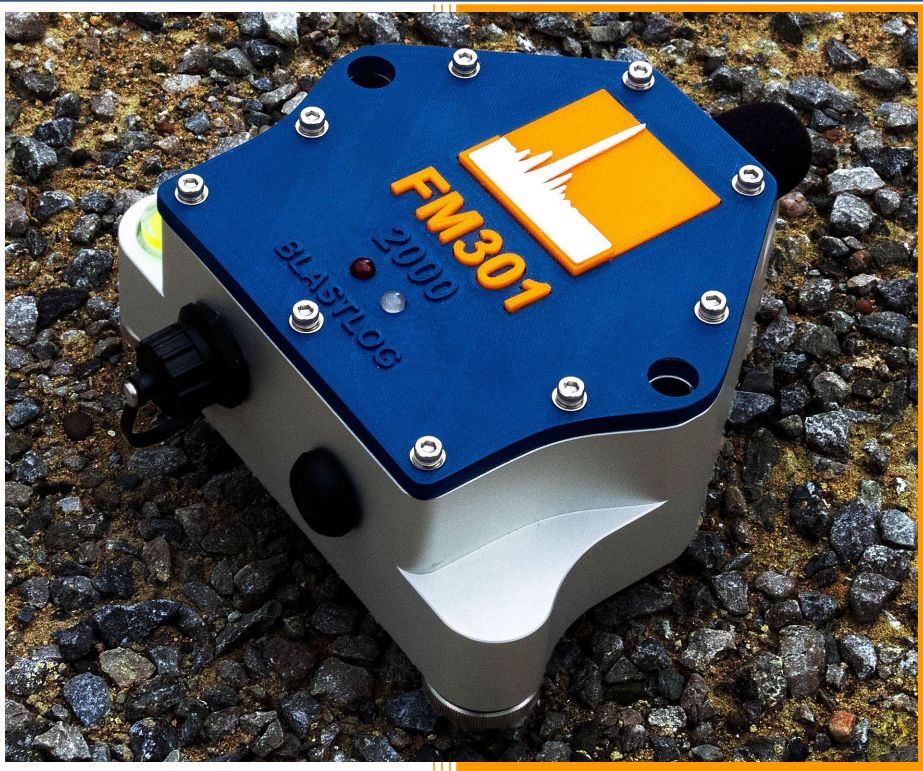
BLAST LOG Ltd

design, performance & compliance

Instruction Manual

FM 301 Blasting Seismograph



Series 2000

For units with serial numbers 2000 and above

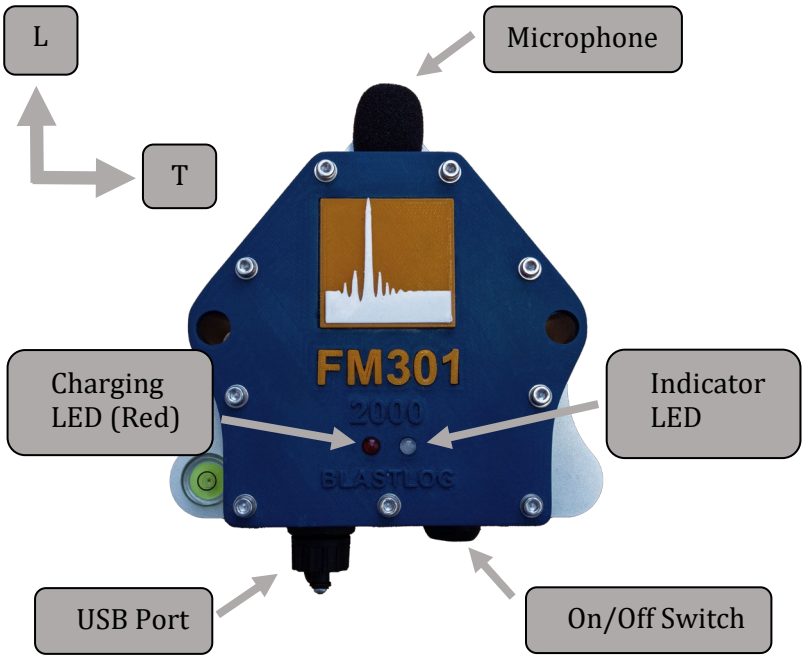
Contents

Chapter 1 – Introduction

This instruction manual provides comprehensive guidance on the operation and maintenance of the FM 301 Blasting Seismograph. **It specifically applies to the updated FM 301 units designated as the *2000 Series*, which begin with serial number 2000.** These units feature updated components and interface features that differ from the earlier *1000 Series* (serial numbers 1000–1999). If your seismograph's serial number is within the 1000–1999 range, please refer to the prior version of this manual.

The FM 301 is a high-performance digital seismograph designed to monitor **vibration** and **air overpressure** generated by blasting operations. Typical applications include surface and underground mines, quarries, and other environments involving explosive use.

Technical specifications for the FM 301 are provided in **Appendix 1**.



Handling Procedures

- Handle all equipment and accessories with care.
- Do not operate the unit if it appears damaged. Power it off immediately and return it to an authorised service facility.
- Ensure all connectors, including USB, are fully inserted and clean before use.

- Do not pull or force cables. Always align connectors before inserting.
- Charge the battery as soon as a low battery condition is indicated.
- **Do not disassemble**, puncture, expose to temperatures above **60°C (140°F)**, or incinerate the battery under any circumstances.

Warning: The FM 301 contains a sealed lithium-ion battery. Mishandling may cause fire or chemical burn. The battery is not user-serviceable and must not be removed by the operator.

- Do not attempt to open or service the unit.
- The FM 301 is water-resistant, but must not be submerged. Clean with a damp cloth only.

Vibration Sensors

The FM 301 uses **triaxial accelerometers** for vibration monitoring. This allows the unit to function accurately in **any orientation**—it does not require levelling to produce valid results.

Unlike moving-mass geophones, accelerometers offer enhanced **reliability** and **durability**. The device internally converts acceleration to velocity, providing both **peak acceleration** and **peak velocity** values.

USB Interface

The FM 301 includes a USB interface for:

- Charging the internal battery
- Connecting to Windows software for data transfer and configuration

The supplied USB cable is required for both communication and charging functions.

Bluetooth

The FM 301 features a **Bluetooth Low Energy (BLE)** interface. This allows the unit to connect wirelessly to the FM Seismograph Android App, enabling remote configuration and event monitoring.

Battery Life

Battery life depends on usage and environmental factors. Typical continuous monitoring runtime is **approximately 24 hours**.

The battery is charged via the USB port. Charging from a fully depleted state takes **approximately 12 hours**.

GPS

The FM 301 includes an integrated **GPS receiver**. When a GPS signal is available:

- The unit stores the **location** of each recorded event
- Timing accuracy is enhanced, enabling synchronisation across multiple devices

Note: GPS position accuracy depends on satellite availability, signal blockage, and atmospheric conditions.

Typical accuracy ranges from **4 to 20 metres**.

Internal Storage

The unit includes internal memory capable of storing up to **1,000 full waveform recordings**.

When capacity is reached, the oldest recordings are automatically overwritten.

Dimensions and Weight

- Dimensions: 160 mm × 138 mm × 55 mm
- Weight: Less than 1 kg

Despite its compact form, the FM 301 integrates advanced monitoring hardware and robust storage capability in a single self-contained unit.

Mounting

The FM 301 includes:

- **Levelling feet** for use on hard surfaces

- **Ground spikes** for deployment on soil
- **Two mounting holes** for permanent installation on solid structures

Although orientation does not affect data validity, a built-in **spirit level** is included for optional levelling.

LED Indicators

The FM 301 is equipped with two LEDs on the top of the unit:

- The **left LED** is a **red charging indicator**. It illuminates while the unit is charging via USB power and turns off when charging is complete.
- The **right LED** is a **multicolour status indicator** (red, green, blue, white) used to display operational states, GPS lock, battery level, trigger events, and data processing.

Chapter 2 – Charging

Charging the seismograph

Charging of the internal batteries is achieved by connecting to any powered USB port with the supplied USB lead.

When the unit is connected to USB power, the **left red LED** will illuminate to indicate that charging is in progress.

- The LED will remain on during charging.
- The LED will automatically turn off once charging is complete.

If the unit is connected to a powered laptop or other computer, charging will continue in the background. It can therefore be convenient to leave your FM 301 connected to a powered USB port when not in use.

The battery level is indicated when the unit is turned on or can be seen using the Android App. **Battery level should only be assessed when the unit is not being charged via USB**.

Charging from a completely flat battery will take approximately **12 hours**.

Note: Do not charge the unit overnight or leave it unattended for long periods while charging.

Chapter 3 – FM 301 Operations

Setup Monitoring Parameters

Before going into the field the monitoring parameters should be set via the supplied Windows software (see section below). For a typical monitoring operation the following parameters are recommended:

- Record Window : 4 seconds
- Vibration Trigger Level : 0.5 mm/s
- Air Overpressure Trigger Level : 115 db(Linear)

Note that the trigger levels can also be changed during monitoring via the Android App – see the App section below for more information.

The monitoring parameters are stored in non-volatile memory and will be used when the machine is turned on.

Field Setup

The FM 301 comes with a set of levelling feet for use on solid surfaces and spikes for use in soils.

Whilst the unit can be operated in any orientation there is a levelling bubble included for use if desired.

Monitoring Start

With the FM 301 in position, and correctly setup, monitoring can be started by turning the machine on via the On/Off button.

Note : The On/Off button is Off when the button is depressed and On when the button is raised. This is to reduce the chance of the power being accidently turned on in the carrying case.

Initial LED Indications

When the unit is powered on, **the right multicolour LED** performs a startup test to confirm it is functioning correctly. The sequence is as follows:

- **Solid white LED** for approximately 2 seconds

After this, the LED will indicate the battery level using one of the following colours:

- **Green** – Battery level is good (several hours of monitoring available)
- **Blue** – Battery level is moderate (approx. one hour remaining)
- **Red** – Battery is low (less than one hour; unit may stop monitoring)
- **Flashing Red** – Battery is critically low; charging is required before monitoring can begin

Monitoring Process

Monitoring will continue until the unit is powered down using the On/Off button.

The **right multicolour LED** indicates monitoring status as follows:

- **Flashing Green** – Monitoring active
- **Flashing Blue** – Monitoring active with a valid GPS signal
- **Solid Red** – Trigger event detected
- **Solid Blue** – Data processing and storage in progress

The LED flashes are synchronised with the recording window. For example, if a 4-second window is set, the LED will flash every 4 seconds.

If the **right LED begins flashing red rapidly**, this indicates that battery power is insufficient and monitoring has been suspended.

Note : If low power is indicated, the unit should be turned off immediately to avoid running the battery too low, which can cause permanent damage.

Monitoring End

The FM 301 will continue monitoring and automatically store each recording to internal memory. When the memory reaches its capacity of **1,000 events**, the oldest recordings will be **overwritten** in sequence.

Monitoring can be stopped at any time by pressing the **On/Off** button.

Chapter 4 – V-Blast Windows Software

Connecting via a USB Port

The FM 301 can be connected to any compatible Windows PC using the supplied USB charging cable.

Setting the FM 301 into USB Communication Mode

Before transferring data to or from the FM 301 via USB, the unit must first be placed into USB communication mode. Activating this mode disables triggering, allowing the unit to remain powered on without false event recordings.

To enter USB communication mode:

1. Power on the unit.
2. During the **solid white LED** shown at startup (approximately 2 seconds), **tap the top of the unit twice**.
3. If the taps are registered correctly, the **right LED will briefly flash white**.
4. After this, the **right LED will illuminate solid white**, indicating that USB mode is active.

- The **solid white LED** will remain on continuously whilst the unit is in USB mode.
- The LED will change to red during USB data transmission (sending or receiving).
- USB mode remains active until the unit is **powered off.**

Alternatively, USB mode can be activated by gently shaking the unit during the startup LED sequence.

Running the V-Blast software

After launching the **V-Blast** software, the main window will open displaying a blank interface with a menu bar. All operations related to file management, data download, and configuration are accessible via the menu options described in the following sections.

File : Open

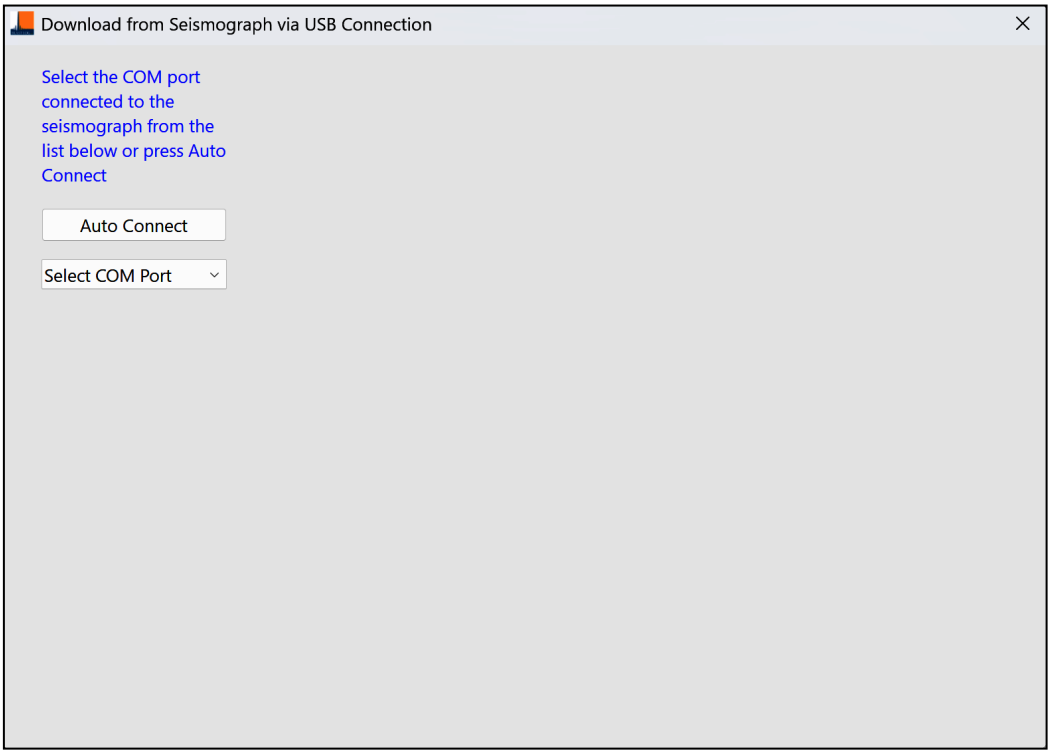
Selecting **File → Open** allows previously saved waveform files to be opened within the software.

These files use the .FMD extension and contain full waveform recordings captured by the FM 301.

Download

Selecting **Download → Local (USB Connection)** opens a new window for connecting to an FM 301 device and managing event file transfers.

Once connected, event recordings stored on the unit can be viewed, selected, and downloaded to the computer for further analysis or archiving.



When the **Download from Seismograph via USB Connection** window opens, two connection options are available:

- **Auto Connect**
- **Select COM Port** (manual selection)

Before proceeding, ensure the FM 301 is:

- **Connected** to the PC using the supplied USB charging cable
- **Powered on** and placed in **USB communication mode**, indicated by a **solid white right LED**

Note: If the unit is powered on and the right LED is solid white, but the software displays **"Error: No Valid Comms Port found."**, the PC has not successfully established communication.

In this case:

- Ensure that **only one unit** is connected
- Retry using **Auto Connect**, or manually select the correct **COM port**
- Check the **USB connection** and confirm that the unit is not still completing its startup sequence

Once the device is ready, click **Auto Connect**. The software will attempt to automatically detect and connect to the FM 301.

If Auto Connect is unsuccessful, use the **Select COM Port** drop-down to manually choose the correct port.

Once a connection is established, the software will display a list of the most recent **20 recorded events**, including the date, time, and peak values for both vibration and air overpressure.

Additional options are available to view a larger set of events:

- **Last 100 Events** – Displays the most recent 100 recordings
- **All 1000 Events** – Displays the full history of recordings stored in the unit's memory

Note: Do not close the window while the event summary is loading. Closing the window during this process may cause the software and FM 301 to become unresponsive.

The software will also display the **serial number** of the connected FM 301 unit and the **assigned COM port**.

To download event files:

1. **Select** one or more events from the list using the checkboxes

- or -

Enter an **Event ID** into the **Event ID** input box

2. Click **Download Event(s)**
3. A **progress bar** will indicate the transfer status
4. When complete, a file browser will prompt for a **destination folder**

Warning: Some Events Records Were Invalid and are Not Listed

If the message "**Warning: Some Events Records Were Invalid and are Not Listed.**" appears, this indicates that one or more event records could not be displayed in the summary list.

To attempt recovery of missing events:

- Close the warning window
- Review the displayed Event ID list
- Identify any **missing Event IDs**
- Enter each missing ID into the **Event ID** input box
- Click **Download Event(s)**

If successful, the progress bar will indicate download progress, and a file browser will prompt for the destination folder when complete.

Multiple recordings can be downloaded simultaneously. All files are saved using a standard 18-digit filename format:

YYYYMMDDHHMMSS####.FMD, where:

- YYYY = Year
- MM = Month
- DD = Day
- HH = Hour
- MM = Minute
- SS = Second
- #### = Unit serial number

For example:

20250722121143 2010.FMD

(Recorded on July 22, 2025 at 12:11:43 by unit 2010)

It is recommended to organise files by site and location using clearly named directories for future reference.

Setup : Seismograph

Before accessing the setup screen, ensure the FM 301 is correctly connected and in USB communication mode.

Failure to do so will result in the error message:

"Error: No Valid Comms Port found."

To avoid this, confirm the following:

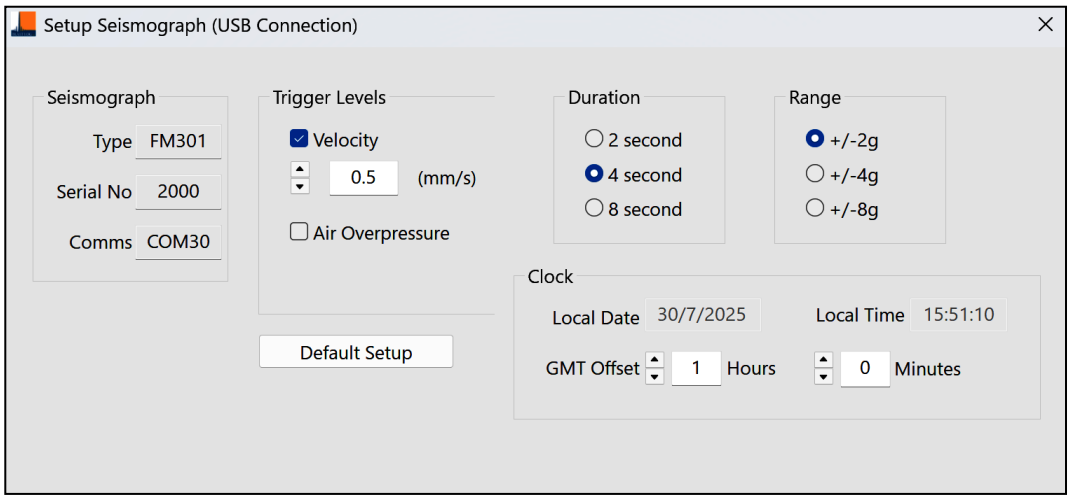
- The unit is **connected** to the PC via the supplied USB charging cable
- The unit is **powered on** and in **USB communication mode** (indicated by a **solid white right LED**)

Once confirmed, select **Setup → Seismograph → Local (USB)** to open the configuration window.

The initial screen presents two connection options:

- **Auto Connect** – Automatically detects the connected FM 301
- **Select COM Port** – Allows manual selection of the appropriate COM port

Once connected, the current configuration of the FM 301 will be displayed.



The following parameters can be adjusted:

- **Trigger levels** for vibration and air overpressure
- **Recording duration**
- **Accelerometer range**
- **Trigger enable/disable** options for velocity and air overpressure

Clicking Default Setup will apply the following default settings:

- Vibration trigger: **0.5 mm/s**
- Air overpressure trigger: **115 dB(L)**
- Duration: **4 seconds**

The Clock section displays the unit's internal time. The **UTC offset** can be set to reflect the local time zone at the monitoring location.

Click **Send to Seismograph** to apply and save the updated configuration.

Setup : Software

Selecting **Setup → Software** opens a window for configuring how data is displayed and interpreted within the V-Blast software environment.

The following settings can be adjusted:

- **Colour scheme** for waveform displays
- **Units**: Metric or Imperial
- **Display of peak resultant values**
- **Vibration monitoring standard**
- **Air overpressure monitoring standard**

Colour options can be modified by clicking the colour swatch next to each parameter.

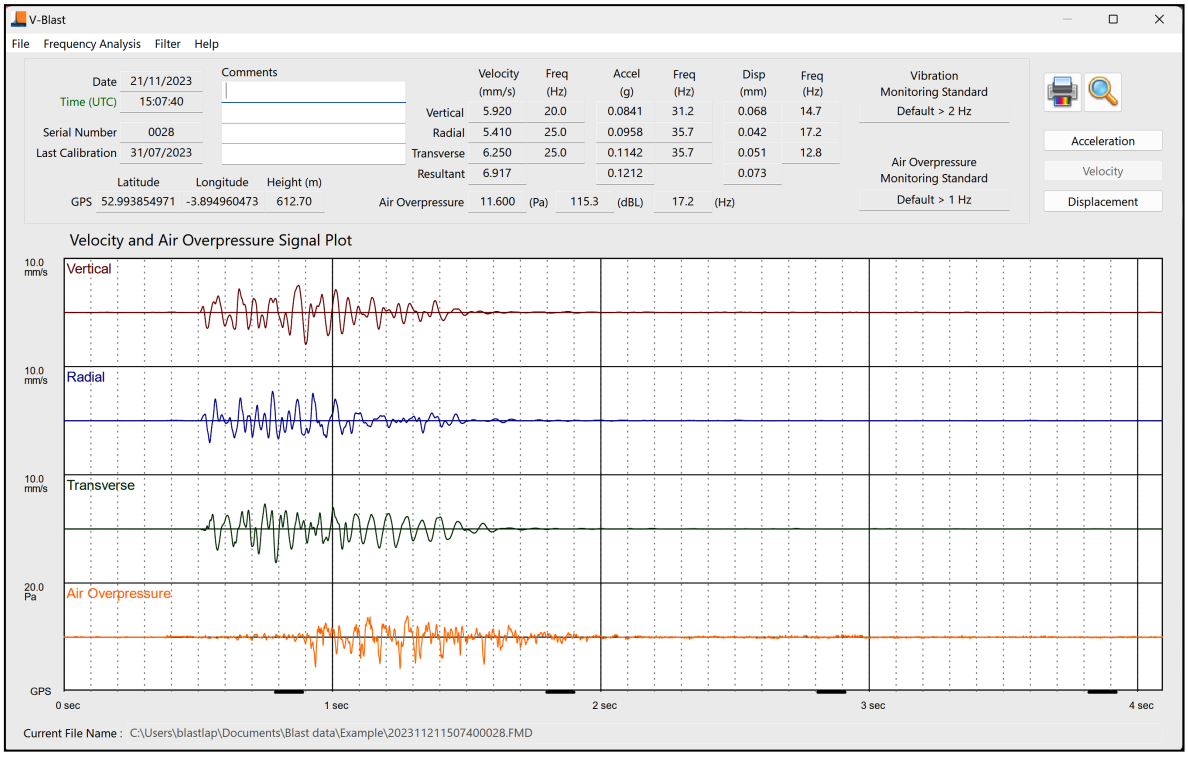
Note : The reported peak values for vibration and air overpressure are dependent on the selected monitoring standard. These may differ from the provisional results shown in the Android App.

Note : The original raw waveform data is preserved in the .FMD file. Any vibration or overpressure values exported to CSV are filtered based on the selected monitoring standards.

Waveform Display

Any .FMD file saved using the V-Blast software can be opened for review by selecting **File → Open** from the main menu.

The waveform will be displayed in a new window, with graphical plots for vibration and air overpressure. By default, the **velocity trace** is shown, but this can be toggled to **acceleration** using the **Acceleration** button or displacement using the **Displacement** button .



If a valid GPS signal was present during recording, **GPS time pulses** will appear along the bottom of the display.

The following information is shown alongside the waveform:

- **Date and time** the event was recorded
- **Time source**: Either the unit's internal clock (RTC) or GPS signal (UTC)
- **FM 301 serial number**
- **Last calibration date**
- **GPS coordinates** (if available)
- **User comments** (up to 4 lines)
  - Comments can be added directly within the display window by clicking on a line and typing.

> **Note**: To save any entered comments, select **File → Save**. Unsaved comments will be lost when the window is closed.

- **Results table**, including:
  - Peak values for each vibration component (velocity, acceleration, displacement)
  - Nominal frequencies
  - Peak air overpressure reading
  - Applied monitoring standards

The waveform view includes options for:

- **Printing** (via the printer icon or PDF export)
- **Zooming** (via the magnifying glass icon)
- **Frequency analysis**
- **Signal filtering**

Printer Icon

Clicking the **printer icon** initiates the print process for the displayed waveform and associated data.

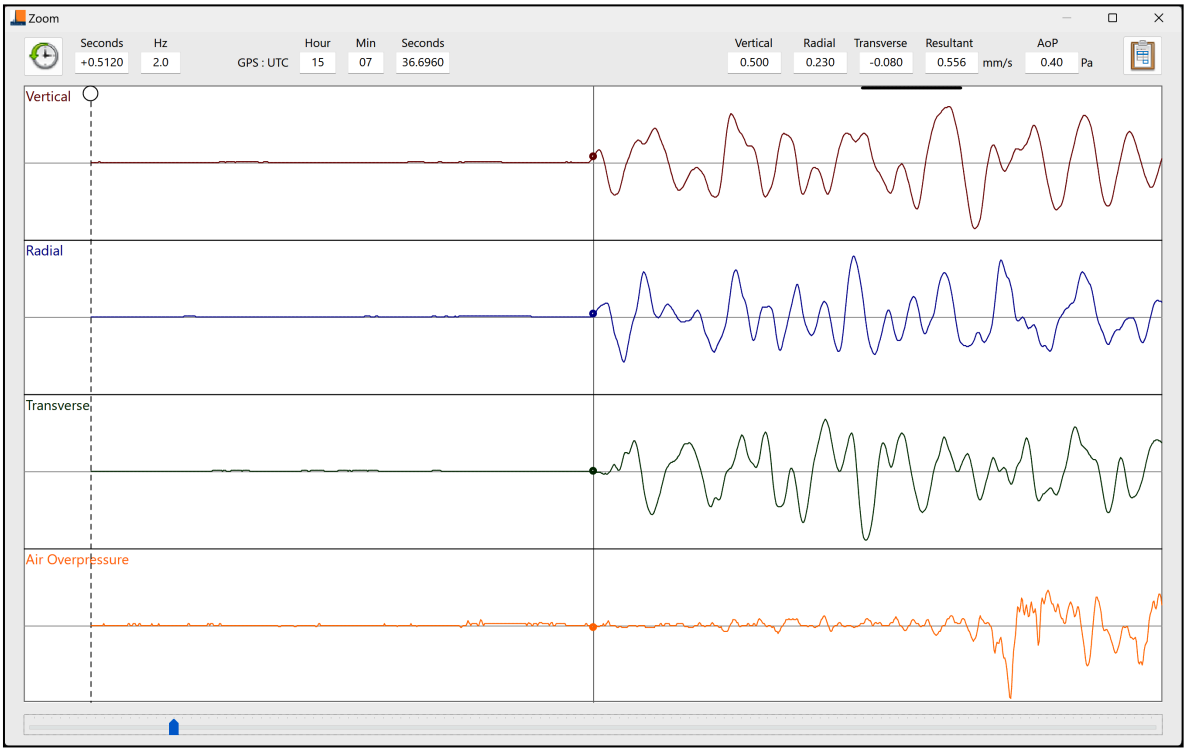
The output will be sent to the default or selected printer connected to the computer.

If a PDF printer is installed, a digital copy of the waveform can be generated as a PDF.

Magnifying Glass Icon – Zoom Function

Clicking the **magnifying glass icon** opens the **Zoom Tool**, which provides a detailed view of the waveform for closer inspection.

- A **solid vertical line** marks the current signal location
- The **blue slider** at the bottom of the window allows panning left or right across the waveform.



Keyboard Navigation:

- ← / → : Move one sample at a time
- **Pg Up / Pg Dn** : Move in larger increments
- **Home / End** : Move to the start or end of the waveform

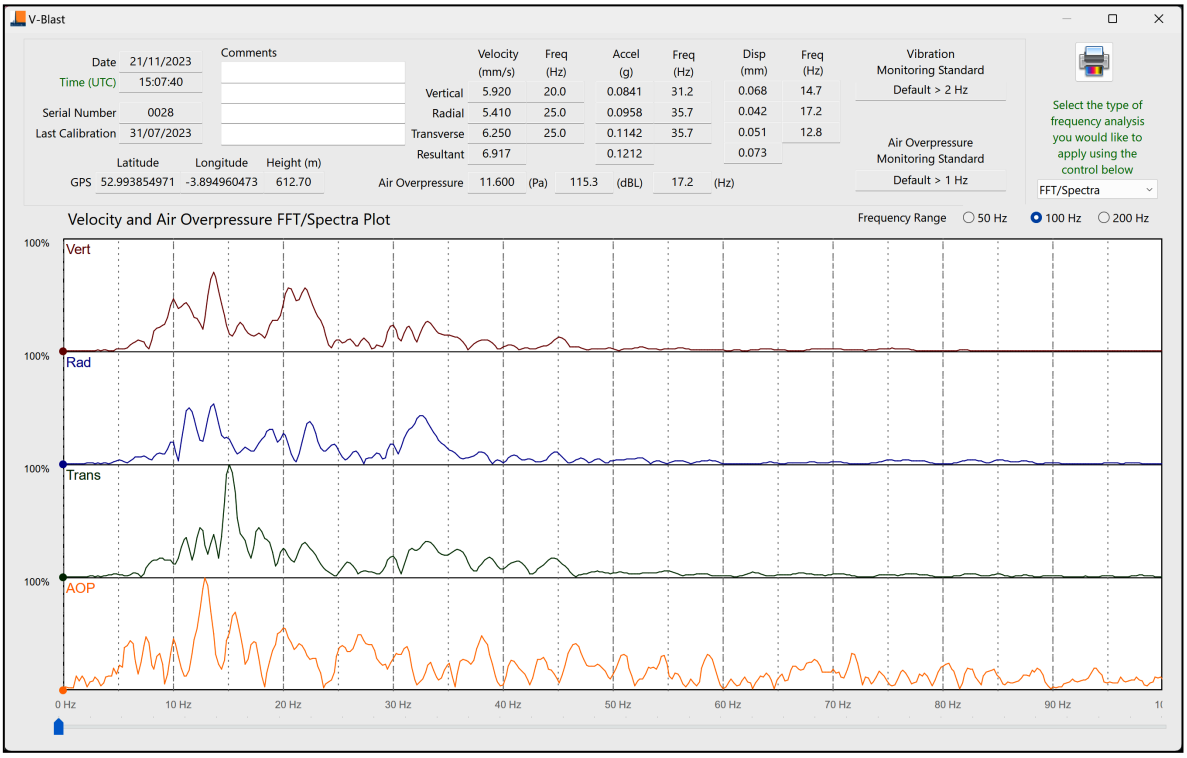
Clicking the **clock icon** in the upper-left sets the time at the current location to **zero**, marked by a dashed line.

Time and frequency values displayed are relative to this point.

Click the **clipboard icon** in the upper-right corner to copy the displayed data to the computer's clipboard.

Frequency Analysis

Clicking the **Frequency Analysis** tab opens a window that displays the frequency content of the selected waveform segment.



A **blue slider** at the bottom of the window allows panning left or right across the signal.

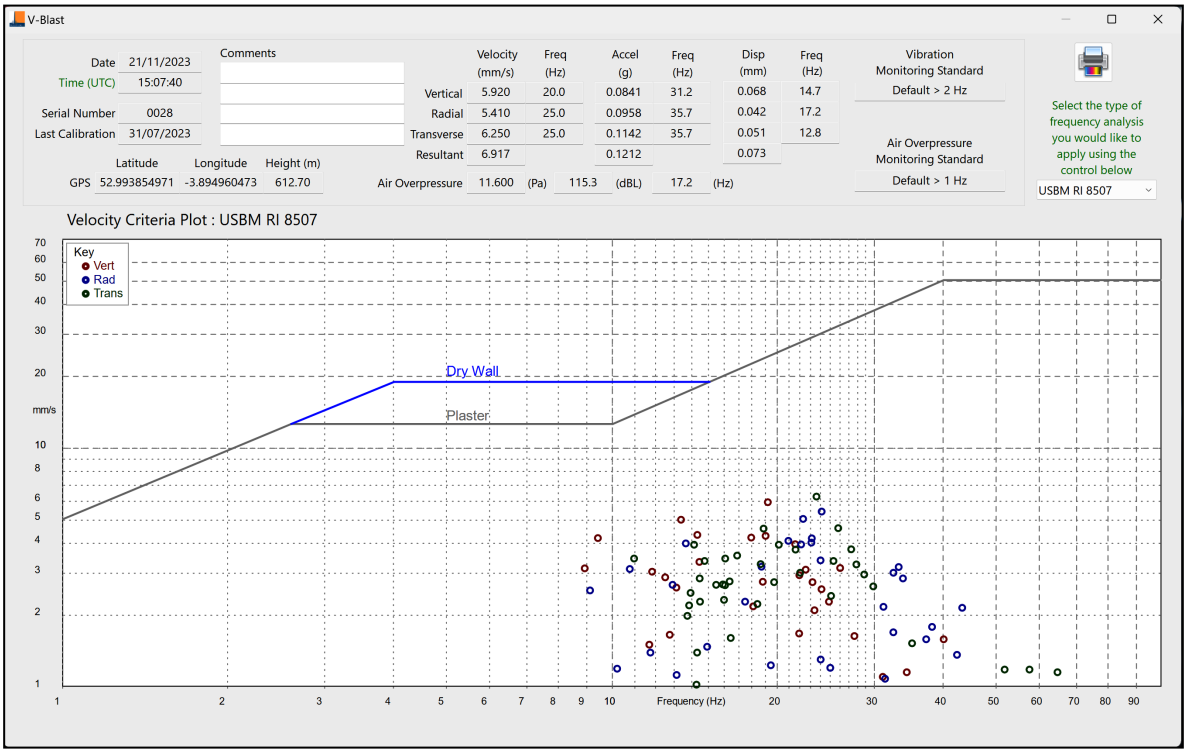
Keyboard Navigation:

- ← / → : Move one sample at a time
- **Pg Up / Pg Dn** : Move in larger increments
- **Home / End** : Move to the start or end of the signal

Three frequency range options are available:

- **50 Hz**
- **100 Hz**
- **200 Hz**

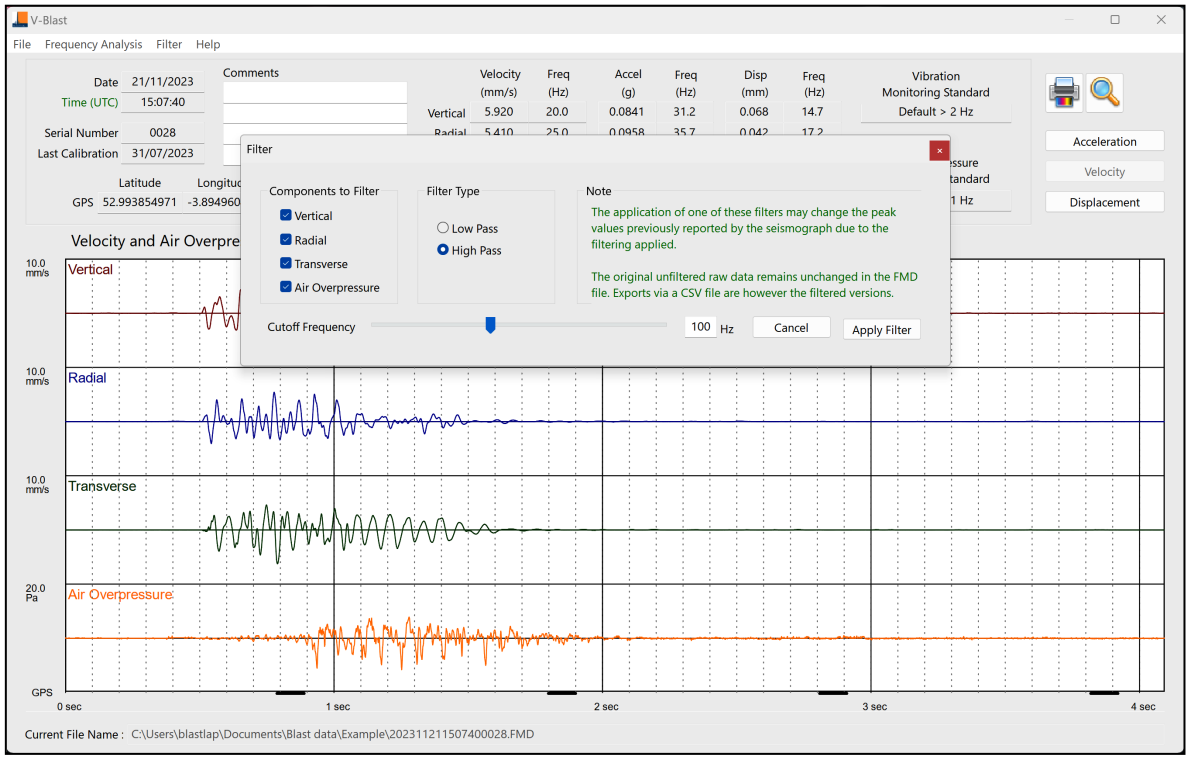
A **drop-down menu** in the upper-right corner allows selection of the frequency analysis standard to apply (e.g. **USBM RI 8507**, among others).



To generate a hard copy or digital output, click the **printer icon**. If a PDF printer is installed, the analysis can be exported as a PDF.

Filter

Clicking the **Filter** tab opens a new window for applying frequency filters to the selected waveform.



Available options include:

- **High-pass** and **low-pass** filters
- **Cutoff frequency** selection to isolate or remove specific frequency ranges

After selecting the desired filter settings, click **Apply Filter**. A new window will display the filtered signal.

To revert to the original, unfiltered waveform, click the **green reverse arrow** in the upper-right corner of the screen.

Chapter 5 – FM 301 Android App

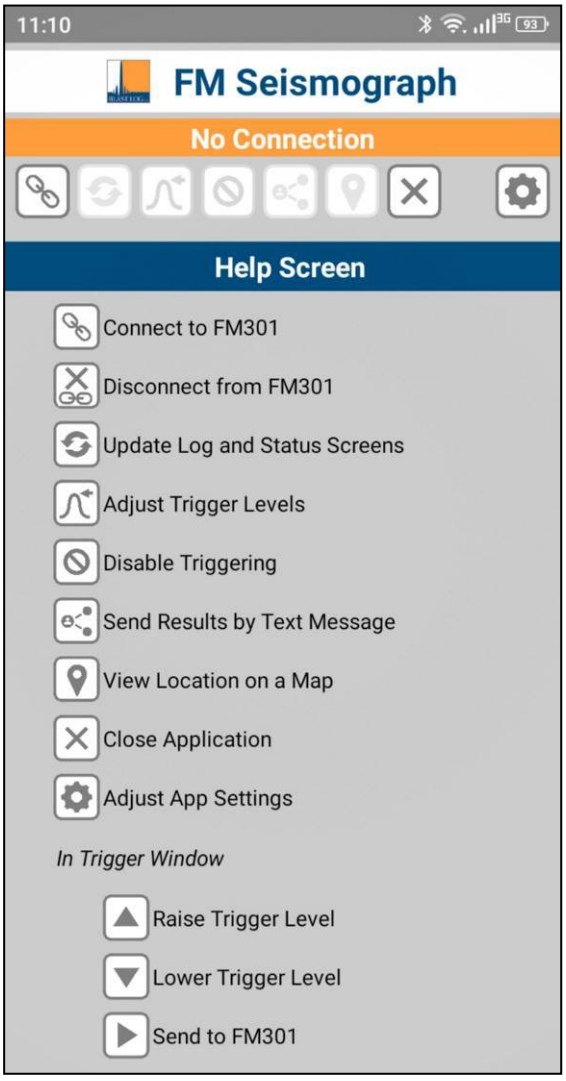
Downloading and installing FM Seismograph App

The **FM Seismograph** application is available for download via the **Google Play Store**.

Search for **"FM Seismograph"** to locate the app.

Note : Availability may be restricted in certain countries due to regional distribution settings.

Using the FM Seismograph App



When the **FM Seismograph App** is launched, the initial screen displays a **status line** at the top of the screen, indicating the current connection state.

For example, if no device is connected, the status will show "**No Connection.**"

Below the status line is a **row of buttons**, each representing a key function of the app.

If any buttons are displayed in **light grey**, the corresponding functions are currently **disabled**.

Once a connection is established with an FM 301 unit, the help screen will be replaced with device status and event data.

Connect to FM 301

Pressing the **Connect** button prompts the app to search for nearby FM 301 units using Bluetooth.

A list of detected devices will be displayed. Each device name includes **"FM301"** followed by a **4-digit serial number**, allowing identification of the correct unit.

To improve connection reliability:

- Remain within **5 metres** of the unit
- Retry the connection process if unsuccessful on the first attempt

Once connected:

- The **status line** will update to show the connected FM 301
- A **Data Log** table will appear, showing a summary of the **last 3 recorded events**
- A **Seismograph Status** panel will display:
  - Serial number
  - Battery level (with colour-coded indicator: green = high, yellow = medium, pink = low)
  - Sampling rate
  - Recording window size
  - Trigger levels
  - GPS data

  If the battery level is pink, less than one hour of monitoring time remains and the unit may stop recording.

If triggering is disabled for vibration and/or air overpressure, the field will display “Disabled” on a yellow background.

If no valid GPS signal is available, “No Fix” will be shown; otherwise, latitude and longitude will be displayed.

Note: The displayed information reflects the FM 301’s status at the moment of connection and is **not updated in real time**.

When the FM 301 detects and stores a new event, the app will display a notification—even if another app is running in the foreground. The Data Log screen will automatically update with the new event.

Note: The reported peak values shown in the app are **provisional**. Final values may differ once processed in the V-Blast software using the selected monitoring standard.

Disconnect from FM 301

Pressing the **Disconnect** button will terminate the connection between the app and the FM 301 unit.

The app will return to the **initial screen**, and all device-specific functions will be disabled until a new connection is established.

Update Log and Status Screens

Pressing the **Update** button refreshes the displayed data, including the event log and current seismograph status.

Note : Updating the display momentarily suspends monitoring.

To avoid missing data, it is recommended not to perform an update until after the blast has taken place.

Adjust Trigger Levels

Pressing the **Adjust Trigger Levels** button opens the **Trigger Settings** panel.

The current trigger levels for **vibration** and **air overpressure** are displayed, along with **up and down arrows** for each channel. Use these arrows to modify the levels as required.

After making a change, a **Send** button (right-facing arrow) will appear. Pressing this button transmits the updated settings to the FM 301.

- If the vibration trigger is set below **0.5 mm/s**, a **yellow background** will appear as a warning of increased risk of false triggers.
- For air overpressure, this warning appears when the level is set below **108 dB(L)**.

Disabling Trigger

Pressing the **Disable Trigger** button will immediately turn off triggering and suspend the monitoring process.

This function is intended for use in environments where background levels of **vibration** or **air overpressure** exceed the configured trigger thresholds, causing continuous triggering.

Once triggering is disabled, the **trigger levels** can be adjusted as needed via the **Adjust Trigger Levels** panel.

Send Results by Text Message

Pressing the **Send Results by Text Message** button opens a panel for sending a summary of recent events via SMS.

- Select one or more of the **three displayed events**
- Enter a **Site Name** and **Monitoring Location** (optional fields)
- Choose the recipient's phone number from the device's contact list

The selected information will be formatted into a text message and sent using the phone's default messaging service.

View Location on a Map

Pressing the **View Location on a Map** button displays the GPS location of the FM 301 on an interactive map.

Note: An active internet connection is required to view the map. This function is disabled if no valid GPS fix is available.

Close Application

Pressing the **Close Application** button will terminate the app and disconnect any active FM 301 connections.

All unsaved changes or pending actions will be discarded.

Adjust App Settings

Pressing the **Adjust App Settings** button opens a configuration screen where display and notification preferences can be customised.

Available settings include:

- **PPV Units**: mm/s (millimetres per second) or i.p.s. (inches per second)
- **Air Overpressure Units**: Pa (Pascals), dB(L) (decibels Linear), mbar (millibars), or psi (pounds per square inch)
- **Date Format**: dd/mm/yyyy or mm/dd/yyyy
- **Button Feedback**: Enable **beep** and/or **vibration** for button presses or event notifications

To apply changes, press **Save**. The selected preferences will be stored for future sessions.

Appendix 1 – Specifications

FM 301 Specifications

Data Channels

3 x Acceleration and 1 x Air Overpressure
3 x Velocity generated by on board integration of acceleration channels

Acceleration Frequency Response

2.47 Hz to 250 Hz at a sampling frequency of 1.0 kHz

Air Overpressure Frequency Response

1 to 250 Hz

Resolutions (nominal and subject to calibration)

Acceleration : 0.0374 mm/sec^2
Velocity : 0.01 mm/sec
Air Overpressure : 0.12 Pa

Ranges

Acceleration : 78500 mm/sec^2 or 8g
Velocity : 314 mm/s at 10 Hz to 31.4 mm/s at 100 Hz
Max. velocity range: +/- 327 mm/s (12.9 in/s)
Air Overpressure : 1000 Pa or 154 dB(L)

Triggering

Vibration velocity : from 0.1 mm/s upwards in 0.1 mm/s steps
Air overpressure : from 2 Pa (104 dB(L)) upwards in 1 Pa steps

Pre-Trigger Recording

Sample Rate	1.0 kHz
Pre-Trigger	0.512 seconds

Recording Windows

Sample Rate	2 second	4 second	8 second
1.0 kHz	Yes	Yes	Yes

Storage Capacity

1000 full waveform recordings

Clock

On-board real time clock accurate to 10 seconds
GPS clock accurate to better than 1 microsecond

Interfaces

USB 2.0 to Windows software
Bluetooth Low Energy to Android application for mobile devices

Integrated GNSS

GPS

Bluetooth

FCC IDENTIFIER: SH6MDBT40
NAME OF GRANTEE: Raytac Corp.
EQUIPMENT CLASS: Digital Transmission System
NOTES: Bluetooth Module
MODULAR TYPE: Single Modular

Dimensions

160 mm x 138 mm x 55 mm (6.3 in x 5.4 in x 2.2 in)

Weight

0.85 kg

V-Blast Specifications

Minimum Requirements

Microsoft Windows 10 operating system

International Vibration Monitoring Standards Included

AS 2187: 2 to 250 Hz

BS 7385: 1 to 150 Hz

ISEE: 2 to 250 Hz

ISO 4866: 1 to 150 Hz

International Air Overpressure Monitoring Standards Included

AS 2187: 2 to 250 Hz

ISEE: 2 to 250 Hz

Velocity Frequency Damage Criteria Included

BS 7385 Part 2

DIN 4150-3

USBM RI 8507

OSM CFR 30

UNE 22-381-93

FM Seismograph App Specifications

Minimum Requirements

Android 5

Blast Log FM 301 Blasters' Seismograph Warranty

The Blast Log FM 301 blasters' seismograph comes with a one year warranty from the date of delivery to the purchaser. The warranty only applies to the original purchaser and is not transferrable. This warranty guarantees that any FM 301 unit manufactured or sold by Blast Log Limited is free from defect, whether this relates to materials or workmanship. Blast Log Ltd undertakes to repair or replace free of charge, any part of the FM 301 unit, provide that the unit has been used in accordance with Blast Log's published specifications and the operator's manual. This warranty is void if the equipment has been neglected, dismantled, altered or abused in any way. Any transportation charges back to the Blast Log office to be payable by the customer. However on receipt of shipping documentation relating to the FM 301 unit, these costs will be refunded by Blast Log Limited. All transport costs relating to return of the unit will be payable by Blast Log Limited.

It should be borne in mind that the FM 301 blasters' seismograph is an electronic instrument. Although the unit is robust, in that it has been specifically designed for field use, it contains sensitive components which cannot be expected to withstand the same stress and shock as construction tools or heavy machinery. The battery is not intended to be replaced by the operator. The unit should be returned to Blast Log Limited to be serviced. Any attempt to service this product will void any and all warranties offered by Blast Log Limited.

BLAST LOG Ltd

design, performance & compliance

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