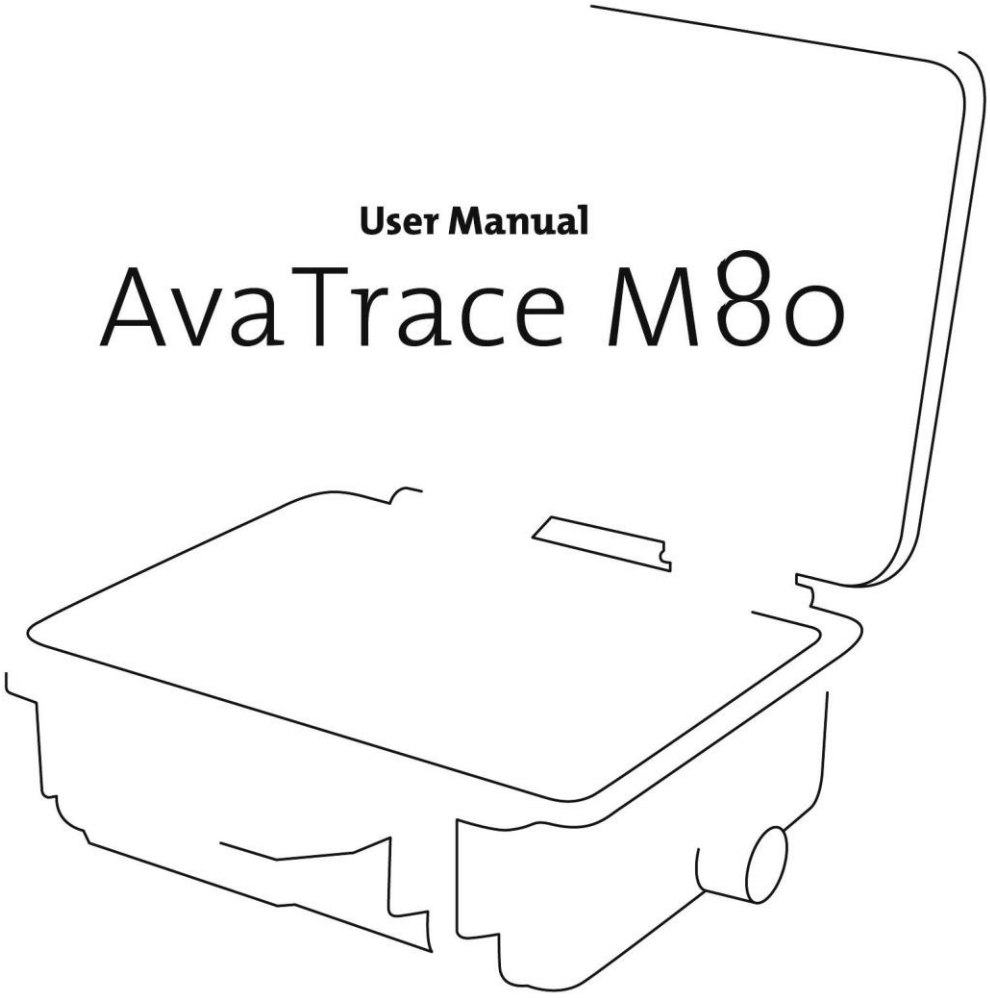
User Manual

AvaTrace M8o



AVA MONITORING®
simpler measurement, automatically

Important Information

The AvaTrace M80 is a sensitive electronic instrument. Every care has been taken to provide you with a robust instrument for use in the field. However, it contains sensitive components and must be handled with care. AvaTrace M80 is resilient to electromagnetic interference and approved for industrial environments, but care must be taken when the instrument is in the vicinity of heavy machinery, transformers, radio transmitters or other sources of severe electromagnetic interference.

Hereby, AVA Monitoring AB declares that the AvaTrace M80 is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address:

http://www.avamonitoring.com/compliance/ce

Moreover, AVA Monitoring AB declares that the AvaTrace M80 has been constructed so that it can operate in all European Union member states without any restrictions of use (Articles 10.2 and 10.10).

Please note that the product variant AvaTrace M80-NA is intended for the North American market and is **not** approved for use within the European Union.

The AvaTrace M80-NA variant complies with the Canadian ICES-003 class B emission limits and the Canadian RSS-102 radiation exposure limits for an uncontrolled environment. The instrument should be installed and operated with a minimum distance of 20 cm from users and bystanders.

La variante AvaTrace M80-NA est conforme aux spécifications de les réglementations ICES-003 classe B et RSS-102 du Canada. Cet équipement doit être installé et mis en fonctionnement à une distance minimale de 20 cm de l'utilisateur et des personnes qui l'entourent.

Contents

1. How to Read This Manual

1.1 Symbols

CAUTION

Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

NOTE

Indicates information considered important but not hazard related, e.g. a situation that, if not avoided, could damage equipment or cause equipment malfunction or loss of data.

SENSITIVE COMPONENTS

Indicates the presence of components sensitive to electrostatic discharge. Handling precautions are required in order to avoid equipment damage or malfunction.

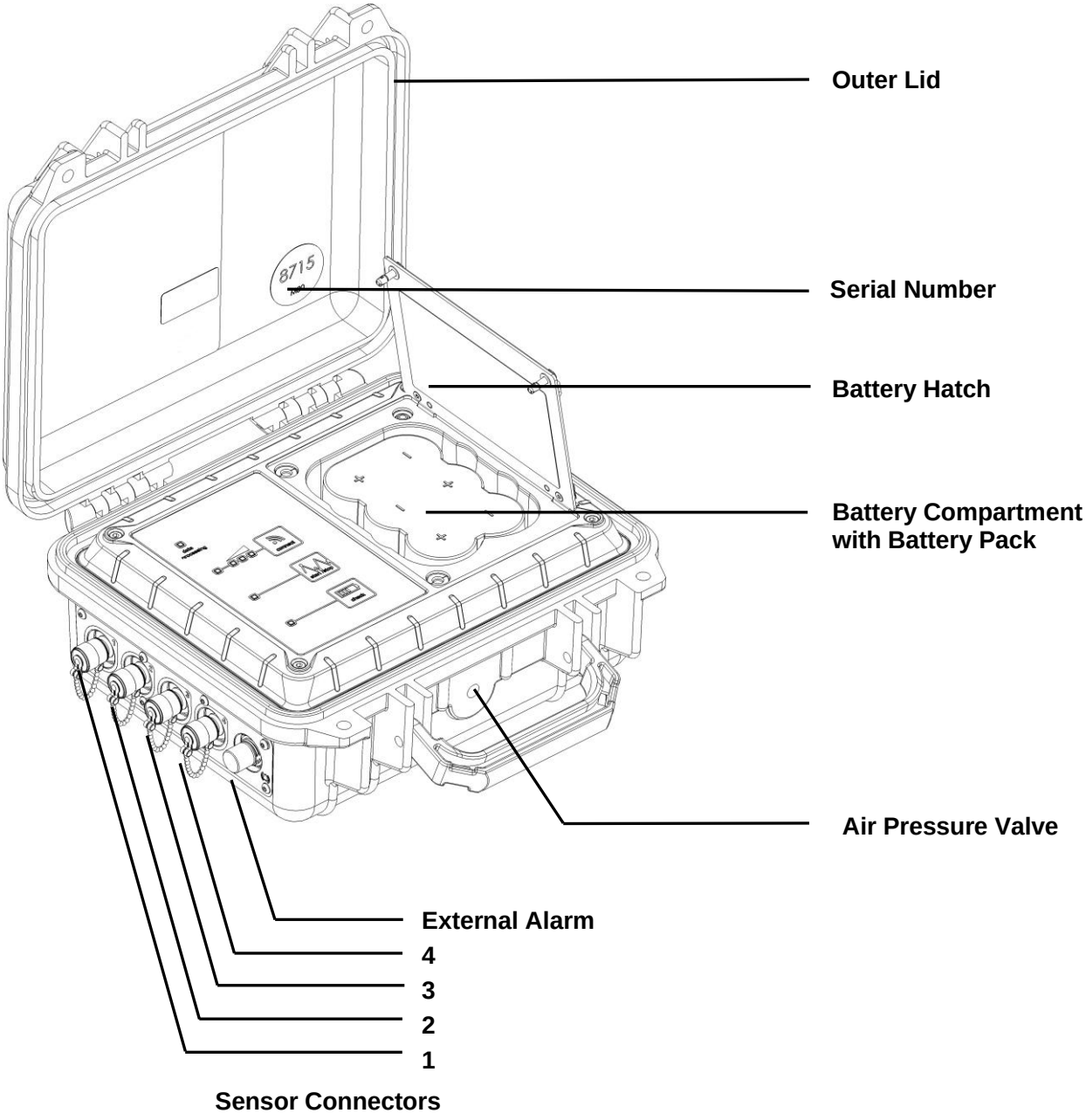
1.2 Further Information

For more information about our products please visit the AVA Monitoring Support Site where you can find tutorial videos, answers to frequently asked questions as well as technical specifications and guides.

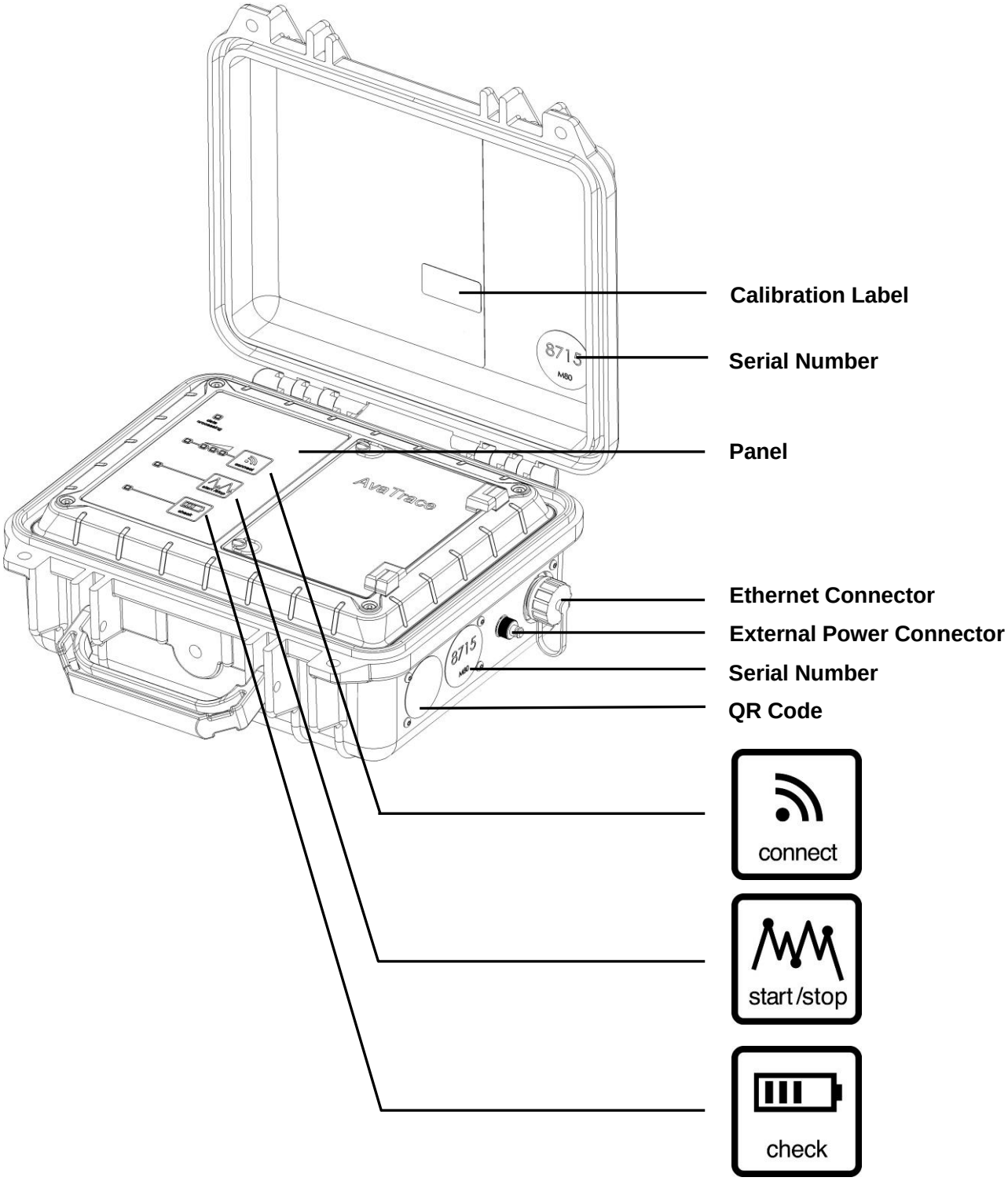
http://avamonitoring.com/support

2. Instrument Overview

Overview Left Hand Side



Overview Right Hand Side



3. First Time Setup

First unpack the AvaTrace M80 and its accessories. Make sure that the instrument has not been damaged during transport. Insert batteries as described in 8.1 Install or Replace Batteries.

The AvaTrace M80 has mobile connectivity enabled by default and no SIM card is necessary. However, if a special subscription is needed, a SIM card can be installed in the instrument by an authorized service representative. In that case, please contact support for further help.

Your AvaTrace M80 is now ready to be used.

4. Systems Overview

4.1 AvaNet and AvaTrace M80

The AvaTrace M80 is a field instrument for unattended measurement of vibration and airblast overpressure. Combined with AvaNet and the accompanying sensors, it provides a complete measuring system.

The AvaTrace M80 has a simple panel where AvaNet connection can be initiated and measurements can be started and stopped. However, all instrument settings for communication and measurement are made in AvaNet. There, you also get information about the status of the instrument. The instrument settings are transferred to the AvaTrace M80 every time the instrument is connected to AvaNet.

When measurement is started, the instrument continuously collects measurement data according to the configured settings. The collected data is transferred to AvaNet where it is saved. The measurement data is then immediately available for the user.

4.2 Measuring Channels and Measuring Points

The AvaTrace M80 is equipped with four external and independent channels with individual filter and sensor configuration. In addition to these channels, the AvaTrace M80 is equipped with internal measuring channels for the instrument temperature and instrument battery voltage. These channels cannot be configured in the same way as the external channels, but can be connected to measuring points and alarm groups.

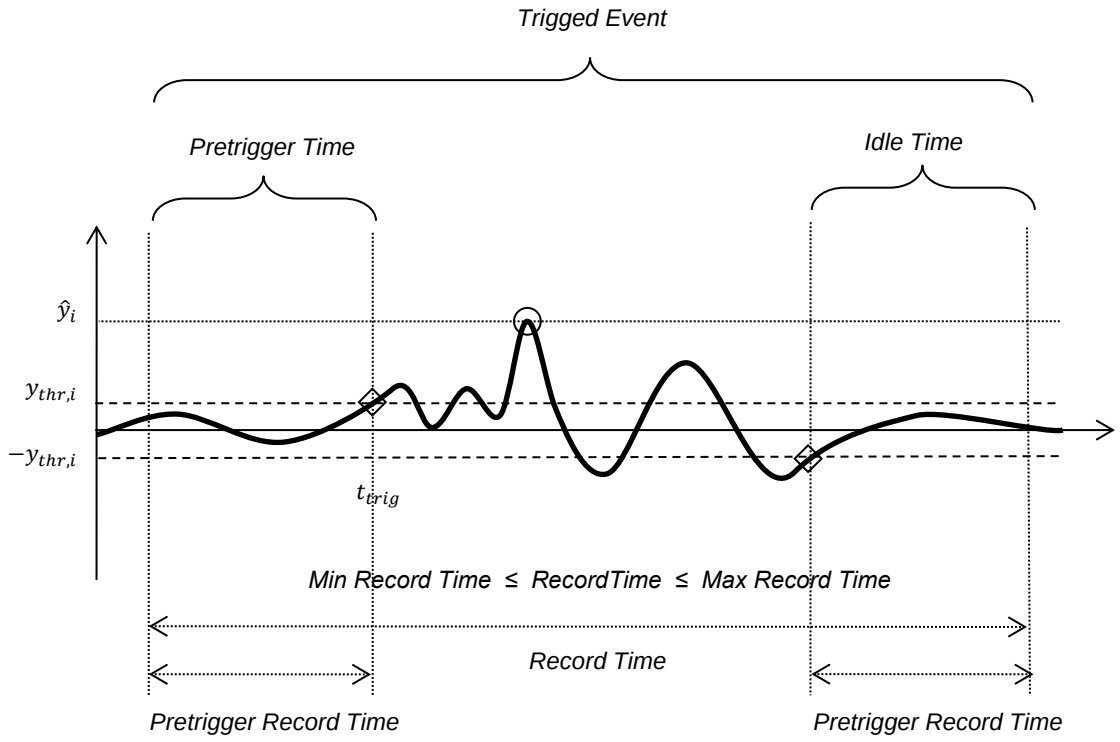
In AvaNet the instrument channels are connected to measuring points. A measuring point in AvaNet is tied to a physical measuring point in the field, not to a specific instrument or sensor. When measurement values are transferred to AvaNet, they are saved not only in the instrument measuring channels but also in the measuring points connected to the channels. This means that the measuring points can be easily connected to a new instrument seamlessly if a problem should occur without loss of earlier measurement values.

In addition to the collected measurement values, AvaNet also saves metadata that identifies the instrument, channel and sensor used for the measurement. This gives great traceability for each measurement value in the measuring point, if instruments or sensors are replaced during the course of the project.

4.3 Measurement, Triggering and Waveforms

4.3.1 Triggering

During triggered measurement, AvaTrace M80 continuously monitors the filtered measurement values for all active channels. Triggering occurs when the absolute value of the signal reaches or exceeds the configured trigger level on at least one of the channels.



Triggered Measurement

When triggering occurs, a trigged event is generated and peak values are recorded for all active channels. The trigged event includes pretrigger data recorded before the triggering occurred. The trigged event ends when the measurement values have stayed below the trigger level on all channels for a specified time. This is the same as the pretrigger time and is configurable.

The trigged event duration is also limited by a configurable maximum and minimum duration. If the maximum duration is reached a new event is automatically generated immediately following the previous event.

Trigged events never overlap. The idle time of trigged events can be reduced to preserve the pretrigger section of the following trigged event. However, trigged events are never shorter than the minimum duration.

A peak value is recorded for each active channel. This value is the highest absolute value of the filtered signal during the trig event. The peak values from different channels need not coincide in time, but they are all recorded with the same timestamp showing the time that the triggering occurred.

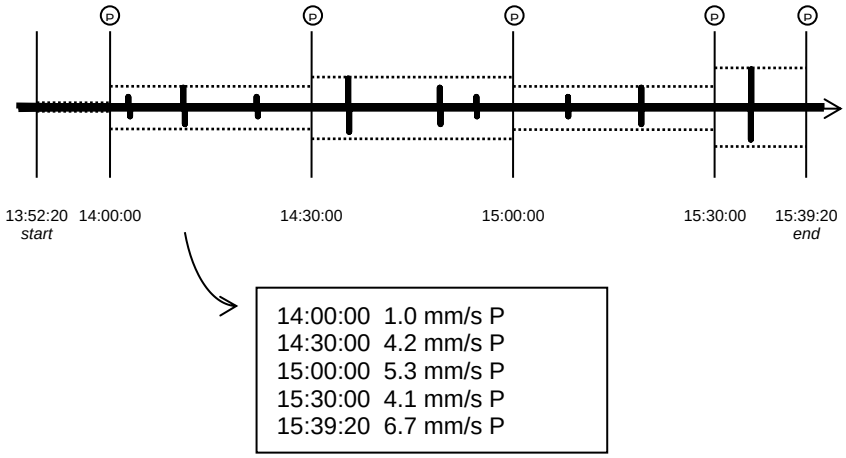
4.3.2 Waveform Recording

For each trigged event, waveforms are recorded for all active channels with either filtered or raw signals from each channel. Waveform recording is limited by the size of the instrument's recording buffers. In some cases waveforms might not be recorded or may be truncated to only contain a part of the trigged event. This limit does not affect the instrument's ability to record and generate trigged measurement values.

4.3.3 Periodic Measurement

During periodic measurement, the measurement period, the time from the start to the end of measurement, is divided into intervals according to the specified storage interval. Time intervals are aligned so that measurement records are generated at even hour or minute times, e.g. at the

turn of each hour. The first and last intervals are therefore usually shorter than the specified storage interval. After each interval, a periodic measurement value is generated containing the highest measurement value for each active channel during the entire time interval. In AvaNet, periodic measurement values are marked with the letter “P”.



Periodic Measurement

4.3.4 Frequency Dependent Triggering

With frequency-dependent triggering, the trigger level depends on the dominant frequency of the recorded vibration around each local maximum or minimum. The AvaTrace M80 estimates the dominant frequency from the zero crossing rate (*zero-crossing frequency*) which is calculated following each zero crossing. The time between two consecutive zero crossings is assumed to correspond to approximately half a period of the dominant frequency.

The frequency dependent trigger level is a piecewise linear function defined by a set of breakpoints in the amplitude-frequency plane (see figure below). The frequency dependent trigger level must be defined so that the trigger level increases with increasing frequency. The trigger level does not have to be strictly monotonous. It may be defined so that it is piecewise constant.

Two breakpoints may be defined at the same frequency (producing a vertical step). In this case, the lower trigger level is applied at the breakpoint frequency.

The trigger level of the first breakpoint is applied for all frequencies below the first breakpoint. The trigger level of the last breakpoint is applied for all frequencies above the last breakpoint.

With frequency-dependent triggering, the trigger event is not always triggered immediately when the signal reaches or exceeds the trigger level, since the trigger level depends on the frequency which is not known in advance. Instead, the event is triggered as soon as it can be established that the signal has reached or exceeded the trigger level at least once since the previous zero crossing. This can be determined at the latest at the following zero crossing.

4.4 Modes, Sensors and Filter Profiles

Mode can be used to quickly set some of the measurement settings to predefined values, such as the storage interval. It also limits the availability of options for other settings such as the filter profile. There are a number of different filter profiles to choose from for each mode.

Measurement is normally performed according to a measurement standard and the selection of filter profile is determined by the choice of measurement standard. A correct combination of sensor type and filter profile is essential in order to ensure that the measuring system fulfils the requirements of the selected measurement standard.

It is very important that the correct filter profile and sensor type are selected before measurement is started so that the measurement is performed according to the desired standard.

When mode is set to “adapted mode” the instrument can be configured with more flexibility, but with less guidance.

When measurement settings are configured, you must first select the correct mode and then select sensor type and finally the correct filter profile. When setting up an instrument using the guide for new measuring points these settings will normally be set to suitable values based on the selections made. It is recommended to always verify the instrument settings when changes have been made.

4.5 Communication

The AvaTrace M80 communicates with AvaNet via the Internet. The instrument is either connected to AvaNet using a mobile network (3G or GPRS) or using the Ethernet port. When using Ethernet there are many different solutions to choose from in order to provide Internet access, for example using a direct connection to a fixed network or using an external mobile router with support for other types of mobile networks.

The AvaTrace M80 is normally configured to connect to AvaNet at regular intervals according to a preconfigured connection schedule as long as measurement is turned on. The instrument can also be configured so that it connects to AvaNet when a trigger level has been reached or when the start/stop button is used to start or stop the measurement. The instrument always connects to AvaNet when the connect button is pressed.

If a problem occurs while the instrument tries to connect to AvaNet new attempts are made automatically. In the event of repeated problems the attempts are made less frequently to save the batteries. Only a limited number of attempts will be made and if the problems persist, the instrument eventually returns to its normal connection schedule.

The instrument is usually connected to AvaNet until all instrument settings and all data requested by AvaNet are transferred. The selection of collected measurement data that is automatically transferred to AvaNet is determined through a number of settings in the instrument panel under the Transfer tab.

It is also possible to disable automatic disconnect in order to keep the AvaTrace M80 connected for a longer period even though there is no new data to communicate. This can be useful if you want to interact directly with the instrument, for example if you want to examine the effects of different settings in real time. The maximum connection time is then ignored. However, the instrument cannot be connected for longer than approximately two hours at a time. It is important not to forget to reset the auto disconnect setting when you are done or the instrument will quickly discharge the batteries.

4.6 Data Storage

The AvaTrace M80 uses circular buffers for data storage. Separate buffers are used for

- trigged measurement data
- periodic measurement data
- environment measurement data (internal sensors)
- event log records.

When a buffer is full (for any type of data listed above) the oldest recorded data is replaced by new data. This ensures that you can always record new data without having to reset the instrument or otherwise free up resources.

The size of storage buffers are designed so that, in normal operation, no data is overwritten before it has been transferred to AvaNet. For example, if you measure vibration levels with a triaxial geophone and the instrument triggers five times a day, recording 30 seconds of filtered data from all channels each time, the AvaTrace M80 will record waveforms for more than one month without overwriting any waveform data. It will also be able to record peak and periodic values for several months.

During normal operation, the AvaTrace M80 automatically transfers data regularly to AvaNet according to your settings. When data has been transferred to AvaNet, it is stored reliably and will not be overwritten or deleted unintentionally.

AvaNet may limit the amount of data transferred in case the AvaTrace M80 has been configured incorrectly and generates excessive amounts of data. In these rare cases waveform transfers are temporarily suspended but other data is transferred as usual.

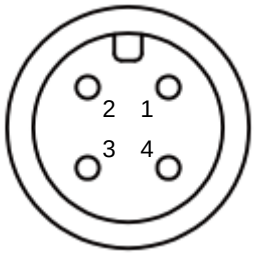
Waveform storage	Up to 14400 seconds of filtered waveforms or 7200 seconds of raw waveforms.
Number of periodic measurement records (*each record contains data for all four channels*)	4000
Number of trigged measurement records (*each record contains data for all four channels*)	1000

AvaTrace M80 Data Storage Limitations

4.7 External Alarms

The AvaTrace M80 is equipped with an external alarm port with two signal pairs that can be used to connect external alarm equipment such as a siren or a warning light.

The two signal pairs are galvanically isolated from each other and from other parts of the instrument hardware. Alarm equipment connected to the AvaTrace M80 must use its own power supply.



External Alarm Port Connector Pinout

The external alarm port is an IEC 61076-2 M12 A-code male 4 pin connector. Pins 1 and 2 are used for signal pair 1. Pins 3 and 4 are used for signal pair 2.

⚠ NOTE

In order to avoid electromagnetic interference, do not connect the external alarm port metal shell to any part of the external equipment.

⚠ CAUTION

The external alarm port is only intended to be connected to a SELV system (separated extra-low voltage system) with an external insulation of at least 1500 VAC rms. To prevent damage to the remote alarm port, make sure the signal input never exceeds the maximum ratings of 24 VDC and 500 mA.

The signal pairs are normally open which means that no current is allowed to pass. However, when an external alarm is generated, the signal pairs are closed, allowing a current to pass so that the connected equipment is activated.

An external alarm is generated when the measurement is turned on, the external alarm function is enabled and the signal reaches the alarm levels specified in the External Alarm Settings tab in the instrument panel. Alarm level 1 is used for signal pair 1. Alarm level 2 is used for signal pair 2. External alarms for the two signal pairs are generated independently.

The minimum duration of an external alarm can be configured using the External Alarm Settings tab in the instrument panel.

4.8 Power Supply

The AvaTrace M80 is normally powered by six alkaline, 1.5V, LR20/D-cell batteries, but can also be connected to an external power supply unit. When the AvaTrace M80 is operated using batteries we strongly recommend that you use premium batteries intended for high power drain. Otherwise the battery time can be significantly shortened.

The AvaTrace M80 reports for how long the batteries have been in operation and displays the operating time along with the battery voltage level in the AvaNet instrument panel. The operating time is reset automatically at battery replacement. The battery operating time counter and the battery voltage level, which decreases slowly as the batteries are discharged, gives you a good basis for determining when batteries need to be replaced.

Battery life depends on a number of factors including how often the instrument is connected to AvaNet, the prevailing radio conditions at the location, the amount of data transferred to AvaNet and the ambient temperature.

When the AvaTrace M80 is operated with external power, one of the following power supply units shall be used, in order to ensure user safety and correct operation:

- XP Power AEL15US09 (*EU/EES/Switzerland/Canada*)
- Mean Well GST25A09-P1J (*Australia*)

Please note that these power supply units are designed for indoor use only. Please refer to the technical specifications for detailed information about operating conditions.

When the instrument is connected to an external power supply unit it should still be equipped with batteries to avoid problems in the event of power failure.

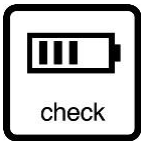
4.9 Buttons and Indicators

The buttons are used to wake the unit, connect to AvaNet, start/stop measurement and to check the battery status. The indicators display the current connection status, measurement status and battery status.

4.9.1 Buttons

A short press on the button is used to request connection to AvaNet. A long press on the button (more than 5 seconds) is used to request activation of the unit's CLI interface.

Starts or stops measurement on all active channels. To start measurement, press the button briefly. To stop the measurement, the button must be pressed for at least 5 seconds.



Used to check the battery voltage status. The result is indicated by the battery status indicator (see below and section 8.1 for detailed information).

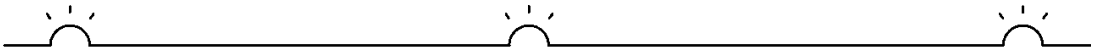
4.9.2 Indicators

Connection status

The indicator at the far left of the “connect” button displays the current AvaNet connection status.

LIGHT

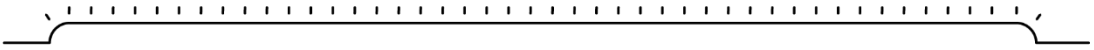
on
off



A slow flashing indicator indicates that connection is in progress.

LIGHT

on
off



A continuous light indicates that the unit is connected to AvaNet or that the CLI port is activated. Note that the duration of the AvaNet connection can vary significantly, from a fraction of a second to several minutes.

LIGHT

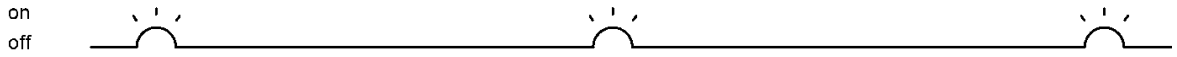
on
off

If the AvaNet connection fails or is terminated in an uncontrolled way, this will be indicated by fast flashing for 30 seconds.

Measurement status

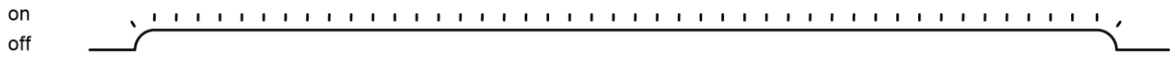
The indicator at the left side of the “start/stop” button displays the current measurement status.

LIGHT



Slow flashing indicates that measurement is in normal progress.

LIGHT

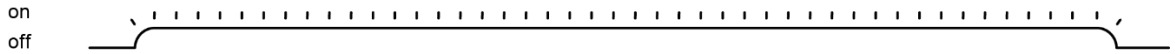


Waveform recording is indicated by a continuous light for the entire record duration.

LIGHT

Fast flashing indicates that a fault has been detected during the self-test. See more information about the fault in AvaNet.

LIGHT



A continuous light occurs during the self-test procedure until measurement starts or is resumed.

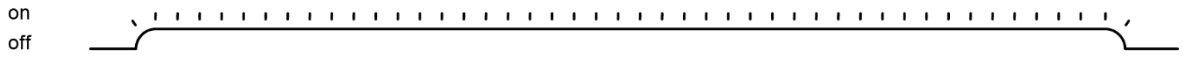
LIGHT

Intermittent flashing indicates that measurement is active but triggering or waveform recording cannot currently be performed.

Battery status

When using the “check” button, the current battery status is displayed during 10 seconds.

LIGHT



A continuous light indicates that the battery voltage level is OK.

LIGHT

Fast flashing indicates that the voltage level is insufficient and the battery pack should be replaced.

LIGHT

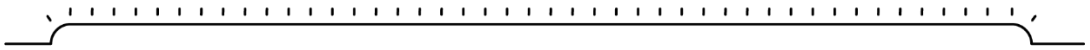
Intermittent flashing indicates that the voltage level is very low or the battery pack is disconnected so that no data processing can be performed. The battery pack must be replaced as soon as possible.

Data processing

The “data processing” indicator displays the current status of the data processor.

LIGHT

on
off



A continuous light indicates that data processing is in progress. (Do not unplug the battery pack.)

LIGHT

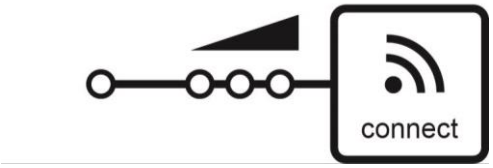
on
off

Intermittent flashing indicates that data cannot be processed due to insufficient power supply. The battery pack should be replaced.

NOTE

Never remove the battery pack when the data processing indicator is lit.

Signal strength



The three indicators directly to the left of the “connect” button displays the current signal strength when connecting using the mobile network. The signal strength is indicated as long as the connection is established.

A continuous light with:

- three indicators lit indicates *very good signal strength*.
- two indicators lit indicates *good signal strength*.
- one indicator lit indicates *moderate signal strength*.

Fast flashing with one indicator, indicates no or insufficient signal.

Other indications

- All indicators will be lit continuously when the unit wakes from power off. The indicators return to normal mode when the unit has been initialized.
- The data processing and battery status indicators are lit continuously during software upgrade.
- Fast flashing with all indicators for a period of 30 seconds indicates that a serious fault has been detected. Should this occur, please contact your local support.

5. Basic Operation

5.1 Prepare in AvaNet

Before the AvaTrace M80 can be used in a project, it must be configured and connected to measuring points in the project. This is done using AvaNet, which is a web application. The easiest way to do this is to create a new project in the project overview and then follow the guide. Please refer to the AVA Monitoring Support Web Site for more details (e.g. details explained in the tutorial videos and the FAQ).

Make sure that all settings are transferred to the instrument by connecting the AvaTrace M80 to AvaNet using the connect button. Wait until the connection status indicator has been turned off. Check the instrument panel in AvaNet to make sure that no settings are marked red or yellow before installing the instrument on site.

5.2 On-site Installation

1. Mount sensors and connect them to the AvaTrace M80.

2. Press “start/stop”. The AvaTrace M80 performs a self-test on all active geophone channels and starts measuring. The measurement indicator will now flash slowly. *Fast flashing indicates self-test failure. Check AvaNet for more information about the detected problems.*

In event of self-test problems, a new self-test can be performed when the problem has been resolved by stopping and restarting the measurement using the start/stop button. This step is not mandatory but is recommended in order to make sure that the problem has been resolved.

5.3 Forced AvaNet Connection

To force a connection to AvaNet. Performed when needed.

1. Connect by pressing the connect button.

2. The connection status indicator first flashes slowly during connection establishment and is then permanently lit during the period of time when the connection is established. Note that the time that the indicator is permanently lit varies from a fraction of a second to several minutes.

If connection fails, the connection indicator will fast flash for 30 seconds. If connection fails repeatedly, try moving the AvaTrace M80 a few meters. In many cases this can enhance the reception of the signals from the mobile network. Large objects close to the AvaTrace M80 can also reduce the mobile signal.

5.4 Stop Measurement

1. Press the start/stop button for more than 5 seconds until the measurement status indicator is turned off.

2. Disconnect the sensors from the AvaTrace M80.

The measurement can also be stopped from AvaNet by unchecking the checkbox Sampling. The measurement will be stopped the next time the instrument connects to AvaNet.

6. Configuration of AvaTrace M80 via AvaNet

6.1 AvaNet Instrument Panel

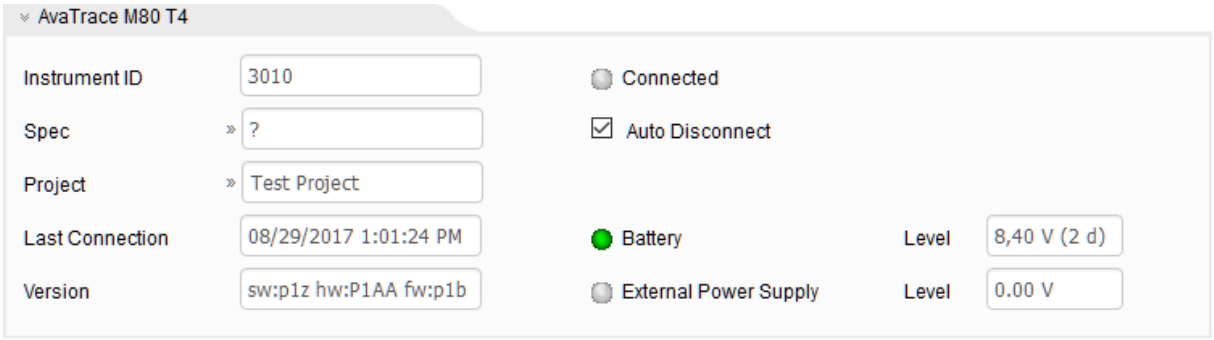
The AvaNet instrument panel is the central point for all the instrument settings and at the same time gives you a good overview of the instrument status. The instrument panel is divided into a number of tabs that can be expanded and collapsed by clicking the headings in order to get a better overview.

To change a value click the double arrow (») next to the field you want to change, edit the field and then confirm the change by clicking the green tick symbol. If the setting has to be transferred to the instrument, the field will be highlighted in yellow to indicate that the setting has been updated but not yet been sent to the instrument.

The information in the instrument panel is automatically updated every 15 seconds so there is no need to manually refresh the page when the instrument is connected to AvaNet.

Like everything else in AvaNet, the instrument panel is controlled by the user rights. Most changes can only be carried out by project administrators. The user rights also determine the contents of the instrument panel. Some of the fields are not visible for all users.

6.1.1 Main Settings



Example of AvaNet Main Settings

AvaTrace M80 T4
The title of the main settings panel is the instrument type and variant.

Instrument ID
The unique identifier for this instrument.

Spec
Free-form text field for any kind of information related to the instrument.

Project
The project where the instrument is currently used.

Last Connection
The time and date of the last connection to AvaNet.

Version
The current software, hardware and firmware version of the instrument.

Connected
This indicator is green when the instrument is connected to AvaNet.

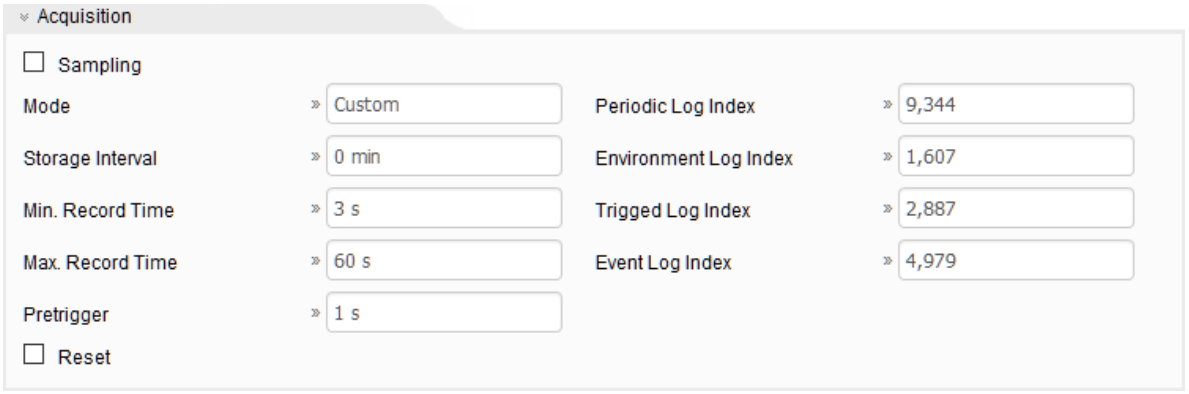
Auto Disconnect
When this option is selected the instrument will be disconnected from AvaNet as soon as measurement values and settings have been transferred. Otherwise, the instrument will be

connected for as long as possible. This option is normally enabled since otherwise batteries are discharged quickly. This is used when you wish to keep the instrument online to make settings more interactively.

Battery
Current battery level and number of days the battery pack has been used. This indicator is green when the battery is used to power the instrument.

External Power Supply
Current external power supply level. This indicator is green when the instrument is connected to an external power supply.

6.1.2 Acquisition Settings



Example of Acquisition Settings

Sampling
Turn measurement on/off.

Mode
The mode field sets other settings such as storage interval to predefined values and limits the set of available options for, for example, filter profile in order to simplify configuration.

Storage Interval
Setting a non-zero storage interval enables periodic measurements. For instance, if the storage interval is set to 1h the instrument will record a peak periodic measurement value for each active channel every hour regardless of the trigger level.

Min. Record Time
Specifies the minimum trigged event duration.

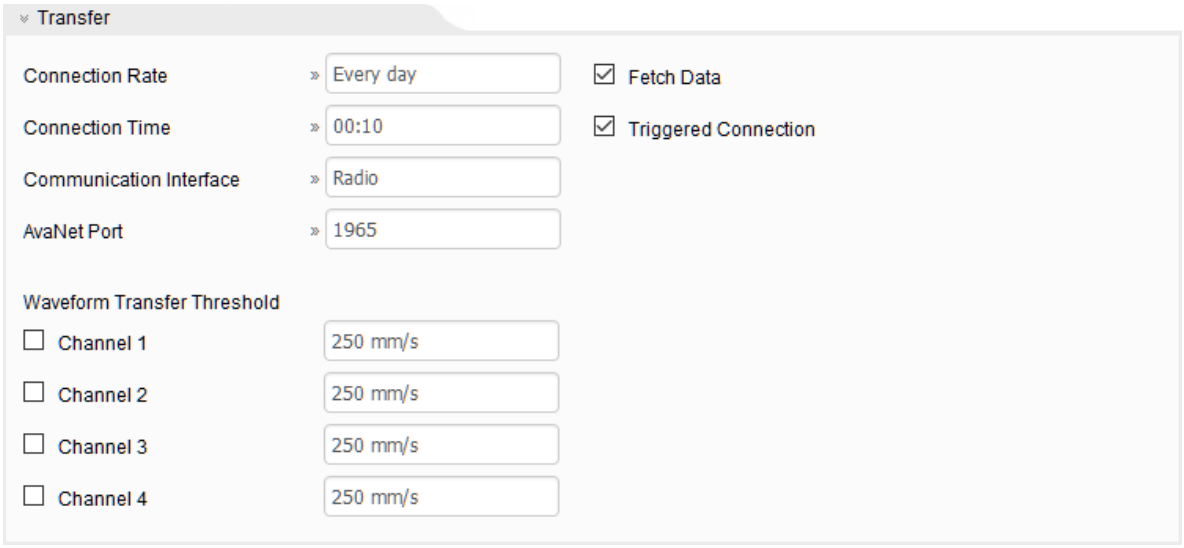
Max. Record Time
Specifies the maximum trigged event duration.

Pretrigger
Specifies the amount of time to be included in the trigged event before the trigger level is reached. Also specifies the time that the signals need to stay below the trigger level before the trigged event ends.

Reset
Remove all recorded values in the instrument.

Log Indices
Counters for the different types of recorded measurement data. These values should not normally be changed.

6.1.3 Transfer Settings



Example of Transfer Settings

Connection Rate
Schedule the interval (e.g. daily, hourly) at which the instrument will connect to AvaNet regardless of triggered connections.

Connection Time
Specifies at what time, within the above set interval, the instrument will connect to AvaNet.

Fetch Data
Set if recorded data (measurement values etc.) should be transferred to AvaNet. Should normally be enabled.

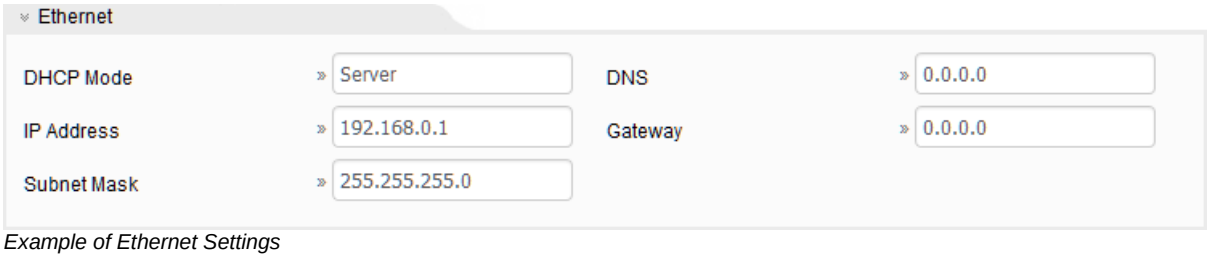
Triggered Connection
Specifies if the instrument should connect to AvaNet when a triggered measurement has been recorded. Should normally be enabled.

Communication Interface
Select if the instrument should connect to AvaNet using GPRS or Ethernet connection. Normally this should be set to GPRS (mobile network).

AvaNet Port
Specifies the AvaNet TCP/IP port used by the instrument during AvaNet connection. This setting should normally not be changed.

Waveform Threshold(s)
Thresholds for automatic waveform transfer for each measurement channel. Check if waveforms should be transferred and the threshold the waveform must exceed to be transferred to AvaNet.

6.1.4 Ethernet Settings



Example of Ethernet Settings

These settings affect how the instrument communicates using Ethernet. They affect both connections to AvaNet and to CLI. These settings should not normally be changed. If the settings are incorrect the instrument will not be able to contact AvaNet.

DHCP Mode
Select if the instrument should act as a DHCP server, DHCP client or not use DHCP at all when communicating over Ethernet.

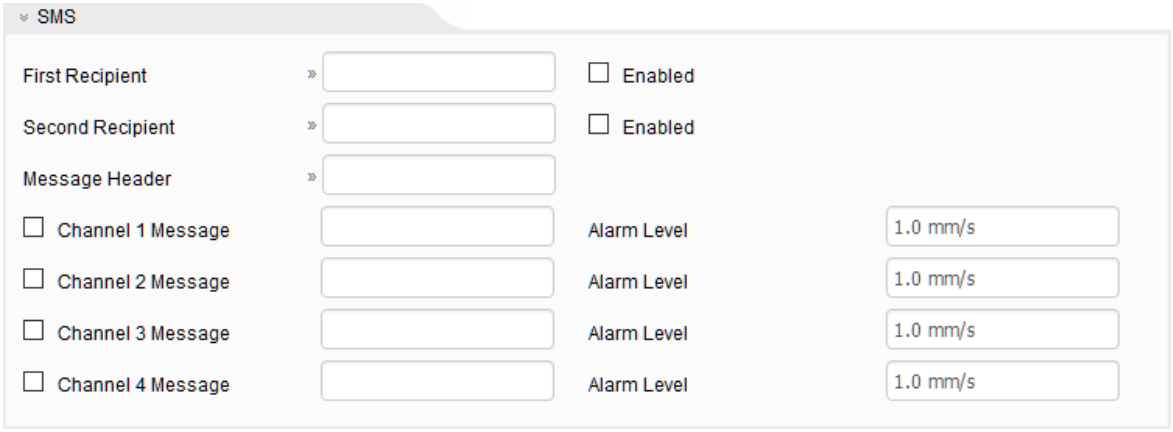
IP Address
Specifies the IP address used by the instrument. Not used in DHCP client mode.

Subnet Mask
Specifies the subnet mask used by the instrument. Not used in DHCP client mode.

DNS
Specifies the IP address of the DNS server. Not used in DHCP client mode.

Gateway
Specifies the default gateway to be used. Only used when DHCP is turned off.

6.1.5 SMS Sender Settings



Example of SMS Sender Settings

These settings affect alarm messages sent directly from the instrument. In some cases this is a simple way to add a few recipients in small projects, but we strongly recommend that you use alarm groups in AvaNet instead.

First/Second Recipient
Telephone numbers to the two SMS recipients. Must include country prefix.

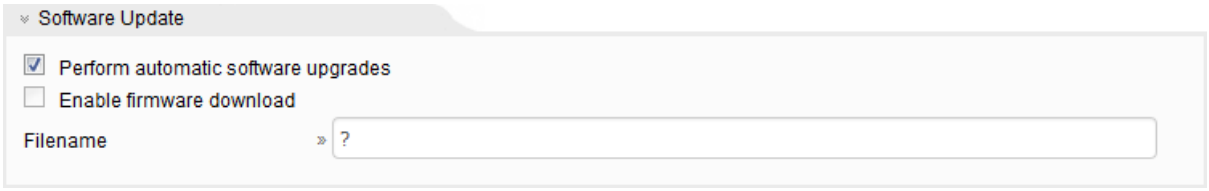
Enabled
The recipient will only receive alarm messages when enabled. Recipients are disabled by default when the instrument is moved to another project.

Message Header
A header text included in each message. The default setting is the project name. Due to the limited number of characters in SMS messages you should keep this brief.

Channel N Message
A text appended to the message for each active channel that emits an alarm. Check if an alarm should be sent for that channel. The default setting is the measuring point name. Due to the limited number of characters in SMS messages you should keep this brief.

Alarm Level
The level for which an alarm is sent. Must be equal to or above trigger level. Only applicable for triggered measurements.

6.1.6 Download Settings



Example of Download Settings

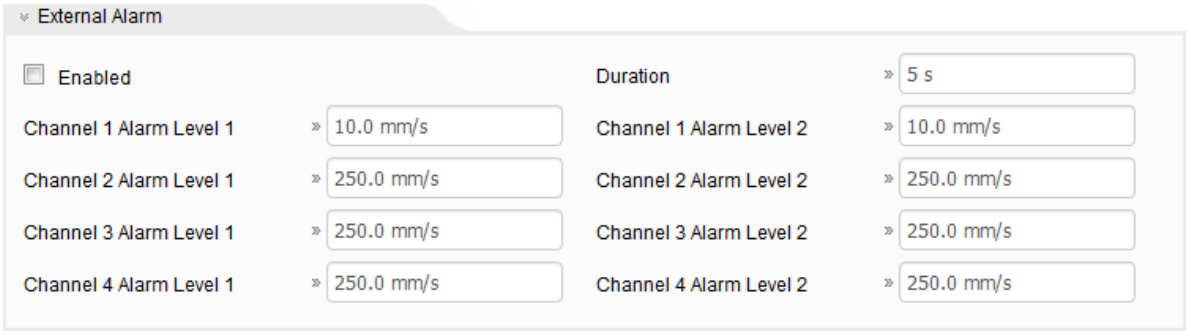
These settings affect the instrument's software and not all settings are available to all users.

Perform automatic software upgrades
If enabled the instrument will automatically download and upgrade to the latest software version as soon as a new version is available. This setting should normally be enabled unless the instrument is used in an especially sensitive project, for instance measuring comfort during both night and day.

Enable firmware download
This setting makes the instrument install the software specified by the given filename the next time the instrument connects to AvaNet.

Filename
URL to the instrument software install package.

6.1.7 External Alarm Settings



Example of External Alarm Settings

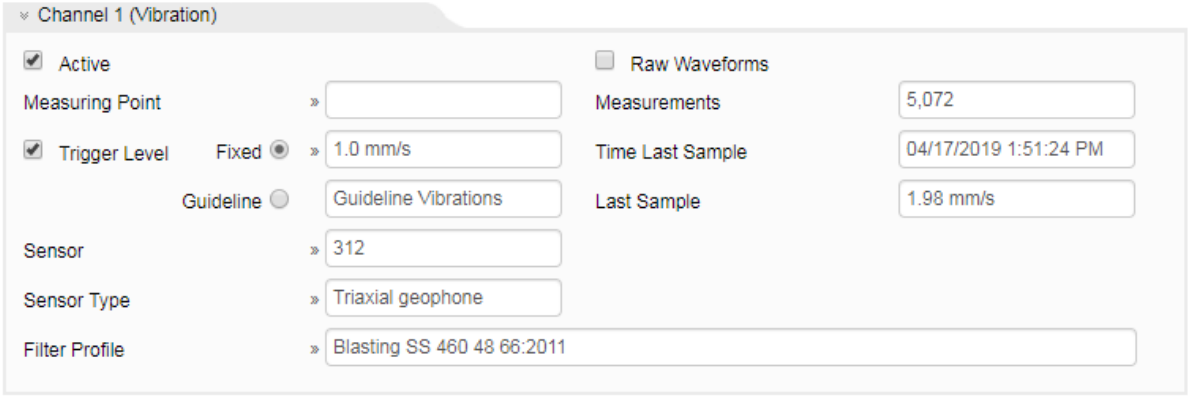
Enabled
If enabled the instrument will trigger the external alarm port.

Duration
The duration for which each alarm level will be triggered when any alarm level criteria has been met.

Channel N Alarm Level 1
The level, for each respective channel, for when the alarm level 1 will be triggered. It will be activated when a triggered measurement reach or exceeds the set level.

Channel N Alarm Level 2
The level, for each respective channel, for when the alarm level 2 will be triggered. It will be activated when a triggered measurement reach or exceeds the set level.

6.1.8 Measurement Channel Settings



Example of Measurement Channel Settings

The AvaTrace M80 has individual settings for each of the instrument's four measuring channels.

Active
Set to enable measurement on this channel.

Raw Waveforms
Set to enable recording of raw waveforms instead of filtered waveforms. Trigged measurement values will still be filtered.

Measuring Point
The measuring point in AvaNet that this instrument channel is connected to.

Measurements
The number of recorded measurements on this instrument channel.

Trigger Level

Set to enable triggering on this channel, based on an either fixed or frequency dependent trigger level. When the signal reaches or exceeds this level, the instrument will record a measurement value and a waveform on all active channels.

Fixed

Used to specify a fixed trigger level.

Guideline

Used to specify a frequency-dependent trigger level based on the specified guideline.

Time Last Sample

The time of the last measurement transferred to AvaNet.

Last Sample

The value of the last measurement transferred to AvaNet.

Sensor

The sensor identifier. Used for traceability. Specified by the user.

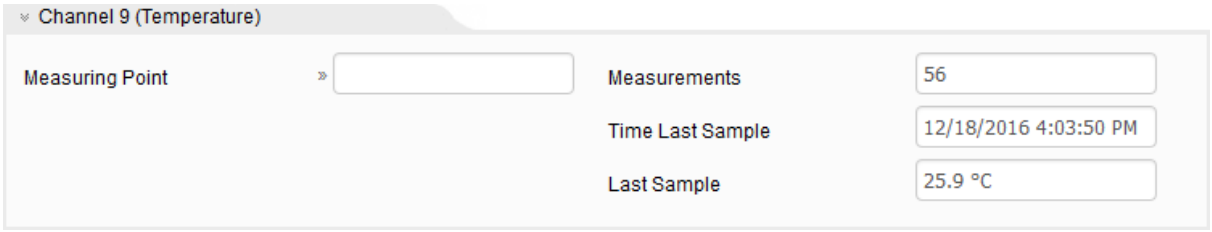
Sensor Type

The type of sensor used. This setting will affect which filter profiles you can use and how measurement is performed in the instrument and it is therefore vital to set the correct type.

Filter Profile

Combined with the sensor type, the filter profile ensures that the measurement system has the correct characteristics for the selected measurement standard.

6.1.9 Internal Measuring Channel Settings



Example of Internal Measurement Channel Settings

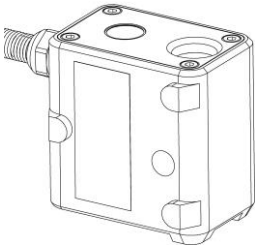
Each AvaTrace M80 comes equipped with five internal measuring channels for temperature and battery voltage. These channels contain fewer fields than the external measuring channels, but those are the same as for the external measuring channels. These channels are always active.

6.2 Log Events

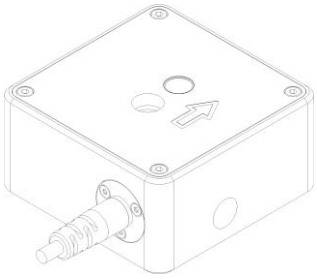
For further information about the instrument, view the instrument's event log. The event log contains among other things information about when the instrument connected to AvaNet, when settings were changed and not least if any problems have occurred. The event log can be accessed by selecting the Log Events menu on the left hand side of the AvaNet instrument panel.

7. Sensors

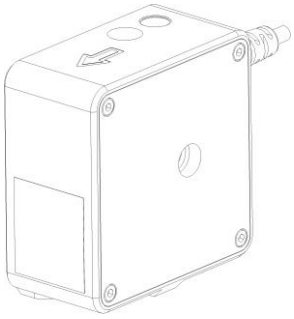
The AvaTrace M80 has a number of supported sensors. Sensors other than those approved by AVA Monitoring cannot be used with the AvaTrace M80. All AvaTrace compatible sensors can be used, for instance the sensors below:



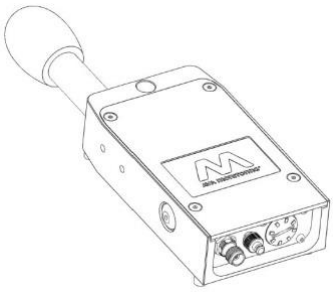
Vertical Geophone



Triaxial Geophone Floor



Triaxial Geophone Wall



Airblast Microphone

Accelerometer

7.1 Geophones

Geophones are supplied in different tolerance classes for use with different standards. The geophones are marked with a tolerance class and you should make sure that you use the correct class for your measurement standard (see technical specification). Note that geophones are designed to be sensitive only to the component of velocity along their own longitudinal axis. Depending on which axis you wish to measure you must select the correct geophone type. The triaxial geophone measures vertically and in two horizontal directions at the same time (x, y, z).

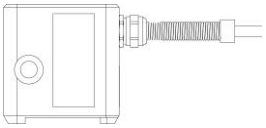
The geophone can be mounted to a measurement object in a number of ways including:

- Bolted directly to a wall or floor
- Bolted to a base plate
- Using ground spikes (triaxial geophones only)

When installing geophones it is very important that the sensor is mounted completely straight in the direction of measurement. Use the spirit level to make sure it is mounted straight and in level. It is important that the geophone always is tightly coupled with the measurement object. Any bolts should be fastened tightly in order to avoid mounting resonance.

7.1.1 Installing a Vertical Geophone

Install the sensor with the cable to the side as illustrated below.



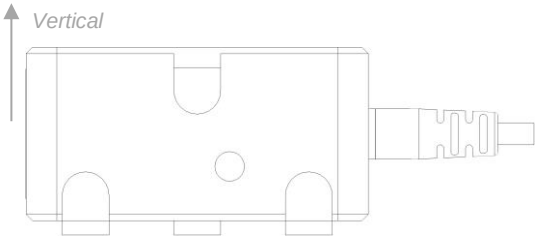
Installed Vertical Geophone

When geophones are attached to a concrete, brick or stone structure we recommend that you bolt the sensor firmly using an MSA 6 Brass Anchor (M6 thread, 24mm length, 8 mm borehole diameter) together with an MC6S M6x40 FZB screw (M6 thread, 40 mm length, socket head cap screw with a flat screw head underside). When using an M6 screw, always use a matching washer, BRB M6 FZB.

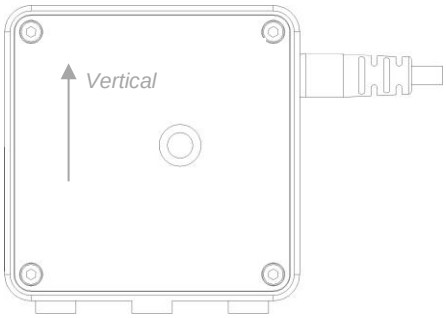
When a geophone is attached to a ground plate provided by AVA Monitoring, we recommend that you use an MC6S M6x40 FZB screw or similar. When using an M6 screw, always use a matching washer.

7.1.2 Installing a Triaxial Geophone

Install the sensor with the cable to the side as illustrated below.



Triaxial Geophone Floor



Triaxial Geophone Wall

When triaxial geophones are attached to a concrete, brick or stone structure we recommend that you bolt the sensor firmly using an MSA 8 Brass Anchor (M8 thread, 30mm length, 10 mm borehole diameter) together with an MC6S M8x75 FZB screw (M6 thread, 75 mm length, socket head cap screw with a flat screw head underside). You do not need a washer when using an M8 screw.

When a triaxial geophone is attached to a ground plate provided by AVA Monitoring, we recommend that you use an MC6S M6x75 FZB screw or similar. When using an M6 screw, always use a matching washer, BRB M6 FZB.

The triaxial geophone is equipped with a single cable and connector. To connect it to an AvaTrace M80 use the adapter cable. It is important to connect the triaxial geophone cables to the AvaTrace channels in the correct order. To facilitate this, cable couplings are marked with color and text labels.

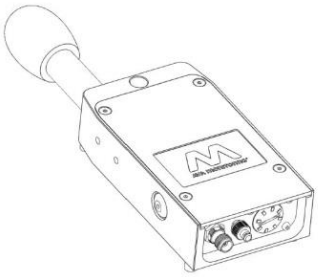
AvaNet Triaxial Measuring Points will be assign by default according to:

- Channel 1 to Horizontal **T**ransversal direction (cable coupling marked **T** on red background)
- Channel 2 to **V**ertical direction (cable coupling marked **V** on black background)
- Channel 3 to Horizontal **L**ongitudinal direction (cable coupling marked **L** on green background)

The arrow symbol on the triaxial geophone marks the longitudinal direction and should generally be pointing towards the source of vibrations if possible.

7.2 Airblast Microphone

The Airblast Microphone for AvaTrace. For proper handling please refer to the Airblast Microphone manual.



Airblast Microphone

7.2.1 Installing an Airblast Microphone

For reflected airblast overpressure measurement the microphone should be mounted on a wall facing upwards as close to the wall as possible. Please refer to the applicable standards for detailed mounting requirements.

For free field measurement the microphone can be attached to a standard tripod for easy deployment in the field.

7.3 Accelerometer

AvaTrace can be used with the Monitran 1020/MF accelerometer.

Monitran Accelerometer with mounting stud

7.3.1 Installing an Accelerometer

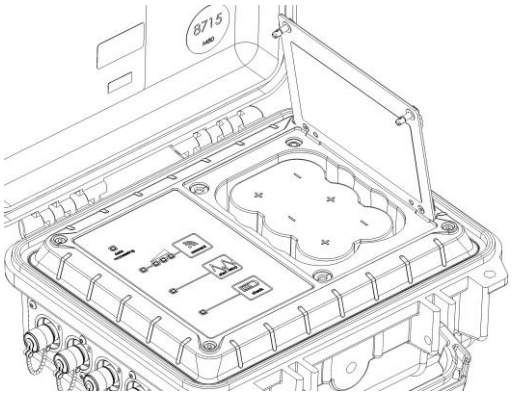
The accelerometer can be mounted in any direction using the mounting stud, which can be glued or otherwise attached to the measurement object. Ensure that the accelerometer is electrically isolated from the measurement object.

8. Maintenance

8.1 Install or Replace Batteries

1. Press the AvaTrace check button to indicate the current battery status. Batteries should be replaced if the AvaTrace battery status indicator flashes quickly indicating insufficient battery level. The battery voltage can also be checked using the instrument panel in AvaNet.

2. Open the battery hatch.

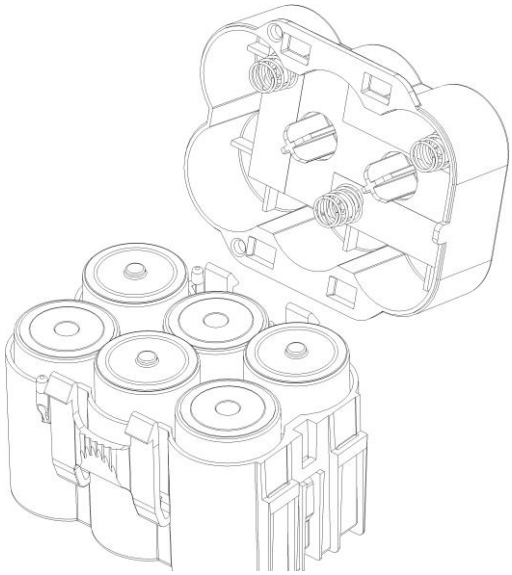


AvaTrace M80 with open Battery Hatch

3. Make sure that the data processing indicator is off, so that no data processing is performed during battery replacement

4. Remove battery pack.

5. Replace the batteries in the battery pack with six fresh batteries. Do not mix old and new batteries. Do not use batteries of different type, size or make. Ensure that the new batteries are correctly inserted and in the correct direction. The equipment may appear to work properly even if one battery is inserted incorrectly. Use LR20/D-cell Alkaline 1.5 V batteries.



Open Battery Pack

6. Insert the battery pack into the battery compartment.

7. Close the battery hatch.

If the data processing indicator *is turned on or flashes while the battery pack is disconnected, the battery replacement procedure should be completed as normal. This is not a problem.*

We recommend that you use the AvaTrace M80 battery limit setting in AvaNet (free of charge) to alert the project administrator by email when the battery voltage reaches the set limit. Note that this AvaNet function will run automatically and continuously but will be performed only once a week.

It's also possible to add a measuring point to the AvaTrace M80 internal battery measuring channels to be used solely to monitor the battery voltage. Then you can add the measuring point to an alarm group to alert one or more recipients by email and/or SMS. Note that this measuring point could be charged additionally.

⚠ NOTE

- Use high quality batteries for best results. See AVA Monitoring Support Site for recommendations.
- Before unplugging batteries always make sure the data processing indicator is off.
- Replace all six batteries at the same time. Do not mix old and new batteries.
- Do not use batteries of another size or type.
- Do not mix different makes of batteries.

⚠ CAUTION

If the batteries are leaking make sure that the battery holder and battery compartment are cleaned in an environmentally safe and correct way. Use protective gloves to avoid skin contact. Use an acid solution, for instance lemon juice, to neutralize the alkaline residue. Use dry paper towels. Work in a well-ventilated area.

⚠ CAUTION

Risk of explosion if the battery is replaced with an incorrect type or in the wrong direction.

⚠ NOTE

Dispose of used batteries according to local instructions.

8.2 Maintenance Carried out by the User

The following maintenance can be carried out by the user. All other maintenance must be carried out by AVA Monitoring or a service provider authorized by AVA Monitoring. If you carry out other maintenance it may invalidate the warranty.

8.2.1 Cleaning

Instrument

Clean the instrument as necessary. Rinse the outside of the box, with the outer lid firmly closed, using a normal shower nozzle (do not use a high pressure washer). Use a dish brush or similar. Wipe the panel with a damp cloth. Use alcohol to remove stains. Avoid using any type of cleaning

cloth that can scratch the panel. Do not use strong solvents as they can damage the instrument.

Sensors
Clean the sensors as necessary. Rinse the outside of the sensor using a normal shower nozzle (do not use a high pressure washer). Use a dish brush or similar. For Airblast Microphone first remove the microphone before cleaning the box. The microphone can be wiped with a damp cloth. Do not use strong solvents as they can damage the sensors. Do not subject the sensors to knocks or impacts when cleaning.

8.3 Storage

When the instrument is to be stored it is important that measurement is switched off. Store the instrument indoors in a cool place and out of direct sunlight.

8.4 Update Software

Software is updated automatically via AvaNet. Updates are usually carried out at night. No measurement is performed during software upgrade when the data processing indicator and battery status indicator are lit. Software upgrade may take up to 15 minutes. Periodic measurement is suspended during upgrade. If you do not want to update the instrument software automatically, e.g. when the instrument is used in a project where measurement cannot be interrupted, uncheck the Upgrade software automatically box in AvaNet. We strongly recommend that this option is enabled.

8.5 Calibration

In order for the instrument and sensors to measure correctly they must be calibrated regularly at a laboratory approved and authorized by AVA Monitoring and according to the procedures prescribed by AVA Monitoring. We specify requirements on the equipment used and how calibration must be related to the national measurement standards. This is important, particularly in the event of any disputes where the accuracy of the measurement results are questioned. The calibration interval requirement is often stated in the measurement standards that you wish to use, although AVA Monitoring recommends a maximum calibration interval of two years for the AvaTrace M80 and one year for sensors.

9. Technical Specification

The full technical specification for AvaTrace M80 can be downloaded from the AVA Monitoring Support Web Site.

9.1 Frequency Bands

The AvaTrace M80 operates on the following frequency bands with the specified power class and maximum transmitted radio frequency power.

GSM 900	Power Class 4	**2 W** (*33.5 dBm*)
EDGE 900	Power Class E2	**0.5 W** (*28 dBm*)
DCS 1800	Power Class 1	**1 W** (*30.5 dBm*)
EDGE 1800	Power Class E2	**0.4 W** (*27 dBm*)
WCDMA FDD B1, B8	Power Class 3	**0.25 W** (*24 dBm*)

Frequency bands and maximum transmitted radio frequency power for AvaTrace M80

The product variant AvaTrace M80-LTE operates on the following frequency bands with the specified power class and maximum transmitted radio frequency power.

GSM 900	Power Class 4	**2 W** (*33.5 dBm*)
DCS 1800	Power Class 1	**1 W** (*30.5 dBm*)
LTE B1, B3, B7, B8, B20	Power Class 3	**0.2 W** (*23 dBm*)

Frequency bands and maximum transmitted radio frequency power for AvaTrace M80-LTE

The product variant AvaTrace M80-NA (intended for the North American market) operates on the following frequency bands with the specified power class and maximum transmitted radio frequency power.

GSM 850	Power Class 4	**2 W** (*33.5 dBm*)
EDGE 850	Power Class E2	**0.5 W** (*28 dBm*)
DCS 1900	Power Class 1	**1 W** (*30.5 dBm*)
EDGE 1900	Power Class E2	**0.4 W** (*27 dBm*)
WCDMA FDD B2, B5	Power Class 3	**0.25 W** (*24 dBm*)

Frequency bands and maximum transmitted radio frequency power for AvaTrace M80-NA

9.2 Operating Time

Approximate operating time for AvaTrace M80 with different sensors under normal operating conditions.

	0–50 ^{0}C	-20–0 ^{0}C
1–4 Geophones or Air Blast Microphones	5–7 months	3–5 months
1–4 Accelerometers	1–4 months	1–3 months

Operating Times at varying Temperatures

9.3 Data Volume

The values below are an indication of how much data is typically sent to and from an AvaTrace M80. How much data that is actually transferred depends on how often the instrument connects to AvaNet and other AvaNet data acquisition settings.

Typical monthly data transfer size (*send and receive*)	0.5–10 Mbyte
Maximum waveform data size (*uncompressed*)	9 Kbyte/second of filtered waveform 17 Kbyte/second of raw waveform
Typical waveform data size (*compressed*)	3 Kbyte/second of filtered waveform 6 Kbyte/second of raw waveform

Periodic measurement size	230 byte/measurement (*four channels*)

Typical Data Volume

Four 3 second waveforms every day of the month on all four channels	5 Mbyte/month
Periodic measurement on all four channels every hour.	10 Kbyte/month

Data Transfer Examples

9.4 Measurement Standards

The measurement standards supported by AvaTrace M80 and the required sensor and filter profile combinations are listed in the table below.

Standard	Variant	Filter Profile	Sensors: Geophone *TC0*	Sensors: Geophone *TC1*	Sensors: Geophone *TC2*	Sensors: AvaAirBlast
SS 460 48 66:2011		Blasting SS 460 48 66:2011	•	•	•	
SS 02 52 11:1999	2 Hz	Piling SS 02 52 11:1999	•	•	•	
SS 460 48 61:1992		Comfort SS 460 48 61:1992	•	•		
NS 8176:2017		Comfort NS 8176:2017	•	•		
SS 02 52 10:1996		Airblast SS 02 52 10:1996				•
NS 8141:2001		Blasting NS 8141:2001	•	•	•	
NS 8141-1:2012 +A1:2013	Blasting	Blasting NS 8141-1:2012 +A1:2013	•	•		
	Air Blast	Airblast NS 8141-1:2012+A1:2013				•
NS 8141-2:2013		Piling NS 8141-2:2013	•	•		
DGMS 1997-07		Blasting DGMS:1997-07	•	•	•	
AS 2187.2-2006		Blasting AS 2187.2-2006	•	•	•	
BS 7385-1:1990	Blasting	Blasting BS 7385-1:1990	•	•		
	Piling	Piling BS 7385-1:1990	•	•		
DIN 4150-3:2016-12[1]	1-80 Hz	DIN 4150-3:2016-12 1-80 Hz	•	•		
	1-315 Hz	DIN 4150-3:2016-12 1-315 Hz	•			
	4-80 Hz	DIN 4150-3:2016-12 4-80 Hz	•	•		
	4-315 Hz	DIN 4150-3:2016-12 4-315 Hz	•			
ISO 4866:2010[2]	Blasting	Blasting ISO 4866:2010	•	•		
	Machinery Inside		•	•		
	Pile Driving	Piling ISO 4866:2010	•	•		
	Traffic		•	•		
	Machinery Outside		•	•		
SN 640 312:2013-12		SN 640 312:2013-12	•	•	•	

[1]Support for amplitude and phase response requirements
[2]Compliant with ISO 4866:2010 requirements for Class 2 (field monitoring) instruments

Table of applicable combinations of Measurement Standards, Sensors and Filter Profiles

simpler measurement, automatically

Contact
support@avamonitoring.com
avamonitoring.com