# V9
# Operation Manual




Version: 260527 ID: DAA39

# Product Description

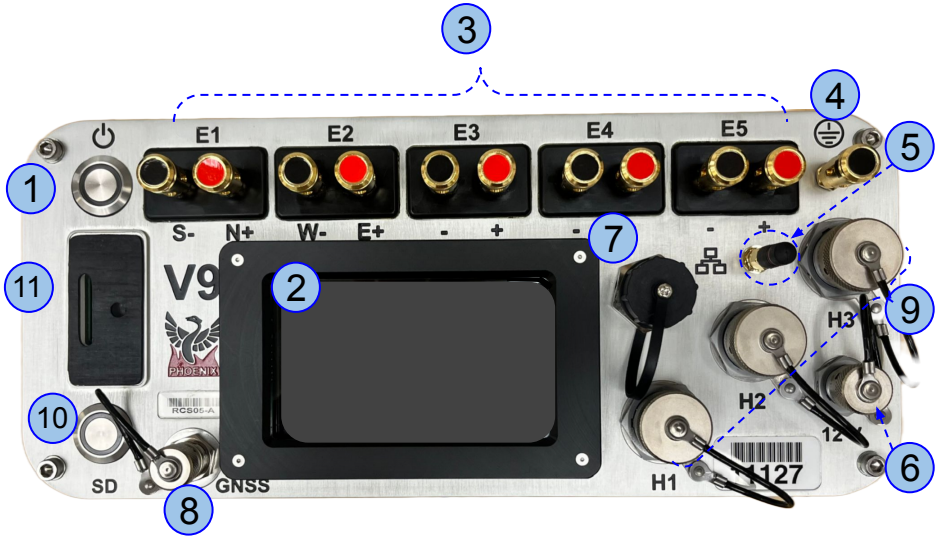
The V9 is the latest multi-function geophysical receiver, designed as a major upgrade to the V8. It features modern hardware, up to 96 KSps sampling per channel, large graphic display, and wireless connectivity. The system includes five electric channels for IP and CSAMT, and three magnetic channels optimized for high-productivity TDEM applications.

The V9 is easier to configure and operate, delivers higher data quality, and records faster at each site than the previous generation. A single software platform is used for system setup, field data Quality Control, and data processing for all MT and CS techniques.

The V9 also offers improved time synchronization, with support for GPS, BeiDou and includes a more robust timing board.

Supported techniques include MT, CSAMT, and TDEM, with more to come: TDIP, SIP, DC resistivity, and FDEM.


Compatible with TXD-1 driver, Transmitters *(TXU-30+/TXU-30, T3, T4)*, TDS-1000 high-sensitivity sensor loop, MTC-155/185 sensors and legacy sensors AMTC-30/MTC-50H/MTC-80H.




| V9 Components | |
|---|---|
| 1 | Power/Record button and indicator |
| 2 | 4.3 inch colour display (800x480 pixels) |
| 3 | E1 (Ex) electrode connectors<br>E2 (Ey) electrode connectors<br>E3 electrode connectors<br>E4 electrode connectors<br>E5 electrode connectors |
| 4 | Ground electrode connector |
| 5 | Wireless antenna |
| 6 | 12V DC power input |
| 7 | LAN connector |
| 8 | GPS antenna connector |
| 9 | H1 (Hx) magnetic sensor connector<br>H2 (Hy) magnetic sensor connector<br>H3 (Hz) magnetic sensor connector |
| 10 | SD card button and indicator |
| 11 | SD card slot and cover |

# V9
# TDEM Technique

# Equipment Required for TDEM

| Transmitter Side | Receiver Side | General equipment | Tools & Supplies |
|---|---|---|---|
| • T-4<br>  ○ Power source for T-4, either:<br>  ■ 12V batteries in series *(24V to 72V), or*<br>  ■ Phoenix battery pack<br>• 12 or 14 AWG wire for transmitting loop<br>• TXD-1 transmitter Driver<br>  ○ TXD-T4 Cable<br>  ○ SD Card<br>  ○ GPS antenna and cable<br>  ○ 12V Battery and Battery cable | • V9 Receiver<br>  ○ GPS antenna and cable<br>  ○ 12V Battery and Battery cable<br>  ○ SD Card<br>  ○ V9 license for TDEM technique<br>• TDS-1000 receiving loop(s)<br>  ○ 10-10 pin cable(s) | • Layout Sheet<br>• Laptop<br>• EMpower v2.56 or above *(Field QC computer doesn't need a license. License required for the computer managing survey data)* | • Handheld compass<br>• Measuring tape<br>• Multimeters *(Analog and digital)*<br>• Pencil and permanent marker<br>• Wire cutter<br>• Electrical tape / Flagging tape<br>• Tarp<br><br>***Note:*** *the use of a handheld GPS can be helpful to set up the transmitting loop, especially when using a large loop.* |

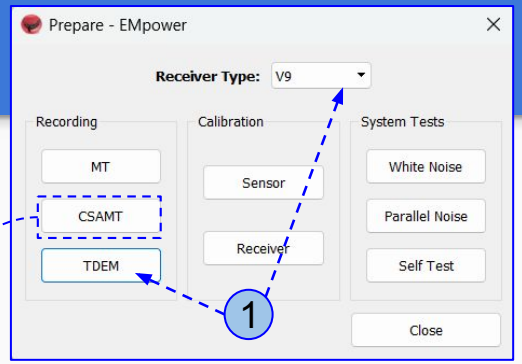
*The T-4 can transmit up to 40A. This electrical current can cause serious injury or death if mishandled. Please read and follow all safety instructions in the T-4 manual.*

# Configuring TDEM Acquisition

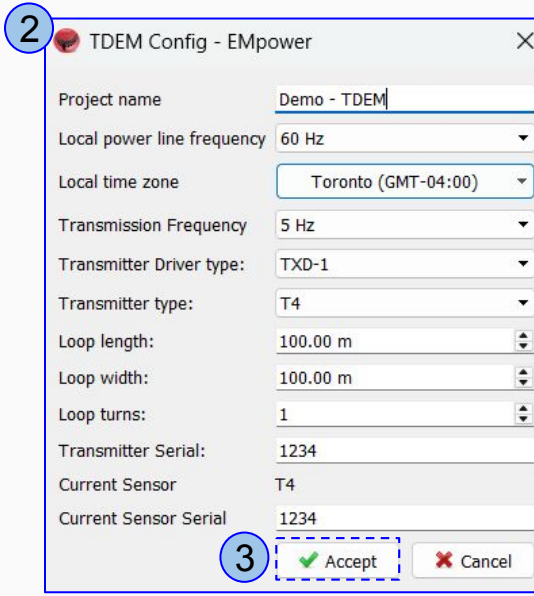
1. In the **Prepare** module, select the **V9** from **Receiver Type** and set the Recording type to **TDEM** .

2. Fill out the **TDEM Config** form, considering:
   - **Local power line frequency** - It's important to this to the local power line frequency since EMpower will only offer Transmission Frequencies that do not receive interference from the local power line.
   - **Transmission Frequency** - Lower repetition rates capture later time gates, helping to resolve deeper layers. The trade-off is that, in noisy environments, earlier time gates are resolved more slowly due to fewer repeated deterministic waveforms per second.
     - Note that V9 innovations allow to resolve early time gates (i.e. 30Hz time gates) when transmitting 5Hz or 1Hz waveforms.
   - **Current Sensor Serial** - For T4, the current sensor is internal, use the serial number of the transmitter *(4 digits)*

3. Click the **Accept** button




*To learn how to use the CSAMT technique, consult the [CSAMT Operation Manual (DAA31)](#).*



# Configuring TDEM Acquisition

**4.** Define the **Magnetic Channel Settings**
- 4.1. Enable only the magnetic channels in use to optimize SD card space and avoid confusion when processing the collected data
- 4.2. Select the **Gain**, in most situations **Normal** Gain is best for TDEM operations

**5.** The default **Sampling Rate** for TDEM is 96,000 sps

**6.** Fill in the **Configuration Layout**

**7. Save** the Config files
- 7.1. Select the number of receiver(s) of the same type
- 7.2. EMpower will create one config file for the transmitter and one for each receiver

The same configuration file is saved for all instruments. Therefore, a saved SD card can be used for the driver or receiver(s), because no serial number is required.

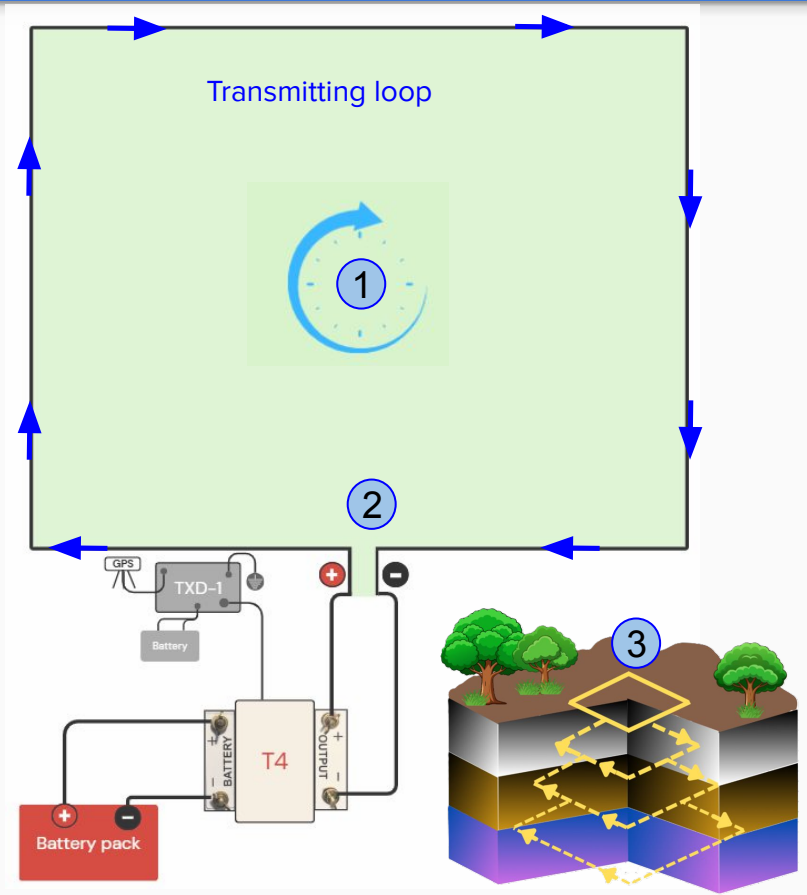

*Note: Use the time zone menu to configure the correct local time for the acquired data in EMpower.*

# Setting up a Central Loop TDEM

# Transmitting Loop Installation

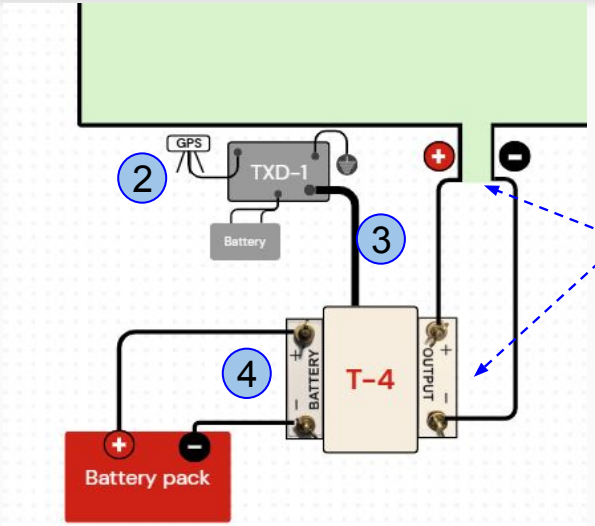
1. A clockwise current *(viewed from above)* generates a downward *(positive)* magnetic field at the loop center.
2. The loop wire should run from the "positive" transmitter output, clockwise, to the "negative" transmitter output.
3. The transmitting loop size can vary from a few tens of square metres to several hundred square metres. Increasing the current will extend the latest detectable signal.

***Note:*** *For a very large transmitting loop (deeper exploration), contact Phoenix*

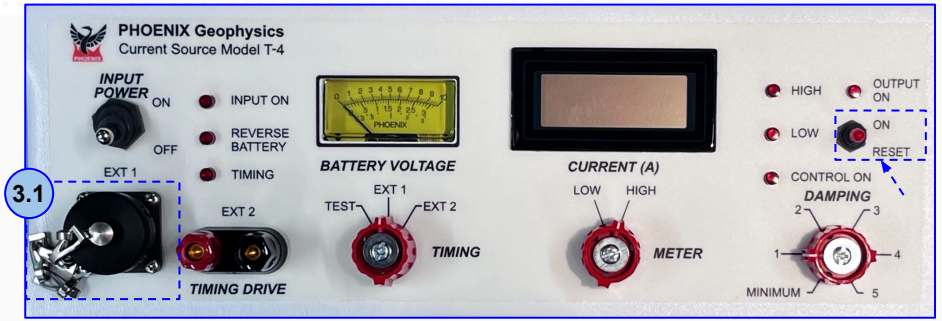


# Transmitter setup

1. Connect the positive **(+)** and negative **(–)** cables of the transmitting loop to the corresponding T-4 Transmitter plugs.
2. TXD-1 connection
   - Battery
   - Ground electrode (optional)
   - GPS antenna
3. Connect the TXD-1 to the T-4
   3.1. Connect the TXD-T4 cable from the the **TXD-1 Driver** connector to the T-4 **EXT 1** connector
4. Connect the Battery pack *or 12V* batteries in series *(24V to 72V). For more details and safety considerations consult the T-4 manual.*








> *The T-4 can transmit up to 40A. This electrical current can cause serious injury or death if mishandled. Please read and follow all safety instructions in the T-4 manual.*

# V9 Connections
# TDEM


**Start by connecting:**

1. Ground electrode
2. TDS-1000 loop to channels **H1**(Hx), **H2**(Hy) or **H3**(Hz) for a central loop setup.
3. GPS antenna
4. 12V Battery

# Receiver Setup for Central Loop TDEM

After installing the transmitting loop, for central loop surveys, set up the TDS-1000 receiver loop at the center of the transmitting loop.

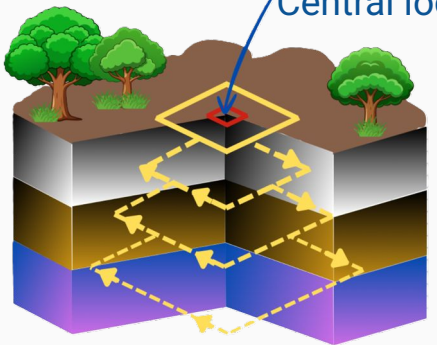
Ensure to use the same polarity for the transmitting and receiver loops and the TDS-1000 receiving loop:

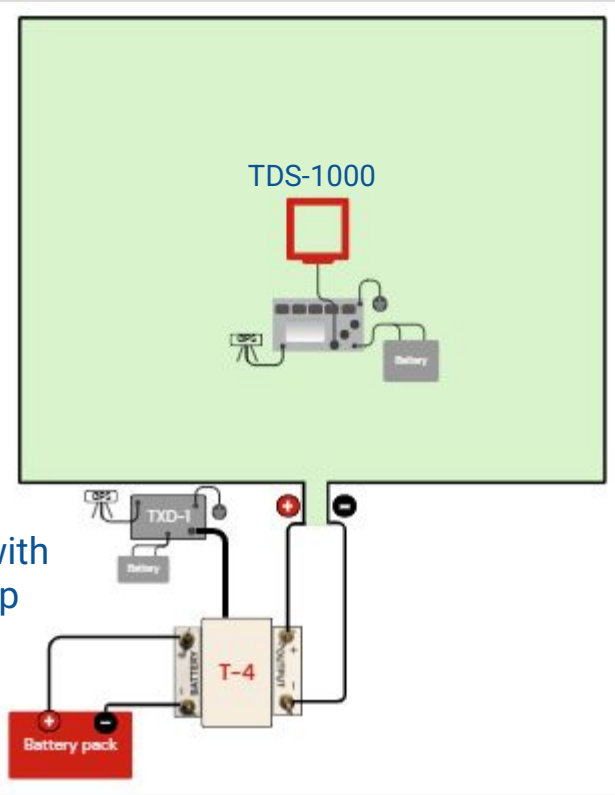
- Transmitting loop orientation explained in previous slides
- Set up the TDS-1000 loop with its bubble level facing up.

*In case of a mistake, a reverse polarity recording can be fixed later in EMpower (see page 20)*

**Receiver Connections**

- Battery
- TDS-1000 Sensor loop
- Ground electrode
- GPS antenna

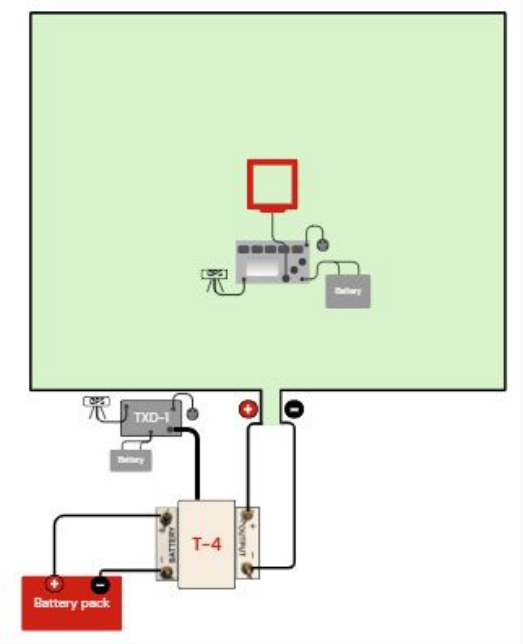


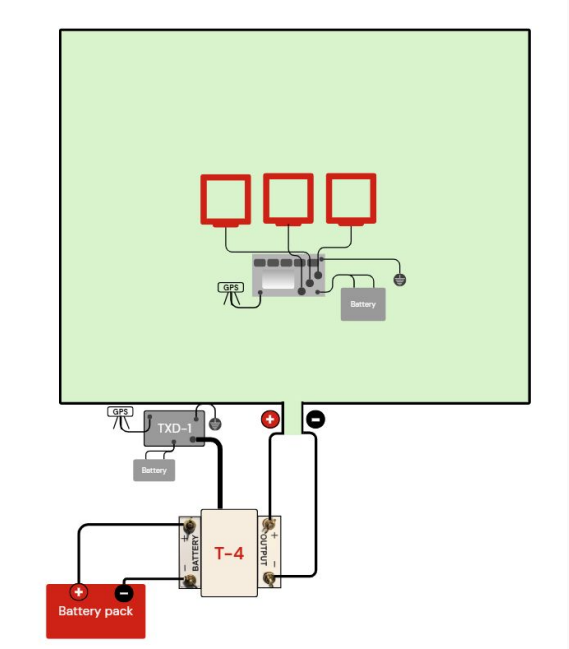



# Considerations for Fixed Loop TDEM

If the transmitting loop is large, in fixed loop survey configurations, up to three coil sensors can be connected to each single V9 receiver, up to 120 m apart, to acquire several points simultaneously.

One or more receivers can move with they multiple sensors within (or even outside) of the transmitter loop, acquiring a grid of TDEM points with a single transmitter layout.



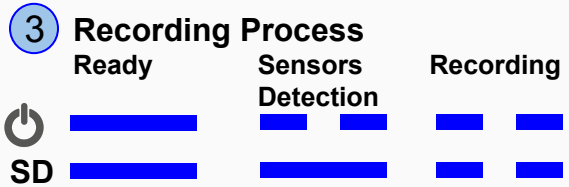



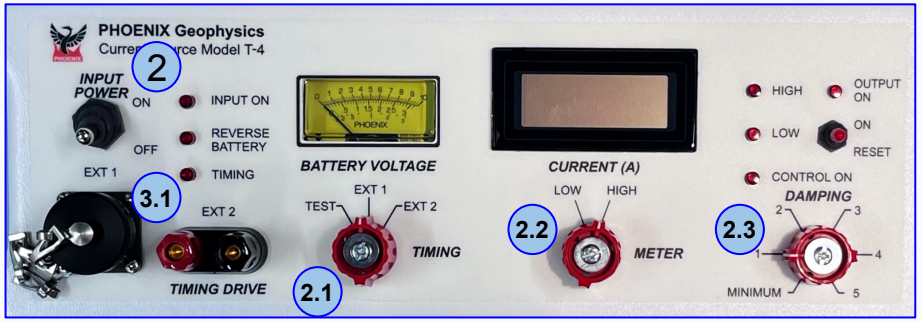

# Recording TDEM Data

# Starting transmission

## Generating a frequency waveform

1. Turn on the TXD-1 Driver by pressing the power button and wait until both LEDs buttons turn solid blue
2. Turn on the T-4 by turning the **Input Power** switch to the **ON** position
   2.1. Set the **TIMING** to **EXT 1**
   2.2. Set the **METER** to **LOW** or **HIGH** *(see the T-4 manual for details)*
   2.3. Set the **DAMPING** value. Most common value is 2 *(see the T-4 manual for details)*
3. When both LEDs of the TXD-1 are solid blue, start the waveform and current recording by pressing the power button
   3.1. The **Timing** LED in the T4 will turn ON:
   - If transmitting at 1 Hz, the **Timing** LED is flashing red
   - If transmitting at 5 Hz, the **Timing** LED is fast flashing red
   - If transmitting at 30 Hz, the **Timing** LED is solid red

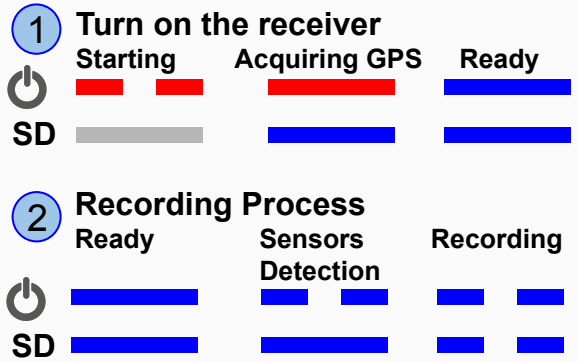
# Receiver Operations

1. Turn on the V9 receiver by pressing the power button and wait until both LEDs are solid blue.
2. Start the recording by pressing the power button

> Take note of the current value displayed on the T-4 screen, *as it is required for data processing.*

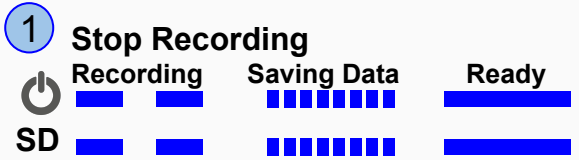
Review the progress in the V9 screen by pressing the SD button

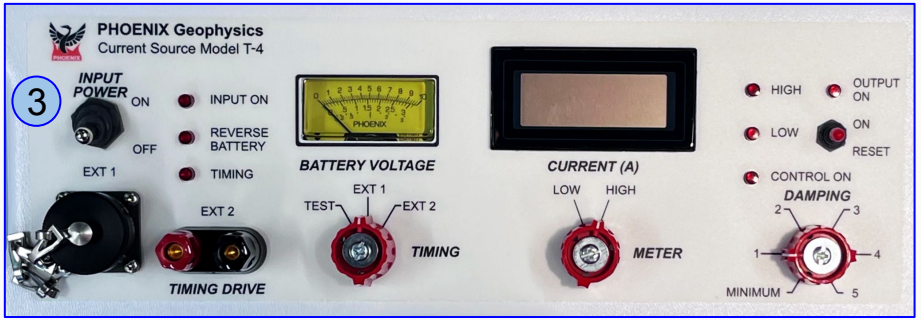
- Channel details
- TDEM live Decay plot



# Stop the Operations

1. Stop the V9 recording first by pushing its power button, followed by stopping the TXD-1 transmission by pushing the power button briefly.
2. Turn off the T-4 output by flicking the switch on the right hand side to the “reset” position.
3. Turn off the TXD-1 and the V9 receiver by holding their power button for more than 3 seconds.
4. Turn off the T-4 by switching the Input Power to the OFF position



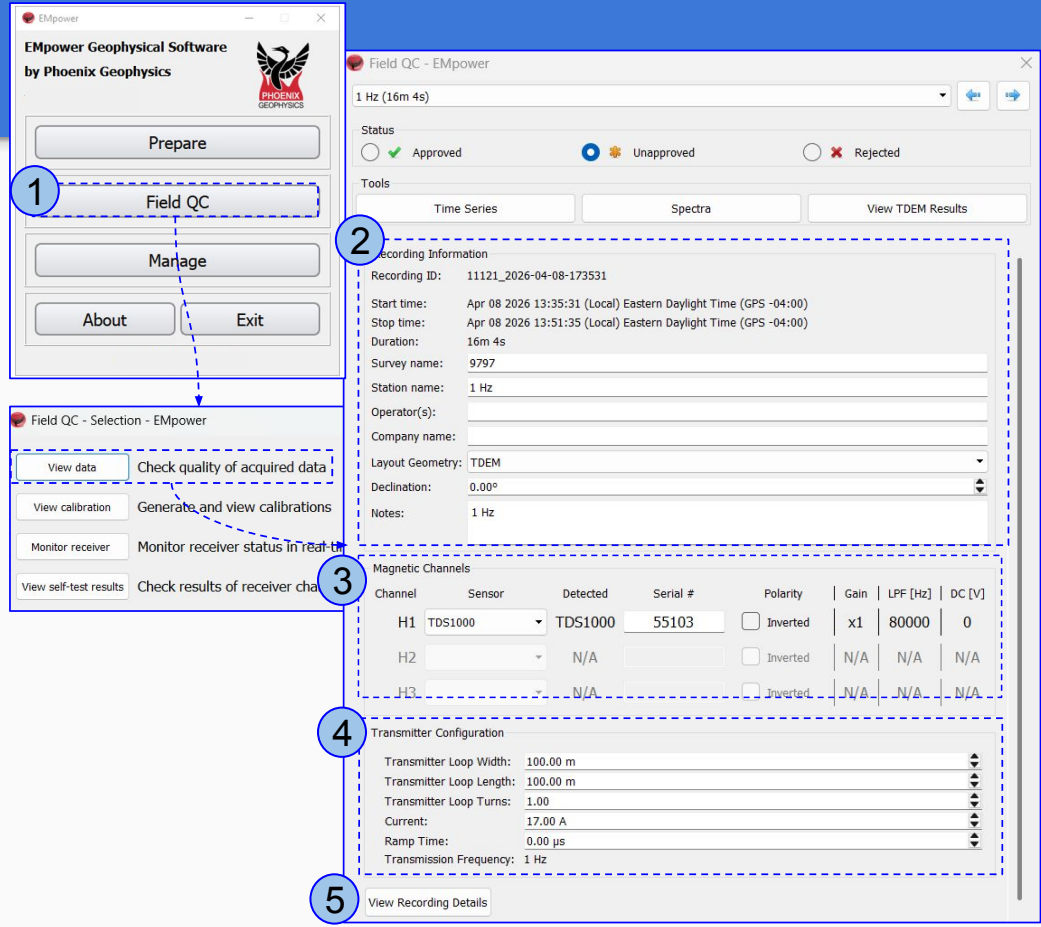




# Viewing and Managing TDEM Data

# Field QC - TDEM

1. From **Field QC**, click **View Data** button and select the recording from the SD card or from your computer
2. Review the **Recording Information** and edit the information if necessary
3. Verify the **Magnetic Channels** information and correct if required
4. Enter the **Transmitter Configuration**
   - **Transmitter Loop Width, Length** and **Number of Turns**
   - **Current** - *Use the values noted from the T4 screen, as they are required for data processing.*
   - **Ramp time** - *(consult page 24, for field QC using the correct value is optional, but it must be correct when interpreting and exporting)*

   These values are required to display the resistivity curve.
5. Review the information on **View Recording Details** *(see page 22)*



# Field QC - TDEM Results

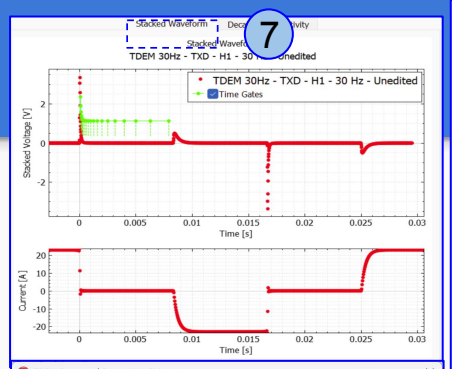
6. Click **View TDEM Results** button, EMpower will display one window per H-channel

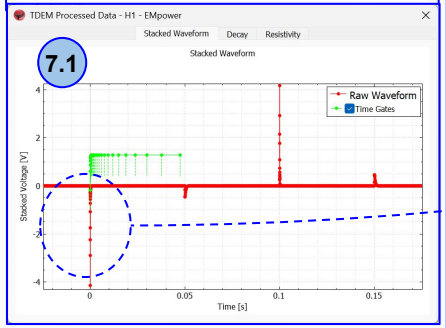
7. **Stacked Waveform** - Evaluate signal quality, detect inconsistencies, and compare waveform behavior across channels.
   7.1. A recording has a reverse polarity when the first spike in the Stacked Waveform is negative. In such case Check the "Inverted" box for that H channel to fix the polarity.

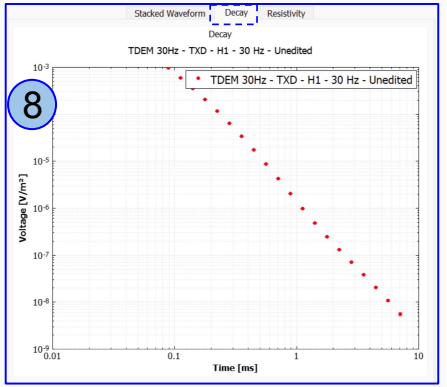
8. **Decay** - Displays the energy returned by the geology at different times after transmitter turn off.

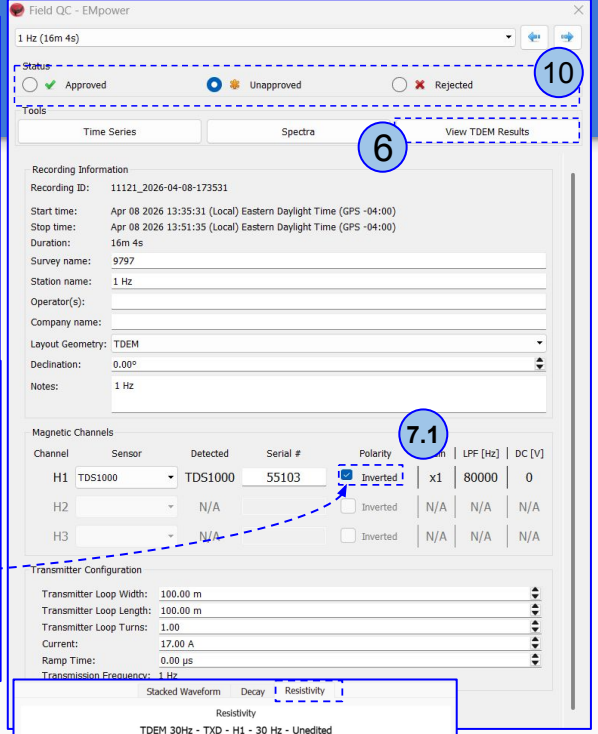
9. **Resistivity** - Obtained from the decay curve measured by the receiver and the transmitter parameters provided. This is a volumetric apparent resistivity. Later times corresponding to deeper layers.

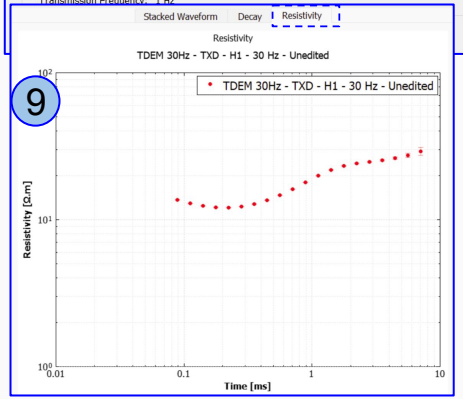
10. **Evaluate** the recording quality and classify each recording as '**Approved**' or '**Rejected**'



# View Recording Details

Review that the following levels are within valid limits for quality control:

**1.** Battery Voltage

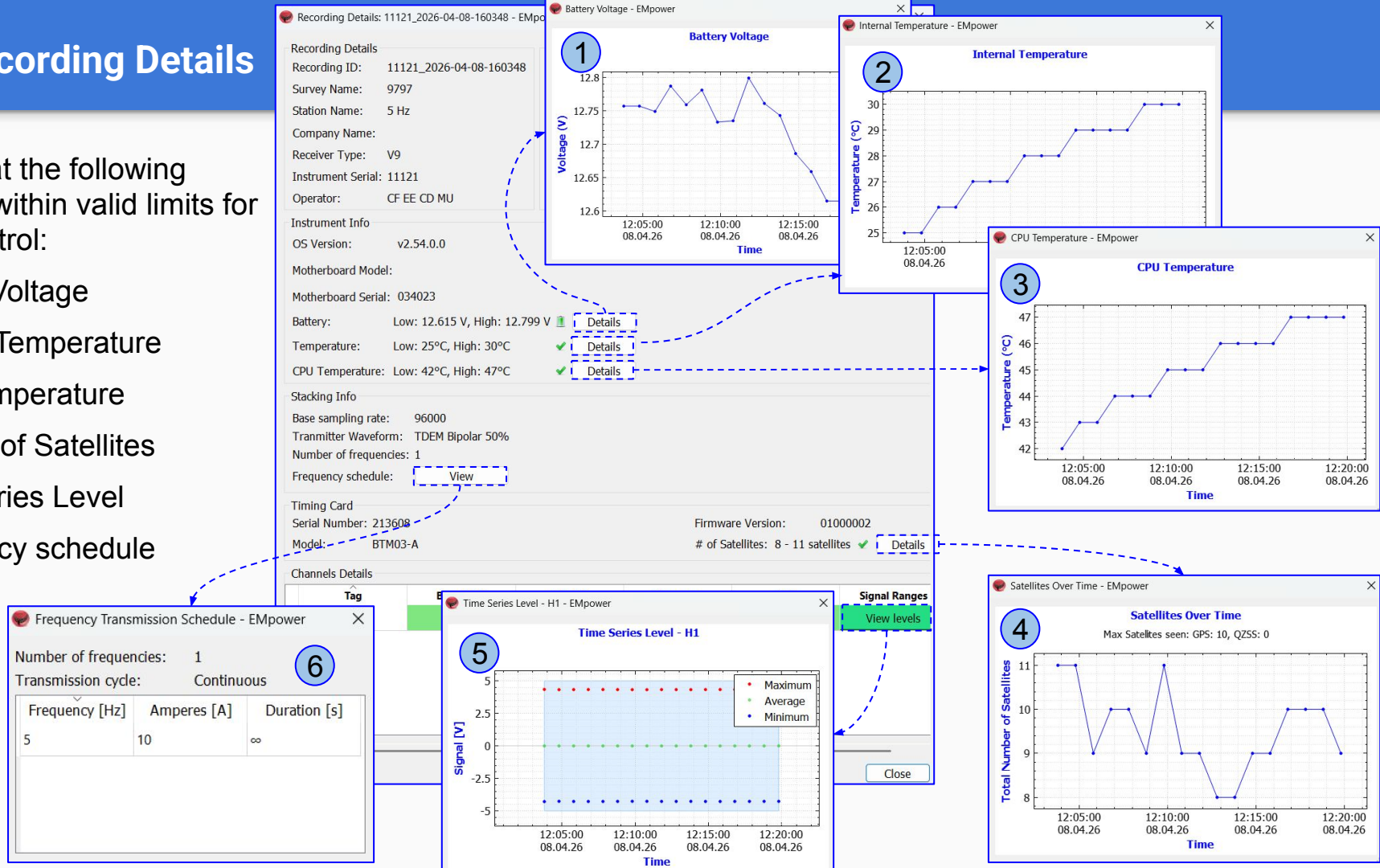
**2.** Internal Temperature

**3.** CPU Temperature

**4.** Number of Satellites

**5.** Time Series Level

**6.** Frequency schedule



# Estimating turn-off ramp time

Turn-off ramp time can be estimated from loop inductance and output current values. Multiply the loop inductance L (mH) by the output current I (A) to estimate the turn-off ramp time Tr (µs).

The turn-off ramp time can be estimated as:
**Tr (µs) ≈ L × I**

*where:*
*L = loop inductance (mH)*
*I = Transmitter output current (A)*

Approximate inductance values:

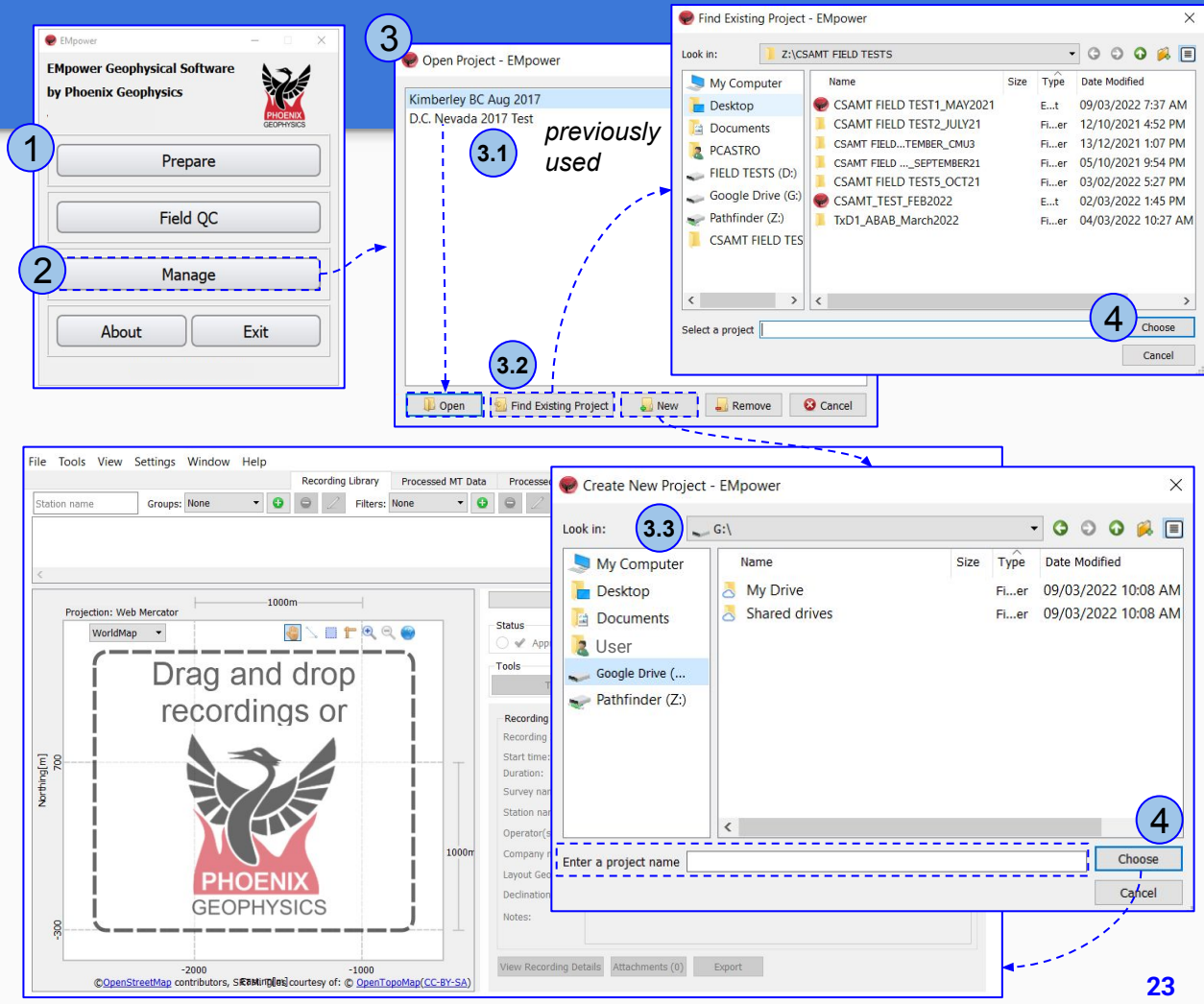
| AWG 12 or 14 Loop size (m) | Inductance L (mH) |
|---|---|
| 50 x 50 | 0.4 |
| 100 x 100 | 0.9 |
| 150 x 150 | 1.4 |
| 200 x 200 | 2.0 |
| 400 x 400 | 4.5 |
| 600 x 600 | 7.6 |

# Managing a TDEM survey

The Manage section of EMpower can be used to aggregate and manage the data of all stations in a survey project through easy-to-use visual tools. To create or open a project, follow these steps:

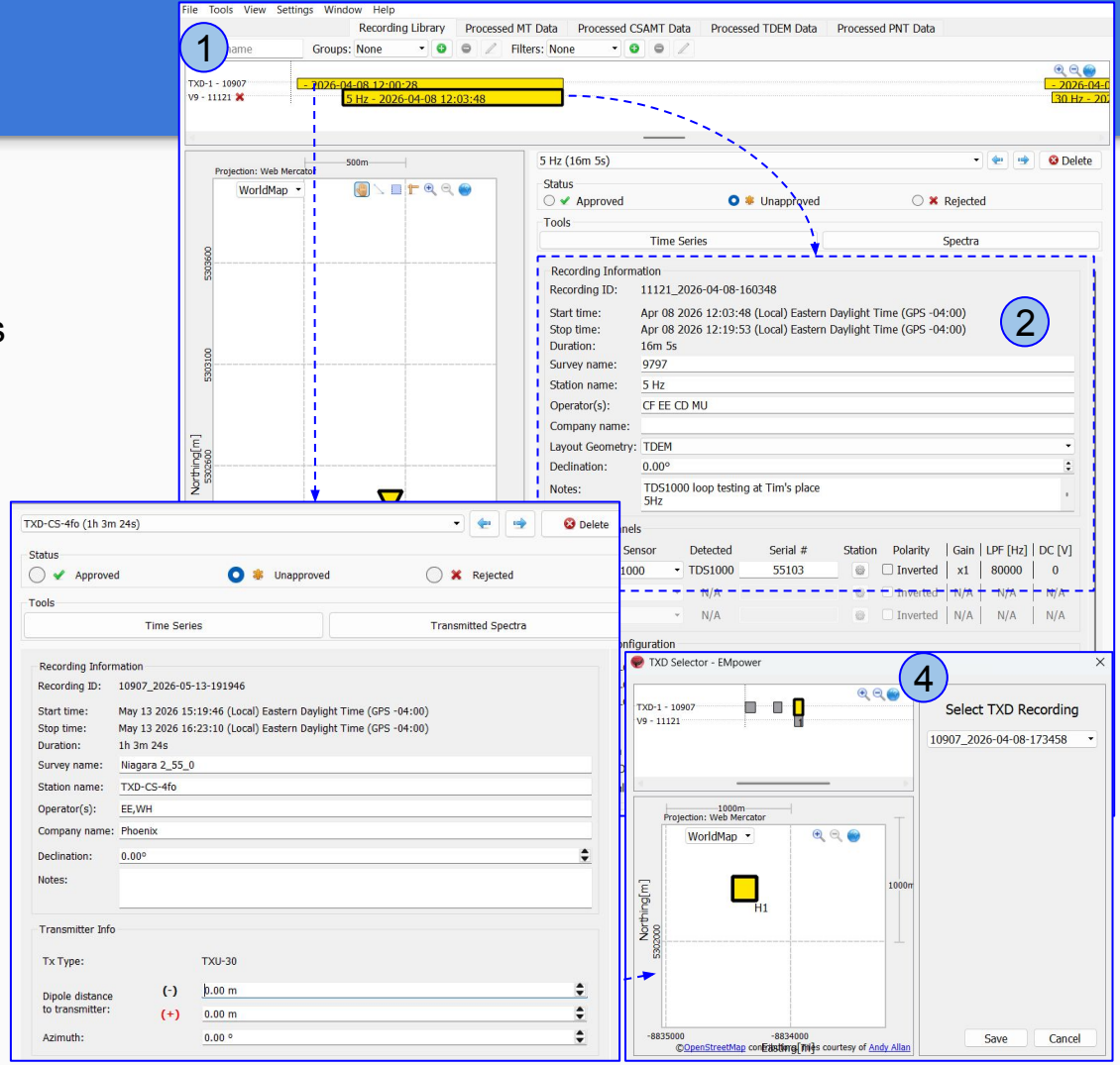
1. Start **EMpower**
2. Click **Manage** module
3. Open or Create a Project
   - 3.1 **Existing Project**
     - Select from the list *(previously used)* and click ***Open***

     *Or*
   - 3.2 Click **Find Existing Project**
     - Select the Project
   - 3.3 **New Project**
     - Click **New**
     - **Enter a project name**
4. Click **Choose**



# Transmitter Configuration

1. Import the TXD-1 and the V9 receiver recordings to the project.
2. Review the **Recording Information** and **Magnetic Channels**, review if the polarity is correct *(see page 20) and* edit the information if necessary.
3. Ensure that the transmitter parameters are correct in the TXD-1 recording. EMpower will automatically link the TXD-1 recording to the corresponding V9 recording, and the V9 will use the TXD-1 parameters to calculate the resistivity curve. (Note, if you change a TXD-1 parameter, all the linked V9 result curves will be automatically updated)
4. If more than one TXD-1 recordings overlap with a V9 recording, Click the icon  in the V9 recording to select the correct TXD-1 recording to use

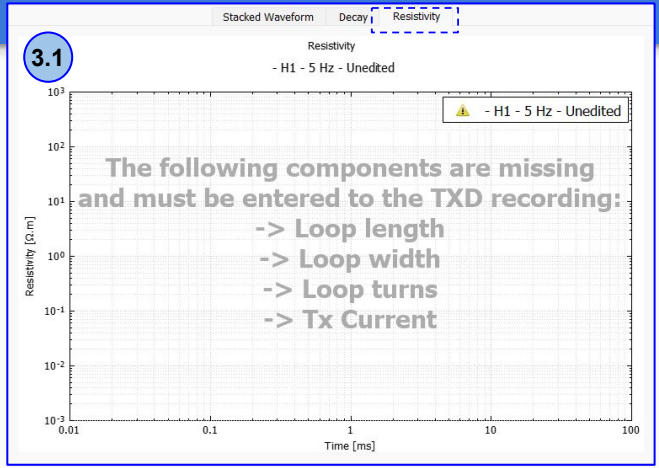


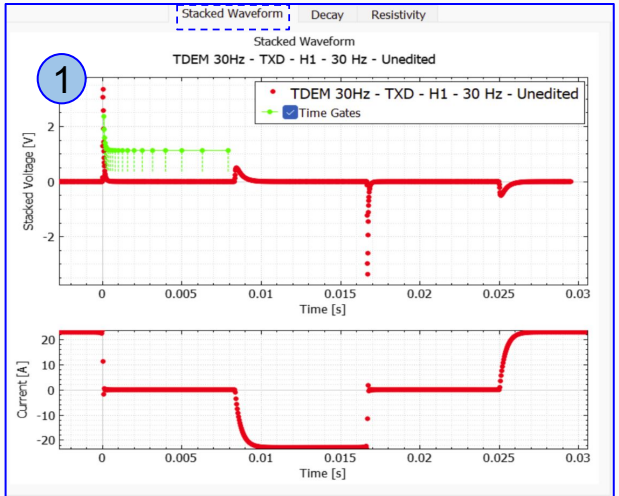
# Processed TDEM Data

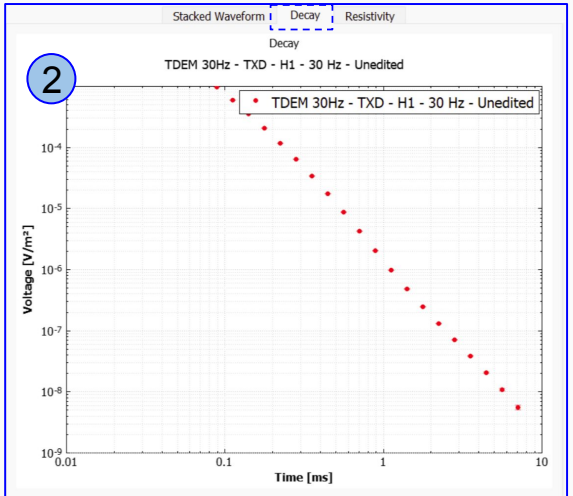
Click on the **Processed TDEM Data** tab and select a recording from the timeline or the map, to visualize the following plots:

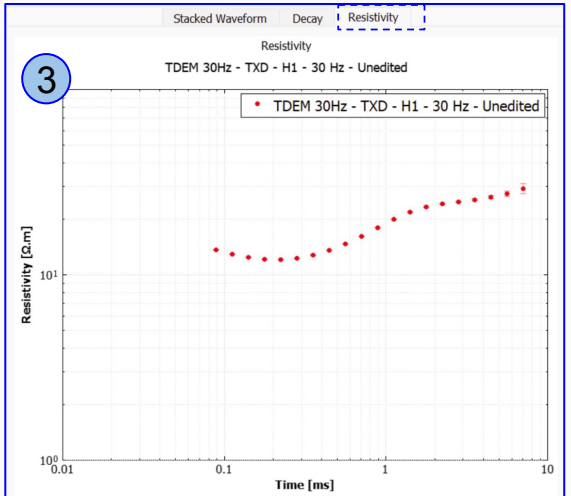
1. Stacked Waveform
2. Decay
3. Resistivity
   3.1. If the **Transmitter Configuration** data is incomplete, a message will appear in the Resistivity plot. *(consult the previous page)*

Use the Stack Rejection Tool *(see next page)* to edit station data.



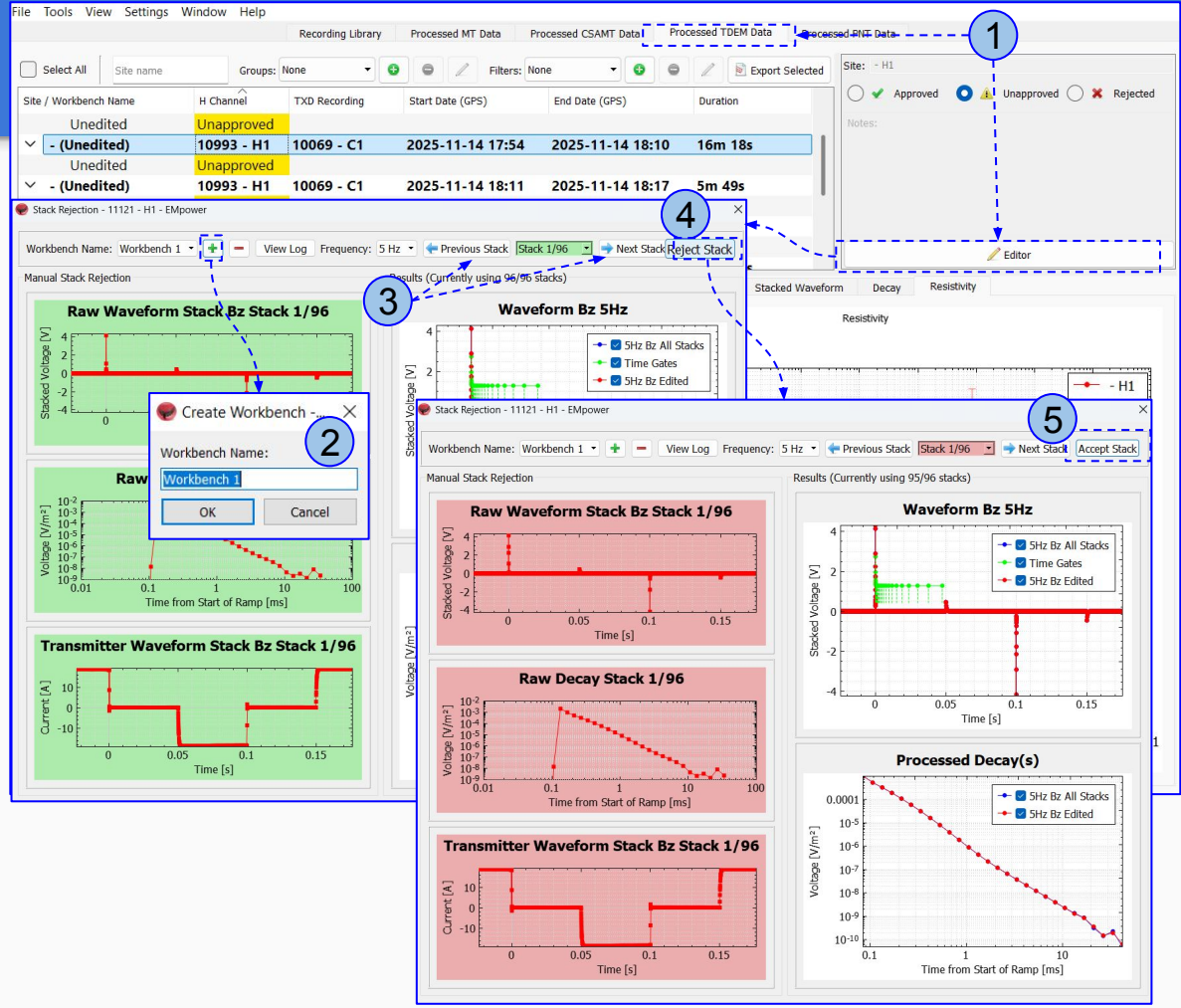



# Stack Rejection Tool for TDEM

The Stack editor is a tool designed to improve the quality of the resulting processed data by removing noisy stacks

1. In the **Processed TDEM tab**, select the site, from the list or the map, and click the **Editor** button.
2. Create a new **Workbench** and define a name.
3. Review the data by clicking the **Previous Stack** or **Next Stack** buttons
4. Reject the stacks that affect the results by clicking the **Reject Stack** button.
   - The rejected stacks will appear in red. Decay plot will display the original curve in blue and the edited curve in red.
5. To restore a stack, use the **Accept Stack** button.

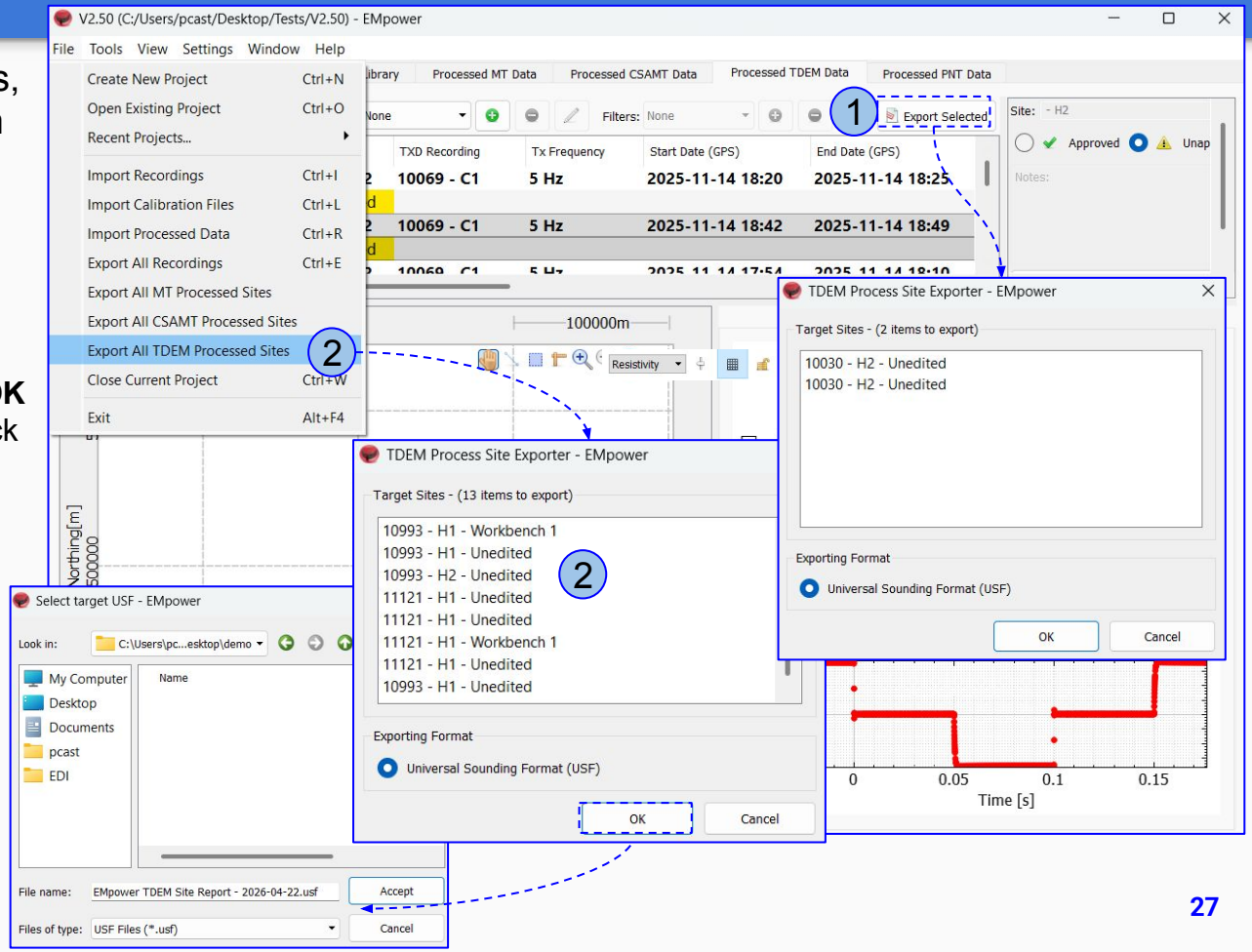


# Processed Data Exporter - TDEM

1. To export one or multiple recordings, select the desired recording(s) from the table or map and click the **Export Selected** button. The data will be exported in USF format

2. To export all the TDEM Sites
   2.1. From **File** menu, select **Export All TDEM Processed Sites** and click **OK**
   2.2. Choose the desired location and click **Accept** to save the file.

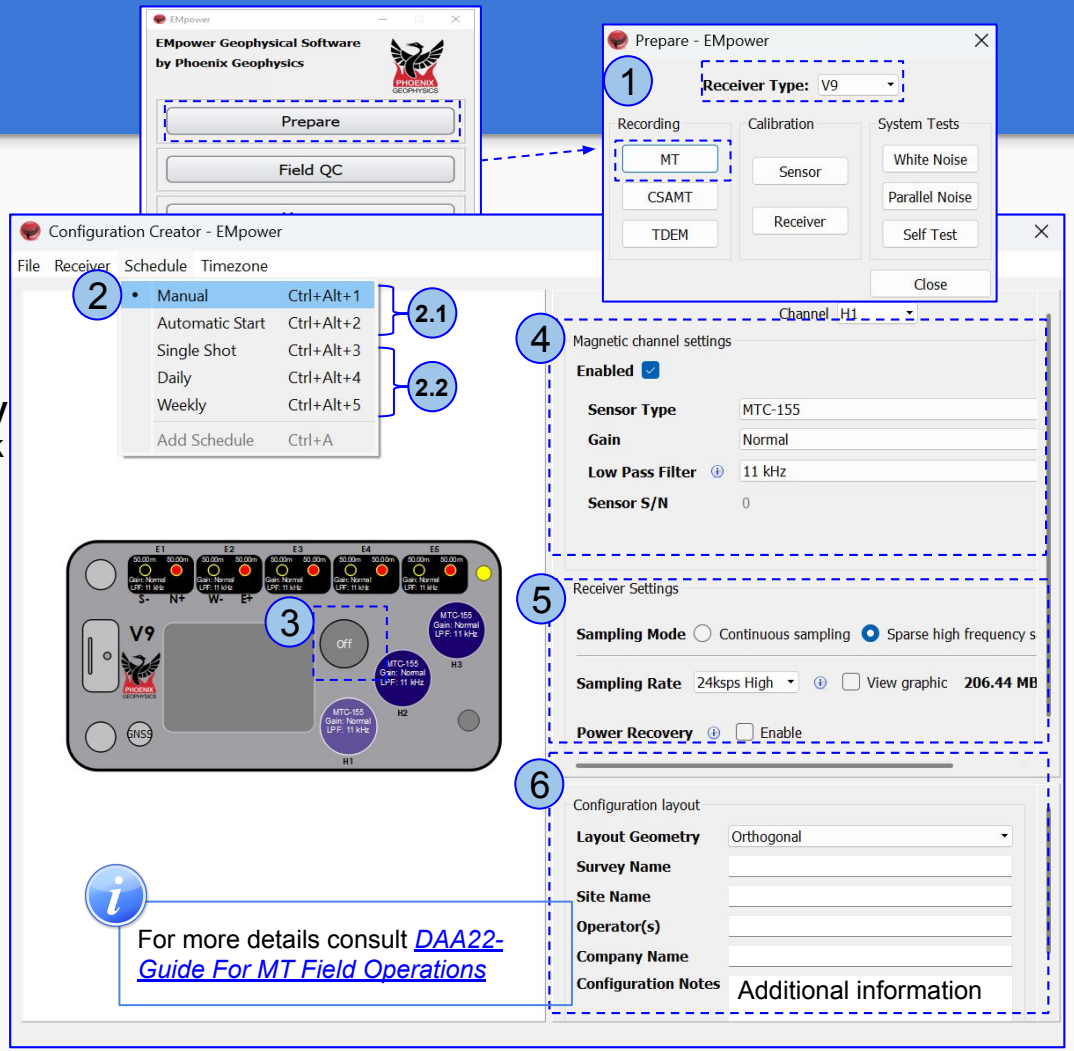
**EMpower is limited to exporting a single workbench per site*



# V9
# MT Technique

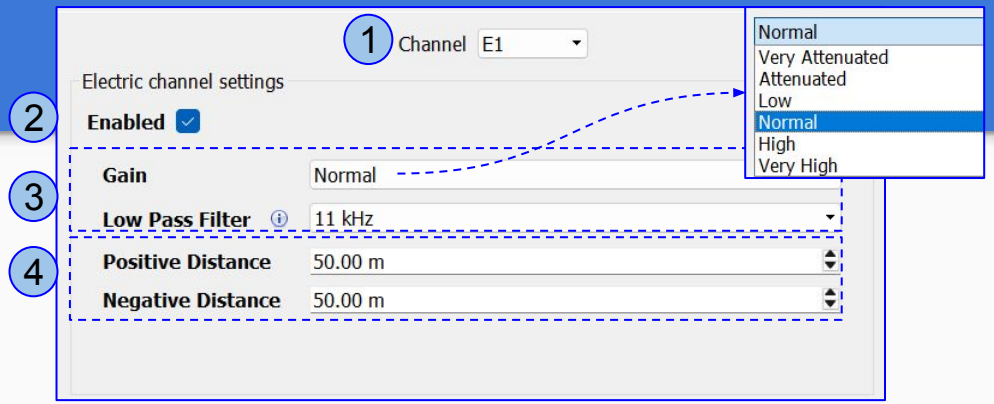
# Configuring MT Acquisition

1. From **Prepare,** select the **Receiver Type** as **V9** and click the **MT** button.
2. Select the **Schedule**
   2.1. **Manual** or **Automatic Start**
   2.2. For a specific schedule, use **Single Shot, Daily** or **Weekly.** For additional dates and times**,** click **Add Schedule**
3. **Ethernet port** *(consult the Remote Networking manuals)*
4. Define the **Magnetic Channel Settings** *(See next pages)*
5. Define the **Receiver Settings**
   - **Sampling Mode** *(Continuous Sampling or Sparse high frequency sampling)*
   - **Sampling Rate** *(see page 34)*
   - **Power Recovery** *(consult the Power Recovery manual)*
6. **Configuration Layout**

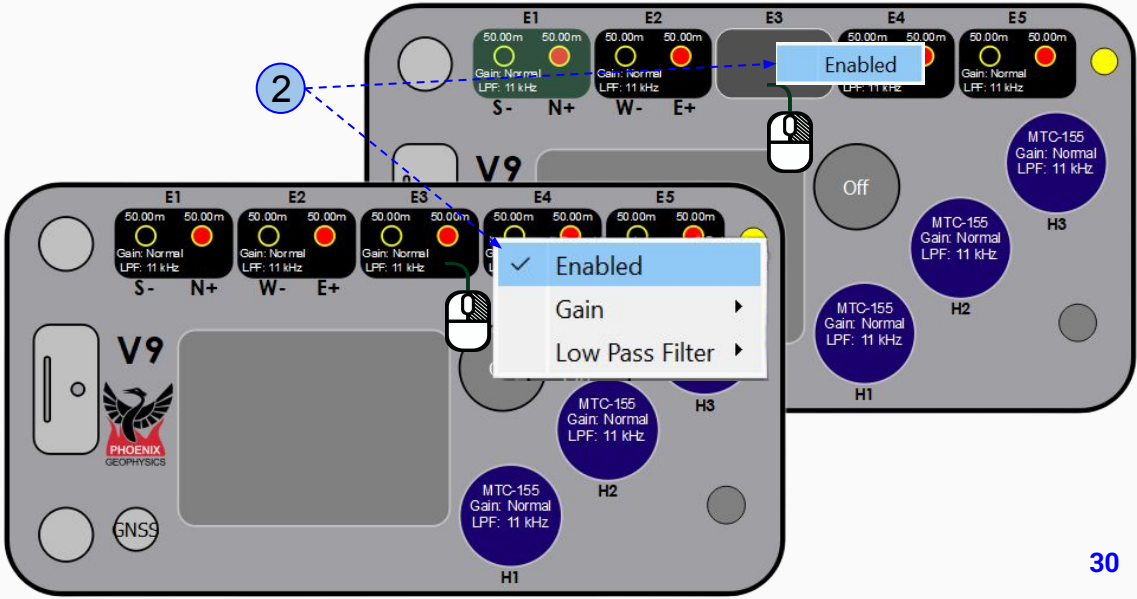


# Electric Channel settings

1. Select the **Electric** channel from the dropdown list.
2. **Enable** or **Disable** channel(s)
   - Disable any channels that will not be used during the recording to save space on the SD card. For regular MT use only two E-channels.
   - Some settings can be configured by using the right-click menu
3. Select the desired **Gain** and **Low Pass Filter.**
   - For most applications, Normal Gain and 11 kHz LPF are best.
4. Type the **Positive Distance** and **Negative Distance** of each electrode to the ground, if known.
   - If the distance is unknown or changes during the site layout, the value must be corrected in Field QC or Manage module before data processing to avoid shifts in the resistivity curves.




Some settings can be configured by using the right-click menu



# Magnetic Channel settings

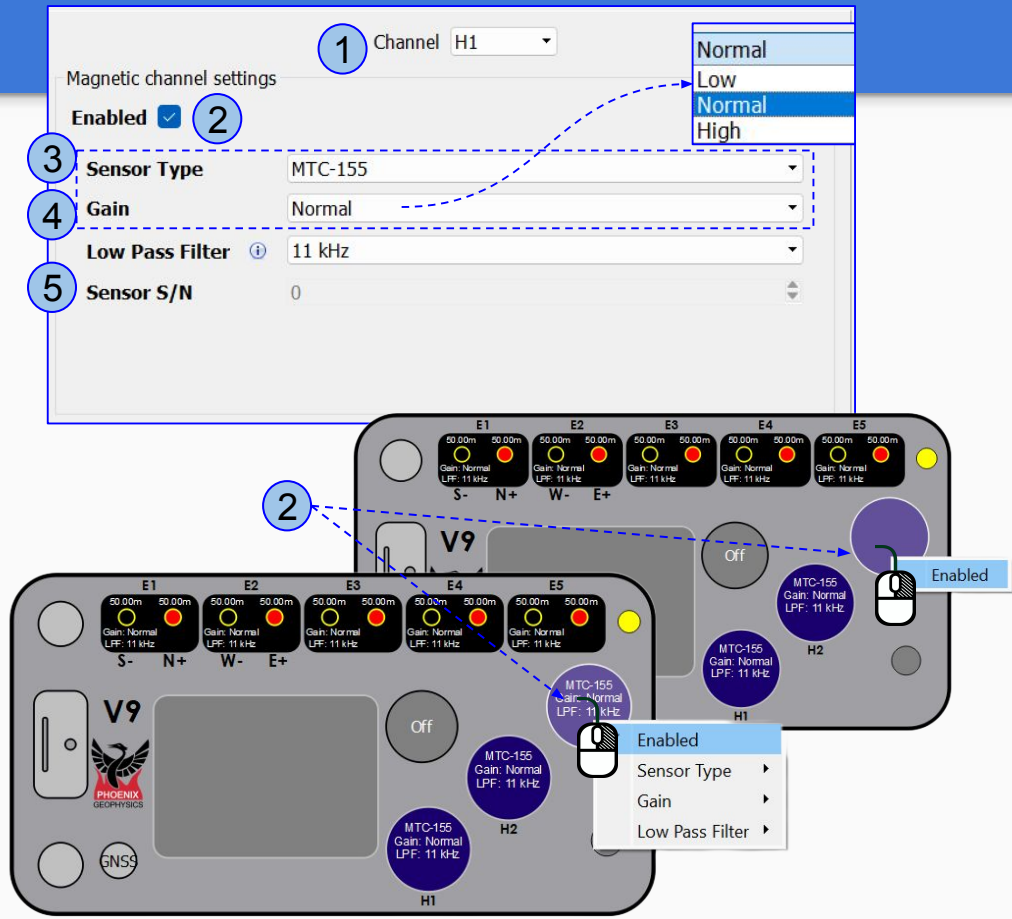
**1.** Select a **Magnetic** channel from the dropdown list.

**2. Enable** or **Disable** channel
- Disable channels that you do not plan to use during the recording. This will save space on the SD card.
- Some settings can be configured by using the right-click menu

**3.** Select the correct **Sensor Type**
- If the sensor type is incorrect in the configuration file, the receiver will display a warning message. However, the recording will not be interrupted

**4.** Select the desired **Gain** and **Low Pass Filter**
- In most situations, the default values are optimized for the selected sensor type

**5.** Type the **Serial Number** of the sensor if required
- The MTC-155/MTC-185 sensors are automatically detected by the receiver; no manual entry is required in EMpower.
- For other sensors, enter the serial number. If you don't know this information in advance, keep field notes to add this information later, after the recording is imported into EMpower.




*Some settings can be configured by using the right-click menu*

# Frequency Sampling - MT acquisition

**Sparse high frequency sampling** combined with **Sampling Rates** is used for common industrial applications such as oil and gas exploration, geothermal exploration, reservoir monitoring, and geotechnical studies.

**1.** Select **Sparse high frequency sampling** and choose the **Sampling Rate**

**2.** Enable the **View graphic** to visualize how the Sampling Rate options work

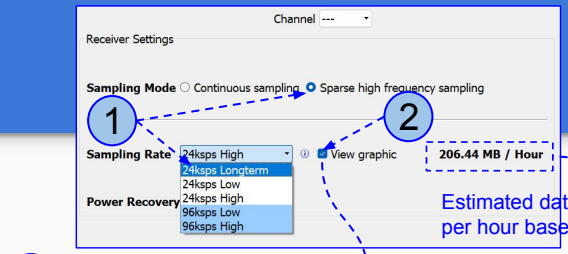
2.1. **24 ksps High,** use this option for environments with varying or moderate noise levels *(overnight recordings)*

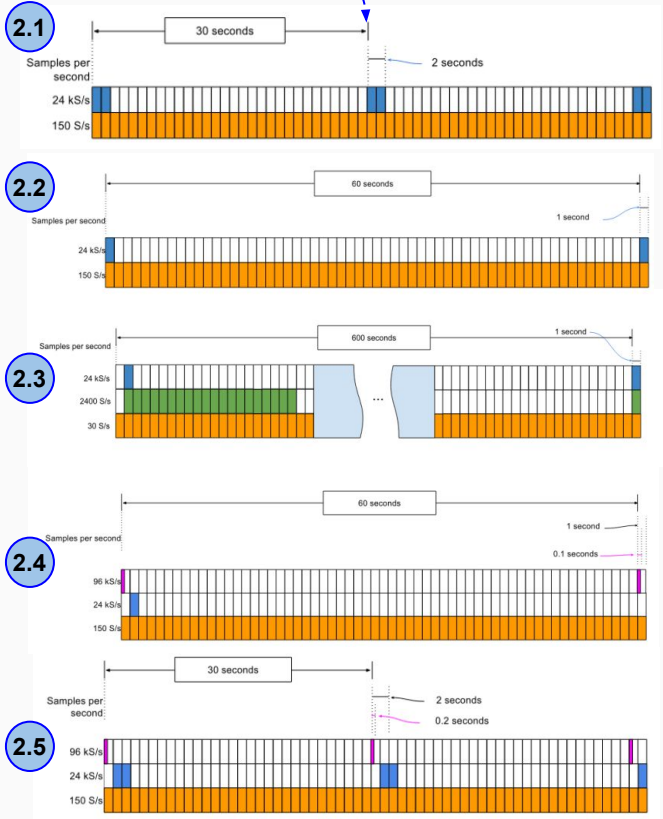
2.2. **24 ksps Low**, use this option for areas where noise levels are consistently low *(overnight recordings)*

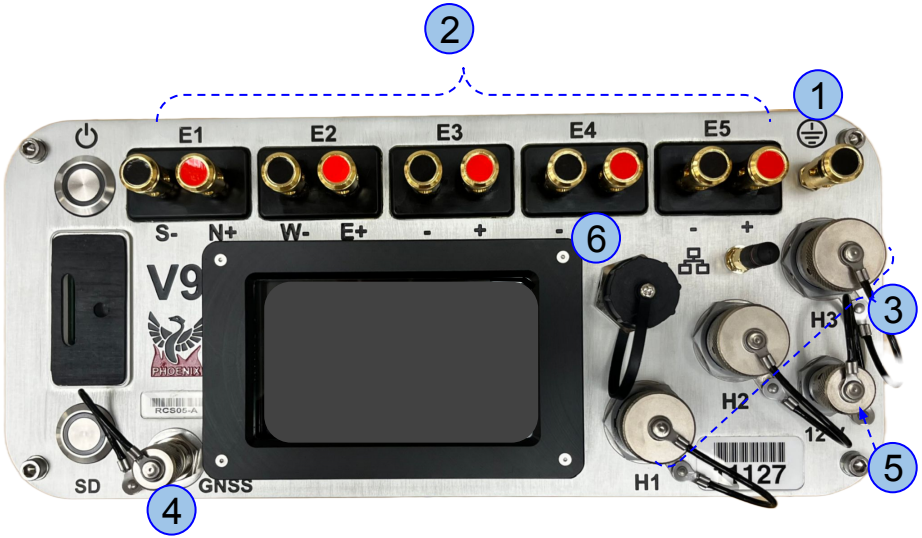
2.3. For remote sites requiring extensive recordings, use the **24 ksps Longterm** option to enable weekly or monthly log recordings while minimizing SD card space usage **Recommended for working with network remote access.*

2.4. **96 ksps Low,** use this option for areas with low to moderate noise levels when higher resolution is required *(short-duration recordings).*

2.5. **96 ksps High,** use this option for environments with moderate to high noise levels when maximum resolution and signal detail are required *(short-duration recordings).*






# V9
# Connections for MT

**Start by connecting:**

1. Ground electrode
2. Electrodes to channel **E1**(Ex) (S-, N+) and channel **E2**(Ey) (W-, E+)
   - Channels E3, E4, E5 are normally not required in a conventional Single site MT survey
3. Magnetic sensors to channels **H1**(Hx), **H2**(Hy) and **H3**(Hz) as needed
4. GPS antenna
5. 12V DC Power Source
6. Network connector *(as needed)*

# Recording MT Data

Before starting a recording, execute the calibration of the receiver and sensors to verify the operating status of the equipment and ensure the quality of the recordings and the reliability of the measurements.

*For more details consult *the* *Guide For MT Field Operations (DAA22)*

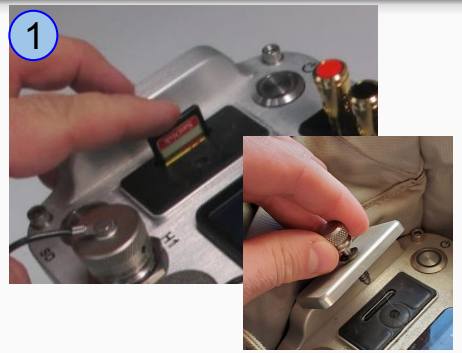
**1.** Insert the **SD card** and close the lid

**2.** To turn ON the receiver, press the **Power** button briefly, wait until both **LEDs** are solid blue

2.1. **LED** pattern for **Automatic Start** recording

**3.** If the schedule type was configured as **Manual,** press the **Power** button briefly and release to start recording

1



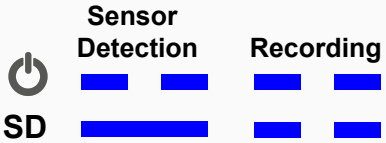
**For any problems with the SD Card, check the System Troubleshooting manual (DAA24)*

The receiver auto-detects serial number and model for magnetic sensors of the new generation (MTC-155/185). The information about the sensor is updated on the receiver screen only at power on and right after each recording starts.

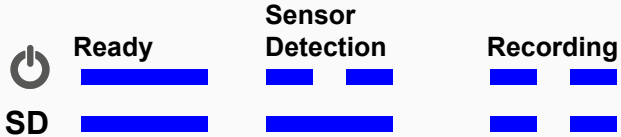
2 Briefly press and release the power button


2.1 ***Automatic Start***

*The recording starts automatically according to the schedule*




3 Briefly press and release the power button




**Indicators**

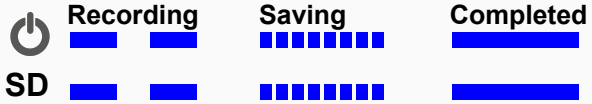
*Slow, equal pulses*

*Solid color / Off*

# Stop a recording

1. Press the **Power** button briefly and release to stop recording
   - Wait until both **LEDs** are steady blue
2. Turn off the receiver by pressing the **Power** button for a few seconds, until the **LEDs** will flash red
   - Wait until both **LEDs** turn off
3. Eject the **SD card**
   - Press the **SD card** and release, pull the **SD card**

1 Press the **Power** button briefly and release




2 Keep pressing the power button 3 sec and release


**Indicators**

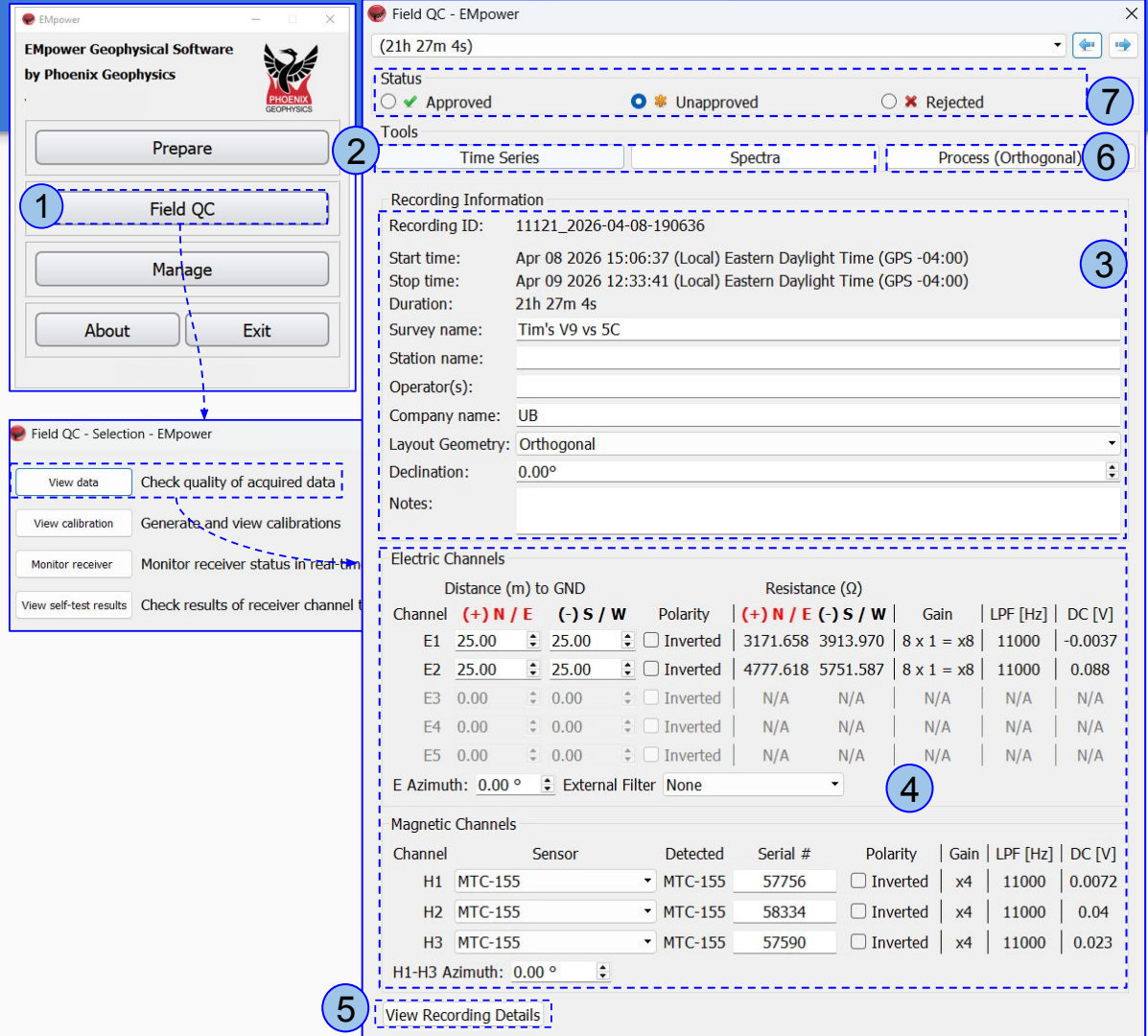
*Rapid, equal pulses*

*Solid color / Off*


# Viewing and Managing MT Data

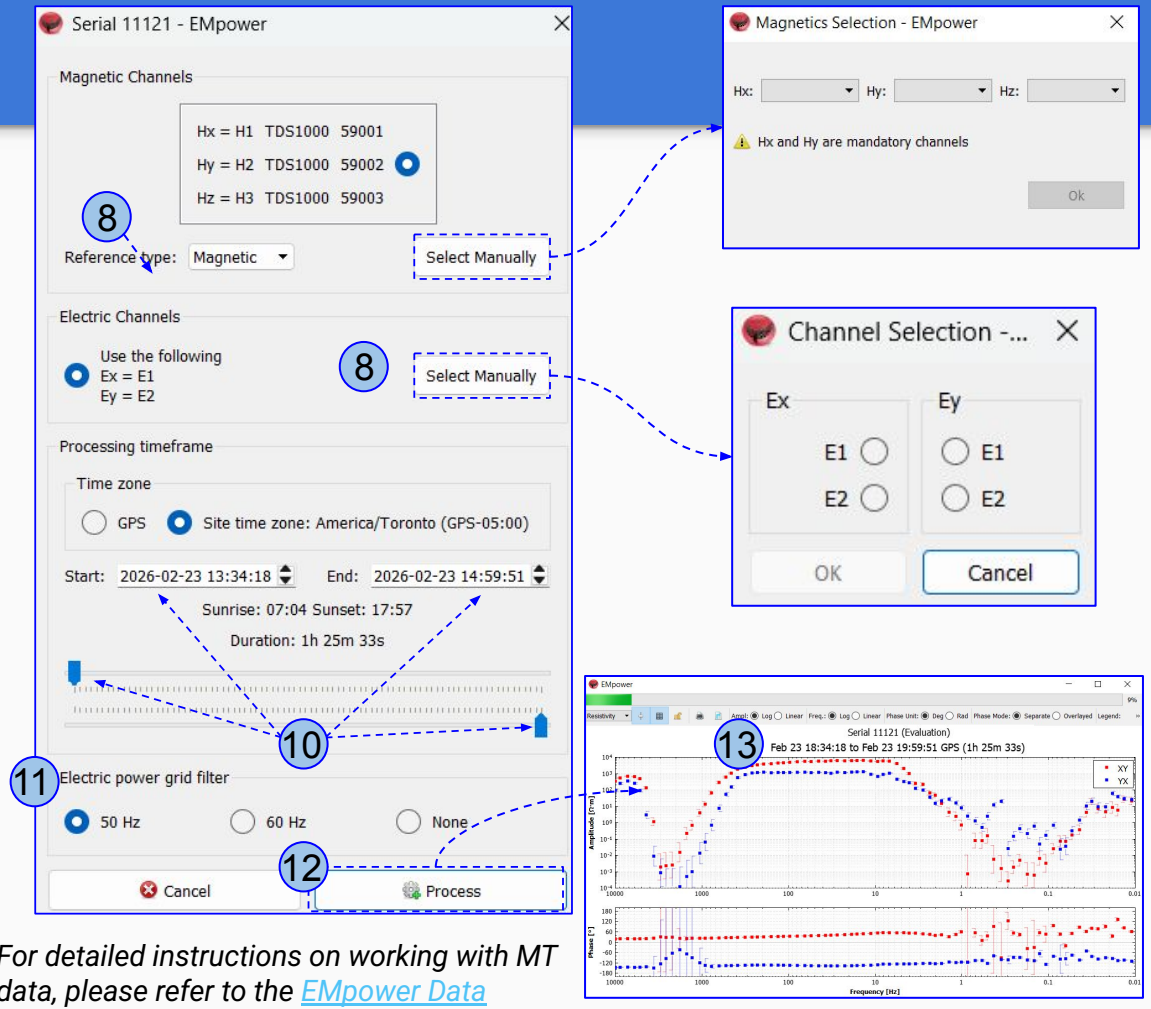
# Field QC - MT

1. From **Field QC**, click **View Data** button and select the recording from the SD Card or from data directory
2. Review the **Time Series** and the **Spectra**
3. Review the **Recording Information** and edit if necessary
4. Validate the **Electric** and **Magnetic Channels**
5. View **Recording Details** *(see page 40)*
6. After reviewing the information, **Process** the data *(see next page)*
7. Evaluate the recording quality and classify each recording as **'Approved'** or **'Rejected'** to track field data quality



# Data Processing - MT

8. Select the **Reference type** for the data processing, Local E-reference or Local H-reference.
9. If needed, click **Select Manually** to change the channel assignment. This applies to both magnetic and electric channels.
10. Define the segment of time series to be processed
    - Type the **Start** and **End** date/time
    - Or use the arrows to define the time period
11. Select the **electric power grid filter** corresponding to the frequency carried by the power lines in the survey area *(50Hz, 60Hz, or None)*
12. Click the **Process** button
13. A live processing window appears.The processed curves are not saved; only PNG exports are available.




*For detailed instructions on working with MT data, please refer to the [EMpower Data Management manual (DAA15)](#).*

# View Recording Details

Review that the following levels are within valid limits for quality control:

**1.** Battery Voltage

**2.** Internal Temperature

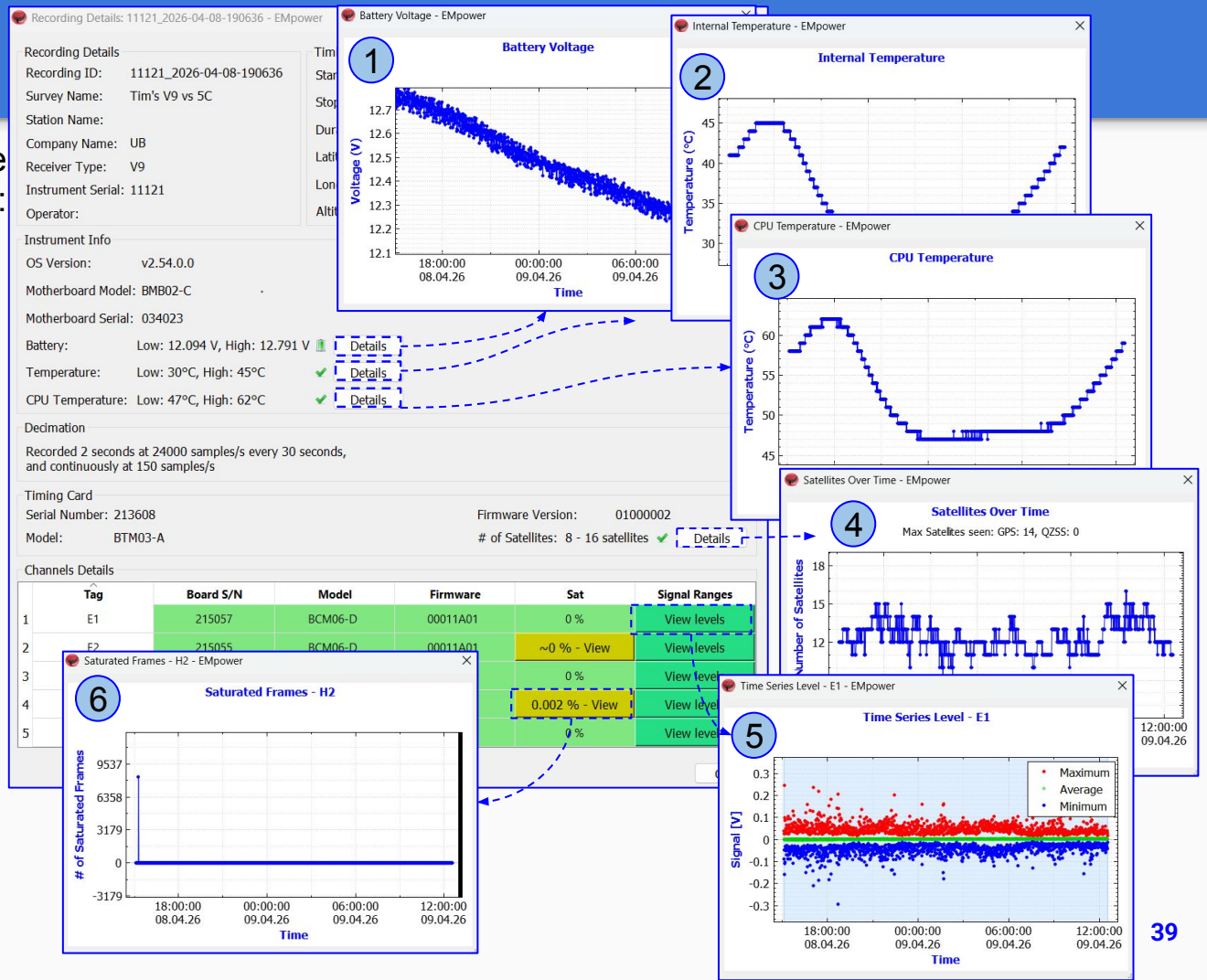
**3.** CPU Temperature

**4.** Number of Satellites

**5.** Time Series Level

**6.** Saturated Frames

- If saturation is not close to ~0%, review the channel configuration, the channel gain might be too high and/or there is artificial noise on your site



# CSAMT

This manual focuses on the TDEM and MT techniques. For instructions on CSAMT, refer to the CSAMT Operation Manual (DAA31).

# Contact support

***Please check out the FAQs***
*https://phoenixgeophysics.freshdesk.com/*
***Or email us at:*** *support@phoenix-geophysics.com*