BLAST LOG Ltd
design, performance & compliance

Instruction Manual

FM 301 Blasting Seismograph

Series 1000

For units with serial numbers 1000 and above

Firmware Version 113 : Hardware with 2 x LED : PC Software 3.20 : Android App 1.1 : Updated 18/09/2025 : SH

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Appendix 1 – Specifications

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 FM 301 units designated as the *1000 Series*, which begin with serial number 1000.**

The FM 301 is an advanced digital blasting seismograph designed for the monitoring of vibration and air overpressure resulting from blasting in surface mines, underground mines, quarries and other operations employing explosives.

The specification for the FM 301 is given in appendix 1.
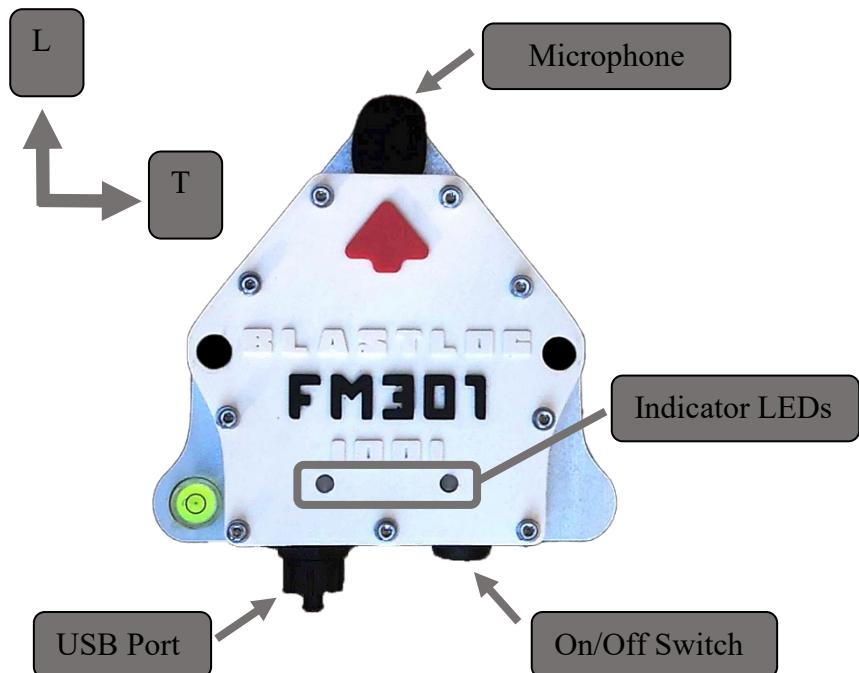
Handling Procedures

- Handle all equipment and accessories with care.

- Do not operate the equipment if the unit has been damaged. Immediately turn the instrument off and have it inspected by a Blast Log repair facility.

- Ensure that the USB connector is fully inserted.

- Ensure the connectors are clean prior to use.

- Do not pull the cord when connecting or disconnecting the USB cable. Align the connector to the port before inserting. Never force the connector.

- To ensure proper operation charge the battery immediately when the FM 301 indicates a low battery condition.

- The battery used in this device may present a fire or chemical burn hazard if mistreated. DO NOT disassemble the battery, heat it above 60°C (140°F) or incinerate.

- Do not open the unit.

- The FM 301 seismograph is water resistant. Do not immerse in water. Clean with a damp cloth.

- The vibration sensors employed in the FM 301 are accelerometers meaning that the unit can be used in any orientation and does not need to be level to give valid results.

Vibration Sensors

The vibration sensors employed in the FM 301 are accelerometers meaning that the unit can be used in any orientation and does not need to be level to give valid results.

The use of accelerometers also gives enhanced reliability compared to other seismographs using moving mass geophones. Conversion from acceleration to velocity is carried out in the unit giving peak results for both acceleration and velocity.

USB Interface

The unit has a USB interface and comes with Windows software to allow for the downloading and analysis of the full waveforms for each recording made, as well as changes to monitoring parameters such as trigger levels and recording duration.

Bluetooth

The FM 301 has a Bluetooth Low Energy interface which enables the unit to be controlled from an application that can be run on any Android equipped device, such as a mobile phone.

Battery Life

Battery life depends upon the mode of operation but is typically in the order of 24 hours of continuous monitoring. Charging of the internal batteries is also done via the USB interface.

GPS

The unit is also equipped with a GPS system meaning that, when a GPS signal is available, the location of the unit is stored with each recording. The use of the GPS also results in highly accurate timing data meaning that multiple seismographs can be time synchronised.

Note : The position accuracy of the GPS is dependant on the orientation of the satellites, signal blockage and atmospheric conditions.

The typical position accuracy of the FM 301 seismograph is between 4 to 20 metres.

Internal Storage

Internal data storage is included meaning that the full waveform recordings are stored for the last 1000 events recorded.

Dimensions and Weight

Despite the high specification of the FM 301 it comes in a single relatively small package weighing less than 1 kg with dimension of 160 mm x 138 mm x 55 mm.

Mounting

As standard each FM 301 comes equipped with levelling feet for use on solid surfaces and spikes for use on soils. The two through holes are available for permanently mounting on a solid surface.

LED Indicators

The FM 301 is equipped with bright indicator red, green and blue LEDs in the top of the unit which are used to show the status and operation of the unit.

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.

As a rough guide, if the unit is used for one hour then it will need charging for one hour.

It is useful to note that all the time the unit is connected to a powered laptop or other computer then charging will be taking place so it can be useful to leave your FM 301 connected to a powered USB port on your computer.

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

Do not charge overnight.

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

On turning on the unit, the LEDs will be tested by showing the following sequence:

- 2 Reds for 1 second
- 2 Greens for 1 second
- 2 Blues for 1 second

The battery level will then be indicated by two red, two green or two blue LEDs indicating the following.

- 2 Greens = OK for several hours
- 2 Blues = OK for one hour
- 2 Reds = Less than one hour and the machine could stop monitoring at any time
- 2 Reds (flashing) = No monitoring can be carried out and the unit requires charging

Monitoring Process

Monitoring will continue until the machine is powered down by pressing the On/Off button.

Monitoring status is indicated by the LEDs as follows :

- Right flashing green = monitoring active.
- Right flashing blue = monitoring active with a valid GPS signal.
- Right red = monitoring but triggered
- Right blue = data processing and storage in progress

The flashing rate for the LEDs is synchronised to the recording window that has been set e.g. for a 4 second window the LEDs will flash every 4 seconds.

If the left and right red LEDs flash left and right continuously then there is insufficient power and monitoring will be suspended.

Note : In this case the machine should be turned off to avoid the risk of running the batteries too low causing permanent damage.

Monitoring End

The FM 301 will continue to monitor and automatically add the recordings to the internal memory. When the memory capacity of 1,000 events has been reached the unit will overwrite the oldest recording.

The unit can be turned off at anytime via the On/Off button.

Chapter 4 – V-Blast Windows Software

Connecting via a USB Port

The FM 301 can be connected to any Windows PC, that meets the minimum requirements, using the supplied USB/Charging cable.

Setting the FM 301 into USB Communication Mode

Before transferring data to and from the FM 301 using the USB cable, the unit needs to be set into USB mode.

Setting this mode disables triggering meaning that the unit can be left powered up on a desk without getting false triggers.

Setting USB mode is achieved on turning the unit on by tapping the top of the unit each time the pair of LEDs is lit.

That is two taps to correspond to the Red, Green and Blue LEDs.

If the tap is successfully registered the LEDs will flash.

As an alternative the same effect can be achieved by pick the unit up and shaking it gently during the LED sequence.

If you have successfully started the USB mode the lefthand LED will then show continuously green.

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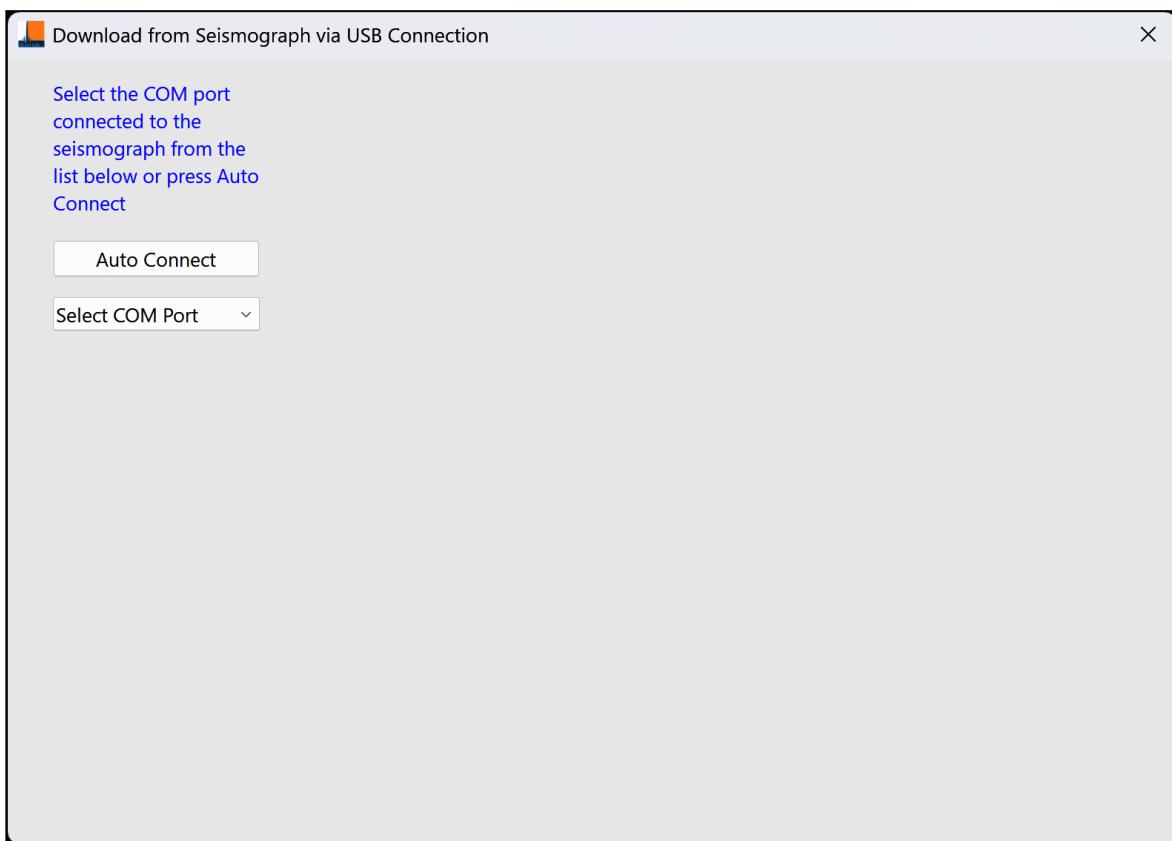
When the **Download from Seismograph via USB Connection** window opens, two connection options are available:

- **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:

202507221211432010.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.
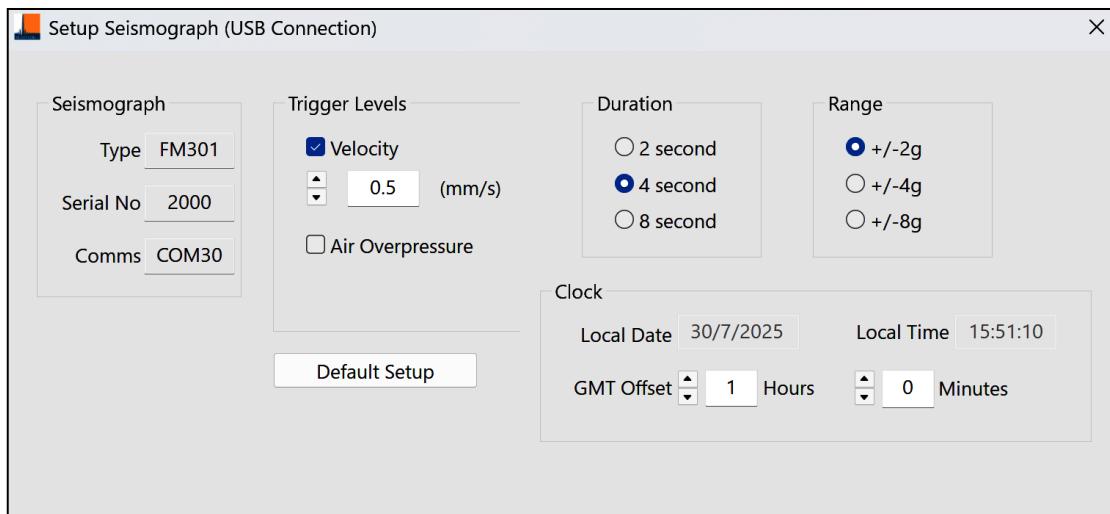
The following parameters can be adjusted:

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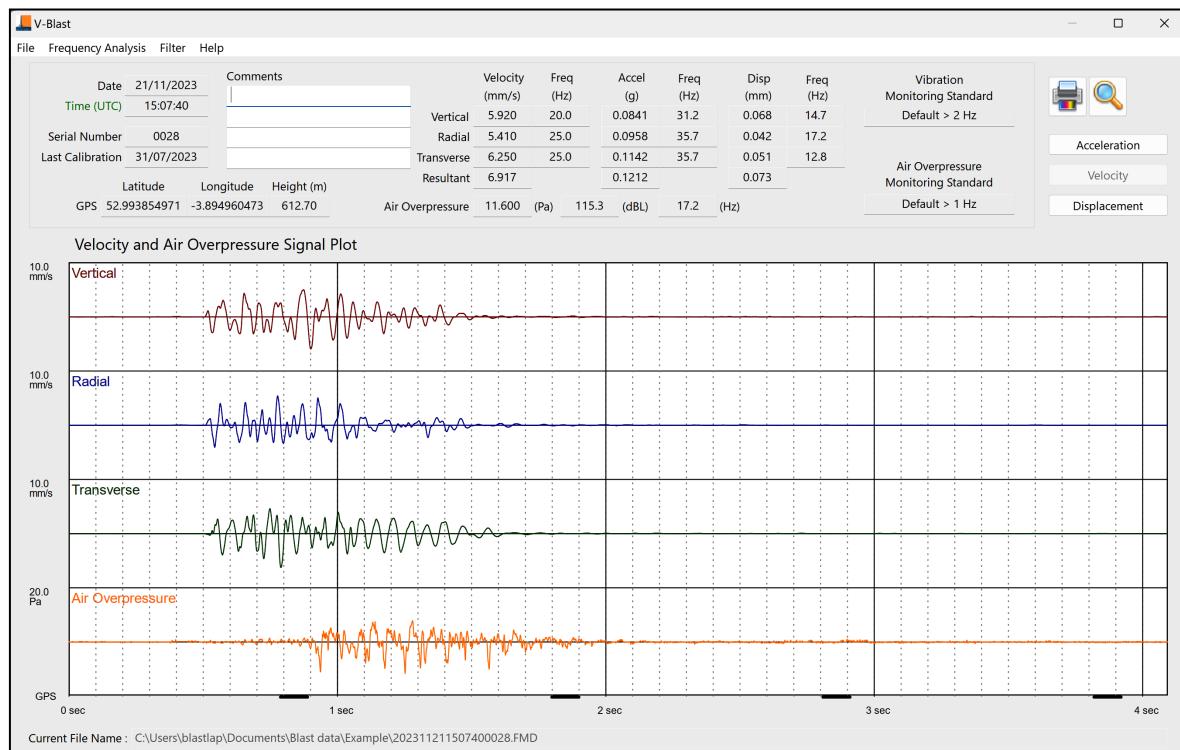
If a valid GPS signal was present during recording, **GPS time pulses** will appear along the bottom of the display.

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.
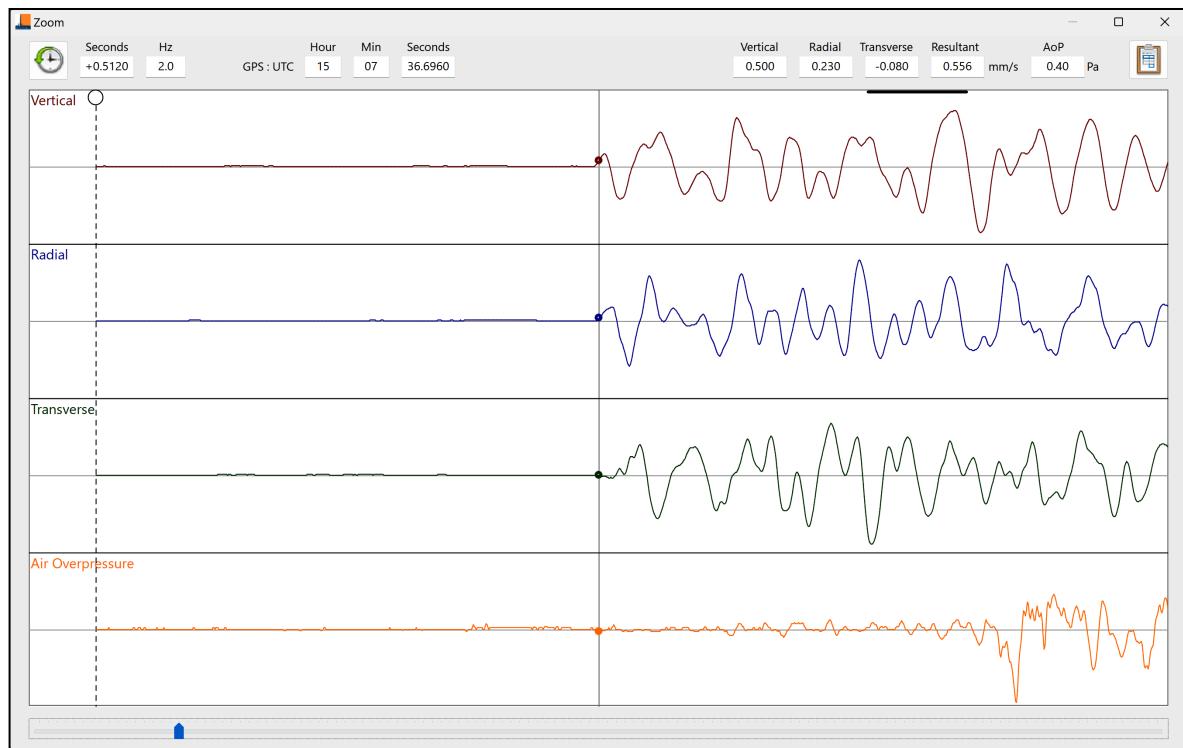
Keyboard Navigation:

- ← / → : 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.
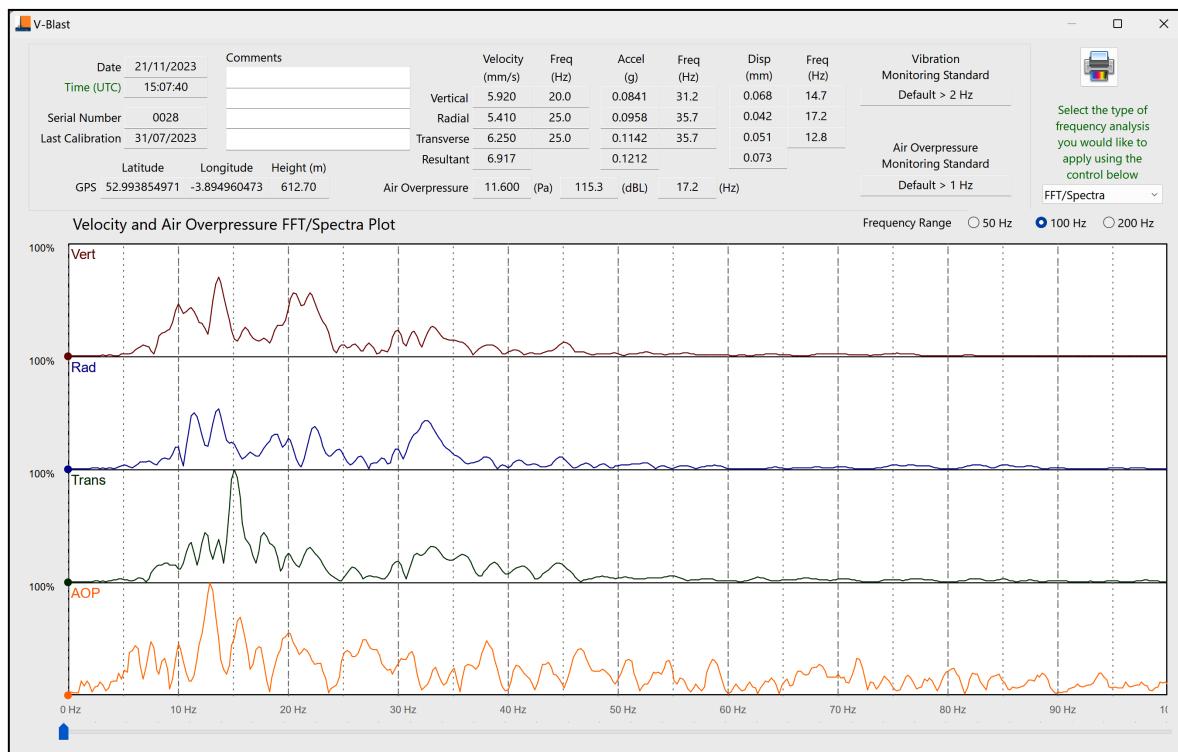
A **blue slider** at the bottom of the window allows panning left or right across the signal.

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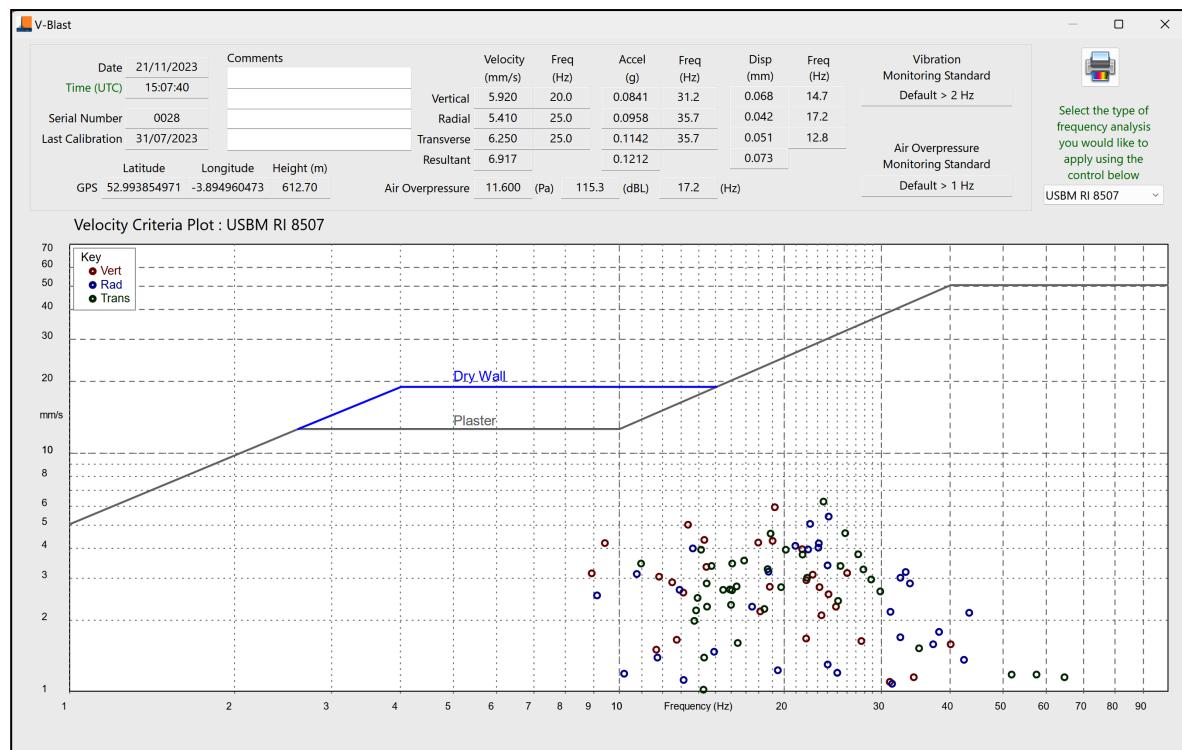
To generate a hard copy or digital output, click the **printer icon**. If a PDF printer is installed, the analysis can be exported as a PDF.

Filter

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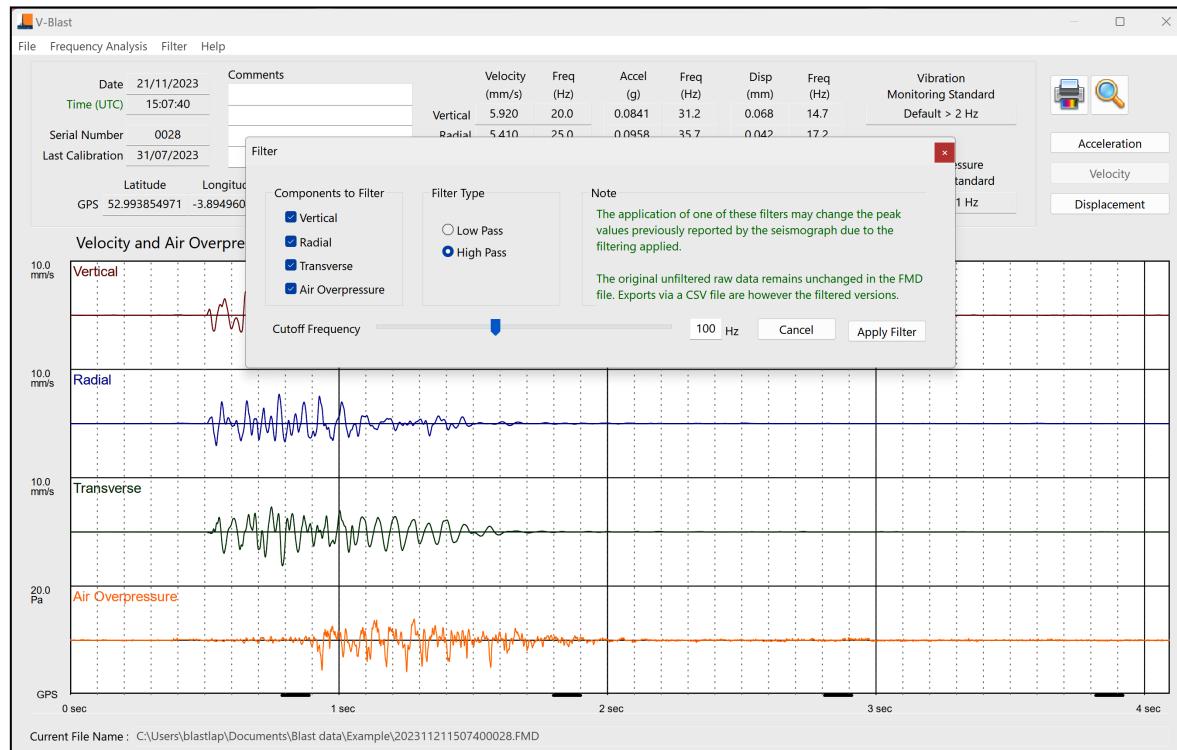
Available options include:

- **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 can be downloaded from Google Play Store by searching for '*FM Seismograph'*.

Note : the App is accessible in specific countries only.

Using the FM Seismograph App

The initial screen that is displayed when the App is run, is below.
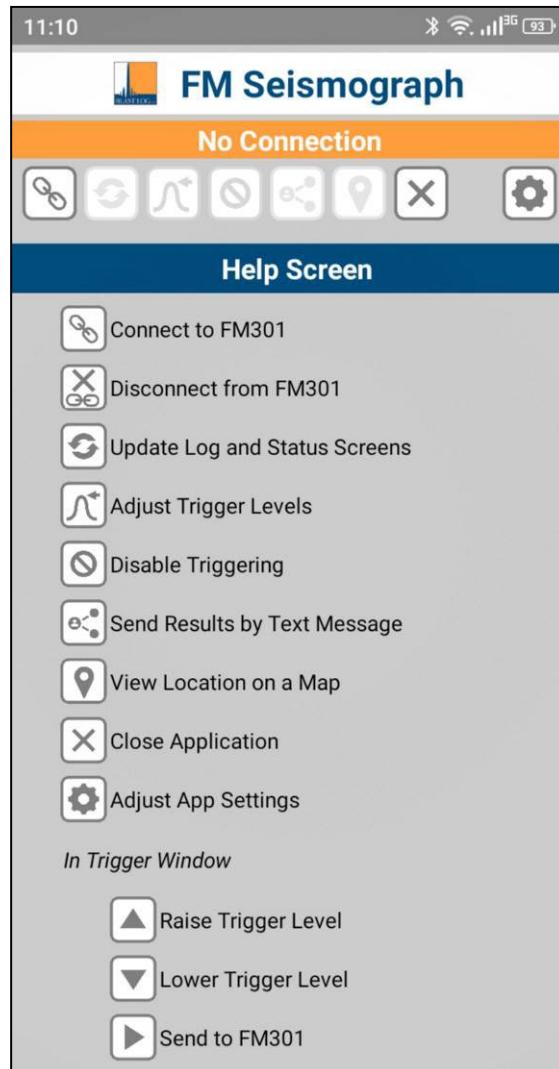
Towards the top of the display is a status line which reflect the current situation with the App and any connection to a FM 301. In the example this is showing '*No Connection*'.

Below the status line is a row of buttons with icons and then below that a simple description of the meaning of each button. A more detailed explanation is given on subsequent pages in this manual. The help screen will disappear when a connection is made.

If the buttons are shown in light grey this means they are disabled.

Connect to FM 301

When this button is pressed the App will look for any FM 301 units that are nearby and then display a list of the devices found. You should select from the list the FM 301 that you wish to connect to. The list of possible devices shows a long name for each, but you should see towards the end of the name '*FM301*' followed by a 4 digit serial number.

The connection process is not always successful and you may need to try several times. The closer you are to the FM 301 the better and certainly not more than 5m away.

When a connection has been made the screen will be updated and the status line should show the FM 301 that is connected. A Data Log table will also be displayed showing a summary of the last 3 events recorded. In addition, a Seismograph Status section will appear showing the serial number, battery level, sampling rate, recording window size, trigger levels and GPS data.

The battery level displays the approximate number of operating hours. The battery level is also colour coded and will be green for high, yellow for medium and pink for low. If the level is shown as pink then you will have less than one hour of monitoring left and the unit may stop monitoring at any time.

If triggering from one or both vibration and air overpressure has been disabled then the display will show '*Disabled*' on a yellow background.

If there is no valid GPS signal then the display will show '*No Fix*' on a yellow background otherwise the Latitude and Longitude will be shown.

Note : The display only reflects the status of the FM 301 at the moment of connection and is not continuously updated.

When a connection has been made and the FM 301 detects an event the FM 301 will notify the App of the event after it has been processed and stored. This notification will be shown on the screen even if another application is being run. The data log screen will also be automatically updated.

Note : The reported peak values are provisional and may change with the application of the relevant national monitoring standards when downloaded to the V-Blast software for processing.

Disconnect from FM 301

Pressing this button will cause the FM 301 to be disconnected and the App will return to the opening screen.

Update Log and Status Screens

Pressing this button will update the display.

Note : The updating process means that monitoring will be suspended for a fraction of a second and that if this is done just before a blast you can get a gap in the data. It is suggested that you do not do an update after the final blast warning has been given.

Adjust Trigger Levels

Pressing this button allows you to adjust the trigger levels for FM 301 and will display a new section with the title '*Trigger Settings*'.

The current trigger levels will be shown along with corresponding Up and Down Arrow buttons.

The trigger levels can be adjusted up and down with these buttons. As soon as a change has been made a new button will appear pointing to the right.

Pressing this button will send the corresponding trigger setting to the FM 301.

If the vibration trigger level is set to less than 0.5 mm/s then it will be shown on a yellow background as a warning of the risk of false triggers. The corresponding value for the air overpressure is 108 dB(L). If the trigger levels are taken very low then the trigger will be disabled and shown on a yellow background.

When the window is closed an automatic update is carried out on the Seismograph Status display.

Disabling Trigger

Pressing this button at any time will immediately disable triggering and stop the monitoring process. This should only be used if the background levels of vibration or air overpressure are above the trigger levels and the unit is continuously triggering. The trigger levels can then be adjusted as previously described.

Send Results by Text Message

Pressing this button allows for a summary of the results to be sent by text message. You will be asked to select from the 3 events displayed (multiple events can be selected). A Site Name can be added to the message along with a Monitoring Location. The telephone number for the message is selected from your phones contact list.

View Location on a Map

Pressing this button will show the reported location of the FM 301 on a map. This button will be disabled if there is no GPS fix.

Requires active data connection or WIFI connection on mobile phone.

Close Application

Pressing this button will close the application down and disconnect any connected devices.

Adjust App Settings

Pressing this button will open a new screen that allows you to adjust various settings.

Included in the permitted changes are:

- PPV Units : Choose from mm/s [millimetres per second] or i.p.s. [inches per second].
- Air Overpressure Units : Choose from Pa [Pascals], dB(L) [decibels linear], mbar [millibars] or p.s.i. [pounds per square inch].
- Date Format : Choose from dd/mm/yyyy [day/month/year] or mm/dd/yyyy [month/day/year].

You can also set a beep and/or vibrate for a button press or event notification.

Pressing the Save button on this screen will ensure the same settings will be used in the future.

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
OSM CFR 30
USBM RI 8507
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.

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