

## PRODUCT INFORMATION:

# SIMPLE AND EFFECTIVE VIBRATION MONITORING TERMINAL

When you need to reduce the risk of structural damage to nearby buildings, assess human response to vibration or monitor background vibration levels to ensure sensitive equipment operates correctly, you need a robust device on which you can rely.

Our Vibration Monitoring Terminal (VMT) achieves it all reliably and with the minimum of effort.



## USE AND FEATURES

### Uses

- Fast alerting on triaxial PPV measurements
- Alerts trigger SMS, email or control of external devices

### Road and rail planning

- Continuous monitoring of vibration levels
- Background surveys prior to construction, or routine assessment during operation

### Ambient monitoring at hospitals/manufacturing

- Alerts if background levels prevent accurate operation of vibration sensitive equipment

### Features

#### Complete solution

Vibration metrics for a wide range of applications

- Continuous uninterrupted measurement
- Immediate and fast data transfer and alert generation if thresholds exceeded
- Mains powered or 18 hour operation with integrated backup battery
- Continuous operation on solar power (optional) subject to panel size and local conditions

#### Easy to operate

- Three status LEDs confirm correct operation or diagnose problems on site
- The unit can be set up with remote display and operation anywhere over digital cellular or wi-fi connection with data transfer to standard applications like Microsoft® Excel®, PULSE Reflex and MATLAB, and with predefined report formats (PDF and CSV)
- Seamless operation with Sentinel: Switch on the unit and it automatically starts delivering data.

## THE VIBRATION MONITORING TERMINAL (VMT)

Our Vibration Monitoring Terminal continually measures ground vibration in three axes, providing vibration metrics for a wide range of applications including monitoring structural damage to nearby buildings, assessing human response to vibration, or monitoring background vibration levels to ensure sensitive equipment operates correctly.

The robust, reliable device is housed in a rugged aluminum enclosure, water- and dustproof to IP 67, and can operate in ambient temperatures from -20 to +55 °C, making it suitable for the harsh environments it will be used in. And, it can be used on its own as a stand-alone meter or as part of a Sentinel compliance monitoring system.

It continuously measures without interruption across three axes in compliance with ISEE (2 to 250 Hz), DIN 45669- 1 (1 to 315 Hz) and DIN 45669- 1 (1 to 80 Hz). The systems extensive dynamic range from 2 µm/s (VC-E) to over 300 mm/s ensures full coverage of vibration velocity levels.

The VMT is a self-contained unit including sensor conditioning, processing, storage, GPS and wireless communication. All suitable antennas are included, so you simply need to insert a SIM card into the easily accessible but well-protected slot, to connect to a 2G/3G/4G/LTE cellular network.

Three status LEDs confirm correct operation and the status of the battery, communications and data logging, and help diagnose problems on-site in an intuitive manner. To confirm data validity, a sensor check can be

made, and scheduled done at regular intervals, and the results recorded.

In addition, the VMT has a heartbeat function to ensure stable operation and, if that fails, its self-healing function ensures continued operation with minimal manual intervention.

The VMT logs data at 1-second intervals, creates periodic reports at intervals of between 1 second and 60 minutes, and identifies vibration alerts based on user-configurable trigger levels. Vibration alerts are generated within seconds of them occurring. Hourly instrument status reports are available and include the status of the battery, sensor check, count of measurements, and wireless and GPS signal strengths.

The unit is typically powered via a mains connection. Alternatively, it can be operated for 18 or more hours with its integrated and robust LiFePO4 battery – or connect it to solar panels and external batteries for continuous operation. To make remote operation cost-effective and easy, the VMT is self-starting, also when power is interrupted, so you do not have to visit the location to turn it on.

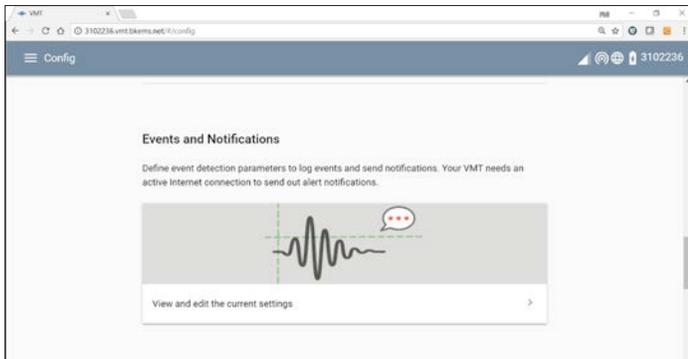
VMT Type 3680 comes complete with ground spikes and a surface-mounting plate for the geophone to ensure that correct and valid data is being collected. A connector security cover is included to hide the display lights from view and to help protect the front panel from damage and physical interference. Alternatively, the LED display may be disabled for outdoor use. Optional items include a geophone wall mount, geophone extension cables and larger antenna options for use in poor cellular coverage areas.

Optional accredited calibrations of the instrument and geophone, both initial and regular, are available if your legislation requires this for traceable measurement and reporting.

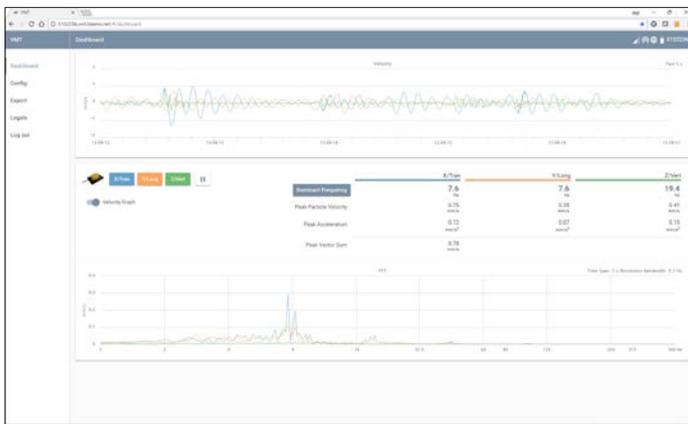


## STAND-ALONE OPERATION

For stand-alone use, the VMT has a built in web server which can be accessed via wi-fi from a laptop or smart device. The same interface enables set-up, display and operation anywhere, as well as data transfer to standard applications like Microsoft® Excel®.



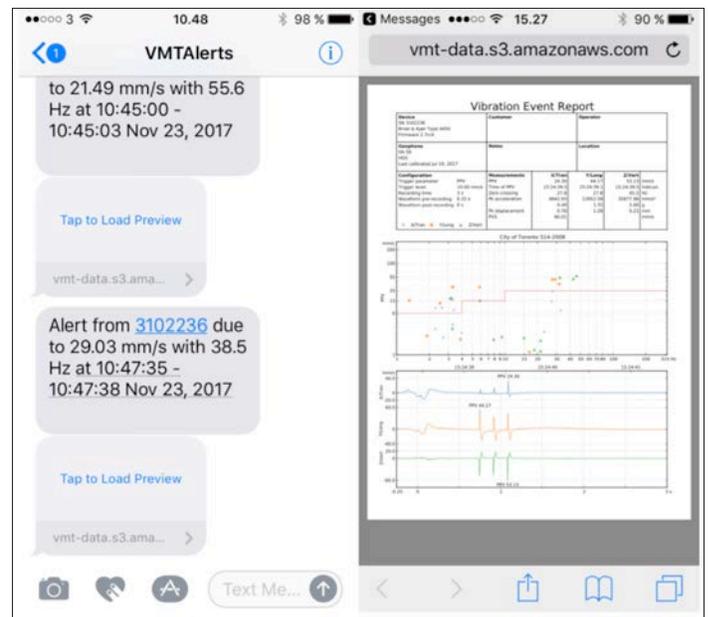
The VMT may be setup using either Bluetooth, wi-fi or cellular connection to the unit from any web browser on a PC, laptop or smart device. The built in web server provides easy to use configuration profiles to set-up including measurement indices, reporting formats optimized to several standards, and trigger level configurations for alerts and reporting. It is also possible to set up at which times of day trigger levels are active.



A variety of measurement parameters are available including velocity and acceleration in each axis, expressed as Peak, RMS and in SI (eg mm/s) or Imperial (eg in/s) units. The dominant frequency in Hz is calculated using either zero crossing frequencies or with FFT depending

on the standard chosen. Realtime data can be viewed updated every second. A wide range of measurement weightings can be selected depending on the measurement standard chosen.

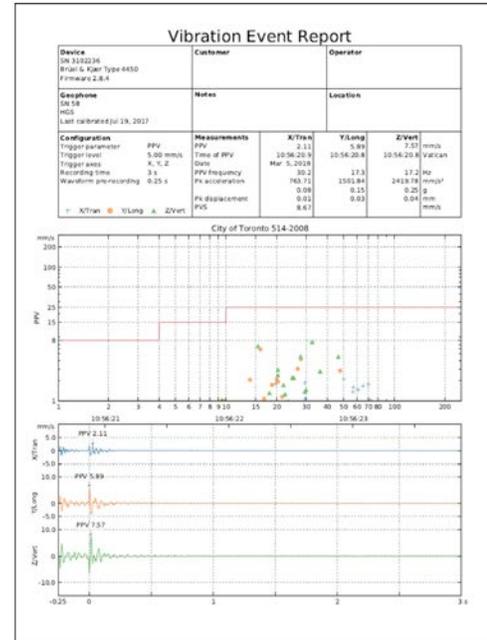
Vibration events occur when vibration level exceed defined limits. Limits are easily set within the browser using a simple threshold on any parameter or compliant with DIN 4150-3. Any or all axes of measurement can be set to trigger an event. When triggered the VMT automatically records the waveform in each axis with a pre and post trigger to ensure the full waveform is captured. The data is processed and a PDF report produced summarizing the vibration alert in accordance with a range of specific standards.



The vibration event may be set to trigger an SMS to a smart phone with an overview of the alert and a link to the alert report for viewing. The VMT can also automatically send the PDF report via email. The VMT can present the vibration data against a range of compliance curves.

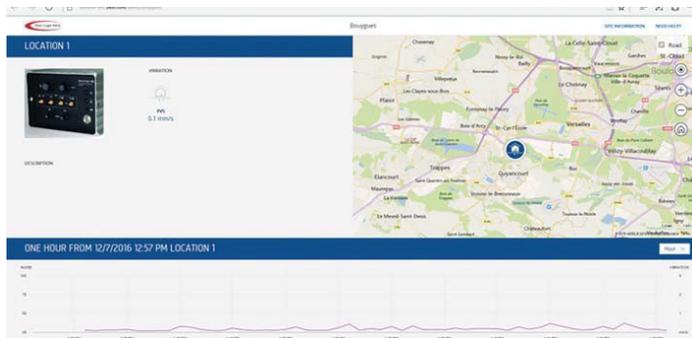
The unit has sufficient memory for storing at least a full year (365 days) of all vibration measurements, alerts, data and recordings. All data is available for reporting and further analysis. The required data set can be selected in the browser and downloaded directly from the VMT. VRMS in 1/3rd octaves is also available in reports for a complete vibration history review. Similarly, system health reports provide a record of the instrument operation throughout the measurement period. Download of reports has no effect on vibration measurement which is continuous.

Raw signal data can be exported to applications such as PULSE Reflex and MATLAB for post-processing and advanced signal analysis to supplement the unit's advanced vibration monitoring functionality.



## USING THE VMT WITH SENTINEL

One or more VMTs operate seamlessly with EMS Brüel & Kjær's Sentinel solution. Simply switch the unit on and it automatically connects, configures itself and starts delivering data. When used with Sentinel, all control of the VMT is done remotely including setup, remote display, operation and reporting.



Vibration alerts are generated within seconds of them occurring and visualized and disseminated by Sentinel. The VMT can be set up with different alert trigger levels for different times of the day, and the reports contain sufficient detail for reporting and cause investigation.

Sentinel shows live vibration velocity data which is updated every minute. To confirm data validity, a sensor check is made daily.



For more information, see the Sentinel product data sheet BP 2389.

## COMPLIANCE WITH STANDARDS



The **CE** marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives

**RCM** mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME

China **RoHS** mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China

**WEEE** mark indicates compliance with the EU WEEE Directive

### SAFETY

**EN/IEC 60950-1**: Safety requirements for information technology equipment ANS/UL  
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### EMC EMISSION

**EN 61326-1 (2013)**: Electrical equipment for measurement, control and laboratory use –  
**EMC requirements – Part 1**: General requirements

**EN 301489**: EMC standard for radio equipment and services:

- **EN 301489-1: V1.9.2 (2011-09)**: Common technical requirements
- **EN 301489-17: V2.2.1 (2012-09)**: Specific conditions for broadband data transmission systems
- **EN 301489-24: V1.5.1 (2010-10)**: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA and E-UTRA) for mobile and portable (UE) radio and ancillary equipment

**CISPR 22**: Information technology equipment – Radio disturbance characteristics of information technology equipment. Class B Limits

**CISPR 25**: Vehicles, boats and internal combustion engines – Radio disturbance characteristics – Limits and methods of measurement for the protection of on-board receivers

**EN 55022**: Information technology equipment – Radio disturbance characteristics – Limits and methods of measurement. Class B equipment, device and apparatus

**FCC Rules, Part 15**: Complies with the limits for a Class B digital device

**Canadian ICES-003**: Information technology equipment (including digital apparatus) — Limits and methods of measurement

### EMC IMMUNITY

**EN 61000-4-3: A2 (2010)**: Electromagnetic compatibility (EMC). Testing and measurement techniques – Radiated, radio frequency, electromagnetic field immunity test

**EN 61326-1 (2013)**: Electrical equipment for measurement, control and laboratory use – EMC requirements

**Note**: The above is only guaranteed using accessories listed in this document

### TEMPERATURE & HUMIDITY

**IEC 60068-2-1 & IEC 60068-2-2**: Environmental Testing. Cold and Dry Heat Operating  
**Temperature**: -20 to +55 °C (-4 to 131 °F)

**Storage Temperature**: -40 to +60 °C (-40 to 140 °F)

**Humidity** upto 100%

### MECHANICAL

Non-operating:

**IEC 60068-2-6**: Vibration: 0.15 mm, 20 m/s<sup>2</sup>, 10 – 500 Hz

**IEC 60068-2-27**: Shock: 500 m/s<sup>2</sup>

**IEC 60068-2-29**: Bump: 1000 bumps at 150 m/s<sup>2</sup>

### ENCLOSURE

**IEC 60529**: Protection provided by enclosures: IP 67

## SPECIFICATIONS – VIBRATION MONITORING TERMINAL TYPE 3680 (VERSION 3.0)

### SENSOR

Triaxial geophone

### PROCESSING AND ANALYSIS

Signal processing with sensor in compliance with ISEE (2 to 250 Hz), DIN 45669-1 (1 to 315 Hz) and DIN 45669-1 (1 to 80 Hz)

**Supported Measurement Standards:** ISO 4866, DIN 4150-3, BS-7385, DIN 45669-1, ISO 2631-1&3, BS 6472 acceleration, ISEE-2017

**Signal Recording:** 3-channel in lossless compressed or calibrated WAV format available for export

**Measurement weighting:** DIN 415669-1 1-80Hz, DIN 45669-1 1-315Hz, DIN 45669-1 4-315 Hz, ISEE 2 – 250Hz, ISO Unweighted 0.5 – 80Hz, ISO Unweighted 1 – 80 Hz, ISO Wd Wb, ISO Wd Wk, ISO Wm, RAW

**Noise floor:** <1.8 µm/s PPV

**Dynamic Range:** 1.8 µm/s up to 312 mm/s PPV

**Accuracy:** ±5% or 0.5 mm/s PPV between 1 and 315 Hz, whichever is smaller.

**Resolution:** 0.1 µm/s

**Sampling Rate:** 24 bit up to 8 kHz

#### Measurement quantities:

- Peak Particle Velocity, PPV
- Zero-crossing frequencies
- FFT-based frequency detection (DIN 4150-3)
- RMS Velocity
- RMS Acceleration

#### Compliance Curves<sup>2</sup>:

- City of Toronto 514-2008
- DIN 4150-3
- NBR 9653
- USBM RI 8507
- BS 7385-2

#### Other features:

- Sensor check
- Built in Web server for set-up, display and data download
- Heartbeat and self-healing operation
- File formats: Microsoft® Excel®, CSV, PDF, Calibrated WAV files, MATLAB®

- Compatible with Brüel & Kjær Sentinel monitoring service and PULSE Reflex
- Over the air software update

### VIBRATION EVENTS

- Triggered from defined vibration level in any measurement parameter.
- Maximum PPV in each axis, zero-crossing frequencies and time of maximum
- Vibration waveform in each axis between 1 to 3 seconds with pre-trigger
- Alerts via SMS or email

### Vibration Climate

- Report period configurable from 1 second to 60 minutes
- Maximum PPV in each axis, zero-crossing frequencies
- Time of maximum level

### System Health Reports

Every hour, including battery, sensor check, count of measurements, clock drift, firmware version and internal temperature, pressure and humidity

### COMMUNICATIONS

- Bluetooth® Low Energy (BLE)
- Wi-Fi® (the product does not use the wi-fi N/AC bands)
- 2G/3G/4G/LTE cellular with SIM card (not supplied)

### Storage

- 365 days of all vibration measurements, alerts and data
- Diagnostics, battery-life, temperature, wireless signal strength, uptime, unit health

<sup>2</sup>Other compliance curves are being added to future updates

\*All temperatures are indicated in shade

## SPECIFICATIONS – VIBRATION MONITORING TERMINAL TYPE 3680 (VERSION 3.0)

### INSTRUMENT DISPLAY

- Battery OK
- Communications OK
- Logging OK

### Web server - Remote access, display and download

Real-time Dashboard updated every second

- Dominant frequency - XYZ
- Peak Particle Velocity - XYZ
- Peak Acceleration - XYZ
- Peak Vector sum – XYZ
- Realtime graph of one of the above parameters
- Real time graph of velocity waveform

### Configuration

- LED lights on/off (hides unit in field)
- Disable power button
- Password reset
- Instrument reboot
- Time zone
- Measurement units
- Measurement Weighting

### Export

- User defined time period of vibration level
- Vibration waveforms, events, periodic reports, 1/3 octaves and system health
- Transferred in either Excel, PDF, WAV, MATLAB, CSV

### CONNECTIONS

- Geophone
- External 4G antenna
- External GPS antenna
- Mains power

### PHYSICAL

**Size:** 140 × 200 × 480 mm (5.5 × 7.9 × 18.9")

**Weight:** Without geophone 8.98 kg (19.8 lb)

**Geophone:** .80 kg (1.77lb)

### ENVIRONMENTAL

- Water- and dust-proof to IP 67
- 18-hour battery backup with full operation with integrated LiFePO4 battery
- Recommended to store at room temperature

**Mains Power:** 90 – 264 VAC

**Operating Temp.** (ambient):\* Subject to operating conditions:

- With Battery: –20 to +55 °C (–4 to +131 °F)
- With Power Supply Plugged In: –20 to +40 °C (–4 to +104 °F)

## ORDERING INFORMATION

- Type 3680-A** Vibration Monitoring Terminal (Europe)  
**Type 3680-B** Vibration Monitoring Terminal (Americas)  
**Type 3680-C** Vibration Monitoring Terminal (Asia-Pacific)

Type 3680 includes the following:

- Type 4450-A/B/C: Vibration Analyzer (according to terminal variant)
- Type 8380: Triaxial Geophone
- KE-0014: Accessory Bag with Shoulder Strap
- FB-0737: Mounting Plate, for geophone
- UA-0006: Geophone Ground Spikes, set of 3
- DB-0009: Handle, Security Cap
- UL-1066: Dual-band Antenna (WiFi, 2.4 to 5.85 GHz), set of 3
- UL-1065: GPS Antenna
- DK-1769: Lock with cable
- DP-0127: Dust Cap for antenna connectors
- 3 × YI-0073: Geophone Stud Nut
- QX-0049: Screwdriver for Security Cap
- Power Supply

### SEPARATE ACCESSORIES AND COMPONENTS

- Type 7871** Sentinel, Web-based subscription service for continuous, real-time monitoring and compliance management
- ZG-0876** Power Supply for EU, 90 – 264 VAC, IP 67, SB107-DK3A (M) to JP-0304, 16 VDC / 4A
- ZG-0878** Power Supply for US, 90 – 264 VAC, IP 67, NEMA 5-15 (M) to JP-0304, 16VDC / 4A
- ZG-0875** Power Supply for AU, 90 – 264 VAC, IP 67, SAA-3 (M) to JP-0304, 16VDC / 4A
- ZG-0877** Power Supply for GB, 90 – 264 VAC, IP 67, BS 1363A (M) to JP-0304, 16VDC /4A

Solar panels, geophone wall mount, geophone extension cables, larger antennas and power control units are also available. Contact your Brüel & Kjær sales representative for more information

### SERVICES

Accredited initial and renewed calibrations are available on request (depending on country)

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