on.** If at any time the Bluetooth Module setup becomes corrupted, this option will instruct the amplifier to initialise the module with default settings when it is next switched on. The usual method would be to use a direct connection for setting the option (if the Bluetooth link would not work), switch off the amplifier, connect the Bluetooth Module to the amplifier and switch on. The amplifier will remember its initialisation task, will detect the Bluetooth Module and initialise it with default values (sufficient to enable it to work).

**NOTE:** it can take several seconds for the Amplifier to do this – do not change anything until the Amplifier is ready. The Amplifier will only do this initialisation once – even if powered off and on again, until instructed again to do it. Also note that at switch-on, if the Amplifier does not detect the Bluetooth Module, the remembered instruction is cleared.

The situations whereby a Bluetooth Module might become corrupted are very rare, however due to the complexity of Bluetooth and the full access given to all the setup parameters, it is possible that inadvertent or inexperienced operation may cause incorrect settings. It should also be noted that it is possible to allow the setup of the Bluetooth Module to occur over a Bluetooth connection (refer later). This could allow unexpected connections to interfere with the Module setup.

- **Use low-power mode (Trackit Mk2 Only).** Only use this option for the early external first generation Bluetooth Module. If ticked this option instructs the Trackit to put the Bluetooth Module into a low-power state after a period of no connection (the configurable timer is described below). This low power state contributes significantly to extending the Trackit's battery life whilst still offering all the desirable features of Bluetooth. In this state the Module is still discoverable and connectable, but upon connection it must be taken out of the low-power state. The application detects whether the Module is in low-power state and if so instructs the Trackit to set the Module to normal mode. To accomplish this, the Bluetooth connection must be dropped momentarily and then reconnected. The entire process is automatic and takes about 5 seconds. During the connection time, the application displays the following:

**NOTE:** When using the new Generation Bluetooth Modules (OEMSPA332i and OBS433i) there is no benefit to using low power mode, so the option should be left off.



- **Low-power mode timeout (Trackit Mk2 only).** This option allows the setting of how many minutes of no connection must elapse before the low-power mode comes into operation.
- **Allow Guest connection (Trackit Mk2 only).** If ticked this option instructs the Trackit to accept more than one simultaneous Bluetooth connection.

**NOTE:** There is a separate enable for the application (described in Section 3.2.2.1.2).

- **Enable Internal Bluetooth (R40 and T4 only).** This option allows the user to enable or disable the internal Bluetooth module.

**NOTE:** The Bluetooth module can be enabled and disabled by pressing the event button 5 times in a row. This action will toggle this setting.

## Trackit Default Options | Tab 4 (Bluetooth Module)

**NOTE:** This setup applies to Trackit Mk3, T4 and R40 amplifiers fitted with Bluetooth.

**NOTE:** This setup does not apply to the Trackit T4A.

Tab 4 contains additional Bluetooth options as shown in Figure 51 below.

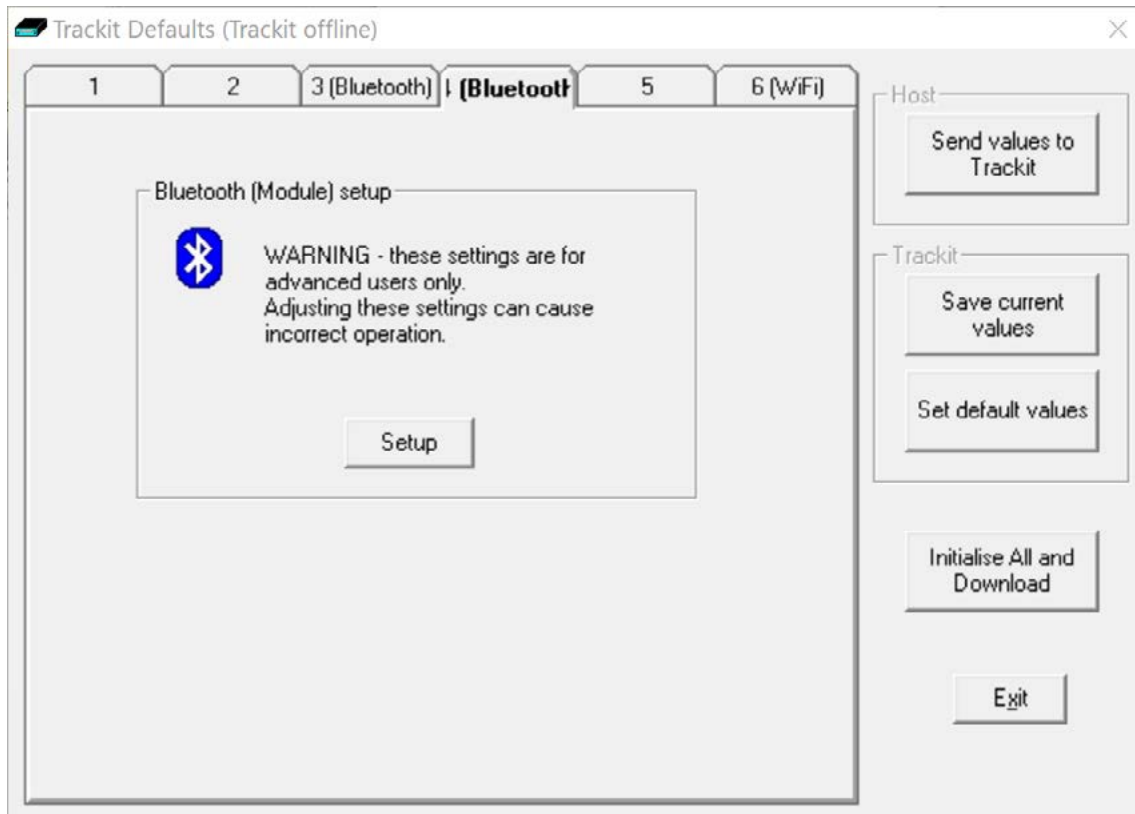


Figure 53: Trackit Defaults Tab 4

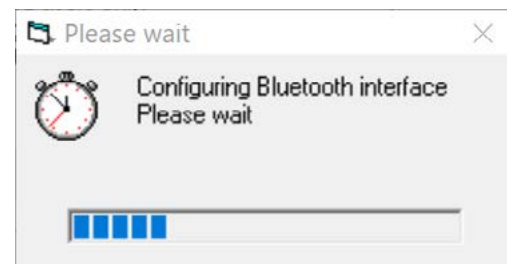


Access is provided here to the full set of Bluetooth configuration parameters in the Module. Adjusting these settings can cause incorrect operation. Please contact your Lifelines Service Representative before adjusting these settings.

The setup of the Bluetooth Module itself is accomplished over the Bluetooth link currently established. This means that no extra hardware is required to connect in some other way to the Module – it remains connected to the Amplifier.

Clicking on the Setup button instructs the Amplifier to enter a special mode to enable the Setup-over-Bluetooth function. During this time the connection must be dropped momentarily and then reconnected. The entire process is automatic and takes about 5 seconds.

After the configuration process has finished, access is provided to the main Bluetooth Setup panels shown below.



## Bluetooth Setup | Tab 1 (General)

The Bluetooth Setup screen is shown in Figure 52 below. It should be noted that even though the Trackit has put the Bluetooth Module into the special Setup-over-Bluetooth mode, no changes are allowed until a special command sequence has been sent to the module. This procedure guards against casual browsers being able to adjust settings (there is much more information about security later on). Clicking on the Connect button sends the special command and also reads from the Bluetooth Module all its current settings which are displayed in the various tab panels.

- Clicking on the **Read** button causes a re-read of all the Module's parameters.
- Clicking on the **Write** button causes all values currently being displayed to be written across to the Module which stores them in its non-volatile memory.
- Clicking on the **Set defaults** button loads default values into all displayed settings (these are not sent to the Module until a **Write** occurs).
- Clicking on the **Disconnect** button finishes the setup session and issues commands to disable changes to the Module setup and also to take it out of Setup-over-Bluetooth mode. The Module is now ready for use with the new settings.

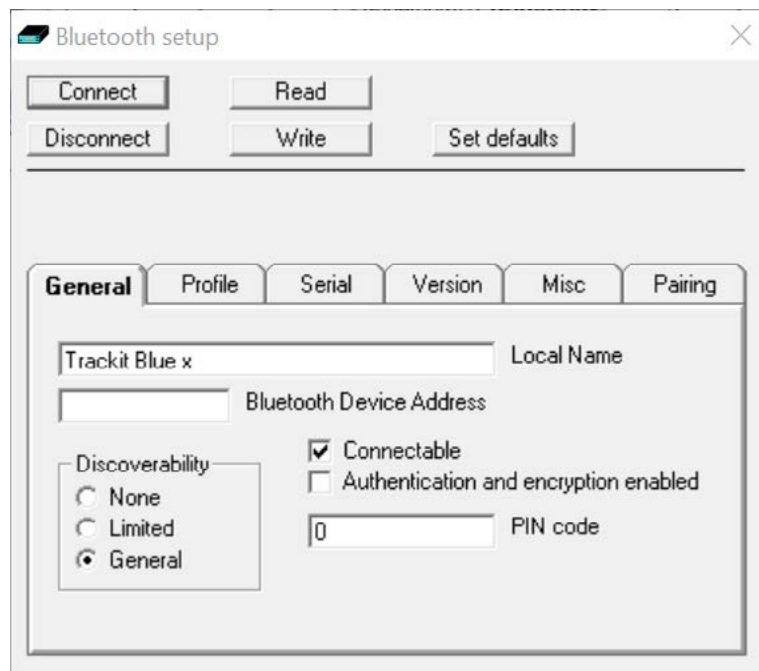


Figure 54: Trackit Defaults | Bluetooth Setup Tab 1 (General)

- **Local Name.** This allows the Module to be given a 'friendly name' (in a similar way to a networked computer). This name is the one reported by other computers during a search or connection. If there are several Trackit Bluetooth devices on-site, it is important that each has a unique name. As supplied, every Module will be uniquely named and this will be in the form of 'Trackit Blue x' where x is numeric. Do not change the name unless there is a good reason to do so.
- **Bluetooth Device Address.** Every Bluetooth device is assigned a unique address (in a similar way to the IP address of a network adapter). The address is read-only and cannot be changed. The Module can be referred to from a remote device by either its local name or in some situations by its Bluetooth Device Address.

**Discoverability**

- **None.** If selected the Module cannot be discovered by other devices during a search – it becomes invisible.
- **Limited.** If selected the module becomes only partially discoverable.
- **General.** If selected the Module can be discovered by other devices.

**Connectable.** If ticked the Module can be connected to by another device. Otherwise a connection is not allowed. The application forces Connectable.

**Authentication and encryption enabled.** If ticked the remote device must know the Module's PIN code passkey to be able to connect. The Module undergoes a 'pairing' procedure with the remote device. Additionally in this mode, all data transfers are encrypted using the same PIN code as a passkey.

**PIN code.** This is the code that must be known to the remote connecting device to enable a connection to be made. The code is entered once only during the 'pairing' procedure on the host (client). It can be set here in the module to any numeric sequence. It is only used if **Authentication and encryption** is enabled in the Module or the remote device requires authentication.

**Bluetooth Setup | Tab 2 (Profile)**

Tab 2 contains the second set of Bluetooth options as shown in Figure 53 below.

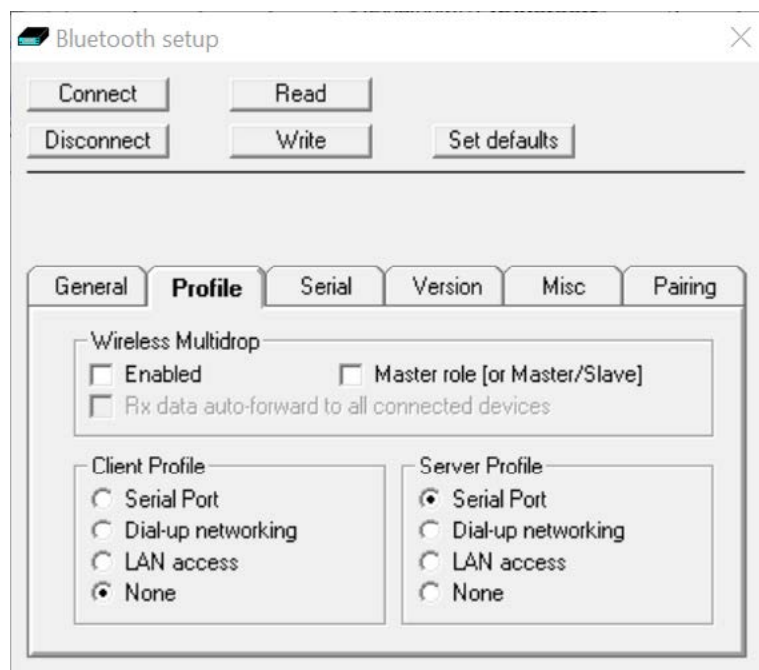


Figure 55: Trackit Defaults | Bluetooth Setup Tab 2 (Profile)

## Wireless Multidrop

This section covers the multiple connection capabilities of the Module. It is possible for several Bluetooth devices within range of each other to set up a 'piconet' amongst themselves, whereby each device can have connections to several other devices simultaneously. In this mode several remote devices can connect simultaneously to the same Trackit. All data transmitted by the Trackit is transmitted to all connected clients (the individual applications filter out the specific data of interest). For received data, the Trackit receives all data transmitted by all clients (the Trackit maintains a separate data flow path for each client).

In Trackit terms, the first connection is the MASTER and it has full control capabilities. Subsequent connections become GUESTs and they have limited control capabilities. It is possible to individually enable each client application as to whether it can become a Guest connection or not.

It should be noted that not all remote Bluetooth devices handle multidrop/piconet connections very well and some will experience dropped connections and loss of data.

It should be noted that within the Bluetooth specification there is provision for such piconets to themselves connect to other piconets – the combination being called a 'scatternet'. In such a situation, each piconet must designate a Master device with all the others in the piconet being Slaves. It is the Masters in each piconet which maintain the scatternet. Such a complex topology is beyond the scope of this document but the brief description is given for completeness. It is the reason for providing the **Master role [or Master/Slave]** option in the panel.

- **Enabled.** If ticked several remote devices can connect simultaneously to the same Trackit. Otherwise multiple connections are disabled.

**NOTE:** If ticked then the **Master role [or Master/Slave]** should also be ticked. If unticked then the **Master role [or Master/Slave]** should also be unticked.

- **Master role [or Master/Slave].** In some of the more complex topological arrangements it is sometimes necessary for a device to switch from being a Master to a Slave and vice-versa. In the Trackit situation this parameter should have the same setting as that for the Enabled parameter. If **Enabled** is ticked then **Master role [or Master/Slave]** should also be ticked. If **Enabled** is unticked then **Master role [or Master/Slave]** should also be unticked.

## Client Profile

- Serial Port
- Dial-up networking
- LAN access
- None

This lists all the possible services offered by the Module when operating as a client. In the Trackit situation, the Module is always the server (it accepts incoming connections) and never a client. This option should only be set to **None**.

## Server Profile

- Serial Port
- Dial-up networking
- LAN access
- None

This lists all the possible services offered by the Module when operating as a Server. In the Trackit situation, the Module provides a Serial Port Protocol service (SPP) and this is the only option that should be selected.



## Bluetooth Setup | Tab 3 (Serial)

Tab 3 contains the third set of Bluetooth options as shown in Figure 54 below.

This option displays the current Baud rate of the Module. The application defaults it to 115200 Baud which is suitable for Trackit Mk1 applications. For Trackit Mk3, T4 and R40 applications, the connection speed is 230400 Baud. Note, however, that when configuring over a Bluetooth connection, it is not necessary to change this parameter from the default.

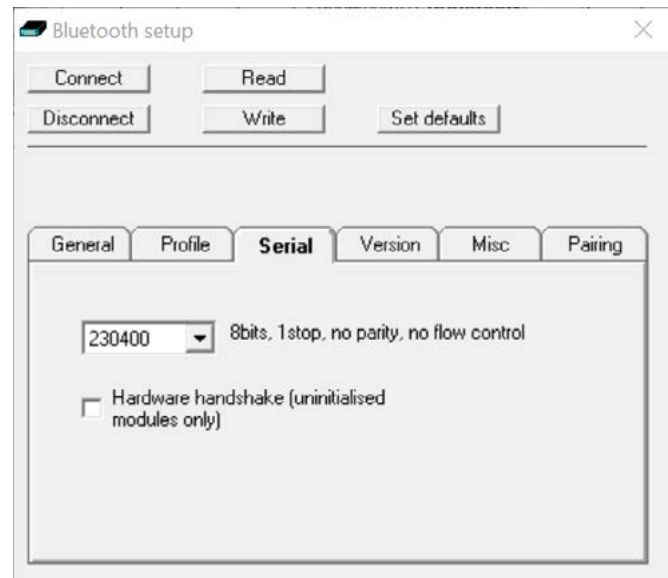


Figure 56 Trackit Defaults | Bluetooth Setup Tab 3 (Serial)

## Bluetooth Setup | Tab 4 (Version)

Tab 4 contains the fourth set of Bluetooth options as shown in Figure 55 below.

Here is listed all the versions of the various hardware and software components in the system.

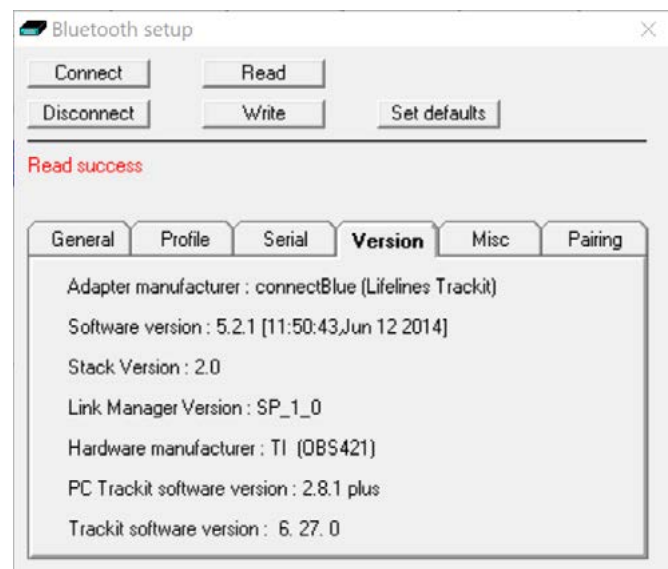


Figure 57 Trackit Defaults | Bluetooth Setup Tab 4 (Version)

## Bluetooth Setup | Tab 5 (Misc)

Tab 5 contains the fifth set of Bluetooth options as shown in Figure 56 below.

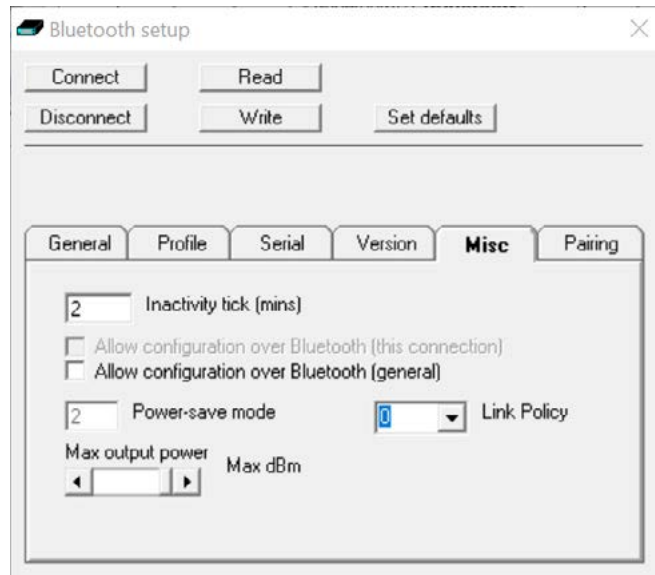


Figure 58: Trackit Defaults | Bluetooth Setup Tab 5 (Misc)

- **Inactivity tick.** This option allows the Module to disconnect after a defined period of no data activity. The Trackit application always transmits heartbeat (keep-alive) packets during connection, so this option really only applies to connections from other types of remote device. To enable the option the desired timeout period in minutes should be entered. To disable the option a zero should be entered. In normal situations the option should be disabled.
- **Allow configuration over Bluetooth (this connection).** This is a read only parameter and simply indicates the fact that the current connection is allowing configuration over Blue tooth.
- **Allow configuration over Bluetooth (general).** In contrast to the above, this option allows the Module to be permanently enabled for configuration over Bluetooth (after this session is closed). This is normally only used for advanced and debugging purposes and the option should be unticked.
- **Power-save mode.** This option defines the power-save mode for the Module. Currently this is fixed at an optimum setting.
- **Max. output power.** This option defines the maximum Radio Frequency (RF) output power from the Module. Currently this is fixed at an optimum setting.
- **Link Policy.** This is an advanced option and should not be changed.

## Bluetooth Setup | Tab 6 (Pairing)

Tab 6 contains the fifth set of Bluetooth options as shown in Figure 57 below.

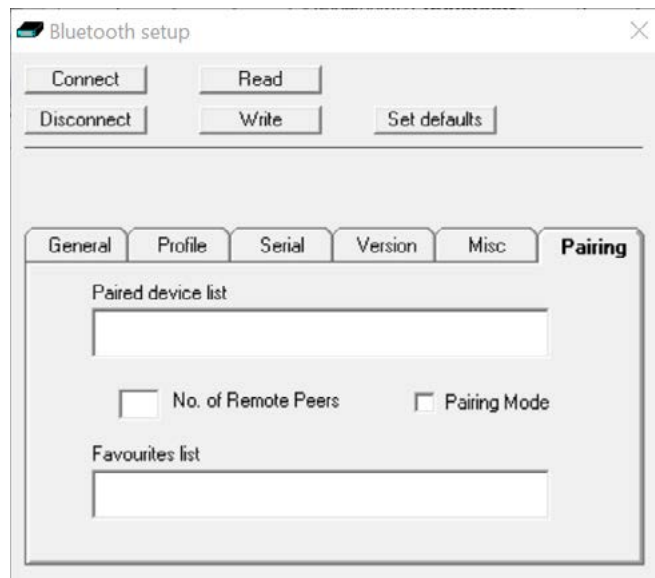


Figure 59: Trackit Defaults | Bluetooth Setup Tab 6 (Pairing)

- **Paired device list.** This lists the current Paired device addresses stored in the module.
- **No. of Remote Peers.** This is fixed at 0.
- **Pairing Mode.** Sets Pairing Mode on or off. The default is on.
- **Favourites list.** This lists the current Favourites device addresses stored in the module.

# Appendix 3: Wireless

## Introduction

The Lifelines range of amplifiers have the following wireless capabilities:

Amplifier	Bluetooth		Wifi	
	Fitted	Specification	Available	Specification
Trackit Mk3	Optional	Bluetooth V4.0	No	-
R40 & R40(24)	Optional	Bluetooth V4.0	Optional	IEEE 802.11 b/g certified
Trackit T4	Optional	Bluetooth V4.0	Optional	IEEE 802.11 b/g certified
Trackit T4A	Yes (fixed)	Bluetooth V4.2 & BLE	No	-

The Bluetooth capabilities allows the amplifier to communicate, wirelessly, with a Bluetooth-enabled PC.

The WiFi module in the T4 and R40 allows a wireless connection to be established between the amplifier and a Wireless Access Point (WAP). This allows the T4 / R40 to be monitored remotely over a secure wireless link up to a range of about 100m or greater (dependent on hardware and environmental factors). Please confirm with Lifelines if your R40 or T4 supports Wifi connections.

## System overview

Bluetooth is a device to computer wireless connection and will connect to any suitably certified Bluetooth host, like a PC or laptop. The connection process uses authentication and password protection.

The WiFi (wireless LAN Module) is a device to network wireless connection and will connect to a designated network via a Wireless Access Point (WAP). The connection process uses authentication and password protection.

## Bluetooth Connection and use

To connect an amplifier to a PC via Bluetooth, the amplifier must first be paired with the PC.

### Bluetooth Pairing - Trackit T4A

The Bluetooth connection on the T4A uses Simple Secure Pairing (SSP) authentication. When the T4A is paired with a computer, a random code is generated and shared between the T4A and the PC. The code must be confirmed on both the PC and the amplifier in order to connect the two devices. This prevents other devices from interrupting the pairing process.

#### To pair to a T4A Amplifier:

1. Switch on the T4A amplifier.
2. In the Windows® Bluetooth options, search for new devices. The T4A will be shown as Lifelines T4A - xx, where xx is the serial number of the amplifier.
3. Select the desired T4A amplifier and click the "Pair" button.
4. A code will be displayed on the PC and on the T4A, as shown below and right.

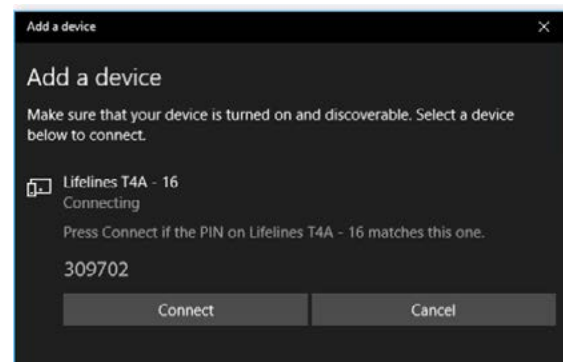


Figure 60: Bluetooth pairing

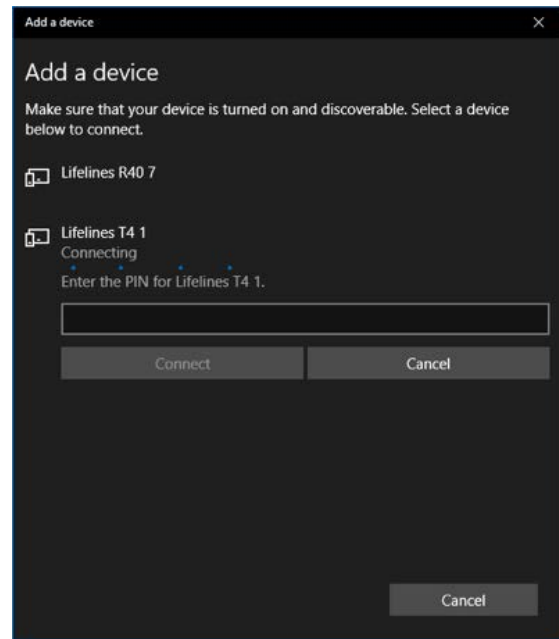
- If the codes match, press the Event button on the T4A amplifier followed by the 'Connect' (Windows 10) or 'Next' (Windows 7) button on the PC.

**NOTE:** There is a 10 second timeout on the T4A amplifier. If the Event button is not pressed within 10 seconds, the pairing will fail and this process will need to be repeated.

- Once the codes have been confirmed on both the PC and the amplifier, the pairing process will be complete.

### Bluetooth Pairing - Trackit Mk2, Mk3, T4 & R40

During the Bluetooth pairing process for the Mk2, Mk3, T4 and R40, the correct PIN must be entered to establish the connection, as shown in the image on the right. Enter the default PIN to complete the pairing process. The default PIN is set to 1.



### Bluetooth Usage

Once paired, the amplifier acts as the server and provides a serial port service (SPP) to the PC, acting as a client. The Serial COM port number can be found in the Windows® Bluetooth settings.

Note: Windows® assigns two COM ports to the amplifier. The required COM port is the 'Outgoing' port.

The allocated COM port can be renamed in the Trackit software application for easy identification. To rename the COM port, open the Trackit Options window and edit the applicable COM port name (see Section 3.2.2.1.1). The custom COM port name must include the word "blue". This allows the Trackit software to identify the COM port as a Bluetooth connection. The Trackit Control panel will show if a Bluetooth connection is in use, as shown in Figure 59.

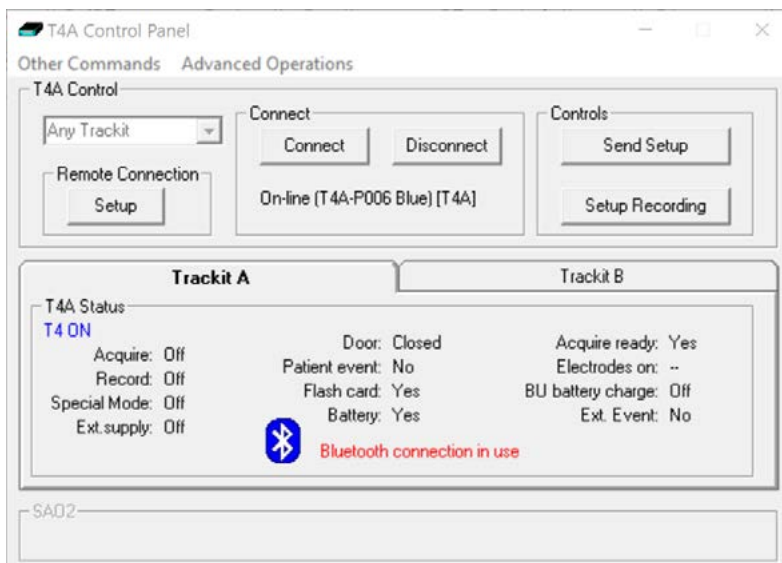


Figure 61: Bluetooth Connection Indication

When the Trackit application has established the Bluetooth connection, a connection quality monitor labelled “Comm Q” is displayed in the status bar at the bottom left of the main screen, as shown below.

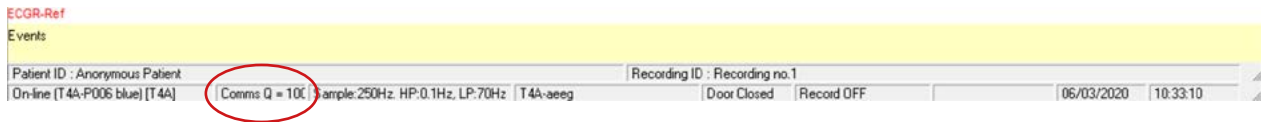


Figure 60: Bluetooth Comms Quality Indicator

This number given as a percentage is an approximate indication of the amount of data received as a ratio to that expected, calculated every second. It is most likely to drop below 100% when either device is at the limit of the transmission range or when either antenna is adversely obscured or under the influence of interference. It will be noticed that the wireless transmission will use its available bandwidth to try to “catch-up” after a drop in signal quality and the indication can read more than 100% momentarily. A reading, therefore, of less than 100% does not necessarily mean a permanent bad connection since data flow can increase shortly afterwards. A sustained low value over several seconds will cause the Trackit application to close the connection. If the Autoconnect feature has been enabled in Options, the application will automatically attempt to reconnect to the amplifier every 10 seconds.

## WiFi Connection and Use

During the setup of the WiFi module, the WAP SSID is entered together with its password. This is achieved through the Trackit Defaults window, as shown below.

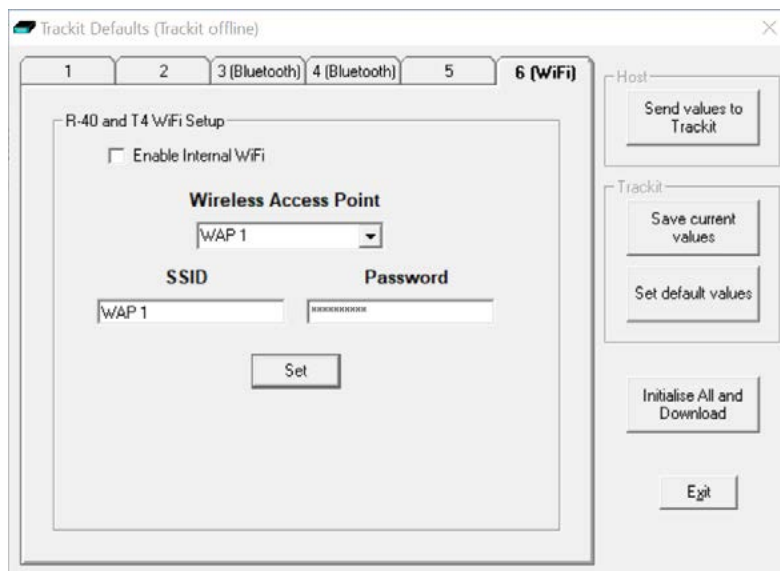


Figure 62: Defaults Tab 6 - WiFi

If an attempt is made to connect to an unsecure network without a password, this is prevented and an error displayed as shown below. For maximum security it is recommended that only WPA2 access is allowed.



### Wireless Communication (general information)

A wireless link can be subject to interference and disruption to communication.

Bluetooth is a wireless technology designed for short range wireless connections between devices in a wireless personal area network (WPAN). Bluetooth is compliant with the IEEE 802.15 standard and operates in the 2.4 GHz band. Wi-Fi is a wireless technology designed to connect devices and an infrastructure in a wireless local area network (WLAN). Wi-Fi is compliant with various IEEE 802.11 standards such as 802.11a, 802.11b, 802.11g, and 802.11n. 802.11b and 802.11g operate in the 2.4 GHz band, 802.11a operates in the 5 GHz band, and 802.11n can operate in both bands

Both Wi-Fi and Bluetooth are based on spread spectrum signal structuring. With this radio transmission technique, a narrowband signal is expanded across a given portion of the radio frequency spectrum to result in a broader or wideband signal. Such a wideband signal provides a very strong immunity to interference compared to a narrowband signal.

Bluetooth uses Frequency Hopping Spread Spectrum (FHSS), whilst WiFi uses Direct Sequence Spread Spectrum (DSSS). Given that both technologies operate in the same frequency band, this use of differing techniques can result in interference issues. FHSS devices and DSSS devices perceive each other as noise.

Both Bluetooth and WiFi technologies, however, use sophisticated error detection and error correction techniques to deliver correct data. Additionally, if a transmission cannot be decoded due to interference, the transmission is resent. This interference will, of course, increase as the number of coexistent devices in proximity to each other increases. Due to the robust error detection mechanisms, however, as the interference level increases, data continues to be delivered correctly, but the data rate decreases as the number of dropped packets increases.

In terms of security, both system use authentication with encryption and pin codes/pass words. In addition, the amplifier itself uses a proprietary Interface Protocol thus preventing a non-authorised user from taking control of the device.

When transmitting wirelessly, data packages are time-stamped when acquired by the amplifier, before being transmitted, and when received by the application they are recorded according to this timestamp. In this way, there is no risk associated with delayed communications or missing data packets over a wireless link since, if the recording software detects missing packages, an event is inserted into the recording to notify the operator. In the extreme case whereby the interference causes the wireless link to be dropped all together, the application automatically reconnects when the interference is removed.

### Quality of Service and Associated Risks

1. The risk of corrupt data due to interference is very small due to error detection, error correction and resend data packet mechanisms. In addition to this error detection and correction, the application provides time-stamped data packages, which enables the detection of corrupt, delayed or missing data.
2. The risk of missing data due to interference is also very small, but at the extreme, the data rate decreases as more and more data packets have to be dropped and resent. Ultimately, in the presence of extreme interference, the data rate will decrease to zero and the wireless link will be dropped. This situation is also adequately handled with the provision of time-coded data packets, which enables the detection of corrupt, delayed or missing data. In the extreme case whereby the interference causes the wireless link to be dropped all together, the application automatically reconnects when the interference is removed. This situation is very similar to being out-of-range and the same mechanisms apply and, again, the application will automatically reconnect when the device comes back into range.

In the presence of extreme and persistent interference, the cabled USB connection is, of course, available.

3. The risk of unauthorised users is very small due to the authentication requirements of the wireless link and the fact that the amplifier's Interface Protocol is proprietary.
4. The medical system uses mature, industry-standard hardware and protocols: Bluetooth and WiFi. This ensures that the system utilises all the benefits associated with these mature standards, concerning the authentication, data integrity and interference performance as discussed in this document.
5. The radio modules are tested according to their own EMC emissions and immunity standards: EN 300 328, EN 301 489-1, EN 301 489-17 and IEC 60601-1-2 (Bluetooth).
6. The radio modules are pre-certified and Type Approved.

Considering the medical system function, its indication for use and very low risk associated with a low level of concern, the analysis, evaluation and preventative measures undertaken reveal the low risk associated with wireless communication. In the presence of extreme interference, the rate of delivery of data packets will decrease until ultimately, the wireless link is dropped. Wireless communication problems are identified, prevented and mitigated, as described. The application identifies these wireless problems and automatically reinstates the wireless link if dropped in the presence of extreme interference. Alternatively, the cabled USB connection is available.



# Appendix 4: Troubleshooting Guide

## COM port problems with Bluetooth communication to Amplifier

- **The COM port is available but is being used by another application.**

This could well be the case if an application such as Microsoft Active Synch is installed and polling the COM port for a Windows CE device. Make sure Connection Mode for Active Synch is set to Only When Device is Connected, and not to Continuous.

Make sure other applications such as virus protection software and personal firewalls (ZoneAlarm) are not accessing the COM port while a connection to Trackit is being made.

## Problems starting the recording

- **The setup has not been sent correctly**

Under Trackit Status, in the Control Panel, check that Acquire Ready shows Yes. If it is not ready, acquisition cannot begin. This could be caused by incomplete transmission of the amplifier setup. Try to adjust the transmission delay for serial communication in the Trackit software as described above.

- **An incorrect setup has been sent**

If an incompatible setup has been sent to the amplifier the message; "unable to comply" will indicate that. If an incorrect setup has been sent, the Trackit Control Panel will show 'Acquire Ready: No'.

- **The card is not formatted correctly**

If the card is not formatted with a correct format (FAT 16 for Mk3, FAT32 for R40, T4 & T4A), a recording cannot commence. Format the SD card using the SD Formatter tool supplied on the Lifelines CD. Format the CF card (for MK3) using the Trackit Software. Refer to Section 5.4.2.2

- **The card is corrupted**

Disk corruption can be caused when a flash card is removed from Trackit or the Card reader while data is being written or accessed.

Amplifier: always stop a recording, or if hot swapping wait for the write LED to go out, before removing the card.

Card reader: make sure the device is stopped, in Card Services, before removing the Card. If the card is removed when this LED is on, the card will be corrupted and a reformat will be necessary. Always stop and eject the card using the icon in the Windows system tray before physically ejecting it.

- **The card is not inserted correctly**

If the flash card is not pushed in far enough, the card will not engage the pins on the card reader. 'No SD card present', in the Status section of the Trackit Control Panel, will evidence this.

# Version History

## Issue 1 (June 2020)

- Initial release, based on Software Section from Trackit Amplifier user manuals

## Issue 2 (May 2023)

Based on Trackit Software V2.8.4.7

- Dual video cameras
- Review in Acquire (with video)
- Password-protected Lockscreen
- File Manager (for end of study file operations)
- Reference electrode impedance measurement
- Additional automatic events (Enter/exit Lockscreen and Review, Battery level)



## Trackit Plus Software

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