

PRODUCT DATA SHEET:

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
 - External batteries supported
 - Range of accessories include blast-overpressure microphone, geophone mounting accessories, etc
 - 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 VMT continuously measures ground vibration in three axes, providing metrics for a wide range of applications including monitoring structural damage to buildings, assessing human response to vibration, or monitoring background vibration to ensure sensitive equipment operates correctly.

The device is housed in a rugged aluminum enclosure, water- and dust-proof to IP 67, and can operate in ambient temperatures from -20 to +53°C, making it suitable for harsh environments. It can be used on its own or as part of a Sentinel monitoring system.

It continuously measures in compliance with ISEE (2 to 250 Hz), DIN 45669- 1 (1 to 315 Hz), DIN 45669- 1 (1 to 80 Hz), ISO 2631 and a range of other standards. The system's 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 complete unit with sensor conditioning, processing, storage, GPS and wireless communication. All suitable antennas are included, so you simply insert a SIM card 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 intuitively diagnose problems on-site. To confirm data validity, a sensor check can be scheduled at regular intervals and results stored. In addition, the robust and reliable 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 generates, within seconds, vibration alerts in real-time, based on user-configurable trigger levels. Hourly instrument status reports include the status of the battery, sensor check, count of measurements, and wireless and GPS signal strengths.

The unit is typically connected to mains power. Alternatively, it can be operated for 18 hours with its integrated, robust LiFePO4 battery*. Directly connect it to solar panels or external batteries for continuous operation. The VMT is self-starting when power is interrupted, so you do not have to visit the location to turn it on. To enable extended operating life, the VMT can operate in "broad-band batch mode" where only broad band data is measured and transmitted every 15 minutes.

The VMT comes with ground spikes and a surface-mounting plate for the geophone to ensure measurements are correct and valid. An included security cover hides display lights and helps protect the front panel from damage and physical interference. Alternatively, its LEDs may be disabled. Optional items include a geophone wall mount, geophone extension cables and larger antenna options for use in poor cellular coverage areas. A robust, outdoor Blast Overpressure Microphone AU-8381 can be added to the unit (see [Product Data - VMT - Blast Overpressure Microphone - EMS17](#)).

Optional accredited initial and regular calibrations of the instrument and geophone are available for traceable measurement and reporting.

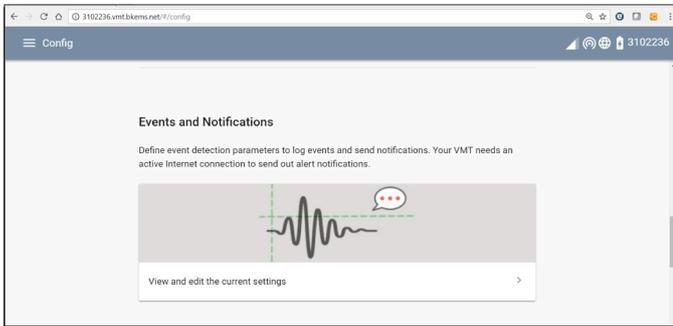
The VMT can be purchased with fewer accessories (-WOA variants). Older VMTs can be upgraded to the latest hardware version to enable you to get the most out of your unit.

* Version 2 hardware

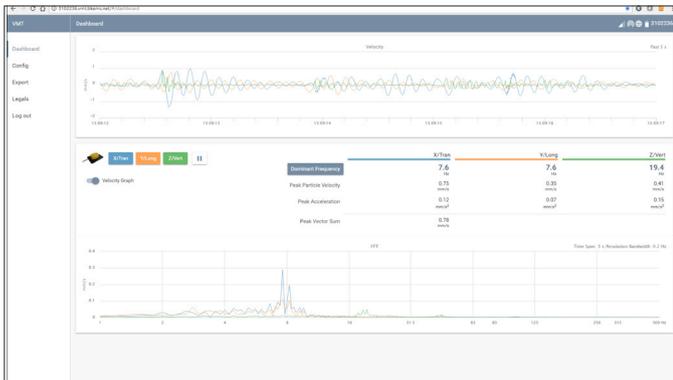


STAND-ALONE OPERATION

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®.



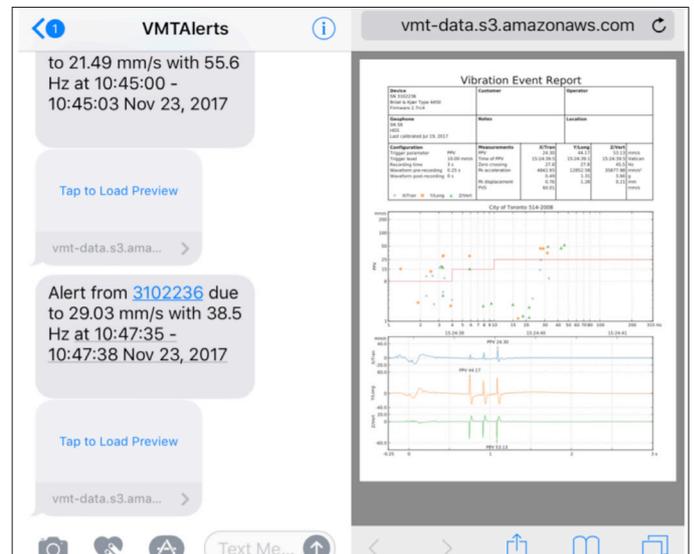
The VMT may be setup using either Bluetooth, wi-fi or cellular connection to the unit from any web browser on a PC, laptop or smart device. The built in web server provides easy to use configuration profiles to set-up including measurement indices, reporting formats optimized to several standards, and 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. Real-time data can be viewed updated every second. A wide range of measurement weightings can be selected depending on the measurement standard chosen.

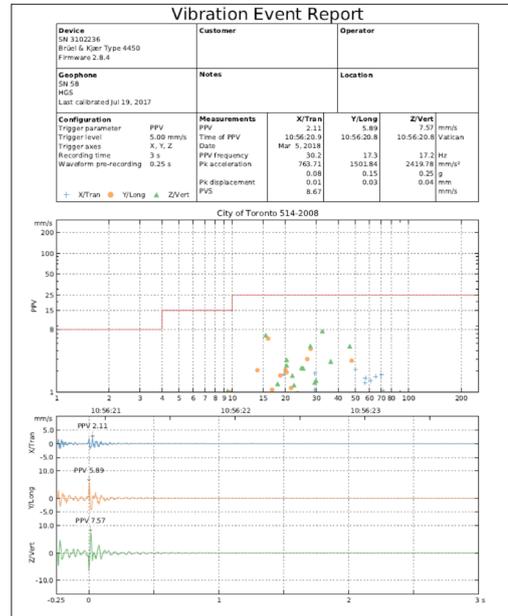
Vibration events occur when vibration level exceed defined limits. Limits are easily set within the browser using a simple threshold on any parameter or compliant with DIN 4150-3. Any or all axes of measurement can be set to trigger an event. When triggered the VMT automatically records the waveform 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.



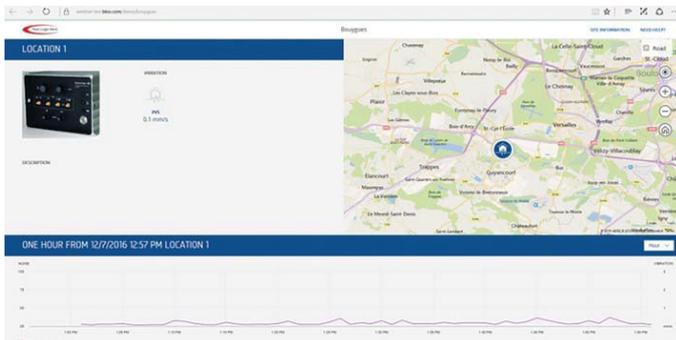
The unit has sufficient memory for storing at least a full year (365 days) of all vibration measurements, alerts, data and recordings. All data is available for reporting and further analysis. The required data set can be selected in the browser and downloaded directly from the VMT. VRMS in 1/3rd octaves 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 Brüel & Kjær's 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.



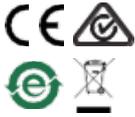
Vibration alerts are generated within seconds of them occurring and visualized and disseminated by Sentinel. The VMT can be set up with different alert trigger levels for different times of the day, and the reports contain sufficient detail for reporting and cause investigation.

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 **60950-1**: Safety requirements for information technology equipment

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 +53°C (-4 to 127°F)

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

Humidity up to 100%

MECHANICAL

Non-operating:

IEC 60068-2-6: Vibration: 0.15 mm, 20 m/s², 10 – 500 Hz

IEC 60068-2-27: Shock: 500 m/s²

IEC 60068-2-29: Bump: 1000 bumps at 150 m/s²

ENCLOSURE

IEC 60529: Protection provided by enclosures: IP 67

COMMUNICATIONS CERTIFICATION

EU RED Directive 2014/53/EU, FCC, ASA/CA S042, Peru (MTC), Anatel, WPC (India), TRCSL (Sri Lanka), CRC (Colombia), CTT (Macau)

SPECIFICATIONS – VMT TYPE 3680 (VERSION 3.2 S/W, VERSION 1 & 2 H/W)

SENSOR

Triaxial geophone , optional blast overpressure microphone AU-8381

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 Parts 1, 2 & 4, 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 2631-4 Wd Wb, ISO 2631-1 Wd Wk, ISO 2631-2 Wm, RAW (linear 0.1-400 Hz)

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 ksp/s

Measurement quantities:

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

Compliance Curves²:

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

Operating Modes

- **Broad-band batch mode:** batch communications every 15 minutes, broadband measurements only
- **Full Power mode:** all measurement data, continuous streaming communications

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

- 256GB of data storage. Retention duration depends on whether blast overpressure is enabled. For vibration only, 365 days of all vibration measurements, alerts and data
- Diagnostics, battery-life, temperature, wireless signal strength, uptime, unit health

²Other compliance curves are being added to future updates

*All temperatures are indicated in shade

SPECIFICATIONS – VMT TYPE 3680 (VERSION 3.2 S/W, VERSION 1 & 2 H/W)

INSTRUMENT DISPLAY

- Battery OK
- Communications OK
- Logging OK

Web server - Remote access, display and download

Real-time Dashboard updated every second, subject to sufficient communication network bandwidth

- 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

Poor communications bandwidth interface

- Enables faster interface with slow communications link
- Automatic change to a simpler interface with slow link information provided to the user

CONNECTIONS

- Geophone/Blast Overpressure Microphone
- External 4G antenna
- External GPS antenna
- Mains power

PHYSICAL

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

Weight: Without geophone:

Hardware Version 1: 9.0 kg (19.8 lb)

Hardware Version 2: 8.3 kg (17.6 lb)

Geophone: 0.80 kg (1.77lb)

ENVIRONMENTAL

- Water- and dust-proof to IP 67
- Integrated LiFePO4 battery

Version 2 Hardware:

- 18 hour battery backup in Broad-band Batch mode (5.4 W)
- 8 hour battery backup in Full Power mode (11.5 W)

Version 1 Hardware:

- 15 hour battery backup in Broad-band Batch mode (6.1 W)
- 7 hour battery backup in Full Power mode (12.4 W)
- Recommended to store at room temperature

Mains Power: 90 – 264 VAC

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

- With Battery: –20 to +53°C (–4 to +127°F)
- With Power Supply Plugged In: –20 to +53°C (–4 to +127°F)

ORDERING INFORMATION

Type AU-3680-A Vibration Monitoring Terminal
(Europe)

Type AU-3680-B Vibration Monitoring Terminal
(Americas)

Type AU-3680-C Vibration Monitoring Terminal
(Asia-Pacific)

Type 3680 includes the following:

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

* Items not included in 3680-X-WOA variants (X is A, B or C)

SEPARATE ACCESSORIES AND COMPONENTS

- Type AU-7871** Sentinel, Web-based subscription service for continuous, real-time monitoring and compliance management
- AU-ZG-0876** Power Supply for EU, 90 – 264 VAC, IP 67, SB107-DK3A (M) to JP-0304, 16 VDC / 4A
- AU-ZG-0878** Power Supply for US, 90 – 264 VAC, IP 67, NEMA 5-15 (M) to JP-0304, 16VDC / 4A
- AU-ZG-0875** Power Supply for AU, 90 – 264 VAC, IP 67, SAA-3 (M) to JP-0304, 16VDC / 4A
- AU-ZG-0877** Power Supply for GB, 90 – 264 VAC, IP 67, BS 1363A (M) to JP-0304, 16VDC / 4A
- AU-UI-0183** Geophone wall mount
- AU-UI-0185** Drill Template for Geophone Wall Mount
- AU-8381** Blast Overpressure Monitoring Microphone
- AU-UA-0006** Blast Overpressure 1.5 m Tripod with Microphone Mount
- AU-AO-0826-D-100** 10m Geophone Extension Cable
- AU-AO-0826-D-030** 3m Geophone Extension Cable

Modifications for older hardware:

- AU-4450-MOD** 4450 Blast Overpressure Hardware Upgrade, done at service centre
- AU-4450-x-HM1** Upgrade of Vibration Analyzer Power Distribution Hardware

Solar panels, larger antennas and power control units are also available. Contact your EMS Brüel & Kjær sales representative for more information

SERVICES

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

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