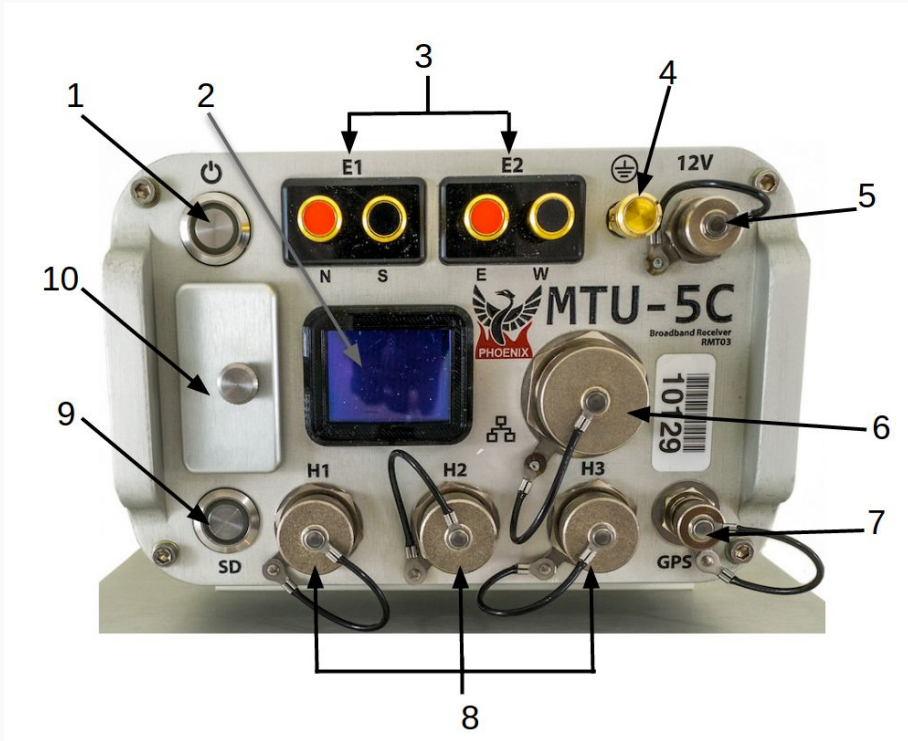


# MTU-5C Quick Start Guide for MT



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## Components

1	Power/Record button and indicator
2	Display
3	E1 (Ex) electrode connectors E2 (Ey) electrode connectors
4	Ground electrode connector
5	12V DC power input
6	LAN connector
7	GPS antenna connector
8	H1 (Hx) magnetic sensor connector H2 (Hy) magnetic sensor connector H3 (Hz) magnetic sensor connector
9	SD card button and indicator
10	SD card slot and cover

# Calibration - Config Files

Perform the Receiver and Sensors calibrations at start of each installation layout, to ensure the instruments are measuring correctly. Calibration verify the working state of the equipment and helps to improve the quality of the records and the reliability of the measurements.

Open **EMpower** and select the **Prepare** module

## 1. Sensor

1.1. Click the Sensor button and choose the magnetic channels that will be used

1.2. Select the **Sensor Type**

1.3. Type the **Serial number**, (*not needed for MTC-155/MTC-185 sensors*)

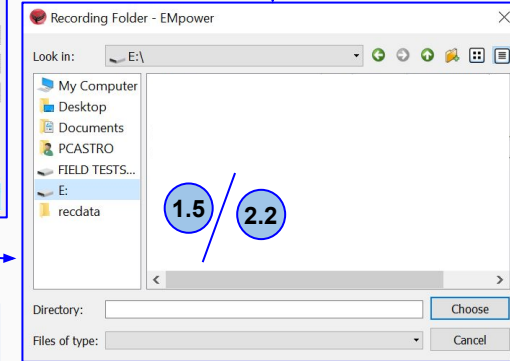
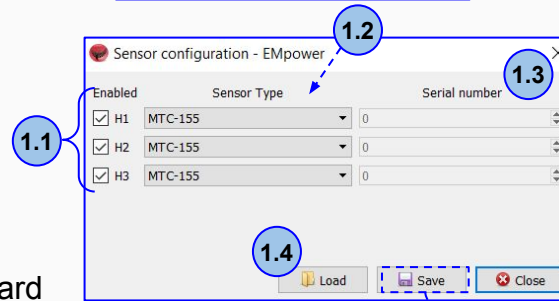
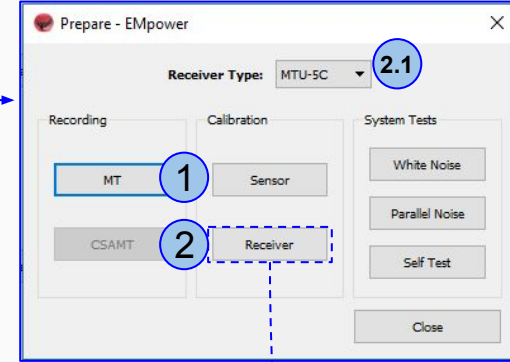
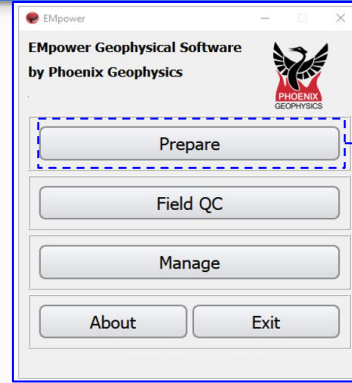
1.4. Or **Load** it from a previous config file

1.5. **Save** the configuration file (config.json) in the SD card (*see page 7*)

## 2. Receiver

2.1. Select the **Receiver Type** and click the **Receiver** button

2.2. **Save** the configuration file (config.json) in the root folder of the SD card (*see page 7*)



For more details consult [DAA22-Guide For MT Field Operations](#)

# Configuration Creator

1. Click **Prepare** and select the **Receiver Type** as **MTU-5C** and click the **MT** button
2. Select the **Schedule**
  - 2.1. **Manual** or **Automatic Start**
  - 2.2. For a specific schedule, select **Single Shot**, **Daily** or **Weekly**, and set the desired time and date, and **Save**
    - To add additional schedules, select **Add Schedule** and define the additional times and/or dates and **Save**
3. Define the **Channel Settings** (See pages 5,6)
4. Define the **Receiver Settings**
  - **Sampling Mode**
    - *Continuous Sampling* (Applicable to research studies)
    - *Sparse high frequency sampling* (See [Frequency sampling page](#))
  - **Sampling Rate**
  - **Power Recovery** (consult the [Power Recovery manuals](#))
5. **Ethernet port** (consult the [Remote Networking manuals](#))
6. **Configuration Layout**

EMpower Geophysical Software by Phoenix Geophysics

Prepare

Field QC

Manage

Prepare - EMpower

Receiver Type: MTU-5C

Recording: MT, CSAMT

Calibration: Sensor, Receiver

System Tests: White Noise, Parallel Noise, Self Test, Close

Configuration Creator - EMpower

File Receiver Schedule Timezone

Manual Ctrl+Alt+1

Automatic Start Ctrl+Alt+2

Single Shot Ctrl+Alt+3

Daily Ctrl+Alt+4

Weekly Ctrl+Alt+5

Add Schedule Ctrl+A

Channel: HI

Magnetic channel settings

Enabled

Sensor Type: MTC-155

Gain: Normal

Low Pass Filter: 10 kHz

Sensor S/H: 0

Receiver Settings

Sampling Mode:  Continuous sampling  Sparse high frequency sampling

Sampling Rate: 24kps High  View graphic 129.02 MB / Hour

Power Recovery  Enable

Configuration layout

Layout Geometry: Orthogonal

Survey Name

Site Name

Operator(s)

Company Name

Configuration Notes

Additional information

MTU-5C Broadband Receiver

Live Tool

MTC-155 Gain: Normal LPF: 10 kHz

This section is used for inputting the parameters and instrument details that will be used for the recording

! To use the magnetic sensor data from a different recording or use a remote reference, all recordings **must** have a matching Sampling Mode and Sampling Rates. Otherwise, EMpower will not allow to process data using borrowed channels or remote reference

# Electric Channel Settings

## 1. Select the **Electric** channel

## 2. Enable **or Disable** channel(s)

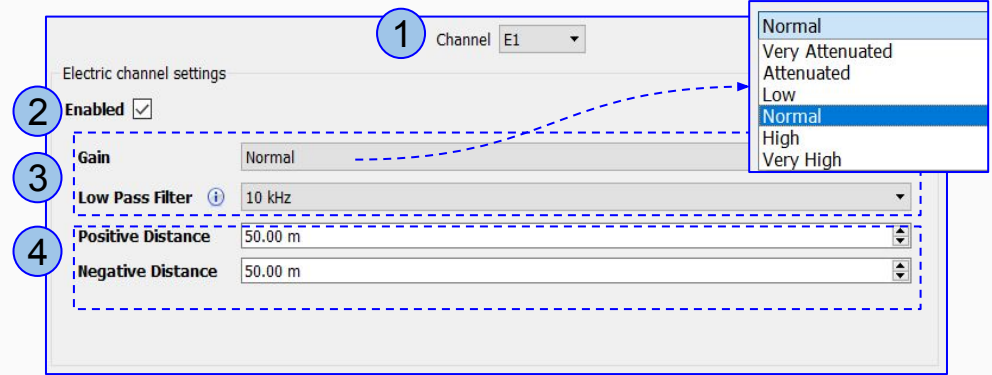
- Disable channels that you do not plan to use during the recording. This will save space on the SD card.

## 3. Select the desired **Gain** and **Low Pass Filter**

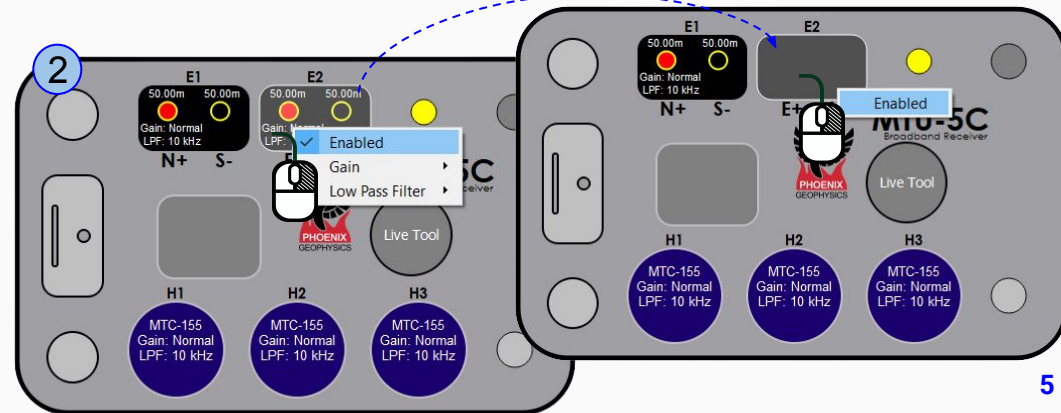
- For most applications, Normal Gain and 10 kHz LPF are best

## 4. Type **distances to the electrodes** of this channel if known

- If not, they will need to be corrected later before data processing

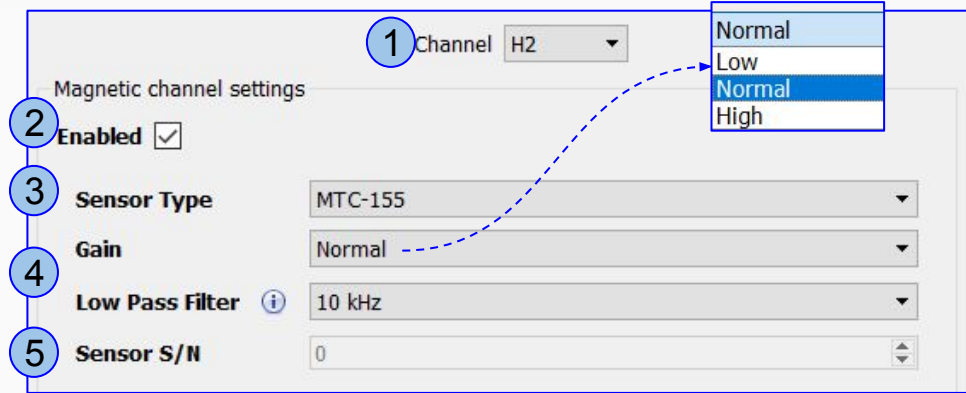


Some settings can be configured by using the right-click menu

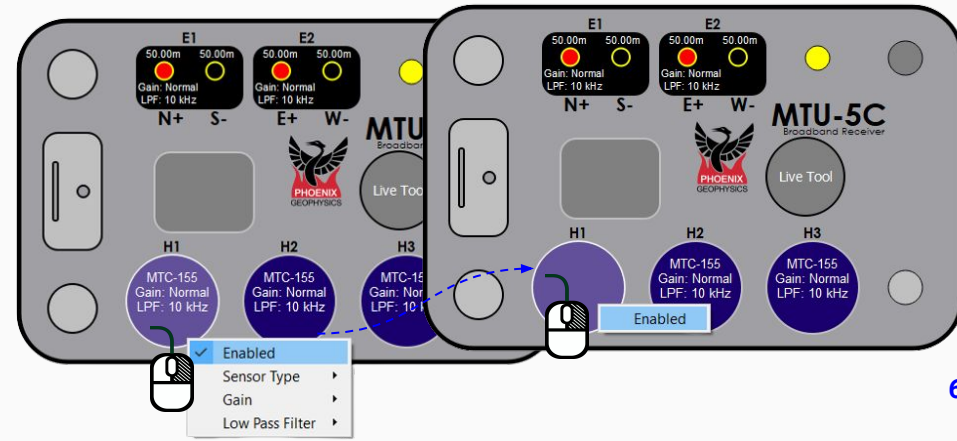


# Magnetic Channel Settings

1. Select a **Magnetic** channel
2. **Enable or Disable** channel(s)
  - Disable channels that not plan to use during the recording. This will save space on the SD card.
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 **LPF**
  - For most broadband applications with MTC-100 series sensors, Normal Gain and 10 kHz LPF are best
5. Type the **Serial Number** of the sensor if required
  - There is no need to type serial number for sensors MTC-155/MTC-185, since it will be automatically detected by the receiver.
  - For older sensors, type the serial number of each sensor. If you don't know this information in advance, keep field notes to add this information later, after the recording is imported into EPower



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





# Using Multi-constellation GNSS satellites

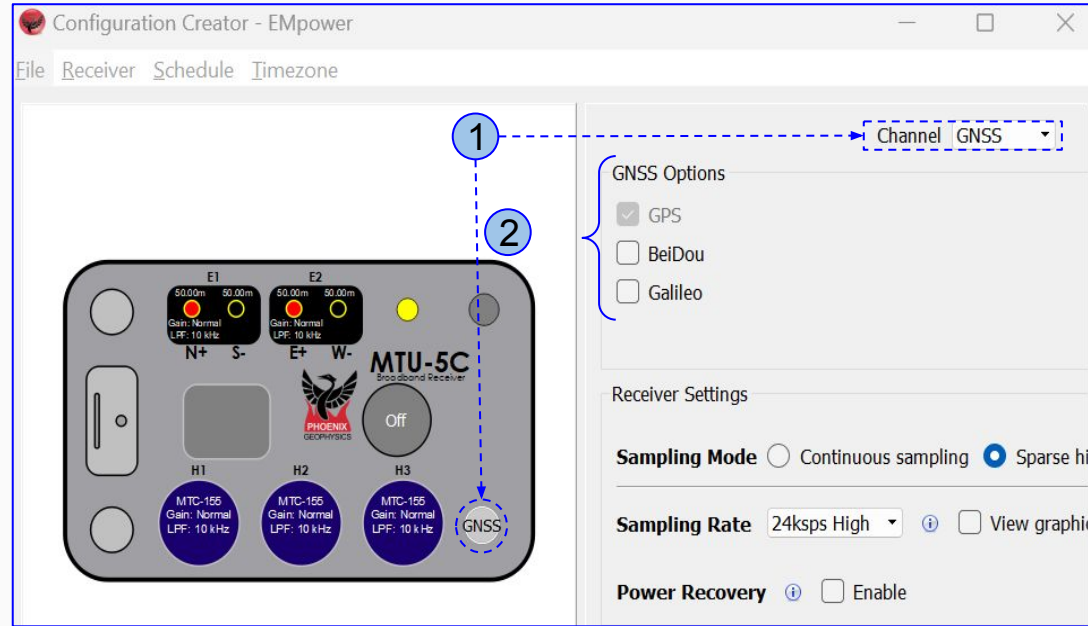
This feature only works in the new MTU-5C<sup>DS</sup> receiver. The MTU-5C<sup>DS</sup> on top of using the GPS satellite constellation is capable of using the Global Navigation Satellite System or GNSS.

The MTU-5C<sup>DS</sup> supports BeiDou and Galileo on top of GPS, ensuring highly accurate positioning.

To configure the MTU-5C<sup>DS</sup> to use other constellations beside GPS:

1. Select the **GNSS** configuration page by clicking in the GNSS connector
2. Choose the **GNSS** to activate
  - GPS (*always active*)
  - BeiDou
  - Galileo

*\*To check which constellations were tracked during the recording process, please consult the manual [EMpower Data Management](#) under Recording Details*



For more details about the Data share feature consult the [DAA37 MTU-5C Data Share System Guide](#)

# Frequency Sampling- MT acquisition

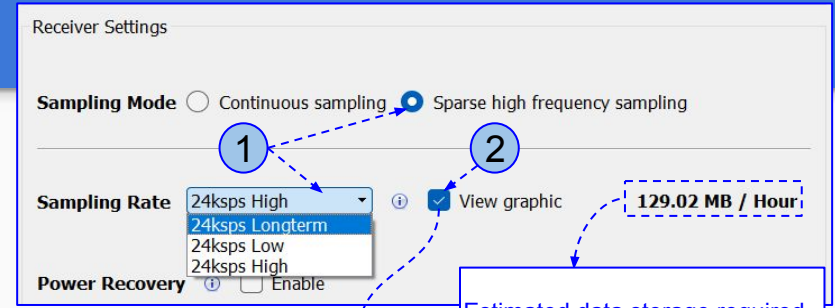
**Sparse high frequency sampling** combined with varying **Sampling Rates** is used for common industrial applications such as oil and gas exploration, geothermal exploration, reservoir monitoring, and geotechnical studies.

1. Select **Sparse high frequency sampling** and choose the **Sampling Rate**
2. Enable the **View graphic** to visualize on the left side how the Sampling Rate options work

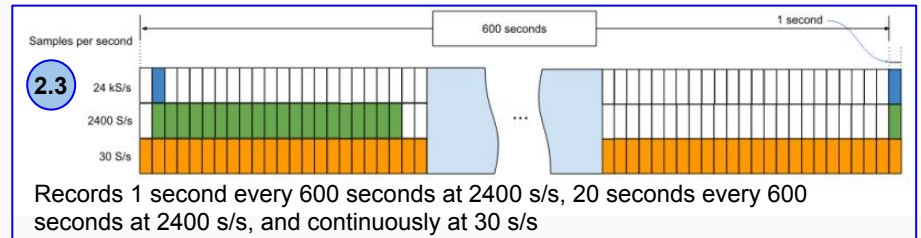
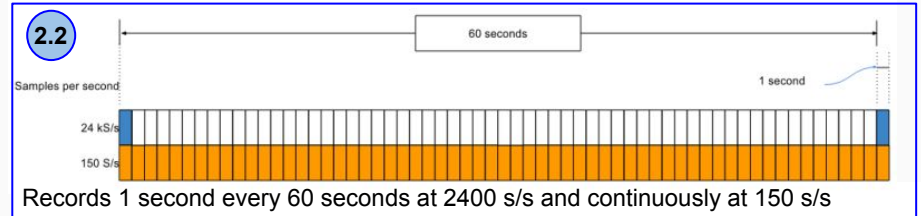
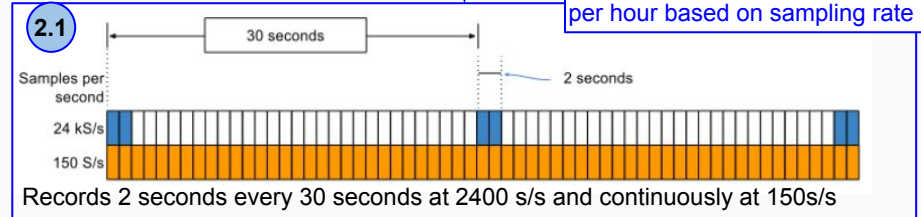
**2.1. 24 ksp/s High**, use this option for environments with varying or moderate noise levels (*overnight recordings*)

**2.2. 24 ksp/s 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 ksp/s Longterm** option to enable weekly or monthly log recordings while minimizing SD card space usage  
*\*Recommended for working with network remote access.*



Estimated data storage required per hour based on sampling rate

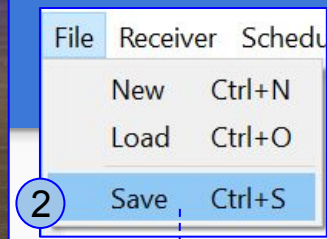




# Saving a Configuration File

## 1. Insert the SD Card

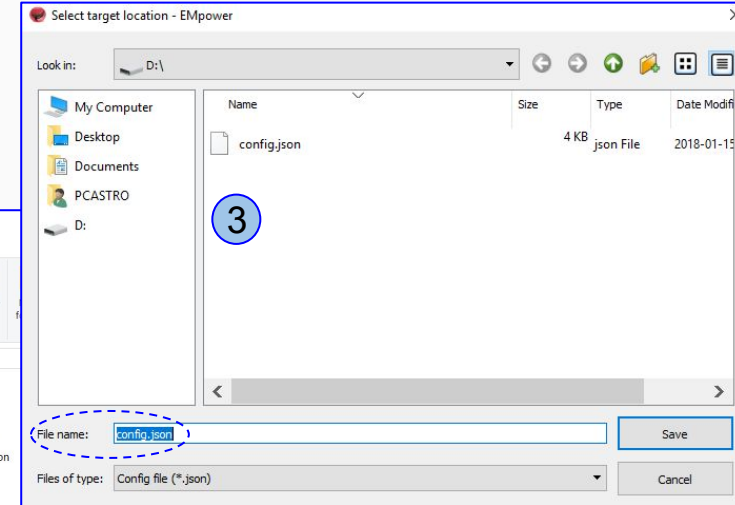
- The computer must be equipped with an SD card slot or use a USB card reader



## 2. Click the **File** menu

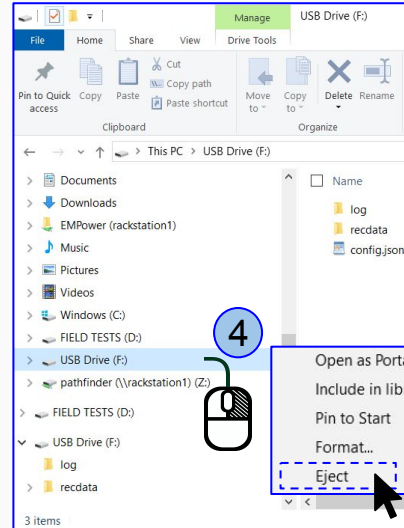
- Save or **Ctrl+S**
- Select the SD card
- **EMpower** will automatically create the file "**config.json**"

## 3. Save the configuration file (*config.json*) in the root folder of the **SD card**



## 4. Open the file explorer

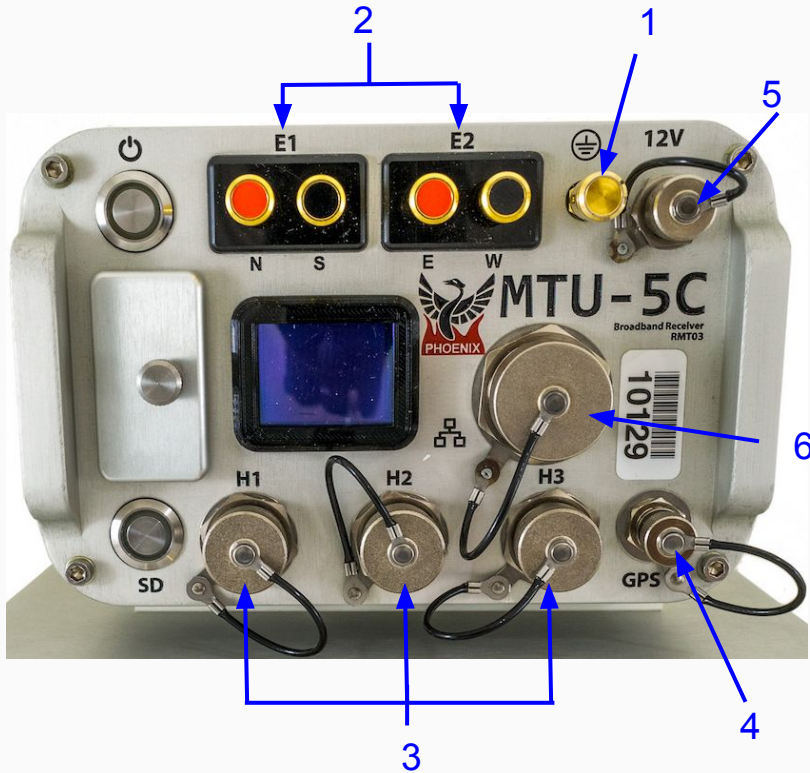
- Right click **SD card** drive
- **Select Eject option**
- **Pull out the SD Card**



# MTU-5C Connections

Start by connecting:

1. Ground electrode
2. Electrodes to channel E1(Ex) (N+, S-) and channel E2(Ey) (E+, W-)
3. Magnetic sensors to channels H1(Hx), H2(Hy) and H3(Hz)
4. GPS antenna
5. 12V DC Power Source
6. Network connector



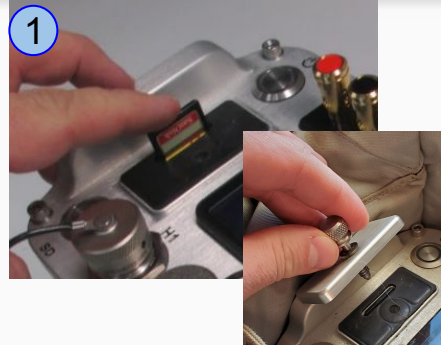
**i** In the field, it is often most efficient to connect the components to the receiver following the order on the right

# Start the Recording

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 [DAA22- Guide For MT Field Operations](#)

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



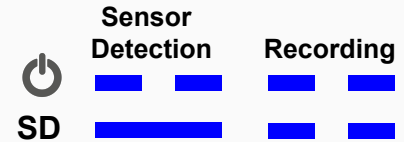
\*For any problems with the SD Card, check the [DAA24 System Troubleshooting manual](#)

**i** The receiver auto-detects serial 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.

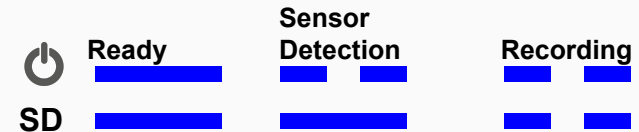
- 2 Briefly press and release the power button



- 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

# Stopping 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**

## Indicators

- Rapid, equal pulses
- Solid color / Off

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

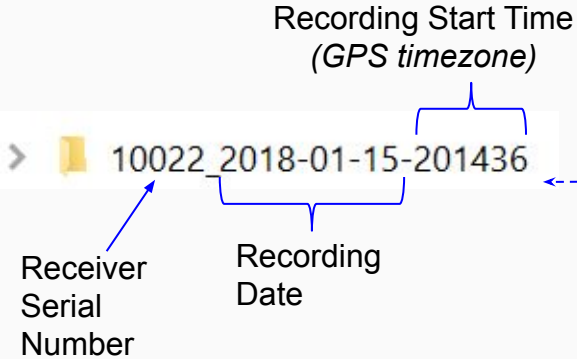
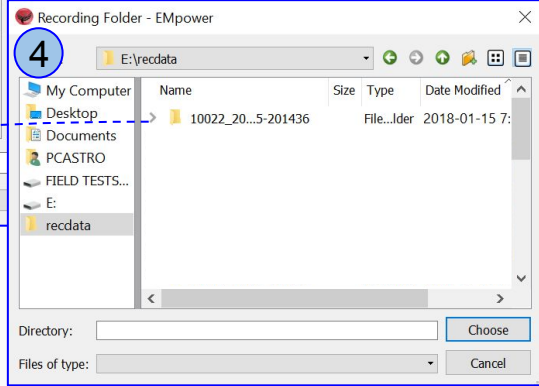
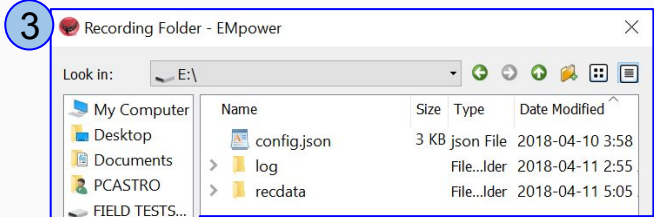
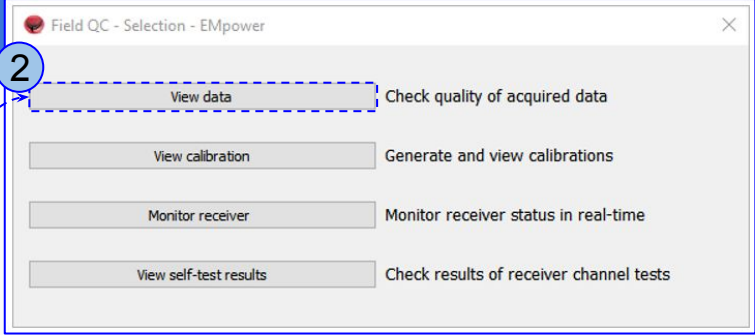
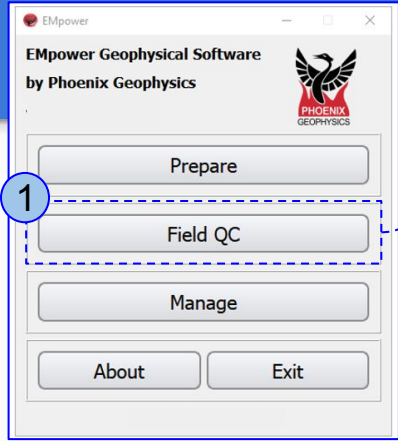


- 2 Keep pressing the power button 3 sec and release



# Importing and Field QC

- 1. Click the **Field QC** button
- 2. Select **View data**
- 3. Select the **SD card**
  - The recording creates two folders, **log** and **recdata**
- 4. Open the **recdata** folder
  - Select the recording file
  - Click **Choose**



1. Review the **Recording Information**
2. Review the Electrode **Resistance** values and make the necessary corrections
  - Electrode **Distance (m) to GND**
  - **Polarity**
  - **E Azimuth**
  - **External Filter**
3. Ensure that the magnetic sensors were detected and make the necessary corrections
  - **Serial #**
  - **Polarity**
  - **H1-H3 Azimuth**
  - **H4-H6 Azimuth**
4. View **Recording Details** (see page 14)
5. After reviewing the information, **Process** the data



*The warning icon indicates that something might be wrong with the recording, review the recording information and make necessary changes if needed. Hover mouse pointer over the warning icon for more information.*

Field QC - EPower
✕

S7\_1\_5C (21h 32m 56s)

Status

Approved
  Unapproved
  Rejected

Tools

Recording Information

Recording ID: 10125\_2017-12-03-203322

Start time: Dec 03 2017 12:33:24 (Local) Eastern Standard Time (GPS -08:00)

Duration: 21h 32m 56s

Survey name: Don Campbell

Station name: S7\_1\_5C

Operator(s): CF MU and GB

Company name:

Layout Geometry: Orthogonal

Declination: 13.00°

Notes:

Electric Channels

Channel	Distance (m) to GND	Resistance (Ω)	Polarity	Gain	LPF [Hz]	DC [V]
	(+) N / E	(-) S / W		(+) N / E (-) S / W		
E1	50.00	50.00	<input type="checkbox"/> Inverted	4 x 4 = x16	10000	-0.011
E2	50.00	50.00	<input type="checkbox"/> Inverted	4 x 4 = x16	10000	-0.014

E Azimuth: 40.00 ° External Filter: None

Magnetic Channels

Channel	Sensor	Detected	Serial #	Polarity	Gain	LPF [Hz]	DC [V]
H1	MTC-155	Not Present		<input type="checkbox"/> Inverted	x4	10000	0.074
H2	MTC-155	MTC-155	53918	<input type="checkbox"/> Inverted	x4	10000	0.032
H3	MTC-155	MTC-155	53195	<input type="checkbox"/> Inverted	x4	10000	-0.078

H1-H3 Azimuth: 40.00 °

View Recording Details

4

**i** This section can also be used to input additional field information if desired

1

2

3



# Processing MT Data

6. Select the local **Reference type** for the channels
7. Select the channels **Manually** button to choose specific channels, this can be done for both magnetic and electric channels
8. Define the segment of time series to be processed, select the **Start** and **End** date/time, or use the arrows to define the time period
9. Select the **electric power grid filter** that corresponds to the frequency carried by the power lines in the survey area (50Hz, 60Hz, or None)
10. Click the **Process** button
11. A live display of the resistivity curve will appear after a few seconds

The image shows a sequence of steps for processing MT data in the EMpower software. The main window is titled "MB 10 Serial 10127 - EMpower".

- Step 6:** The "Magnetic Channels" section shows a table with columns for channel type and name. The "Reference type" is set to "Magnetic".
- Step 7:** The "Electric Channels" section shows "Use the following" selected, with "Ex = E1" and "Ey = E2". "Select Manually" buttons are visible for both magnetic and electric channels.
- Step 8:** The "Processing timeframe" section shows "Site time zone: America/Edmonton (GPS-06:00)" selected. The "Start" and "End" dates are set to 2017-08-28 12:29:22 and 2017-08-29 09:55:09, respectively. Sunrise and sunset times are also displayed.
- Step 9:** The "Electric power grid filter" section shows "60 Hz" selected.
- Step 10:** The "Process" button is highlighted.

Two dialog boxes are shown:

- Magnetics Selection - EMpower:** A dialog box with dropdown menus for Hx, Hy, and Hz. A warning message states "Hx and Hy are mandatory channels".
- Channel Selection - ...:** A dialog box with radio buttons for Ex (E1, E2) and Ey (E1, E2).

**Step 11:** A plot window titled "EMpower" displays the results. The top plot shows "Resistivity (Ohm m)" vs "Frequency (Hz)" on a log-log scale. The bottom plot shows "Phase (°)" vs "Frequency (Hz)" on a semi-log scale. The plot title is "MB 10 Serial 10127 (Evaluation)" and the subtitle is "Aug 28 18:29:22 to Aug 29 15:55:09 GPS (21 h 25 m 47 s)".

# Recording Details

Ensure the following levels are within acceptable limits

## 1. Battery Voltage

## 2. Internal Temperature

## 3. Number of Satellites

**3.1. Max Satellites Seen** shows the highest number of satellites tracked for each constellation since power on and until the end of the corresponding recording.

**3.2. The Satellites Over Time** plot shows the number of satellites being tracked throughout the recording process, and updates every minute.

## 4. Saturated Frames

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

## 5. Time Series Level

The screenshot displays the recording software interface with several key components:

- Recording Details:** Recording ID: 10711\_20, Survey Name: Test v2.3, Station Name, Company Name, Receiver Type: MTU-5C, Instrument Serial: 10711, Operator: Pilar Cast.
- Battery Voltage (1):** Line graph showing Voltage (V) over Time. The y-axis ranges from 12.4425 to 12.465. The x-axis shows time from 14:05:00 to 05:09:24.
- Internal Temperature (2):** Line graph showing Temperature (°C) over Time. The y-axis ranges from 44.75 to 46.25. The x-axis shows time from 14:03:20 to 05:09:24.
- Satellites Over Time (3):** Line graph showing Total Number of Satellites over Time. The y-axis ranges from 17 to 22. The x-axis shows time from 14:07:30 to 05:09:24. A summary box indicates: Max Satellites seen: GPS: 12, BeiDou: 0, Galileo: 8, QZSS: 0.
- Decimation:** Recorded 2 seconds at 24000 samples/s every 30 seconds, and continuously at 150 samples/s.
- Timing Card:** Serial Number: 210963, Firmware Version: 00022408X, Model: BTM02-A, # of Satellites: 17 - 22 satellites.
- Channels Details Table:**

Tag	Board S/N	Model	Firmware	Sat	Signal Ranges
E1	201462	BCM03-B	1001a	0%	View Levels
- Time Series Level - E1 (5):** Scatter plot showing Signal [V] over Time. The y-axis ranges from -0.3 to 0.3. The x-axis shows time from 12:46:40 to 25:04:19. Legend: Maximum (red dots), Average (green line), Minimum (blue dots).
- Saturated Frames - E2 (4):** Line graph showing # of Saturated Frames over Time. The y-axis ranges from 0 to 1. The x-axis shows time from 12:46:40 to 25:04:19.



*Please check out the [FAQs](#)*

*<https://phoenixgeophysics.freshdesk.com/>*

*Or email us at: [support@phoenix-geophysics.com](mailto:support@phoenix-geophysics.com)*