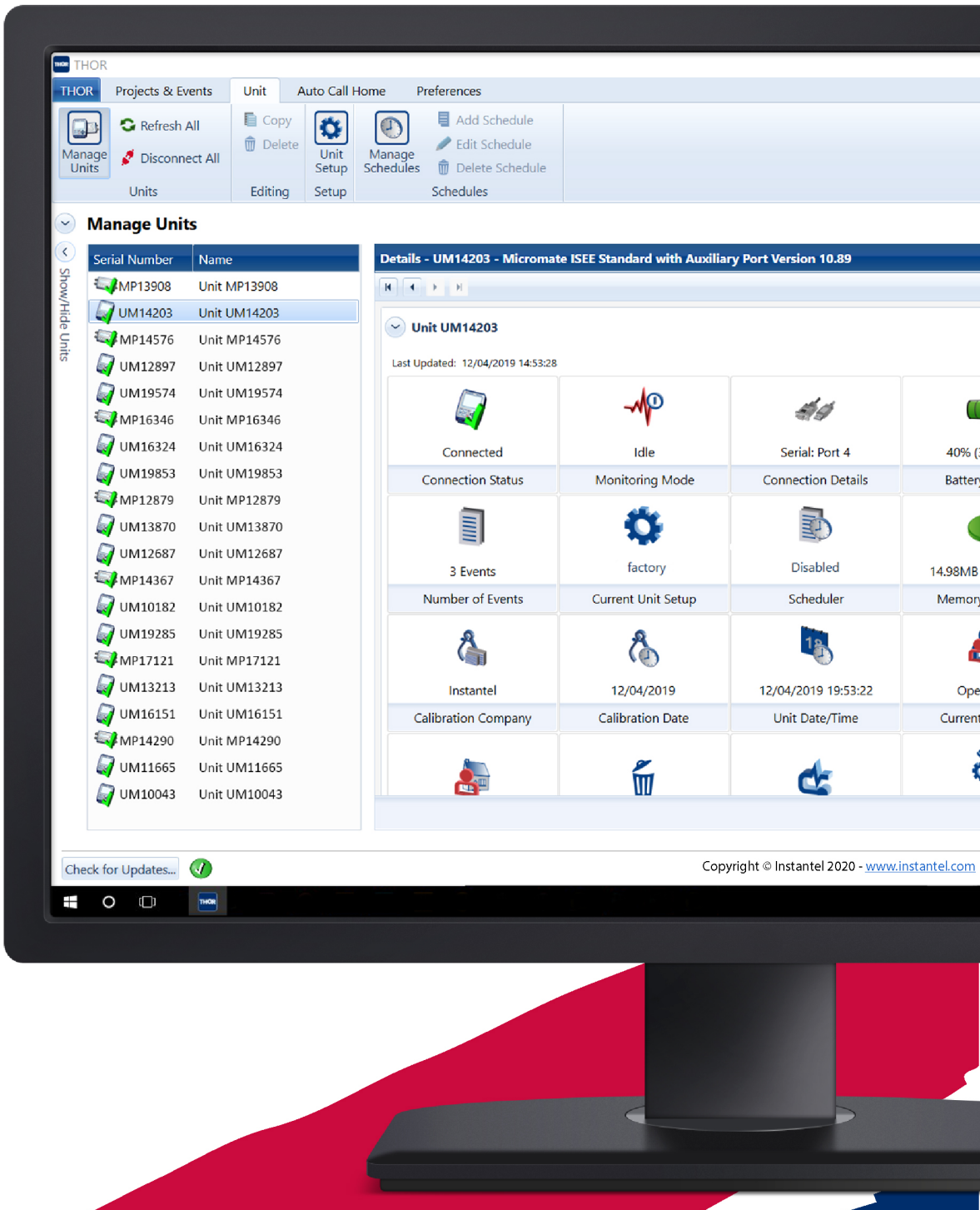
THOR™

Operator Manual



Powered by Instantel

723U0201

Contact

International / Canadian Customers:

Instantel
309 Legget Drive
Ottawa, Ontario
K2K 3A3 Canada

U.S.A. Customers:

Instantel
808 Commerce Park Drive
Ogdensburg, NY 13669
U.S.A.

Telephone: 1-613-592-4642
Toll-free: 1-800-267-9111
Fax: 1-613-592-4296
Website: www.instantel.com

Customer Support

Instantel is represented by a network of qualified dealers throughout the United States, Canada, and internationally. For further information, including product literature and the dealer nearest you, contact Instantel.

- Extensive dealer network
- Comprehensive application support
- In-depth user documentation
- Technical support, 1–613–592–4642 or e-mail service@instantel.com

Legal

Printed in Canada, Dec 2019. 723U0201 Rev 08

TABLE OF CONTENTS

DOCUMENT CONVENTIONS

The following typographical conventions appear throughout this manual.

A blue sidebar contains supplemental information that is relevant to the topic or the procedure.

WARNING A warning box contains information that you should know before proceeding. Whenever you see a warning box, ensure that you read and understand the information it contains.

Alternative Path: When more than one option exists to perform the same function, it is noted as an alternative path.

CONVENTION	INDICATES
Bold type	The names of user interface elements, such as buttons, fields, and checkboxes, are indicated in bold type.
Italic type	Information to type is indicated in italics. E.g. “In the empty field, type *filename.doc”*. Italics are also used for emphasis. E.g. “To identify which event data is on the unit and which is on the computer look at the *Location* column.”
Underlined blue type	Underlined blue type indicates a clickable hyperlink to jump to another place in the document or a URL on the Internet.
NOTE	The word ***NOTE***, in blue, indicates a brief comment that elaborates on or draws attention to some portion of the text.

NOTE In this manual, the term "Minimate Pro" refers to both the Minimate Pro4 (4 Channel) and the Minimate Pro6 (6 Channel) devices.

NOTE In this manual, the term “Unit(s)” refers to the “Monitoring Unit(s)” noun.

1. INTRODUCTION

1.1 GETTING TO KNOW THE APPLICATION

1.1.1 THOR FUNCTIONS AND FEATURES

- **Communicates** with Instantel's Micromate, Minimate Pro, Minimate Plus and Blastware III units through a physical connection or a cellular modem. This facilitates fast and easy communication with no data loss.
- **Shares** events automatically with Instantel's cloud-based Vision platform.
- **Organizes** units and event data into projects, storing data that belong together in a single location for at-a-glance comprehension.
- **Configures** units from the THOR interface remotely. This prevents unnecessary travel.
- **Configures** multiple compliance setups allowing you to save previous settings for re-use on compatible units.
- **Visualizes** event data, letting you sort, group, and filter data.
- **Ensures** regulatory compliance with industry-standard reports.
- **Ensures** timely reception of events with automated data transfer using Auto Call Home.
- **Updates** stakeholders using THOR's email service to send event data based on configurable thresholds.
- **Automatically checks** for THOR software updates when Internet access is available.
- **Automatically checks** for Unit firmware updates when Internet access is available.

1.1.2 TRANSITIONING FROM BLASTWARE

For Blastware users transitioning to THOR, please review the differences between Blastware and THOR.

FEATURE	BLASTWARE	THOR
Projects	Not available	New in THOR
Unit Details Dashboard	Not available	New in THOR
Auto Call Home	A separate application	Fully integrated with THOR
Share events with Vision	A separate application	Fully integrated with THOR
THOR Email	A separate application	Fully integrated with THOR
Reports	Available	Updated with interactive functionality
Monitoring units supported	All units	Minimate Pro and Micromate full support. Minimate Plus and Blastware III units are partially supported.

1.2 WHY USE THOR?

THOR was developed for the latest generation of Instantel monitoring units. THOR is fully compatible with the Micromate and Minimate Pro units. Additionally, THOR supports Blastmate III and Minimate Plus units with the Auto Call Home service as well as offering users the ability to view their data and manage some configurations on the THOR software platform. THOR can communicate with Instantel's cloud-based Vision software solution.

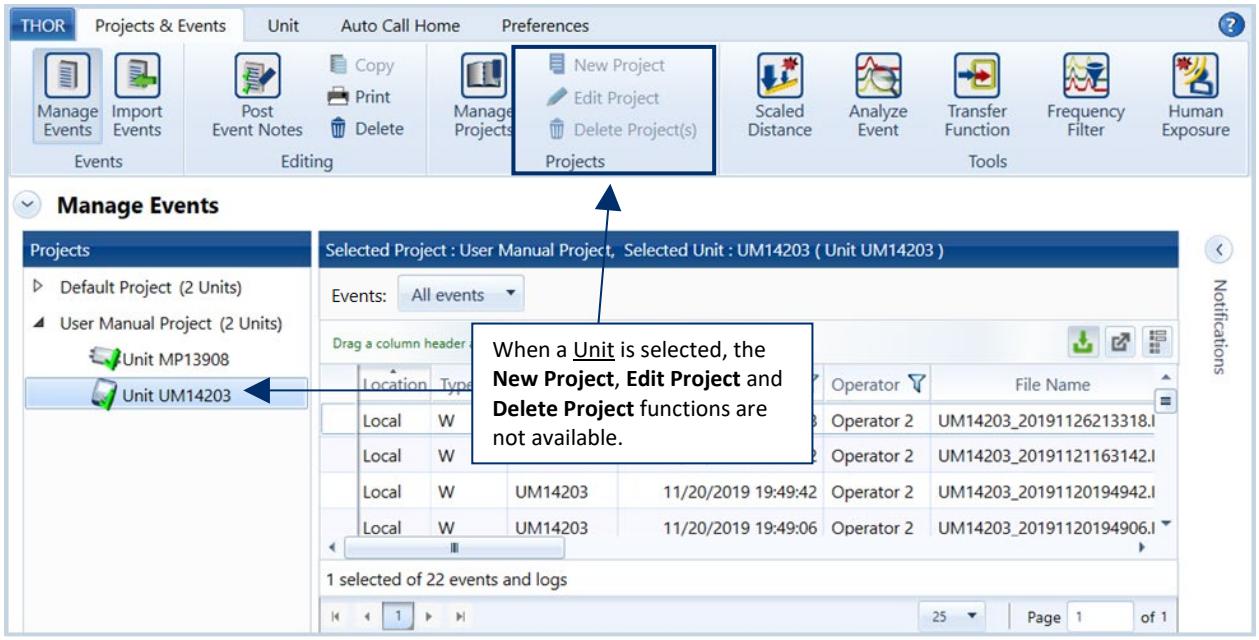
1.3 INTERFACE DETAILS

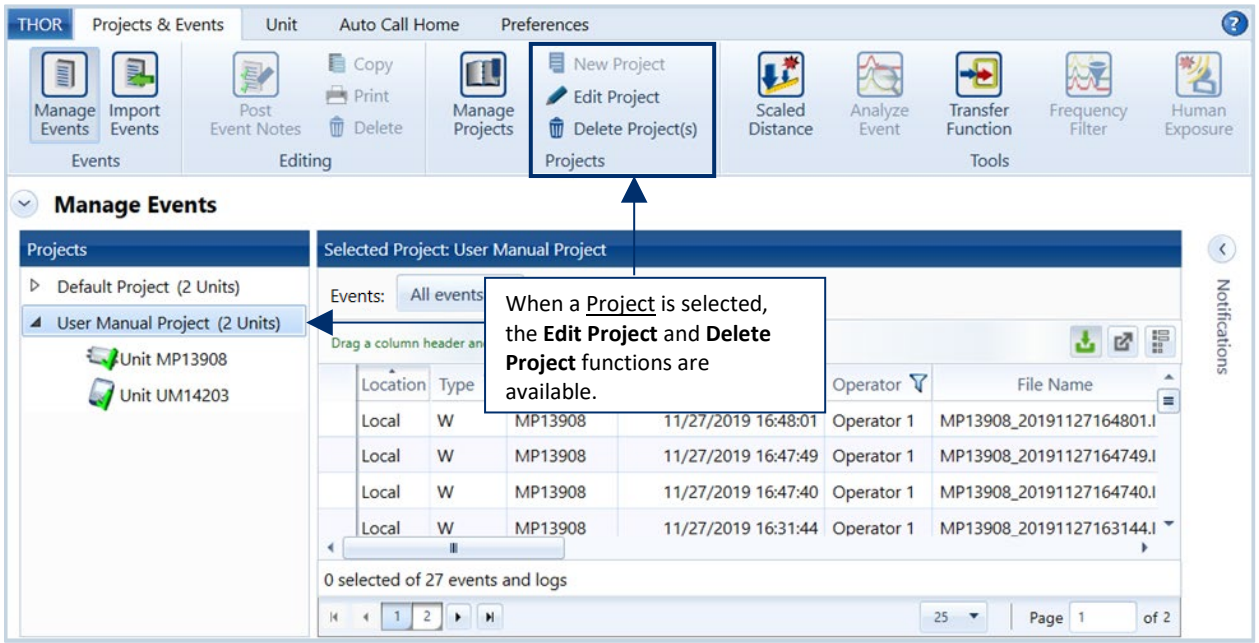
Context-Sensitive Icons

THOR's menu is context-sensitive, this means that icons on the top ribbon, change depending on the active tab.

E.g. Icons relating to Auto Call Home appear on the Auto Call Home tab and icons that let you manage units appear on the Unit tab.

Icon functionality is not available when greyed out.



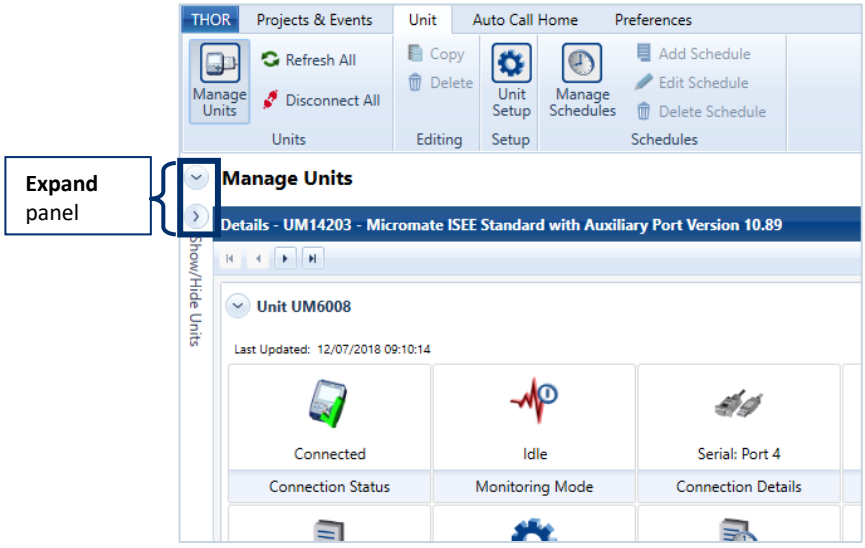


Dynamic Windows & Navigation Arrows

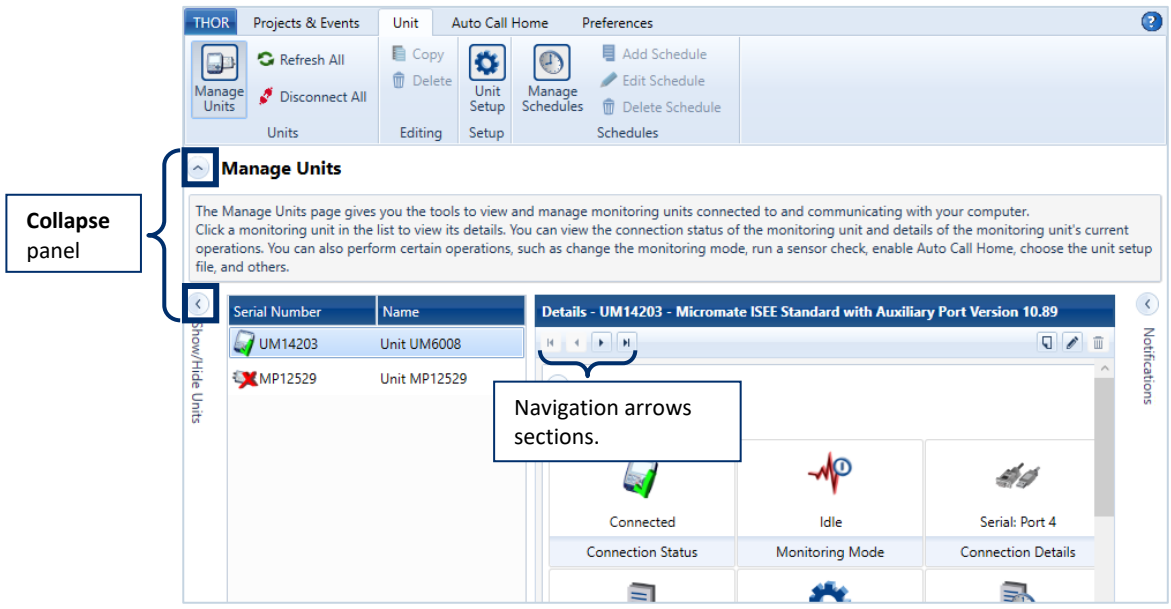
To save screen space, panels can be expanded (horizontally or vertically) when in use and collapsed when not needed. Navigation arrows appear in lists to help select an item from the list.

Icon	Dynamic Windows
	Collapses horizontally
	Expands horizontally
	Collapses vertically
	Expands vertically

Icon	Navigation Arrows
	Go to the first item in a list
	Go to the last item in a list
	Go to the next item in a list
	Go to the previous item in a list



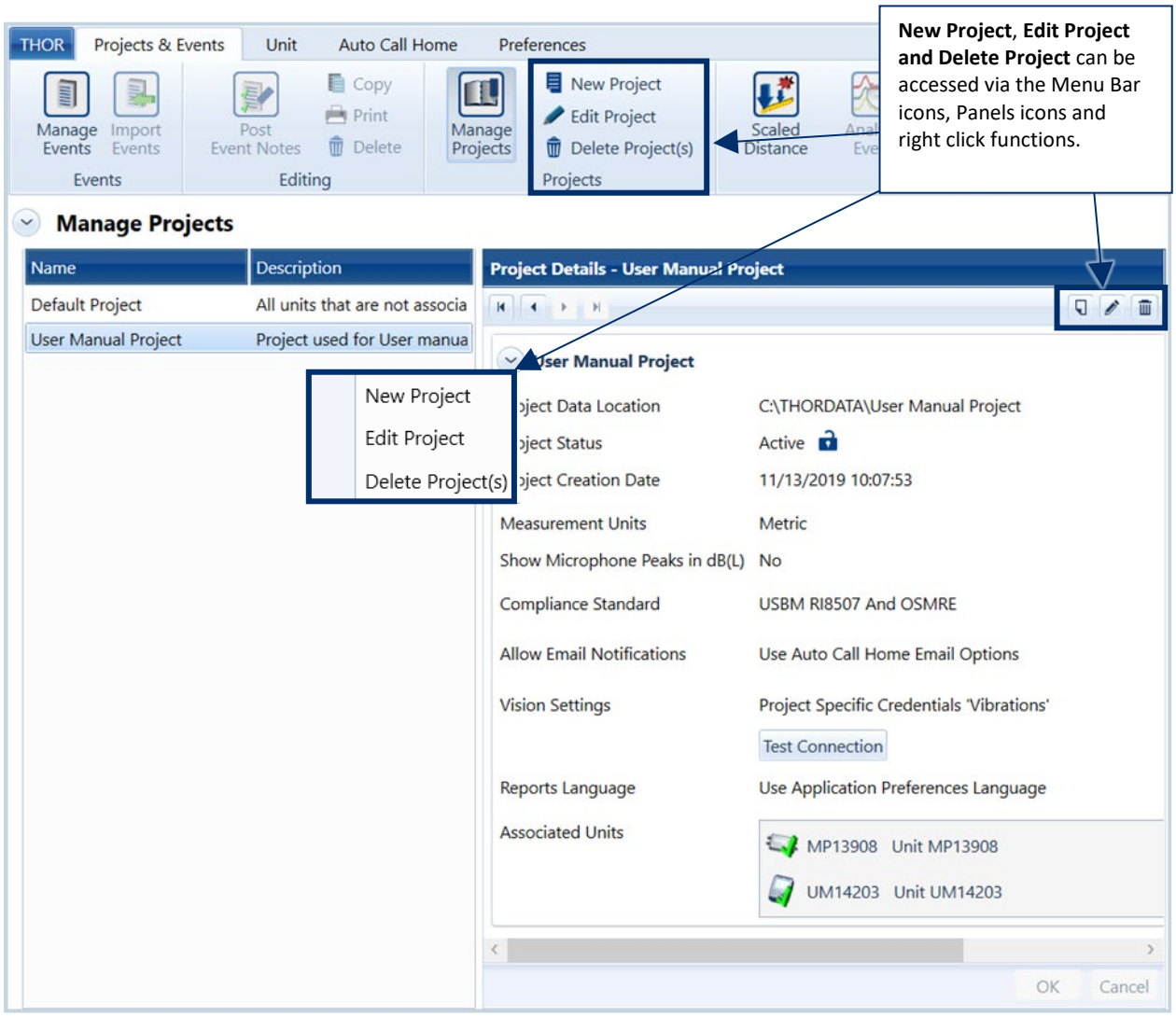
If this manual refers to something, that is not visible on your screen, look for an expand icon. The section may be collapsed. Click the expand icon to reveal additional functions.



Shortcuts

Functions can be accessed using, *buttons, icons, drop-down menus, collapsible panels, right clicks, keyboard,* or *navigation arrows*. This manual's procedures do not show all the alternatives, rather for clarity only one straightforward path is used.

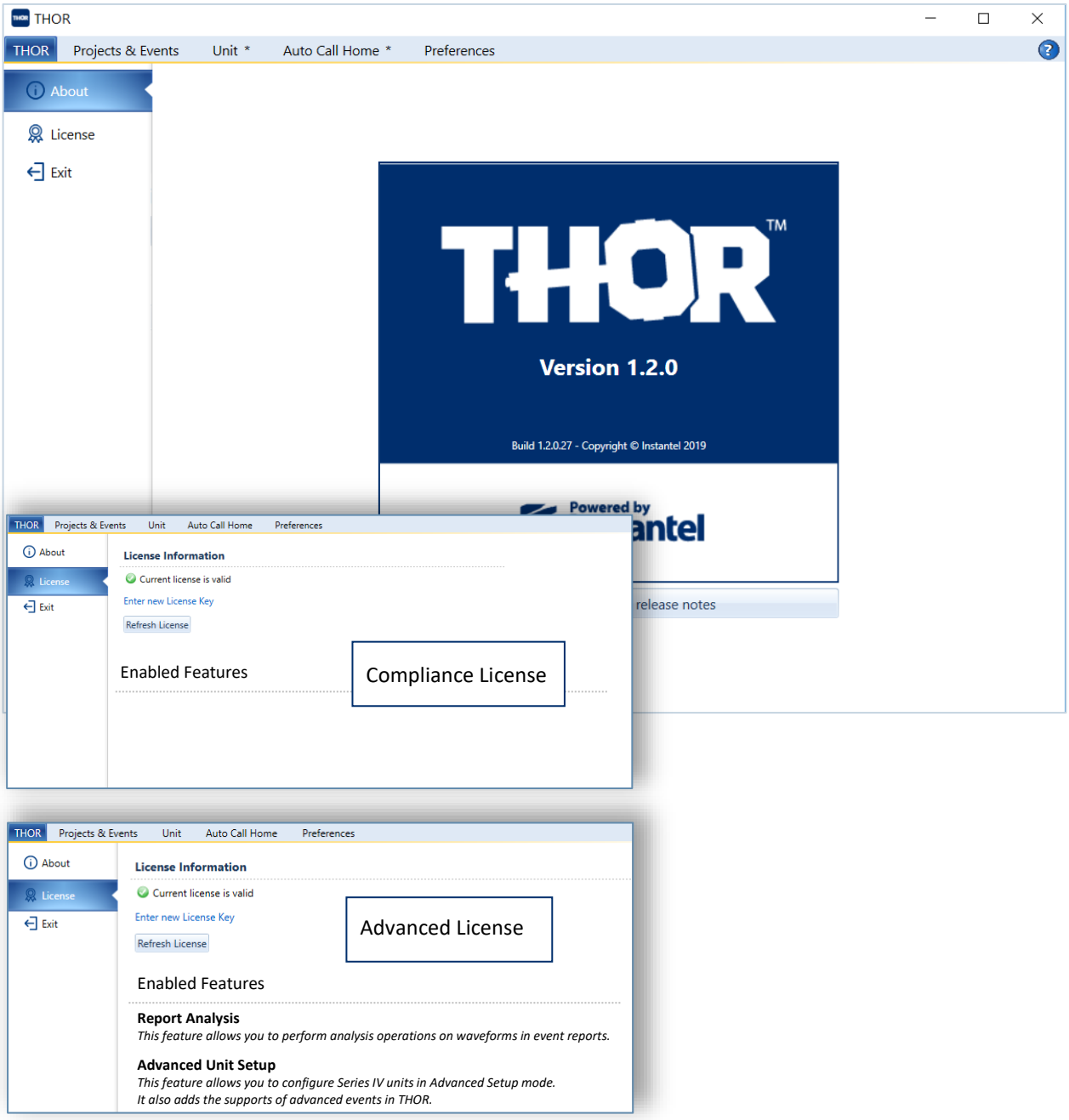
E.g. There are occasions where the same function is available via a different path.
The functions **Add Project**, **Edit Project** and **Delete Project** have three ways to access their functionality. An icon exists in the Menu Bar, in the Project Details Panel and also by right-clicking on a project.



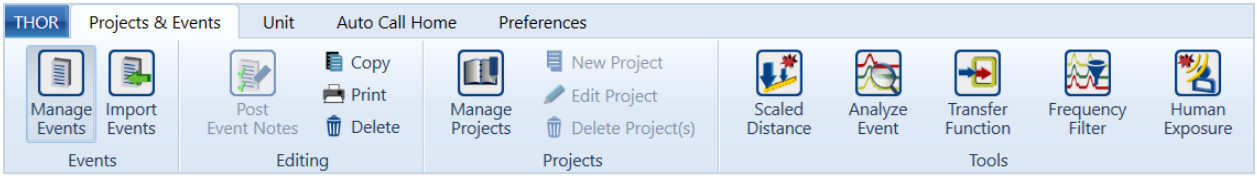
1.4 THOR MENU - A BRIEF INTRODUCTION

1.4.1 THOR TAB

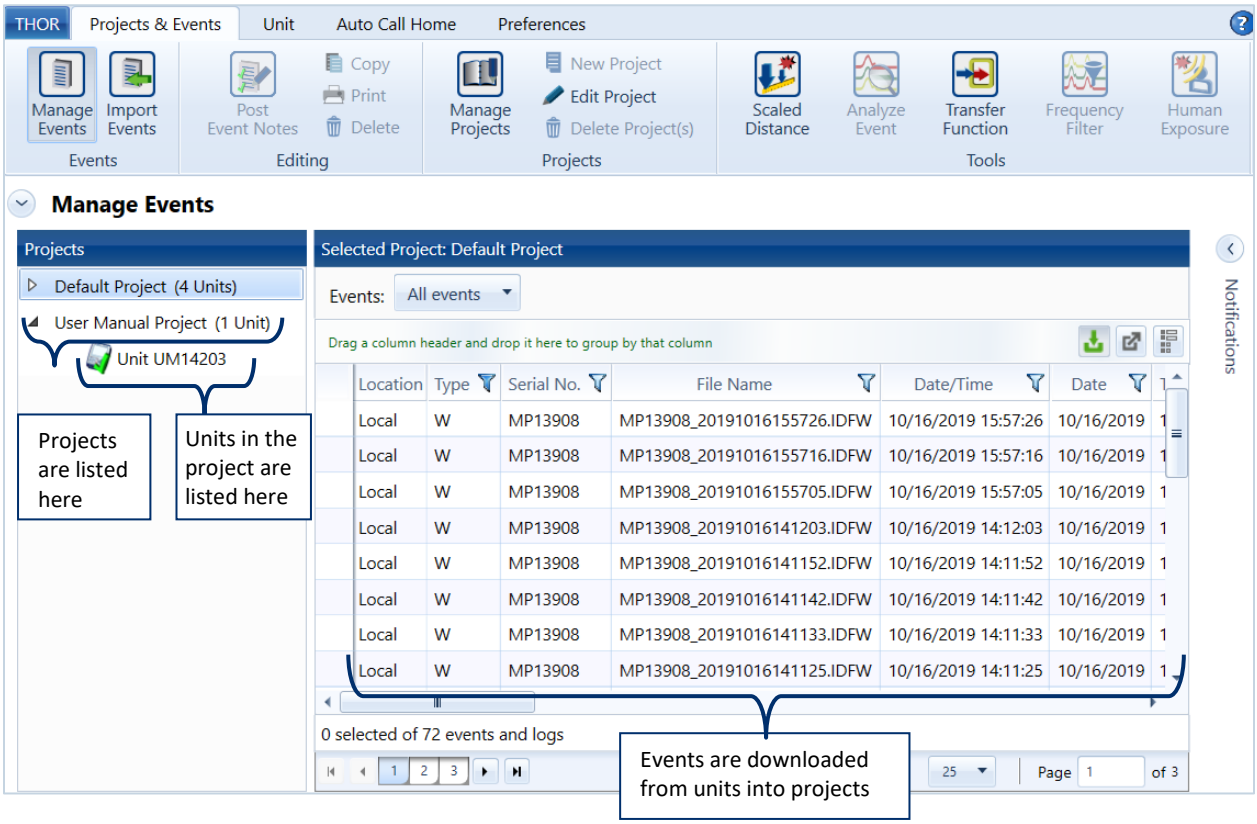
The THOR tab provides information on the installed version, with features and any changes from previous versions described in the Release Notes. The License section indicates the current license and provides a field to activate a new license key for advanced functionality. Advanced features are described in Section 8 on page 167. Please contact Instantel for more information about advanced licensing.



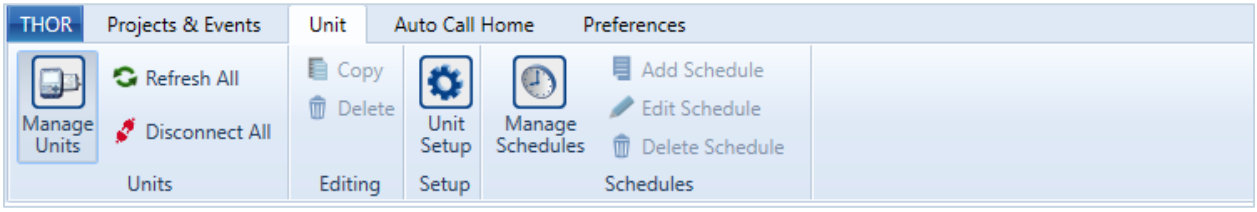
1.4.2 PROJECTS & EVENTS TAB



THOR organizes data into **Projects and Events**. Projects automatically group related events for easy navigation and analysis. For more information, see section 4.1 Understanding Projects on page 74 and section 5.1 Understanding Events and the Event Table on page 86.



1.4.3 UNIT TAB – THE DASHBOARD



The unit tab displays the dashboard which provides important information about the units such as:

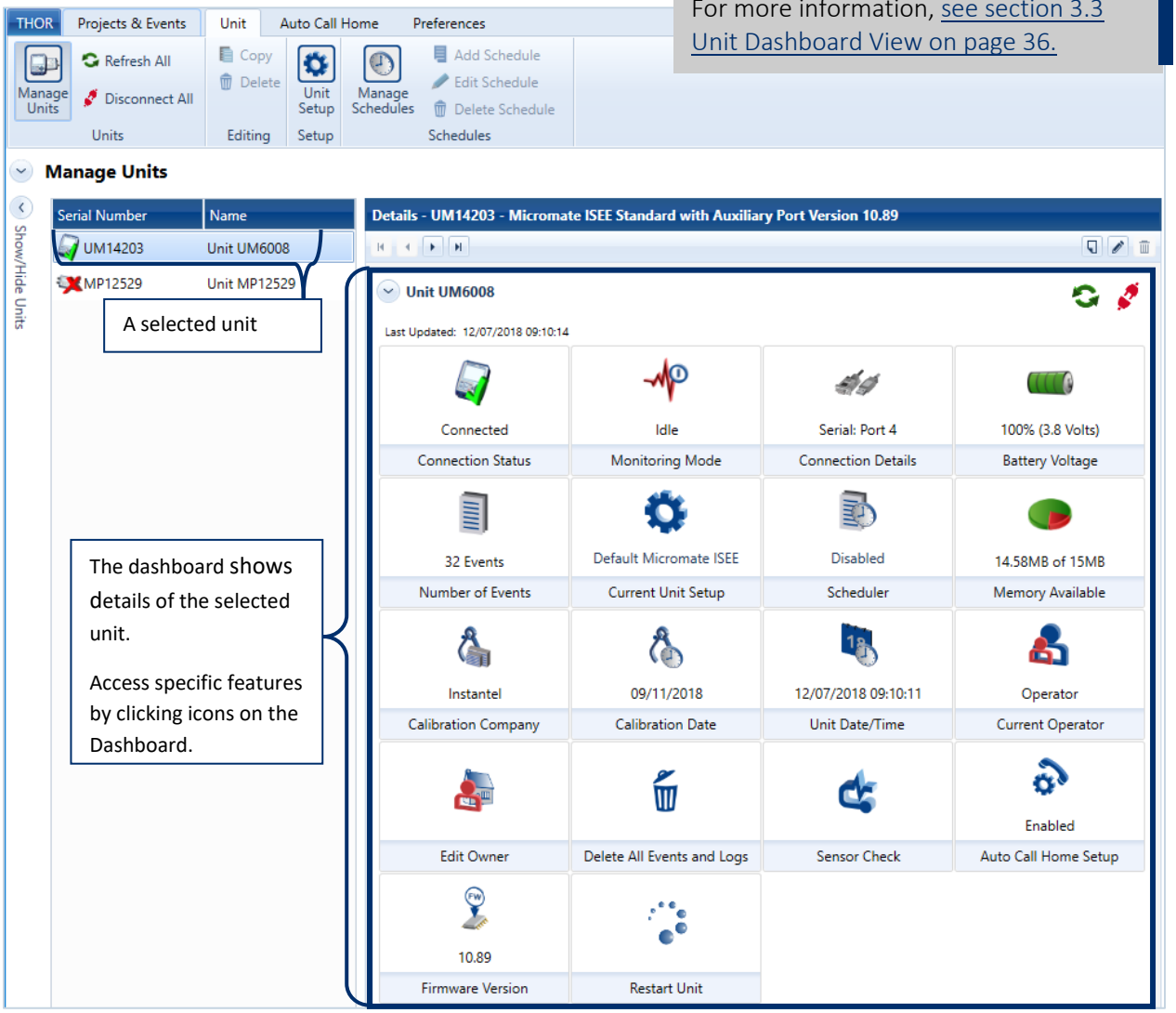
Connection status, monitoring mode, connection details, battery health, available memory, scheduler status, current unit setup, number of events residing on the unit, name of the assigned operator, unit date and time, last calibration date, calibration company, firmware version, and Auto Call Home state.

The dashboard provides tools to add, edit, delete, and manage units. The dashboard can also help configure units connected to THOR either through a local computer or through remote communications.

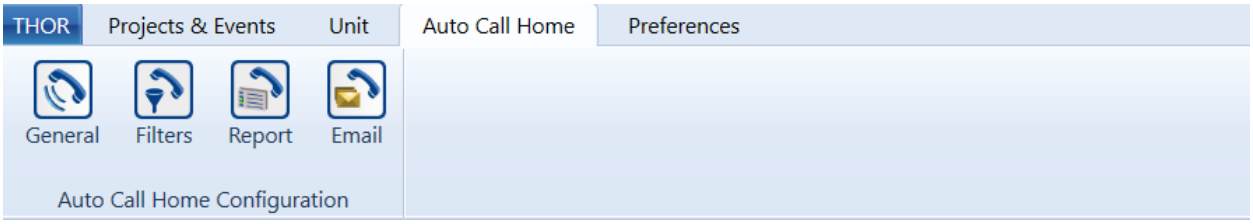
Some common tasks accessible via the dashboard:

Change the monitoring state, define a schedule, update date and time, reload the unit's setup file, add and remove operators, change the owner, delete events and logs, perform a sensor check, manage Auto Call Home, update the firmware, restart the unit.

For more information, see section 3.3 Unit Dashboard View on page 36.

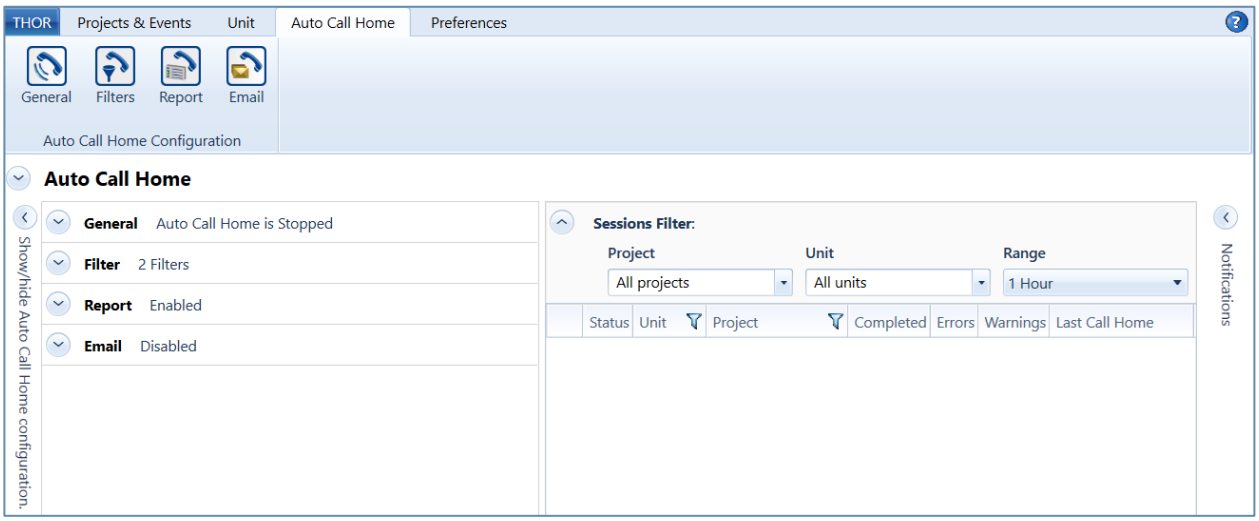


1.4.4 AUTO CALL HOME TAB



The Auto Call Home (ACH) tab defines the ACH communication parameters, and customizable settings for reports, filters and email.

NOTE The Auto Call Home function uses a Windows Service and does not require THOR to run to be active. See section 6 Auto Call Home Setup and Management on page 135. Understanding Auto Call Home (ACH)



NOTE Whereas Blastware Mail was a separate application, THOR integrates email functionality. From within the THOR user interface, you can set up a Secure Sockets Layer (SSL) or Transport Layer Security (TLS) secure connection with your Simple Mail Transfer Protocol (SMTP) server, as well as email a PDF of event data to stakeholders.

Details on **General**, see section 6.2.2.1 on page 141.

Details on **Filter**, see section 6.2.2.2 on page 142.

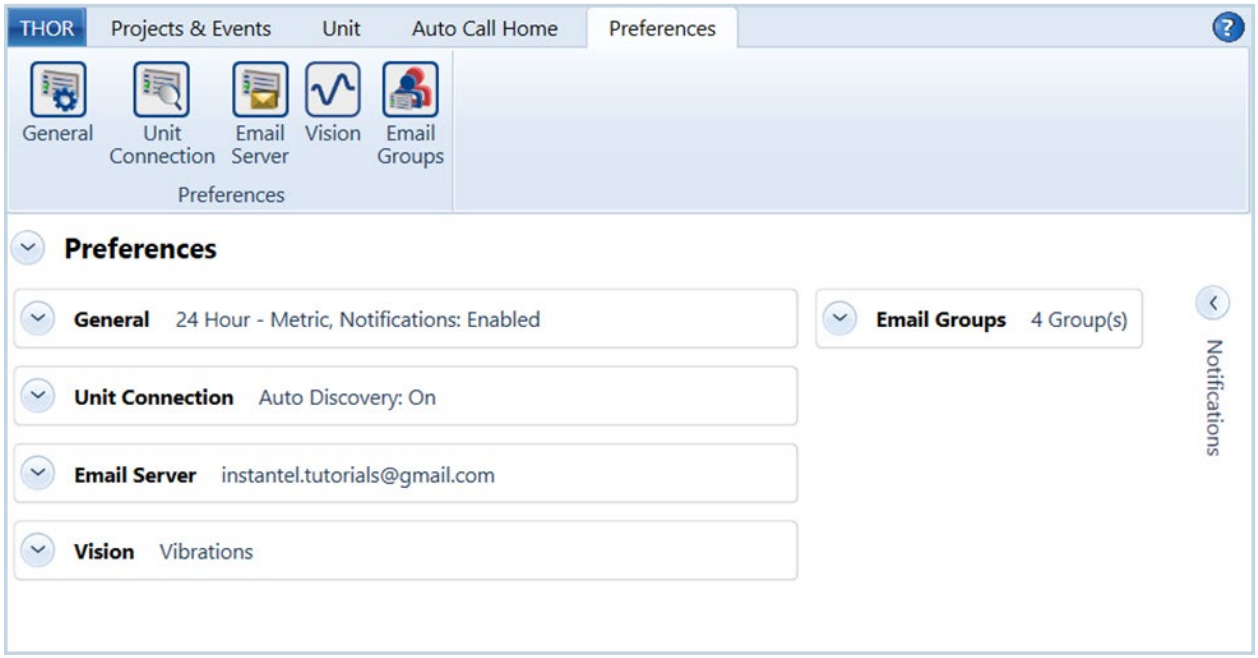
Details on **Report**, see section 6.2.2.3 on page 144.

Details on **Email**, see section 6.2.2.4 on page 146.

1.4.5 PREFERENCES TAB

General preferences define which format THOR uses to display date/time, measurement units, and compliance standards. Setting these preferences only changes how data is viewed in THOR. The settings of the units are unaffected.

These are the default settings for all Projects & Events. If you change preferences for an individual Project/Event, they will override the general preferences for that Project/Event.



Details on **General**, see section 7.1 on page 156.

Details on **Unit Connection**, see section 7.2 on page 157.

Details on **Email Server**, see section 7.3 on page 158.

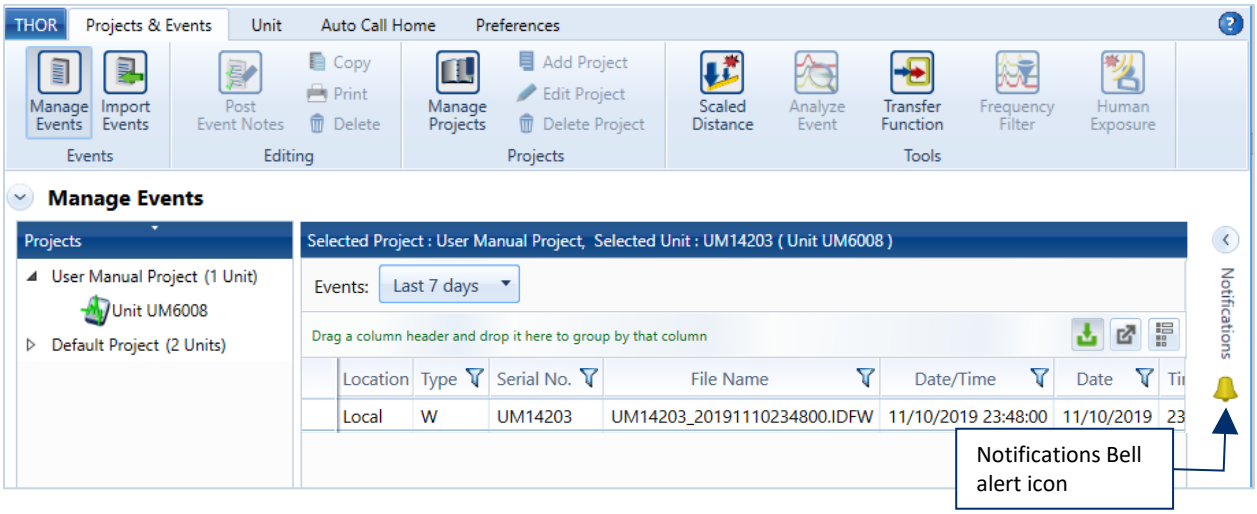
Details on **Vision**, see section 7.4 on page 162.

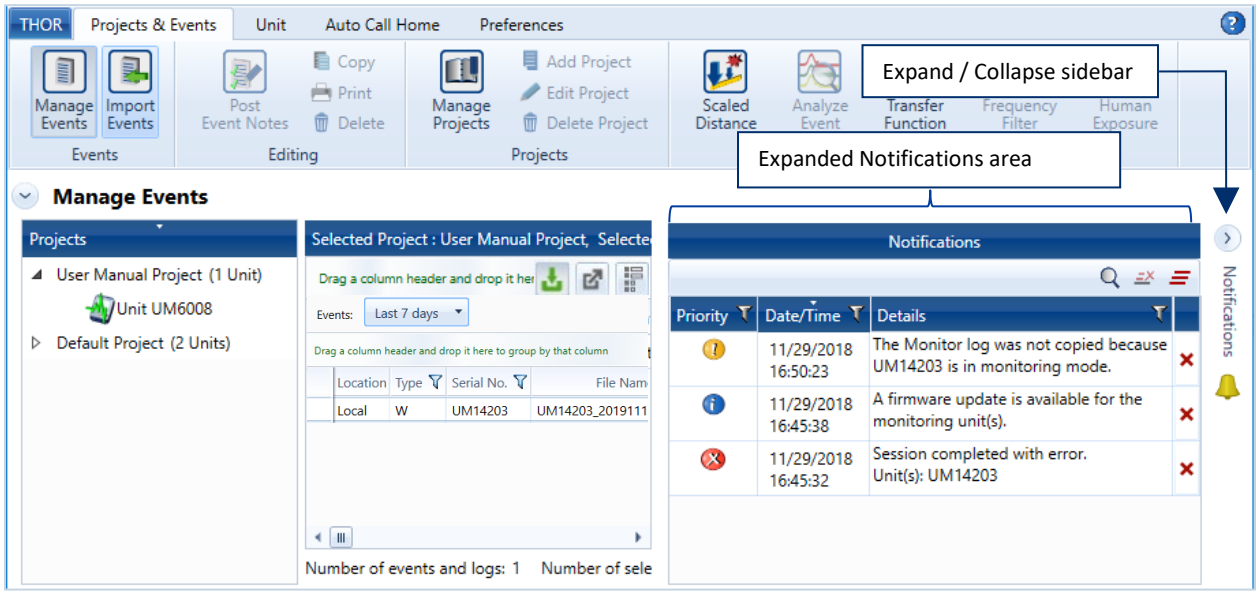
1.5 NOTIFICATIONS

Notifications are short messages that bring attention to new information. They appear in a designated sidebar and are accessible regardless of the active tab. You can configure which notifications to display by selecting their respective checkboxes in the Preferences→ General section. See section 7.1 on page 156.

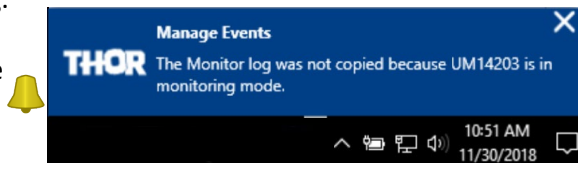
Notification type:

- **Info**, General information (E.g. A new firmware update is available).
- **Warnings** (E.g. The Monitor log was not copied because the unit is in monitoring mode).
- **Errors** (E.g. Session completed with error).





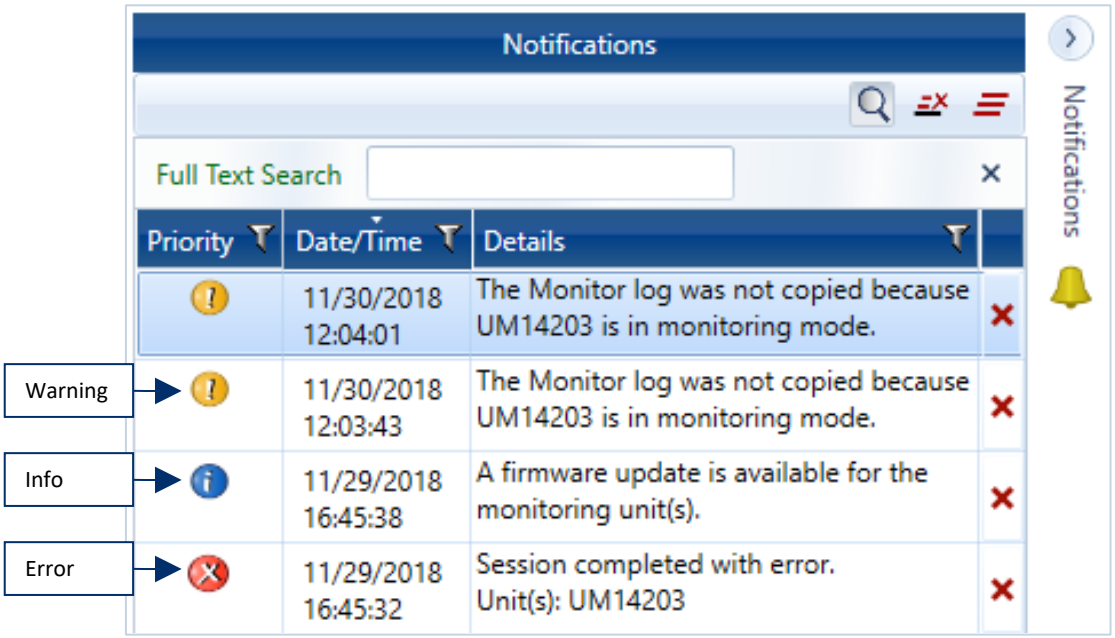
Notifications can also appear as Popups to direct the user's attention to the new information. Popups will only appear when THOR is not the active screen, (E.g. A user is writing an email while a notification occurs). Popups disappear after a few seconds, either click on the link in the Popup or expand the notifications sidebar to view the notification. The sidebar shows a Bell icon to indicate that there are notifications for reviewing.

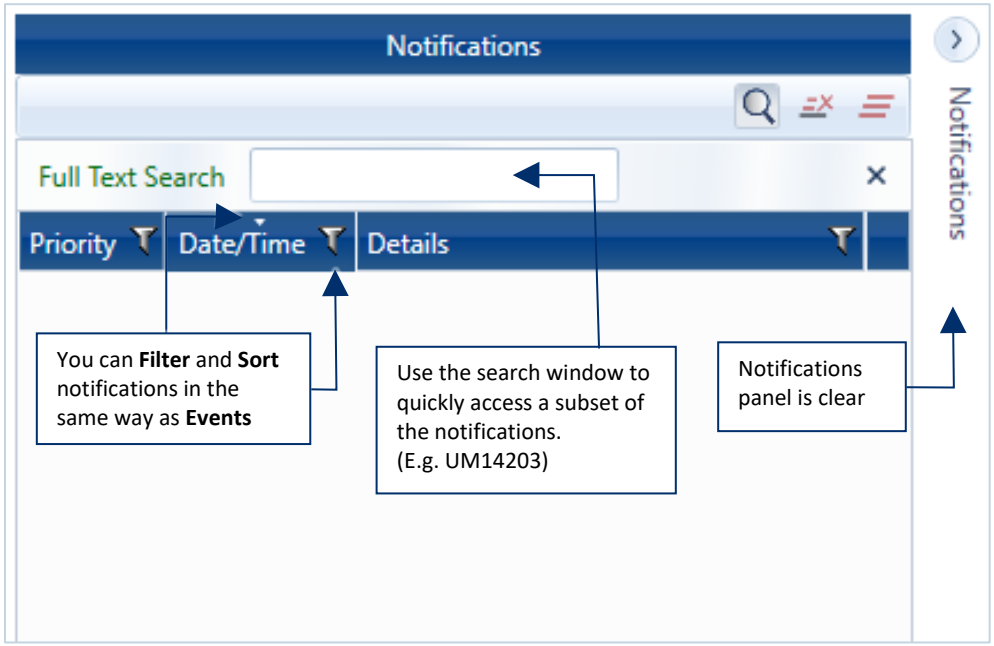


1.5.1 DELETING NOTIFICATIONS

To delete single notifications, select the notification and click the ✖ icon. To delete multiple notifications, select the notifications (using CTRL or Shift) and click the icon. To delete all notifications, click the icon.

NOTE You can Filter and Sort notifications in the same way as with Events, see section 5.7.5 Filter Events on page 102 and section 5.7.6 Sort Events on page 106.





2. INSTALLATION

2.1 SYSTEM PREREQUISITES

2.1.1 SUPPORTED INSTANTEL MONITORING UNITS

INSTANTEL MONITORING UNIT	SUPPORTED
Micromate®	Yes
Minimate Pro™	Yes
Minimate Plus™, Blastmate III™	* Partially supported, Auto Call Home fully functional
Blastmate™ Series II and earlier	No

NOTE For unit upgrades, please contact your local Instantel dealer.

NOTE * See the release notes for a full description of Series III support. Date/time can only be updated when the unit stops recording and enters the idle state.

2.1.2 SYSTEM REQUIREMENTS

THOR is supported on the following Microsoft® operating systems running Ver 4.5 or higher of the .NET Framework.

- Windows 7 (32 or 64-bit)
- Windows 8.1 (32 or 64-bit)
- Windows 10
- Windows Server 2012 R2

NOTE Only one instance of THOR can run on a computer at a time. THOR does not support multi-user environments, such as Citrix solutions.

You also require:

- An Internet connection (installations, patches, upgrades, email notifications, sending events to Vision).
- A USB port to physically connect THOR to a Micromate, Minimate Plus or Blastmate III.
- An Ethernet, USB, or RS232 serial port, to physically connect THOR to a Minimate Pro.

OPTIONAL

- PDF viewer—to view reports
- Printer—to print reports
- Optical drive (DVD or CD)—to install THOR using a CD
- A cellular modem connection may be used to connect a unit to a cellular network.

NOTE The Auto Call Home feature and connecting to a unit (to configure the unit from THOR) using remote communications requires a cellular modem. Instantel recommends using the Sierra Wireless™ AirLink™ GX-400, LS-300 series or Raven RV-50 modems.

2.2 INSTALLING AND STARTING THOR

2.2.1 NEW INSTALLATION

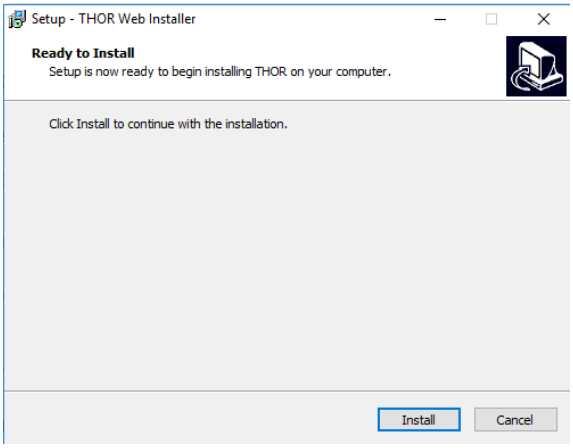
Make sure the computer is connected to the internet and you have administrator rights on the computer.

NOTE Once installed THOR can run without an internet connection although some features will not be available. (E.g. THOR cannot communicate with units on the network or check for software updates.) THOR connects occasionally (7 days) to the license server to verify Advanced licenses. Advanced licenses that have expired will revert to the functionality of Standard licenses until they are renewed.

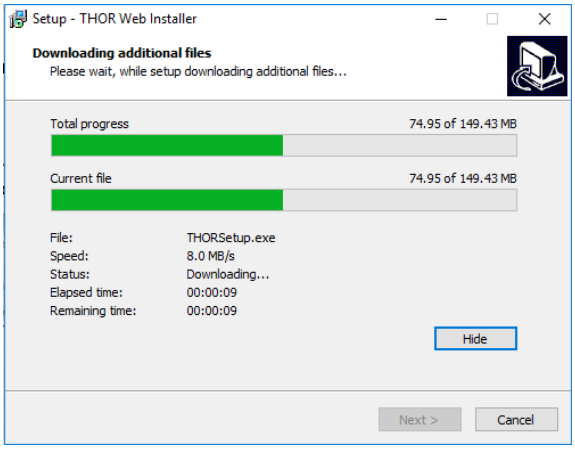
1 Download the THOR installer from https://www.instantel.com/resources under the Software section.

2 Run the **THORWebInstaller.exe**.

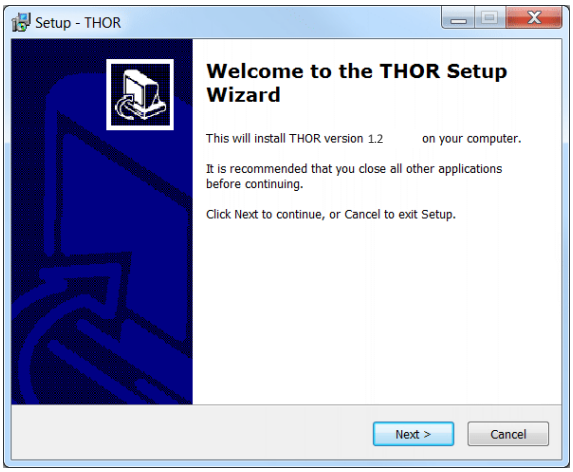
If a Security Warning dialog opens, click **Run**



3. On the **Ready to Install** page of the installer, click **Install**.

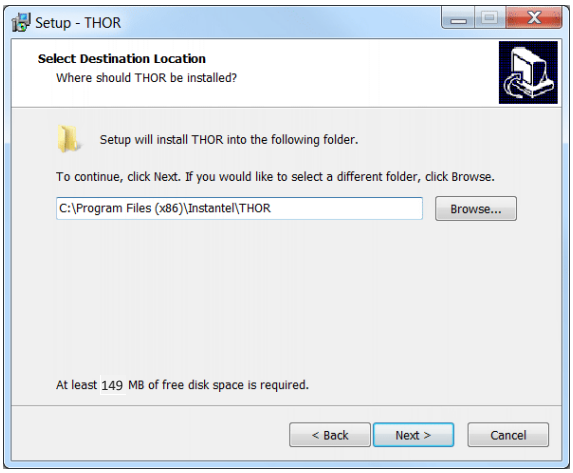


4. Wait while the installer downloads additional files.

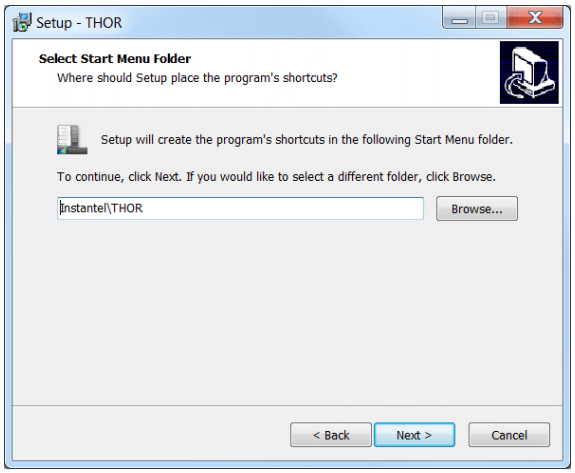


5. On the Welcome page, click **Next**.

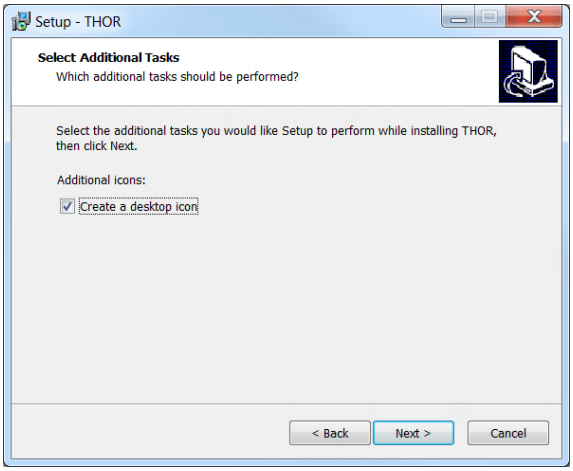
6. Read and Agree to the license agreement then click **Next**.



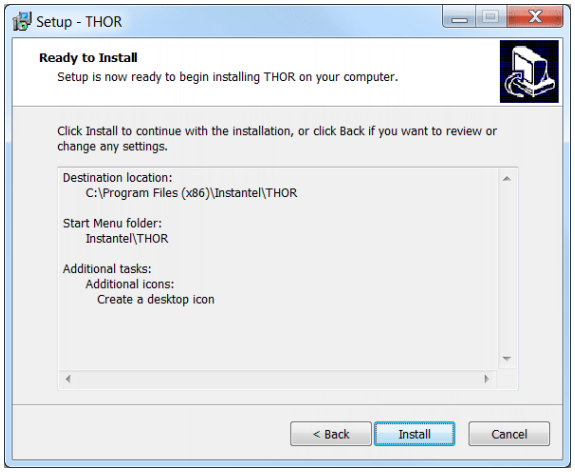
7. Choose a folder to install THOR and click **Next**.



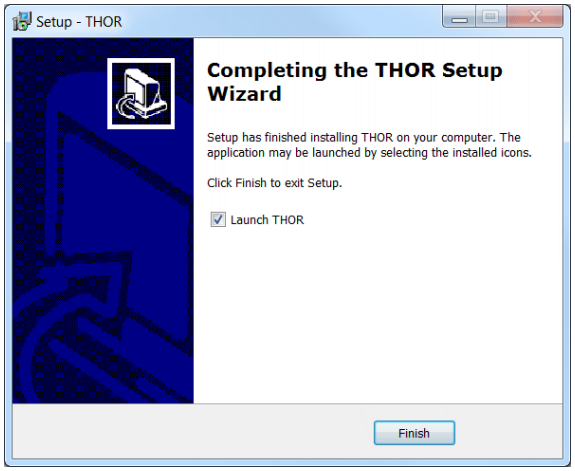
8. Define the location for the Start Menu folder then click **Next**.



9. (Optional) To install THOR without creating a desktop icon, uncheck, then click **Next**.



10. Click **Install**.



11. Check *"Launch THOR"* and click **Finish**.

2.2.2 UPDATE AN EXISTING INSTALLATION

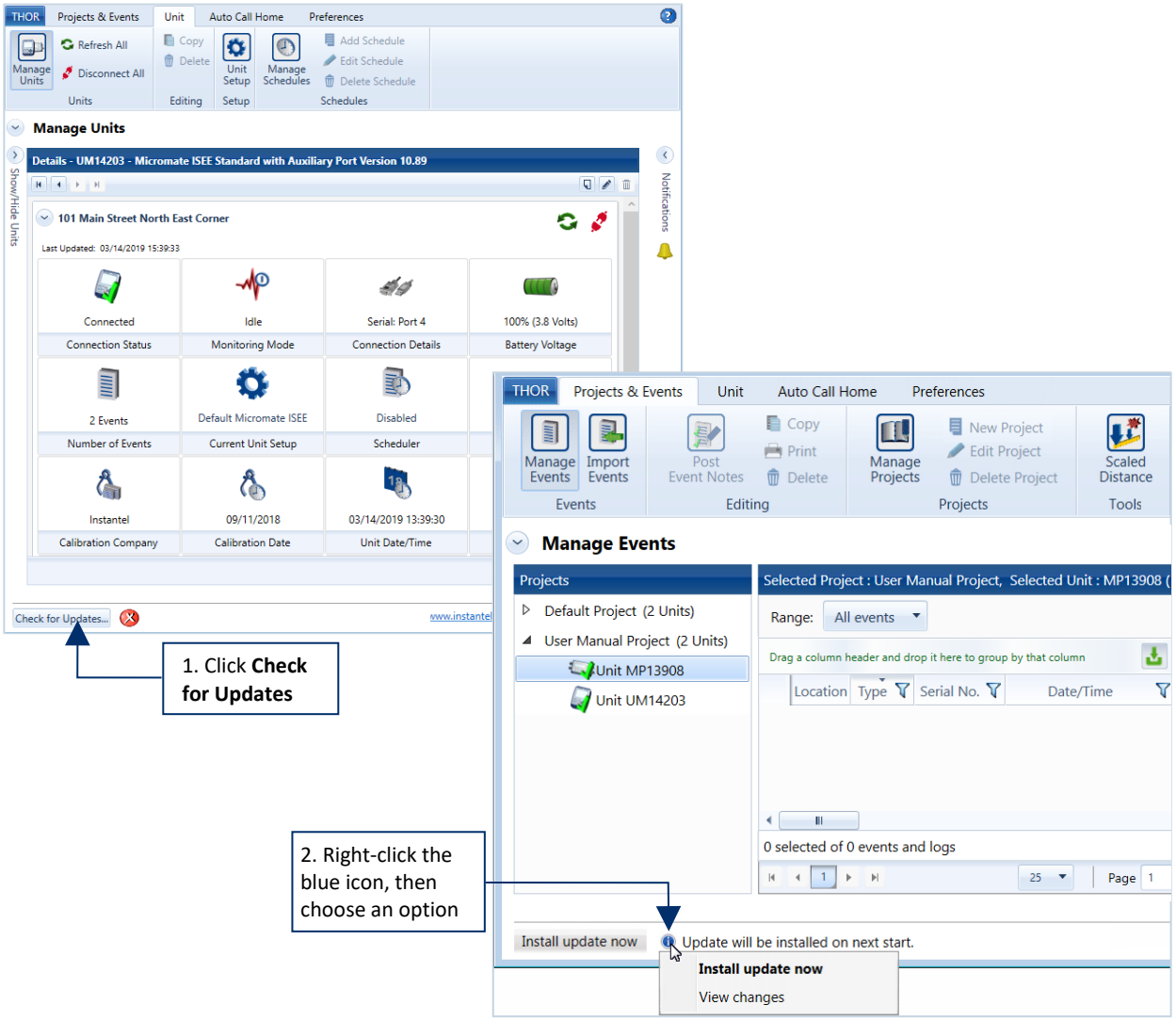
To update to the latest release of THOR, click the **Check for Update** button. If an update is found, it is downloaded and the **Check for Update** button changes to display **Install update now**. Click to install the update or preview the changes included in the update by clicking on **View Changes.**

> **WARNING**
> THOR does not support reverting back to older versions. If you proceed with the update you will not be able to restore to your previous version.

MONITORING UNIT FIRMWARE UPDATES

Updates to monitoring unit operating systems may be included with THOR updates. When this is the case, see Updating Unit Firmware on page 51.

Click the **Check for Updates** button.



3 (Optional) If the **Check for Updates** button changes to **Install update now**, you can:

Read the release notes for the new version (right-click the blue icon and select **View changes**).
Install the update (right-click the blue icon and select **Install update now**).

2.2.3 STARTING THOR

Start THOR from the Start menu, or from the shortcut on your desktop.

NOTE You can run THOR without an Internet connection, however certain features will not be available. (E.g. Communicating with units on the network or software updates.)

Windows 8.1 or Windows 10

1. Hover the cursor in the top right corner of the screen.
2. Click the **Search** tool.
3. In the **Search** box, type *THOR*.
4. Click the magnifying glass button.
5. Click the **THOR** icon.

NOTE If you have set up a THOR desktop icon, you can start THOR by double-clicking the icon.

Other Versions of Windows

Either:

Click the **Start** button, then **THOR**.

On your desktop, double-click the **THOR** shortcut.

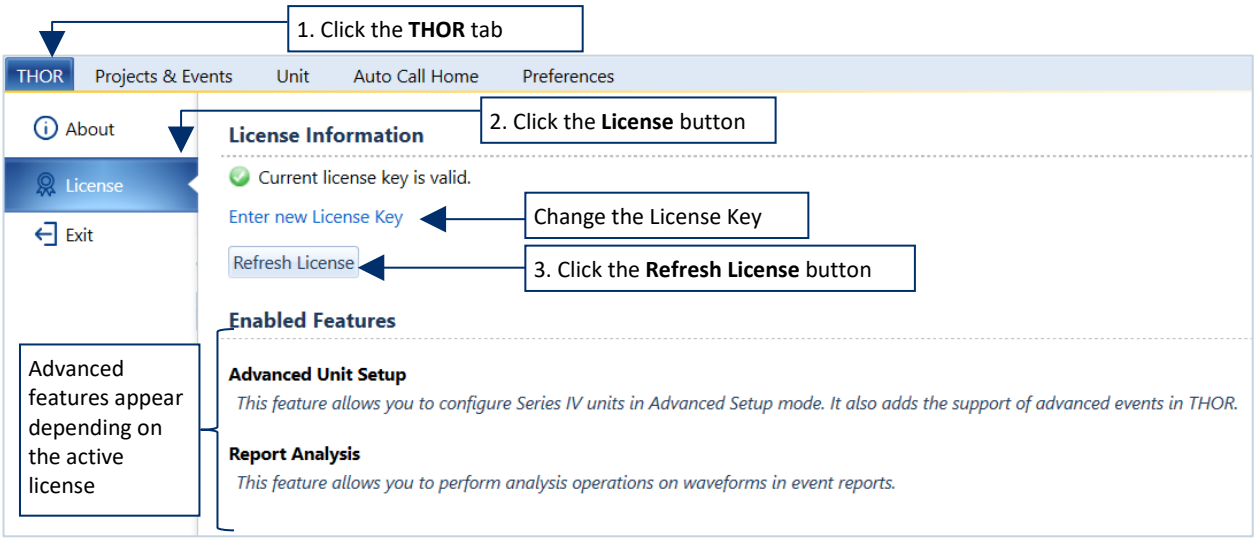
The THOR splash screen will appear while THOR is initializing.

2.3 LICENSING

2.3.1 LICENSE INFORMATION

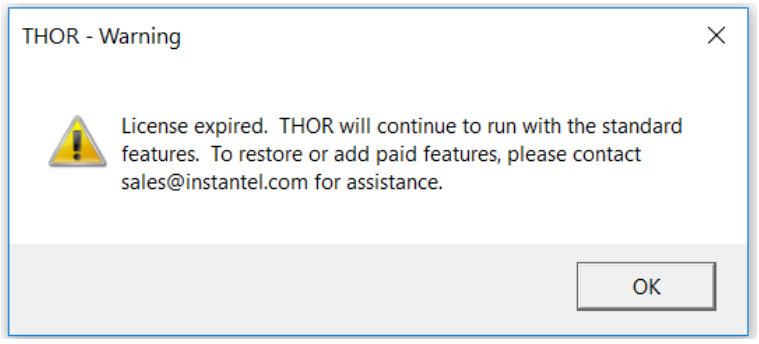
Information about your license appears in the License Information window. From this window, you can enter a new License Key, refresh your license to view information about Enabled Features (license dependent).

1. Click the **THOR** tab
2. Click the **License** button



3. To refresh your license, click on the Refresh License button, (or change the License Key).

Expired licenses will open a warning message. You will be able to continue using THOR's standard features however all Advanced functions will be disabled until the license has been renewed.



2.3.2 LICENSE AGREEMENT

INSTANTEL LICENSE AGREEMENT

This is a legal agreement between you (either an individual or an entity) and Instantel, Stanley Black & Decker, Inc. By clicking the **I accept the agreement** button or taking any step to install or use the software product, you are agreeing to be bound by the terms of this agreement. If you do not agree with the terms of this agreement, click the I do not accept the agreement button.

The software which accompanies this license agreement (the "Software") is warranted against defects in materials and workmanship and shall perform substantially in accordance with the accompanying written materials for a period of one year. Should a product fail within this period it shall be repaired or replaced free of charge. Instantel does not warrant that the operation of the Software will be uninterrupted or error-free. Instantel does not represent that any product will prevent bodily injury or damage to property. This warranty is void if the product has been dismantled, altered or abused in any way. EXCEPT FOR THE WARRANTIES SPECIFIED IN THIS AGREEMENT, THERE ARE NO WARRANTIES OR CONDITIONS, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OR CONDITIONS OF FITNESS FOR PURPOSE, MERCHANTABILITY OR FUNCTION OF THE SOFTWARE FOR A PARTICULAR PURPOSE AND THOSE ARISING BY STATUTE OR OTHERWISE IN LAW OR FROM A COURSE OF DEALING OR USAGE IN TRADE. USE OF THE SOFTWARE IS ENTIRELY AT YOUR SOLE RISK.

INSTANTEL WILL NOT BE LIABLE FOR: (A) HARM TO OR LOSS OF YOUR RECORDS OR DATA; (B) ANY CLAIMS AGAINST YOU BY THIRD PARTIES; OR (C) ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, EXEMPLARY OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO LOST PROFITS, LOST BUSINESS REVENUE, OR FAILURE TO REALIZE ON SAVINGS, EVEN IF INSTANTEL HAS BEEN ADVISED OF THE POSSIBILITY OF THESE DAMAGES. THIS LIMITATION APPLIES TO ALL CLAIMS BY YOU IRRESPECTIVE OF THE CAUSE OF ACTION UNDERLYING THE CLAIM BUT NOT LIMITED TO BREACH OF CONTRACT INCLUDING FUNDAMENTAL BREACH, TORT INCLUDING NEGLIGENCE AND MISREPRESENTATION; AND BREACH OF STATUTORY DUTY. IN NO EVENT SHALL THE LIABILITY OF INSTANTEL EXCEED THE COST OF THE SOFTWARE.

This agreement allows you to use the Software on one computer and make one copy of the software solely for backup purposes. You must reproduce on any such copy all copyright notices and any other proprietary legends on the original copy of the Software. You may not decompile, reverse engineer, disassemble, or otherwise reduce the Software to a human conceivable form.
This agreement gives you limited rights to use the Software. You do not become the owner of, and Instantel retains title to, the Software, and all copies thereof. All rights not specifically granted in this agreement are specifically reserved by Instantel.

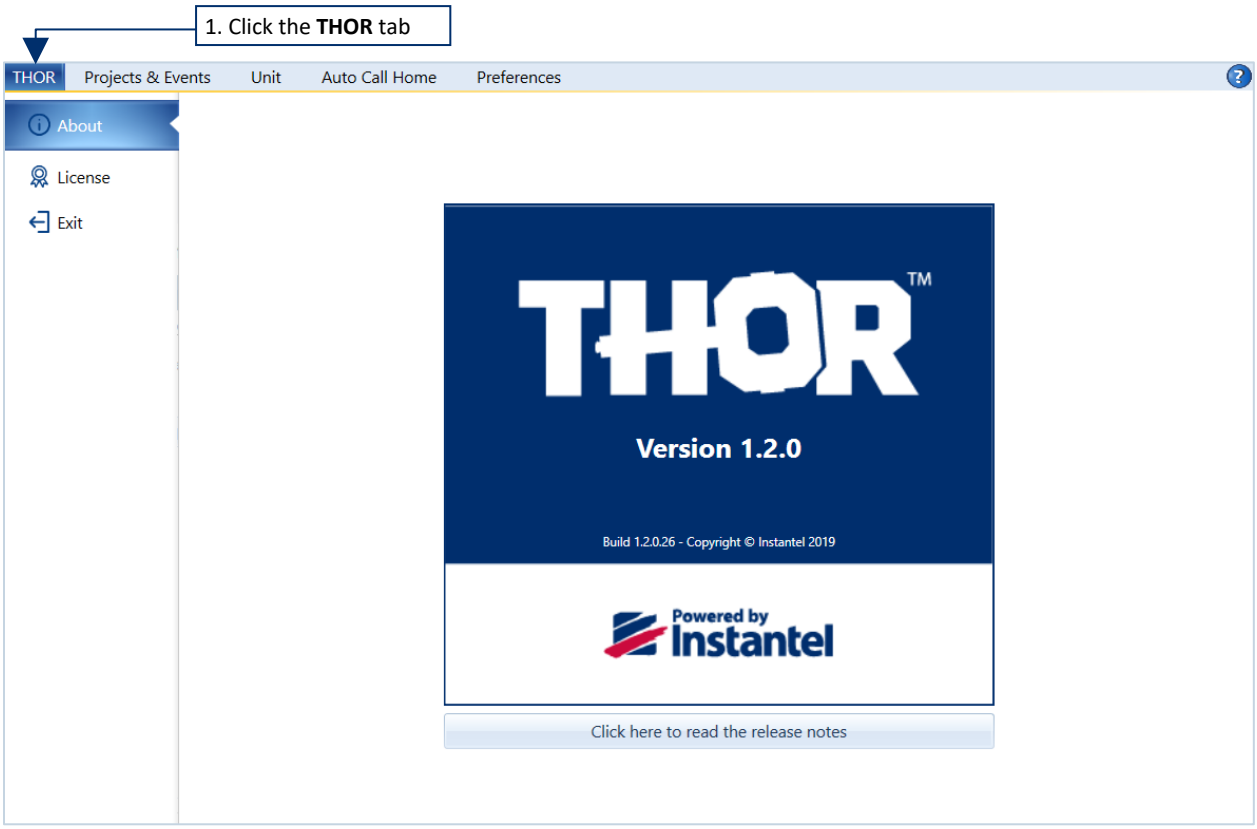
Instantel may terminate your license if you breach any term of this agreement and do not remedy the breach within 10 days written notice of the breach. Upon termination, you will immediately delete the Software from the computer in which it is installed and return all copies of the Software to Instantel.

This agreement constitutes the entire agreement of the parties with respect to the subject matter and supersedes all prior agreements, understandings, negotiations and discussions, whether oral or written, between the parties. This agreement will be governed by the laws of the Province of Ontario excluding the law of conflicts and excluding the United Nations Convention of Contracts for the Sale of Goods. You agree to attorn to the exclusive jurisdiction of the courts of the Province of Ontario which will have exclusive jurisdiction over matters in respect of this agreement.

2.3.3 VIEWING THE RELEASE NOTES

You can view the Release Notes through the THOR tab at the top of the main window.

1. Click the **THOR** tab at the top of the window.
2. Click the button below the THOR box to download the latest Release Notes.



3. MANAGING MONITORING UNITS COMPLIANCE SETUP

3.1 CONNECTING UNITS TO THOR

Units and THOR can communicate:

Directly

Use a serial, USB or Ethernet cable to create a direct physical connection between the computer and the unit.
(For cable/unit compatibility see section 3.1.1 Direct Link to a local Computer on page 27.)

Remotely

Use a cellular modem to create a remote connection between the computer and a remote unit.

Over a Local Area Network (LAN)

This configuration is not covered in this manual, please contact our technical support if your setup requires a local area network connection (Minimate Pro only).

THOR can control most settings (see note) on the unit. Event data can be downloaded to THOR.

THOR can view and update the following unit settings:

- Turn monitoring mode ON/OFF
- Add operators
- Change the default operator
- Set up and activate Auto Call Home
- Scheduler

NOTE: Some settings can only be accessed on the physical unit: Ex. The Auxiliary “modem power” port must be configured on the Micromate unit. ACH baud rate, ACH session time out. For more information see the unit’s respective Operator’s manual.

3.1.1 DIRECT LINK TO A LOCAL COMPUTER

Connecting the unit to a local computer using the appropriate cable.

Minimate Pro

Connect the Minimate using the default Ethernet cable provided or with an optional serial cable. (a USB to serial adaptor can be ordered separately from an Instantel dealer.)

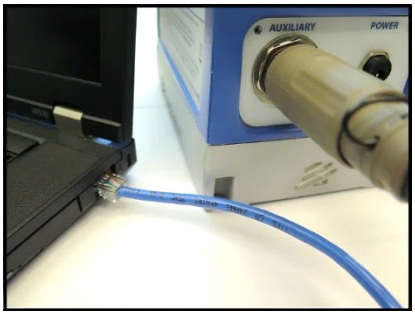
WARNING
Forcing these quarter-turn connectors may damage them.

1. Connect the auxiliary connector to the auxiliary port located on the side of the unit.

2. Attach the other end according to the available connections on the computer:
   a. Serial cables connect to a serial port on the computer
   b. USB to serial adaptors connect to the USB port on the computer
   c. Ethernet cables connect to an Ethernet port on the computer

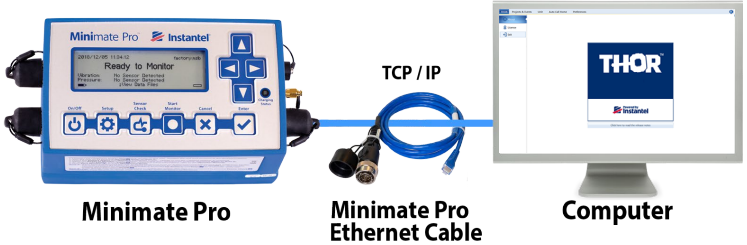
2a. Serial Cable (Part # 720A3401) to Serial port

2b. Serial Cable (Part # 720A3101) to Serial-to-USB adaptor (Part # 714A7001) to USB port



2c. Ethernet cable (Part # 720A4101) to Ethernet port

Both devices must be on the same Subnet, please contact your IT specialist for how to set up a local IP network.



Micromate

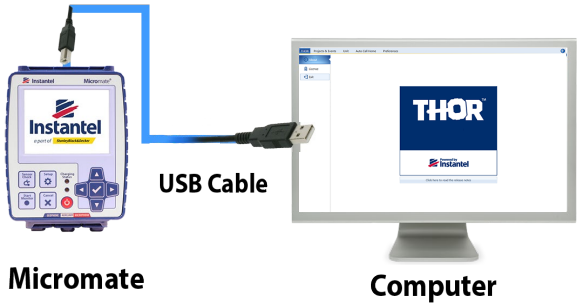
Connect the Micromate using the default “PC to USB” cable.

1. Connect the square end of the USB cable to the Micromate’s PC port.
2. Connect the rectangular end of the USB cable to the computer’s USB port.

NOTE The unit and the PC will beep, indicating that Windows has detected the Micromate.

NOTE The Micromate must be connected and powered on to access Micromate settings or upload data to the computer.

Micromate's PC port to Computer USB



3.1.2 REMOTE LINK USING A MODEM

Remote connections provide access to recorded data as if the unit were physically connected to THOR on a local computer.

Setting up modem communications requires three steps. Once completed the unit should be connected to the computer and ready to upload event files from the units to the computer.

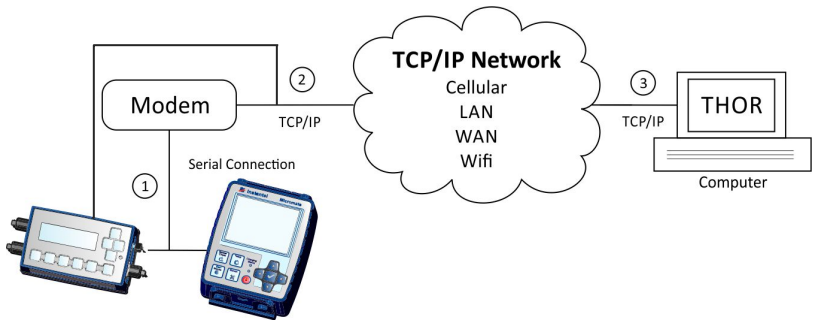
Only use Instantel cables.

1 **Configure serial communications on the monitoring unit**
   a. see the user manual for the specific unit.

2 **Configure the remote cellular modem**
   a. Configure the modem before taking it into the field to connect with the remote unit. If the modem is used in parallel with third-party software, make sure it is configured to be compatible with THOR. Then try a test call.

NOTE Configuring the modem depends on the manufacturer and model. Refer to the instructions provided with the modem. For the latest information on modem deployment, consult Instantel's online support site.

3 **Connect the remote cellular modem**
Once initialized and configured, connect the cellular modem to the monitoring unit.
   a. The Micromate recommends connecting to a cellular modem using the Sabrent CB-FTDI USB to serial cable (Part # 721A1001).
   b. The Minimate Pro must be connected to a cellular modem using the provided serial cable (Part # 720A3401) or it can also connect to a LAN using Instantel's Ethernet cable (Part # 720A4101).



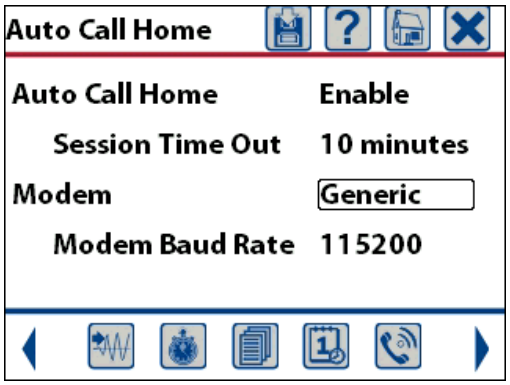
Modem relay setting power ON is not accessible via THOR.

LABEL	CONNECTIONS
①	The unit (Minimate Pro or Micromate) connects to a modem through a serial connection.
②	The modem uses the TCP/IP protocol to connect to a network.
③	The network uses the TCP/IP protocol to connect to a computer running THOR.

Remote Communications Example with a Micromate

The following is an excerpt from the Procedure for Configuring the Micromate for Auto Call Home.

1. Touch the Auto Call Home short cut icon on the Micromate touch screen.
2. Enable Auto Call Home. Set the Session Time Out to 10 minutes, Modem to Generic and Modem Baud rate to 115200.



For modem connected Unit

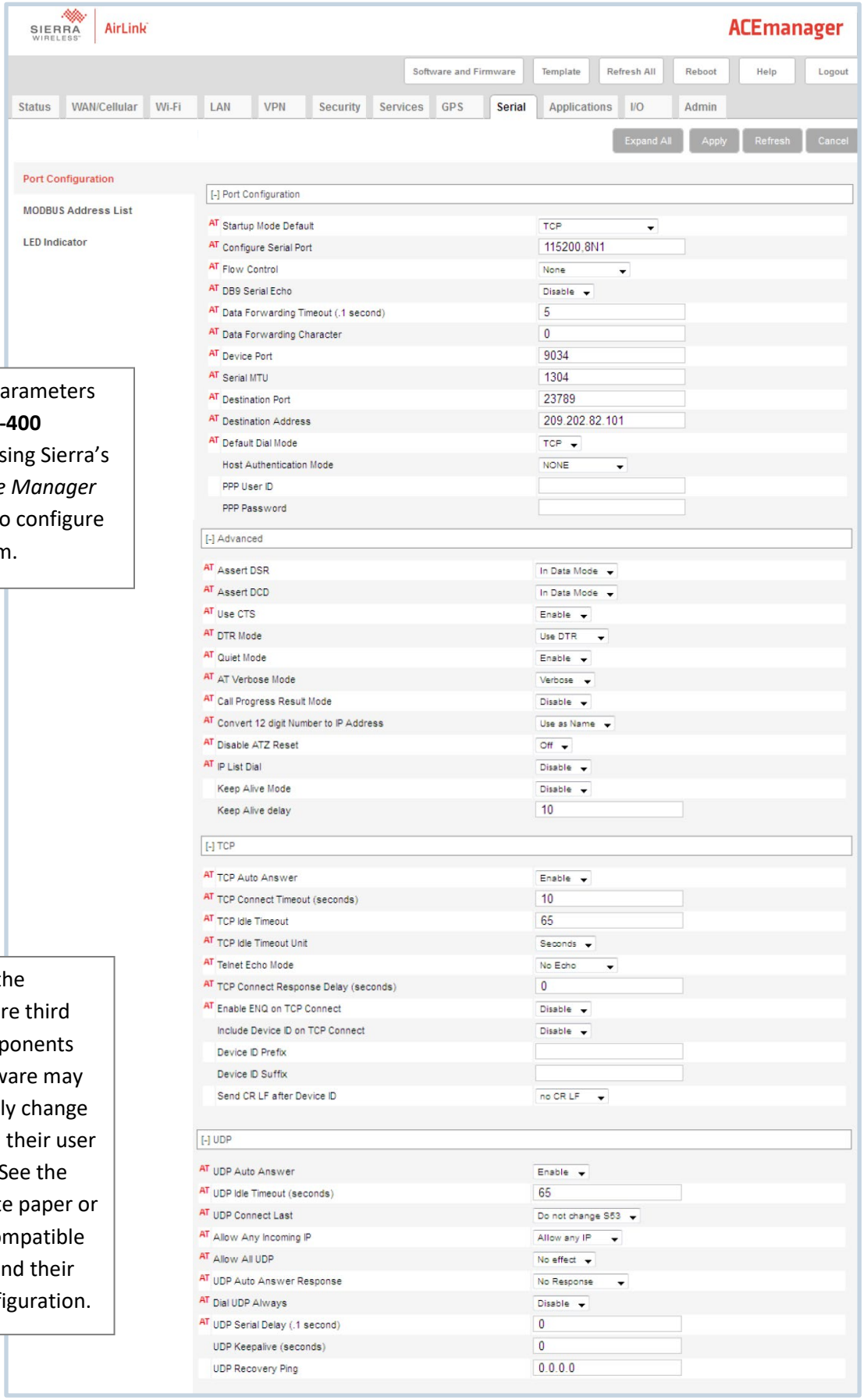
NOTE Session Time Out is used to exit Auto Call Home and return to monitor mode. Use this feature to set the maximum amount of time the Micromate will NOT be in monitor mode.

Instantel recommends using the tested and fully compatible **Sabrent CB-FTDI** USB to Serial Cable to connect the Micromate to the modem.

The Micromate units are tested and fully compatible with **Sierra RV-50**, **LS-300,** and **GX-400** modems. Example of the GX-400 modem, using the AirLink Ace Manager software to configure the modem.

When setting the **TCP idle time-out** value, use the following values based on your expected usage.

- If you remotely configure the Compliance Setup or Schedule of the unit, we recommend using 10 minutes to allow for the TCP idle time that occurs between the time the Compliance Setup window is opened in THOR and the time the new configuration is sent to the unit.
- If you do not remotely configure the Compliance Setup and Schedule of the unit, we recommend using 65 seconds to allow for TCP idle time that occurs when an Auto Call Home session executes a Delete All on the unit.



Example parameters for the **GX-400** modem, using Sierra's *AirLink Ace Manager* software to configure the modem.

NOTE As the modems are third party components their firmware may occasionally change along with their user interface. See the latest white paper or FAQ for compatible modems and their setup configuration.

3.2 ADD AND EDIT UNITS

Units are added to THOR:

- Manually
- Using Auto Discovery

THOR will automatically add a unit if the unit initiates an Auto Call Home session, and a filter exists recognizing the unit's serial number.

Blastmate and Minimate Plus units may connect in this way to THOR.

See section 6.2.2.2 *Filters & Actions* on page 142

3.2.1 MANUALLY ADD / EDIT

When the network settings don't align with Auto Discovery requirements it must be set up manually. Remote units can also be added manually. The manual setup is also the best alternative when the unit has customized details. The following table outlines when to use Auto-Discovery / Manual.

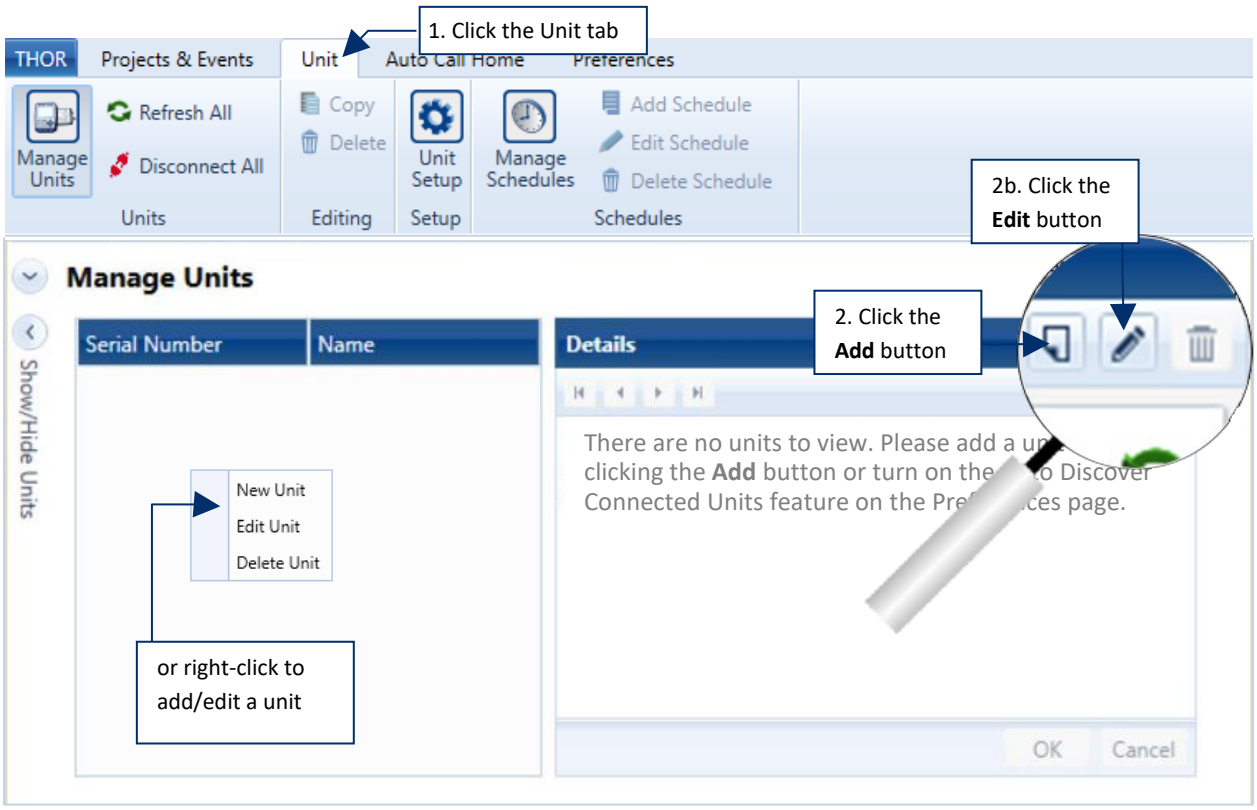
CONNECTION TYPE	ADDING A UNIT TO THOR	
	MANUALLY	AUTO DISCOVERY
Direct/Local	Yes	Yes
Local Area Network (LAN)	Yes	Yes
Wide Area Network (WAN)	Yes	Depends on network*
Minimate Pro connected directly to the Internet	Yes	No
Modem communication through the Internet	Yes	No
Internet	Yes	No

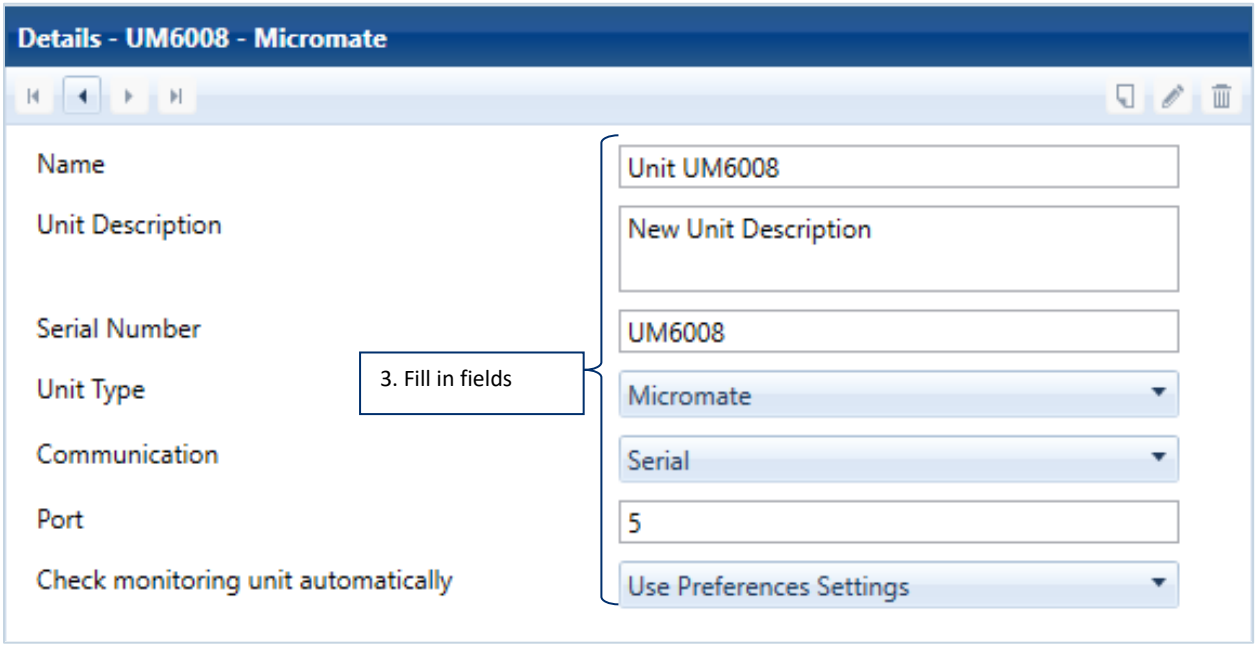
*If the WAN blocks broadcasts to the LAN where THOR resides, Auto-Discovery will not be available.

NOTE Any event data that the unit collected will remain in THOR even if the unit is deleted from THOR.

To Manually Add / Edit a unit:

1. Click the **Unit** tab.
2. Click the **Add** button to add a new unit, or, 2b. Click the **Edit** button to edit an existing unit.
3. Fill in the various fields.





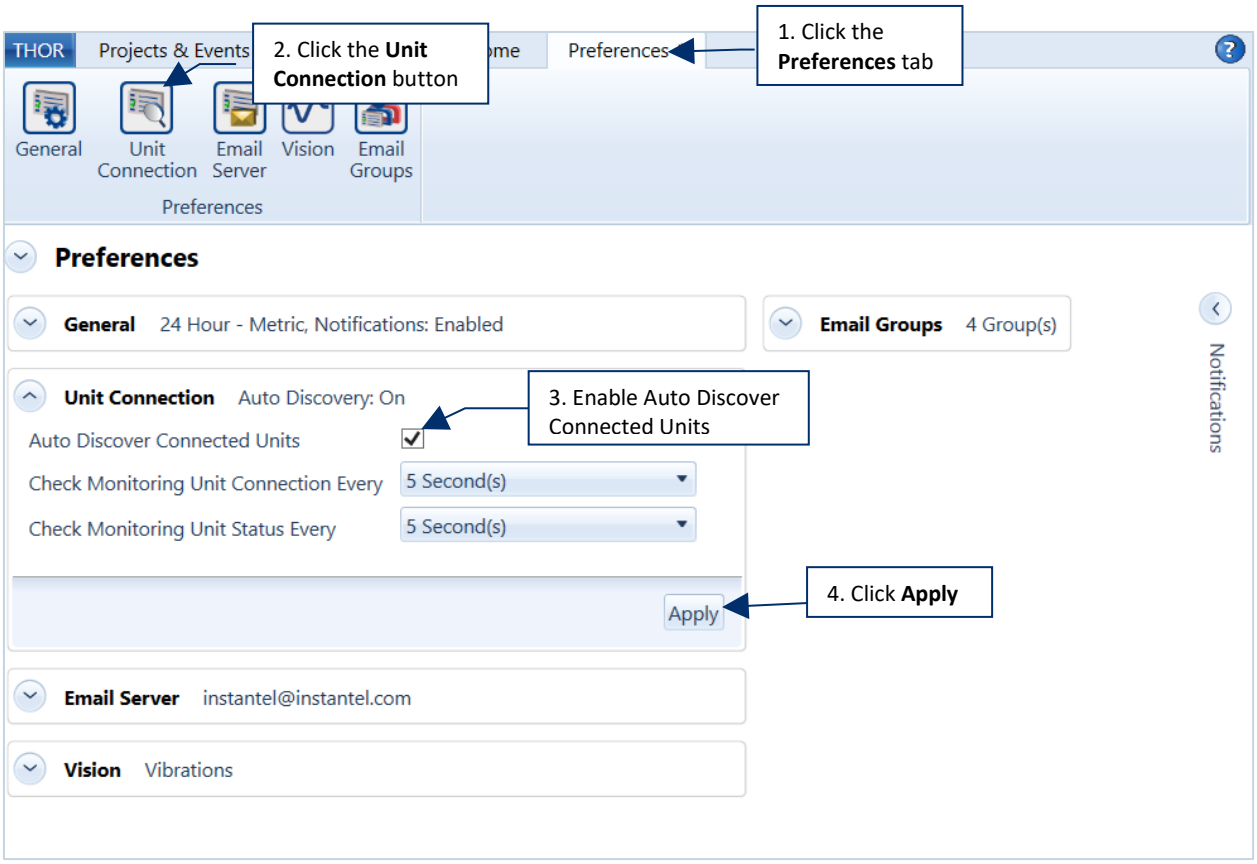
FIELD	FUNCTION
Name	A unique name for the unit.
Unit Description (Optional)	A description or note that is useful for identifying the unit.
Serial Number	The exact serial number of the unit. Without the correct serial number, THOR cannot communicate with the unit.
Unit Type	The model of the unit. Without the correct model type, THOR will not communicate with the unit.
Communication	**Serial** In the **Port** field, Enter the COM port. Minimate Pro and Minimate Plus units must also have their communication speed defined. **Baud Rate**: Minimate Pro: choose between 9600, 38400, 115200. Minimate Plus: must be set to 38400.
	TCP When using a modem, in the **IP Address** field, type the public, static TCP/IP address configured on the modem. THOR supports IPv4 and IPv6 address formats. In the **Port** field, type the TCP/IP port configured on the modem. For Minimate Pro units connected to a network, in the **IP Address** field, type the TCP/IP address configured on the Minimate Pro. In the **Port** field, type 9034.
	Domain Name The domain name of the unit. (E.g. Instantel.com)
Check monitoring unit automatically (Optional)	**Disabled** Do not use this function
	Use Preferences Settings Apply the same settings as those defined in Preferences
	Use Specific Settings **Check Connection every:** defines the polling interval to verify the unit is connected with THOR. **Check Status every:** defines the polling interval to relay the unit's status.

3.2.2 AUTOMATICALLY ADD A UNIT WITH AUTO DISCOVERY

When the unit is connected to the network, (or via a direct local connection) THOR detects the unit automatically and sets up the connection using the current settings on the unit.

NOTE Auto-Discovery will only detect properly configured units.

1. Click the **Preferences** tab.
2. Click the **Unit Connection** tab.
3. Enable the **Auto Discover Connected Units**.
4. Click Apply.



3.3 UNIT DASHBOARD VIEW

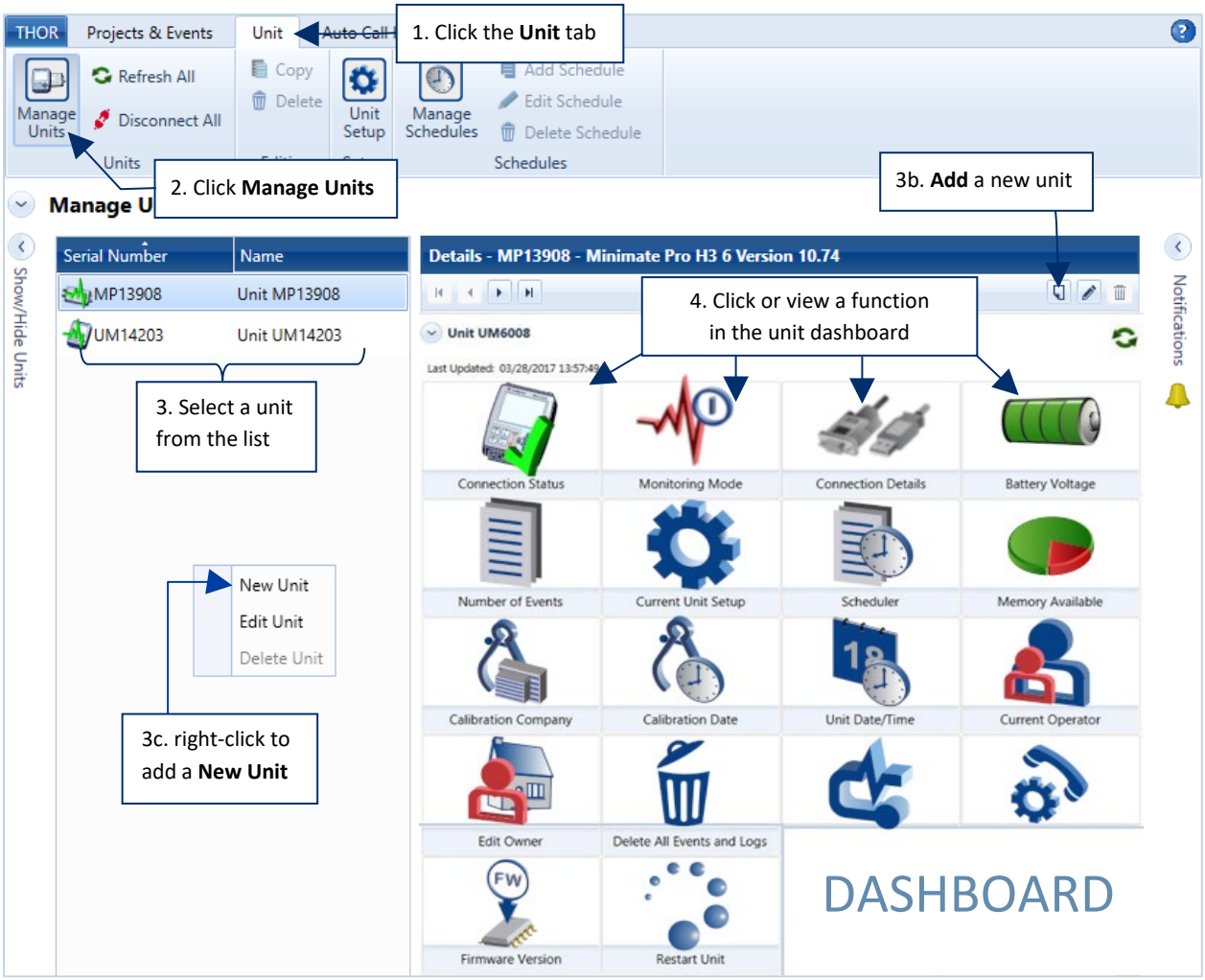
3.3.1 SINGLE UNIT DASHBOARD INFORMATION

This section provides a detailed description of each element of the unit dashboard and contains procedures that show how to:

> Change the monitoring state, define a schedule, update date and time, reload the unit's setup file, add and remove operators, change the owner, delete events and logs, perform a sensor check, manage Auto Call Home, update the firmware, and restart the unit.

To work with the unit DASHBOARD:

1. Click on the **Unit** tab.
2. Click on the **Manage Units** button.
3. Select a unit from the list, or, **3b**. **Add** a new unit, or, **3c.** right-click to add a new unit.
4. Click or view a function in the Unit Dashboard.

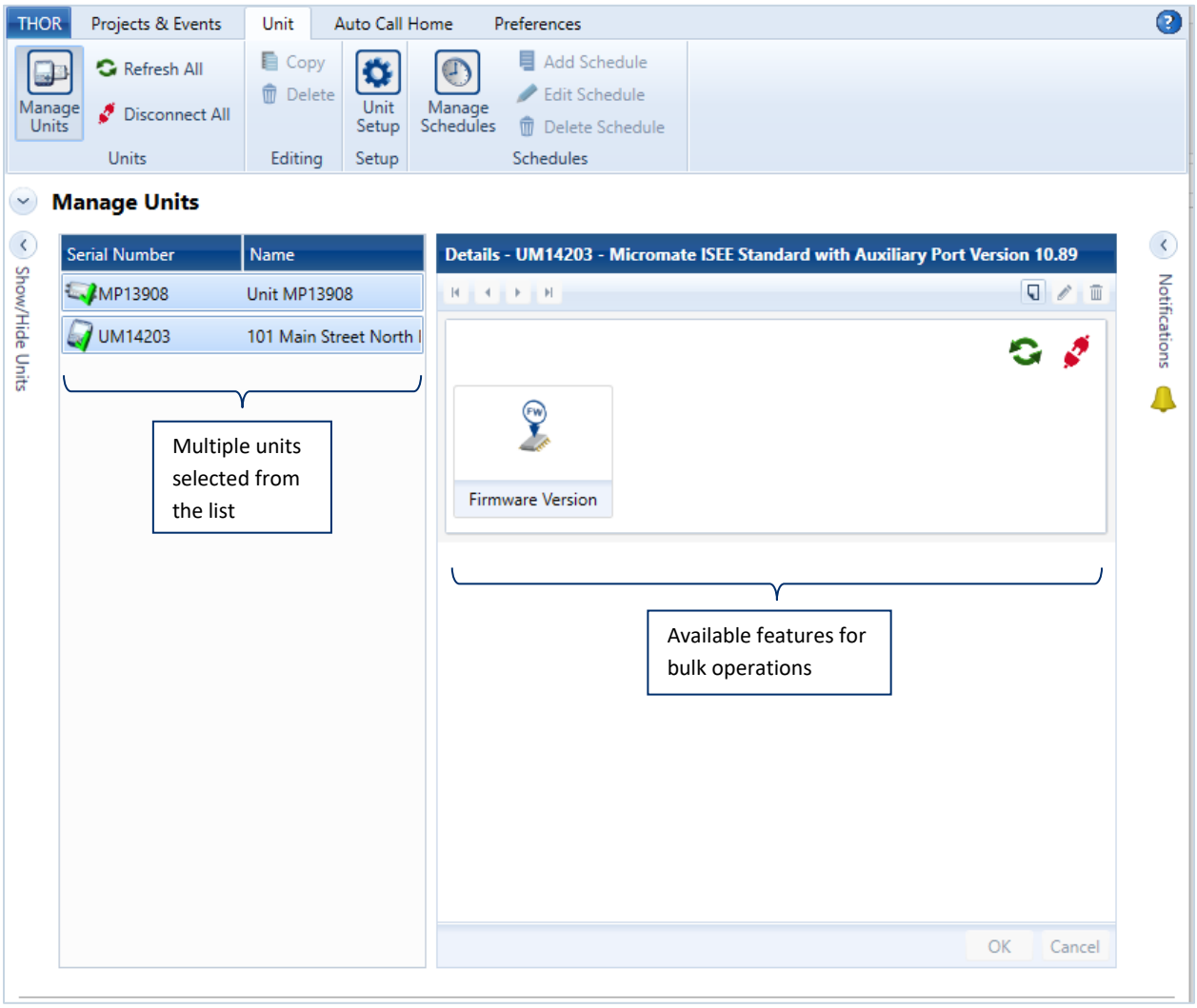


WARNING THOR will only function properly with compatible units. To upgrade a unit please contact Instantel at sales@instantel.com.

3.3.2 MULTIPLE UNIT DASHBOARD INFORMATION

The Multiple unit dashboard allows you to perform bulk operations in an efficient manner.

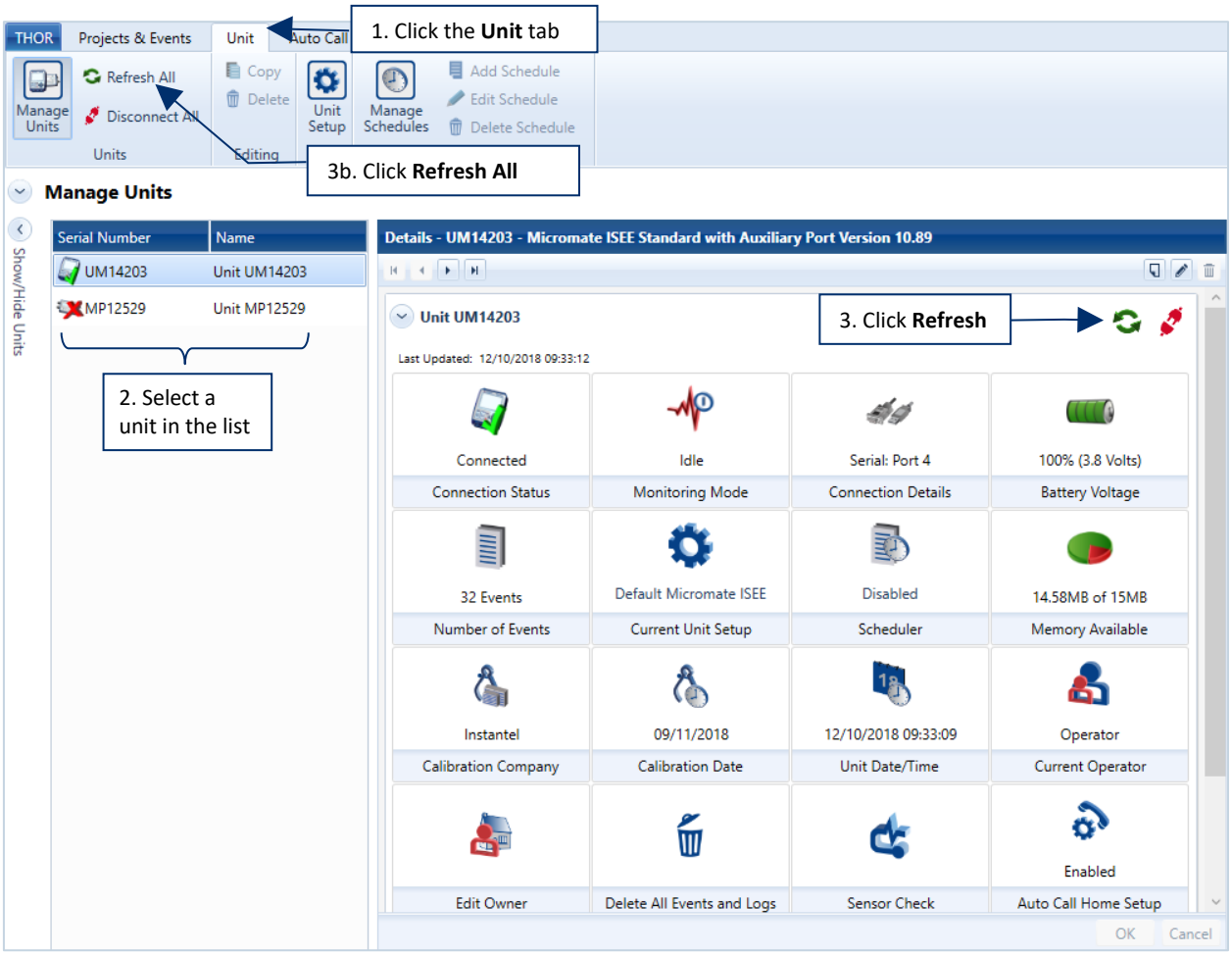
This can be useful for example to update the firmware, refresh, or disconnect multiple units in one shot. This dashboard appears when you select multiple units from the list of available units.



3.3.3 REFRESH COMPONENT INFORMATION MANUALLY

You can refresh the component information of a unit by clicking the **Refresh** button. This will retrieve and display all elements on the **Unit** D**ashboard**. Refresh manually when you know an element has changed, but that change is not yet displayed.
Ex: After powering on a unit, if the unit connection status does not update to read "Connected."

If a unit's last known connection status was disconnected, a manual refresh will try to re-establish a connection and then retrieve the unit's status.

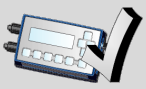
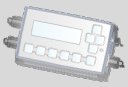


1 Click the **Unit** tab.
2 Select a unit in the list of units.
3 Click the **Refresh** icon on the unit dashboard, or
3b. Click the **Refresh All** icon on the top menu panel to refresh all known units.

3.4 CONNECTION STATUS AND DETAILS

3.4.1 CONNECTION STATUS ICONS

Units are represented with icons that may vary according to their status. Hovering over an icon will display information about its functionality.

STATE	MEANING The monitoring unit:	ICON		
		SERIES III	MINIMATE PRO	MICROMATE
Connected and monitoring Connection monitoring automatically as defined in preferences refresh rate.	▪ Associated with the current project ▪ Communicating with THOR ▪ Last known state was connected and **monitored** ▪ The connection is automatically monitored			
Last known state connected and monitored Not monitoring automatically	▪ Associated with the current project ▪ Not communicating with THOR ▪ Last known state was connected and **monitored** ▪ The connection is not currently monitored			
Connected Connection monitoring automatically as defined in preferences refresh rate.	▪ Associated with the current project ▪ Communicating with THOR ▪ Last known state was connected ▪ The connection is automatically monitored			
Last known state connected Not monitored automatically	▪ Associated with the current project ▪ **Not** communicating with THOR ▪ Last known state was connected ▪ The connection is **not** currently monitored			
Disconnected Connection monitoring automatically as defined in preferences refresh rate.	▪ Associated with the current project ▪ **Not** communicating with THOR ▪ Last known state was disconnected ▪ The connection is automatically monitored			
Last known state disconnected not monitored automatically	▪ Associated with the current project ▪ **Not** communicating with THOR ▪ Last known state was disconnected ▪ The connection is not currently monitored			
Auto Call Home	▪ Currently calling home			
Not active in the current project	▪ Not associated with the current project ▪ Events from the unit were downloaded into the project in the past, but the unit is not associated with that project at this time			

3.4.2 CHECK UNIT CONNECTION AND STATUS AUTOMATICALLY

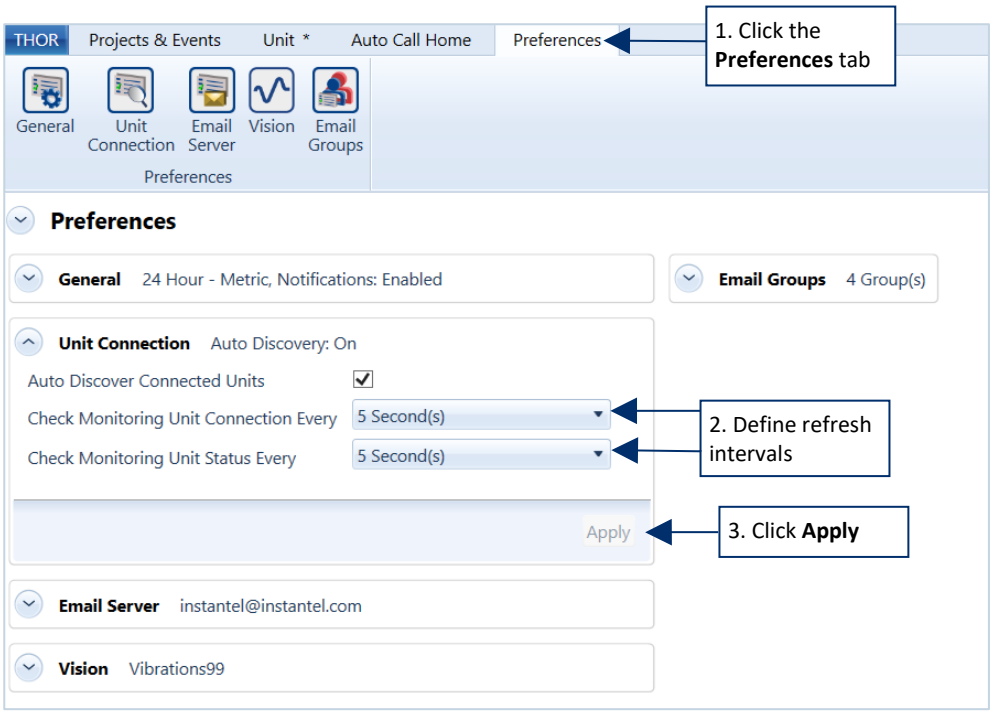
THOR's Unit Details dashboard can check the unit connection and status automatically, communicating with units to retrieve the latest status information and displaying that information as it is updated.

You can choose to check the connection and status of all units automatically or select individual units to check automatically.

WARNING Refreshing unit status automatically can use a significant amount of data, as the units are in constant communication with THOR.

3.4.2.1 CHECK THE CONNECTION / STATUS OF ALL UNITS AUTOMATICALLY

1 Click the **Preferences** tab.



2 Define refresh intervals for the two fields:

Check monitoring unit connection every

Check monitoring unit status every

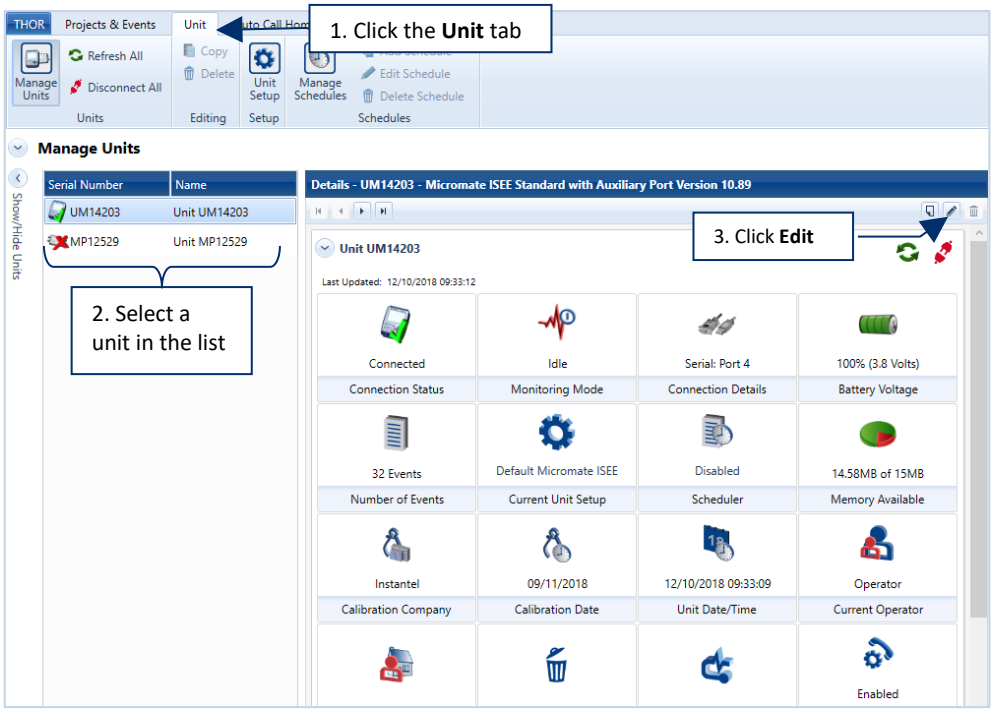
3 Click **Apply**.

NOTE The Auto Discover Connected Units function will monitor the computer's ports and detect any units that get connected to the computer. This is only to establish a connection. The following two settings determine the Dashboard display's refresh rate of the unit status. This means, for a refresh rate of 1 hour, if the unit's status changes within the hour, THOR will only reflect this change after one hour, or if the user chooses to refresh manually.

3.4.2.2 CHECK THE CONNECTION / STATUS OF AN INDIVIDUAL UNIT AUTOMATICALLY

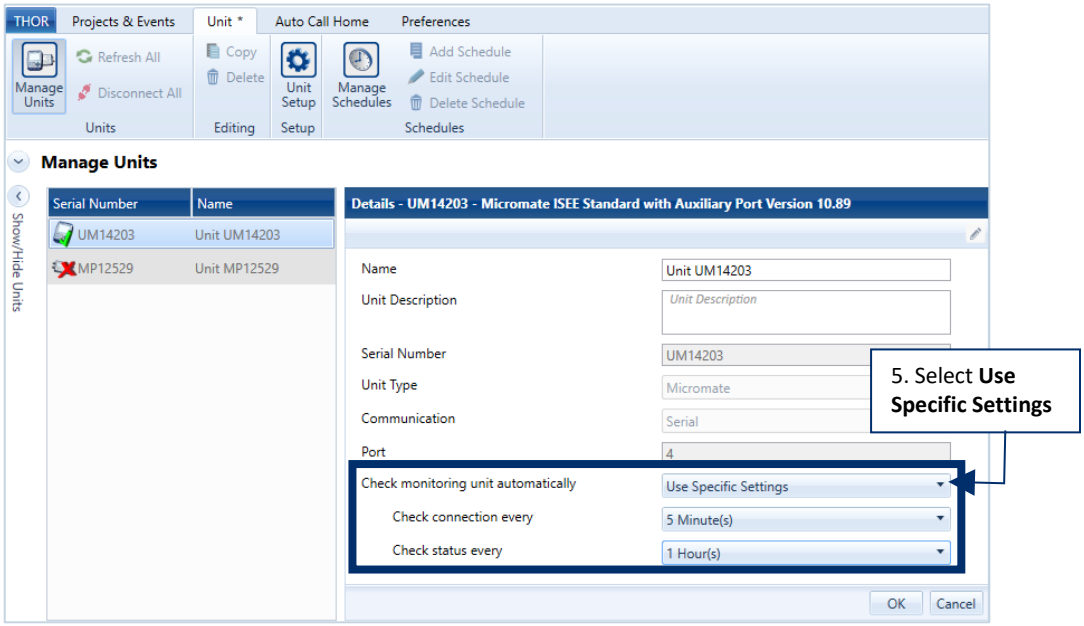
1 Click the **Unit** tab.

NOTE Unit level settings always override the general preferences settings in section 3.4.2.1.



2 Select a unit in the list of units.

3 Click the **Edit** icon, (or right-click on the unit and select **Edit Unit**)



4 Select **Use Specific Settings** and define the refresh intervals for the two fields.

3.4.3 DISCONNECTING A UNIT / ALL UNITS

1 Click the **Unit** tab.

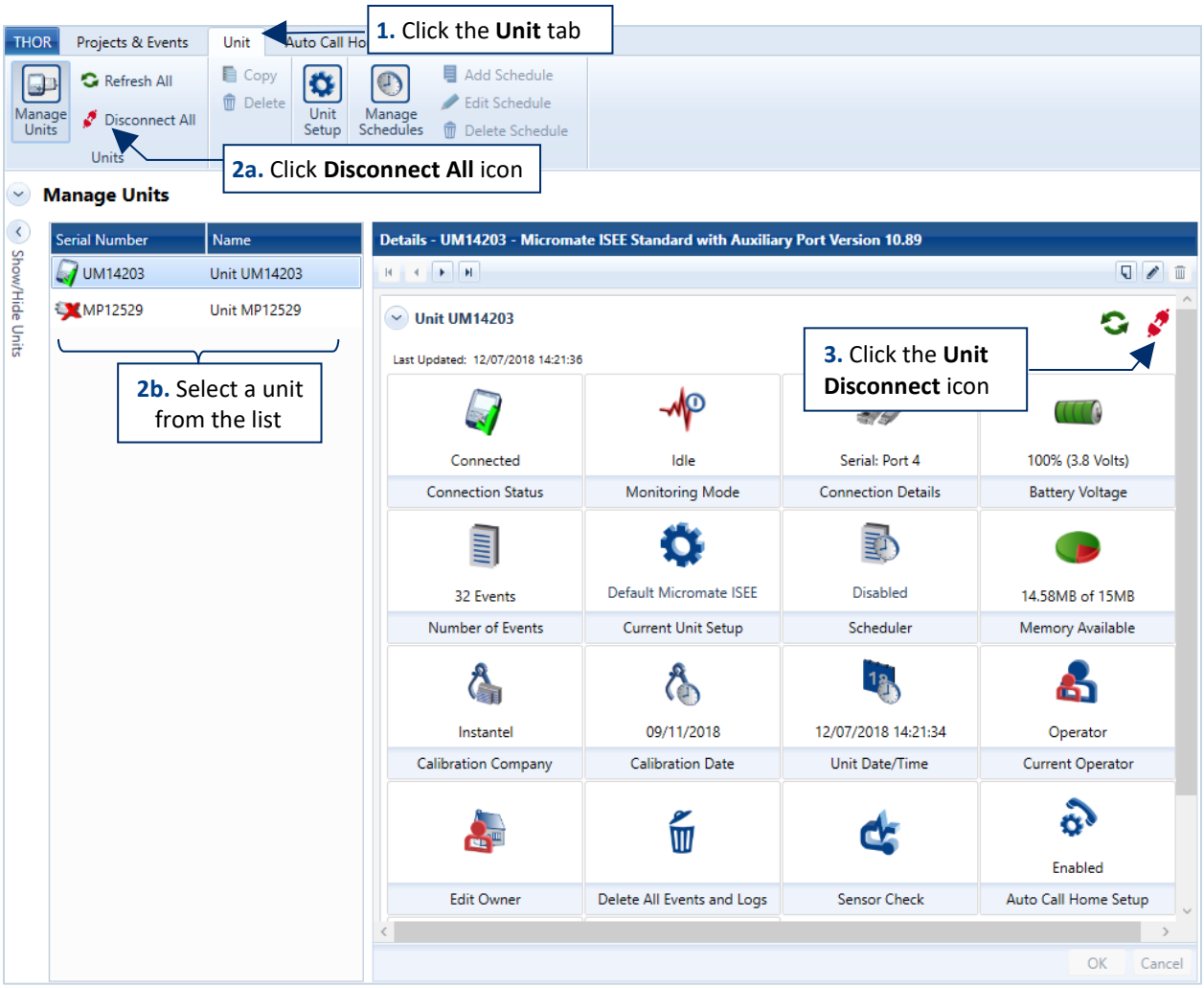
2

2a. Click on the **Disconnect All** icon.

Or

2b. Select a unit from the list of units.

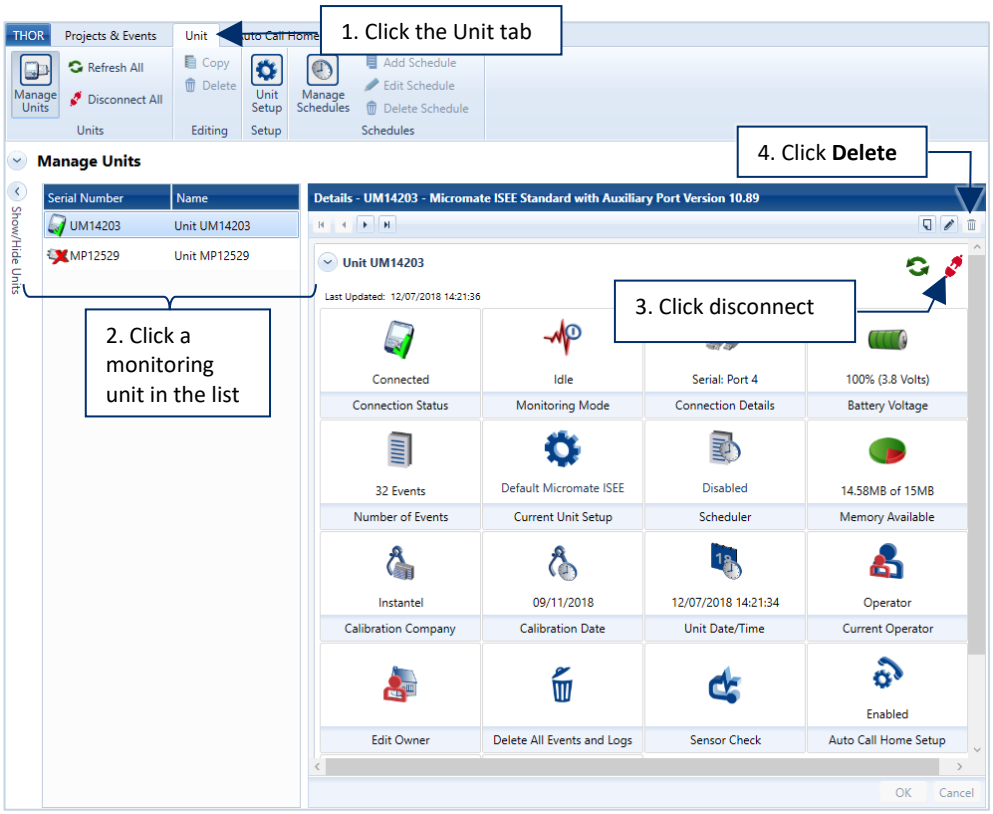
3 Click on the **Unit Disconnect** icon.



The disconnect feature will not stop a unit that is actively calling home. In this case you will see that not all units are disconnected, and you must try again.

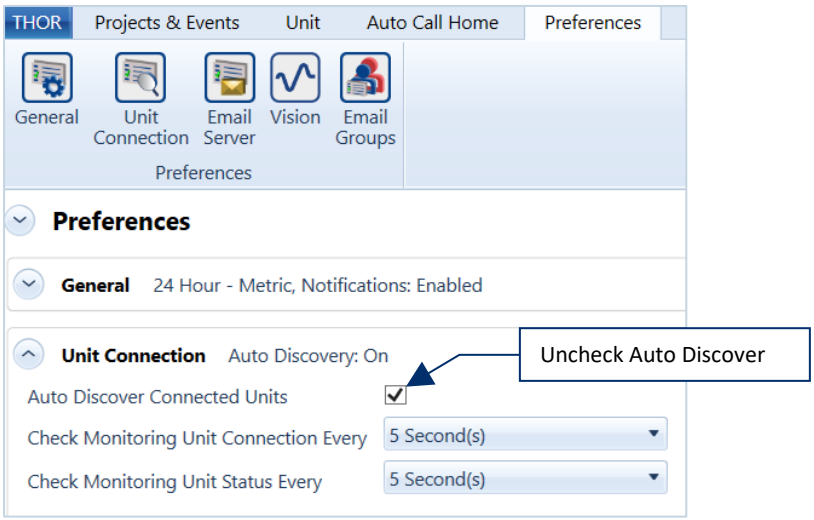
3.4.4 DELETE A UNIT

1. Click the **Unit** tab.
2. Click a unit in the list of units.
3. Disconnect the unit by clicking on the disconnect icon.
4. Click **Delete** (In the confirmation dialog box, click **OK**.)



NOTE You cannot delete a unit that is currently connected.

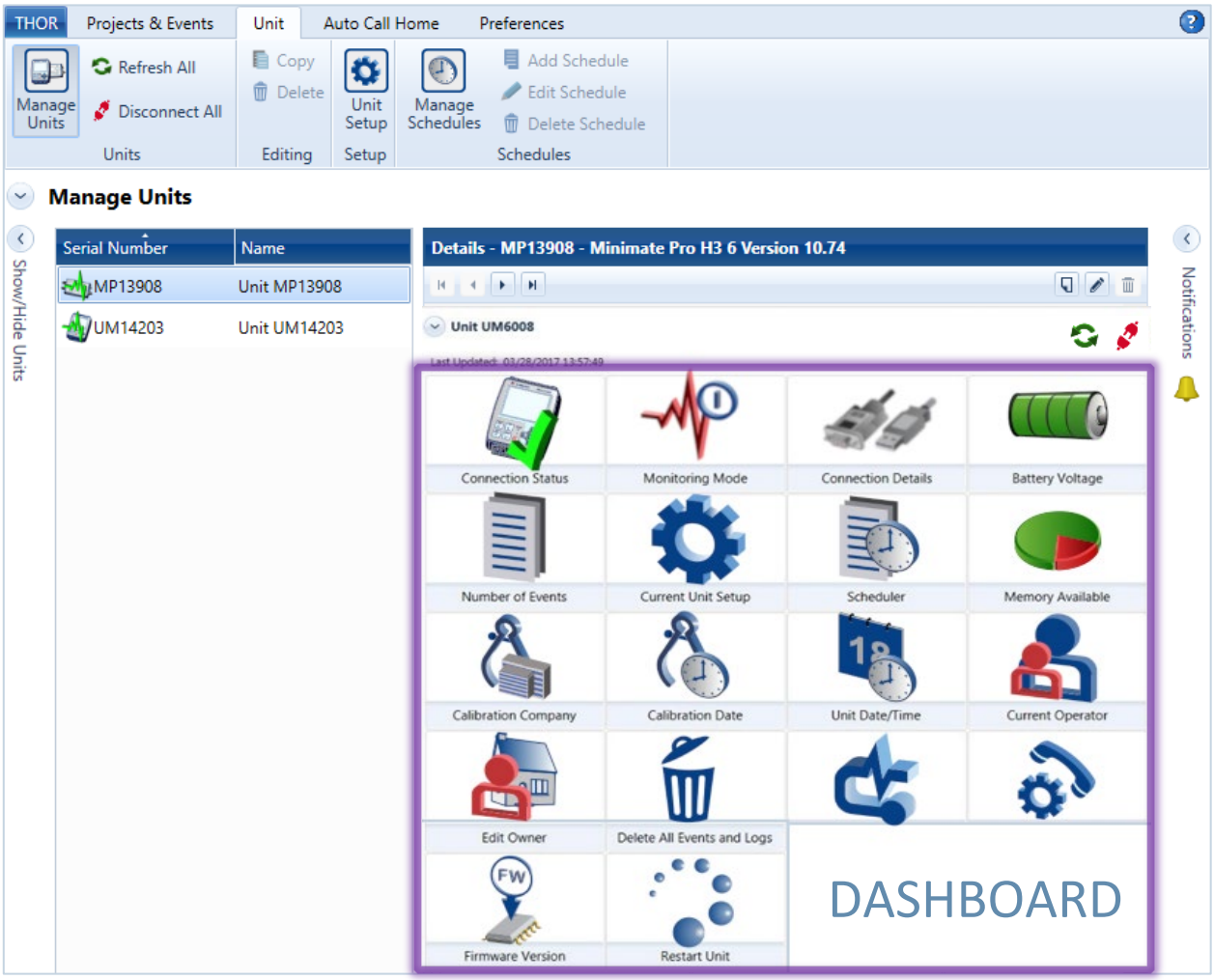
NOTE You may need to temporarily disable the Auto Discover settings in the Preferences → Unit Connection section. If the checking interval is short, the unit may reconnect before you have time to delete it.



3.5 UNIT MANAGEMENT

The monitoring unit dashboard (Described in section 3.3 Unit Dashboard View on page 36 and reproduced here) displays information and functionality on all unit components:

- Date and time of the unit
- Current operator
- Current owner
- Delete all events and logs from the unit
- Sensor check
- Auto Call Home status
- Date and time of the last update
- The firmware version
- Restart the unit
- Connection status
- Monitoring mode
- Connection details
- Battery voltage and remaining charge
- Number of events stored on the unit
- Current unit setup
- Scheduler and its status
- Available memory
- Calibration company and the date of most recent calibration



3.5.1 MONITORING MODE 

The icon displays the Monitoring Mode of the unit.

IDLE	SCHEDULER	MONITORING			
 Idle Monitoring Mode	 Scheduler Running Monitoring Mode	 Waveform Monitoring Mode	 Waveform Manual Monitoring Mode	 Histogram Monitoring Mode	 Histogram Combo Monitoring Mode
Idle, the unit is not currently monitoring.	A **Schedule** is running, but the unit is not currently monitoring.	The unit is monitoring in **Waveform** mode.	The unit is monitoring in **Waveform Manual** mode.	The unit is monitoring in **Histogram** mode.	The unit is monitoring in **Histogram Combo** mode.

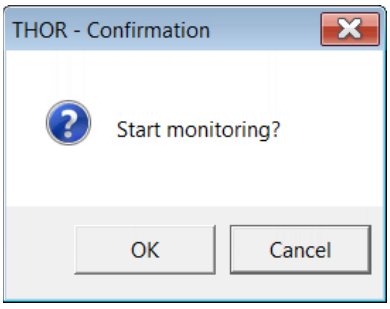
NOTE The icon updates based on the refresh interval defined in THOR.
See section 3.4.2 *Check Unit Connection and Status Automatically* on page 40.

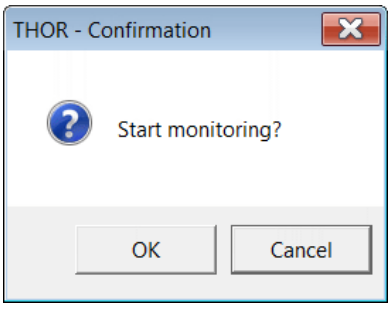
NOTE Minimate Plus and Blastmate III only display the active state of *monitoring*, other monitoring modes are not shown in the icon for these units.

3.5.1.1 TURNING MONITORING ON / OFF

When a unit is online (connected with THOR), THOR can send a signal to the unit to start/stop monitoring.

1. Click the **Monitoring Mode** icon (if it is in idle mode, it will ask to start. If it is monitoring, it will ask to stop)
2. In the confirmation dialog box, click **OK**.





The icon will change to reflect the new Monitoring Mode of the unit.
When the unit is no longer monitoring, the icon will return to Idle.

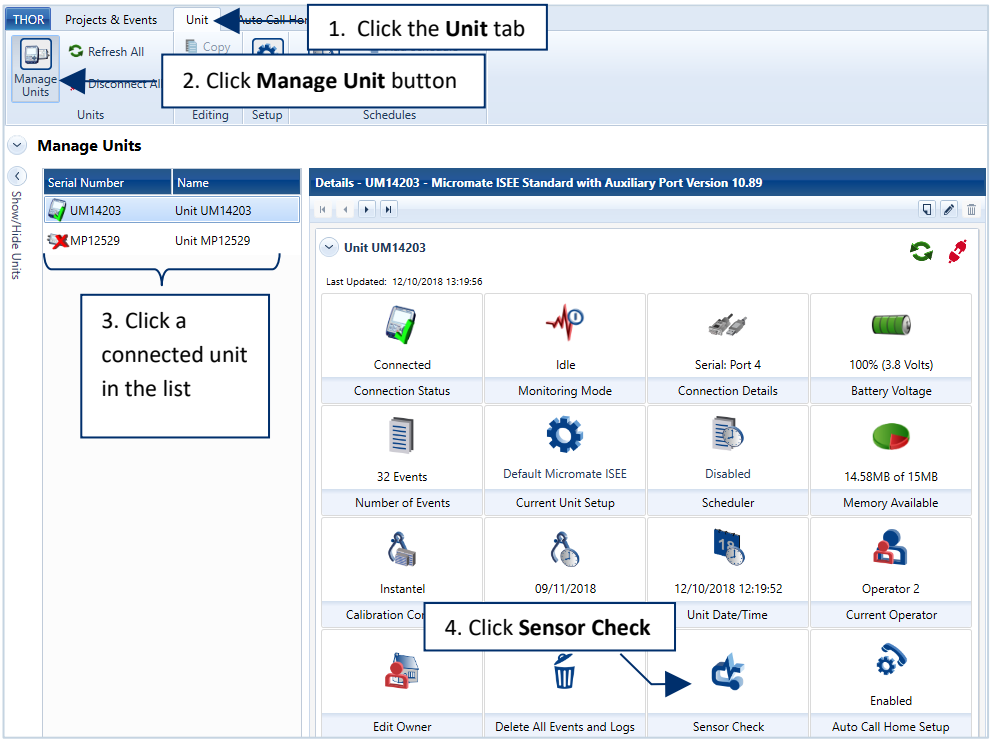
3.5.2 SENSOR CHECK

Checking sensors tests the configured and enabled sensors on a unit. Sensors are configured as part of the active compliance setup.

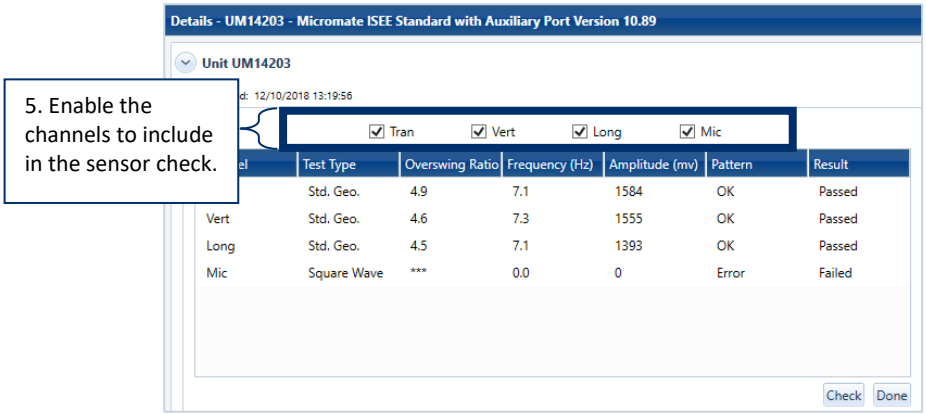
The test results are displayed. If no results are expected (E.g. for microphone results), dashes will fill the column (-------). If a check fails, asterisks fill the column (*****).

For the results of each channel, scroll to the results column on the right.

1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. Click a connected unit in the list.
4. Click the **Sensor Check** button (A message indicates a full sensor check is taking place. Results are then displayed in the sensor check window.)



5. Enable the checkboxes of the channels to include and click the **Check** button. (A sensor diagnostic begins and shows the results in the window.



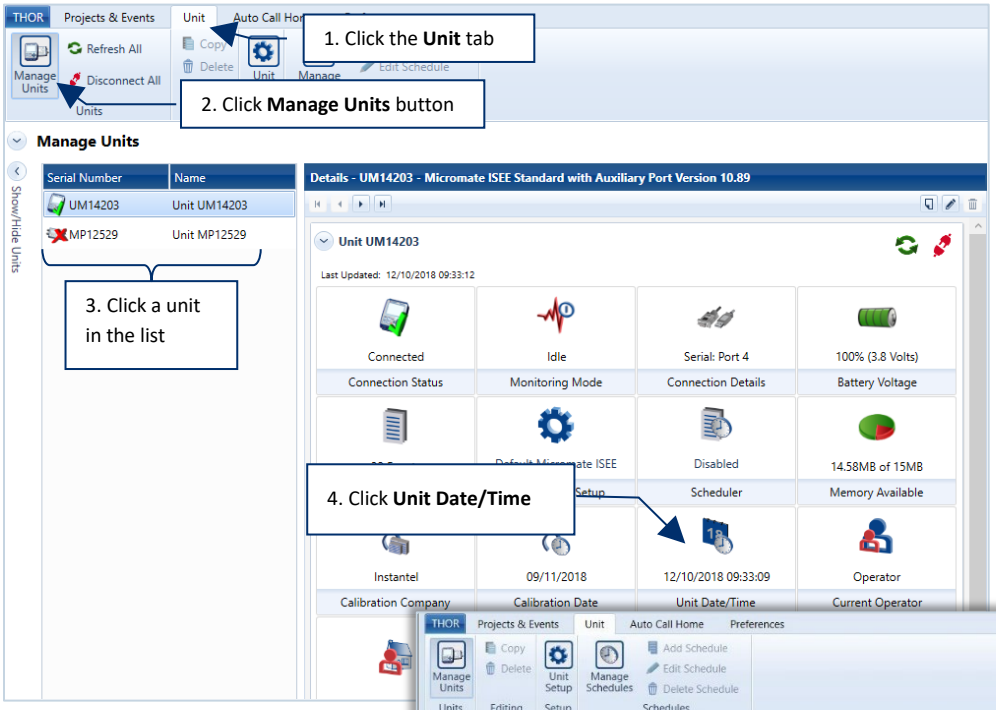
This function is disabled for units using an Advanced Setup file.

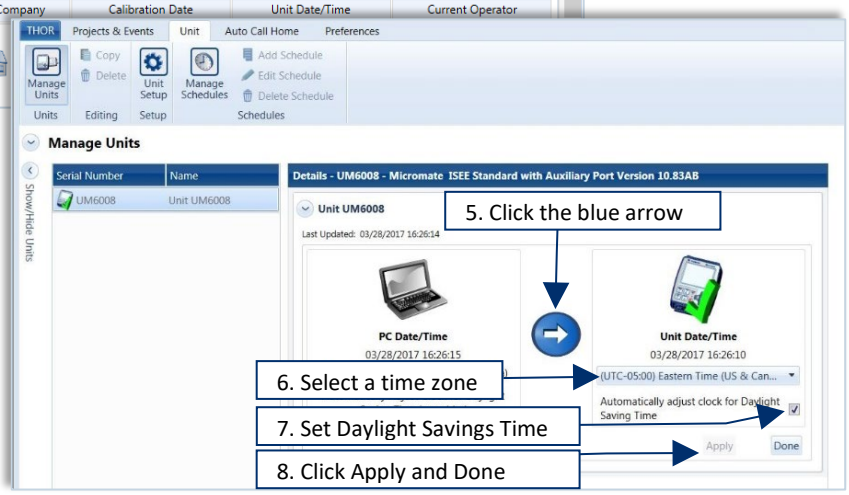
3.5.3 UNIT DATE AND TIME

Minimate Pro and Micromate units can synchronize with the computer's date and time. Enabling Daylight Savings Time (DST) on Micromate units will apply the DST policy for their respective time zone.

1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. Click a unit in the list of connected units.
4. Click the **Unit Date/Time** button.

A unit's monitoring mode must be *Idle* to change its Date and Time





Daylight Saving Time (DST) options are not available for Minimate Pro units.

DST only appears for time zones using DST.

5. To synchronize the computer's time, click the **blue arrow** button.
6. Select the time zone.
7. (Optional) enable the **Automatically adjust clock for Daylight Saving Time** checkbox.
8. Click **Apply** and **Done**.

3.5.4 UNIT OPERATOR

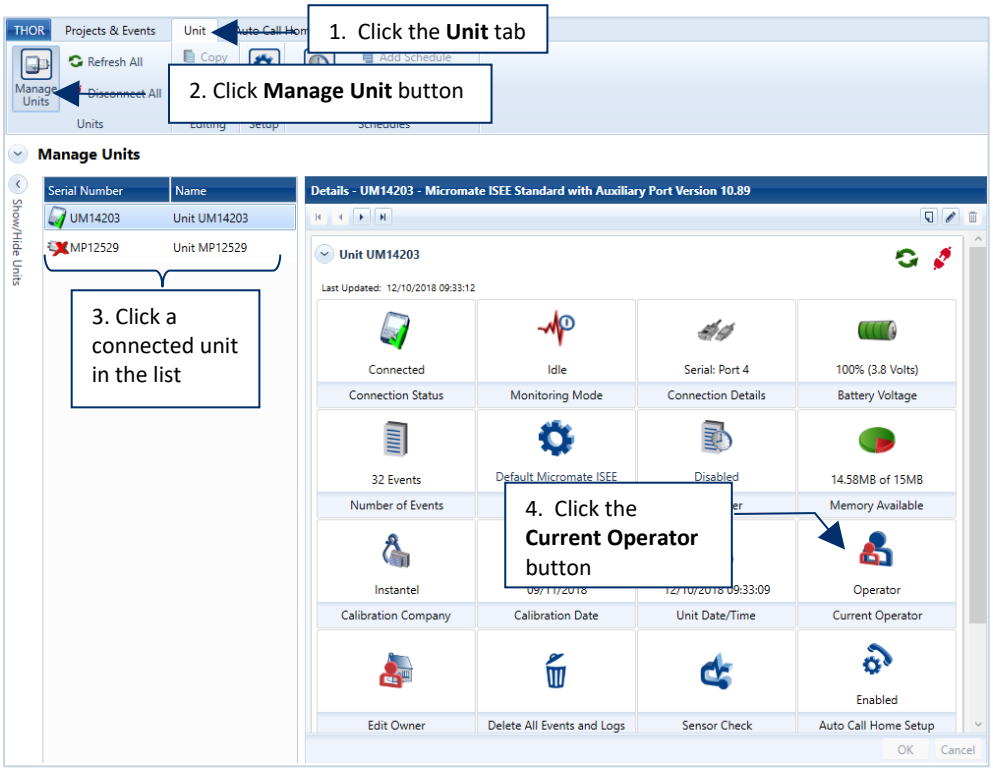
All registered events are associated with an operator. Though multiple inactive operator names can be registered, only one may be active at any time.

The following procedure describes how to:

- Create / Delete an operator
- Associate an operator with a unit
- Set the active operator on a unit

Creating an operator will not automatically associate it with a unit, nor is it automatically made the active operator.

1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. Click a connected unit in the list of units.
4. Click the **Current Operator** button.



Operators cannot be deleted when in use on actively connected units.

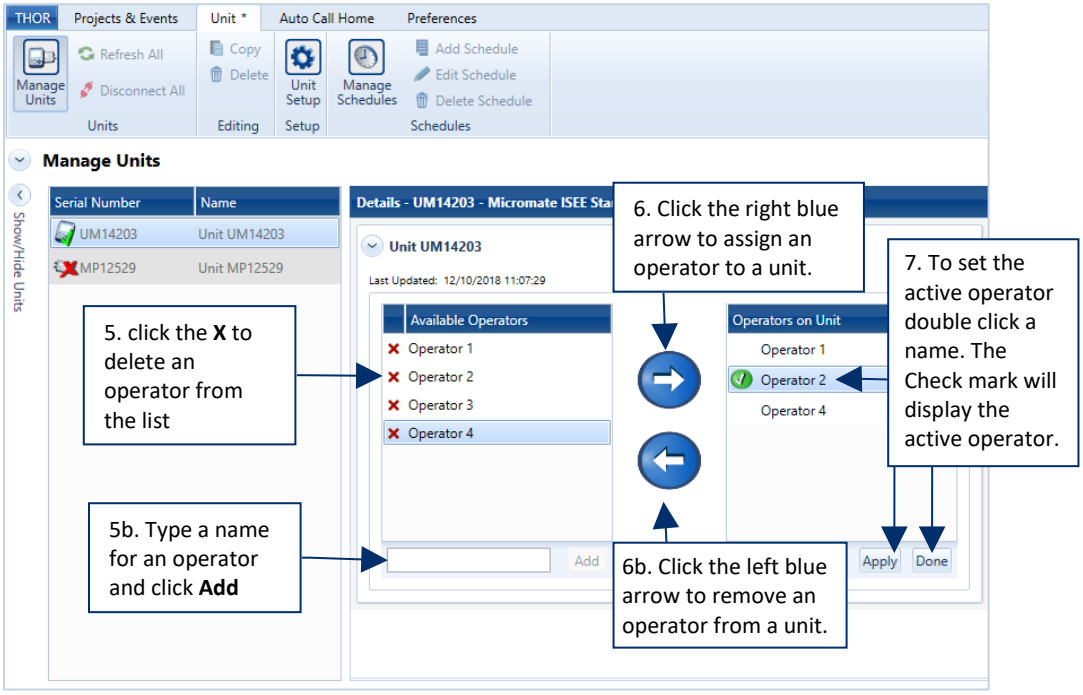
5 To **delete** an operator, click the **X** icon next to an operator's name in the Available Operators list.

5b. To **add** an operator: Type a name for the operator and click the **Add** button.

6 Click the right blue arrow to assign an operator to a unit.

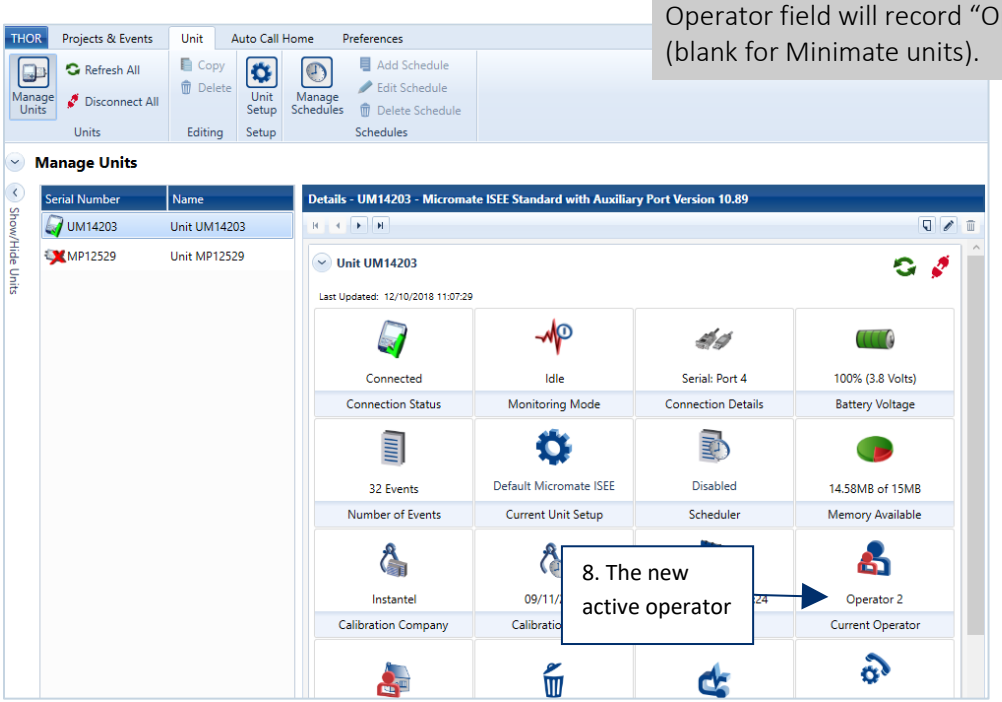
6b. Click the left blue arrow to remove an operator from a unit.

7 Double click a name to assign an operator as the "Active Operator" and click **Apply** and **Done**.



8 The Dashboard reflects the new active operator.

If the active operator is removed, the Operator field will record "Operator" (blank for Minimate units).

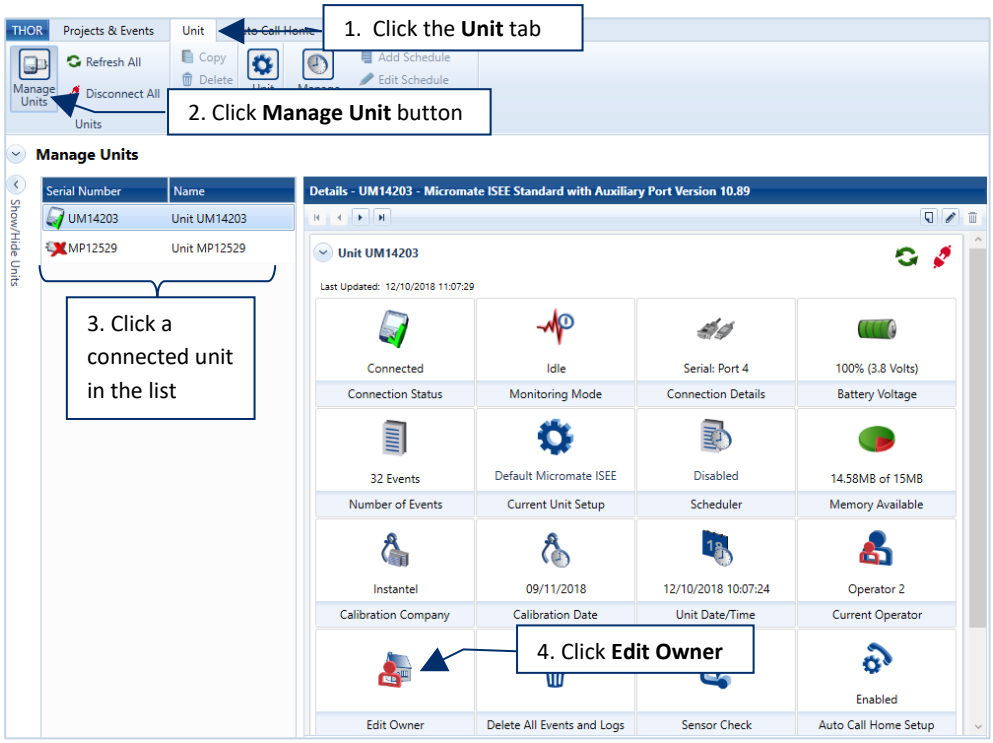


3.5.5 UNIT OWNERS

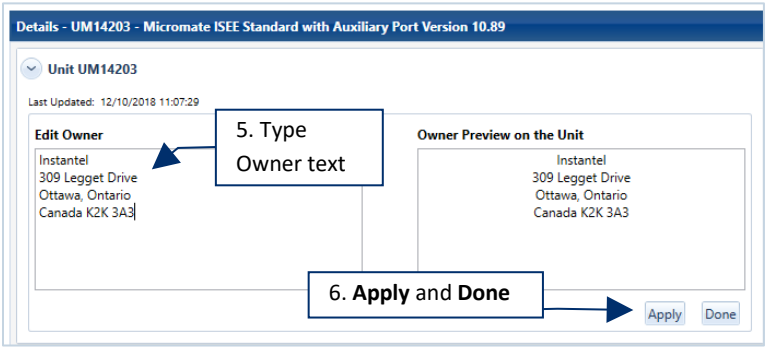
The unit's owner is displayed on Micromate units (not available for Minimate units) and can contain up to seven lines of text. Unit owner information can include company name, address, and contact information.

Each unit can only have one owner. Owners are not mandatory but may facilitate rental situations and must be defined using THOR.

1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. Click a connected unit in the list
4. Click the **Edit Owner** button.



5. In the **Edit Owner** box, type up to seven lines of text.
6. Click **Apply** to send the text to the unit and click **Done** to return to the dashboard.

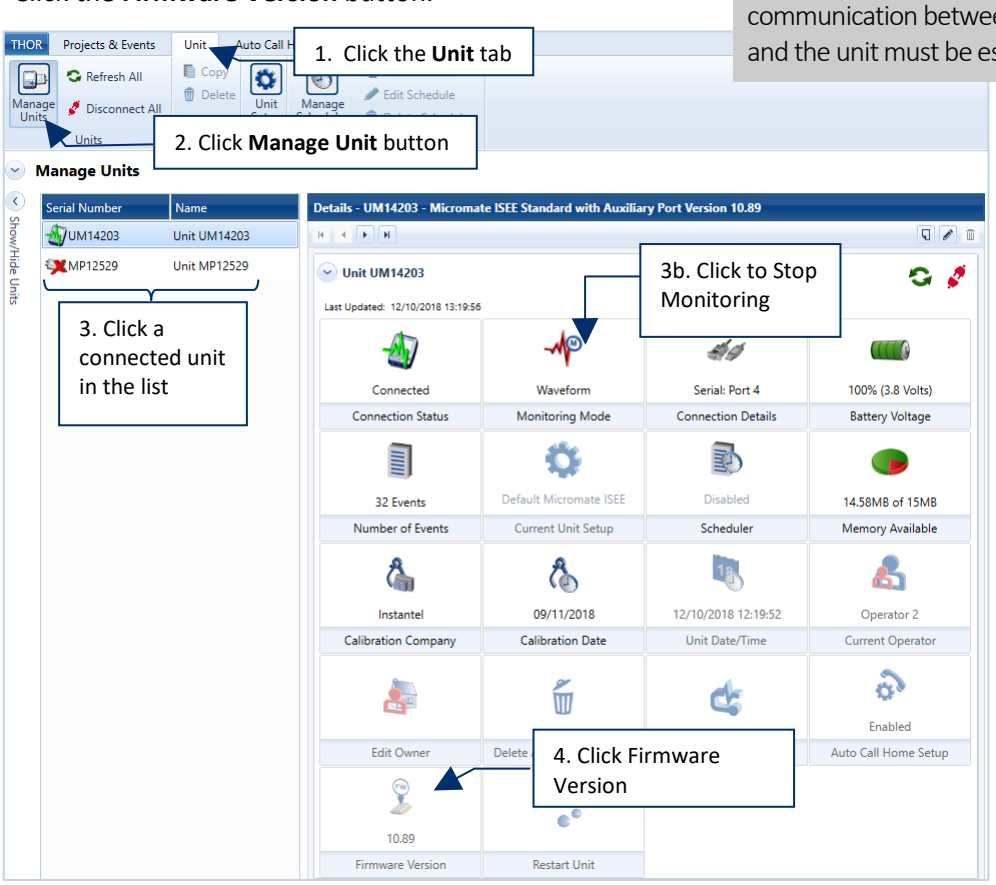


3.5.6 UPDATING UNIT FIRMWARE

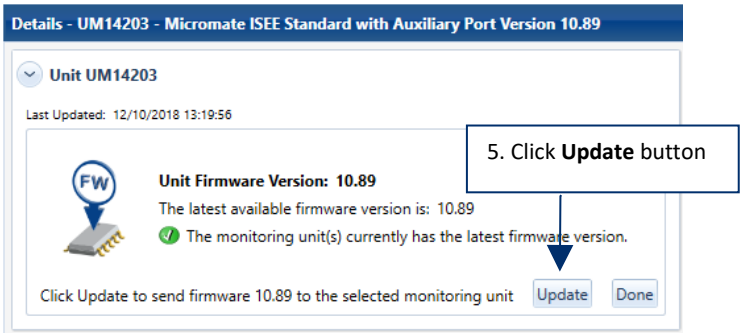
THOR displays the firmware of the unit and the most recent firmware available from Instantel. This procedure will override the current firmware version and then restart the unit.

1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. Click a connected unit in the list. (**3b.** If the unit is not in the Idle state, click the **Monitoring Mode** icon to stop monitoring)
4. Click the **Firmware Version** button.

To load the firmware, communication between THOR and the unit must be established

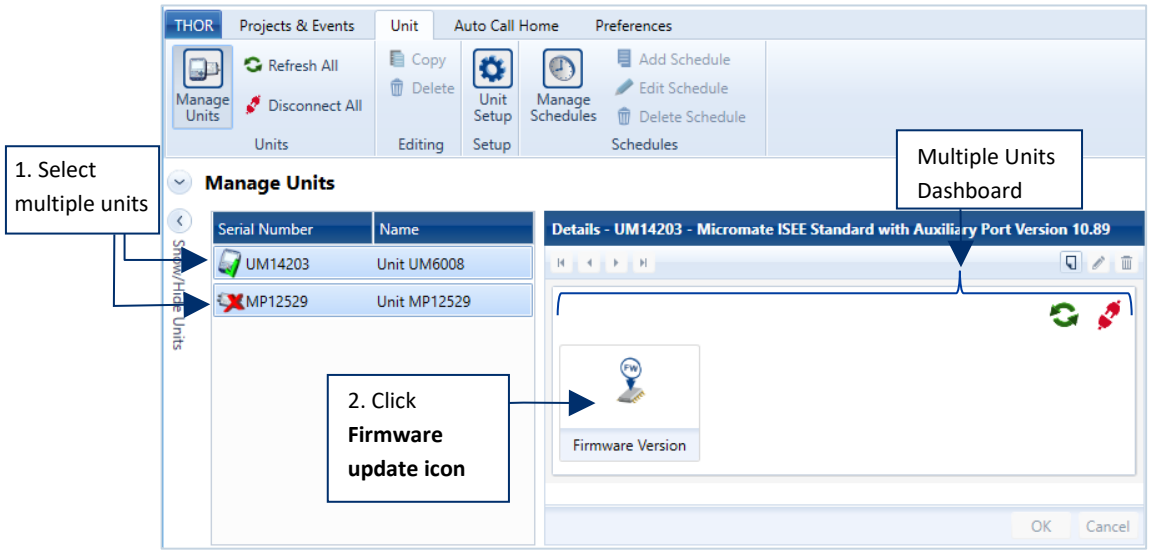


5. Click the **Update** button and then click **Done** to return to the Unit Dashboard.



3.5.6.1 UPDATING FIRMWARE ON MULTIPLE UNITS

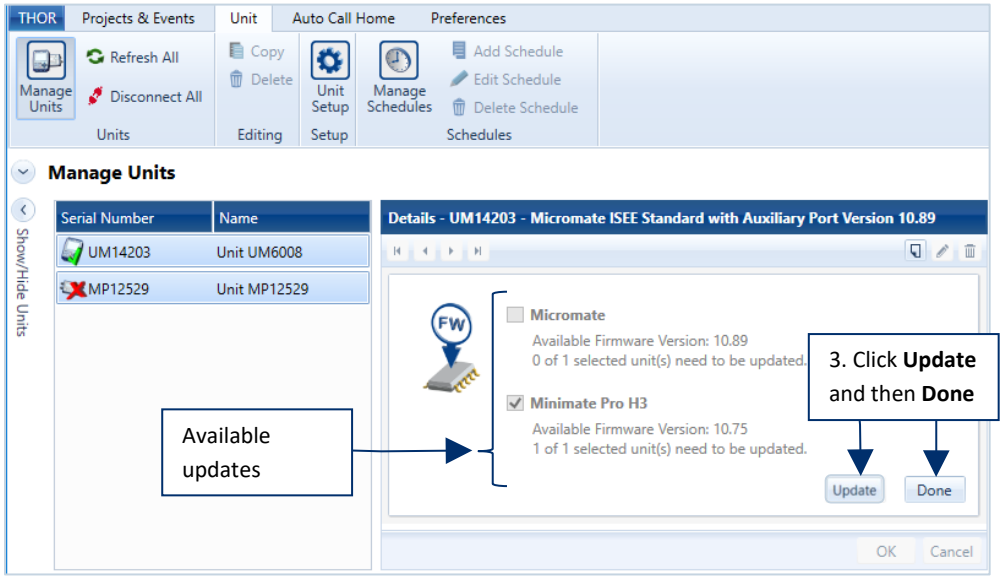
1 Select the units (using CTRL or Shift) to display the Multiple Units Dashboard.



2 Click on the **Firmware update icon**. THOR will provide a status summary of the available updates for units, including their current firmware version and any updated firmware version that is available.

3 Click **Update**, then click **Done** to return to the Multi-Units Dashboard.

NOTE To return to the Individual Units Dashboard, click on a single unit.



Alternative Path: You can also double-click on the **Notification** that may appear when THOR restarts *"A Firmware update is available"*. This will take you directly to the Update page.

3.5.7 RESTARTING A UNIT

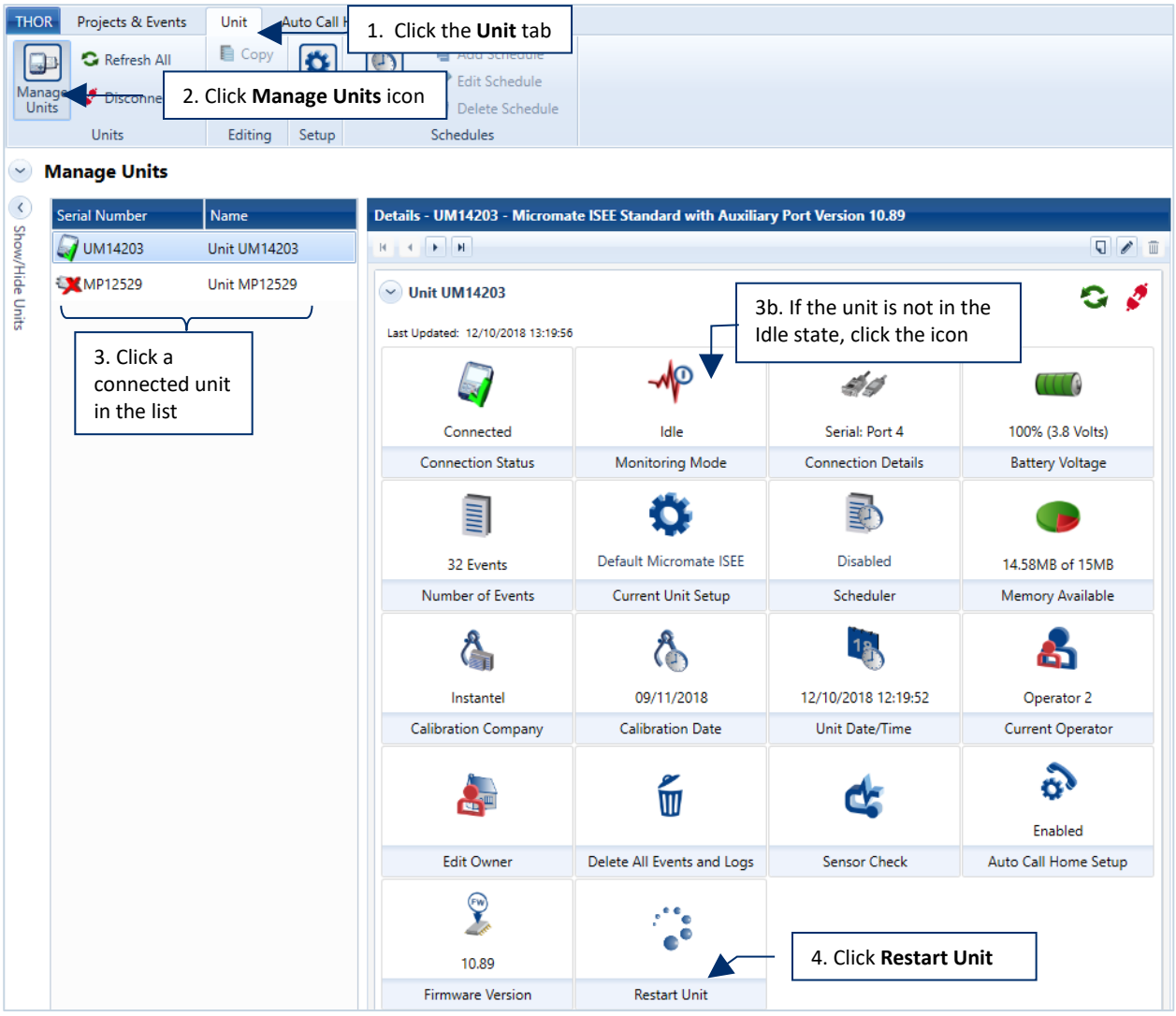
Restarting a connected unit requires it to shut down, it will not perform this task while actively monitoring.

1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. Click a connected unit in the list.

3b. Ensure the Unit is in the Idle state

4. Click the Restart Unit button then click OK in the confirmation dialog box.

Units must be in the Idle state to restart.



During firmware updates, this function is disabled.

3.6 MANAGING UNIT SCHEDULES 

THOR can set up daily, weekly and repeatable schedules that program the unit to act at specific times. The actions are:

- Start monitoring
- Stop monitoring
- Self-check
- Auto Call Home

Online units can be programmed to act at any time. Schedules can be saved and transferred to units of the same type.

E.g. The schedule from one Micromate can be sent to five Micromate units provided their Setup files are the same. Micromate schedules are not compatible with Minimate schedules and vice-versa.

There are three critical components:

1. The unit's status when the schedule is enabled
2. Transitions between scheduled activities
3. Auto Call Home settings

Units with daily schedules will look at previous activities on that day. Units with weekly schedules will look at the activities scheduled earlier in the week to determine their monitoring state.

If an activity on the schedule is Self-Check or Auto Call Home, the unit will search for previous activities to find a "Start Monitoring" action. If found it will start to monitor using the compliance setup and the unit's Auto Call Home configuration. If "Start Monitoring" action is not found in the schedule, then the unit will enter into a Scheduler Running state until it reaches the next defined action in the schedule.

When a unit is monitoring due to a schedule and it reaches a Start Monitoring event, the unit will stop the current monitoring session, run any Auto Call Home actions, load the compliance setup and continue monitoring.

3.6.1 SCHEDULED AUTO CALL HOME

Scheduled Auto Call Home must have the Auto Call Home enabled and configured on the unit. Auto Call Home must be running on THOR to receive data on the local computer. (ACH can also send data directly to Vision.)

Some Auto Call Home features can affect schedules:

- Call Home after the recorded event
- Monitoring while calling home

Call Home After a Recorded Event

E.g. A scheduled activity such as *Start Monitoring* or *Stop Monitoring* generates a Histogram event. The unit will begin an Auto Call Home session. In this case, you can use Start Monitoring or Stop Monitoring in your schedule, while already in a scheduled Histogram or Histogram Combo monitoring session, to trigger an Auto Call Home session.

NOTE If the Call Home After Event Recorded checkbox is disabled, a unit running a schedule will not call home after an event occurs. The unit will only call home if there is an Auto Call Home entry in the schedule.

Monitoring While Calling Home (MWCH)

Monitoring While Calling Home (MWCH) can have the following states:

Disabled: a unit running a schedule will stop monitoring during an Auto Call Home session that was triggered by an event. (This does not apply to Auto Call Home sessions triggered from a schedule. Only Auto Call Home sessions triggered because Auto Call Home is enabled on the unit and an event occurred.)

Enabled: if an event occurs, the unit will continue to monitor during the Auto Call Home session. The monitor log will not be copied, events will not be deleted, and time will not synchronize at the end of the Auto Call Home session.

When performing a scheduled Auto Call Home session, (not an Auto Call Home session due to an event occurring) monitoring will stop and complete any in-progress events. This allows all events for that time period to be transferred during the Auto Call Home session, and for events to be deleted from the unit,

Auto Call Home on unit: Records events + transfer data, no stopping to monitor.
Scheduled Auto Call Home session: Stop monitoring + transfer data (or delete events, or synchronize)
E.g. Monitoring in Histogram Combo mode, transfer data every six hours, daily, delete events, copy the log and synchronize time once a day. Do the following:

1. Create a daily schedule and enable the Repeat mode checkbox
2. Add a Start Monitoring event to the schedule at 0:00, 06:00, 12:00
3. Add an Auto Call Home event to the schedule at 18:00

Self-check is a diagnostic tool that performs a variety of tests on the unit. For information collected by a self-check, see the operator manual included with the monitoring unit.

3.6.2 SETTING UP SCHEDULES

Select an action for the unit to perform and select the time when to perform the action. (The unit will execute any actions in a schedule using its current settings.)

Saved schedules appear in the list of schedules.

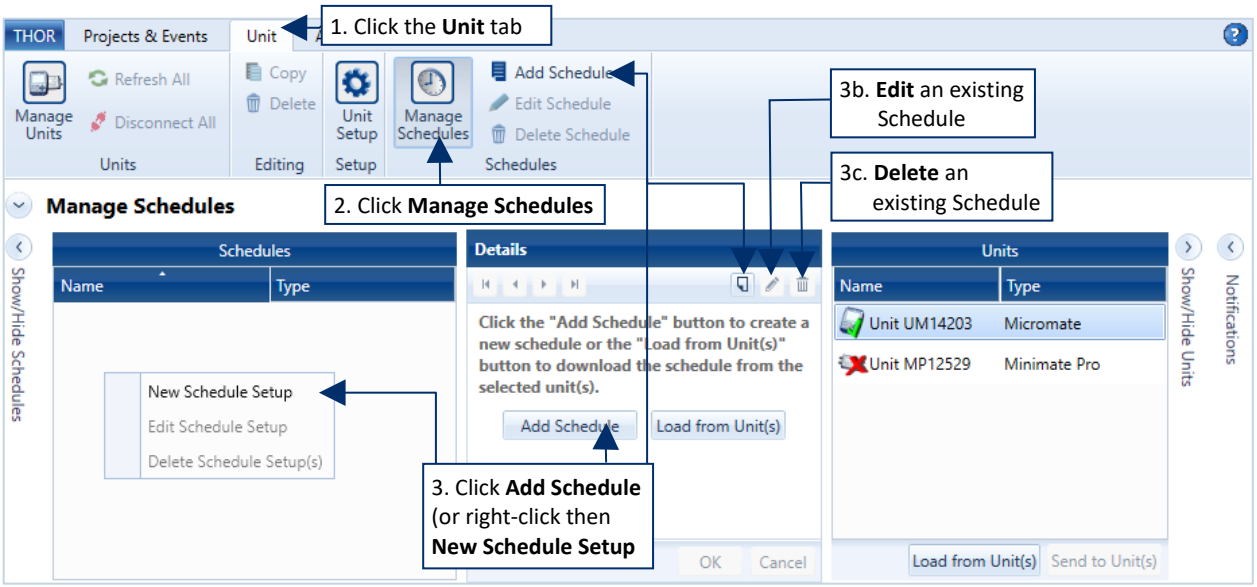
NOTE Before creating a schedule, set the workday range (Start time / End Time), this is purely to help in planning visualization, actions outside of these times can still work.

E.g. The workday starts at 8:00 AM and ends at 5:00 PM. The time grid will display 8:00 AM to 5:00 PM. If an action is set up for 7:00 AM, that action is still scheduled and will process.

1. Click the **Unit** tab.
2. Click the **Manage Schedules** icon.
3. Click the **Add Schedule** button (or the **Add Schedule** icon, or right-click and **New Schedule Setup**).

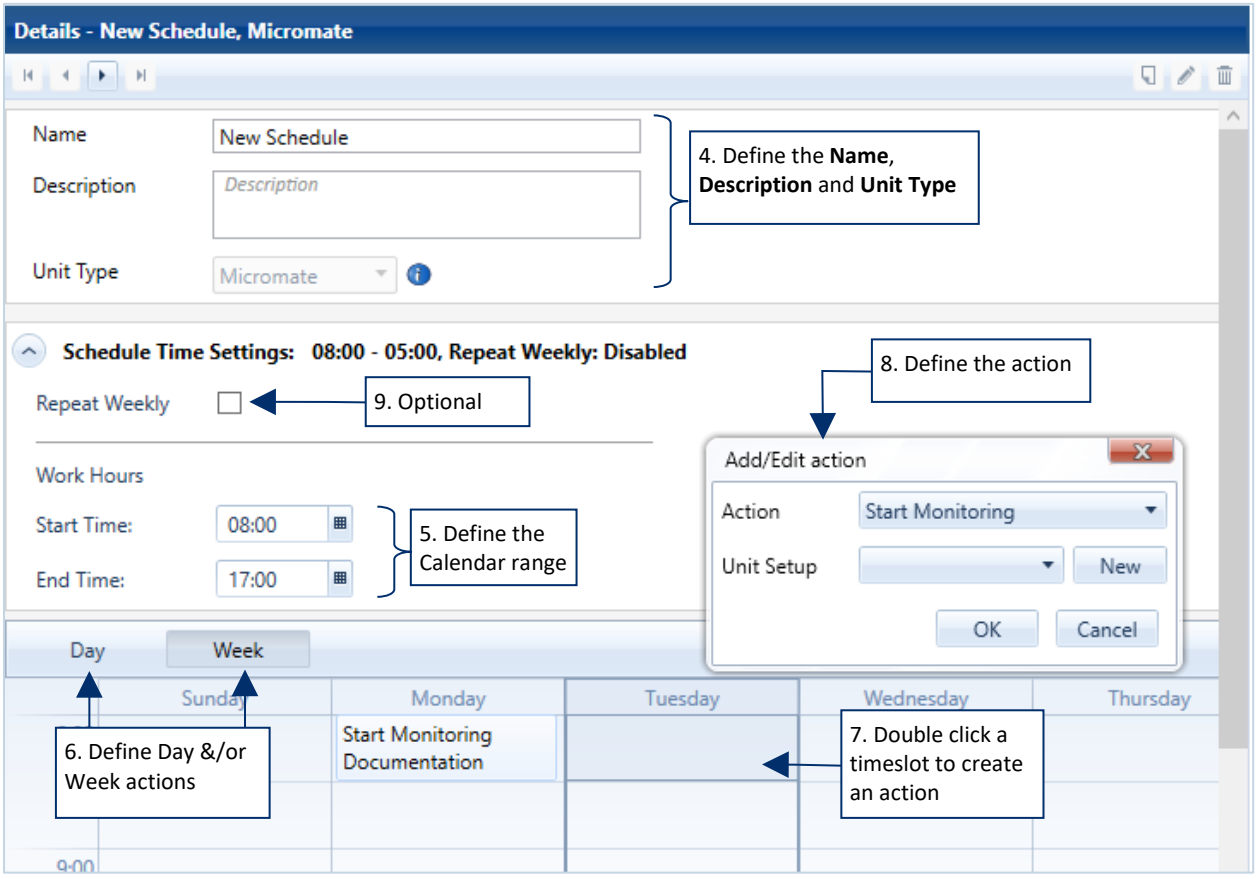
3b Or **Edit** an existing Schedule. (You must first **Load** the schedule from the unit if the Schedules List is empty.)

3c Or **Delete** an existing Schedule.



4 Define the Schedule's **Name**, **Description,** and the **Unit Type**. (Micromate or Minimate Pro).
5 Define the range for the calendar display (**Start Time** and **End Time**).
6 Select Day to setup actions on a daily routine (E.g. Start at 10:00 and Stop at 14:00).
Select Week to set up actions on a weekly routine (E.g. Self-Check or Auto Call Home every Monday at 8:00 and Friday at 17:00).
7 To create an action, double-click in a time slot.
8 Select the appropriate **Action** and the **Unit Setup.** (A Unit Setup must exist, either create one first or download one from a unit.
9 (Optional) To repeat the schedule, enable the **Repeat Daily / Repeat Weekly** checkbox.
10 Repeat steps 7-8 until all actions are added.

NOTE Right-clicking an interval can facilitate edit, delete, copy and paste actions.

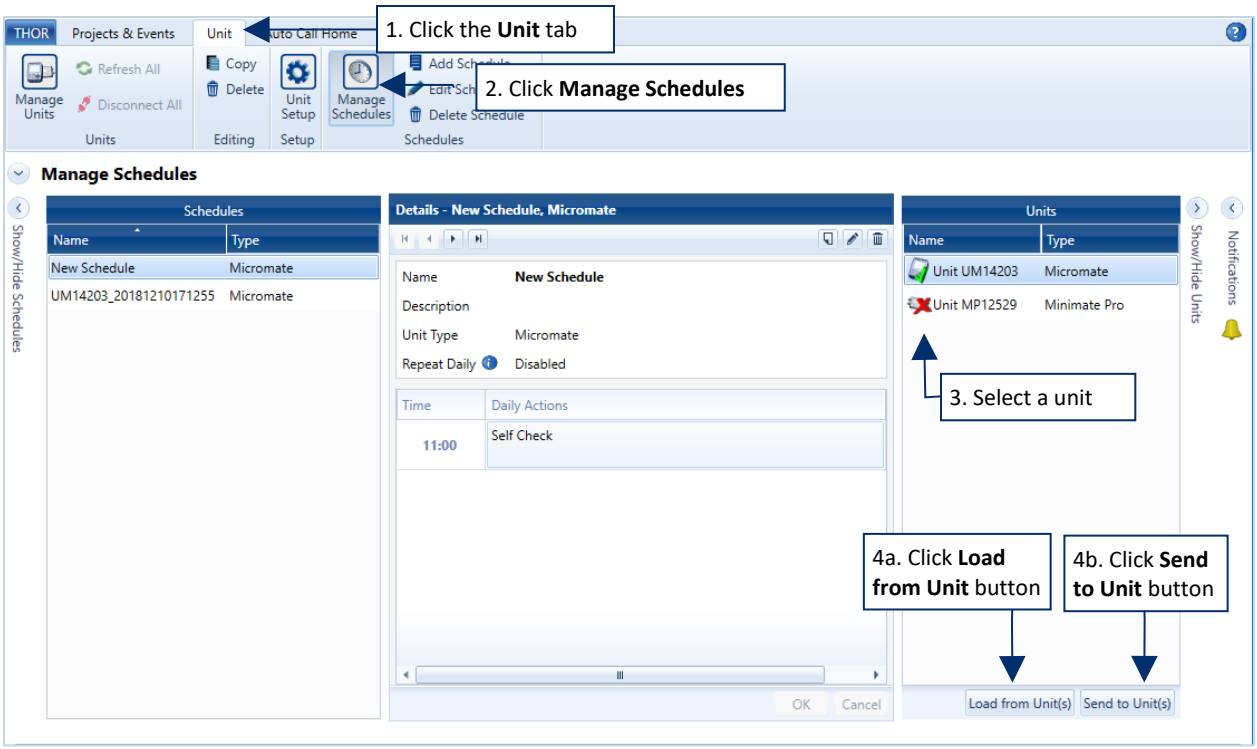


NOTE Saving a schedule will only store it on the computer, it must still be sent to the unit and enabled for the schedule to take effect.

3.6.2.1 LOAD / SEND SCHEDULES

New or edited schedules are first saved to the computer and then sent to the unit. Units can only use one schedule at a time, this means when you send a schedule it will overwrite any existing schedules. It is good practice to first **Load** a schedule from a unit, then make modifications and **Send** it back to the unit. Loading a schedule from a unit places a copy of the schedule in THOR's Schedules list.

1 Click the **Unit** tab
2 Click the **Manage Schedules** button
3 In the **Units** list, Select one or multiple units
4a Click the **Load from Unit(s)** button to download all schedules of the selected unit(s).
or
4b Click the **Send to Unit(s)** button to upload a schedule to all selected units.



Schedules can only be loaded and sent to units that are communicating with THOR. The units must be of the same type. (Micromate schedules cannot be sent to a Minimate Pro, and Minimate Pro schedules cannot be sent to a Micromate.)

NOTE A schedule's setup file must coincide with the hardware used. This means if the Setup file specifies a microphone, but no microphone is connected to the unit, an error will be generated.

NOTE After sending a schedule, you must enable the schedule for it to run.

NOTE Loading a schedule to THOR does not remove it from the unit.

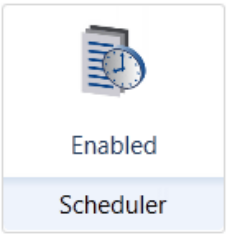
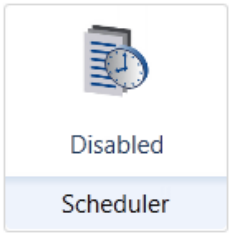
Loaded schedules follow this naming convention: SERIAL#_YYYYMMDDHHMMSS, where:

- SERIAL# is the unit's serial number
- YYYY is the year when the schedule was loaded
- MM is the month when the schedule was loaded
- DD is the day when the schedule was loaded
- HH is the hour when the schedule was loaded (24-hour format)
- MM is the minute when the schedule was loaded
- SS is the second when the schedule was loaded

NOTE If a Start Monitoring event on the schedule refers to a compliance setup that is not available, a warning icon is displayed in the Start Monitoring block on the schedule.

3.6.2.2 ENABLING / DISABLING THE SCHEDULER

Unit schedules must be enabled to run. The scheduler section of the Unit Details page reveals the enabled/disabled status.

Enabled	Disabled
	

NOTE Clicking the icon in the Scheduler section  will not enable or disable the scheduler. You must click the word Enabled / Disabled:

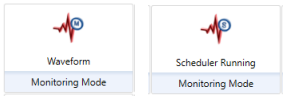
3.6.2.3 RUNNING A SCHEDULE UNIT

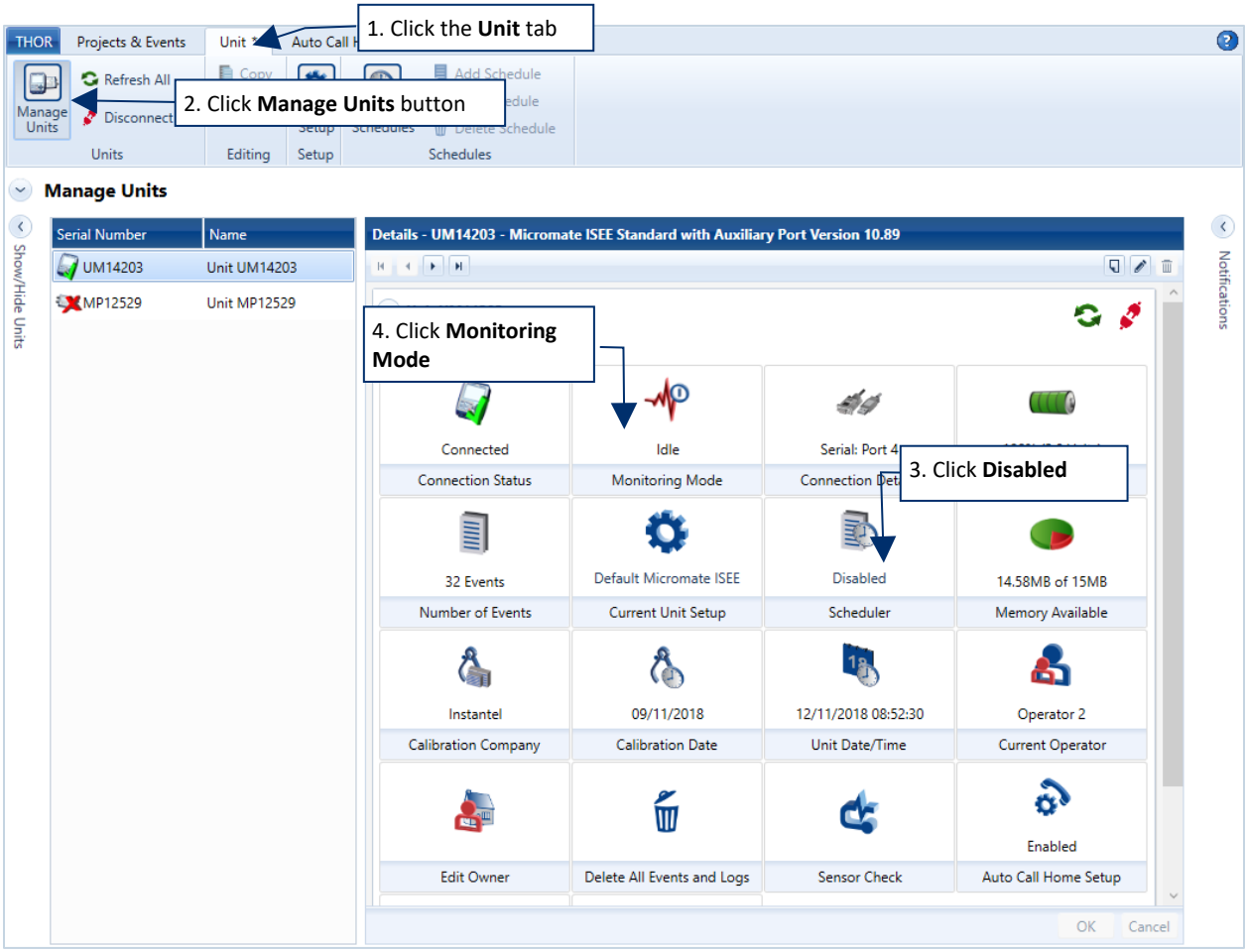
1. Click the **Unit** tab.
2. Click the **Manage Units** button.
3. In the **Scheduler** section, click the **Disabled** button.

NOTE Clicking the icon in the Scheduler section will not enable the scheduler. You must click the word Disabled and see it toggle to Enabled.

4. Click the **Monitoring Mode** button.

   If the last item on the schedule was *Start Monitoring*, the **Monitoring Mode** icon will display the current monitoring mode:
   (Waveform, Waveform Manual, Histogram, or Histogram Combo).
   Otherwise, the **Monitoring Mode** icon will display *Scheduler Running*.





3.7 MANAGING UNIT SETUP FILES COMPLIANCE 

Each unit contains a configuration file known as the “Unit Setup”. All units can use the standard Compliance setup while the Minimate Pro units can benefit from Advanced setup features.

Unit Setup files can be created, edited and used as templates for other units. Saving unit settings for later use facilitates switching between configurations. Once created in THOR they simply need to be loaded into the unit.

E.g. A Minimate Pro operating on a pile driving project (using Histogram mode) is moved to a blasting project. In this case, the unit set up with waveform parameters would be loaded into the unit to adapt its monitoring for blasting.

Setup files can be sent to any unit of the same type (Minimate Pro or Micromate). The same unit setups can be used on multiple units.

E.g. Applying a single unit setup to three Micromate’s used to monitor the same series of blasts at a quarry.

NOTE For one unit’s setup file to work without errors in another unit, they must have the same active channels and sensors. This means a Unit Setup with an attached microphone will cause an error with a unit with no microphone or with a different microphone.

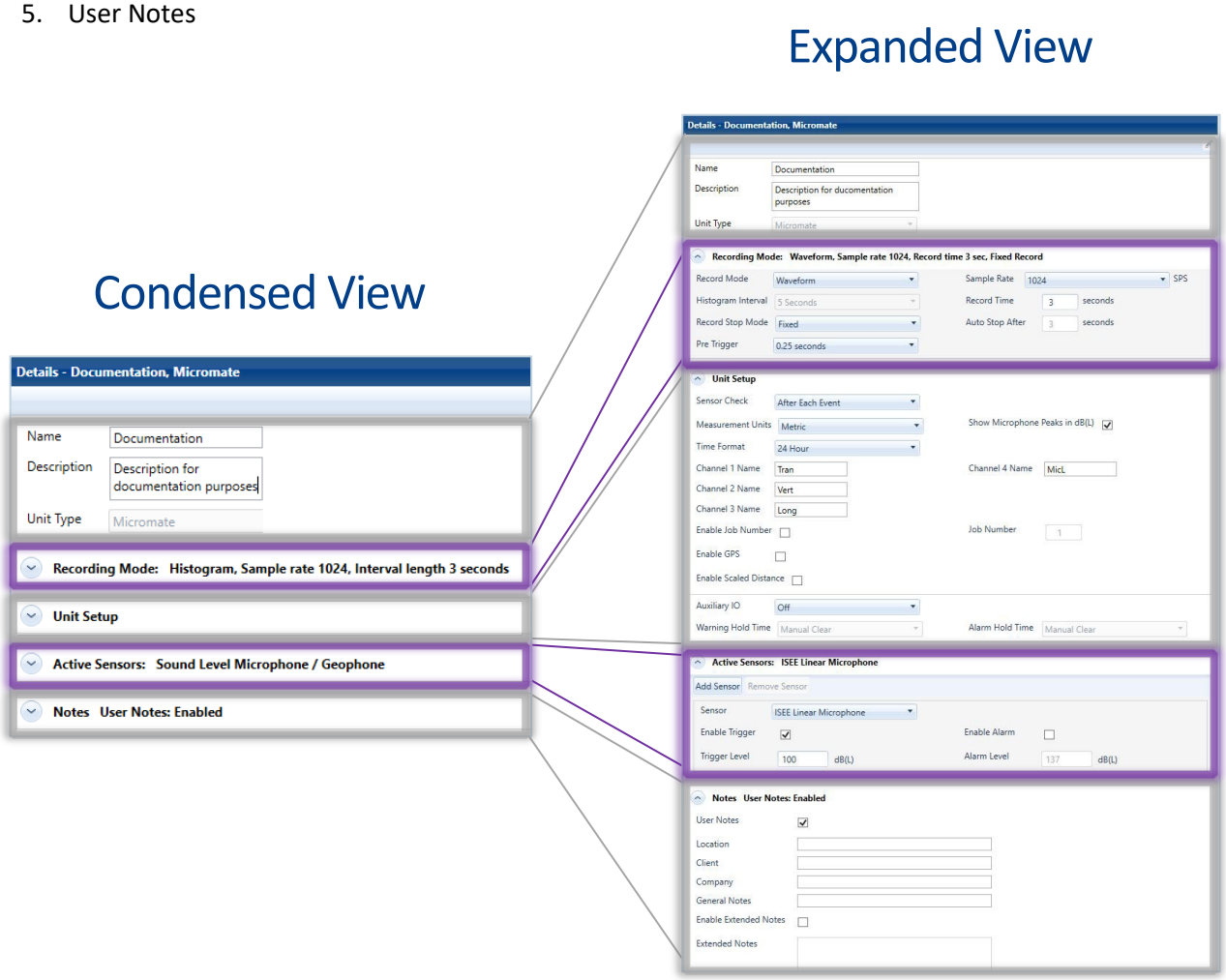
Unit setup files are managed remotely through THOR resulting in no interruption of onsite event monitoring.

The same settings are accessible through the Micromate or Minimate Pro interface (see their respective user manual).

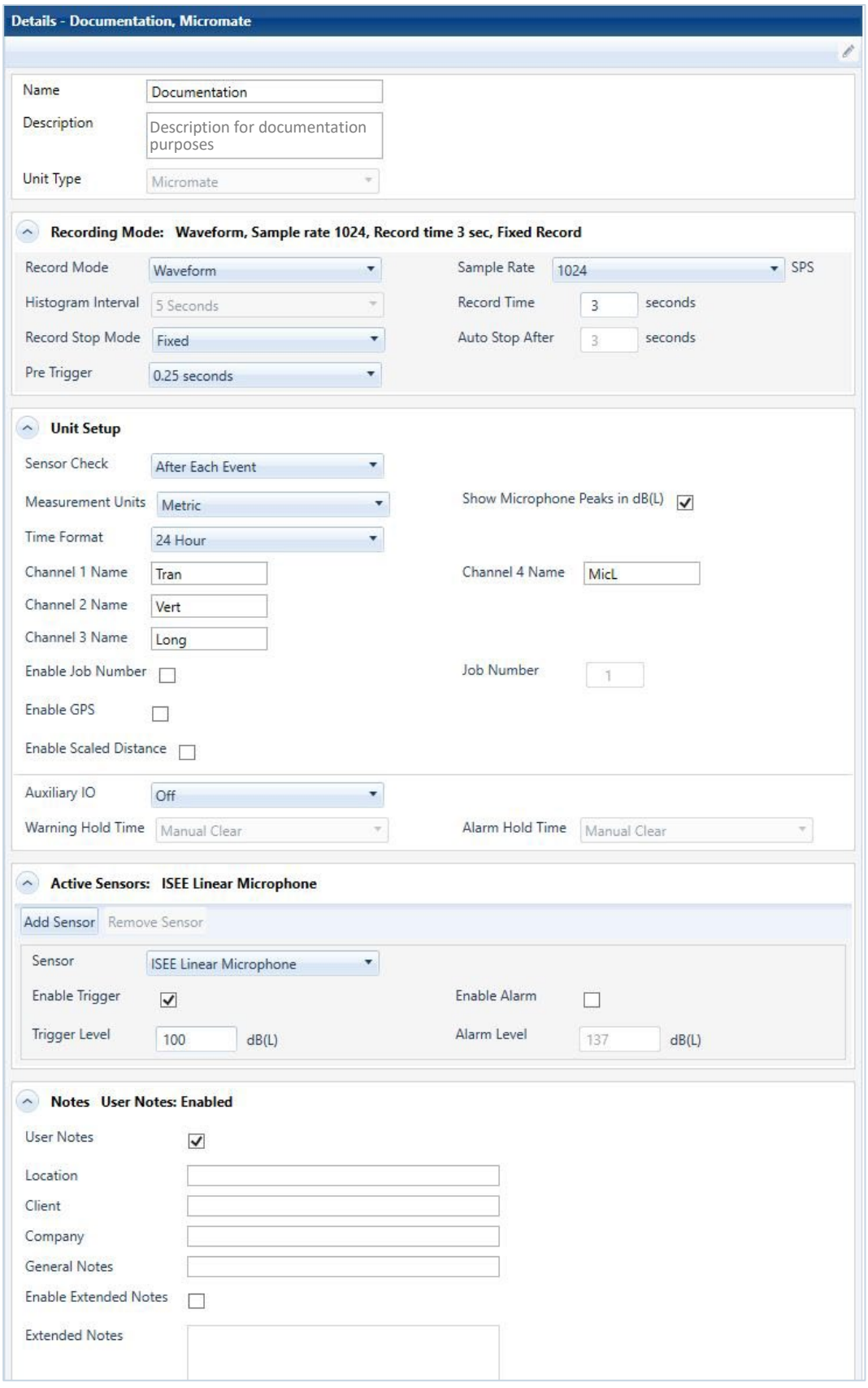
NOTE Some settings are dependent on the chosen Recording Mode: Waveform, Waveform Manual, Histogram, or Histogram Combo. Ex: Waveform does not set an interval. Histogram does not set the record time or record stop mode.

The setup file is composed of 5 parts, shown here for a quick overview. These parts can collapse for ease of use. The available fields vary depending on the selected options. (Micromate settings are different from Minimate Pro settings)
All components are described in detail in the following tables.

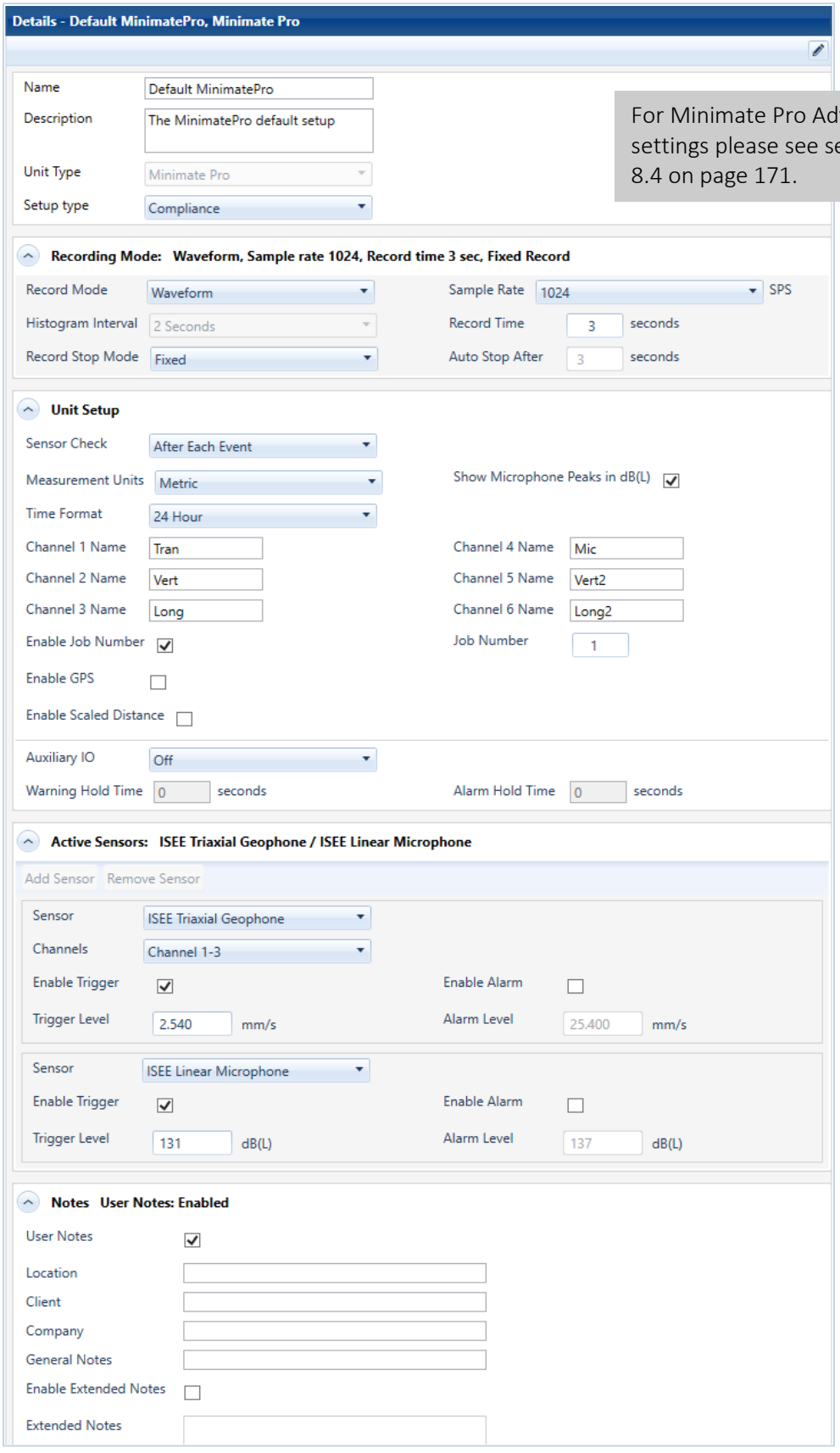
1. Name, Description and Unit type
2. Recording Mode
3. Unit Setup
4. Active Sensors
5. User Notes



Expanded View Micromate Compliance

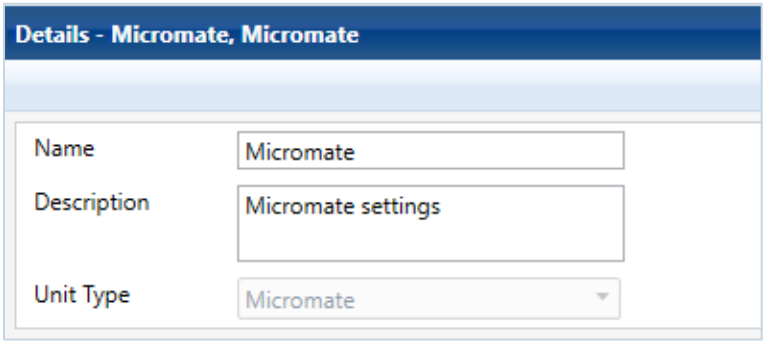


Expanded View Minimate Pro Compliance

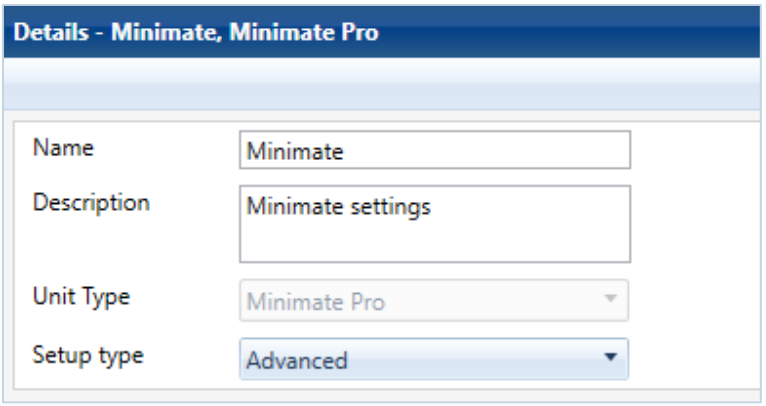


For Minimate Pro Advanced settings please see section 8.4 on page 171.

3.7.1 DETAILS – NAME, DESCRIPTION AND UNIT TYPE



Micromate units



Minimate Pro units

(offers some extended functionality)

FEATURE	VALUE	DESCRIPTION
Name	Text	Choose a name that will easily identify the unit. (E.g. "Waveform Series IV" for waveform monitoring)
Description	Text	Describe the unit for reference purposes (E.g. Quarry 2)
Unit Type	Micromate Or Minimate Pro	Some features are unit specific and will/not appear depending on this selection. (E.g. Choosing Unit Type = Micromate will not give the option to choose Setup type)
Setup type	Compliance	The Standard setup
	Advanced	You must have an extended license to use the advanced features. It offers more possibilities to define the active sensors per channel. (Only available for Minimate units.)

3.7.2 DETAILS – RECORDING MODE

FEATURE	VALUE	DESCRIPTION
Record Mode	Waveform	To record multiple events automatically with no lag time between events. (Ex: Blasting) The unit records an event, displays the results, and continues to monitor for events exceeding the trigger level to record.
	Waveform Manual	Used when automatic triggers are unreliable due to high wind or nearby vehicle activity. Used also to record background noise levels near a site.
	Histogram	For long-term recording periods. (Ex: Pile driving) The unit stores summary information in intervals. The unit gathers continuous data based on the sample rate but only registers relevant peaks for the interval. (This reduces the recorded data and increases storage capacity.) For each **interval**, the unit calculates the maximum peaks, the largest peak frequency, and the peak vector sum. For each **channel**, the unit calculates the maximum peak and its frequency. It also calculates the largest peak vector sum over the entire event, displaying the peak of each interval in a bar chart.
	Histogram Combo	This will create a waveform record while Histogram recording. (This happens when an event exceeds the waveform trigger level, Ex: Pile driving) Records data on peak events and Histogram events. The waveform event is saved as a separate file, while the Histogram Event file remains continuous, limited only by the amount of available memory. *NOTE* The auxiliary trigger is automatically disabled in this mode.
Histogram Interval	2 sec to 60 minutes	Defines the sample interval for Histogram/Histogram Combo mode
Record Stop Mode	Fixed / Auto	Sets how the unit stops recording once triggered**.** **Fixed record** time sets the recording time to a specified length. **Auto record** continues to record event activity as long as the activity remains above the trigger level (sufficient memory and battery power must be available). Recording stops a specified period after the event activity falls below the trigger level. Used when there is an uncertainty of the actual event duration.
Pre-Trigger	0.25, 0.50, 0.75, 1.00 seconds	An interval where data is recorded prior to the trigger. The default setting is 0.25 seconds. (only available on Micromate)
Sample Rate	512, 1024, 2048, 4086	Increasing the sample rate increases the accuracy of the waveform recording. (Higher sample rates use more battery and memory resources)
Record Time	1 - 90 seconds	When an event is triggered the unit will record for this defined length of time
Auto Stop after	1-10 seconds	When in Record Stop Mode – Auto Record: Recording stops a specified period after the event activity falls below the trigger level.

3.7.3 DETAILS – UNIT SETUP

FEATURE	VALUE	DESCRIPTION	
Sensor Check	After each Event	Automatically runs a sensor check to test a monitor and its sensors after each event.	
	Before Monitoring	Automatically runs a single sensor check immediately after entering monitoring mode. The results appear with each Event recorded during the monitoring session. This provides a zero recycle time and ensures no Events are missed when using the continuous record mode.	
	Disabled	Does not run sensor checks.	
Measurement Units	Metric / Imperial	Displays results using Metric or Imperial units.	
Time Format	24 hour, 12 hour (am/pm)	Displays time in either 24 hours or 12 hours (AM, PM).	
Channel 1 Name	Tran	The description given to the Transverse axis, This name will appear in reports (up to 6 characters max)	
Channel 2 Name	Vert	The description given to the Vertical axis, this name will appear in reports (up to 6 characters max)	
Channel 3 Name	Long	The description given to the Longitudinal axis, this name will appear in reports (up to 6 characters max)	
Channel 4 Name	Mic	The microphone channel (Linear, or Sound Level Microphone)	
Channel 5 Name	Vert2	Only valid with Minimate Pro Compliance. The description given to the Vertical axis, this name will appear in reports (up to 6 characters max)	
Channel 6 Name	Long2	Only valid with Minimate Pro Compliance. The description given to the Longitudinal axis, this name will appear in reports (up to 6 characters max)	
Enable Job Number	Checkbox	Used by THOR to keep track of recorded events. (Optional, and must be between 1 and 9999)	
Enable GPS	Checkbox	Will include GPS notes in the event report	
Enable Scaled Distance	Checkbox	THOR can calculate a scaled distance based on the unit's distance from the blast and the charged weight.	
		Distance from Blast	Distance between the blast and the unit (m or ft)
		Charge Weight	The weight of the explosive used (Kg or lb)
		Scaled Distance	Calculated based on the DfB and CW
Show Microphone Peaks in dB(L)	Checkbox	Show results in decibels otherwise in linear units.	
Job Number	1 - 9999	Helps keep track of recorded events.	
Auxiliary IO	External Trigger	The unit will record an event based on an external trigger instead of exceeding a threshold measurement value.	
	Remote Alarm	The auxiliary port will send a signal that can be used for activating an alarm (siren, beacon or other)	
Warning Hold Time	Manual Clear, 2 sec to 300 sec	How long a warning signal is active. Manual clear requires an operator to physically clear the warning on the device.	
Alarm Hold Time	Manual Clear, 2 Sec to 300 sec	How long an alarm signal is active. Manual clear requires an operator to physically clear the alarm on the device.	

3.7.4 DETAILS – ACTIVE SENSORS / CHANNELS

This section defines the various sensors available, they can be added sequentially. Each sensor has different default settings and options that appear when selected. (Though the setup parameters may be identical, sensors are specific to the unit type. This means that Micromate and Minimate units cannot interchange their physical sensors as they have different connectors.) The following table describes the sensor options.

FEATURE		VALUE	DESCRIPTION	
Add Sensor		Button	First, define the sensor options then click the add sensor button to register the sensor.	
Remove Sensor		Button	Select a sensor from the list and click to remove the sensor	
Sensor	(Micromate specific)	Geophone	The standard configuration for ISEE/DIN/SWB Geophones	
		Geophone SWP	Uses a higher resolution than other geophones.	
	(Minimate specific)	ISEE Triaxial Geophone	Compliance Setup: choose the sensor's channel Advanced Setup: uses predefined sensor settings (channel, units, sensitivity)	
		DIN 1-315 Hz Geophone	Complies with the DIN 45669-1 Class I standard.	
		DIN 1-80 Hz Geophone	Complies with the DIN 45669-1 Class I standard.	
	Sensor Both Micromate & Minimate	ISEE Linear Microphone	Records air overpressure. Frequency range: 2 – 250 Hz, Amplitude 2 – 500 Pa, (88 – 148 dB)	
		Sound Level Microphone	Records noise. Frequency range: 10 Hz – 20 kHz, Amplitude 30 – 140 dB	
			Weighting	A or C
			Response	Slow/Fast
			LN1	Statistical noise level as a percentage
			LN2	Statistical noise level as a percentage
Enable Trigger		Checkbox	Use the selected sensor as a trigger source. (once triggered, all channels will begin to record data) When enabled it will send a warning signal to the Auxiliary port (if the trigger level is surpassed)	
Trigger Level		mm/s	A defined threshold before monitoring can begin. This should be set high enough to prevent monitoring noise and low enough to catch all events. (Histogram Combo mode triggers will initiate waveform recording)	
Enable Alarm		Checkbox	Alarms create a visual, audio or other notification based on the trigger level set for warnings/alarms. Remote alarm controllers can set the alarm levels as part of the compliance setup. When enabled it will send an alarm signal to the Auxiliary port.	
Alarm Level		mm/s	A defined threshold before an alarm is sent.	

3.7.5 DETAILS –NOTES

Notes are included with every event recorded by the unit using that particular setup file.

FEATURE	VALUE	DESCRIPTION
User Notes	Checkbox	Enable/disable the use of notes
Location	Text box	Max 40 Characters
Client	Text box	Max 40 Characters
Company	Text box	Max 40 Characters
General Notes	Text box	Max 40 Characters
Enable Extended Notes	Checkbox	Enable/disable the use of notes
Extended Notes	Text box	Max 640 characters

3.7.6 ADD/EDIT/DELETE/COPY, UNIT SETUP FILES

1 Click the **Unit** tab.

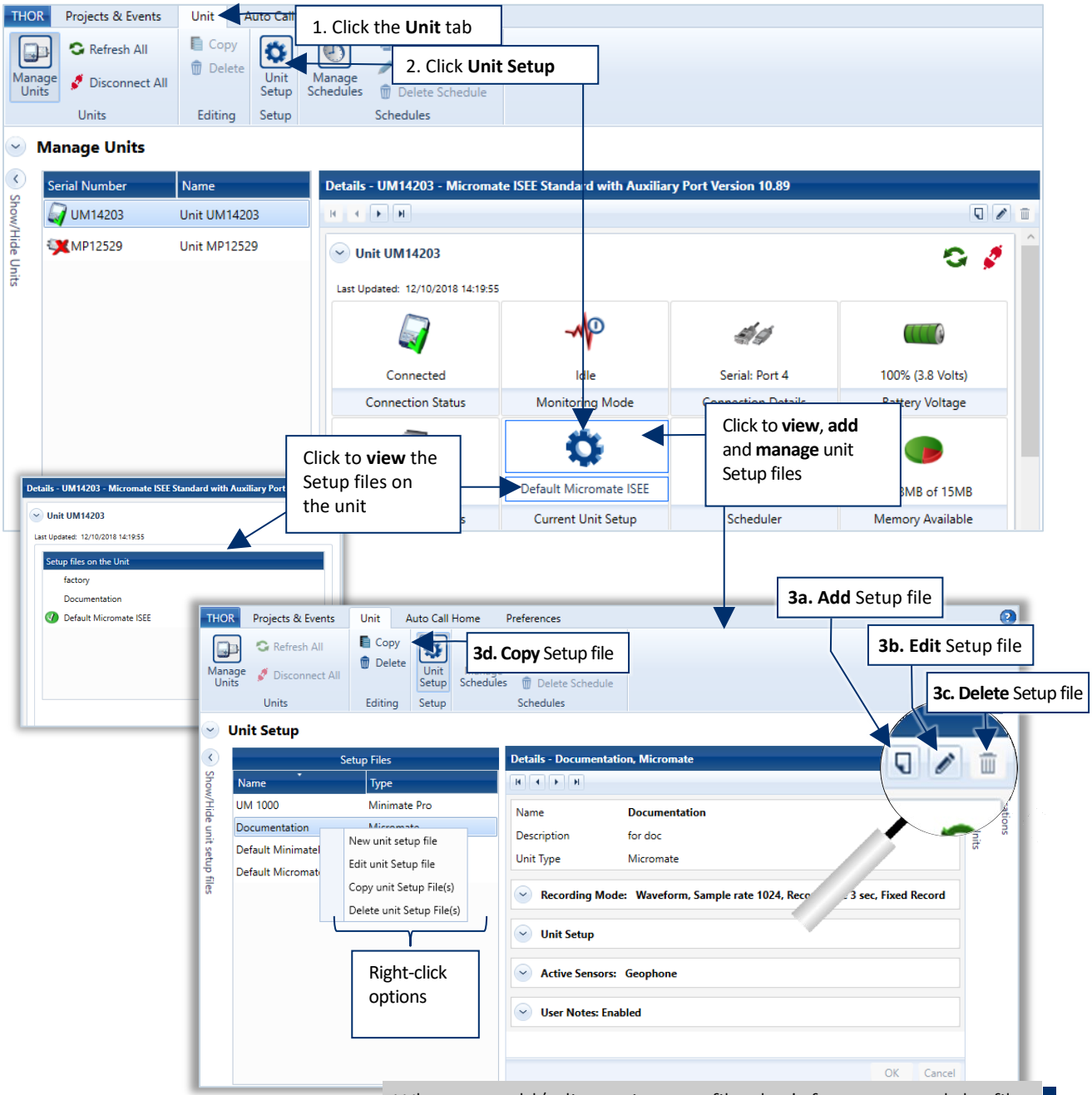
2 Click the **Unit Setup** button on the menu bar or in the Dashboard

3a. To add a setup file click the **Add** icon (or right-click the unit and **New Unit Setup File**)

3b. To edit a setup file click the **Edit** icon (or right-click the unit and **Edit Unit Setup File**)

3c. To delete a setup file click the **Delete** icon (or right-click the unit and **Delete Unit Setup File**)

3d. To copy a setup file click the **Copy** icon (or right-click the unit and **Copy Unit Setup File**)



When you add/edit a unit setup file, don't forget to send the file to the unit! It will automatically become the active setup file.

see Transferring Setup Files on page 71.

3.7.7 TRANSFERRING SETUP FILES

Loading a setup file will copy a unit's setup file to THOR. This can then be edited and sent back to the unit. The setup file may also be used as a template to send to other units.

NOTE Unit setup files can only be used on units of the same type, with the same environments. (Micromate setup file for Micromate's, Minimate Pro setup file for Minimate Pro's.)

Procedure to Load or Send a Setup file

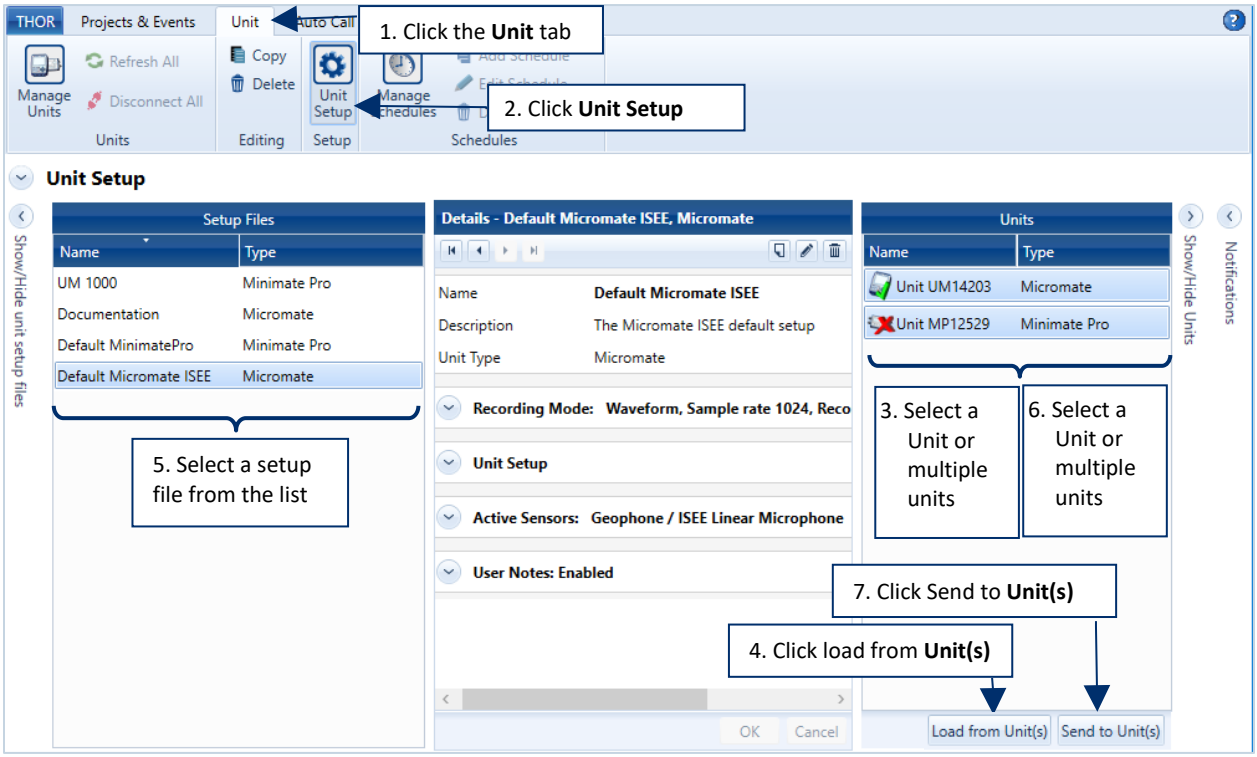
1. Click the Unit tab.
2. Click the Unit Setup button.
3. Select a unit or multiple units.
4. Click **Load from Unit(s)** to download the unit's setup file into THOR. (You can also select multiple connected units and import them in one shot.)

Or:

5. Select a setup file from the list.
6. Select one or multiple Units to send the file.
7. Click **Send to Unit(s)** (to transfer a single setup file to one or multiple units).

WARNING

When THOR sends a **Unit Setup** file to a unit, it becomes the current setup on the unit. If the unit setup happens to have the same name as the unit setup of the existing unit, it will overwrite the file.



NOTE Once a setup file is loaded into THOR, it will appear in the Setup files list, ready to edit. If the setup file has a name conflict, you must decide to overwrite the existing file or rename it.

4. PROJECT SETUP AND MANAGEMENT

4.1 UNDERSTANDING PROJECTS

Using Projects is optional, though they provide a convenient way to group data.

Projects link event data from different units. Once linked, all events downloaded from the units will appear in the specific project folder.

Project folders are accessible from the **Projects & Events** tab under the **Manage Events** icon or **Manage Projects** icon. New projects require a unique name. Each project folder can contain numerous monitoring units. Units can be assigned dynamically to existing projects.
(For more information, see section 3 Managing Monitoring Units on page 25.)

Units not assigned to any active projects are automatically assigned to the default catch-all project. (The default project cannot be deleted.)

Projects are a new concept introduced in THOR version 1.0.

Projects are particularly useful when events:

- Occur on a specific site
- Occur at the same time
- Belong to the same contract

Projects can contain multiple units. However, a unit can only be assigned to one active project at a given time.

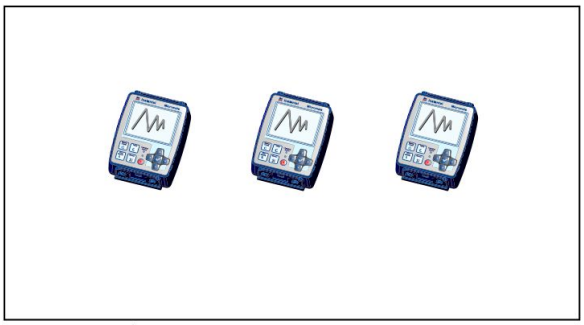
Grouping data together allows for easy comparisons of events. Projects are especially useful when one must:

- Perform multiple contracts simultaneously
- Monitor multiple sites simultaneously
- Archive completed contracts

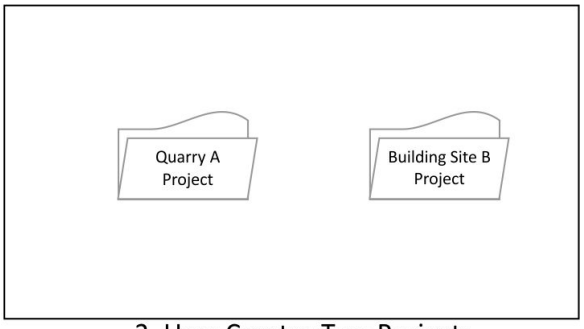
Projects can have the status of active or archived. For more information, see section 4.5 Archive and Delete Projects on page 82.

NOTE Rented units may work best by setting up a project with the name of your company. All events from the unit will be downloaded into this project for easy identification.

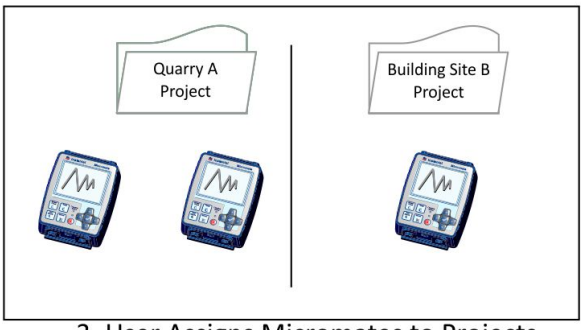
Example of how two projects can organize data from three Micromate units:



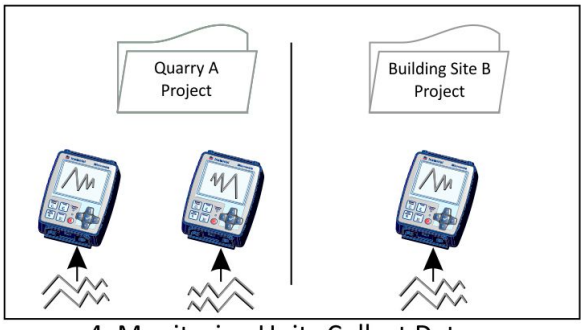
1. Three Micromates at Two Sites



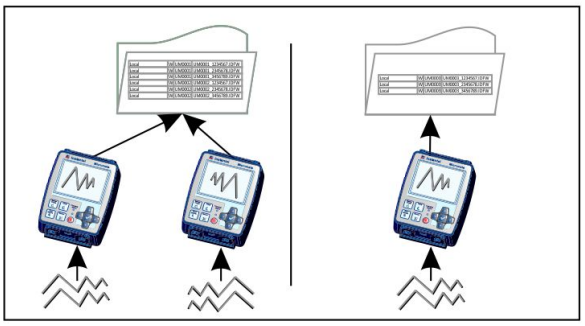
2. User Creates Two Projects



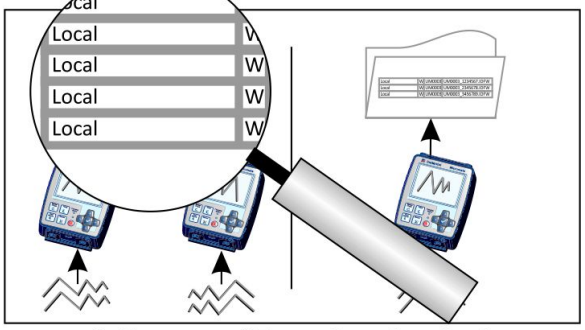
3. User Assigns Micromates to Projects



4. Monitoring Units Collect Data



5. Event Data Uploads to Projects



6. Close up of Event Data in a Project

Panel 1: A user monitors “Quarry A” with two units and “Building Site B” with one unit.

Panel 2: In THOR, the user creates one project for “Quarry A” and one project for “Building Site B”.

Panel 3: Then the user adds the two units installed at the quarry to the “Quarry A Project” and one unit at the building site to the “Building Site B Project”.

Panel 4: The units collect event data.

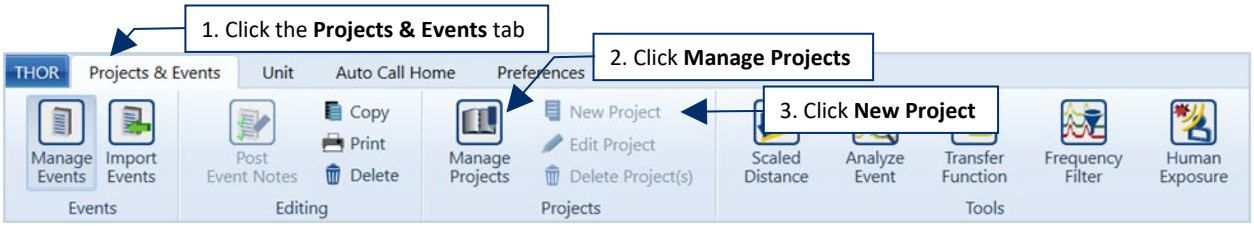
Panel 5: When the units upload their event data, the data will automatically appear in the corresponding project.

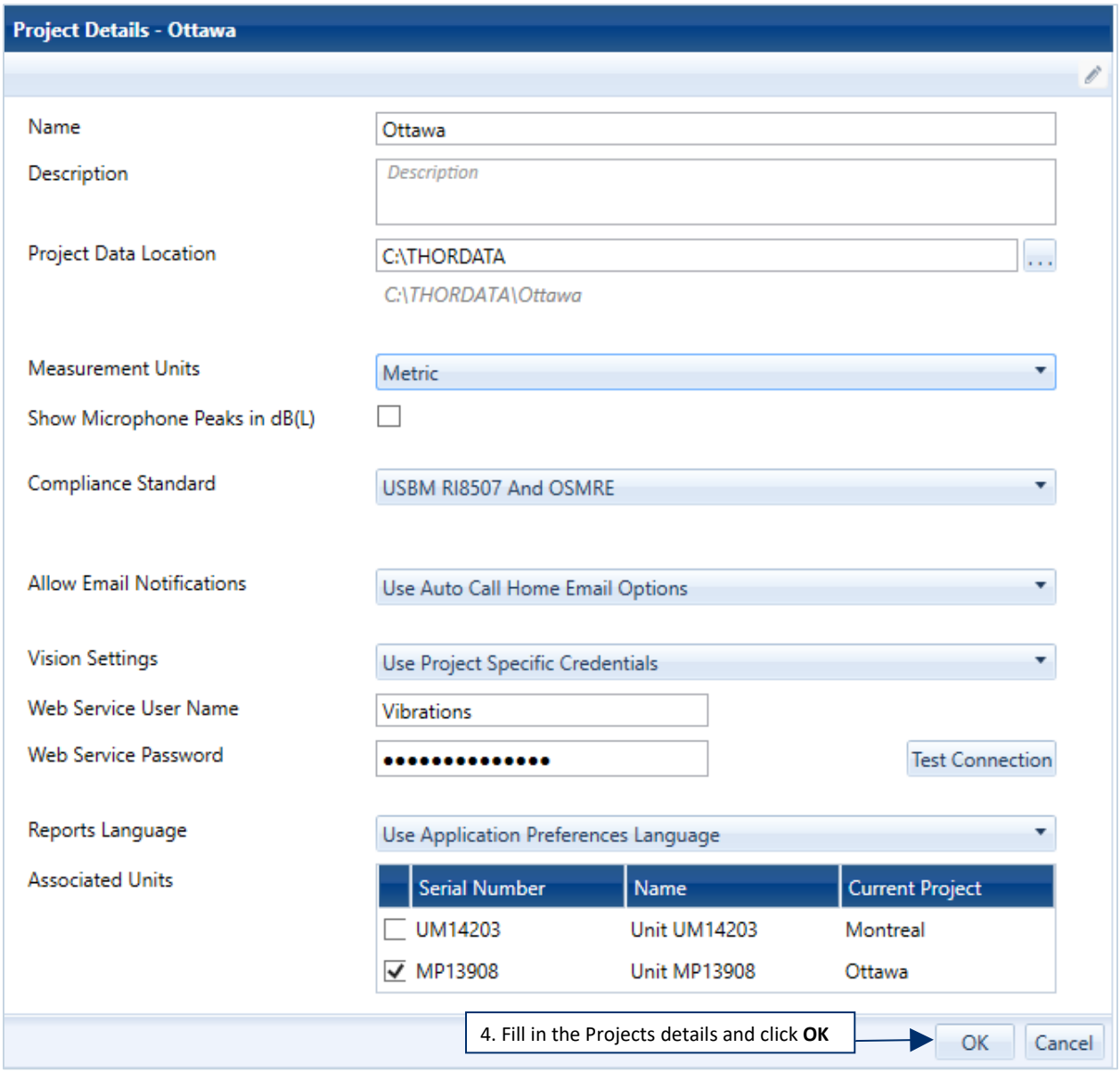
Panel 6: Event data becomes accessible within each project.

NOTE Event data remains with the project even after a unit is re-assigned to a new project.
See section 4.4.1 *Assign a Unit to a Project* on page 80.

4.2 CREATING A PROJECT AND EDITING DETAILS

1. Click the **Projects & Events** tab.
2. Click the **Manage Projects** button.
3. Click the **New Project** button.
4. Fill in the Project details (see table for descriptions) and click **OK**.





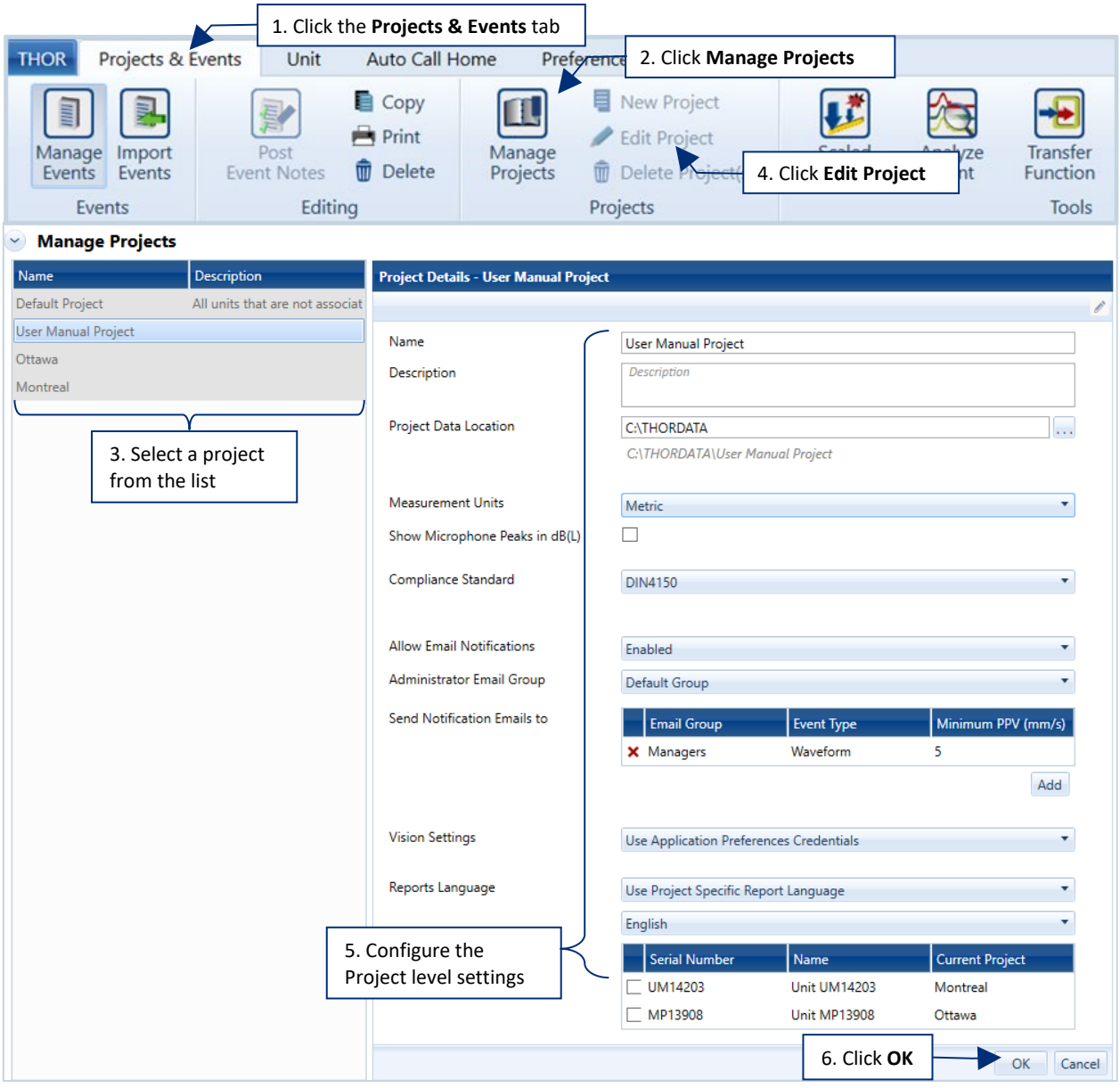
OPTION	PROJECT DETAILS DESCRIPTION
Name	The project must have a unique name identifier.
Description	Use this field to remind you of any project specifics.
Project Data Location	Click the three-dot file selector and choose a suitable location to save the project data.
Measurement Units	Select between Metric (meters) and Imperial (feet) *NOTE* This setting only affects how data is displayed. It will not influence the unit.
Show Microphone Peaks in dB(L)	(Optional) Displays linear microphone peaks in decibels, enable the checkbox.
Compliance Standard	Choose a standard that applies to the regulatory constraints of the monitoring area.
Allow Email Notifications	Select a group to send email notifications.
Vision Setting	(Optional) To send event data to Instantel's Vision during THOR Auto Call Home sessions. Choose among: ▪ **Use Application Preferences Credentials**—The credentials will be taken from the **Preferences** tab. ▪ **Use Project Specific Credentials**—Type the Vision user name and password in the **Web Service User Name** and **Web Service Password** boxes. *NOTE* For more information about sending event data to Vision, see section 7.4.5 Send *Data to Vision using ACH* on page 166
Reports Language	Assigns the output format for reports. ▪ **Use Application Preferences –** as defined in the global settings page. ▪ **Use Project Specific Report Language –** will give the option for English/French/Swedish/Spanish
Associated Units	Check the boxes of any units to associate with the project. *NOTE* This option is not available if no units have been added.

4.2.1 EDITING PROJECT DETAILS

Apart from the standard information when a project is created, the editing panel displays the project status (Active or Archived) and the project creation date (not editable).

NOTE Archived projects cannot be edited apart from their project description.
see section 4.5 Archive and Delete Projects on page 82.

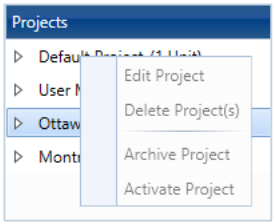
1. Click the **Projects & Events** tab
2. Click the **Manage Projects** button (or right-click on a project in the Manage Events section)
3. Select a project from the list
4. Click the **Edit Project** button
5. Configure the Project level settings (these override the Global Preferences)
6. Click **OK** (in the confirmation dialog box click OK a second time)



4.3 PROJECT SPECIFIC SETTINGS

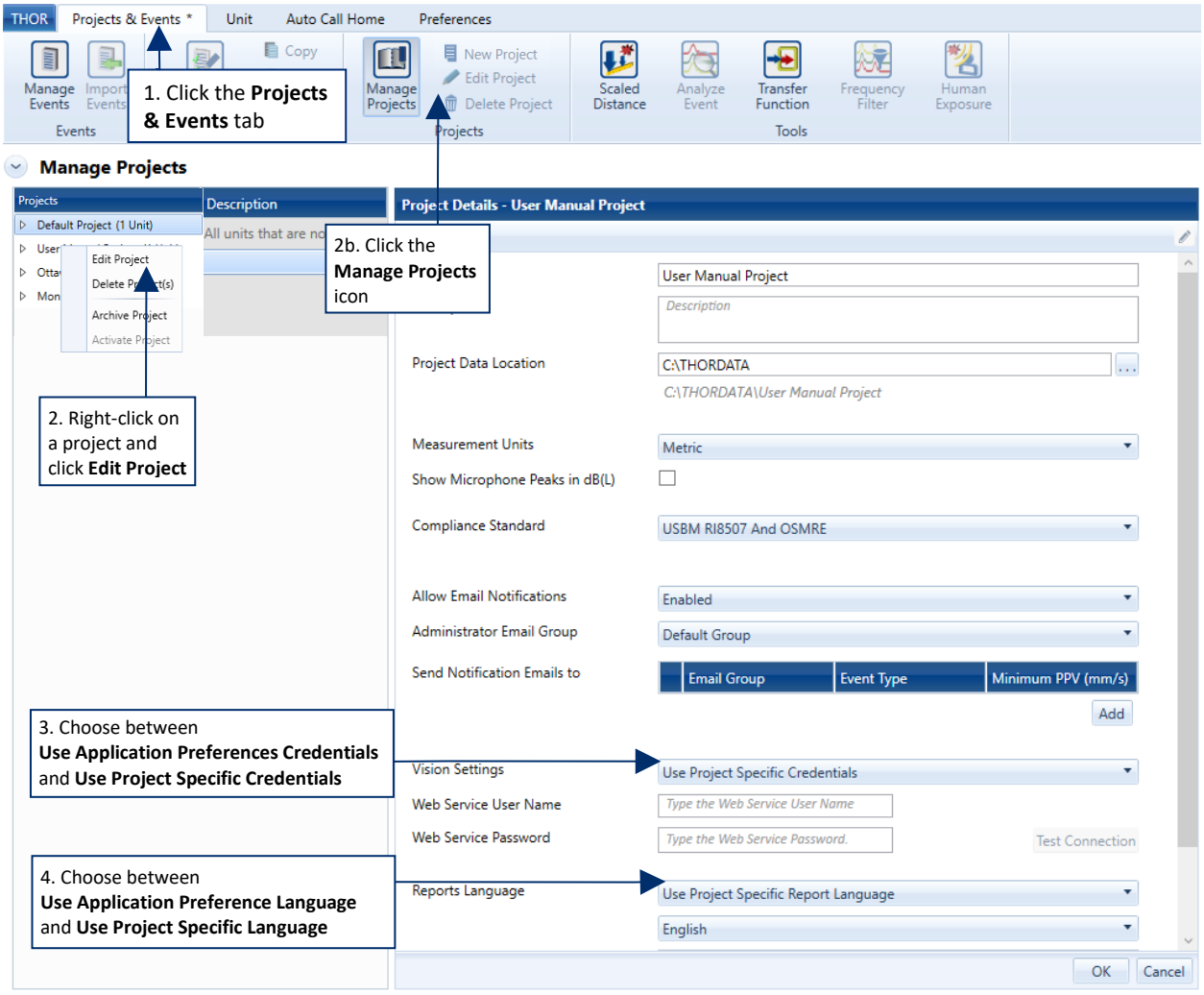
Individual projects retain their own settings and override THOR's General Preferences. You may, however, choose to assign some General Preferences within the project. To do this:

1. Click on the **Projects and Events** tab.
2. Right-click on a project and click **Edit Project**



2b. If these options are greyed out, this indicates an unfinished operation in the Manage Projects window. When this is the case, click on the **Manage Projects** icon, then right-click on a project and click **Edit Project** (or create a new one – **New Project**).

3. In the **Vision Settings** drop-down field choose between **Use Application Preferences Credentials** (uses the General Preferences values) and **Use Project Specific Credentials** (you must enter the project-specific values).
4. In the **Reports Language** drop-down field choose between **Use Application Preferences Language** (uses the General Preferences to determine the report's language) and **Use Project Specific Report Language** (you must select the project default language to generate reports).

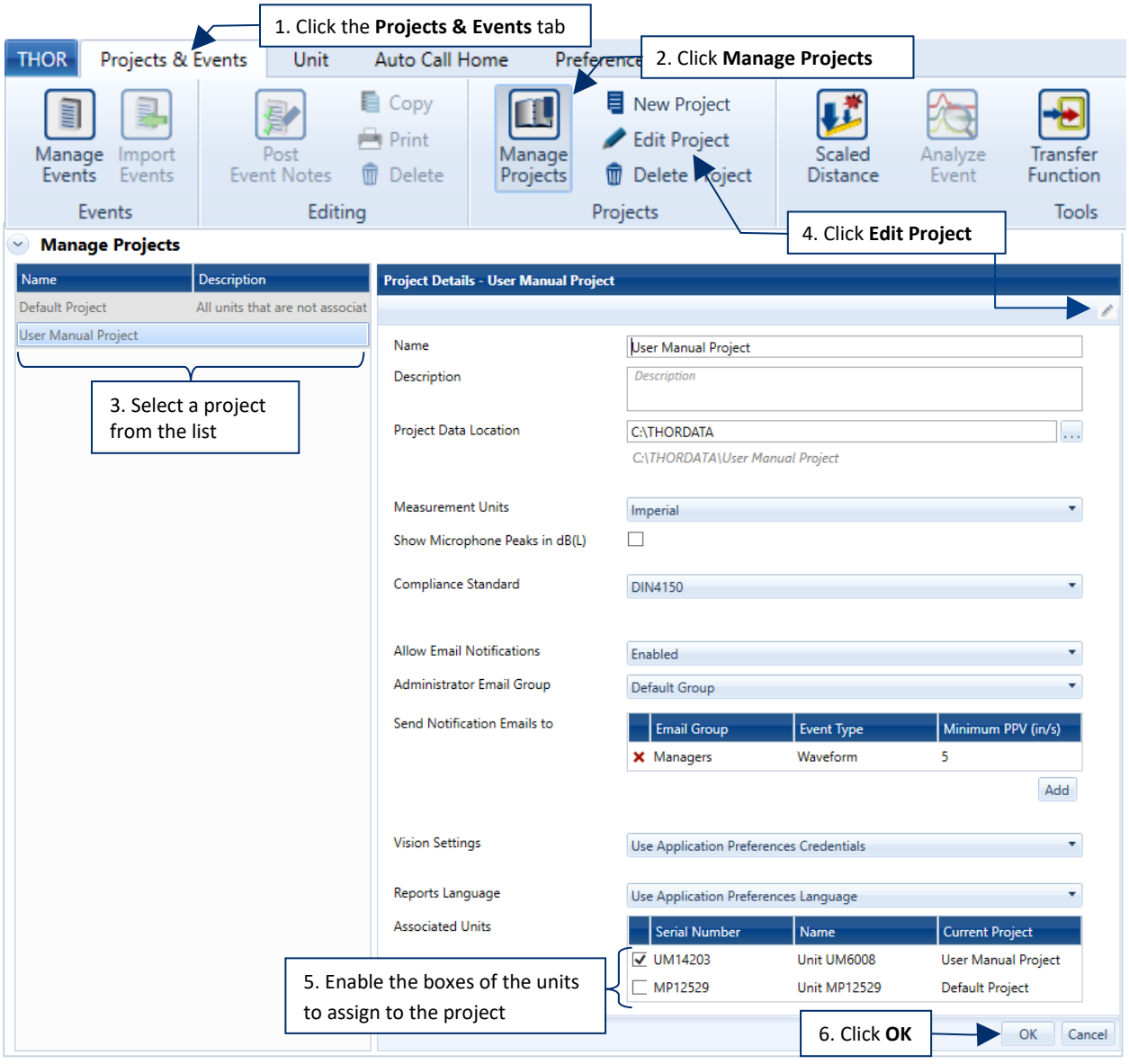


4.4 LINKING UNITS WITH PROJECTS

4.4.1 ASSIGN A UNIT TO A PROJECT

1. Click the **Projects & Events** tab.
2. Click the **Manage Projects** icon.
3. Select a project from the list of projects.
4. Click either of the **Edit Project** icons.
5. In the **Associated Units** section, select all units to associate/dissociate with the project.
6. Click **OK** (in the confirmation dialog box click **OK** a second time).

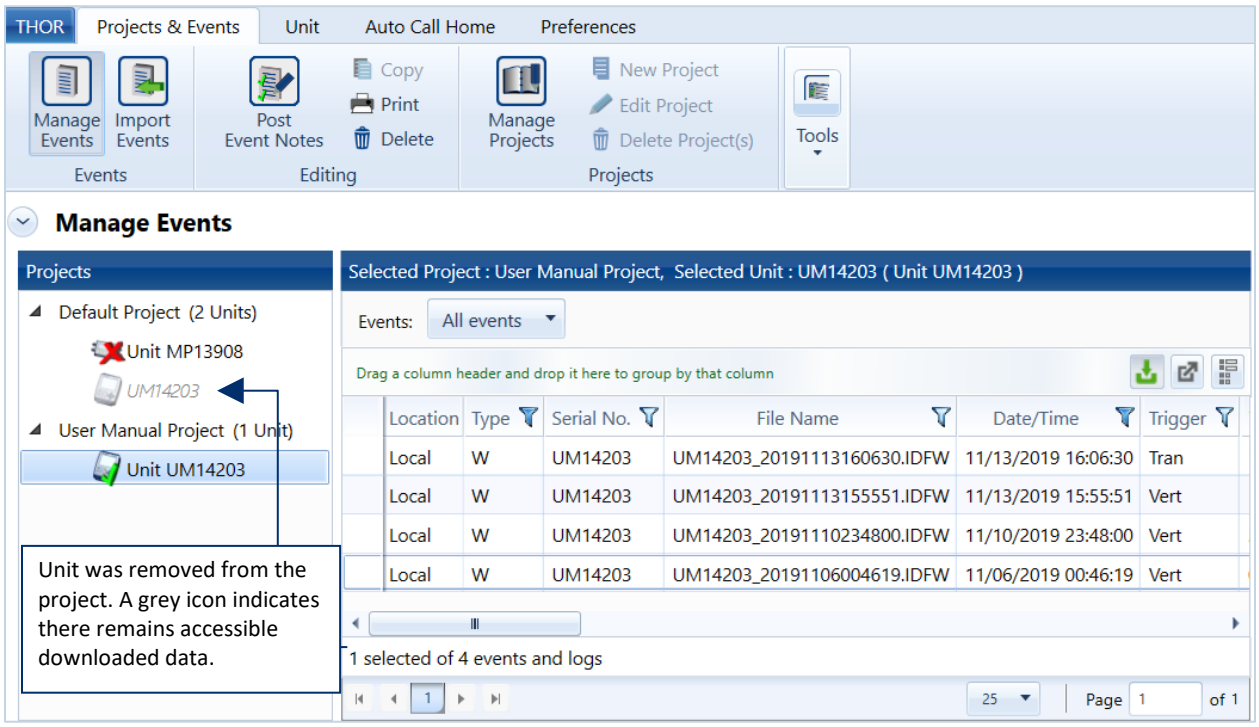
NOTE Units previously assigned to a project, are disassociated and reassigned through this procedure to the newly chosen project.



4.4.2 REMOVE A UNIT FROM A PROJECT

If a unit is removed from a project while event data exists from that unit, a grey icon will remain in the project to continue to access the downloaded events. The unit will return to the Default project.

To remove a unit from a project, follow the same procedure as when adding a unit, this time instead of selecting, deselect the units (they will turn grey).



4.5 ARCHIVE AND DELETE PROJECTS

When a project is complete, you can close the project folder by archiving or deleting it.

(It is best practice to archive projects.)

Deleted projects are permanently removed from THOR, while archived projects can be reactivated. Archived projects will maintain their settings and event information.

You cannot archive or delete the default project

When to Archive / Delete:

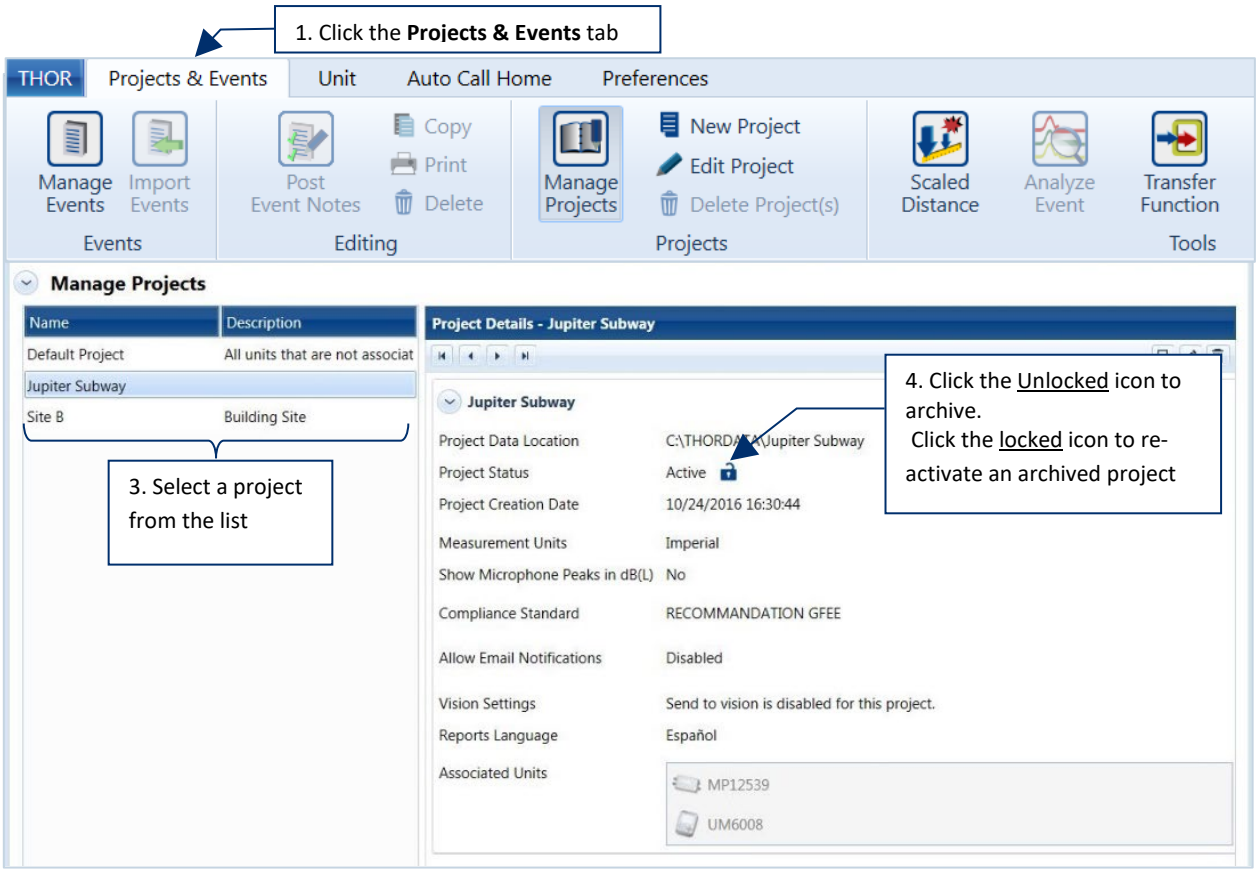
ARCHIVE	DELETE
If the project may become active again sometime in the future.	If the project will never be re-activated in the future.
To view the event data sometime in the future.	If you never need to view the collected event data again.

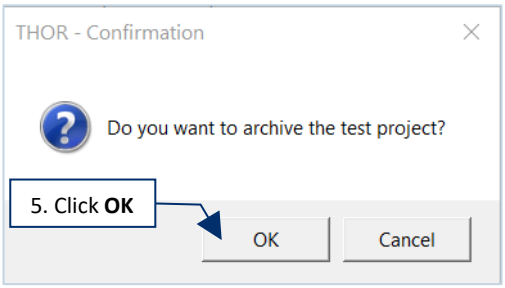
When a project is archived, a grey icon is displayed for any units that were assigned to it and had events downloaded to the project. Units assigned to archived or deleted projects are automatically reassigned to the default project.

NOTE Any unit that has been assigned to the default project will NOT be reassigned automatically to a project if that project was archived and reactivated.

4.5.1 ARCHIVE / RE-ACTIVATE A PROJECT

1. Click the **Projects & Events** tab.
2. Click the **Manage Projects** button.
3. Select a project from the list.
4. Click the **Unlocked / Locked** icon. (The status will toggle between Active and Archived.)
5. Click **OK i**n the confirmation dialog box.



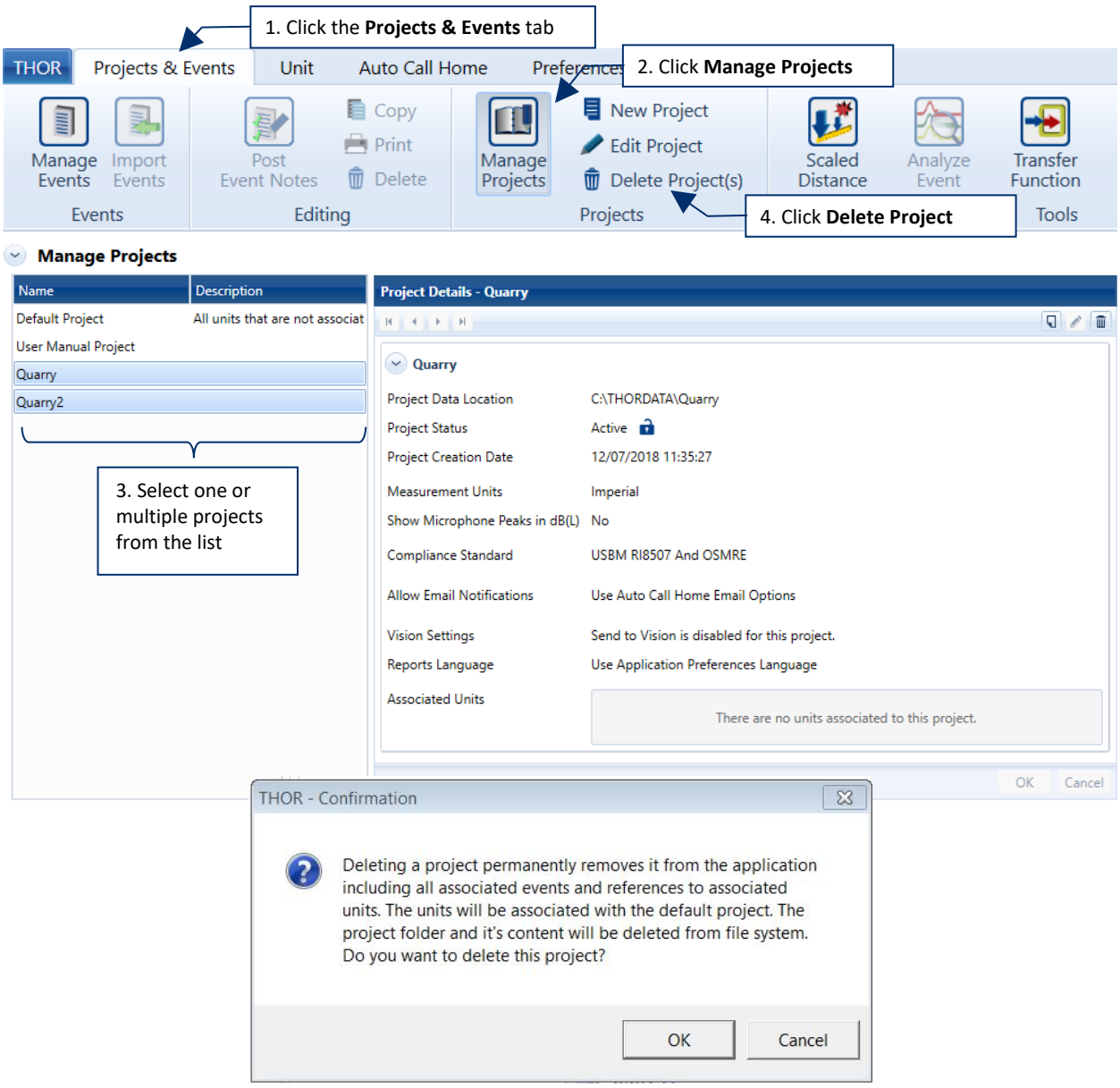


Alternative Path: Projects & Events, Manage Events, right-click on the Project and select Archive Project.

4.5.2 DELETE A PROJECT(S)

WARNING Deleting a project will permanently remove all project and event data. Archiving is an alternative to deleting.

1. Click the **Projects & Events** tab.
2. Click the **Manage Projects** button.
3. Select a project (or multiple projects using CTRL / Shift) from the list.
4. Click the **Delete Project** button.
5. In the confirmation dialog box, click **OK.**



Alternative Path: Projects & Events, Manage Events, right-click on the Project and select Delete Project.

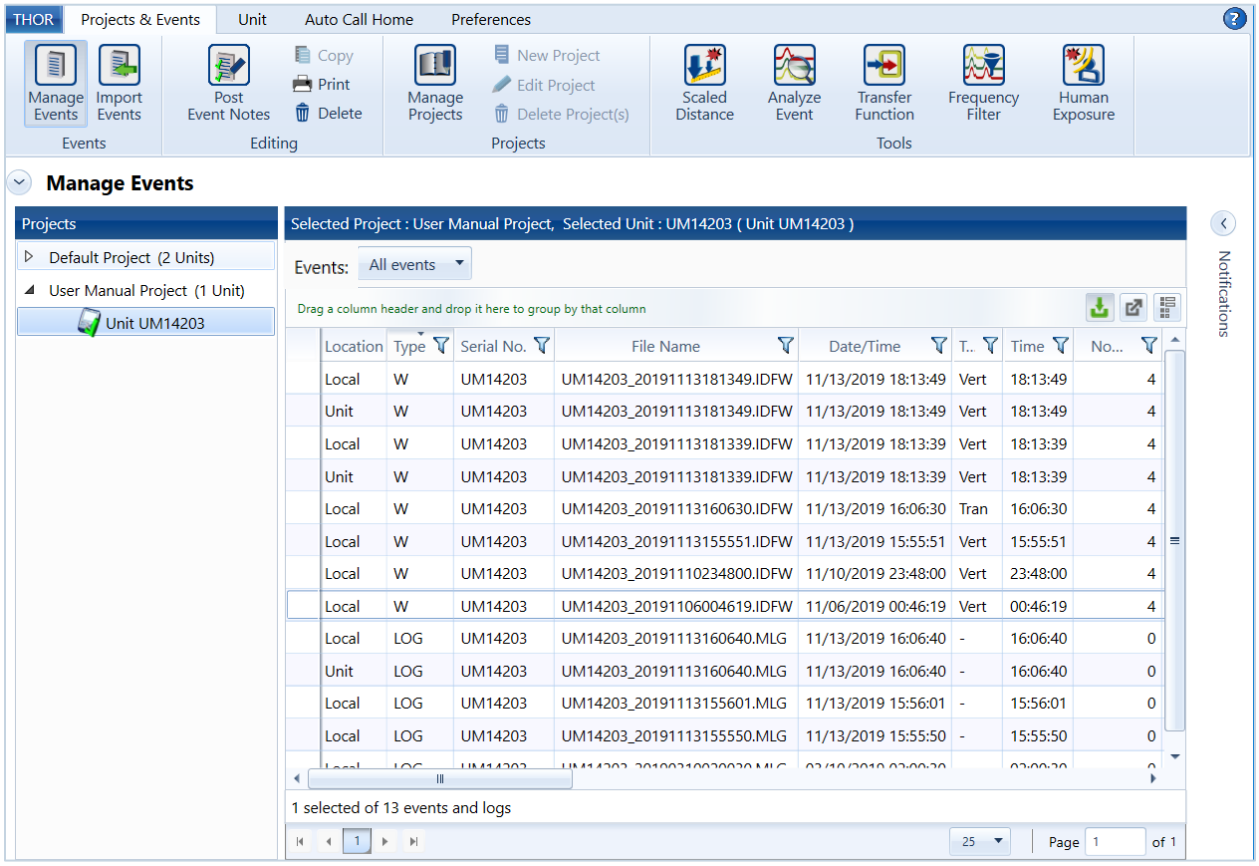
5. EVENT SETUP AND MANAGEMENT

5.1 UNDERSTANDING EVENTS AND THE EVENT TABLE

Events are created every time units trigger and record data from their sensors. Event data can contain over 60 data columns including:

- Type of event recorded
- Triggered channels
- Serial number of the unit
- Date and timestamp of event
- Sampling rate
- Frequency analysis
- File Name
- Operator
- Sound Mic Peak

...etc



THOR can:

1. View events
2. Copy events to your computer
3. Delete events
4. Group and filter events
5. Print and export events
6. Export events list

> You can also create reports on events. For more information see section 5.8 Monitoring Logs

When event data is loaded into THOR, if the unit is not assigned to a project, the data will appear in the default project. (To set up a project that includes related events (E.g. on a single job, or at one location.) see chapter 4 Project Setup and Management on page 73.

5.2 UPLOAD EVENTS TO A COMPUTER

Uploading event data can be done in three ways:

USE...	TO...
Import Event Files to THOR	Access external event file data offline. For event data that has already been transferred to a computer or USB device. See section 5.3 on page 88. (Note: You cannot import event data while the unit is monitoring.)
Copy Events from a Unit	Transfer event data on a case-by-case basis. Copying events does not need to be planned. See section 5.4 on page 90.
Auto Call Home	Automate transferring event data. A transfer is planned and may be set up on a recurring basis. See section 6 on page 135.

THOR can display event data from a physically connected or remotely connected unit. To view events of a unit that is not connected, you must create a local copy (at some point when the unit is connected, using the **Copy Events from a Unit** function) of the events on a local computer.

5.3 IMPORT EVENT FILES TO THOR

Use the **Import Events** function to access data offline when the event data has already been transferred to a computer or USB device. You can import either single events or all events in a folder (and subfolders).

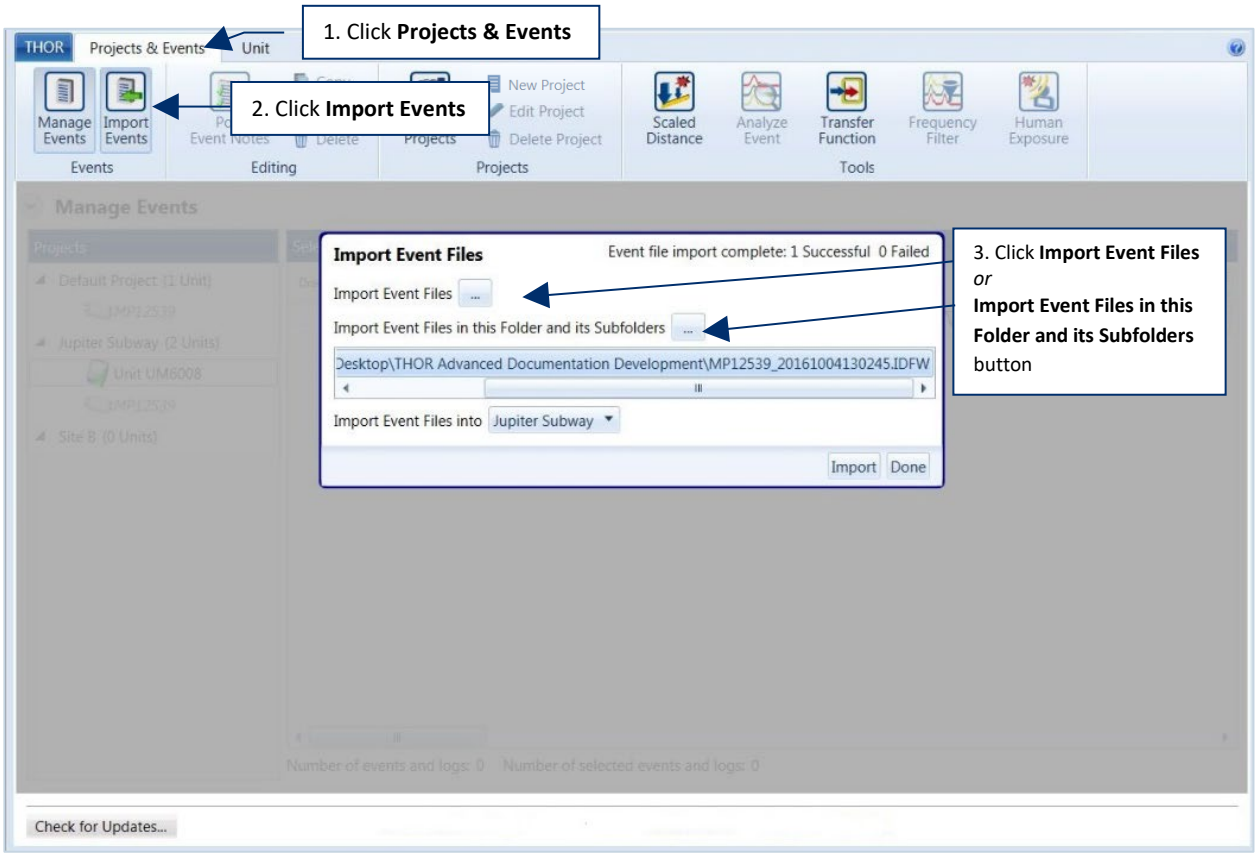
NOTE Events can only be imported into an active project (not archived projects).

NOTE Files and folders other than events are not imported.

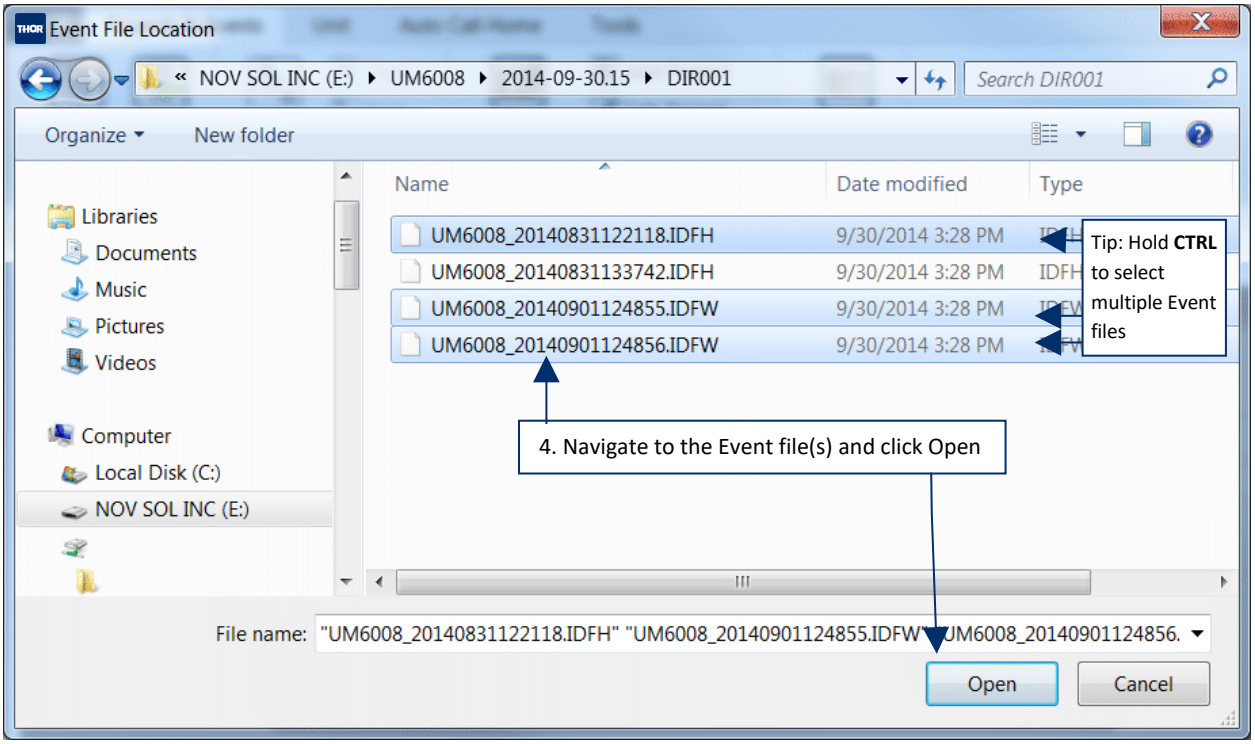
The Import Event Files' icons show the status of the files. Hover the cursor over the icons for status details.

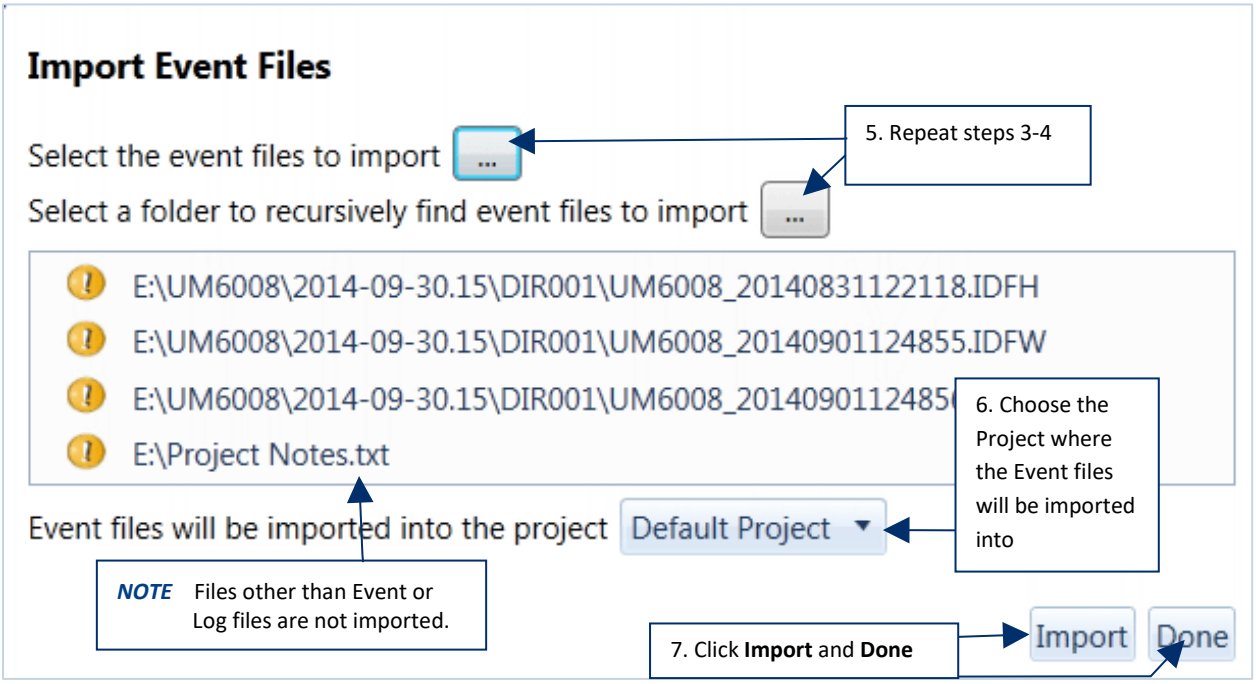
ICON	MEANING
	File was imported successfully
	File not imported
	Invalid event file

1. Click the **Projects & Events** tab
2. Click the **Import Events** button
3. Either click the **Import Event Files** button or **Import Event Files in this Folder and its Subfolders** button



4 Navigate to the event file(s) to import and click **Open**.





5 Repeat Steps 3-4 until all the files to import appear in the list.

6 Choose the **Project** where the Event Files will be imported into.

7 Click **Import** and then **Done.**

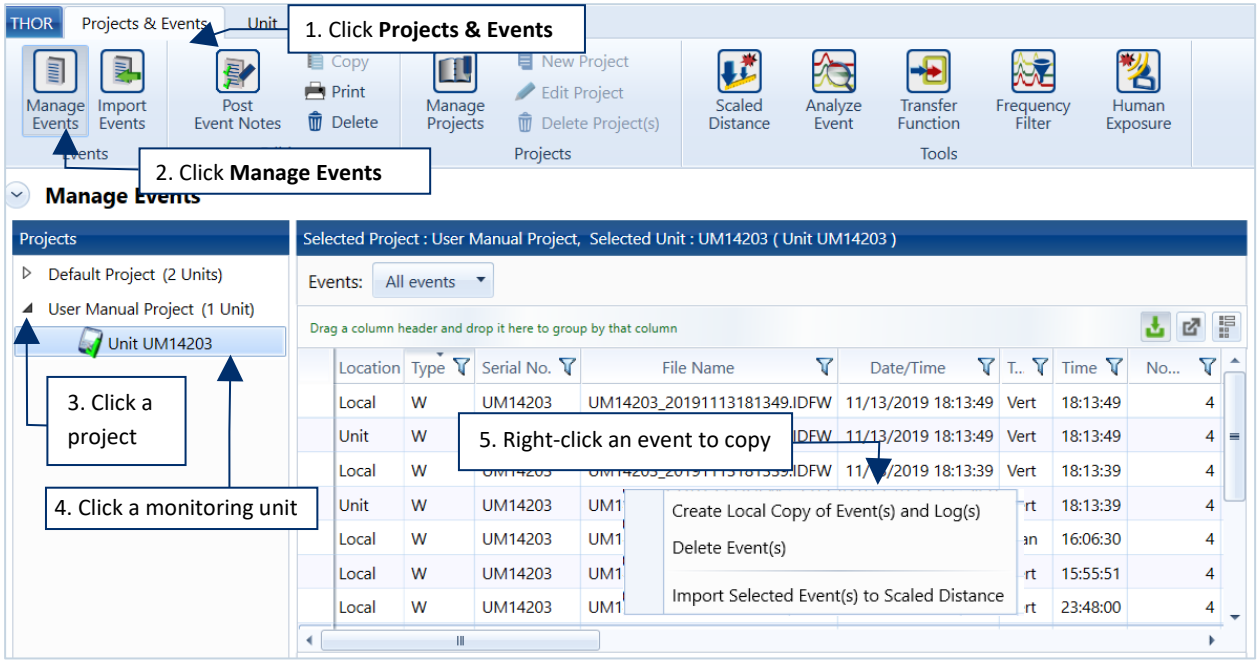
5.4 COPY EVENTS TO A COMPUTER

Use this function to store a copy of the event file(s) onto your local computer. The Location attribute indicates where the event file resides.

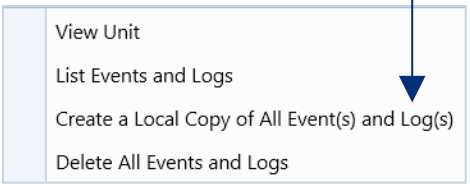
Unit: The event file is stored on the unit and is being viewed temporarily in THOR.

Local: A copy of the event file has been downloaded to the local computer and can be viewed permanently in THOR.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click a project's arrow that contains the unit's event data to copy.
4. Click a monitoring unit.
5. Select one or more events with the Location Type *Unit*, then right-click and select **Create Local Copy of Event(s) and Log(s)**. or click the **Copy** icon.
   (Events with the Location Type *Local* are already copied onto the computer.)



Alternative Path: Projects & Events, Manage Events, click on a Project, right-click a unit and select **Create local Copy of All Events and Logs.**

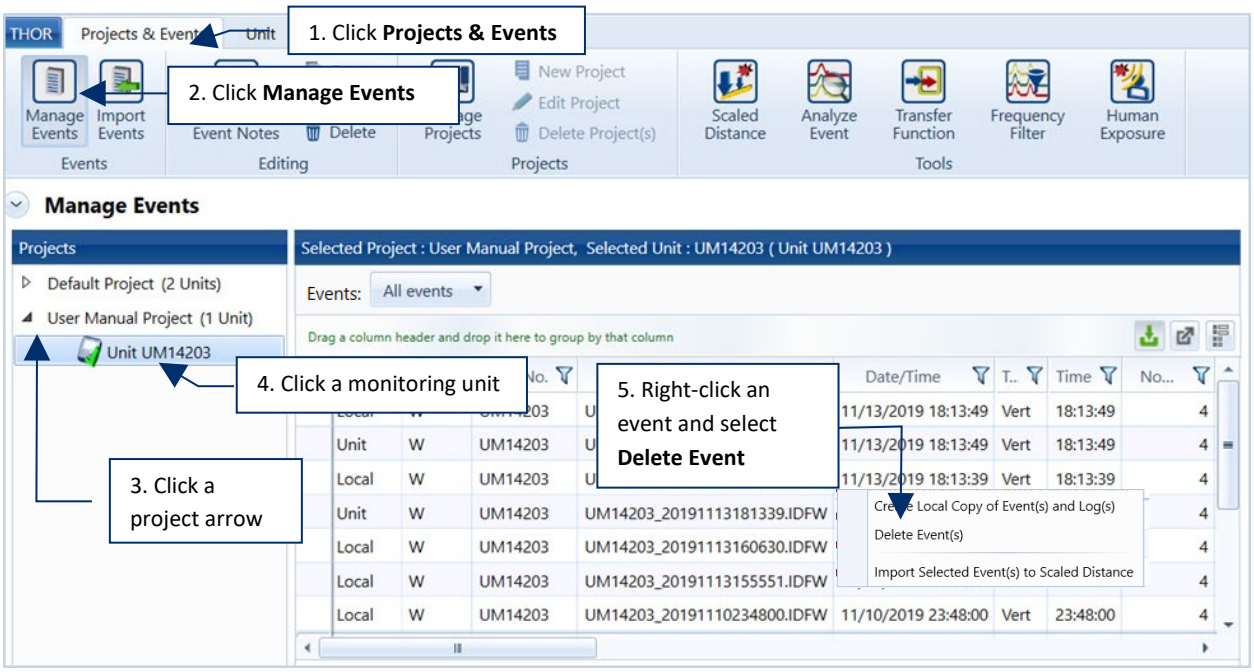


5.5 DELETE EVENTS FROM A UNIT

5.5.1 DELETE EVENTS IN PROJECTS

WARNING Deleted events that have been removed from the unit cannot be restored.

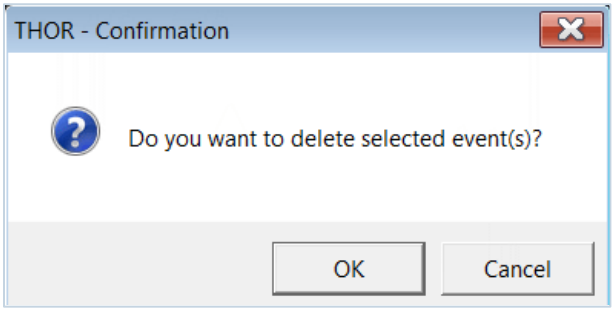
1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click a project's arrow that contains the unit's event data to delete.
4. Click a monitoring unit.
5. Select one or more events then right-click and select **Delete Event(s).**



Tip: To select multiple events, hold down **CTRL** on the keyboard and select the events.

6. In the confirmation dialog box, click **OK**.

WARNING Deleting an event, will delete all associated reports with it.

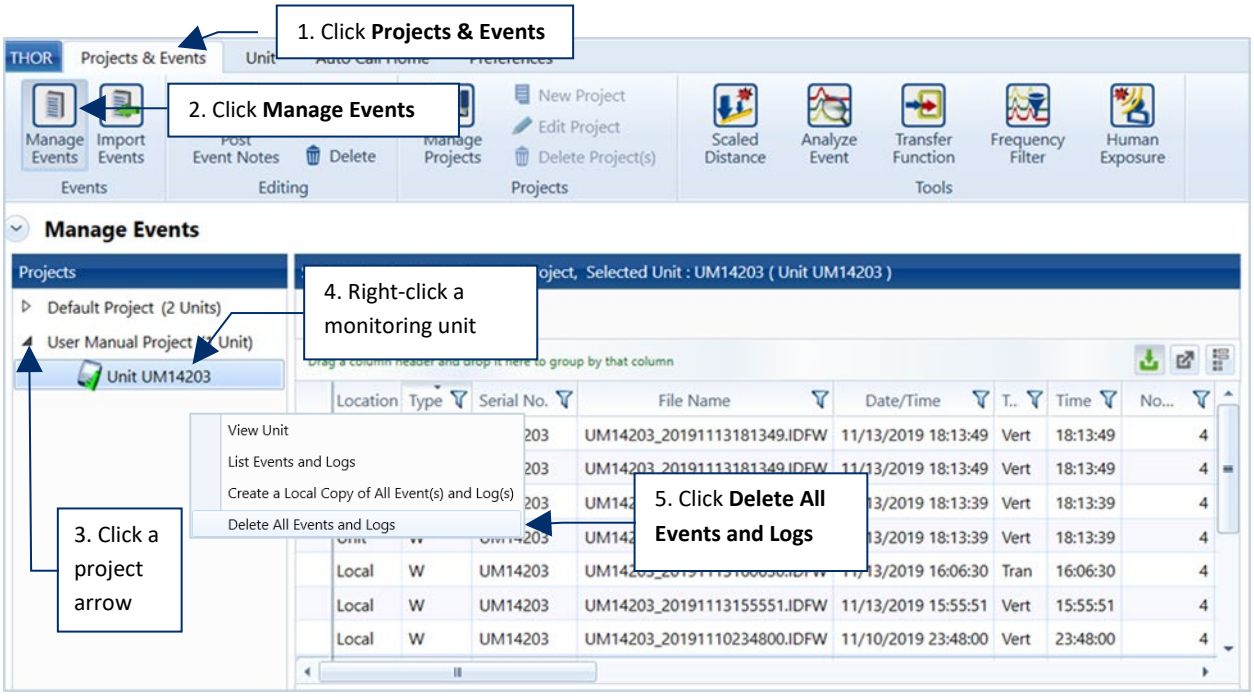


5.5.2 DELETE ALL EVENTS IN MONITORING UNITS

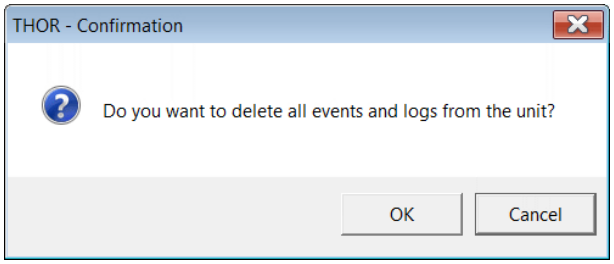
To delete all the events in a unit:

> WARNING Deleted events cannot be restored.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click a project's arrow that contains the unit's event data to delete.
4. Right-click a monitoring unit.



5. Click **Delete All Events and Logs**.
6. In the confirmation dialog box, click **OK**.

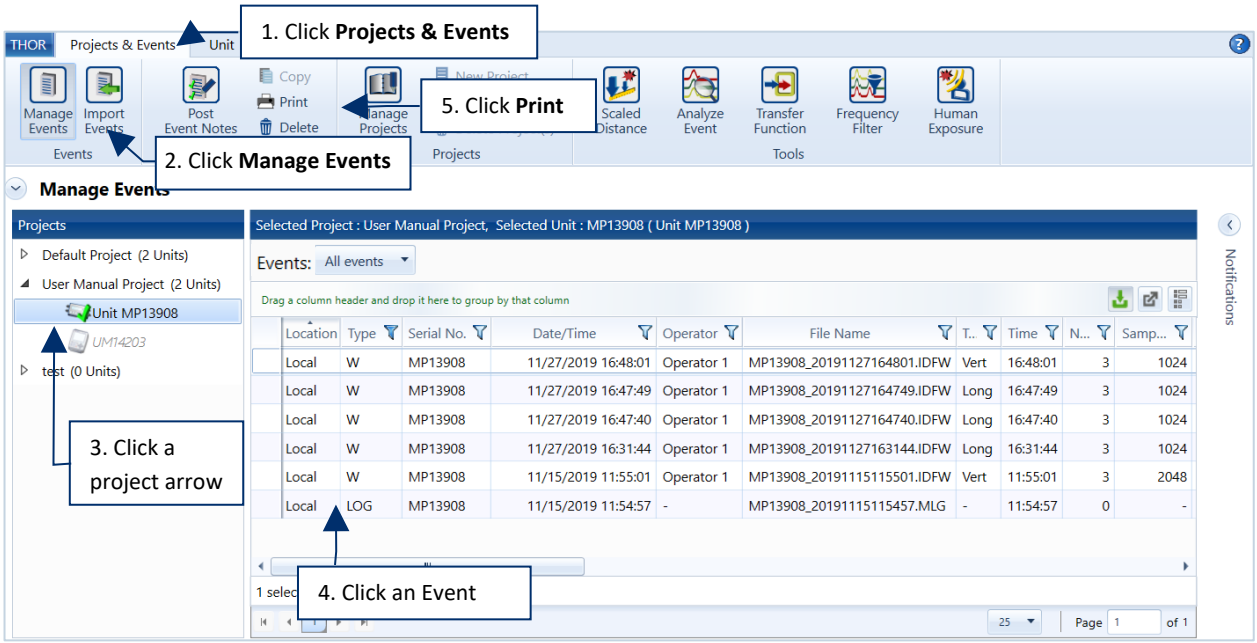


> *Alternative Path*: Units tab, select a unit, click on the **Delete All Events and Logs** icon

5.6 PRINT EVENTS

Events can be printed as reports, to print an event:

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click a project's arrow.
   a. (Optional) Click a unit to filter events and logs only associated with the unit.
4. Click an Event (To select multiple events, use CTRL and click additional events).
5. Click the **Print** button.



NOTE Multiple events will be printed as individual reports. To customize event reports or add a custom logo before printing see section 5.9.3.1 Printing an Image on Reports on page 124.

Instantel

Waveform Trigger Source	Vert at November 6, 2018 16:38:15	**Serial Number**	UM14203
Trigger Level(s)	Geo 0.5000 in/s,Mic 0.01001 psi	**Model Number**	Micromate ISEE 10.89
Pre-Trigger/Record Time	0.25 sec/3.0 sec (Fixed)	**Battery Level**	3.4 volts
Sample Rate	1024 sps	**Unit Calibration**	September 11, 2018 by Instantel
Setup File Name	Default Micromate ISEE.mmb	**Event File Name**	UM14203_20181106163815.IDFW
Operator	Operator	**USB Sensor Support**	Disabled

Notes
Location
Client
Company
General Notes

Post Event Notes No text to be displayed.

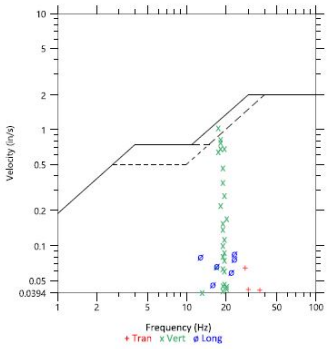
Geophone	**Tran**	**Vert**	**Long**
Peak Particle Velocity	0.0661 in/s	1.0594 in/s	0.0872 in/s
Zero Crossing Frequency	28.4 Hz	17.7 Hz	22.3 Hz
Time (Relative to Trigger)	0.044 sec	0.029 sec	0.002 sec
Peak Acceleration	0.030 g	0.359 g	0.049 g
Peak Displacement	0.000 in	0.010 in	0.001 in
Sensor Check	✓ Passed	✓ Passed	✓ Passed
Frequency	7.1 Hz	7.3 Hz	7.1 Hz
Overswing Ratio	4.8	4.5	4.5

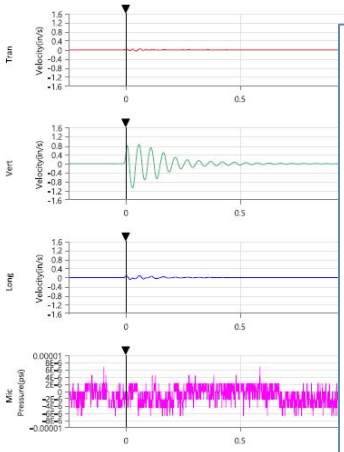
Peak Vector Sum 1.0602 in/s at 0.029 sec

ISEE Linear Microphone

Peak Sound Pressure Level	<0.000073 psi
Time (Relative to Trigger)	1.322 sec
Zero Crossing Frequency	73.1 Hz
Sensor Check	X Check
Frequency	0.0 Hz
Test Amplitude	0 mv

USBM RI8507 And OSMRE
Velocity versus Frequency (Zero Crossing)





Example of a printed event in the form of a report. This is fully customizable, see section 5.9 Reports on page 113.

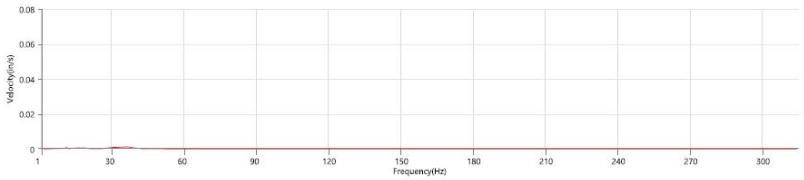
Instantel

Waveform Trigger Source	Vert at November 6, 2018 16:38:15	**Serial Number**	UM14203
Trigger Level(s)	Geo 0.5000 in/s,Mic 0.01001 psi	**Model Number**	Micromate ISEE 10.89
Pre-Trigger/Record Time	0.25 sec/3.0 sec (Fixed)	**Battery Level**	3.4 volts
Sample Rate	1024 sps	**Unit Calibration**	September 11, 2018 by Instantel
Setup File Name	Default Micromate ISEE.mmb	**Event File Name**	UM14203_20181106163815.IDFW
Operator	Operator	**USB Sensor Support**	Disabled

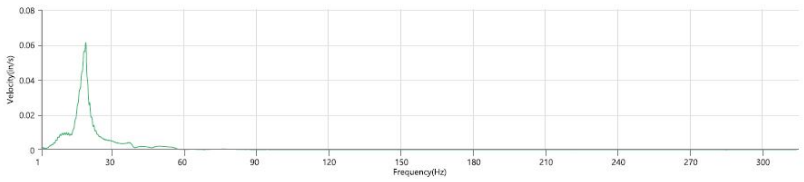
Notes
Location
Client
Company
General Notes

Post Event Notes No text to be displayed.

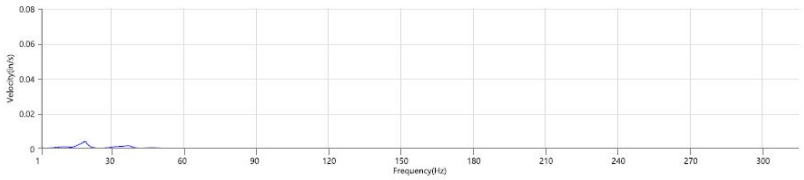
Tran - Dominant Frequency 36.2 Hz, Amplitude 0.0013 in/s (Peak Particle Velocity: 0.0661 in/s)



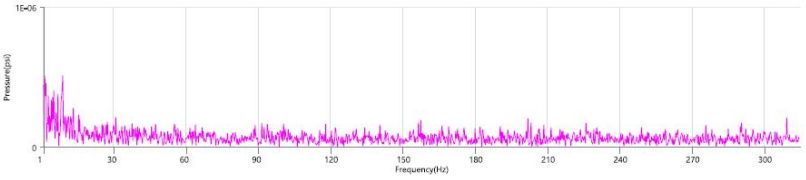
Vert - Dominant Frequency 19.2 Hz, Amplitude 0.0609 in/s (Peak Particle Velocity: 1.0594 in/s)



Long - Dominant Frequency 19.2 Hz, Amplitude 0.0040 in/s (Peak Particle Velocity: 0.0872 in/s)



Mic - Dominant Frequency 1.5 Hz, Amplitude 0.00000 psi (Peak Sound Pressure Level: 0.000009 psi)



Page 2 / 2

5.7 VIEW AND ORGANIZE EVENTS WITHIN THE EVENT TABLE

THOR provides tools to help organize event data:

FEATURE	DESCRIPTION
Viewing	Show only certain columns and hide others. Restore hidden columns at any time. For more information see section 5.7.1 Preferences for Viewing Events on page 96.
Sorting	Sort columns to make events appear in a different order. Use column sorting to show data with ascending or descending values, (alphabetical order or reverse alphabetical order). For more information see section 5.7.6 Sort Events on page 106.
Grouping	Isolate events with a subset of data. For more information see section 5.7.4 *Group Events by Columns* on page 100.
Filtering	Find and work with a subset of data. Filtering data will only display rows that meet certain conditions. Rows that don't meet these conditions are hidden. For more information see section 5.7.5 *Filter Events* on page 102.

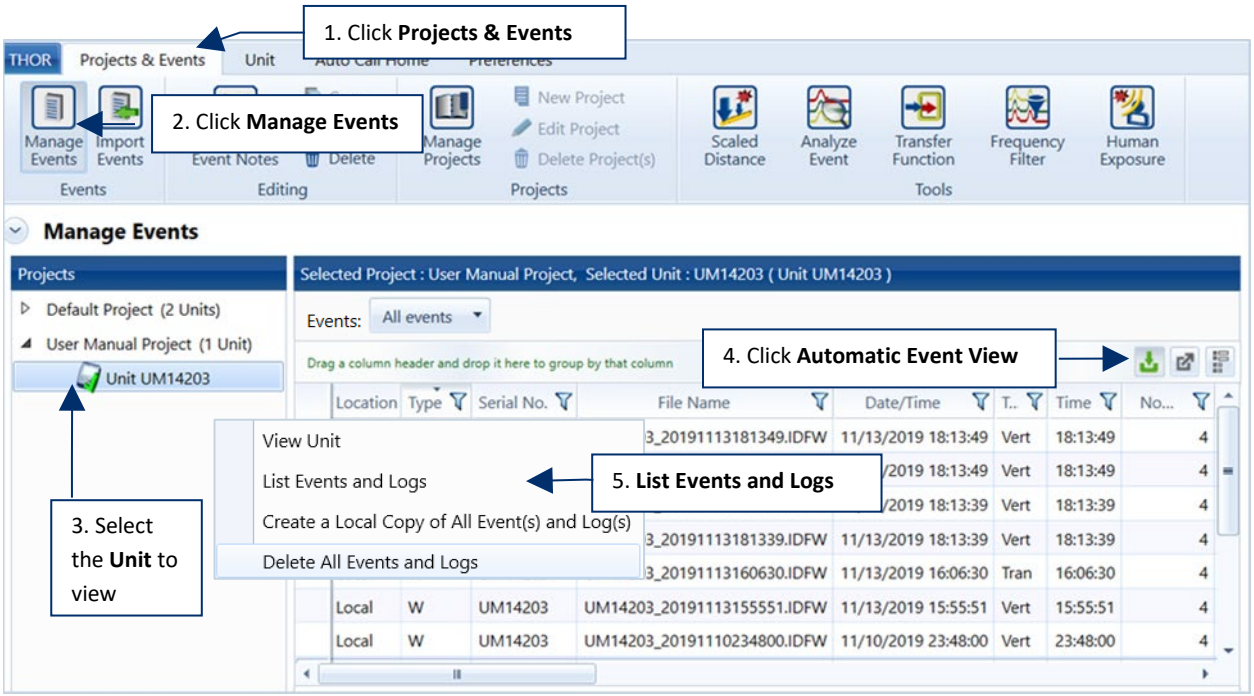
5.7.1 PREFERENCES FOR VIEWING EVENTS

When the Automatic Event Viewing is enabled, all events stored locally and on the unit will be displayed when you click on a unit. This feature helps avoid large data transfers and delays which could be a factor when using remote modem connections. When disabled and a unit is clicked in a project, only the event data that has been downloaded from the unit and saved to the project will be displayed.

Enable / Disable Automatic Viewing of Events

NOTE Events on units that are offline cannot be viewed automatically.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Select the unit to view.
4. Click the **Automatic Event View** button.
   When the button is grey, automatic viewing is disabled.
   When the button is green, automatic viewing is enabled. (Events stored on the unit will appear when you click on the unit.)
5. To view events on a unit whose automatic viewing event data is:
   - Disabled, right-click on the unit and click on **List Events and Logs**.
   - Enabled, click on the unit and all events and logs will appear.



5.7.2 VIEW EVENT DATA

THOR displays all downloaded events residing on a local computer (even when a unit is no longer connected) and all events from units currently connected to the computer (either physically via a cable or remotely via a modem and cellular network).

> If there are no custom projects, all event data will reside in the default project.

When viewing a PROJECT

Only the event data that was registered by the unit while it belonged to the project will be displayed.

- Events whose *location* is Local are displayed.
- Events whose *location* is Unit are not displayed.

(In some cases, event data exists from the same unit while it was assigned to another project. Those events will not appear in the currently selected project).

When viewing a UNIT

- Automatic Event View is enabled: All events are displayed regardless if their *location* is Local or Unit.
- Automatic Event View is disabled: Only events whose *location* is Local are displayed.

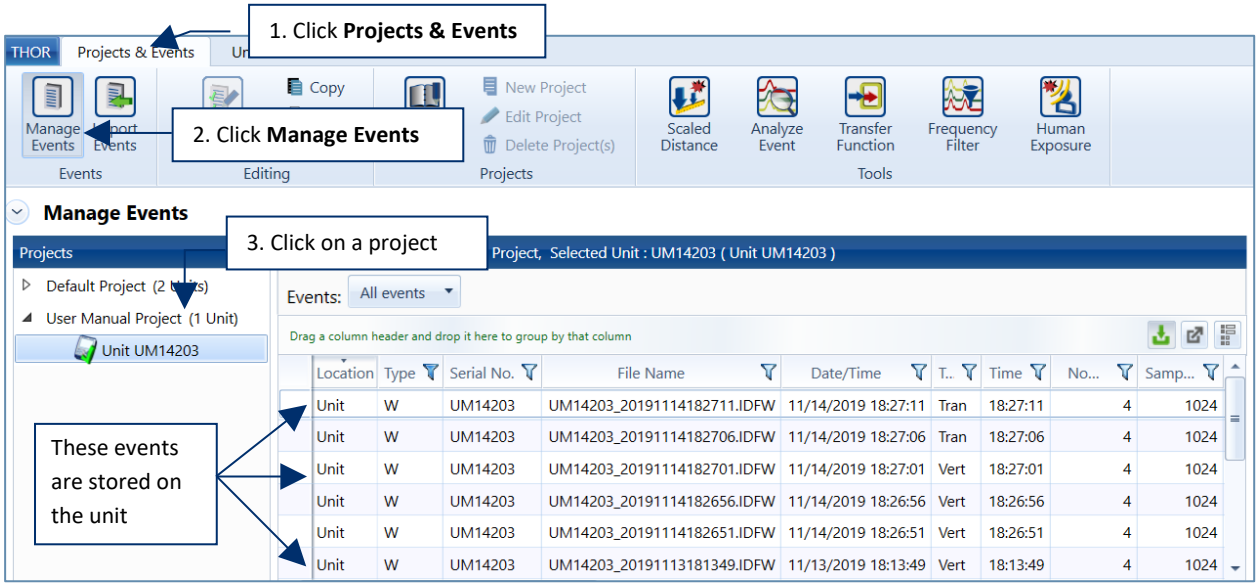
Viewing the data will not automatically upload it to the computer. For this you must either:

- Copy event data to the computer.
- Send the event data to the computer using Auto Call Home.
- Import the event data.

To identify which event data is on the unit and which is on the computer look at the *Location* column when events are displayed.

LOCATION	MEANING
Unit	The event resides on the unit
Local	The event resides on the local computer

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** icon.
3. Click on a Project.

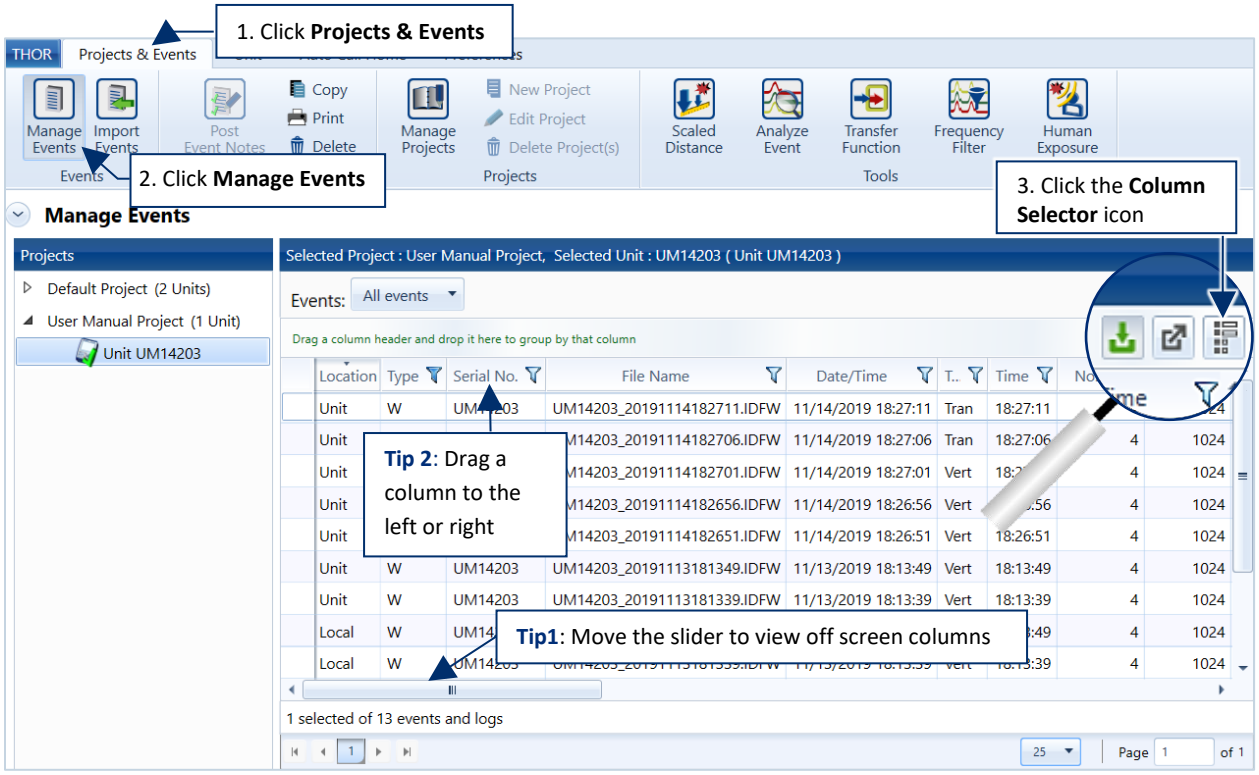


NOTE If an event resides on the computer and has not yet been deleted from the monitoring unit, the event will appear twice in the events list, once as Unit, and once as Local.

5.7.3 COLUMN SELECTION

Columns can be organized and re-arranged according to your needs. There are over 60 field types, some more important than others depending on your application. Rearranging these fields can help improve work efficiency and detecting critical data. To customize the column view:

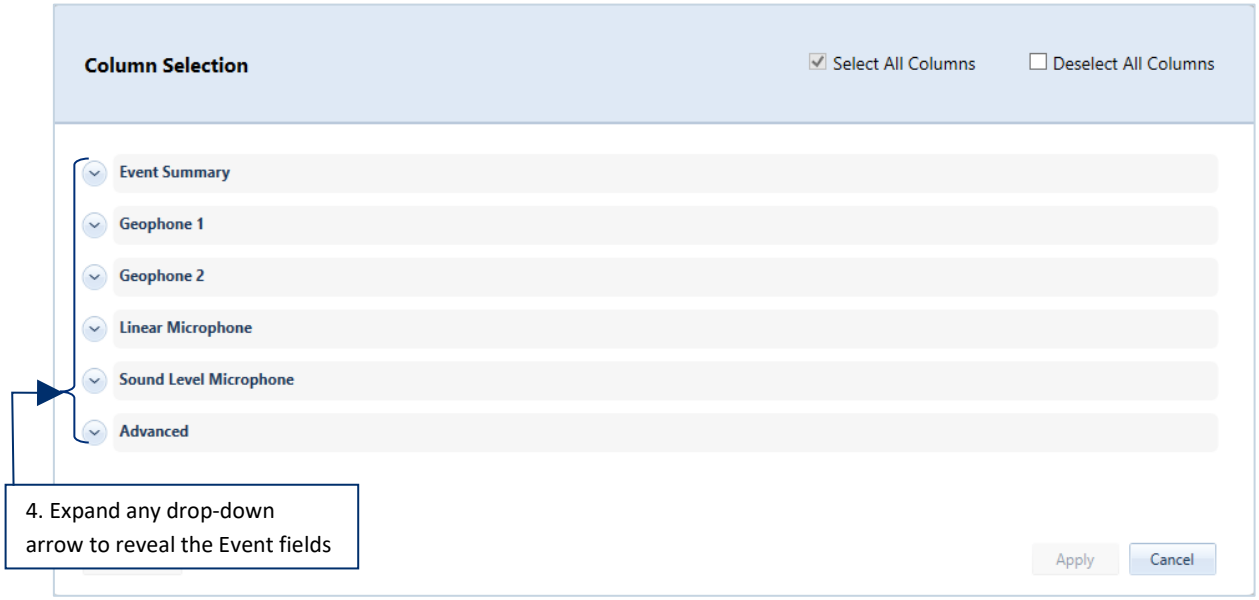
1. Click the **Projects & Events** tab.
2. Click the **Manage Events** icon.
3. Click the **Column Selector** icon.



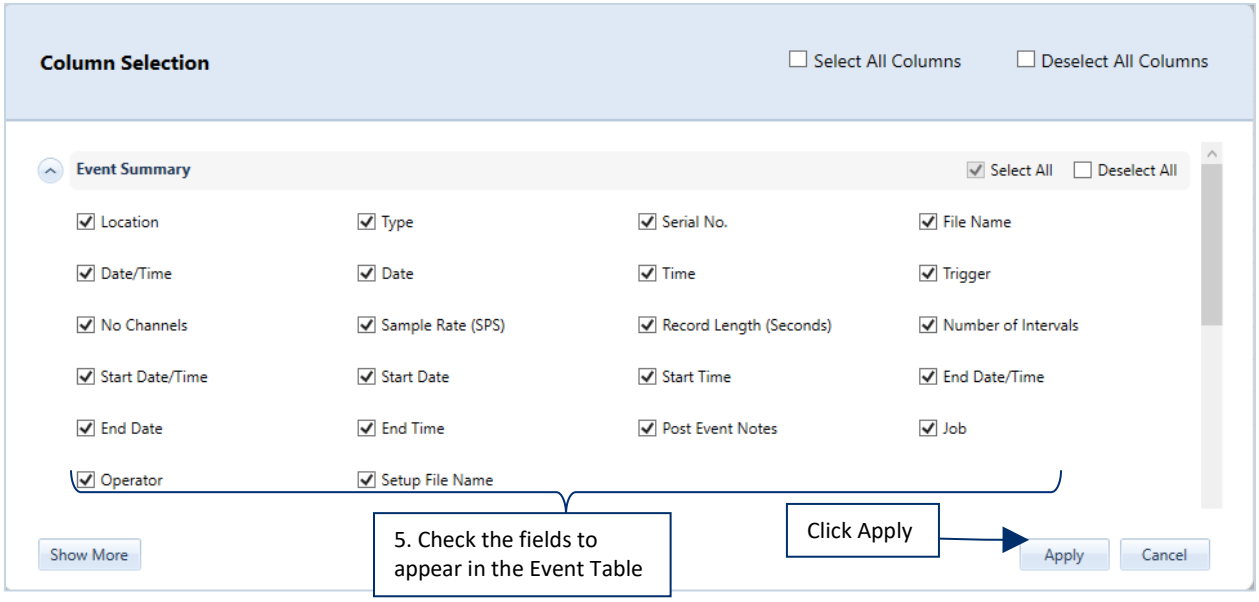
Tip 1: Move the slider to view off-screen columns.
Tip 2: Drag a column to the left or right to re-order its relative position.

NOTE When columns are rearranged, their relative positions are stored at the project level. This means that all units within the project will display the same column arrangement. Every project contains its own column arrangement independent of the other projects.

4 Expand the areas of interest by clicking on the drop-down arrow. You can also select everything by checking the **Select All Columns** field or deselect everything by checking the **Deselect All Columns** field.



5 Check the columns to appear in the Event Table. If there are fields that do not fit into the window view, use the scrolling bar on the right side or click on the **Show More** button.



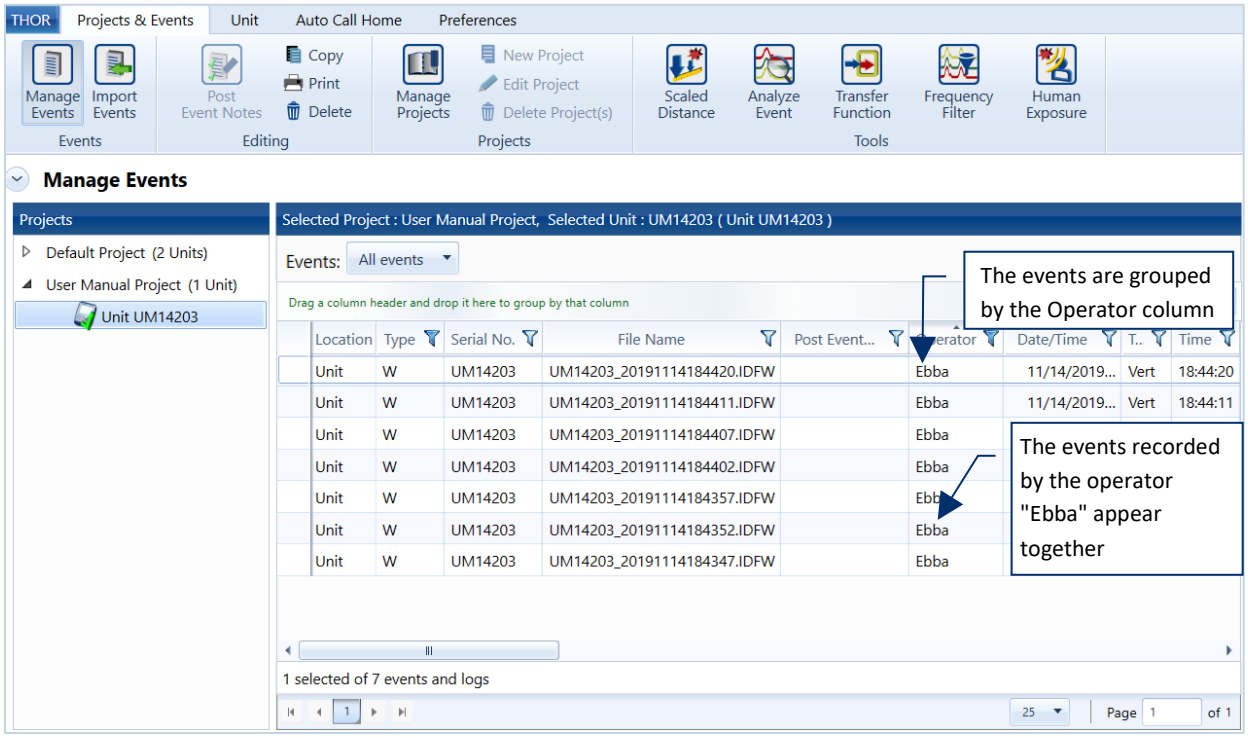
6 Click the **Apply** button.

NOTE At least one field must be selected. In the case when Deselect All Columns is selected, the Apply button will remain grey until a field is selected.

5.7.4 GROUP EVENTS BY COLUMNS

Grouping places events with essential data together. This could be considered as a type of filter, though it will not hide data (as filtering does) it merely re-orders the data to display it within the chosen groups.

E.g. Events grouped by the Operator column for values containing "Ebba" are grouped together.

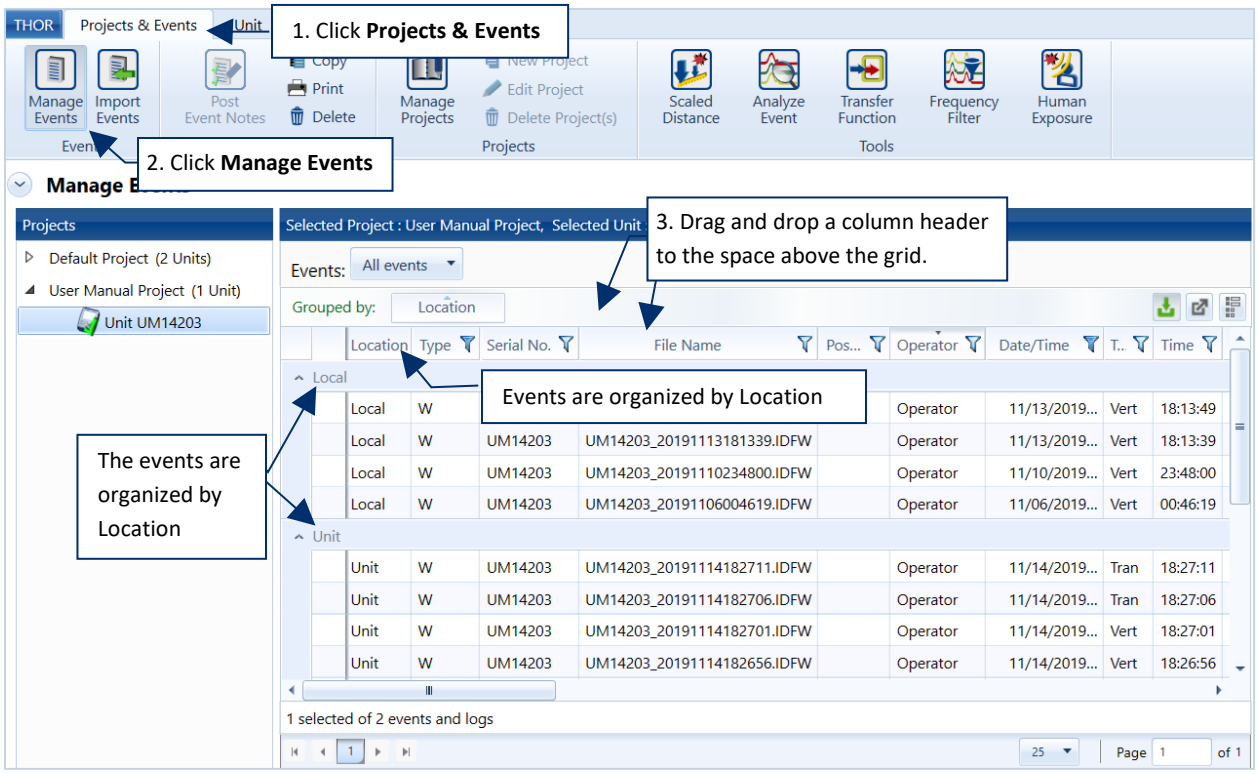


Events can be grouped by more than one column.

In multiple column groups:

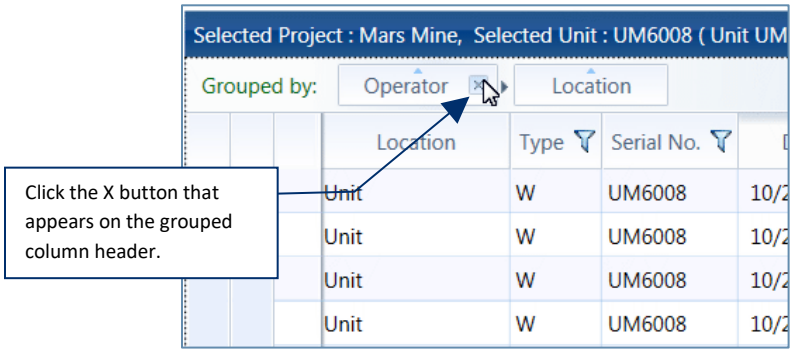
a. The first column is the major category.
b. Additional columns will organize the data within the major category.

Ex: Grouped data by the Operator column: all data recorded by Ebba appears together. If the Storage column is added, the data recorded by Ebba will appear together and within the Ebba group. Events from Storage and the Events from Unit appear separately.

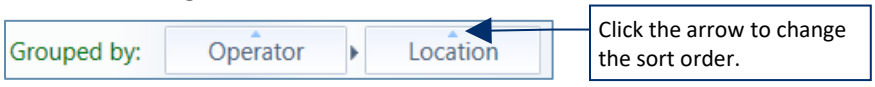


1. Click the **Project & Events** tab.
2. Click the **Manage Events** button.
3. Drag and drop a column header to the space above the project grid.
4. (Optional) To add additional columns, repeat step 3.

To remove column groupings, hover the mouse over the column header in the **Grouped by** area and click the **X** button that appears.



You can also sort any column that is grouped to display the rows by ascending or descending values. Click the arrow in the header button to change the sort order.



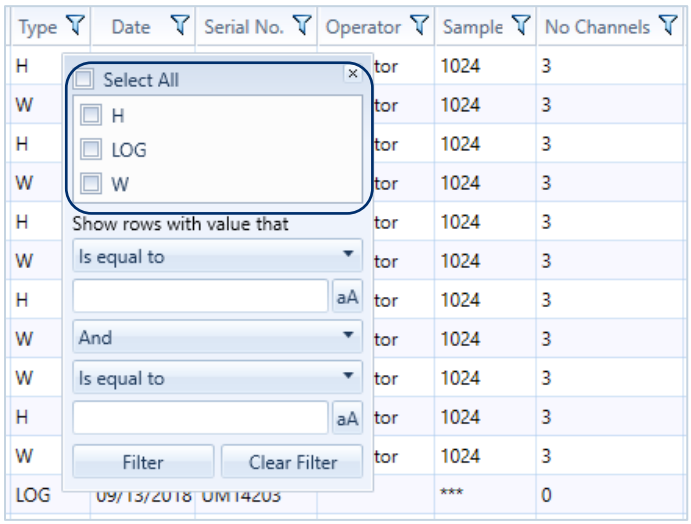
5.7.5 FILTER EVENTS

Filtering events displays all data that meets certain criteria and hides everything else. THOR applies filters using the funnel filter icon.

An empty filter icon indicates that the filter is off (inactive).
A blue filter icon indicates that the filter is on (active).

Simple Filters

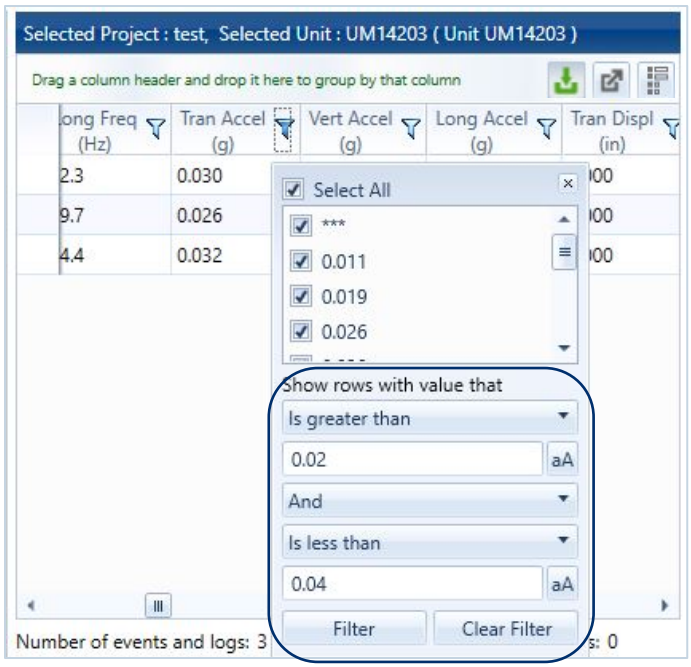
E.g. The Operator field is used to filter with possible choices (H, LOG, W) if LOG is selected, then only the events with LOG files will be displayed.



Complex Filters

Complex filters use multiple conditions to filter data.

E.g. Filtering the **Tran Accel** column for all events that had a Tran Accel greater than 0.02 and less than 0.04.



NOTE The columns are dynamic, refreshing as filters are added.
To return the data to the standard view, (displaying all events) clear the filters.

5.7.5.1 LOGICAL OPERATORS

The following logical operators are available for complex filters. This table uses examples based on a **Serial No.** column that contains four values:

- UM6008
- UM1009
- MP12528
- MP99900

OPERATOR	RETURNS
Is equal to	Data that matches the alphanumeric value. Example: filtering **Serial No.** with *Is equal to UM6008* *returns: UM6008*
Is not equal to	Data that does not match the alphanumeric value. Example: filtering **Serial No.** with *Is not equal to UM6008* returns all entries with a value other than *UM6008* in the **Serial No.** field. *returns: UM1009, MP12528*, and *MP99900*
Starts with	Data that begins with the alphanumeric value. Example: filtering **Serial No.** with *Starts with UM* will return all entries with a value that begins with *UM* in the **Serial No.** field. *returns: UM6008* and *UM1009*.
Ends with	Data that ends with the alphanumeric value. Example: filtering **Serial No.** with *Ends with 8* returns *MP12528* and *UM6008*.
Contains	Data that contains the alphanumeric value in any position. Example: filtering **Serial No.** with *Contains 00* returns: *UM6008*, *UM1009*, and *MP99900*
Does not contain	Data that does not contain the alphanumeric value. Example: filtering **Serial No.** with *Does not contain 125* *UM6008*, *UM1009*, and *MP99900* are returned. *MP12528* is not returned because 125 is found in *MP12528*.
Is contained in	Data with a value that is part of the typed alphanumeric value. Example: filtering **Serial No.** with *Is contained in 9MP125289* *returns: MP12528* (because *MP12528* can be found within *9MP125289)*
Is not contained in	Data with a value that is not part of the typed alphanumeric value. Example: filtering **Serial No.** with *Is not contained in 9MP125289* returns: *UM 6008, UM1009*, and *MP99900* (because they are not found within *9MP125289)*

OPERATOR	RETURNS
Is empty	Fields that contain no data. Example: filtering **Serial No.** with *Is empty* returns: no data (because events always include the serial number of the unit that recorded them. Alternatively, filtering **Trigger** with *Is empty* returns: all events that were recorded without using a trigger.
Is not empty	Fields that contain any data. Example: filtering **Serial No.** with *Is not empty* returns: all data (because events always include the serial number of the unit that recorded them)
Is less than	Data that has a lesser value than the typed alphanumeric value. Example: filtering **Serial No.** with *Is less than UM6008* returns: *UM1009*, *MP12528*, and *MP99900*. (M appears before U in alphabetical order)
Is less than or equal to	Data that is less than or equal in value to the typed alphanumeric value. Example: filtering **Serial No.** with *Is less than or equal to UM1009*, returns: *UM1009*, *MP12528*, and *MP99900* (M appears before U in alphabetical order, *UM6008* is not returned because it has a higher value than *UM1009*)
Is greater than	Data that has a greater value than the typed alphanumeric value. Example: filtering **Serial No.** with *Is greater than MP12528*, *returns: UM1009*, *UM6008*, and *MP99900* (U appears after M in alphabetical order)
Is greater than or equal to	Data that is greater than or equal in value to the typed alphanumeric value. Example: filtering **Serial No.** with *Is greater than or equal to MP99900*, *returns: MP99900*, *UM1009*, and *UM6008* (U appears after M in alphabetical order)
Is null	Fields with data entries of "null". Example: filtering **Serial No.** with *Is null*, returns: no data (Events always include the Serial No. of the unit that recorded them) Alternatively, filtering **Operator** with *Is null*, returns: all events recorded with no active operator.
Is not null	Fields with data that does not equal "null". Example: filtering **Serial No.** with *Is not null* returns: all events (Events always include the serial number of the unit that recorded them. Alternatively, filtering **Operator** with *Is empty* returns: all events recorded when there was no active operator

Filters can be combined. This means that multiple columns can be filtered at the same time. Example: To find all the Histograms collected by Ron, filter the *Type* column for Histograms and the *Operator* column for *Ron*.

5.7.5.2 CREATE A FILTER / REMOVE A FILTER

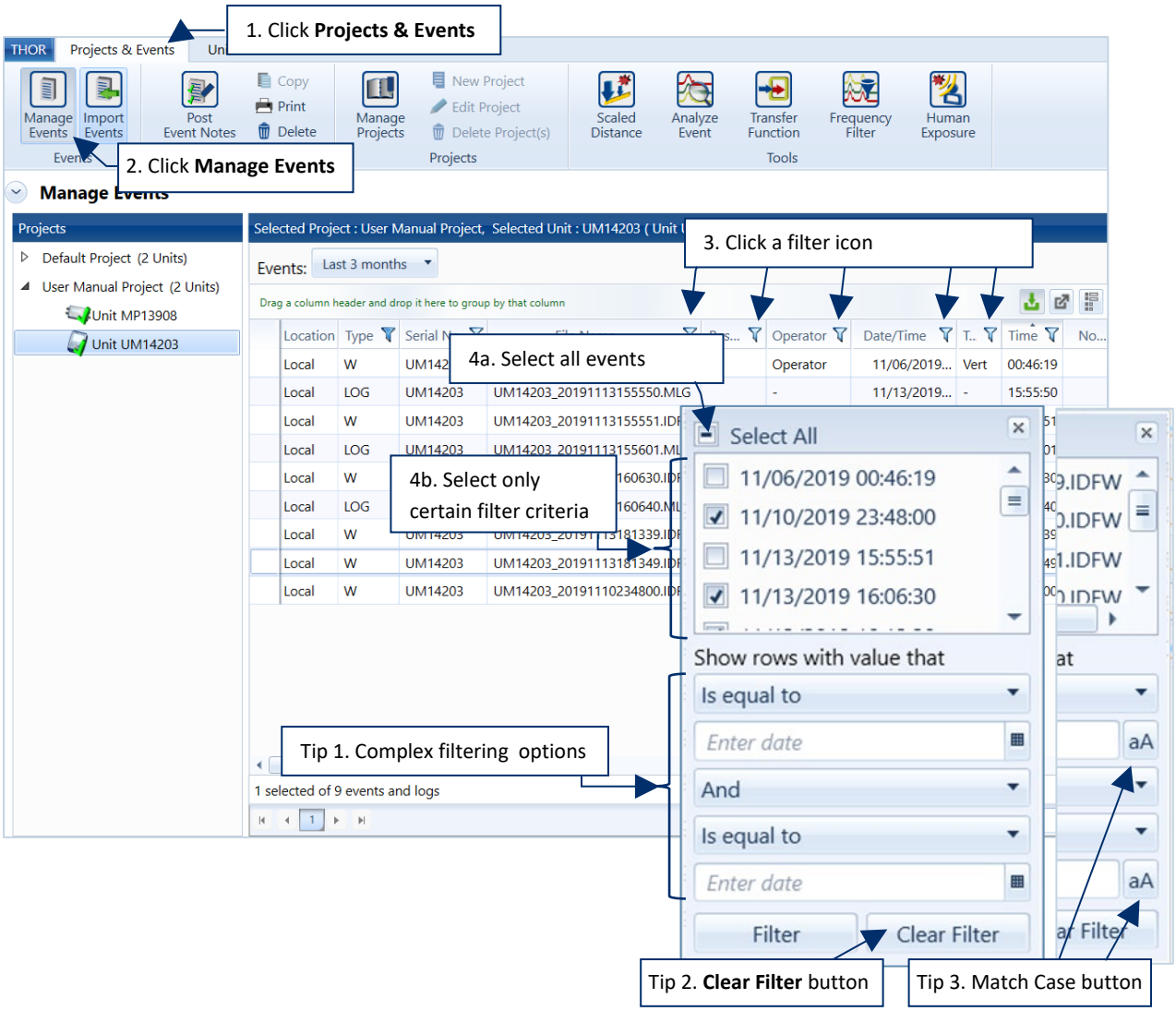
1 Click the **Projects & Events** tab.

2 Click the **Manage Events** button.

3 Click a filter icon in a column.

4a. To view all events, enable the **Select All** checkbox.

4b. To view events that meet specific filter criteria enable one or more checkboxes.
(When multiple checkboxes are enabled, data that meets any of the criteria is displayed.)



Tip 1. To add complex filtering options, use the section "**Show rows with value that**" In this section, you can use logical operators for comparisons (see the table below describing all options).

Tip 2. To remove a filter, select the filter then click the **Clear Filter** button.

Tip 3. To use a case sensitive filter, click the **Match Case** button. (not available for Time/Date functions).

5.7.6 SORT EVENTS

Events can be sorted with ascending or descending values.
E.g. Sort by Linear Mic Peak, the event with the lowest psi(L) appears first, the event with the highest psi(L) last. Clicking the column twice reorders them from highest to lowest.

Three sorting states are indicated by the small blue arrow in the column header.

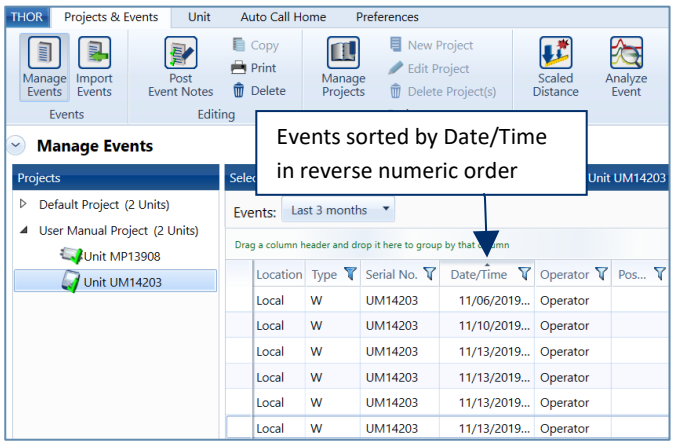
No arrow: The column is not sorted. By default, events are displayed by the Date/Time column, chronologically from oldest to most recent, with the event that occurred first appearing first in the list of events.

Arrow pointing up ( ) The column is sorted with the highest number first, descending to the lowest number. If the column contains text, the text displays in alphabetical order (A-Z), following the numeric values.

Arrow pointing down ( ) If the column contains text, the text displays in reverse alphabetical order (Z-A), followed by numeric values. The lowest number displays immediately following the text, ascending to the highest number.

Example: A column containing the values: CCC, ZZZ, 999, AAA, BBB, 123,
would appear according to their sorting state as follows:

NO SORT	UP ARROW	DOWN ARROW
CCC	999	ZZZ
ZZZ	123	CCC
999	AAA	BBB
AAA	BBB	AAA
BBB	CCC	123
123	ZZZ	999



Events sort one column at a time, they will reorder when the header of another column is clicked.

In the Date/Time column, no arrow or the up arrow will show events chronologically with the event that occurred first appearing first in the list. The down arrow will show events in reverse chronological order.

A chosen sorting will remain on the same computer until changed even after logging out. Logging back into the same computer with the same user name will keep the same sorting.

5.7.7 EXPORT THE EVENT LIST

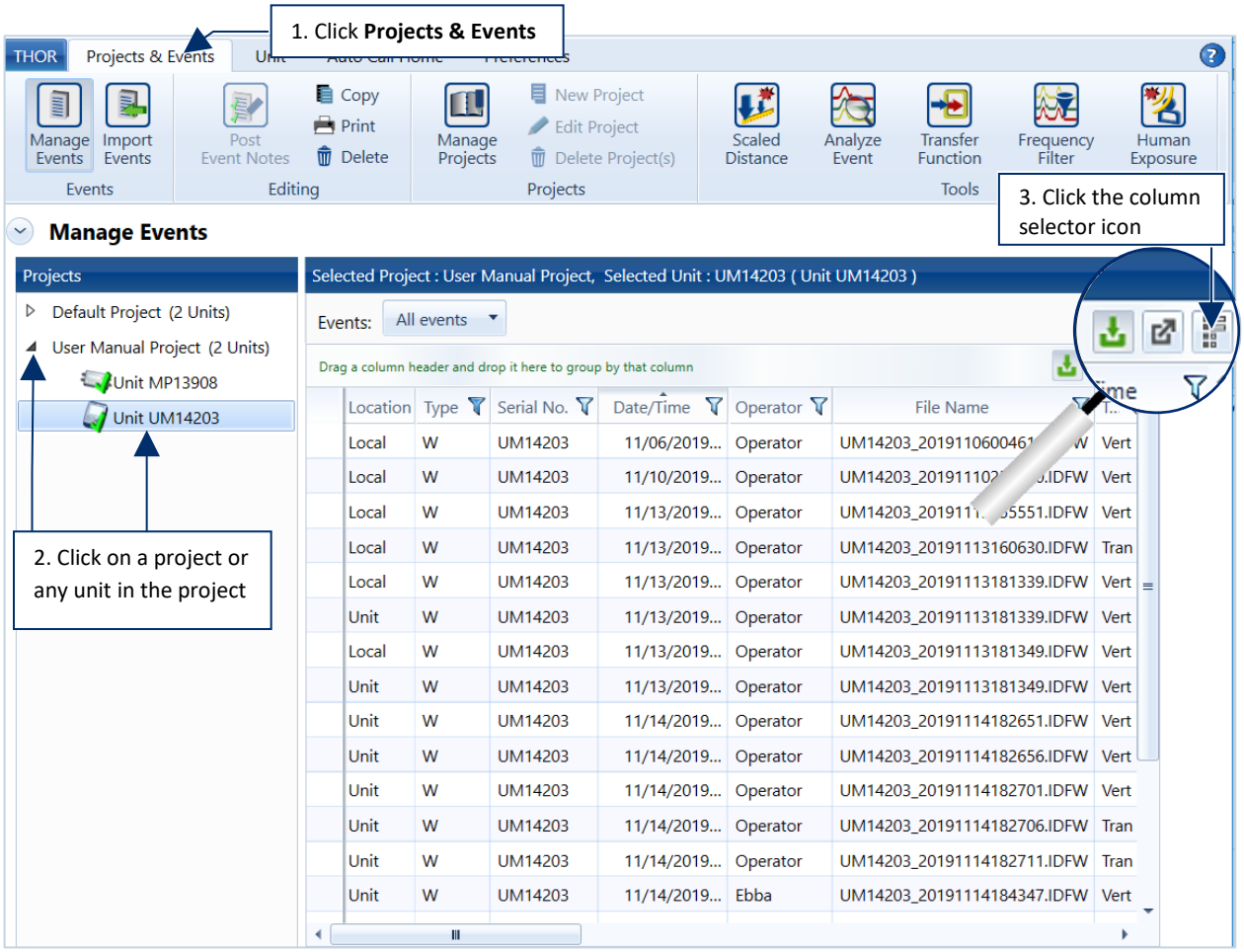
Event lists can be exported to comma-separated value (.csv) or Excel (.xlsx) file formats. To export an event list:

1. Click on **Projects & Events** tab
2. Click on a **Project** or **any Unit** within a Project.

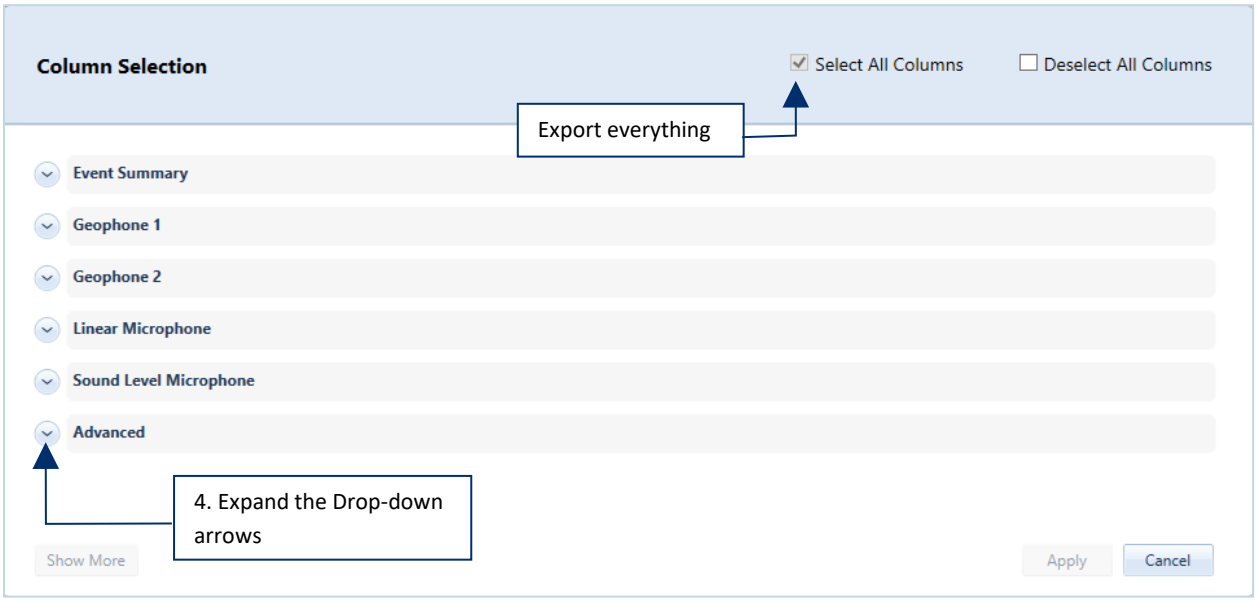
NOTE The Project view will display all downloaded events from all units within the project. Whereas the Unit view will only display events from the individual unit. The Unit view has the benefit of being able to display all events downloaded to THOR and currently residing on the unit. The Project view cannot display events that reside on the unit and have not been downloaded to THOR.

The exported file will mirror what is seen in the Event List Table. Before exporting, it is recommended to adapt the data fields to your needs.

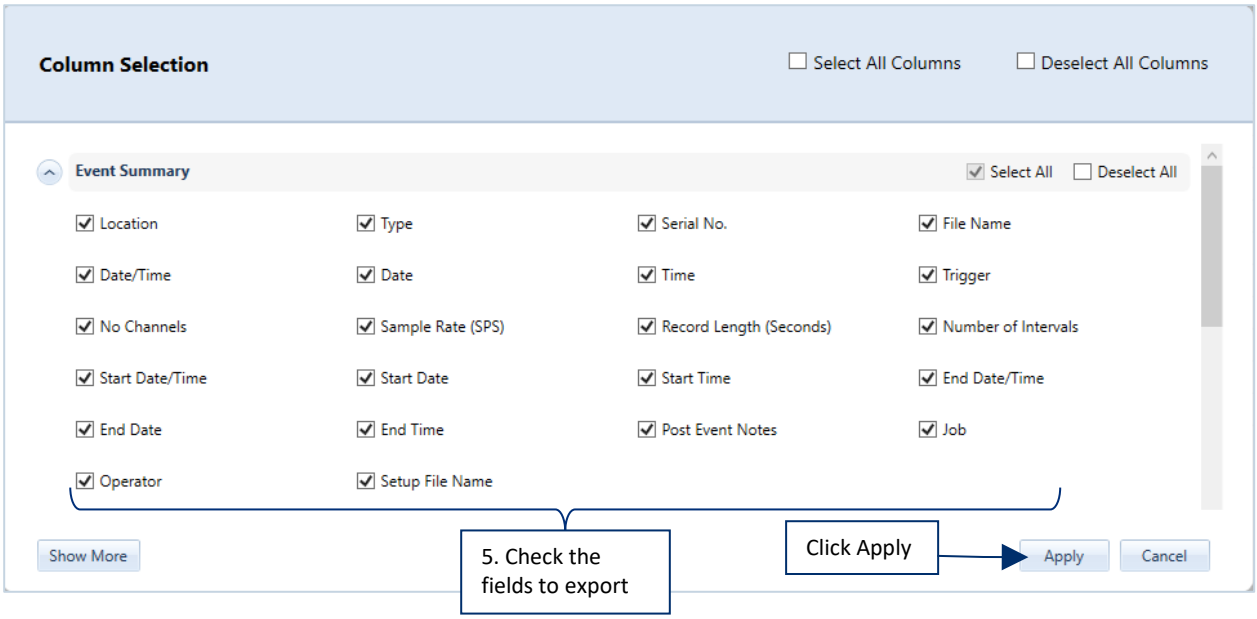
3. Select the data fields to include in the exported file by clicking on the column selector icon.



4 Expand the areas of interest by clicking on the drop-down arrow. You can also export everything by checking the **Select All Columns** field.

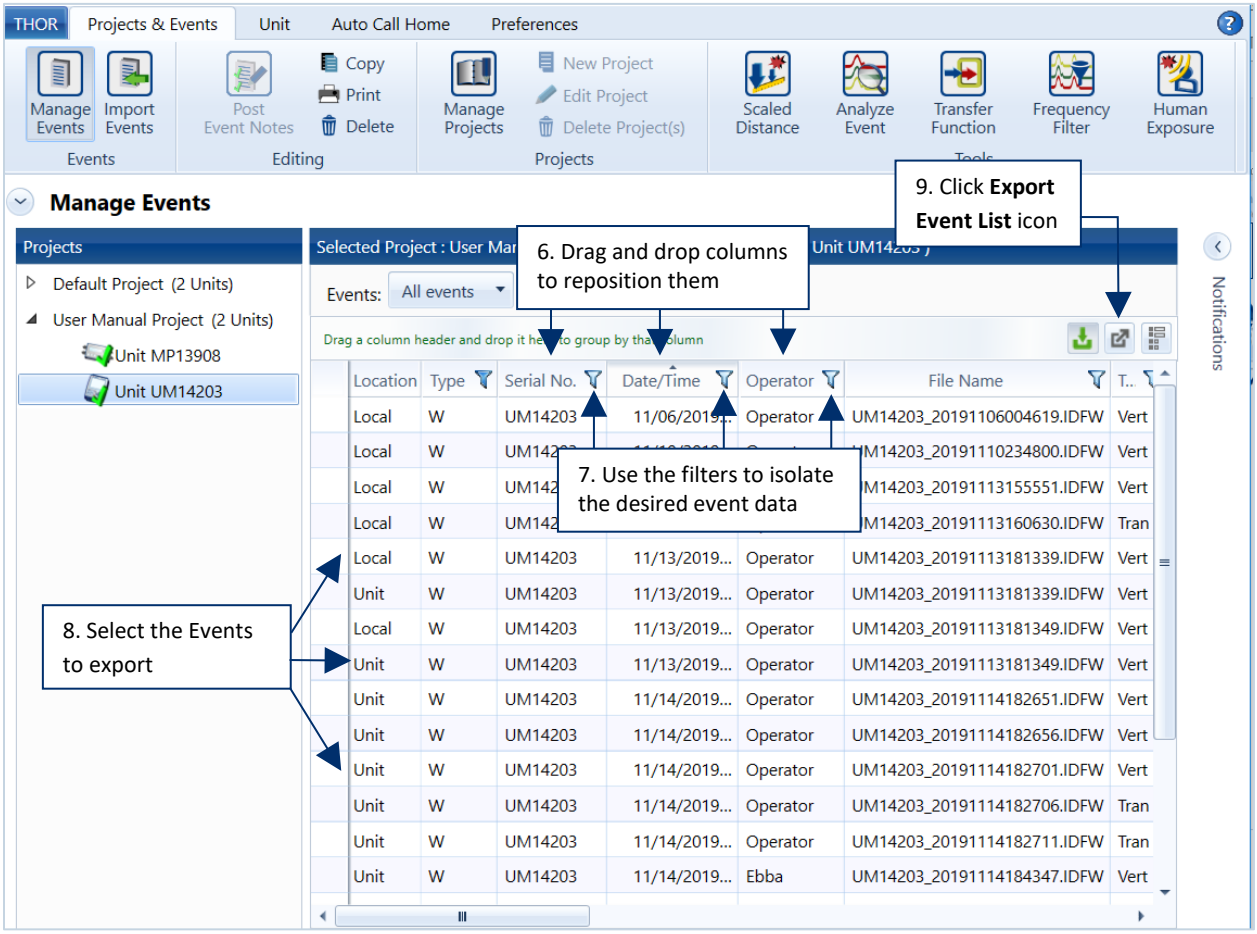


5 Check the columns that will appear in the export file and click on the **Apply** button. If there are fields that do not fit into the window view, use the scrolling bar on the side or click on the **Show More** button.



6 Rearrange the columns by dragging and dropping them to a different position.

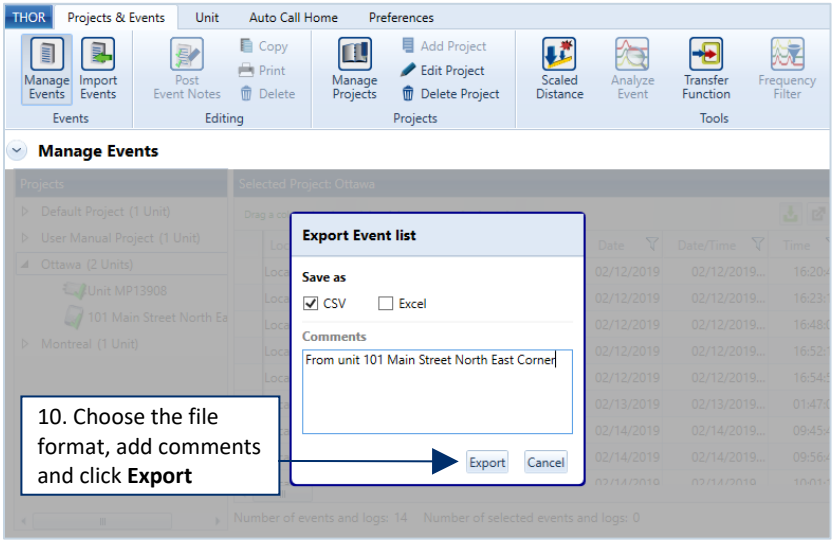
7 Use the filters to isolate the desired event data.



8 Select the Events to export by clicking on each row using the CTRL/Shift key.

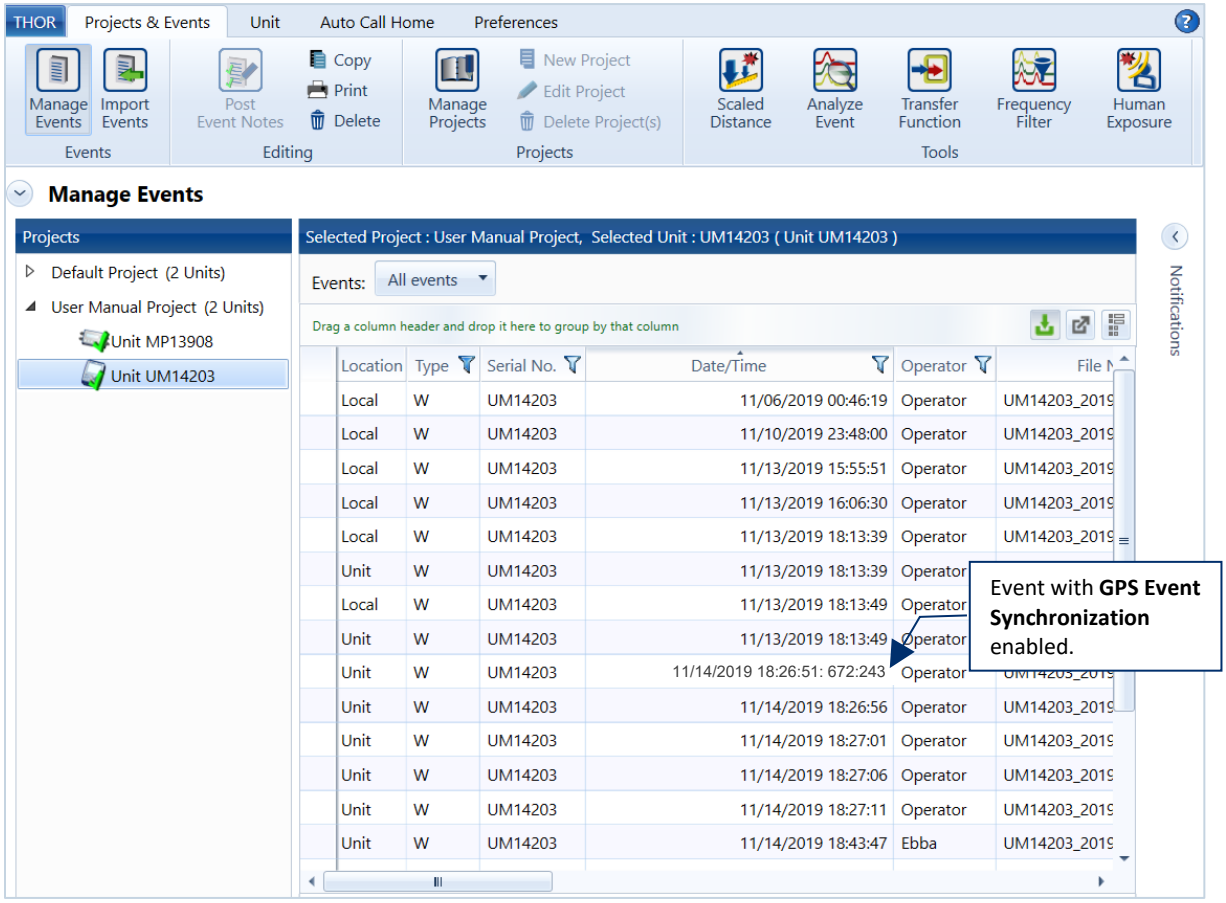
9 Click on the **Export Event List** icon and select **Export Selected Events** (or **Export All Events**).

10 Choose the file format, either CSV or Excel, add an optional comment and click **Export**.



5.7.8 GPS EVENT SYNCHRONIZATION

When viewing the time an event occurred on a Minimate Pro unit with **GPS Event Synchronization** enabled, the unit will display a higher time resolution. Displayed are hours, minutes, seconds, milliseconds, and microseconds. For events that occurred on a Micromate or Minimate Pro (with GPS Event Synchronization disabled), the time resolution displayed is in hours, minutes and seconds. For more information about **GPS Event Synchronization**, see the Minimate Pro Owner's Manual.



5.8 MONITORING LOGS

Units record an overview of all their actions in log files. THOR can search and filter these log files and display the start/end date and time of an action as well as display the type of action.

Monitoring Logs should not be confused with Auto Call Home (ACH) Logs.

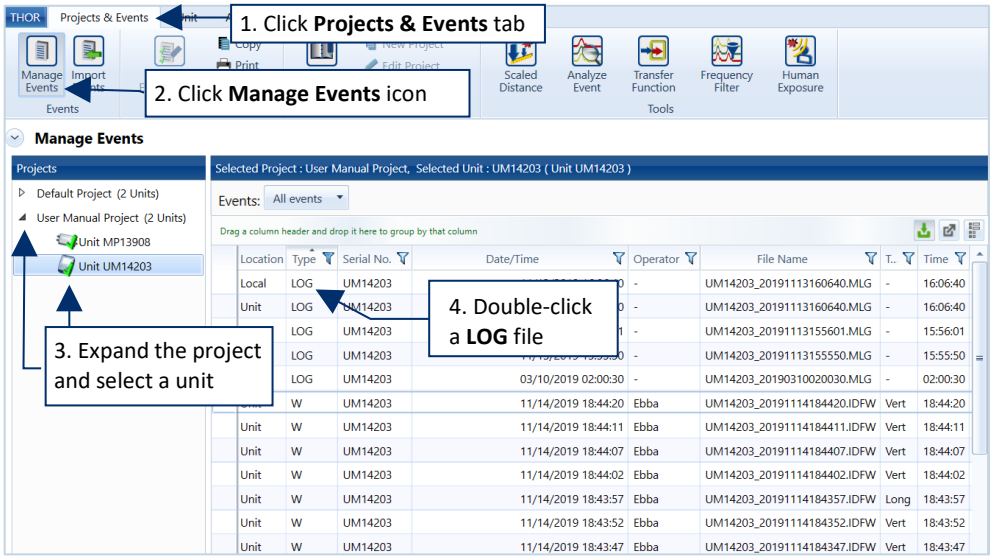
- ACH Logs keep track of communications between units and THOR.
- Monitoring Logs keep track of actions that units experience to detect and store vibrations.

For more information about ACH Logs see section 6.4 on page 151.

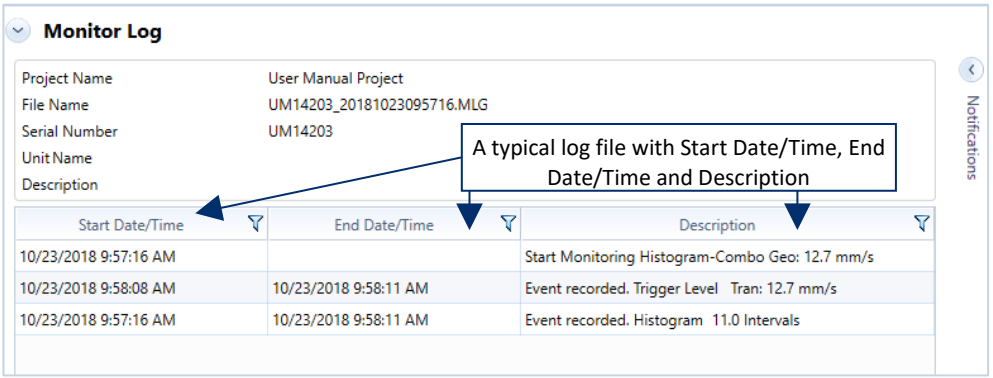
5.8.1 VIEW A MONITORING LOG

THOR can display monitor logs regardless if they are stored locally on a computer or on units.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** icon.



3. Expand the project and select a unit.
4. Double-click a unit's log file. (They display **LOG** in the **Type** column. To filter the grid to see only logs, click the funnel icon in the **Type** column and enable the **LOG** checkbox.)



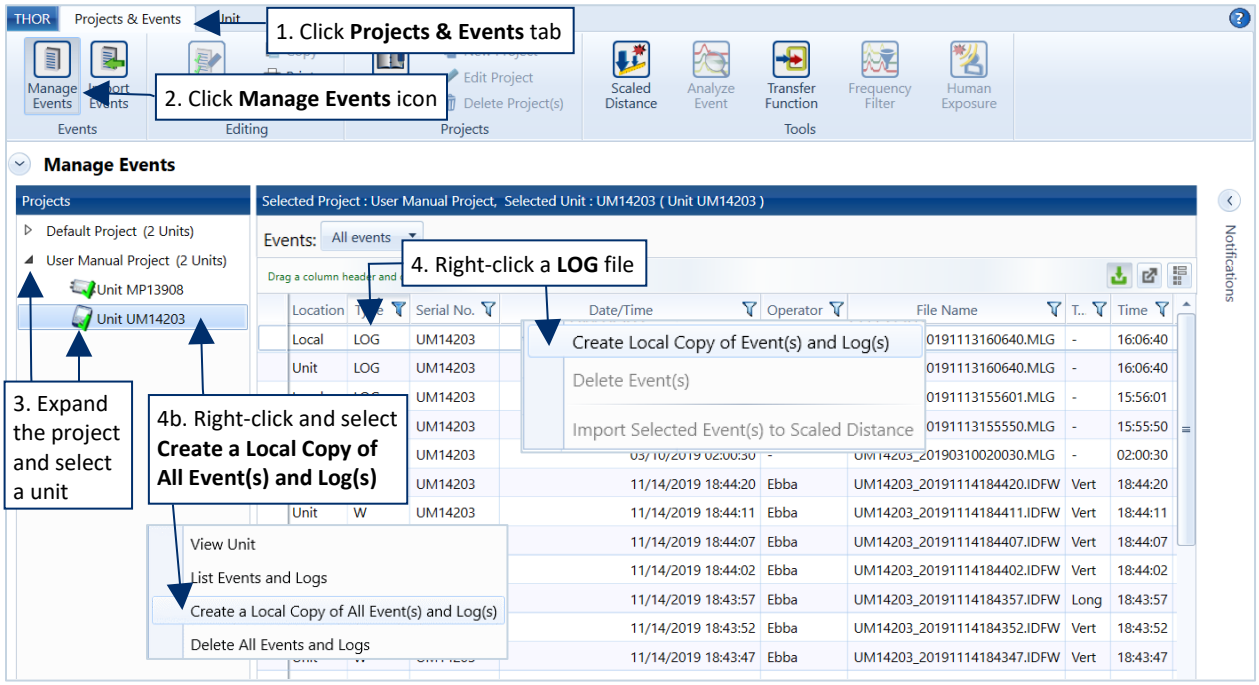
5.8.2 COPY MONITORING LOGS TO A COMPUTER

Before attempting to copy a monitoring log file to a computer, note that:

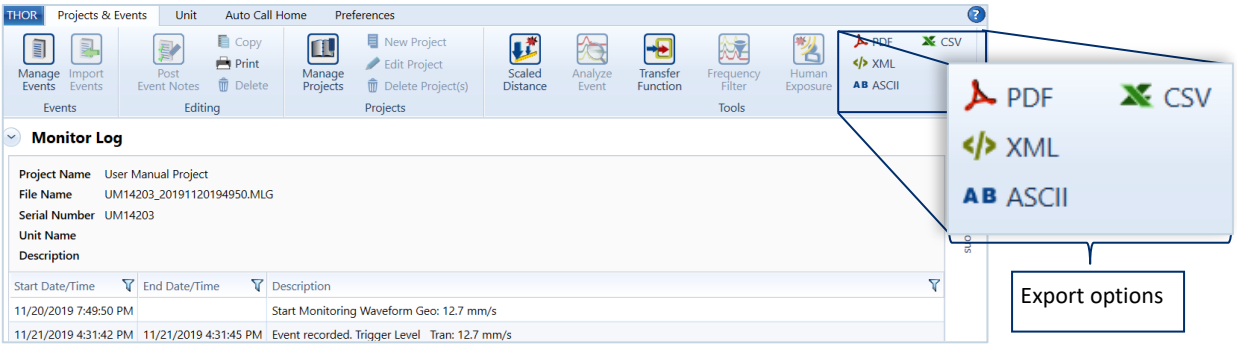
- You cannot copy a log file from a unit that is currently monitoring.
- Log files with the Location type *Local* are already copied into THOR and will appear greyed out.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** icon.
3. Expand the project and select a unit.
4. Right-click a LOG file and select **Create a Local Copy of Event(s) and Log(s).**

4b. Alternatively, right-click on the unit and select **Copy All Events and Logs**.



To **export** a file into different file formats (PDF, CSV, XML, ASCII) **double-click** the LOG file and in the Tools section, click one of the export options.



Filtering log files is done the same way as filtering events.
See section 5.7.5 *Filter Events* on page 102.

5.9 REPORTS

5.9.1 VIEW

Reports are a convenient way to present event data in a customized format that can highlight important information with a quick visual representation.

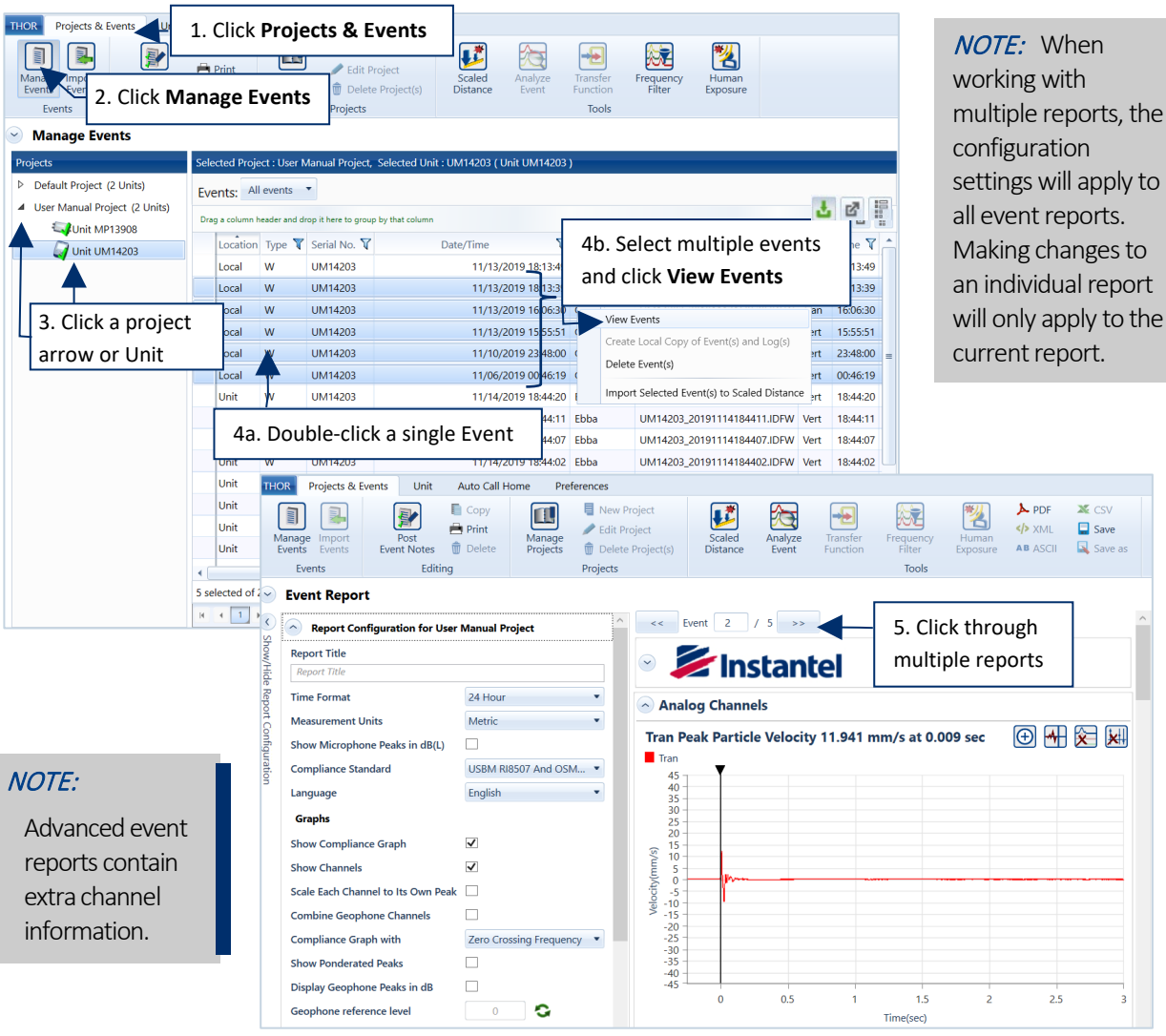
They can have their own company logo, unique title, as well as customized language, graphing scale, and units. All customizable components are accessible through the configuration side panel. This panel is accessed by double-clicking on any event that appears in the project Events page.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click the arrow next to a project (or click a unit in the project to see only that unit's event.

4a. To view a single report, double-click an event.

4b. To view reports for multiple events, use the Shift or CTRL keys to select up to 100 reports then right-click and select **View Events**.

5. Click through multiple reports using the arrow keys. (They will appear in chronological order.)



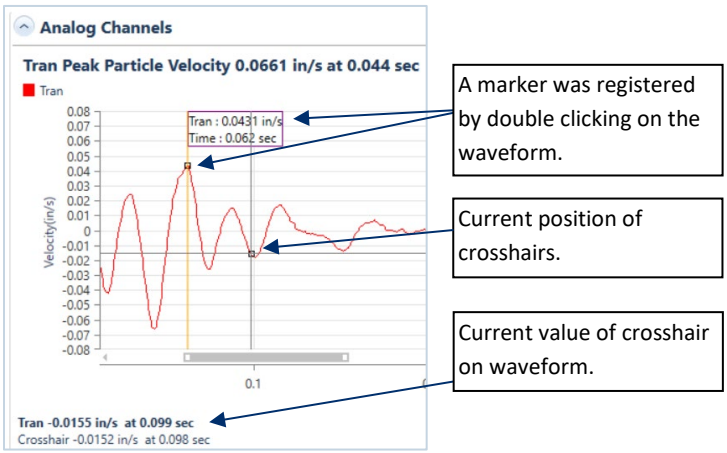
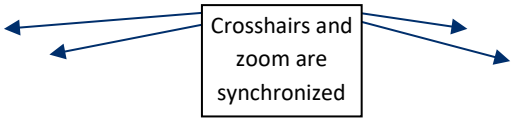
NOTE: When working with multiple reports, the configuration settings will apply to all event reports. Making changes to an individual report will only apply to the current report.

NOTE:

Advanced event reports contain extra channel information.

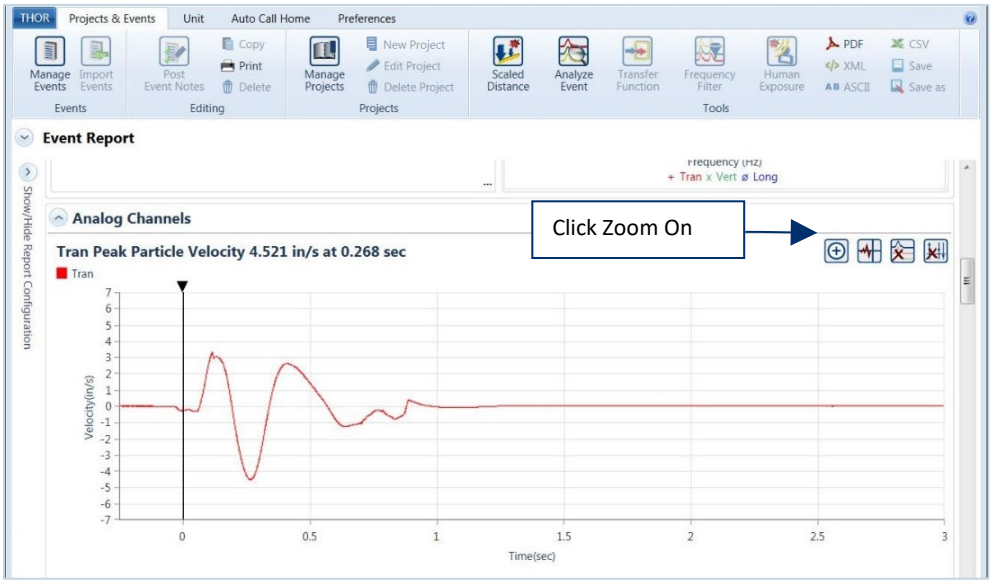
5.9.1.1 ICON DESCRIPTIONS

The following Icons help to view single or multiple reports. You can zoom on areas of interest and add crosshair markers to pinpoint an exact time and velocity of a section of a waveform.

ICON	FUNCTION	DESCRIPTION
	Enter Zoom Mode	Once selected, zoom in on an area of the channel's graph.
	Resets the Zoom level	Will return a single channel to its "home" position. If graphs are synchronized, all channels will return to their "home" position.
	Exit Zoom Mode	Returns all channels to their "home" position (regardless if they are synchronized or not).
	Crosshair Tool On	The cursor becomes a crosshair that is snapped to the waveform. Double-clicking on the waveform will register a marker. 
	Crosshair Tool Off	Turns off the Crosshair functionality.
	Synchronize Graphs On	All channel graphs will record a marker when using the Crosshair Tool. Zoom functions will apply to all graphs. Clearing crosshair markers will remove crosshairs from all graphs. 
	Synchronize graphs Off	All Zoom commands and Crosshair functions apply exclusively to the selected channel.
	Remove Crosshair markers	All markers on the channel will be erased. If channels are synchronized this will remove all markers on every graph.

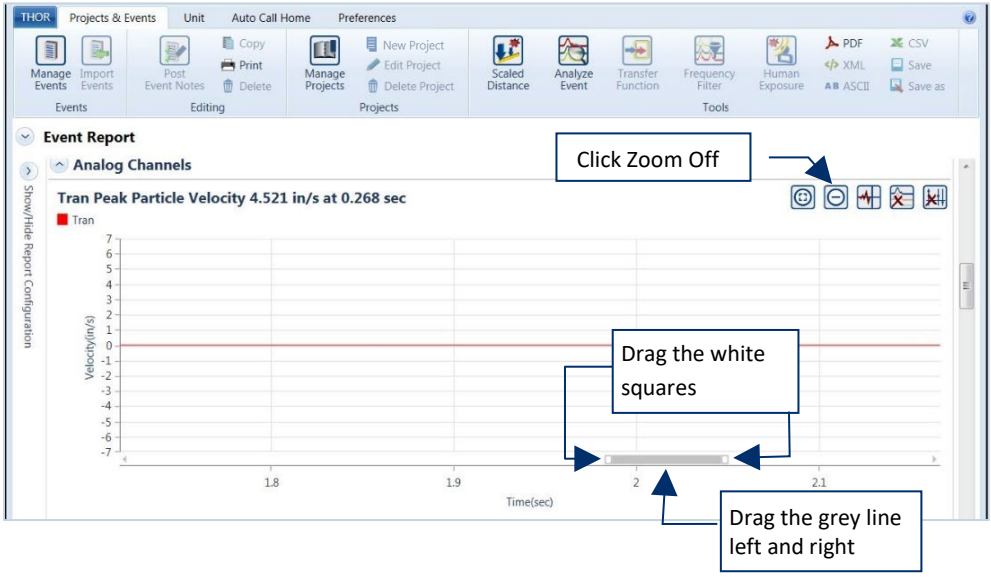
5.9.1.2 ZOOM FUNCTION

To zoom on a waveform graph, first, activate the zoom function by clicking the icon  .



Then either:

- Hold down the left mouse button and select an area of the graph.
- Drag the white markers on the grey slider to zoom in on the axis.



Drag the grey slider (left and right) to view the parts of the waveform that are offscreen. When finished zooming, click the **Zoom Off** button to zoom out.

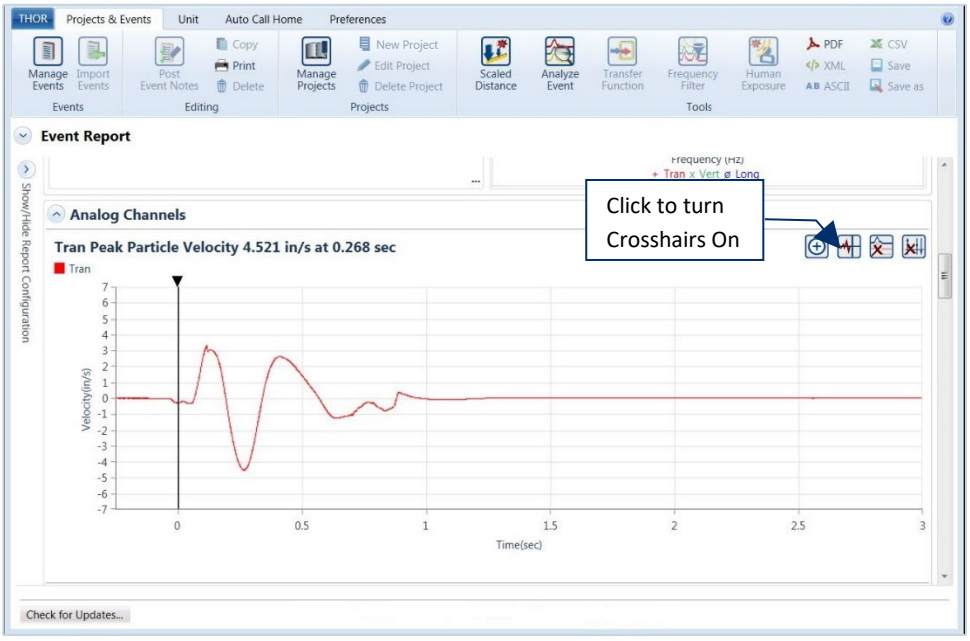
NOTE To reset the zoom, click the Reset Zoom button  .

NOTE Zooming is not available for histogram graphs.

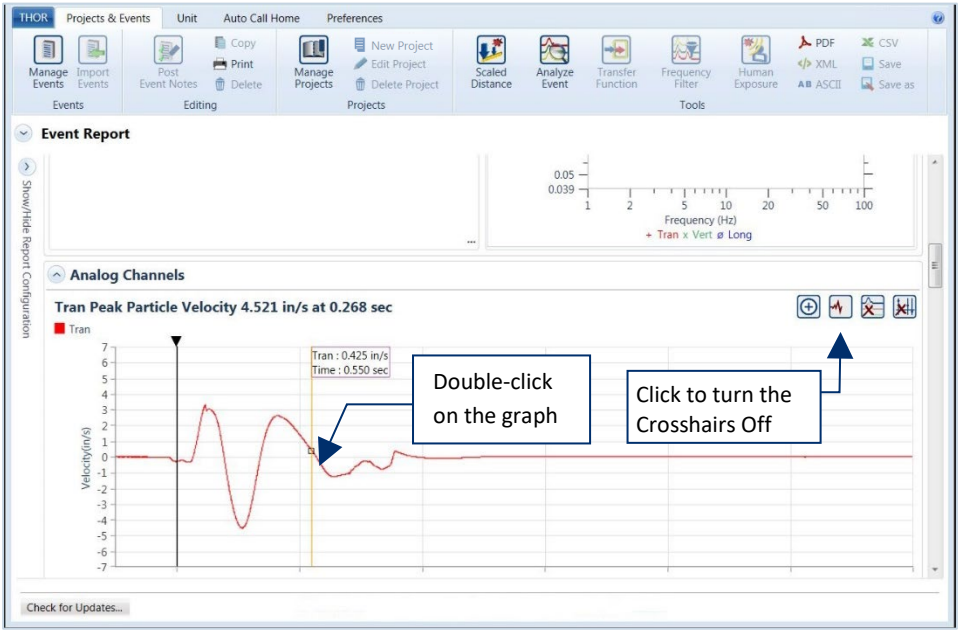
When working with multiple reports, zoom settings are saved (until reset) to facilitate switching between reports.

5.9.1.3 ADD A CROSSHAIR

1 While viewing a report, turn on the Crosshairs by clicking the icon. It will change to the Crosshair On icon .



2 Double-click anywhere on a graph. (A crosshair is added, with the velocity and exact time.)



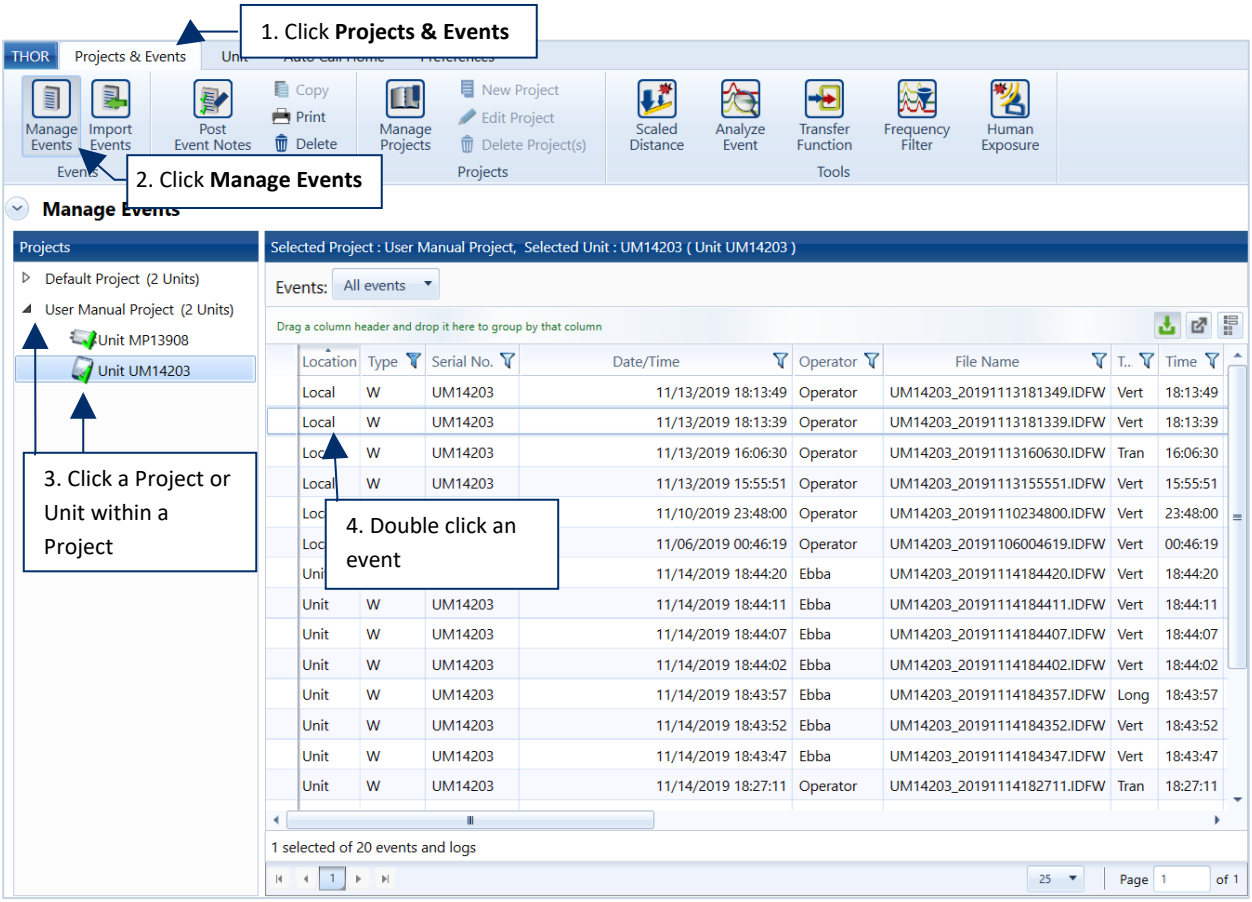
To turn the cross-hair tool off, click the **Turn Cross-Hair Off** icon.

NOTE You can add multiple crosshairs.

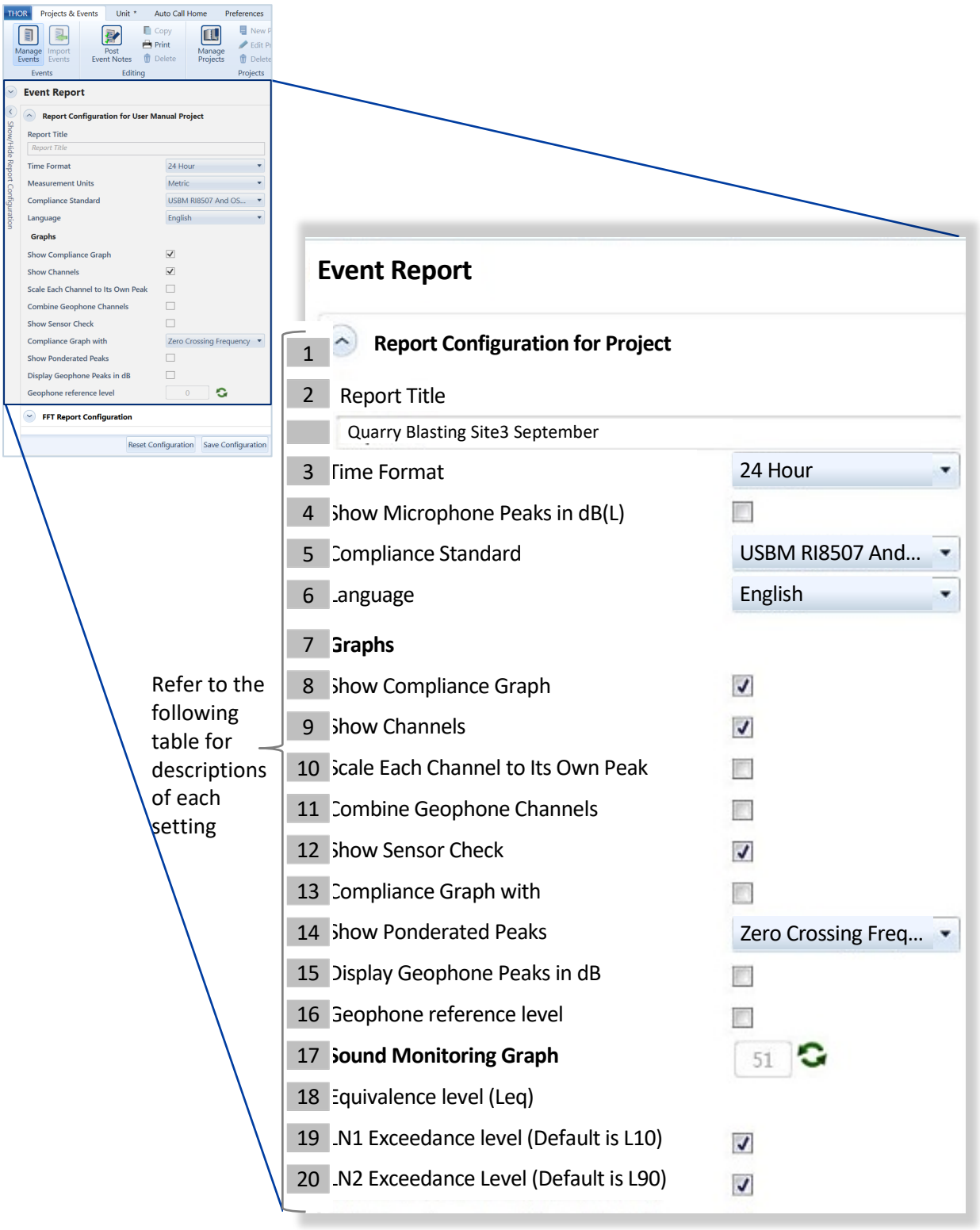
5.9.2 CONFIGURE

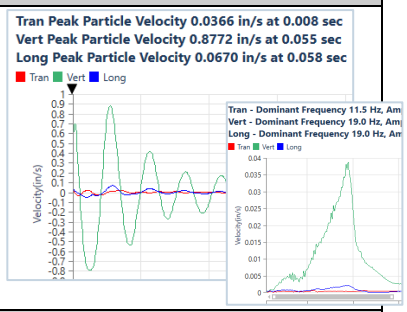
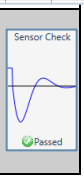
To access the configuration side panel:

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click a Project or Unit within a Project.
4. Double click on an event.



5.9.2.1 EVENT REPORT CONFIGURATION



	FUNCTION	DESCRIPTION
1	**Report Configuration for Default Project**	Every project has its own event report configuration. These default parameters are used when reports are generated automatically (E.g. Using Auto Call Home)
2	Report Title	Choose a name that will easily identify the unit. (E.g. "Quarry Blasting Site3 North Side")
3	Time Format	24 hours or 12 hours (AM, PM)
4	Show Microphone Peaks	When enabled, this will show results in decibels otherwise in linear units.
5	Compliance Standard	Choose the applicable standard among the list of worldwide standards.
6	Language	Sets the default language for reports in the project. Available language options: English, French, Spanish and Swedish. These can be configured either 1. *Use Project Specific Report Language* (will permit each project to have its own report language, defined at the project level) 2. *Use Application Preferences Language* (will use the language of the Software as the default for reports) These settings are found under→Projects and Events →Manage Projects ***NOTE*** Setting the language of a report will always override any default setting.
7	**Graphs**	The available options for the graphical display of the report.
8	Show Compliance Graph	Includes or omits the compliance graph in the report. *FFT* and *Zero Crossing Frequency* are calculations that define how points on the graph are calculated. The parameters should be based on the compliance standard applicable to the report. • Waveform reports: Compliance graphs with *Zero Crossing Frequency* or *FFT* can be viewed. • Histogram reports: Only compliance graphs with *Zero Crossing Frequency* can be viewed.
9	Show Channels	Includes or omits Channels in the report. (Transverse Peak Particle Velocity, Vertical Peak Particle Velocity, Longitudinal Peak Particle Velocity, Mic Peak Sound Pressure Level, Transverse Dominant Frequency, Vertical Dominant Frequency, Longitudinal Dominant Frequency, Mic Dominant Frequency)
10	Scale Each Channel to Its Own Peak	Adjusts the graph's scale to enhance the visual representation of the channel's waveform.
11	Combine Geophone Channels	Superimposes all three geophones (Transverse, Vertical, Longitudinal) onto one channel for Peak Particle Velocity and onto one channel for the Dominant Frequency. 
12	Show Sensor Check	If a sensor check was included after the event monitoring, the report will indicate the status of the sensor check, either passed or failed. This helps to indicate of the sensors were functioning properly (validating or invalidating the integrity of the results) 

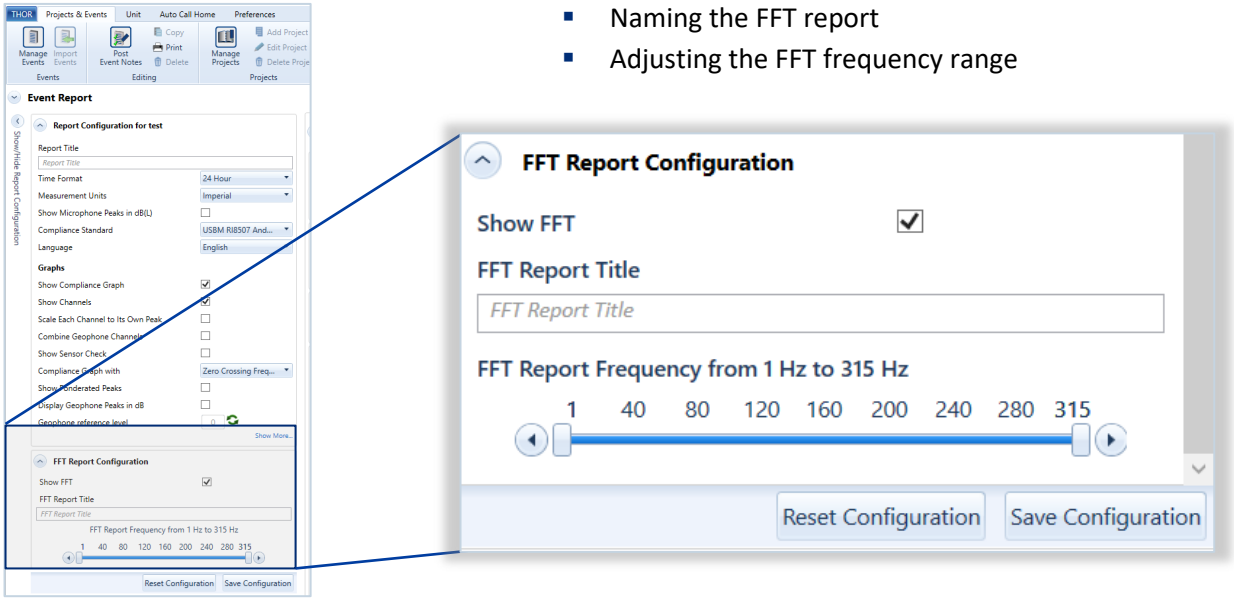
	FUNCTION	DESCRIPTION
13	Compliance Graph with:	See 8 Fast Fourier Transform (FFT) – (only for Waveform events) or Zero-Crossing Frequency – (only for Histogram events)
14	Show Ponderated Peaks	Ponderation is a weighting of waveform frequencies specifically used for the French National Compliance standard. Changing the geophone reference level will refresh the report viewer and recalculate peaks in decibels based on the formula*: PeakIndB = Math.Abs (*20 *x Math.Log*$_{10}$*(PPV) + Reference Level)*
15	Display Geophone Peaks in dB	Adds a row to the Geophone data indicating the Peak Particle velocity in dB
16	Geophone reference level	this value must be in dB, to calculate the proper value you must first convert the Reference PPV value, using the following formula: Reference dB = 20 x LOG (1/Reference PPV)
17	**Sound Monitoring Graph**	Options available when using a Sound Level Microphone
18	Equivalence level (Leq)	The true equivalent sound level measured over the time of the recording
19	LN1 Exceedance level (Default is L10)	The percent of the recording that was at, or above, the default L10 level. Example: If L10 = 51.2 dB then 10% of the time recording was above 51.2 dB
20	LN2 Exceedance Level (Default is L90)	The percent of the recording that was at, or above, the default L90 level. Example: If L90 = 42 dB then 90% of the time recording was above 42 dB

5.9.2.2 FFT REPORT CONFIGURATION

Fast Fourier Transform (FFT) is an algorithm that converts a time-domain signal into the frequency domain. THOR performs FFT and displays the data points on a graph.

FFT reports are for Waveform ground and linear channels only. You cannot perform an FFT on Histogram or sound events. An FFT report will appear at the bottom of the event report and will be printed on a separate page.
The options for configuring FFT reports are:

- Show /Hide the FFT report
- Naming the FFT report
- Adjusting the FFT frequency range



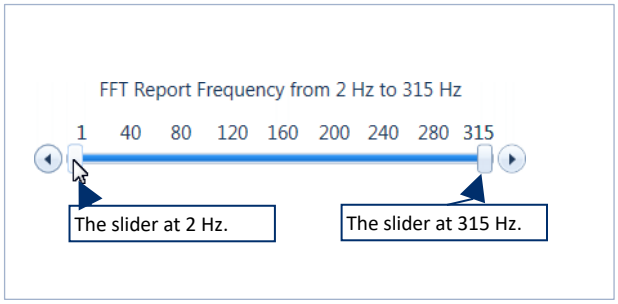
Adjusting the FFT Frequency Range

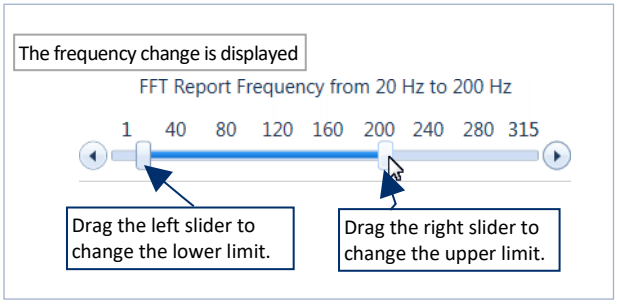
Move the sliders on the FFT Report Frequency Range control by clicking and dragging the mouse.

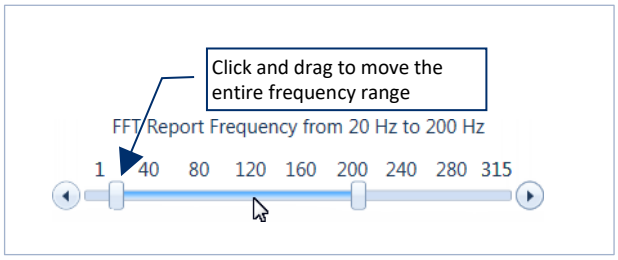
A frequency **range** of 25 Hz will cover the frequencies dependent on the start position.

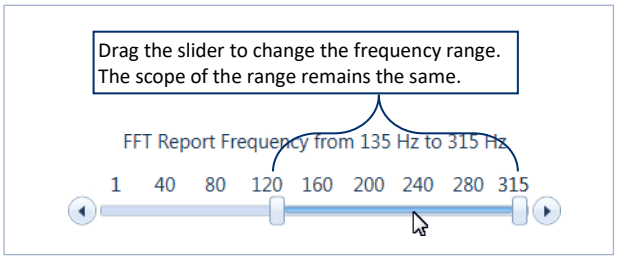
E.g. Start 75 Hz → End 100 Hz
Start 10Hz → End 35 Hz

Tip: Use the keyboard arrows to advance the sliders a single unit at a time.





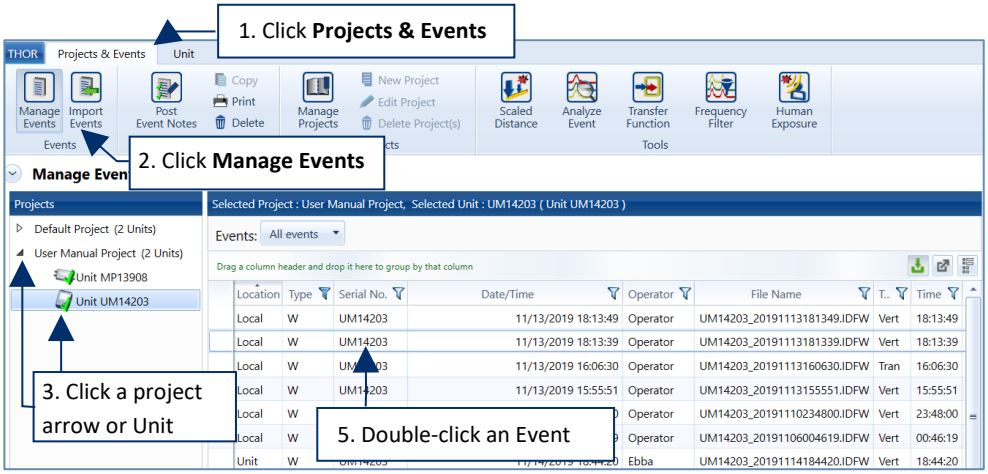




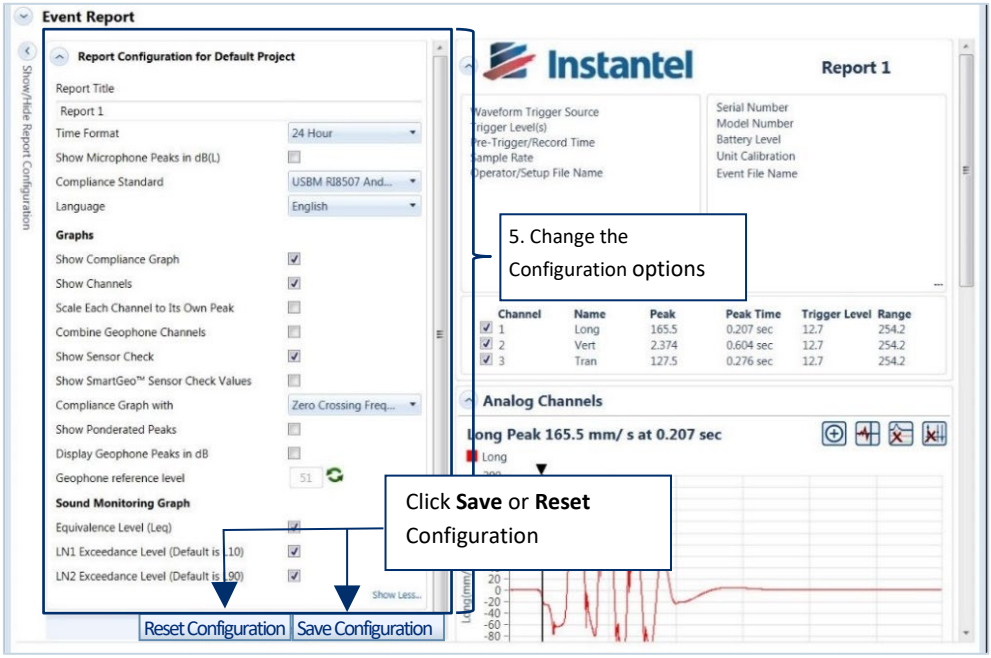
5.9.2.3 SAVE / RESET REPORT CONFIGURATIONS

Saving changes of a report configuration will apply to all new reports in that associated project. The Reset Configuration button will discard all unsaved changes and reload the saved configuration.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click the arrow next to a project (or click a unit in the project to see only that unit's events).
4. Double-click any event to generate a report.



5. Change the configuration options.
6. Click the **Save Configuration** button to save changes or **Reset Configuration** to discard changes.



NOTE Only one configuration is saved at a time. Any saved configuration re-writes the current configuration.

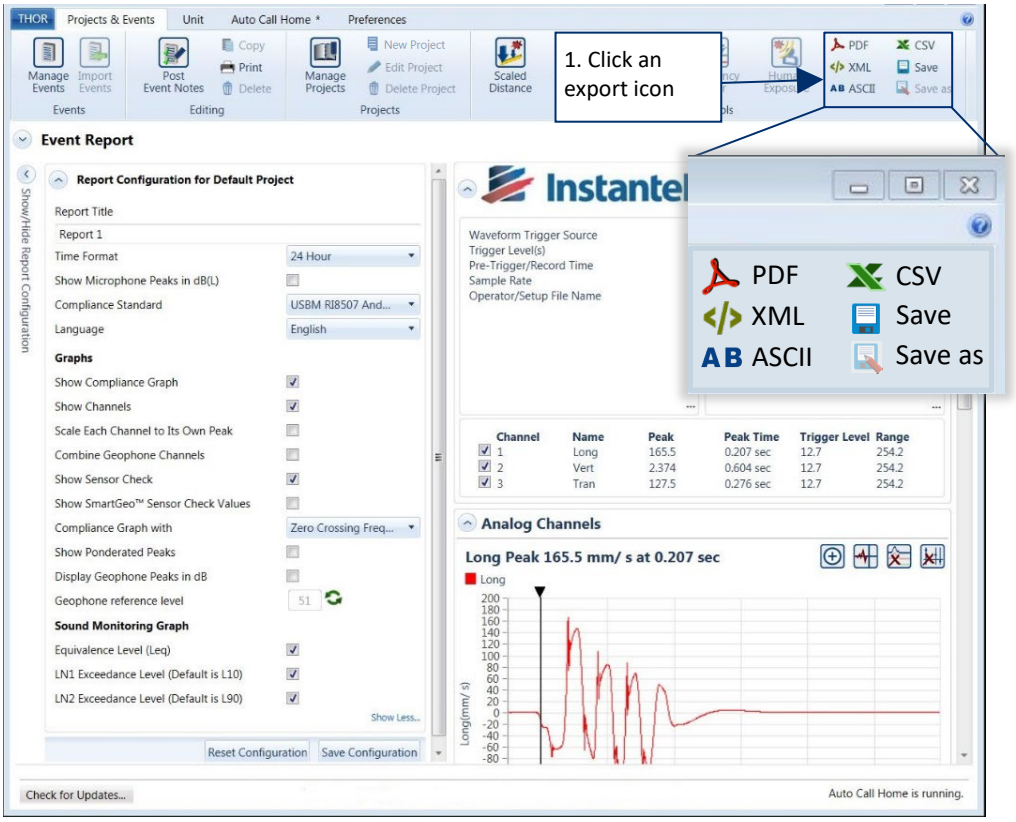
5.9.3 EXPORT REPORTS

THOR can export individual reports into four file formats:

- PDF
- XML
- Text/ASCII
- CSV (Comma Separated Value)

Exporting multiple reports is only available into a single PDF file. They will appear sorted chronologically from the date and time that the events took place.

1 While viewing a report, click one of the export icons:



2 Give the report a file name and click Save.

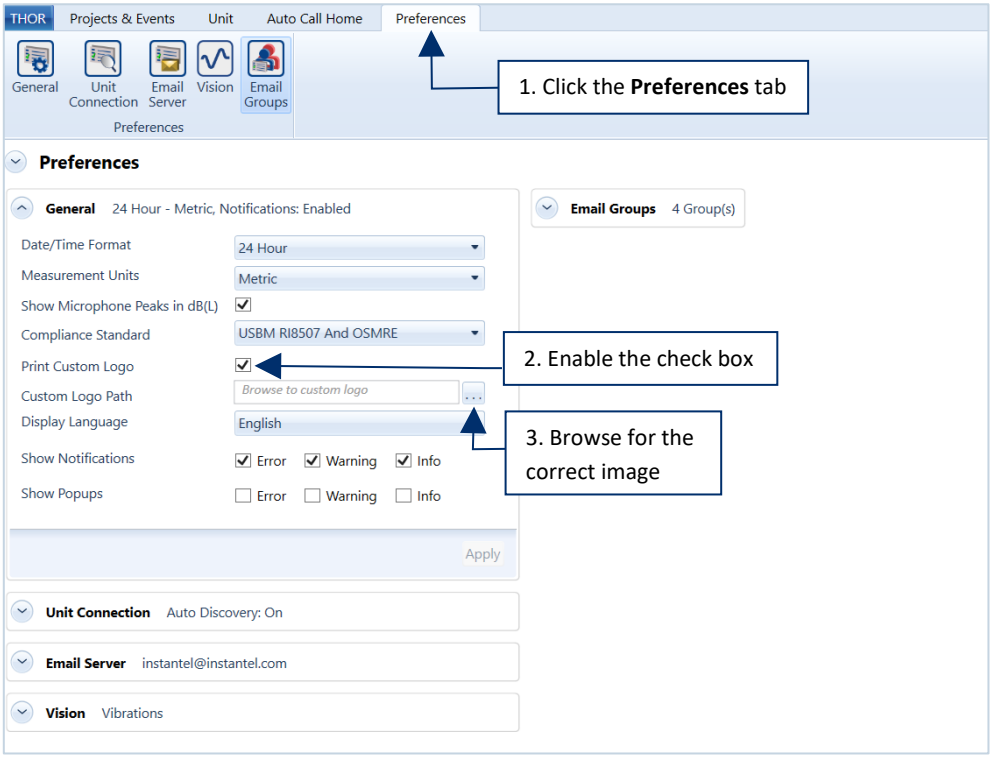
3 To Export multiple event reports, select and view all the events together and click on Export PDF.

5.9.3.1 PRINTING AN IMAGE ON REPORTS

You can include an image, such as a company logo, on printed reports. Images are automatically resized to fit in the report.

The accepted image formats are .bmp, .jpg, .gif, and .png.

1 Click the **Preferences** tab.



2 In the **General** section, enable the **Print Custom Logo** checkbox.

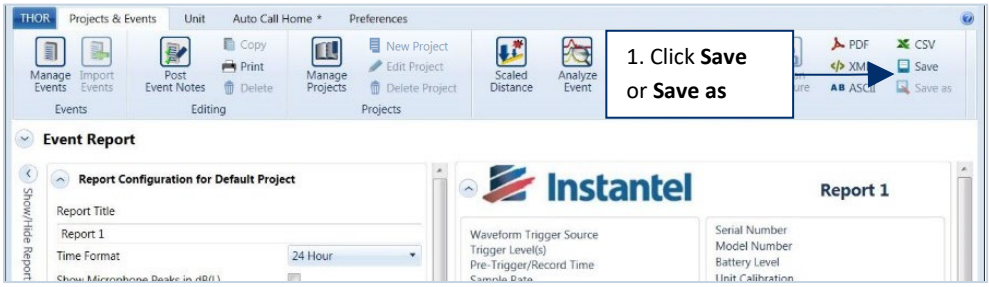
3 Click the **Custom Logo Path** button and browse for the correct image to include in the report.

5.9.4 SAVE, PRINT, DELETE

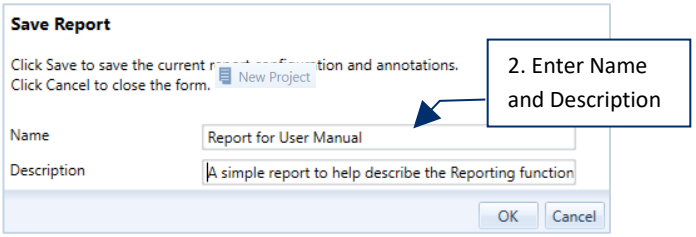
Saving a report is a convenient way to make it easily available for future reference. Saved reports can be retrieved to view, print or delete. A single event can generate multiple reports.

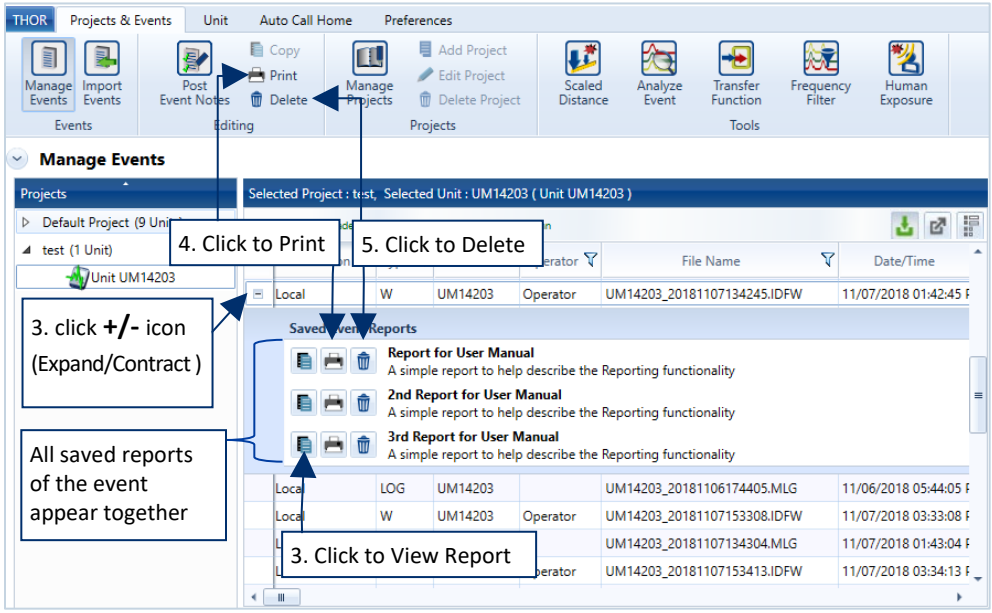
1 To save a Report, click either: (You must be in the report viewer, see section 5.9.1 on page 113)

- Save  or Save as  (Saves a report that has already been saved, with a new name)



2 Fill in a Name and Description for the report and click OK





3 To **View** the report, along with other reports of that event, click the expand (**+**) symbol and click the **View** icon 

4 To **Print** the report, click on the **Print** icon 

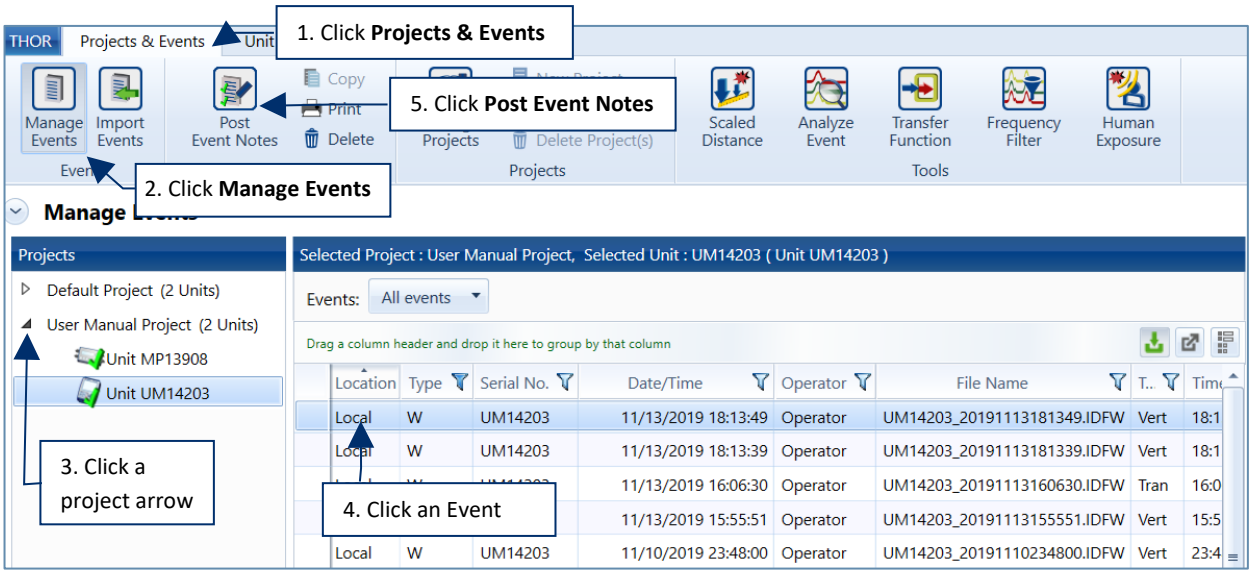
5 To **Delete** the report, click on the **Delete** icon  (This does not delete the raw data of the event)

5.10 ADD A POST EVENT NOTE TO LOCAL EVENTS

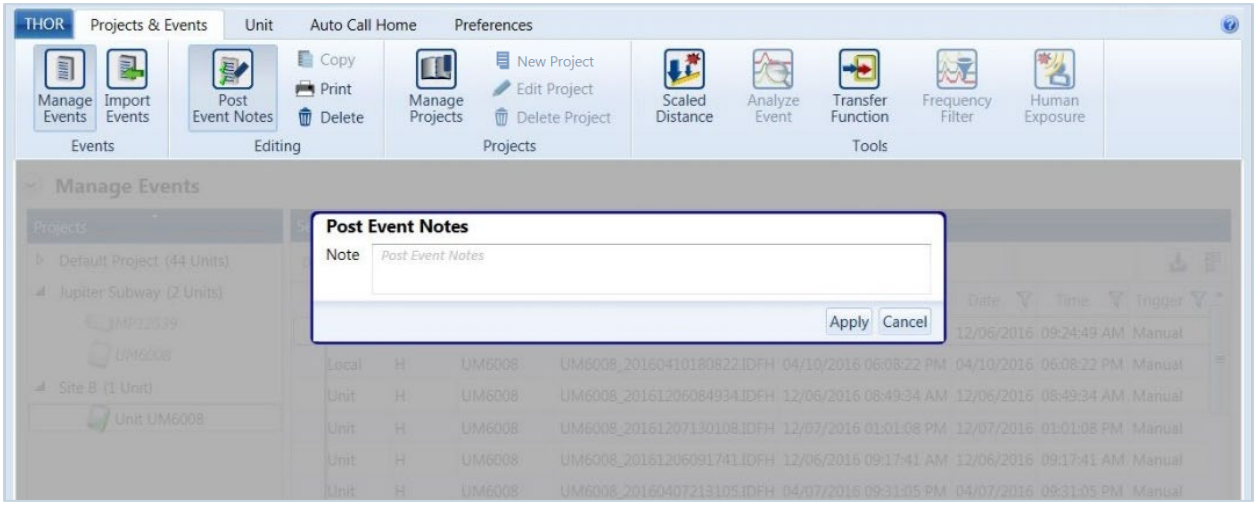
Events with the location type Local may receive a post-event note. This is useful to add detail to an event or to record company information on a recorded event. These notes will appear on any report created from the event.

NOTE To delete a post-event note, follow the procedure to add a post-event note, and remove the text.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click a project's arrow.
4. Click an event. (To select multiple events, use **CTRL** and click additional events).
5. Click the **Post Event Notes** button.



6. Type a note and click **Apply**.



5.11 SCALED DISTANCE CALCULATIONS

Mining operations and other applications like the blasting industry require detonating explosives. As the surface blast energy dissipates in all directions in a circular (or spherical) path surrounding the blast, an estimate of the effects of the explosive charges at different distances can be calculated. This is known as Scaled Distance.

THOR calculates the scaled distance based on the distance from the event source divided by the square root of the weight of the explosives detonated, (as well as factoring in any delays).

This gives an estimate of expected vibration levels at a site.

THOR's Scaled Distance files display the estimates graphically to better visualize their effect. The scaled distance graph can reflect the Square Root, Cube Root, or Air Blast. You can also customize the percentage of the regression plotline.

5.11.1 TECHNICAL DESCRIPTION

This section describes the formulas THOR uses to calculate scaled distance.

The actual value of the scaled distance depends on the units of measure used in the equation,

$$SD = D/W^r$$

where the distance **D**, and weight of charge **W**, may be expressed in either Metric or Imperial units and **r** is either 1/2 or 1/3 depending on whether the square or cube root is used. (Air pressure always uses cube root scaling.)

There is a correlation between scaled distance and particle velocity. If enough PPV (or pressure) - SD sample pairs are available, statistical analysis can be used to derive an expression to show this dependence. It is of the form:

$$P = H(SD)^{-ß}$$

Where:

P = PPV is peak particle velocity (or air pressure)

H = Velocity (or air pressure) axis intercept (P when SD = 1)

SD = Scaled Distance

ß = The slope of the curve, (the negative decay exponent)

This is an equation for a curve of the form $\mathbf{y = ax^b}$. (In the case of air pressure in dB, the equation is of the form P = a+b logSD where P is pressure.) If the logarithm is taken of both sides, we have **log y = log a + b log x**. This gives a linear xy relationship when plotted using log-log scales. Since the curve is reduced to a straight line, we can perform a linear regression analysis to find its equation. Linear regression is a statistical tool for determining a line of fit through a distribution of points on a graph.

Linear regression is used to find the equation of a straight line of the form

$$y = a + bx$$

where the slope **b** is computed from the expression:

$$b = \{ \sum (x_i * y_i - n * x * y)\} / \{ \sum (x_i - n * x^2) \}$$

and the intercept **a** is computed from the expression:

$$a = y - b * x$$

The coefficient of correlation **r** is obtained by evaluating the expression:

$$r = \{ \sum (x_i * y_i - n * x * y)\} / [\{ \sum (x_i^2 - n * x^2)\}\{ \sum (y_i^2 - n * y^2)\}]^{1/2}$$

and the sample standard deviation is evaluated from:

$$s = [\{(\sum y_i^2 - n * y^2) - \sum (x_i * y_i - n * x * y)^2 \ / \sum (x_i^2 - n * x^2)\} / n \ ]^{1/2}$$

In the equations above, **n** is the number of points (or Event PPV, SD pairs) $\mathbf{x_i}$ and $\mathbf{y_i}$ are the i^{th} variable in the set **i = 1** to **n**, and **x** and **y** are means of each of the variables in the given set.

A confidence line is based on the "rule of thumb" as a special case of Chebyshev's Rule. It states that in a normally distributed large population approximately 68% of the members lie within one standard deviation of the mean, whereas 95% of the members lie within two standard deviations.

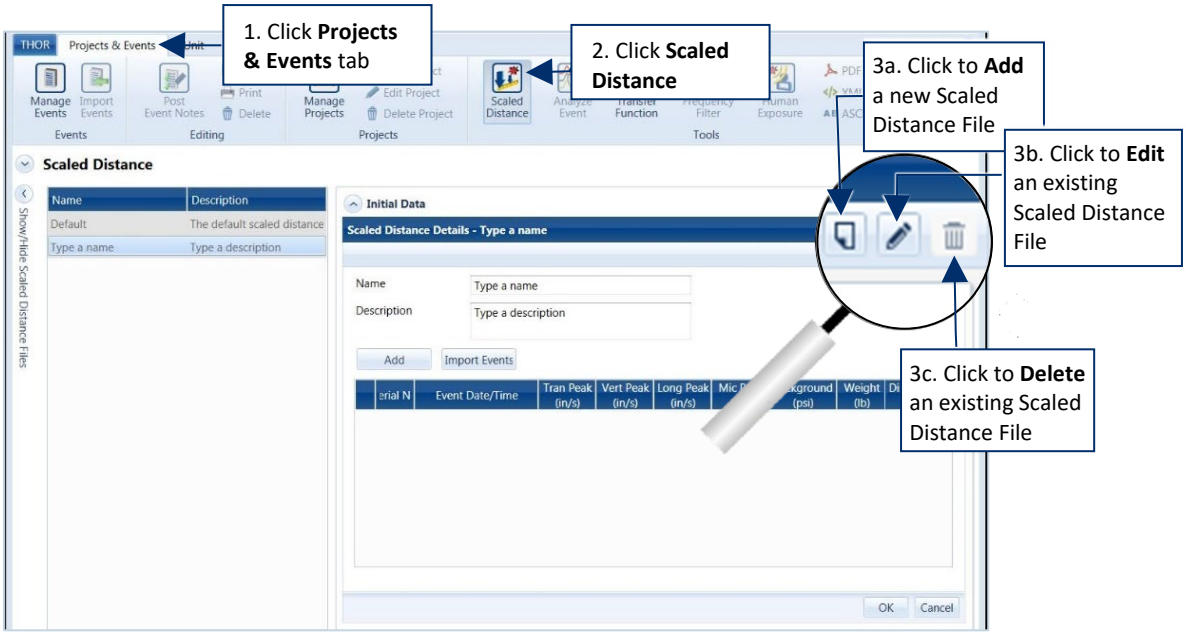
For further reading, see the following references:

- Dowding, Charles H. *Blast Vibration Monitoring and Control*. Englewood Cliffs, NJ: Prentice-Hall Inc., 1985.
- Federal Register, Vol.48, No. 46, Tuesday, March 8, 1983. *Rules and Regulation*. Washington, D.C.: U.S. Government Printing Office.
- Newbold, Paul. *Statistics for Business and Economics*. Englewood Cliffs, NJ: Prentice-Hall Inc., 1984.
- Rosenthal, Michael F. and Gregory L. Morlock. *Blasting Guidance Manual*. Office of Mining Reclamation and Enforcement (OSMRE), March 1987.

5.11.2 CREATE, EDIT, DELETE, SCALED DISTANCE FILES

Scaled Distance File calculations are based on the information from four or more records. The records can be existing waveform events that are imported into the Scaled Distance File, or they can be records that you create and customize yourself. You need at least four events to plot a Scaled Distance graph.

1 Click the **Projects & Events** tab.

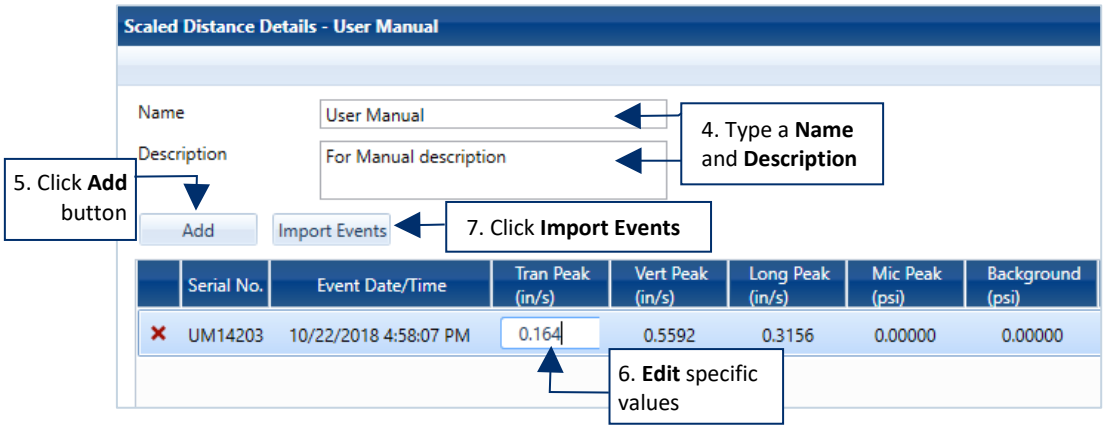


2 Click the **Scaled Distance** button.

3a. Click the **Add** icon to add a new Scaled Distance File.

3b. Click the **Edit** icon to Edit an existing Scaled Distance File (first select a file to edit).

3c. Click the **Delete** icon to remove an existing Scaled Distance File (first select a file to delete).



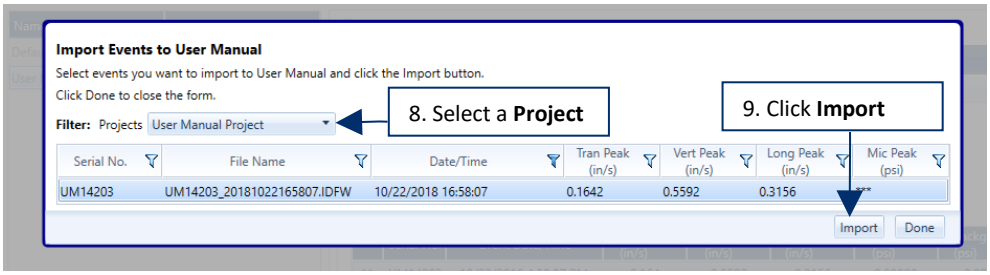
6 Type a **Name** and **Description**

7 Click the **Add** button. The event will appear in the list.

8 To edit specific values, click on a column and manually change the value.

9 To Import existing events, click the **Import Events** button.

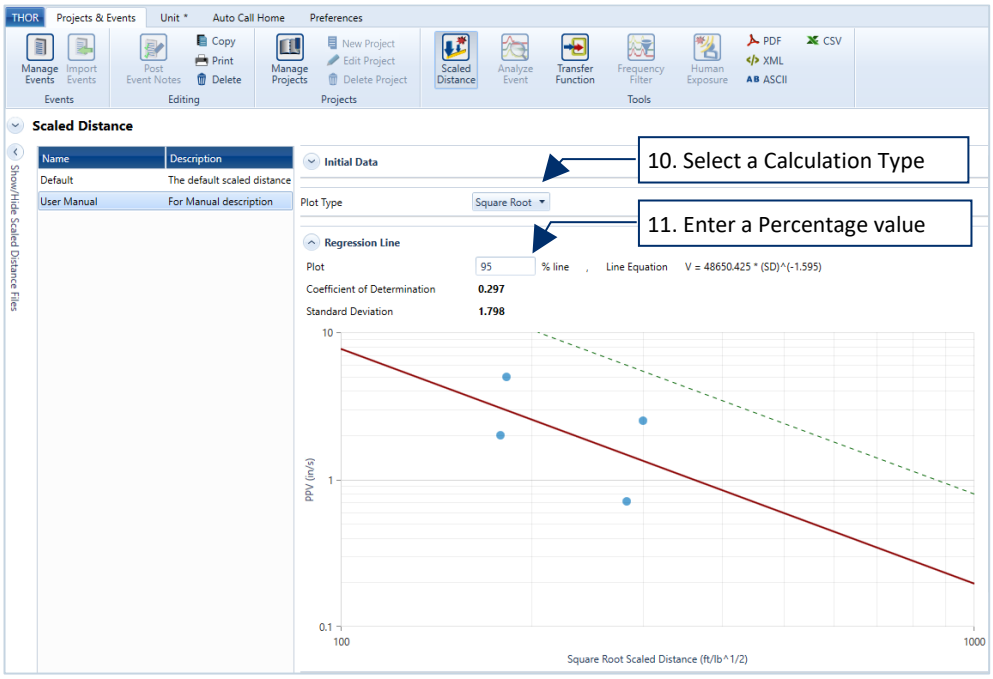
Scaled Distance



10 In the **Projects** Filter, select a project from the dropdown menu

11 Select an event or multiple events to import, and click **Import**, **Done**, and **OK**.

NOTE Only waveform events can be imported.



12 In the **Plot Type** field, select a calculation type for the regression line. (Square Root, Cube Root, Air Blast)

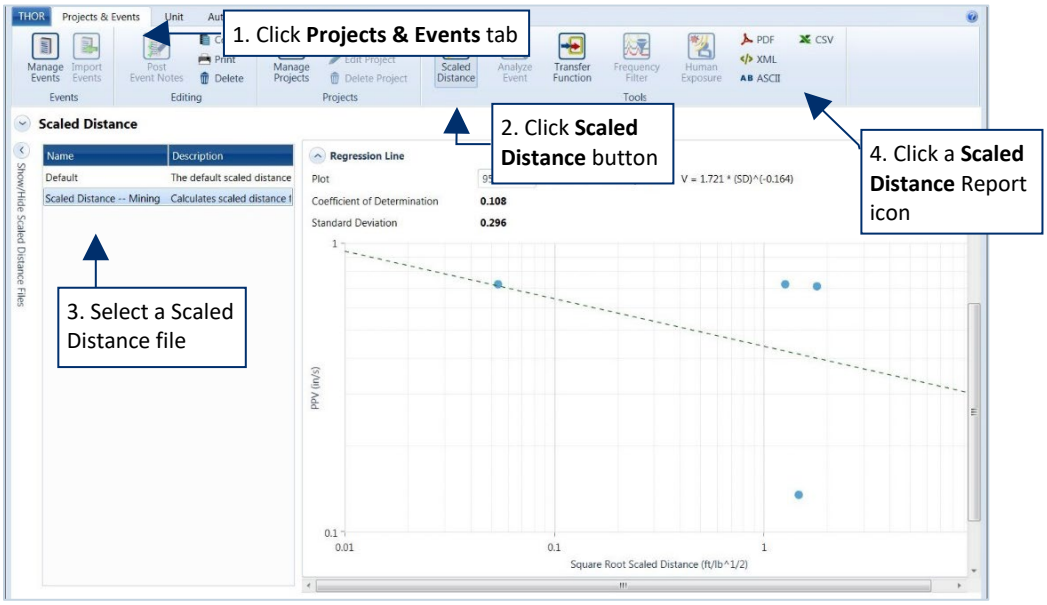
13 In the **Plot** field, enter a percentage value for the regression line.

5.11.3 EXPORT A SCALED DISTANCE REPORT

You can export a Scaled Distance File in the form of a report. The raw data can be exported into XML, CSV, ASCII formats, for the best presentation we recommend using the user-friendly PDF format.

NOTE Available file types for exporting will depend on your THOR license.

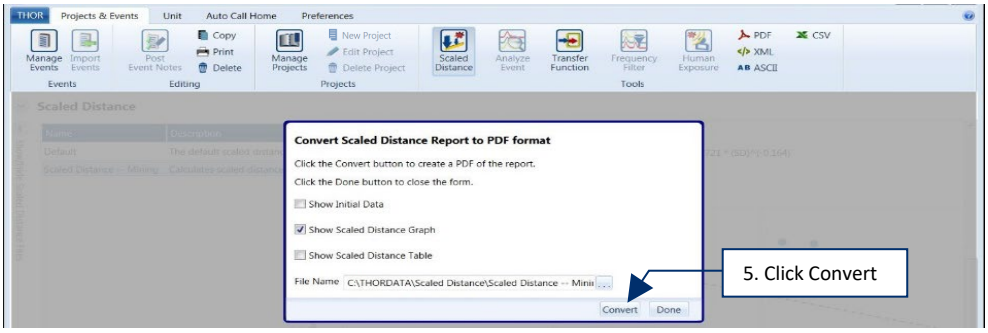
1 Click the **Projects & Events** tab.



2 Click the **Scaled Distance** button.

3 Select a Scaled Distance file in the list.

4 Click a Scaled Distance Report export icon.



A **PDF** report offers a few extras to enhance the report:

- **Show Initial Data**—Displays the data before the scaled distance calculations were performed.
- **Show Scaled Distance Graph**—Displays a chart of the scaled distance data.
- **Show Scaled Distance Table**—Displays a table of the scaled distance data.

To customize the PDF name, type a new **File Name**.

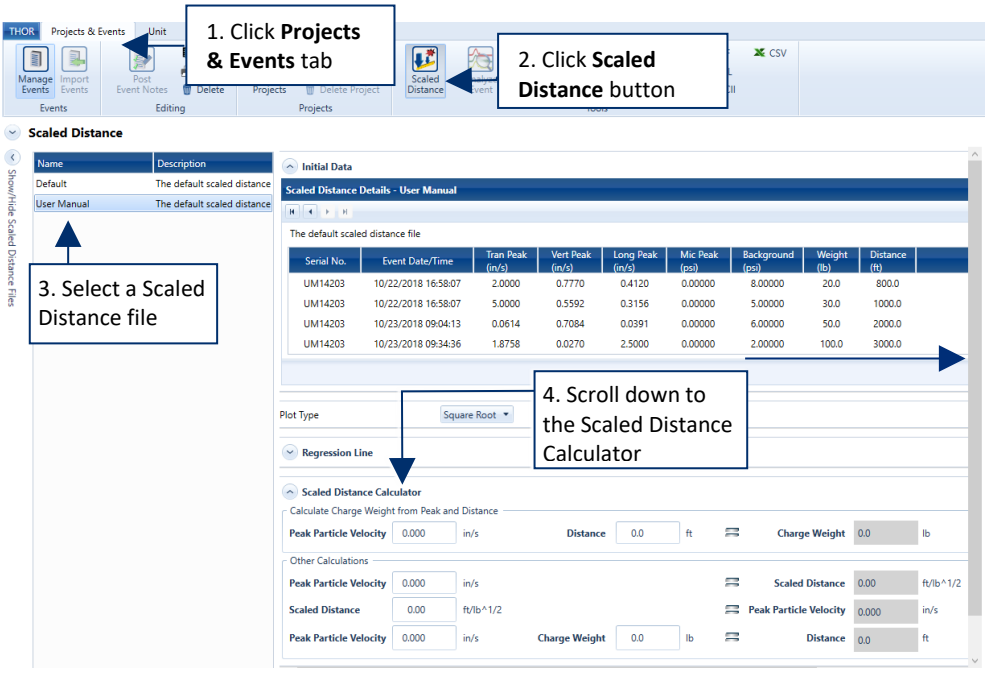
5 Use the Browse button to modify the saving folder location, then click **Convert.**

5.11.4 THE SCALED DISTANCE CALCULATOR

THOR's Scaled Distance calculator is an onboard tool to estimate Charge Weight, Scaled Distance, Peak Particle Velocity (PPV), and Distance based on an event or manually entered data.

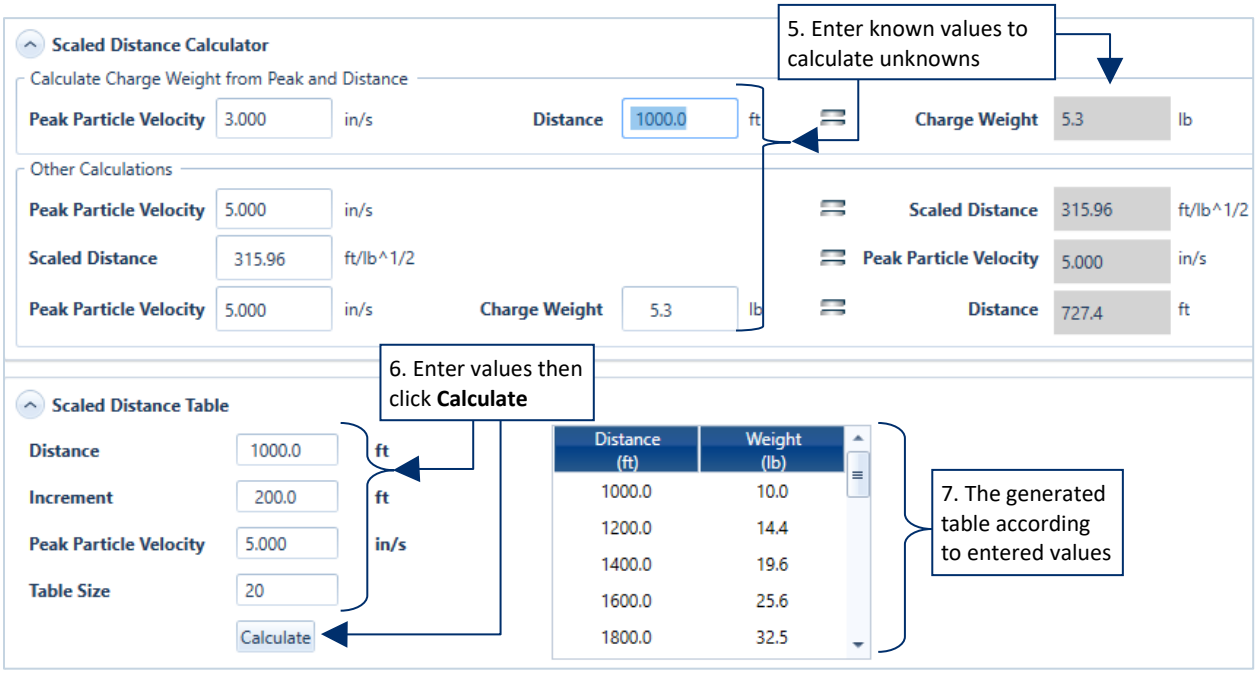
TO CALCULATE...	YOU NEED...
Charge Weight	Peak Particle Velocity (PPV) & Distance
Scaled Distance	Peak Particle Velocity (PPV)
Peak Particle Velocity (PPV)	Scaled Distance
Distance	Peak Particle Velocity (PPV) & Charge Weight

1. Click the **Projects & Events** tab.
2. Click the **Scaled Distance** button.
3. Click a Scaled Distance file.
4. Scroll down to the Scaled Distance Calculator.



5 Use the **Scaled Distance Calculator** to:

- Calculate the Charge Weight, enter values in the PPV and Distance boxes.
- Calculate the Scaled Distance, enter a value in the PPV box.
- Calculate the Peak Particle Velocity, enter a value in the Scaled Distance box.
- Calculate the distance, enter values in the PPV and Charge Weight boxes.



6 To display a **Scaled Distance Table**, enter values for the **Distance**, **Increment**, **PPV**, and **Table Size**, then click **Calculate**.

7 A table is generated displaying the calculated **Charge Weight** relative to **Distance** with increments as defined by the **Increment** field.

6. AUTO CALL HOME SETUP AND MANAGEMENT

6.1 UNDERSTANDING AUTO CALL HOME (ACH)

Auto Call Home (ACH) sets the unit to upload event data to a destination computer when events are recorded,

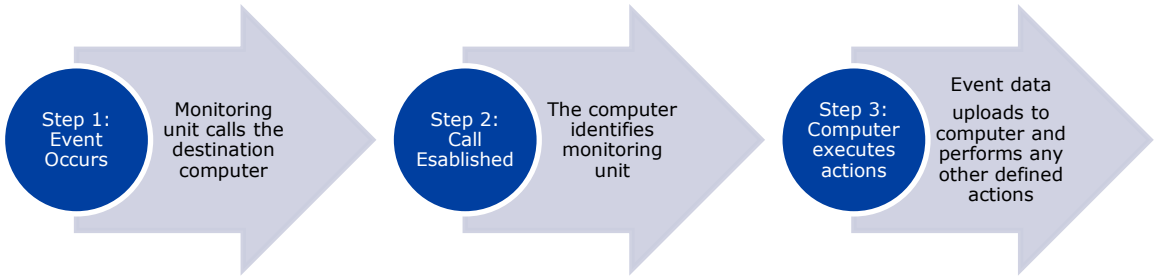
> *WARNING* Auto Call Home will not work if communication between the unit and the host PC is not setup and working properly.
> See chapter 3, Managing Monitoring Units on page 25.

or at specified times. A unit using ACH can initiate a session to transfer data and execute other actions.

During ACH you can:

- Sync the unit's date and time from a computer.
- Generate reports after retrieving event data.
- Free memory by removing events from units in the field.
- Email/SMS events to stakeholders when event data is uploaded.
- Automate downloading event data from units in real-time or on a schedule.

> In Blastware, ACH was a separate application. THOR has integrated ACH into a Windows service. Once you have set up ACH through THOR, the program can close, and the service will still run.



Step 1. The unit's configuration defines how communications are established when calling a computer.
Step 2. Once ACH is initiated by the unit, the computer identifies the unit using its protocol filters.
Step 3. Once identified, actions are taken during the Auto Call Home session.

Possible Actions:

- Copy events (that haven't previously been copied)
- Copy monitor logs
- Delete event data from the unit after upload
- Send event data to Vision
- Synchronize the date and time

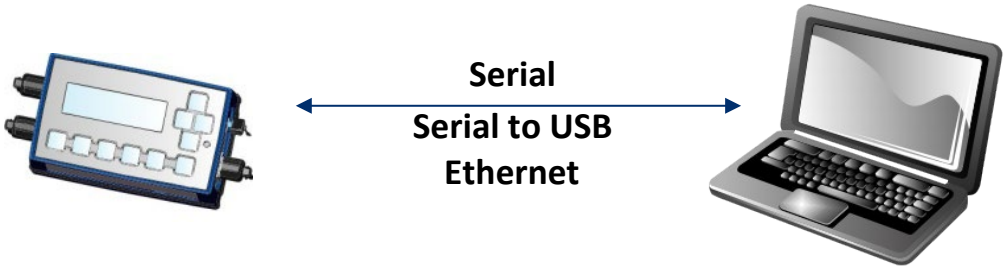
> For information on ACH and Vision, see section 7.4.5 *Send Data to Vision using ACH* on page 166.

NOTE Though THOR was designed for Minimate Pro and Micromate units, ACH can download event data from Blastmate and Minimate Plus units. See section 1.1.2 *Transitioning from Blastware* on page 2.

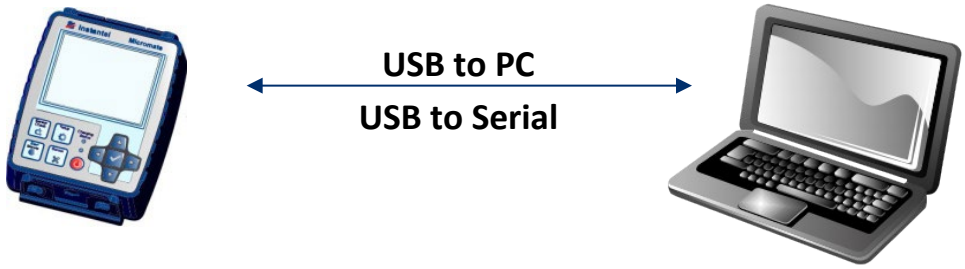
6.1.1 DIRECT COMMUNICATIONS

Minimate Pro and Micromate units use different connection types.

Minimate Pro units connect to computers directly using serial, serial to USB, and Ethernet cables.
For more information, see section 3.1 Connecting Units to THOR on page 26.



Micromate units connect to computers directly using USB to PC and USB to serial cables.
For more information, see section 3.1.1 Direct Link to a local Computer on page 27.



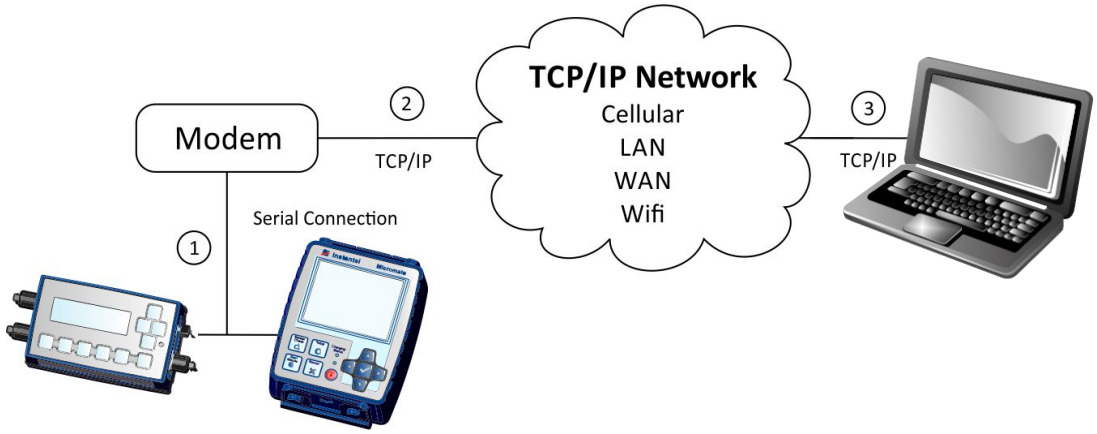
NOTE For information on modem connection types, see section 3.1.2 Remote Link using a Modem on page 29.

6.1.2 REMOTE COMMUNICATIONS

Remote communications refer to when a computer and a unit are not in the same location.

The graphic below illustrates a Minimate Pro or Micromate connected to a modem using a serial connection. The modem can:

- Connect to a network that supports TCP/IP
- Be connected directly
- Communicate over a cellular network



LABEL	CONNECTIONS
①	The monitoring unit (Minimate Pro or Micromate) connects to a modem through a serial connection.
②	The modem connects to a network using the TCP/IP protocol.
③	The network connects to a computer running THOR using the TCP/IP protocol.

NOTE UDP connections are not supported by THOR.

NOTE The Minimate Pro can also connect directly a network using its onboard TCP/IP config and its Ethernet port.

NOTE For more information about communication between Units and THOR,
see section 3.1 Connecting Units to THOR on page 26.

6.2 CONFIGURING ACH

Auto Call Home must be configured on both:

- The unit
- The computer running THOR

THOR can configure ACH on both the computer and the unit with one exception; the *Session Time Out*. This must be configured directly on the unit. (See the unit's User Manual for information on how to set up its Session Time Out.)

Units store their unique configuration locally and are independent of THOR. THOR has one single configuration stored on the host computer. You must set up each configuration independently, then THOR and the unit will use both configurations to determine how to communicate and which actions to perform during the Auto Call Home session.

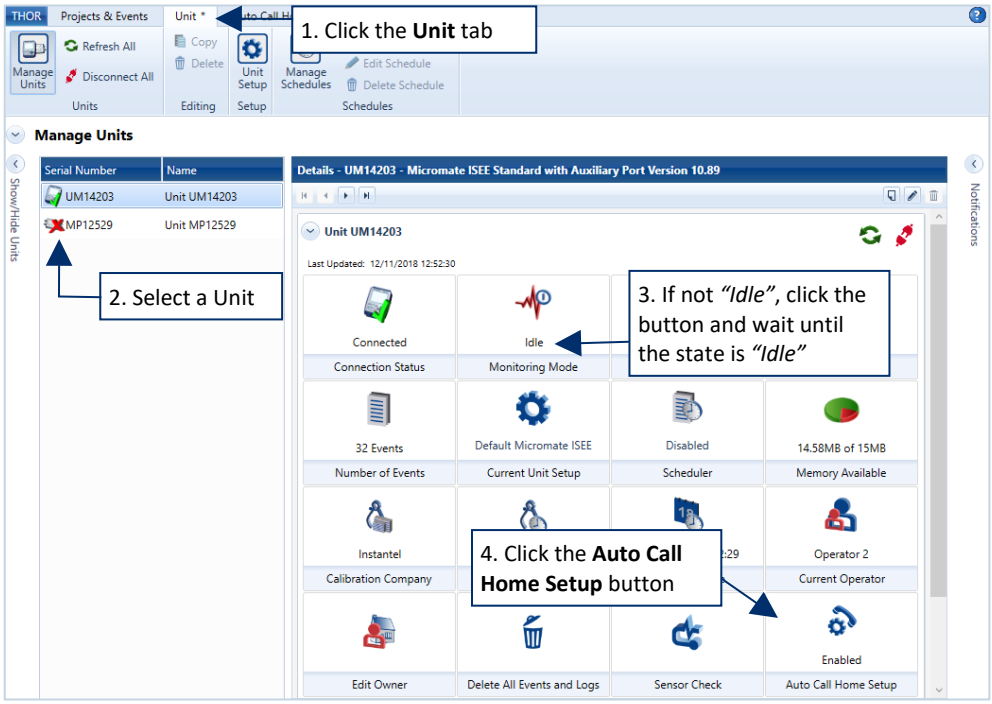
Minimate Pro units connecting to THOR over their Ethernet port must configure their TCP/IP to match the TCP/IP address of the computer running THOR.

6.2.1 CONFIGURE UNITS FOR ACH

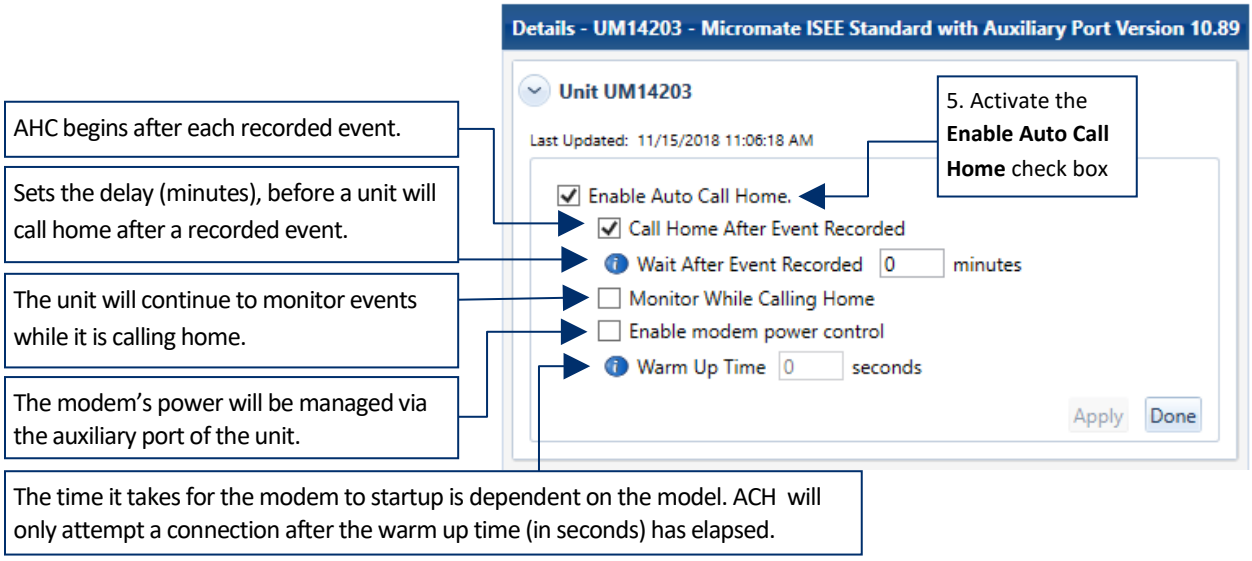
Units use a set of parameters that are saved as a configuration file.

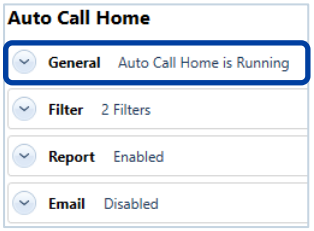
To access these settings:

1. Click the **Unit** tab.
2. Click a unit in the list of units.



3. The **Monitoring Mode** must be *"Idle"*. If not, click the button and wait until the unit is ready to perform configuration functions displaying *"Idle"*.
4. Click the **Auto Call Home Setup** button.
5. Activate the **Enable Auto Call Home** check box and apply the desired settings.





6.2.2 CONFIGURE THOR FOR ACH

To configure THOR for Auto Call Home (ACH)

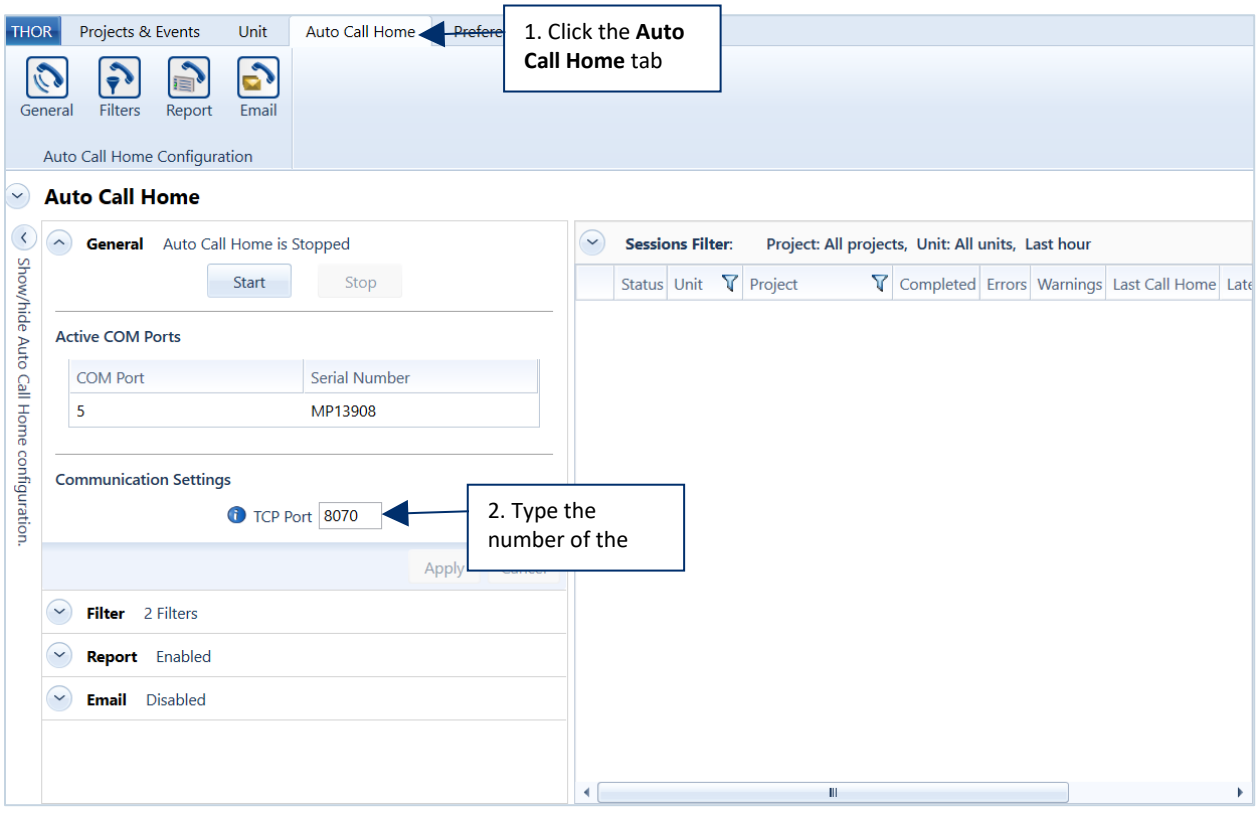
1. Define the General Settings
2. Define the Filters and Actions
3. Define the Report details
4. Setup Emailing details

6.2.2.1 GENERAL

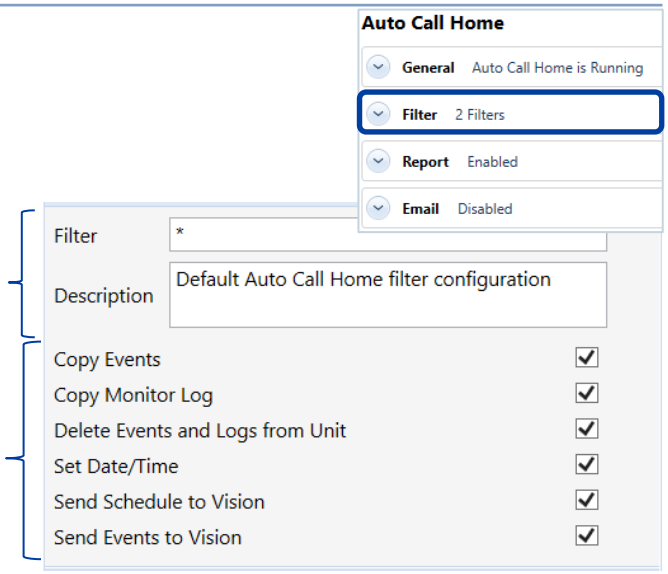
Set the TCP Listener Port.

The TCP Listener is the computer's port that communicates with the unit's modem (or in the case of the Minimate Pro with the Ethernet port). When THOR attempts an Auto Call Home, it will poll the TCP port for network interfaces.

1. Click the Auto Call Home tab.
2. In the TCP Port field, type the number of the TCP listener port and click Apply.



6.2.2.2 FILTERS & ACTIONS



Auto Call Home Filters contain two parts:

1. Filter—Criteria used to select which unit's data will be processed.
   (THOR compares the filter with the serial numbers of the units it communicates with.)
2. Actions—What Auto Call Home will perform when a link is established.

Filter	Returns
A unit's serial number	A single unit
*	All units
BA	All Blastmate III units
BC	All Minimate Plus units with an internal geophone
BE	All Minimate Plus units without an internal geophone
*B**	All Blastmate III and Minimate Plus units
*MP**	All Minimate Pro units
*UM**	All Micromate units

Actions	Description
Copy events	Events download to the computer (Only applies to events not previously downloaded). ***NOTE*** You can view copied monitor logs in the Projects & Events page, under the associated project.
Copy monitor log	Monitor logs download to the computer. ***NOTE*** You can view copied events on the Projects & Events page, under the associated project.
Delete events and Logs from Unit	Events and logs will be deleted from the unit.
Set Date/Time	The unit will synchronize its date and time with the computer.
Send Schedule to Vision	The unit's schedule is downloaded to the computer. If you need to send a schedule to Vision for the automatic Watchdog feature, then this must be enabled.
Send Events to Vision	Events are copied to Instantel's cloud-based software "Vision".

The simplest filter is a serial number. Filtering for a serial number will return one single result.

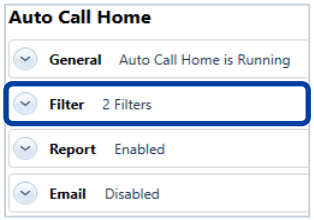
Example: To create a filter for a Micromate unit with the serial number UM2222,
Type *UM2222* in the filter field.

Filters can use the wildcard character *. This can be used to represent one or more unknown characters.

Example: Micromate serial numbers begin with UM. Minimate Pro serial numbers begin with MP.
To filter Micromate units type MP* in the filter field.
To filter Minimate Pro units type UM* in the filter field.

THOR uses best match logic when multiple filters are used.

Example: If the following filters were defined: *UM12**, *UM123**, and *UM1234*, to find a unit with serial number UM1234. The *UM1234* filter will be used.



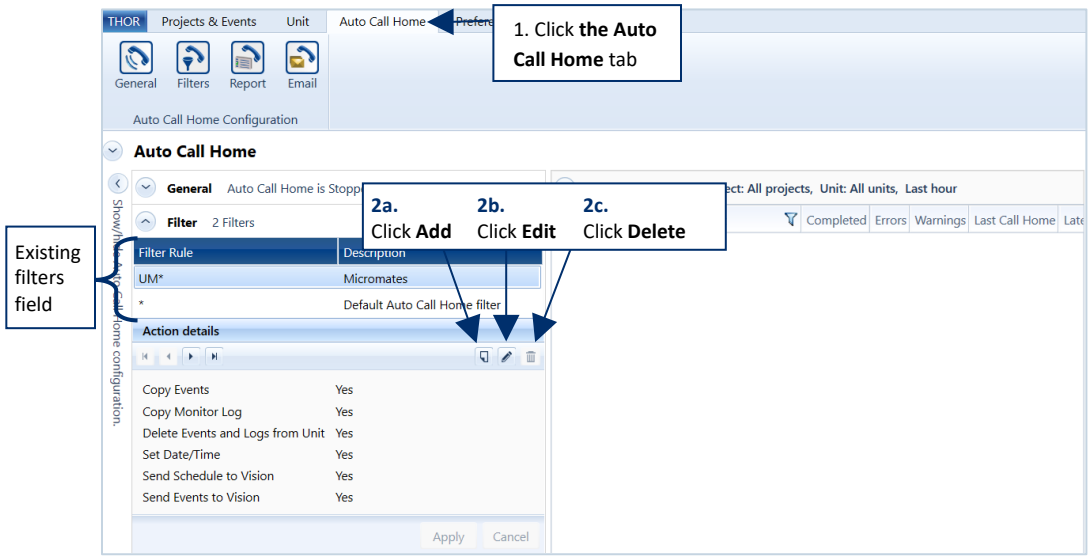
Add, Edit, Delete, ACH Filters

1 Click the **Auto Call Home** tab.

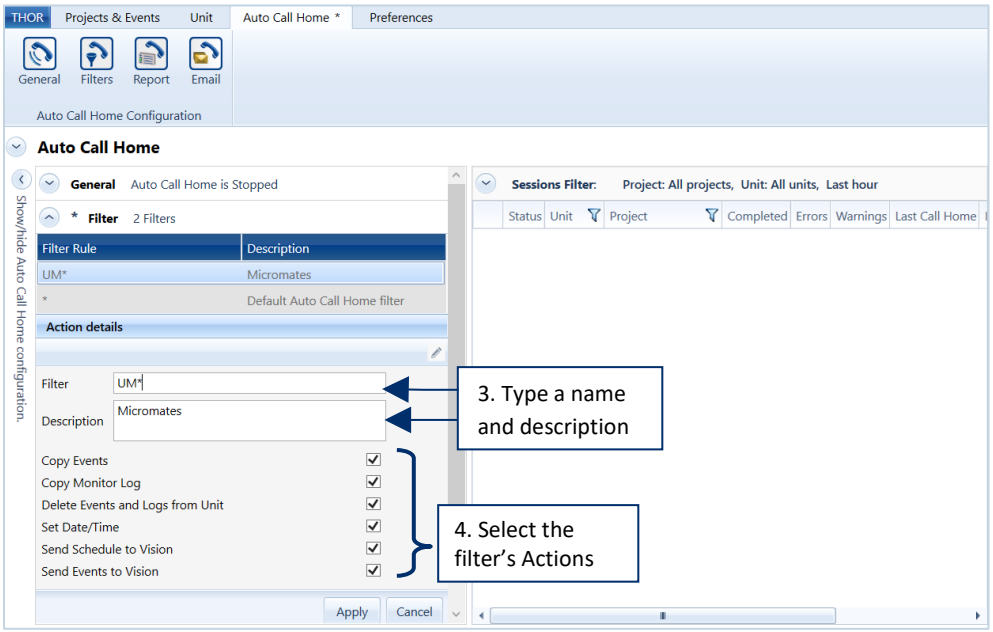
2a. To **Add** a filter, in the **Action Details** section, click the **Add** button.

2b. To **Edit** a filter, select an existing filter, then in the **Action Details** section, click the **Edit** icon.

2c. To **Delete** a filter, select an existing filter, then, in the **Action Details** section, click the **Delete** icon, (or press delete on the keyboard)

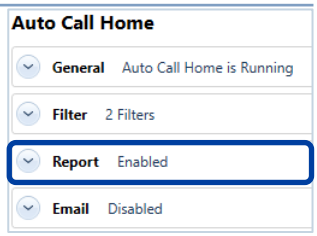


3 In the **Filter / Description** fields, type a name and description of the filter.



4 Select the filter's Actions, then click **Apply** and **OK**.

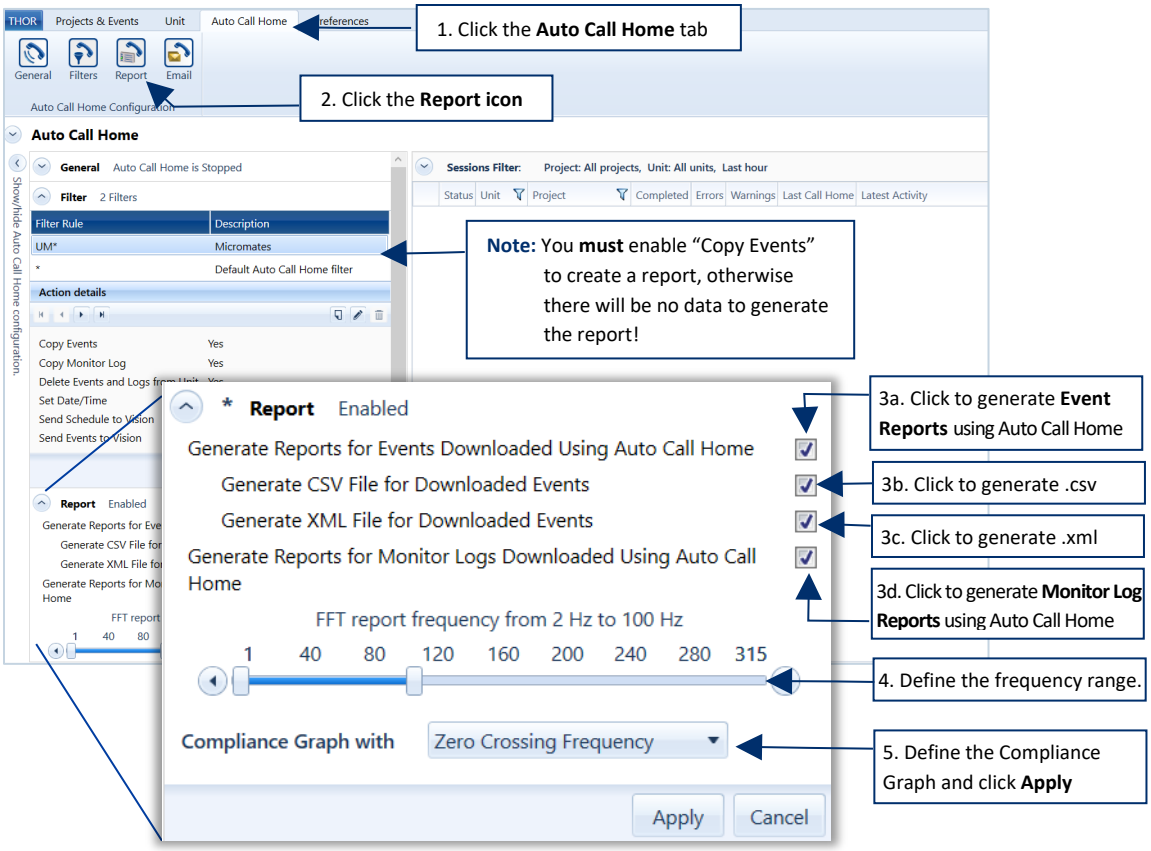
WARNING If you enable **"Delete Events and Logs from Unit"** but disable **"Copy Events"**.
The events and logs will be deleted without being uploaded.



6.2.2.3 REPORTS

Auto Call Home (ACH) can generate *Event Reports* and *Monitor Log Reports*. Before generating these reports, the Frequency Range and Compliance Graph must be defined. To generate ACH reports:

1 Click the **Auto Call Home** tab.



2 Click the **Report** icon.

3 **3a. / 3b. / 3c. / 3d.** In the **Report** section, select which reports to generate.

4 Define the Frequency Range using the sliders (see *Adjusting the FFT Frequency Range* on page 121).

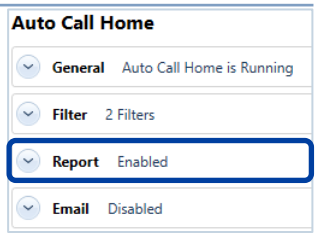
5 Define the Compliance Graph to use when generating the report and click **Apply**.

Auto Call Home has limited compatibility with Blastmate and Minimate Plus units. The configuration must be setup within the unit (no configuration within THOR). All generated reports will use the default preferences as defined in THOR.

A note about Compliance Graph Options

Fast Fourier Transform (FFT) and Zero Crossing Frequency calculate data points differently. The correct function to use is based on the compliance standard that applies to your report.

Report Folder



When Auto Call Home generates reports from a unit's event data, they are generated in four formats:

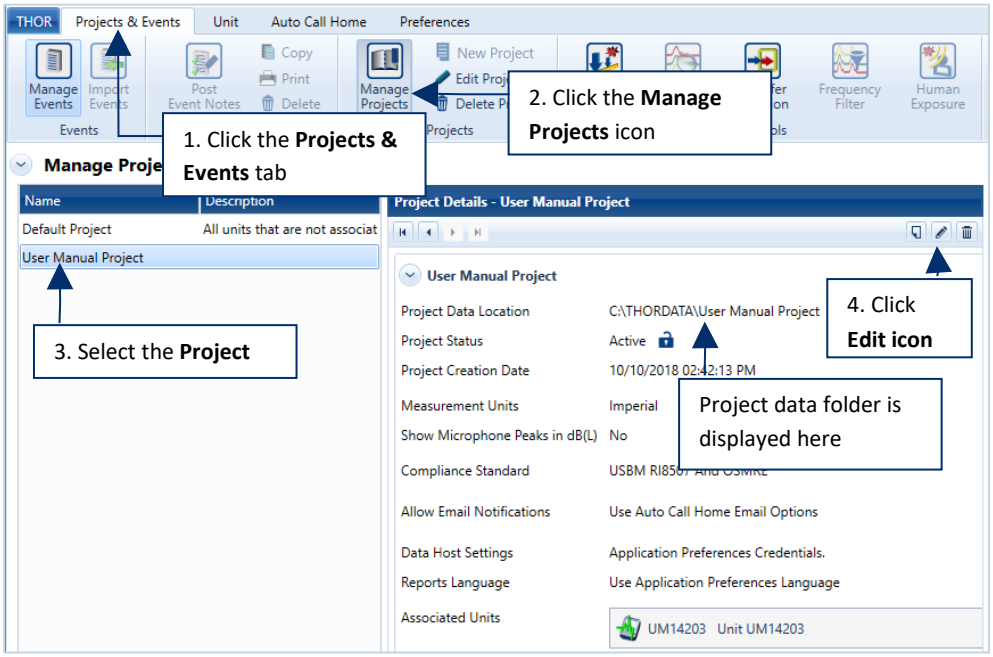
- PDF
- XML
- ASCII
- CSV

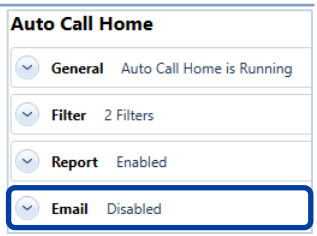
Some formats may not be available, depending on your THOR license.

These files are saved to the project's data folder. The default catch-all folder can be found at *C:\THORDATA\Default Project*. It contains all file types and the raw source data from the units that established an Auto Call Home connection.

To Locate/Edit the Project folder:

1. Click the **Projects & Events** tab
2. Click the **Manage Projects** button.
3. Select the project. The project's data folder path is displayed in the Project Details section
4. Click the **Edit** icon (or right-click the project and choose **Edit Project**) to change the path or other project details.

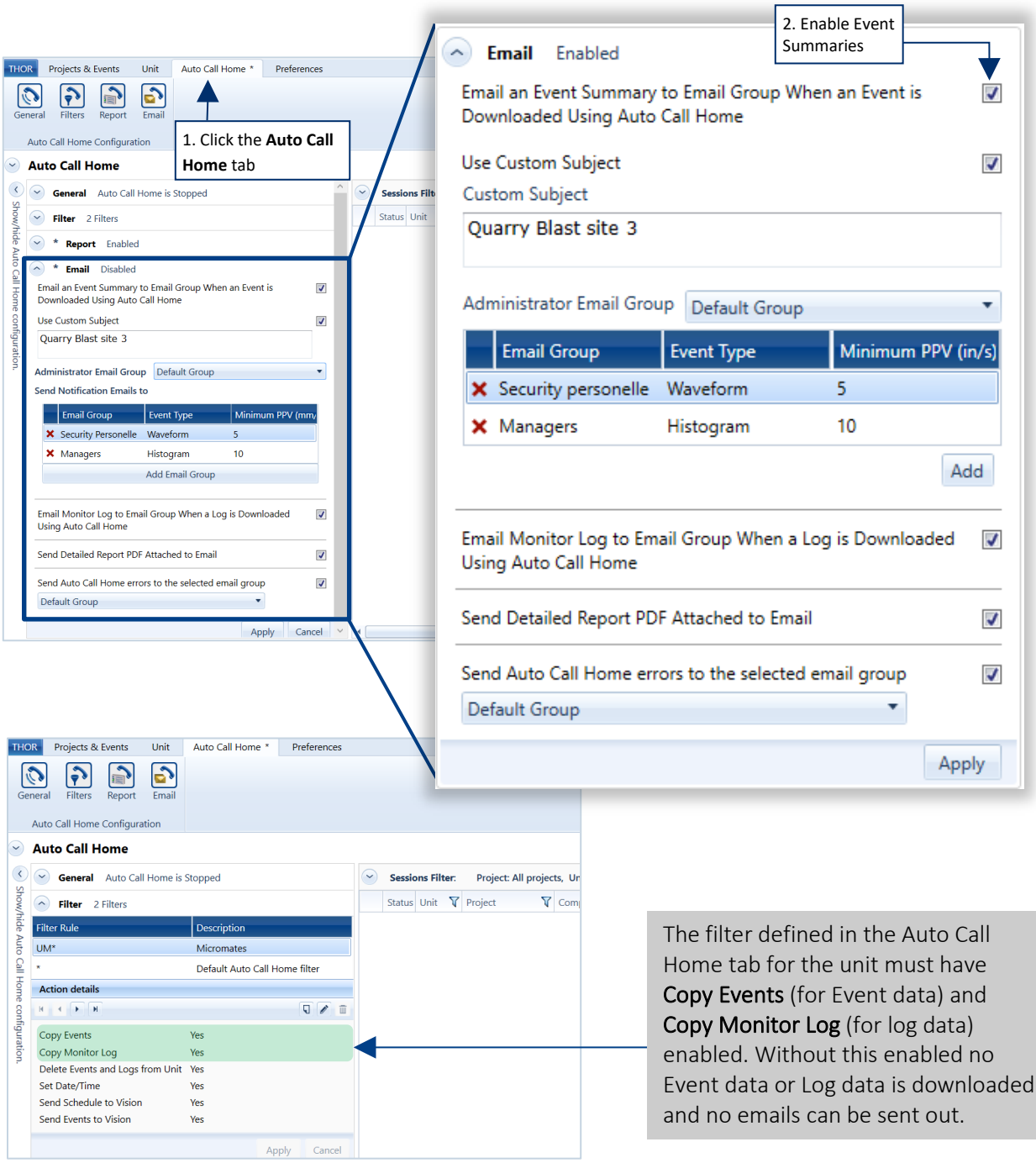




6.2.2.4 EMAIL DISTRIBUTION LIST DEFAULT

The Email distribution list defines who receives Auto Call Home emails based on certain criteria. These default settings are overridden when changes are made at the project level.
(Projects & Events → Manage Projects→ Project Details)

1. Click the **Auto Call Home** tab.
2. In the Email section, enable the **Email an Event Summary to Email Group When an Event is Downloaded Using Auto Call Home** checkbox.



The filter defined in the Auto Call Home tab for the unit must have **Copy Events** (for Event data) and **Copy Monitor Log** (for log data) enabled. Without this enabled no Event data or Log data is downloaded and no emails can be sent out.

3 (Optional) The **Custom Subject** line allows you to personalize the email. (E.g. Quarry Blast site 3)

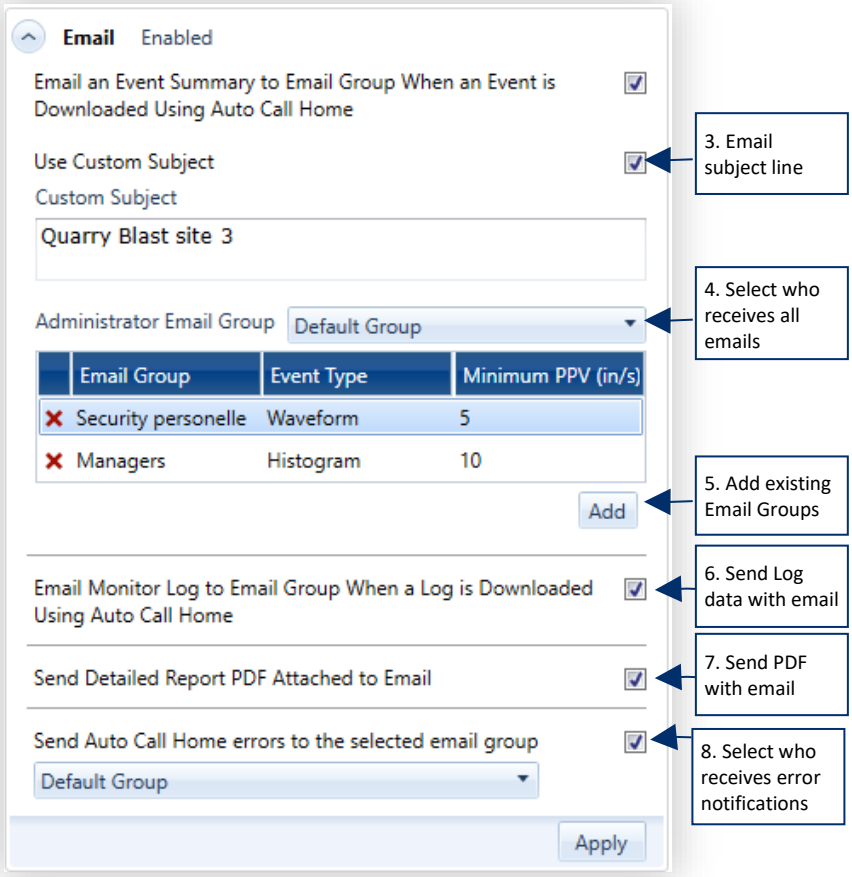
4 Select the **Administrator Email Group**, this is the group that receives all messages.

5 (Optional) The other Email groups only receive event files based on their defined preferences.
Event Type: Only sends emails conforming to this recorded event (when empty, all events are sent)
Minimum PPV: Only sends emails of events exceeding this threshold (when empty, all events are sent)

6 (Optional) The **Email Monitor Log to Email Group When a Log is Downloaded Using Auto Call Home** check box sends log data in the email. (See note for step 2)

7 (Optional) **Send Detailed Report PDF Attached to Email** attaches a PDF report to the email.

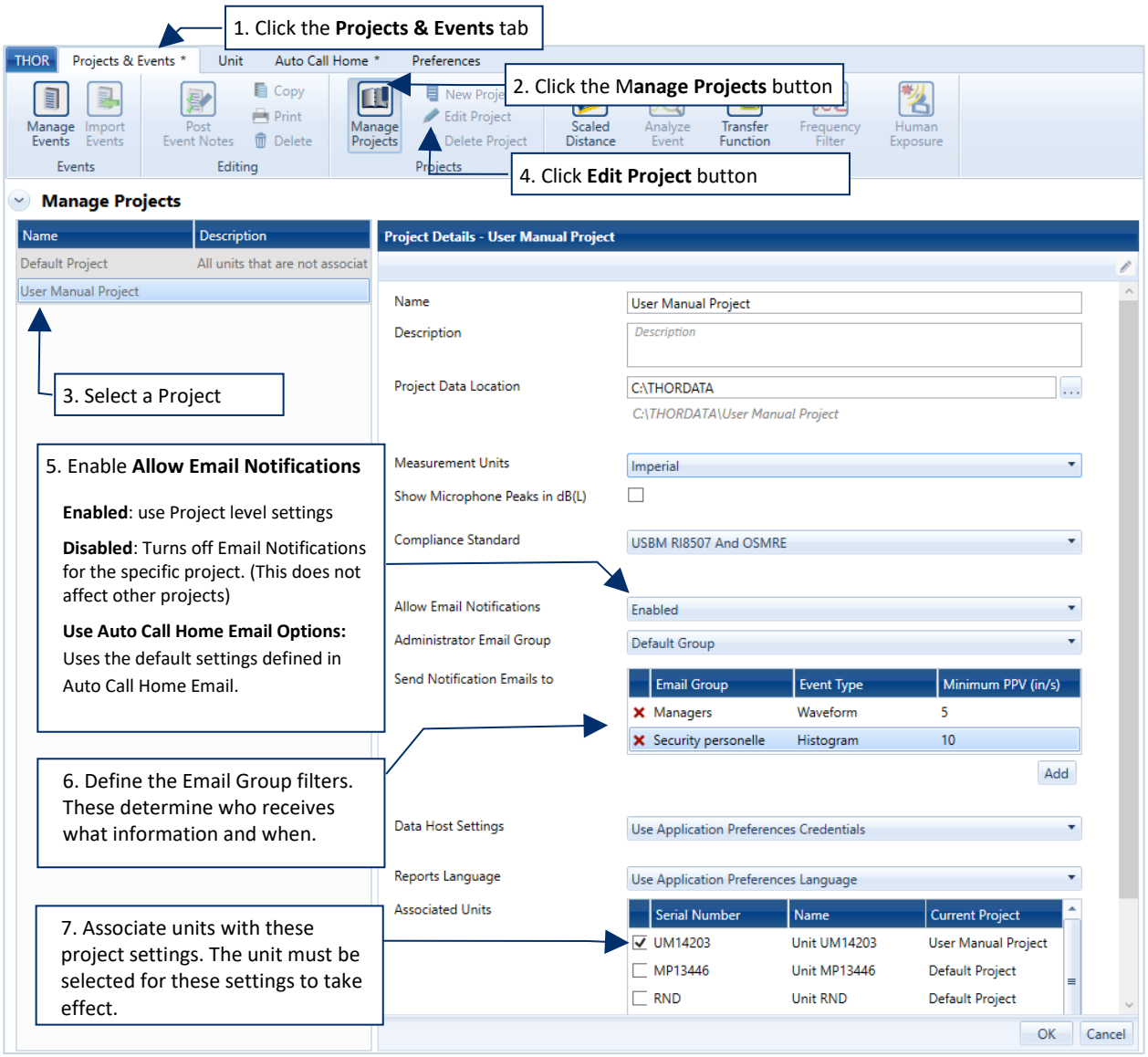
8 (Optional) **Send Auto Call Home errors to the selected email group** sends error notifications for incomplete Auto Call Home sessions to the selected dropdown group.



6.2.2.5 EMAIL DISTRIBUTION LIST - PROJECT LEVEL

Email distribution lists that are defined at the project level override the default Auto Call Home settings.

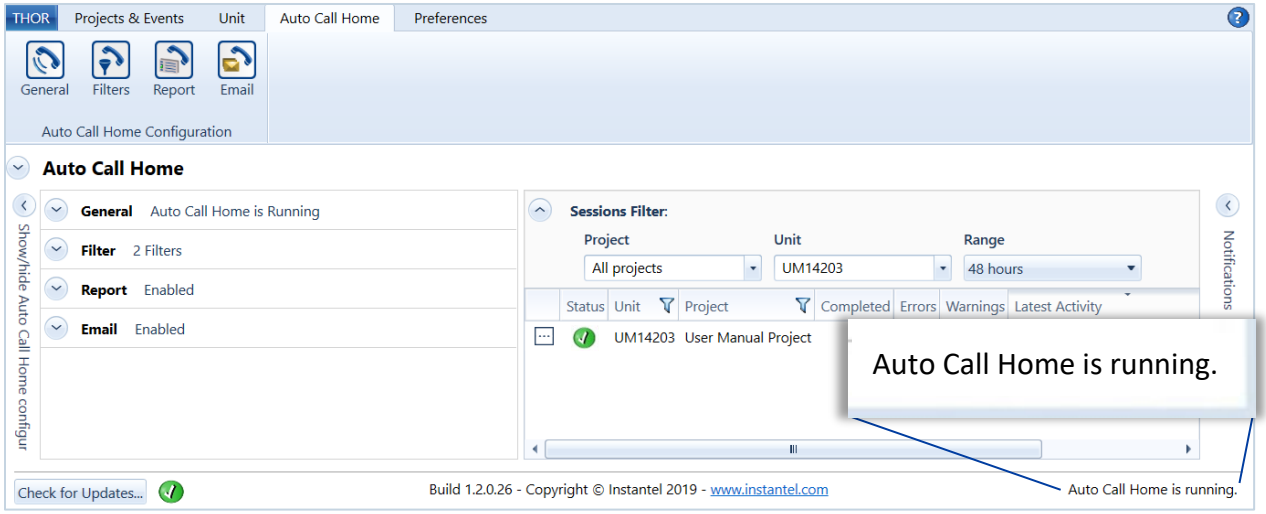
1. Click the **Projects & Events** tab.
2. Click the **Manage Projects** button.
3. Select a Project.
4. Click the **Edit Project** icon (or right-click the project and click **Edit Project**).
5. Enable **Allow Email Notifications** (Only Projects who have this "Enabled" will override the default settings.)
6. Define the **Email Group** filters. (Only Email Groups who meet the "Send Notification Emails to" criteria will receive email notifications.
7. Associate units with the project settings and click **OK** to validate the changes. (Only Units assigned to the project are affected by these settings.)



6.3 USING AUTO CALL HOME

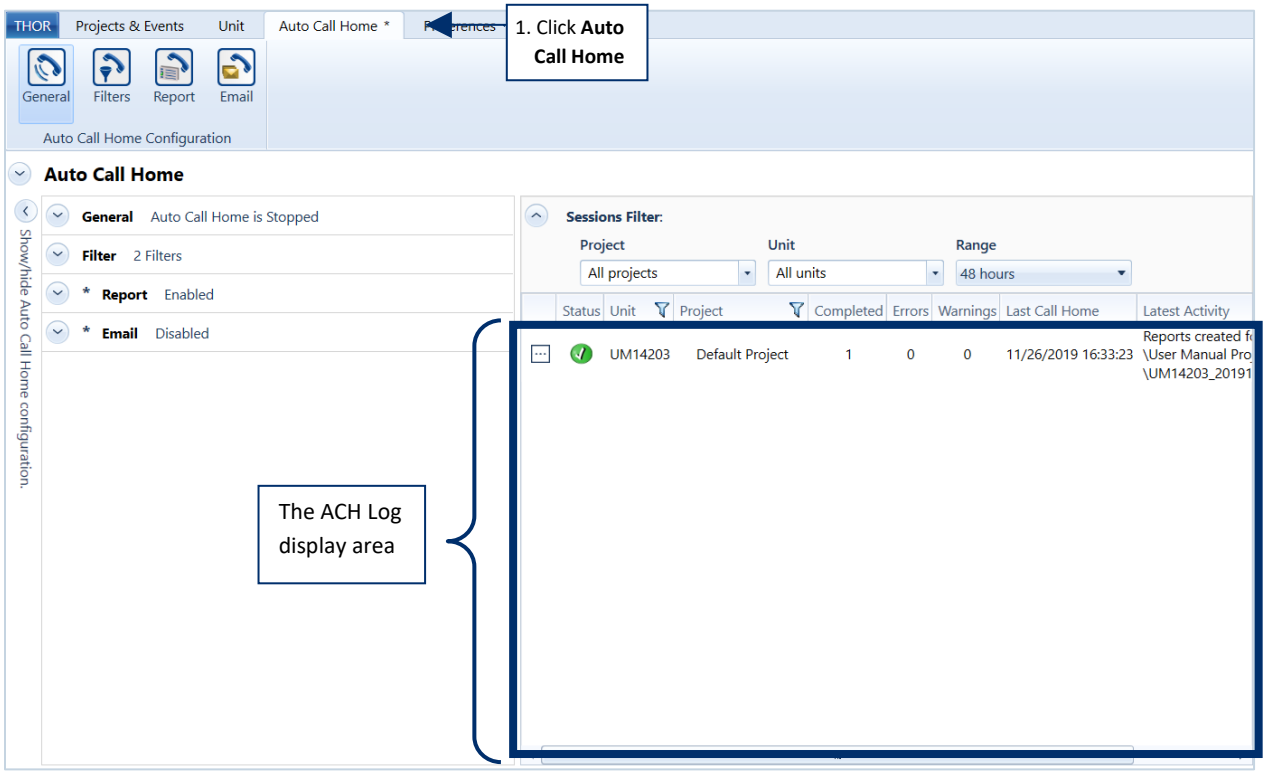
Once configured, Auto Call Home is ready to communicate with the computer and transfer remote monitoring data.

When Auto Call Home starts, it will notify the user in THOR regardless of the active tab.



Auto Call Home sessions generate Auto Call Home logs that record session connections, successes/failures, and transferred data. To view the Auto Call Home logs:

1 Click the **Auto Call Home** tab.



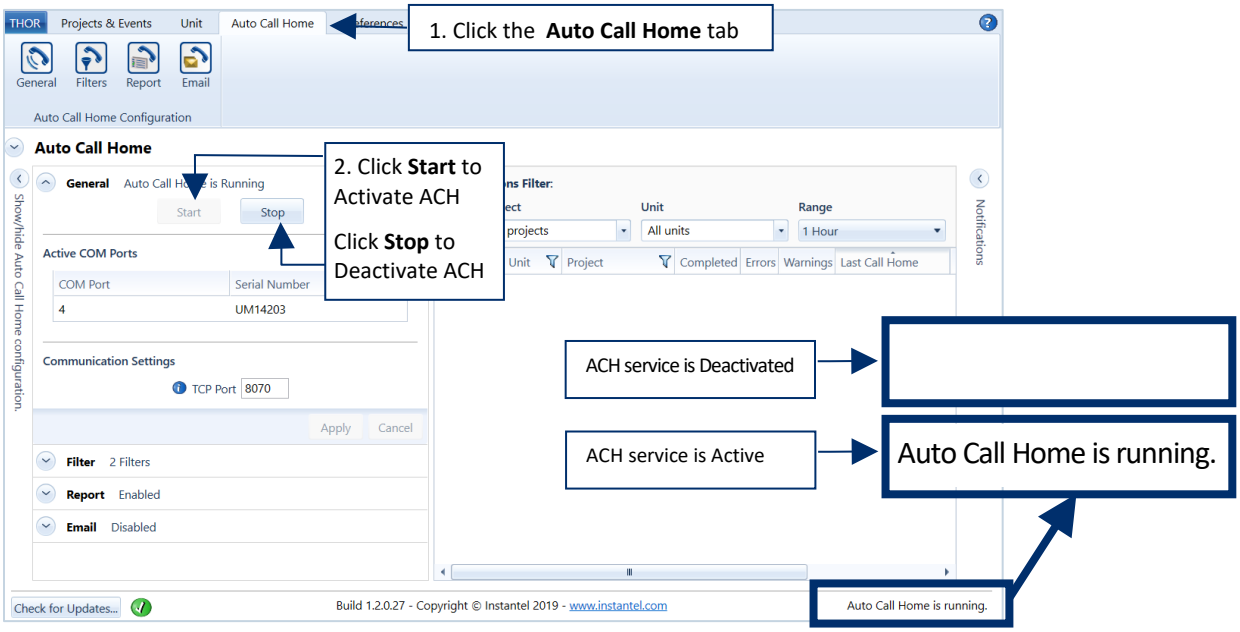
6.3.1 START / STOP AUTO CALL HOME

Starting Auto Call Home (ACH) enables the service to process incoming Call Home sessions. When Auto Call Home is stopped its preferences are stored for future use.

SETTING	RESULT
Start Auto Call Home	THOR processes Auto Call Home sessions
Stop Auto Call Home	THOR does not process Auto Call Home sessions

NOTE Auto Call Home is installed as a Windows service and runs in the background of the computer.

1 Click the **Auto Call Home** tab.



2 In the **General** area, click the **Start** or **Stop** button. The Service will activate/deactivate and show the status in the lower right corner of the THOR window.

6.4 AUTO CALL HOME LOGS

Auto Call Home (ACH) Logs should not be confused with Monitoring Logs.

- ACH Logs keep track of communications between units and THOR.
- Monitoring Logs keep track of actions that units experience to detect and store vibrations. (Start monitoring, recorded events, stop recording…etc.)

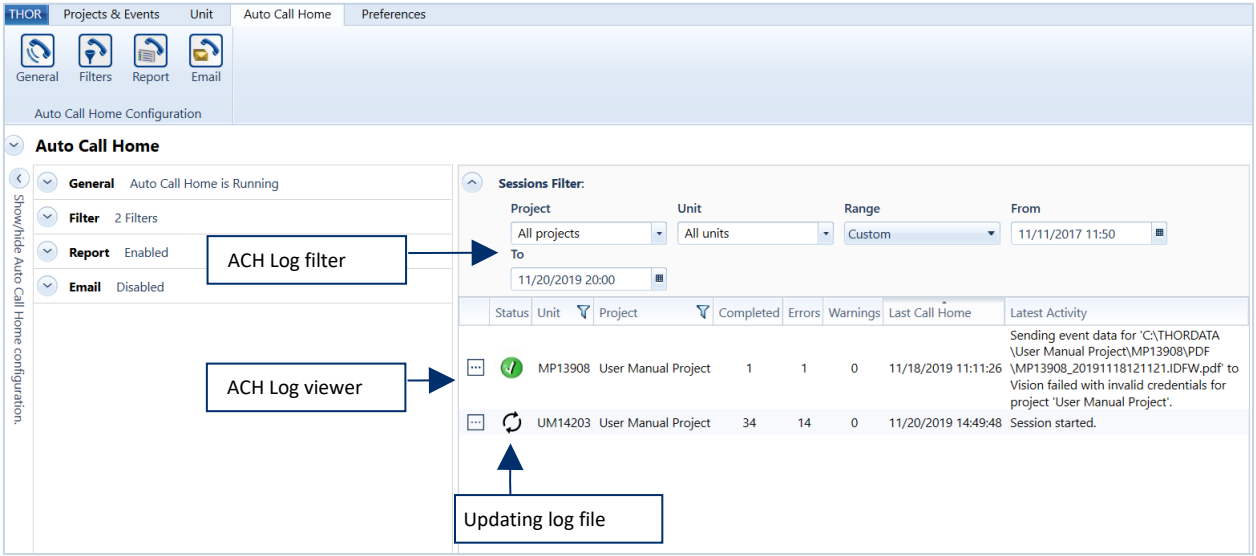
For more information about Monitoring Logs see section 5.8 on page 111.

Auto Call Home (ACH) logs record every step of an ACH session:

- The serial number of the unit calling home
- The time THOR detected an incoming ACH call
- The port used for the incoming call
- The time the session began
- The time the session completed
- Event files downloaded
- Any reports generated
- Any email notifications that were sent to notification recipients
- Data transfer status when linking with Instantel's Vision platform
- Warning messages, E.g. "The Monitor log was not copied because the unit is monitoring"
- Error messages, E.g. "Sending event data to Vision failed with invalid credentials for project."

ACH logs are XML/TXT files, they can be viewed with plain text viewers such as Notepad, and most HTML editors, THOR also provides an in-app viewer.

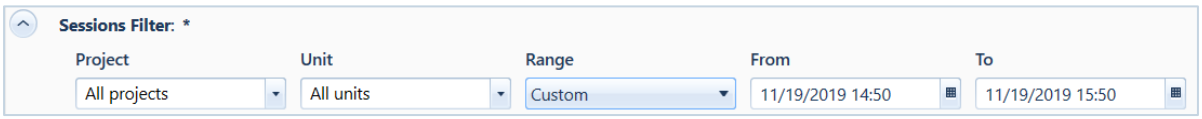
To access the Auto Call Home Logs, click on the Auto Call Home tab.



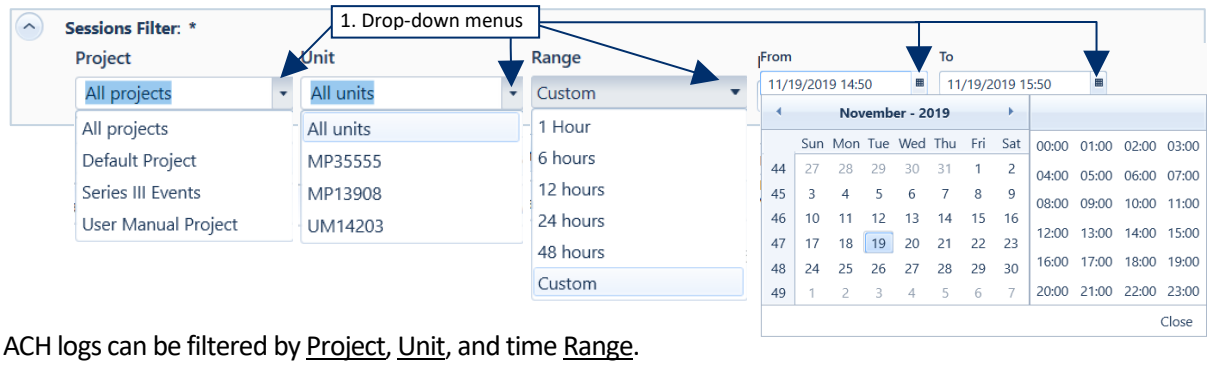
THOR displays the latest logs on the right side of the ACH page. ACH logs update automatically indicated by a spinning wheel under the status header.

6.4.1 LOG FILTERS

You can use the filter options to display a subset of the entire log file list.



1 Click the drop-down menu in any of the fields to view the available options. Click the calendar icon in the Custom date/time fields.



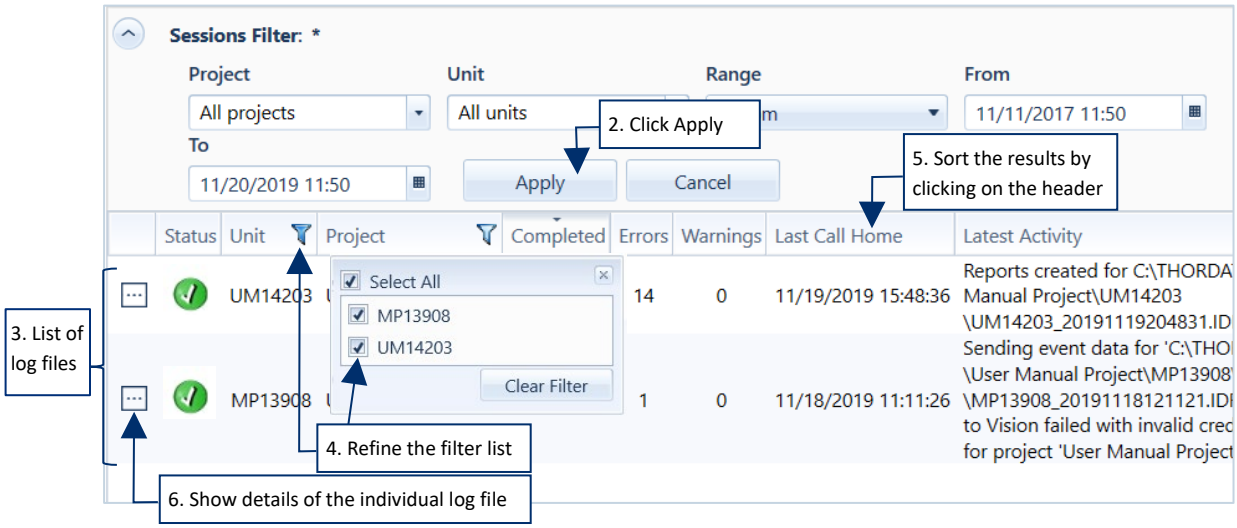
ACH logs can be filtered by Project, Unit, and time Range.

Project: Choose the project from the dropdown menu containing the logs to display.

Unit: Choose the unit's serial number containing the logs to display.
(Only units that have once connected to THOR will display, including archived units in the default project.)

Range: Choose between a set of time options from 1 to 48 hours or use the custom option to set a start date/time and end date/time range. The time range refers to how far into the past to display unit logs. E.g. Choosing "6 hours", will display ACH logs from the previous 6 hours.

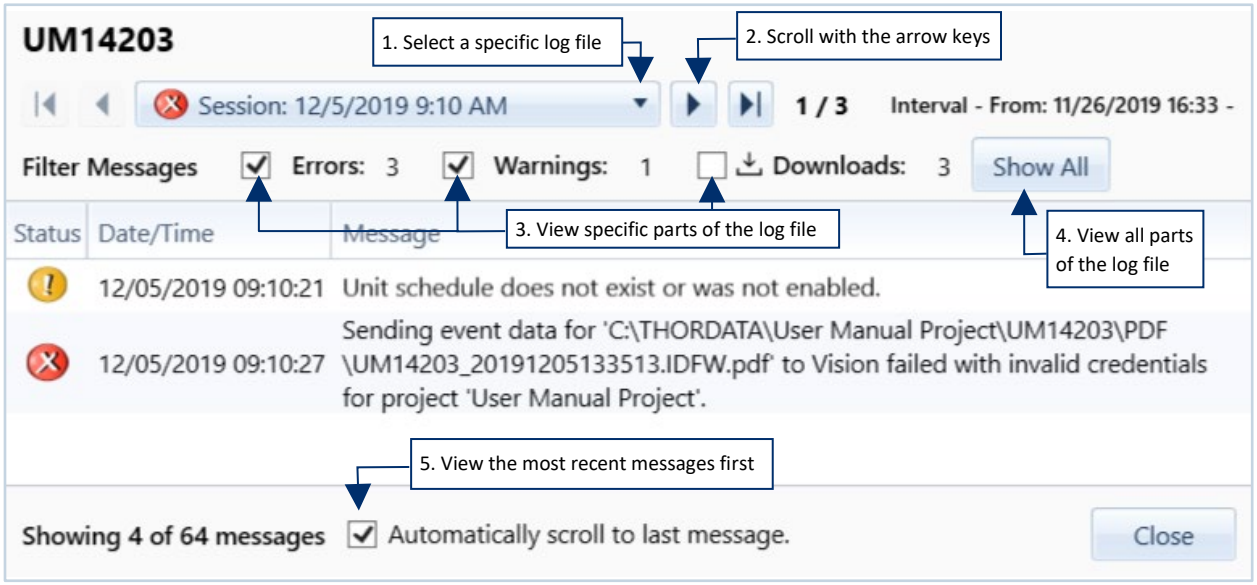
2 Click on Apply to filter the results.
3 A list of Log files will appear.
4 Refine the filter list by clicking on the funnel icon
5 Sort the list by clicking on any column header.
6 Double click in any row or click the "Show Details" icon to view the details of the log file.

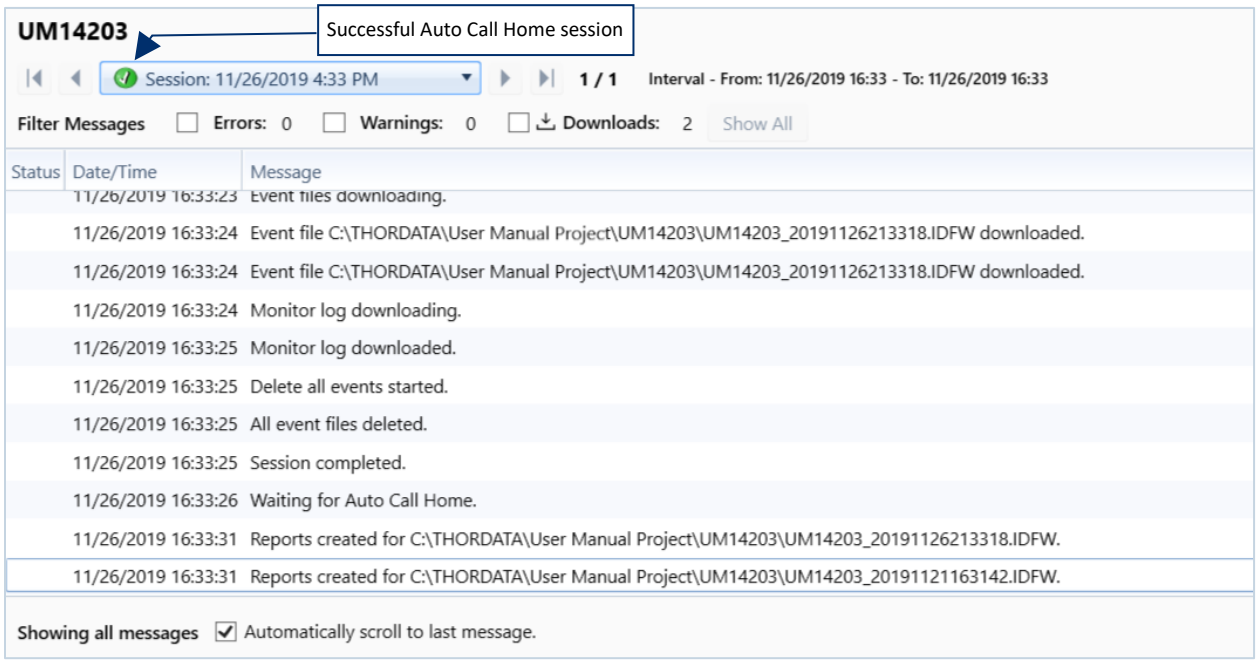


6.4.2 LOG FILE DETAILED VIEW

Every time a unit connects to THOR using Auto Call Home session, a log file is generated. The Log file will show the status of the data transfer with any error/warning messages, and event file downloads. Below are two ACH sessions, with errors/warnings and as a complete successful transfer.

1. Use the drop-down menu to select a specific log file.
2. Scroll through the different log files using the arrow keys.
3. Activate the checkboxes to view specific parts of the log file (Errors, Warnings, Downloads).
4. Click Show All to view all parts of the log file.
5. When **Automatically scroll to last message** is checked, the list will push the messages to the top so that the most recent messages appear first.





6.4.3 SORTING AUTO CALL HOME LOGS

You can sort Auto Call Home (ACH) logs when they display a small clickable arrow in the column header.

By default, events are sorted by the **Last Call Home** column, in chronological order from most recent to oldest, with the log that occurred first appearing last in the list.

No arrow: The column is not sorted. By default, logs are displayed by the Date/Time column, chronologically from oldest to most recent, with the log that occurred first appearing first in the list of logs.

Arrow pointing up ( ) The column is sorted with the highest number first, descending to the lowest number. If the column contains text, the text displays in alphabetical order (A-Z), following the numeric values.

Arrow pointing down ( ) If the column contains text, the text displays in reverse alphabetical order (Z-A), followed by numeric values. The lowest number displays immediately following the text, ascending to the highest number.

Example: If the Project column contains the values: *Quarry West End*, *Pile Driving East End*, and *Downtown Construction*, the values would appear as follows:

NO SORT	UP ARROW	DOWN ARROW
Pile Driving East End	*Downtown Construction*	*Quarry West End*
Quarry West End	*Pile Driving East End*	*Pile Driving East End*
Downtown Construction	*Quarry West End*	*Downtown Construction*

Logs sort one column at a time, they will reorder when the header of another column is clicked.

In the **Last Call Home** column, no arrow or the up arrow will show logs chronologically with the log that occurred first appearing first in the list. The down arrow will show logs in reverse chronological order.

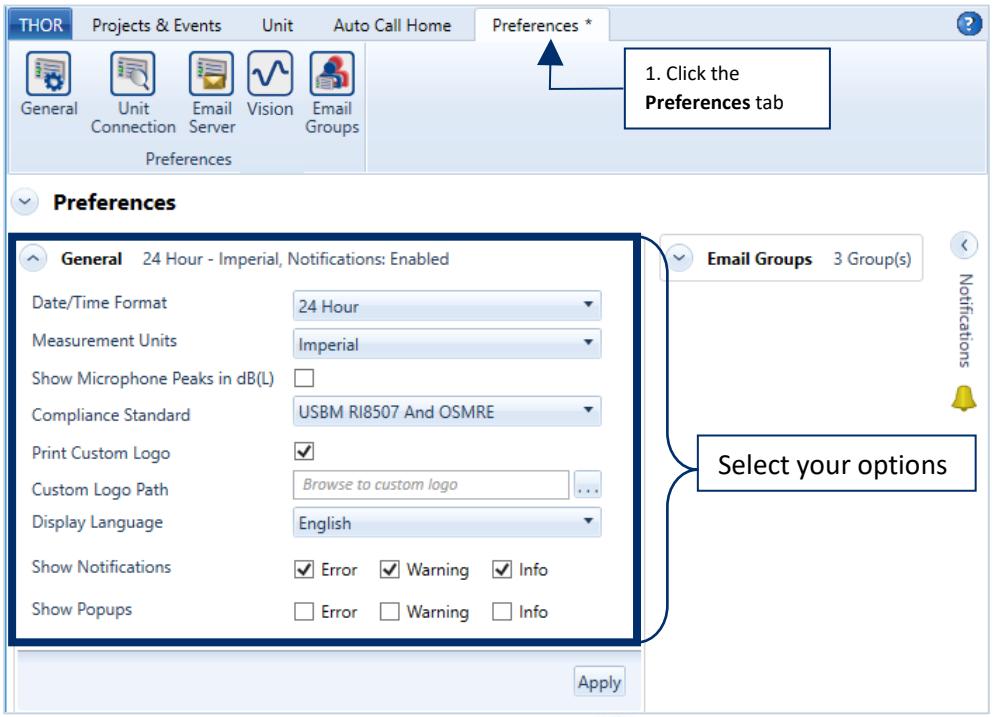
A chosen sorting will remain on the same computer until changed even after logging out. Logging back into the same computer with the same user name will keep the same sorting.

7. THOR PREFERENCES

7.1 GENERAL SETTINGS

The general Preferences are used by default. The **Projects & Events** section can override most of these settings (excludes Notifications). However, if they have not been configured at the Project level then these are taken as the Global default settings.

1 Click the **Preferences** tab.



NOTE If the General section is not expanded, click the Expand arrow.

FIELD	TYPE	DESCRIPTION
Date/Time format	Dropdown	Select between 24 hours and 12-hour (AM, PM) time.
Measurement Units	Dropdown	Select between Metric and Imperial units.
Show Microphone Peaks in dB(L)	Checkbox	Adds the microphone units in dB(L). They are expressed in Metric (Pascals-PA), or Imperial (Pounds per square inch - psi).
Compliance Standard	Dropdown	Select the Compliance Standard that applies to your region.
Print Custom Logo	Checkbox	Customize reports using your company logo.
Custom Logo Path	Browse menu	Indicate which file to use for the custom logo.
Display Language	Dropdown	Sets the default language used whenever a report is generated in a project. You can override this by setting the report language individually. See section 5.9.2 Configure Reports on page 117.
Show Notifications	Checkboxes	Check the types of notifications that will appear in the sidebar.
Show Popups	Checkboxes	Check the types of notification popups that briefly appear.

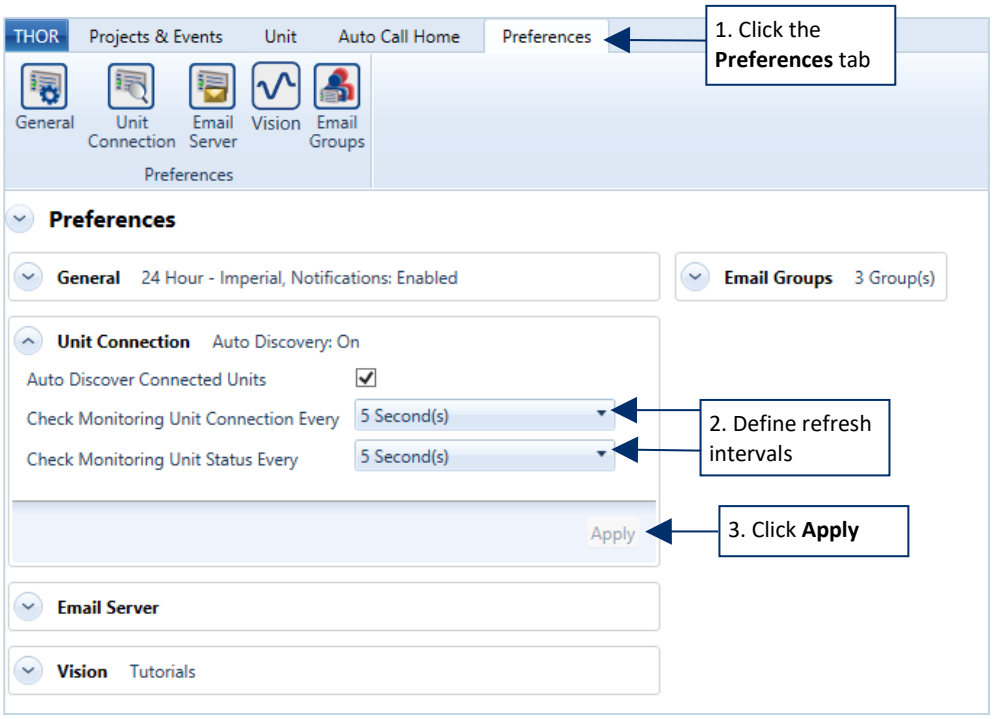
7.2 UNIT CONNECTION

THOR's Unit Details dashboard can check the unit connection and status automatically, communicating with units to retrieve the latest status information and displaying that information as it is updated.

WARNING Refreshing unit status automatically can use a significant amount of data, as the units are in constant communication with THOR.

7.2.1 CHECK THE CONNECTION / STATUS OF ALL UNITS AUTOMATICALLY

2 Click the **Preferences** tab.



4 Define refresh intervals for the two fields:

Check monitoring unit connection every

Check monitoring unit status every

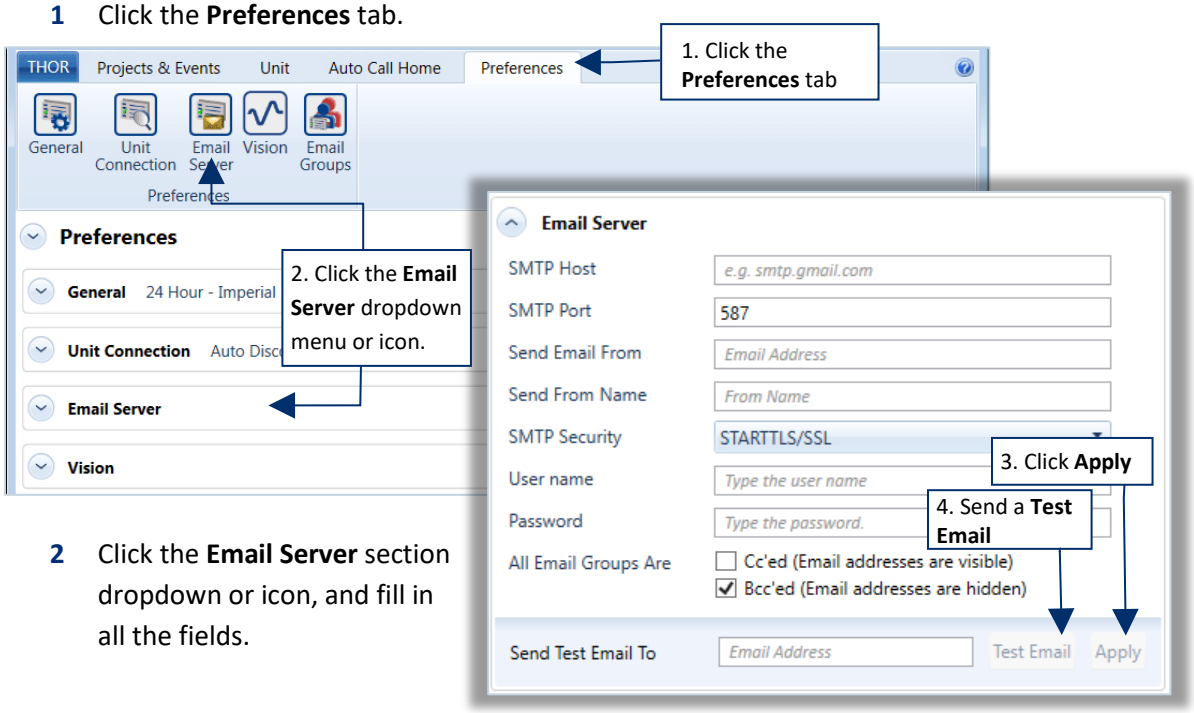
5 Click **Apply**.

NOTE The Auto Discover Connected Units function will monitor the computer's ports and detect any units that get connected to the computer. This is only to establish a connection. The following two settings determine the Dashboard display's refresh rate of the unit status. This means, for a refresh rate of 1 hour, if the unit's status changes within the hour, THOR will only reflect this change after one hour, or if the user chooses to refresh manually.

7.3 EMAIL SERVER SETTINGS AND EMAIL GROUPS

To use Auto Call Home email, you must configure the SMTP email server and test the connection.

1 Click the **Preferences** tab.



2 Click the **Email Server** section dropdown or icon, and fill in all the fields.

LABEL	DESCRIPTION
SMTP Host	Simple Mail Transfer Protocol Host.
SMTP Port	Simple Mail Transfer Protocol Port. By default, SMTP uses email port 587.
Send Email From	The email address you want to send an email from.
Send Email Name	The email name that will appear in the email notification.
SMTP Security	Choose between StartTLS/SSL and None. If you select None, the user name and password are optional, if you use them, they are transferred in clear text, with no encryption. The default SMTP port for None is port 25.
User name	Type the user name for your email account.
Password	Type the password for your email account.
All Email Groups Are	CC'ed: Everyone in the Email Group receives and sees who received the email. Bcc'ed: Everyone in the Email Group receives but does not see who received the email.
Send Test Email To	Tests the SMTP configuration by sending an email with the entered values.

3 Click the **Apply** button.

4 (Optional) Enter an email address into the *Send Test Email To* field and click the **Test Email** button.

NOTE If you don't know your SMTP information, contact your IT department. Some SMTP services do not allow modifications to the *Send Email From* and *Send Email Name* options.

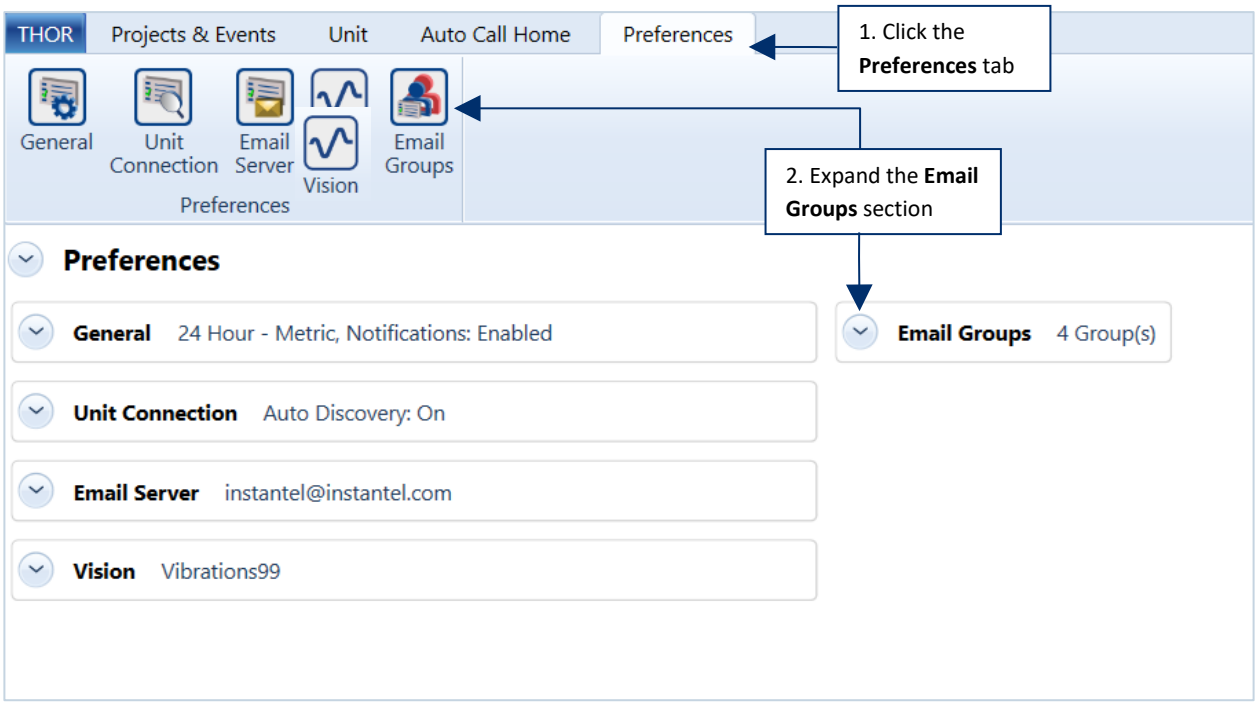
7.3.1 CONFIGURE EMAIL GROUPS / RECIPIENTS

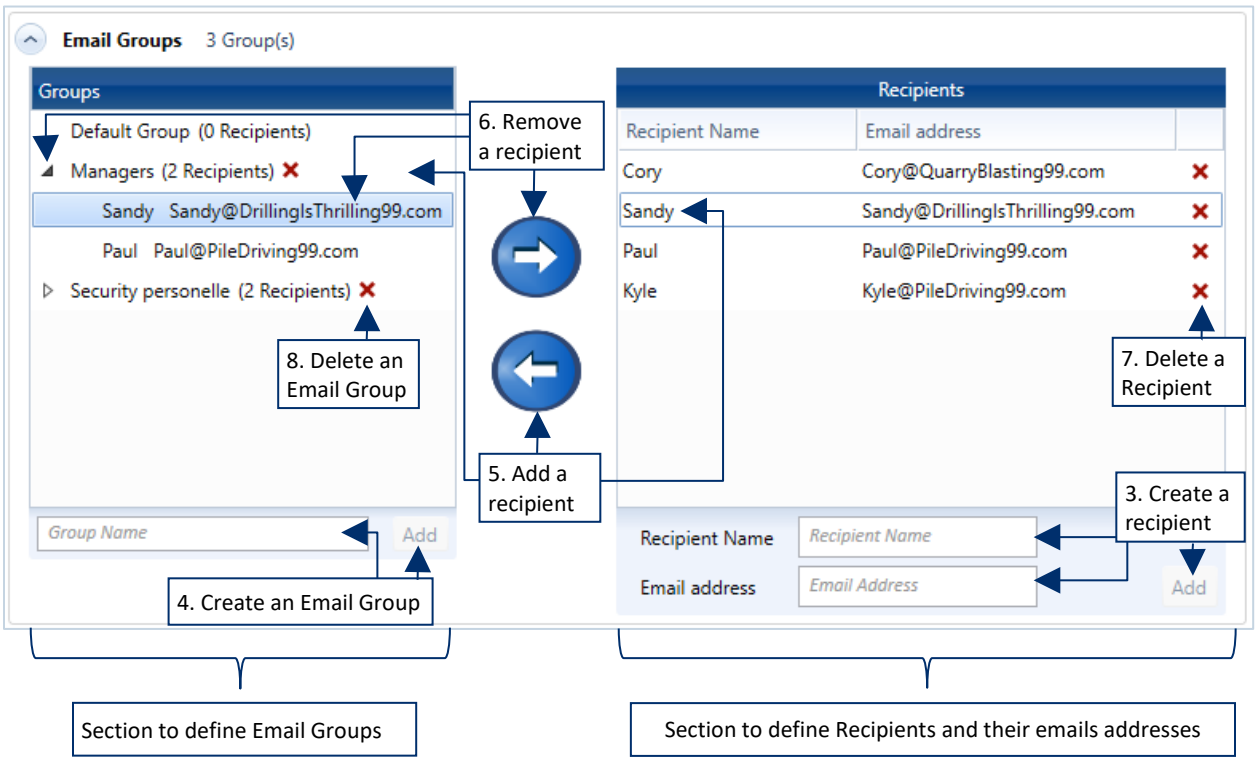
The Email Groups section contains two parts; one for defining groups and the other for registering contact emails (recipients). A distribution list (see section 6.2.2.4 *Email Distribution List* on page 146) is created using these defined groups. An Email Distribution List may contain numerous groups, but individual contacts must belong to at least one group.

- A recipient can be in multiple groups at any time.
- Recipient email addresses do not need to be in a group, they can remain as part of a pool of recipients for creating future lists. (To receive emails, they must belong to a group.)
- You can remove a recipient from a group and assign them to another group.
- To delete a recipient, it cannot be assigned to an email group.
- Removing a recipient from a group does not delete the recipient, it simply removes them from the group.

To configure email recipients and groups:

1. Click the **Preferences** tab.
2. Expand the **Email Groups** section.





3 Create Recipients by entering a **Recipient Name** and **Email Address** and clicking on **Add**. The new name will appear in the recipients' list. (Repeat this for as many recipients as needed.)

4 Create Email Groups by entering a **Group Name** and clicking on **Add**. (Repeat this for as many groups as needed.)

NOTE You can rename an existing group by double-clicking on the group.

5 To **Add a Recipient** to an Email Group, first select the Email Group then select the Recipient and click the left arrow.

6 To **Remove a Recipient** from an Email Group, Select the Email Group, then select the Recipient in the Group and click the right arrow. (This does not delete the Recipient but disassociates it with that group.)

7 To **Delete a Recipient**, click the Delete icon next to the Recipient's name. (You can only delete a Recipient if they are not associated with a group)

8 To **Delete an Email Group,** click the Delete icon next to the Email Group's name.

7.3.1.2 USING AN SMS SERVICE

Emails can be sent to mobile phones using an SMS service. You may need to contact your carrier to configure this option. Here is a list of commonly used carriers in North America.

- Bell: [10-digit phone number]@txt.bell.ca
- Bell MTS: [10-digit phone number]@text.mtsmobility.com
- Chatr: [10-digit phone number]@pcs.rogers.com
- Eastlink: [10-digit phone number]@txt.eastlink.ca
- Fido: [10-digit phone number]@mms.fido.ca
- Freedom: [10-digit phone number]@txt.freedommobile.ca
- Koodo Mobile: [10-digit phone number]@msg.koodomobile.com
- PC Mobile: [10-digit phone number]@mobiletxt.ca
- Public Mobile: [10-digit phone number]@msg.telus.com
- Rogers: [10-digit phone number]@pcs.rogers.com
- Sasktel: [10-digit phone number]@sms.sasktel.com
- TBayTel: [10-digit phone number]@pcs.rogers.com
- TELUS: [10-digit phone number]@msg.telus.com
- Virgin Mobile: [10-digit phone number]@vmobile.ca

- T-Mobile number@tmomail.net
- Virgin Mobile number@vmobl.com
- AT&T number@txt.att.net
- Sprint number@messaging.sprintpcs.com
- Verizon number@vtext.com
- Tracfone number@mmst5.tracfone.com
- Ting number@message.ting.com
- Boost Mobile number@myboostmobile.com
- U.S. Cellular number@email.uscc.net
- Metro PCS number@mymetropcs.com

7.4 VISION SETTINGS

7.4.1 VISION INTRODUCTION

Vision is Instantel's cloud-based hosting application for event data. When data is uploaded using Auto Call Home, Vision provides secure, encrypted web-based access to the latest information from any desktop, laptop or tablet with internet access. With web-based hosting, stakeholders can access data efficiently, providing instant sharing for time-sensitive projects.

Vision's functionality includes:

- Access data, anytime, anywhere
- Control user access levels for sensitive information
- Visualize vibration and overpressure trends immediately
- Localize units on a map
- Sharing information
- Set alarm and warning levels per project
- Print event reports with customized information
- Secure storage of Event Monitoring Data in the cloud

NOTE For more information on trial versions or for purchasing a Vision license please contact sales@instantel.com.

7.4.2 VISION WEB INTERFACE

The first time you must log in to Vision's web interface at https://vision.instantel.com with the username and one-time password that you received from Instantel. Upon logging in, you must create a Company and set up the **Web Service User Name** and the **Web Service Password**.

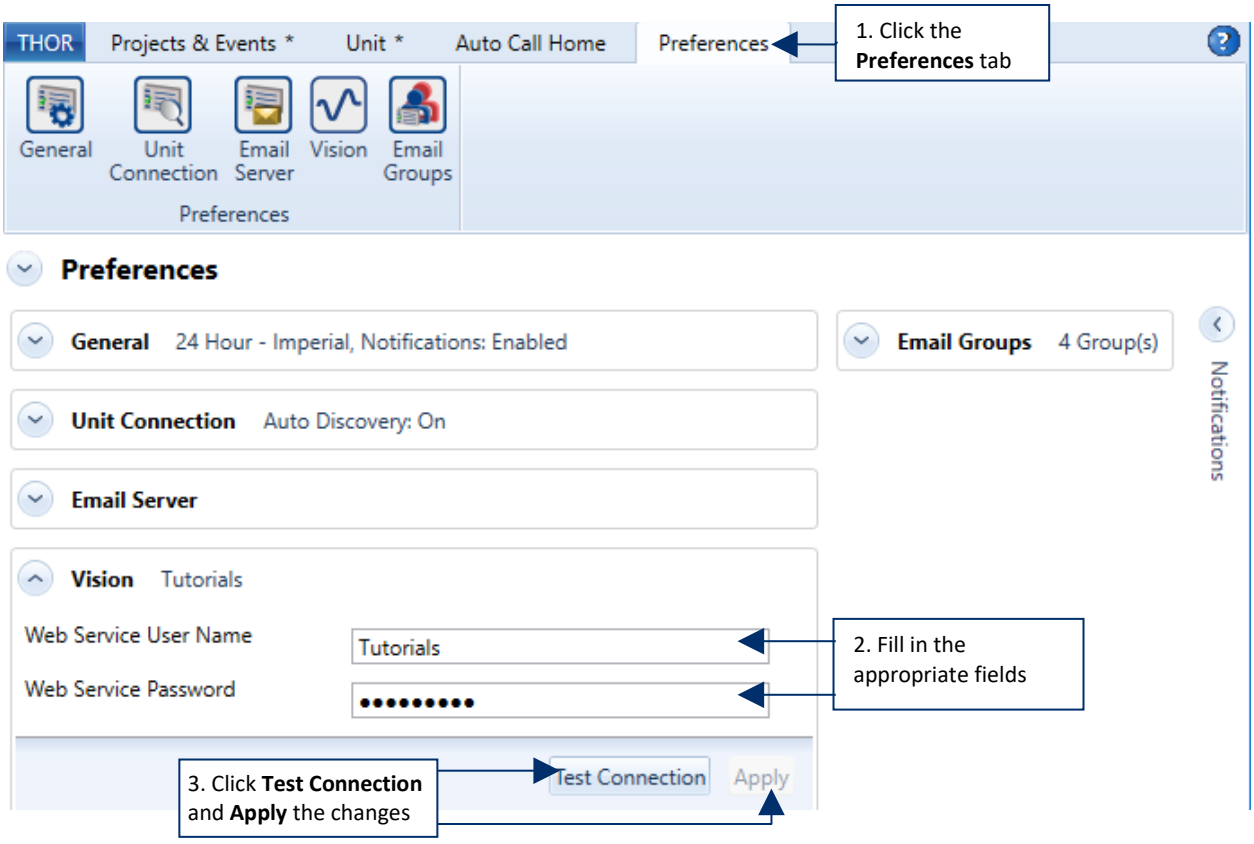
7.4.3 DEFAULT VISION SETTINGS

The default Vision settings are always used unless overridden by individual projects that configured their project-specific settings. When you create a new project, you can choose whether that project will use the existing user name and password, or use a project-specific user name and password.

1. Click the **Preferences** tab.
2. Fill in the mandatory fields.

Once you have created a **Web Service User Name** and the **Web Service** Password on the Vision web interface, they can be entered in THOR. Once THOR has established a connection it can upload data to your Vision account.

3. Click **Test Connection** to verify the web service link and click **Apply** to register the changes.

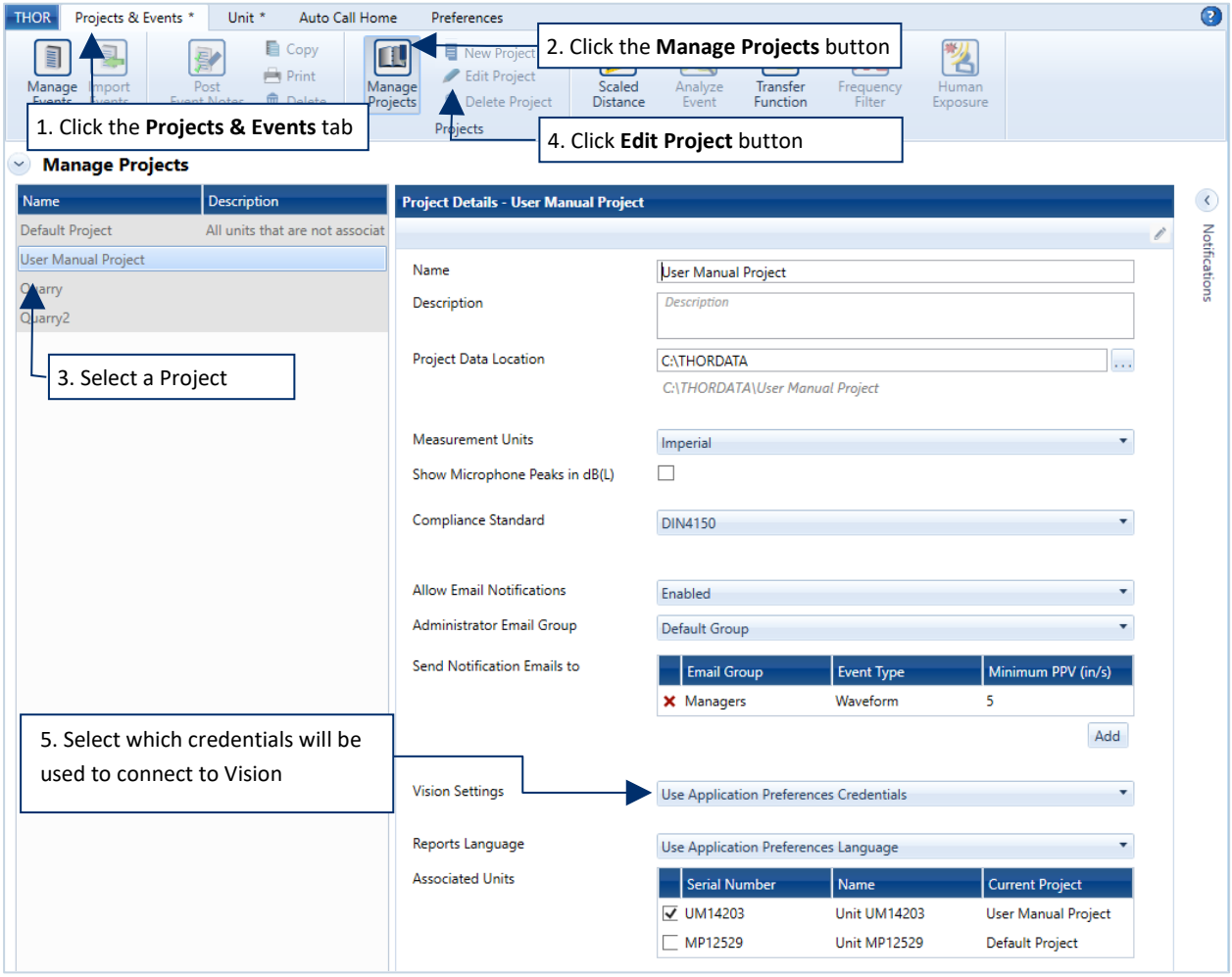


7.4.4 PROJECT VISION SETTINGS

When you configure a project for Vision, you must choose whether the project will use the default **Web Service** user name and password set up in **Preferences** or a **Project Specific** user name and password. You can also decide that the project will not send any event data to Vision.

1. Click the **Projects & Events** tab
2. Click the **Manage Projects** button
3. Select a Project
4. Click the **Edit Project** button
5. In the **Vision Settings** field, select one of the following options:

Use the **Project Specific Credentials** if you are a dealer hosting a project for a client.



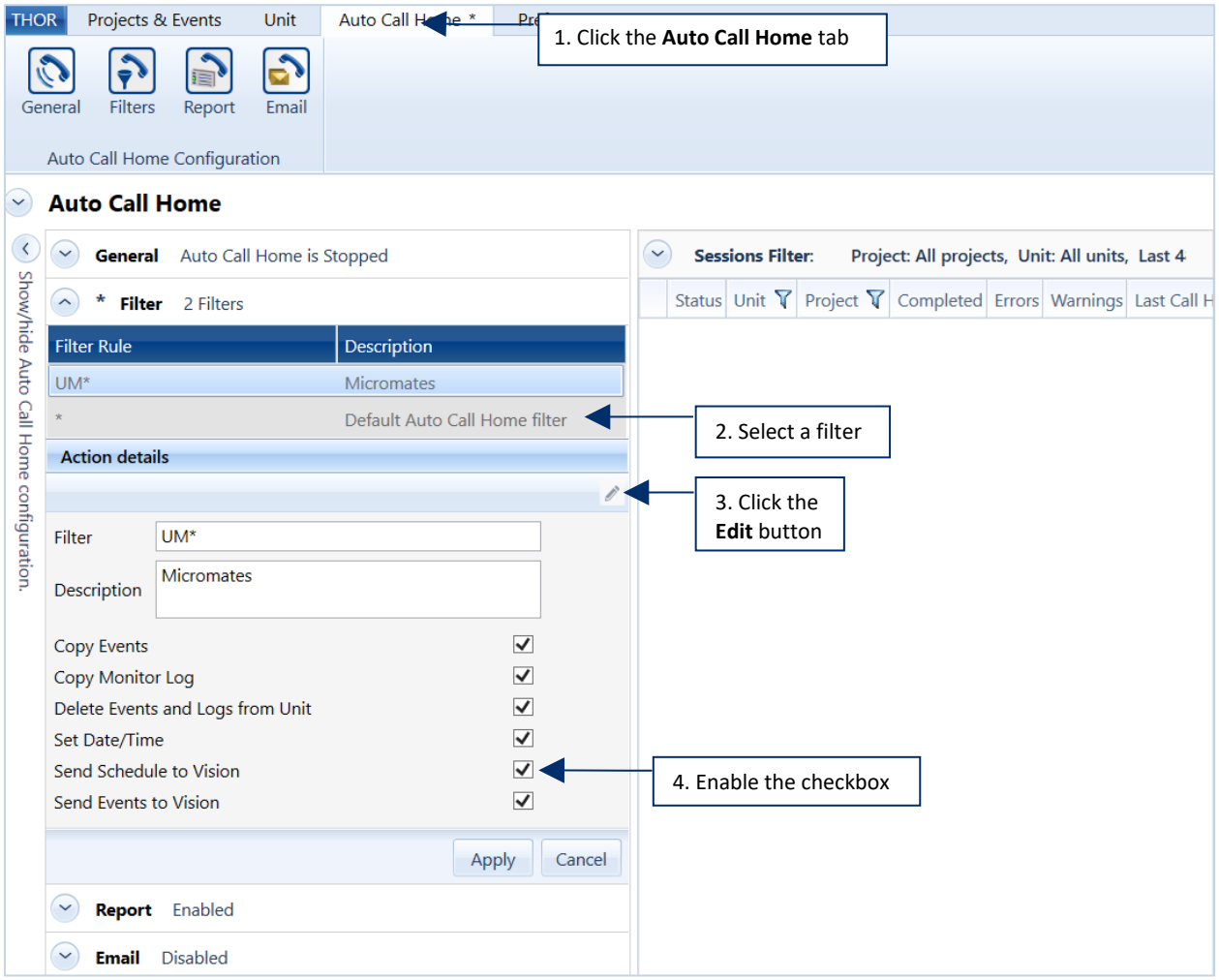
7.4.5 SEND DATA TO VISION USING ACH

Before event data can be uploaded to Vision, ensure:

- You have a valid Vision license.
- You have set up your Vision **Web Service User Name** and **Web Service Password**. (see section 7.4.3 *Default Vision Settings* on page 164)
- You set up the unit to properly communicate with THOR. (See section 6.2.1 *Configure Units for ACH* on page 140)
- Auto Call Home is running (see section 6.3.1 *Start / Stop Auto Call Home* on page 150)
- The ACH filter is set up to send events to Vision (see section 7.4.5.1 below)

7.4.5.1 SET UP ACH FILTER TO SEND EVENTS TO VISION

1. Click the **Auto Call Home** tab.
2. In the **Filter** section, select a filter.
3. Click the **Edit** button.
4. Enable the Checkbox **Send Events to Vision**.
5. Click **OK** to validate.



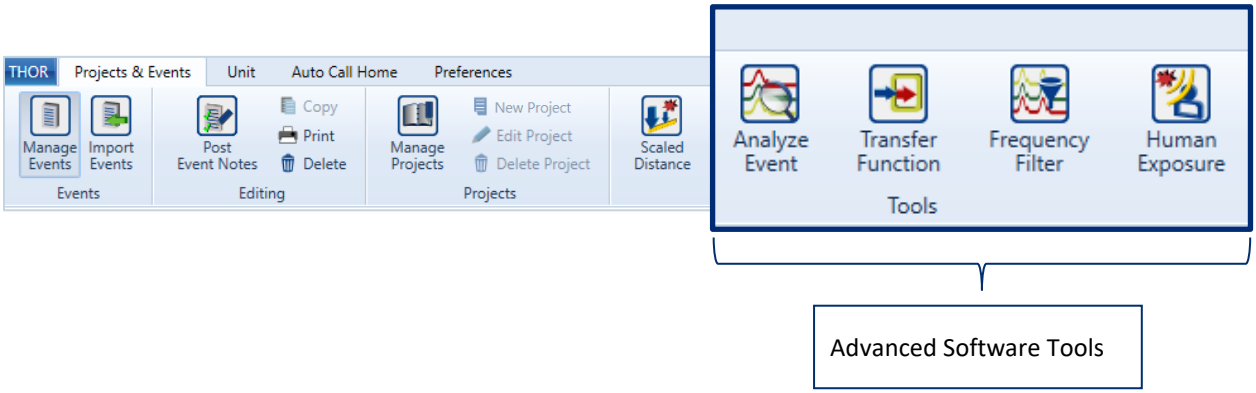
8. ADVANCED THOR FEATURES

8.1 INTRODUCTION

This chapter describes the optional Advanced module which offers additional features and capabilities to the THOR program. Features include **Advanced Unit Setup Files** that can be configured to use sample rates ranging from 512 sps to 65,536 sps, and the ability to configure virtually any type of sensor that can connect to the Minimate Pro monitors. The advanced module is enhanced with **Software Tools** that allow you to perform waveform analysis regardless of the data source (Series III, Minimate Plus, Minimate Pro, Micromate). You can perform FFT calculations and determine the frequency of a waveform at any point with the easy to use Windows® interface.

The Advanced module is designed to easily integrate with the Compliance module. It adds features to the Compliance module without changing the look and operation of the THOR software, allowing you to easily begin using the software. It builds on the Compliance module.

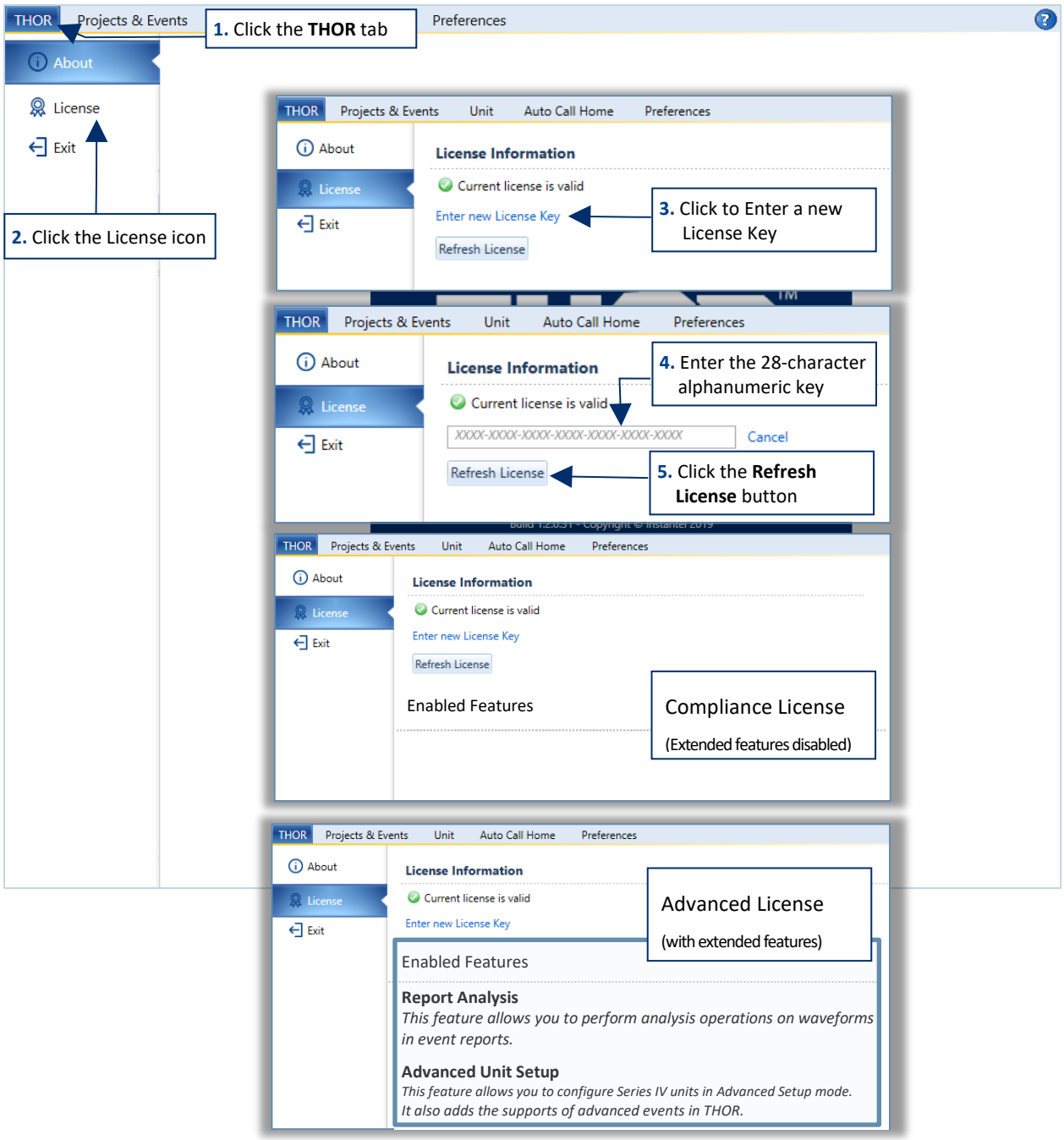
This section of the manual explains the new Advanced module features without repeating the Compliance module information. All operations that are performed using the Compliance module remain available from the THOR menus.



8.2 ACCESS ADVANCED MODE

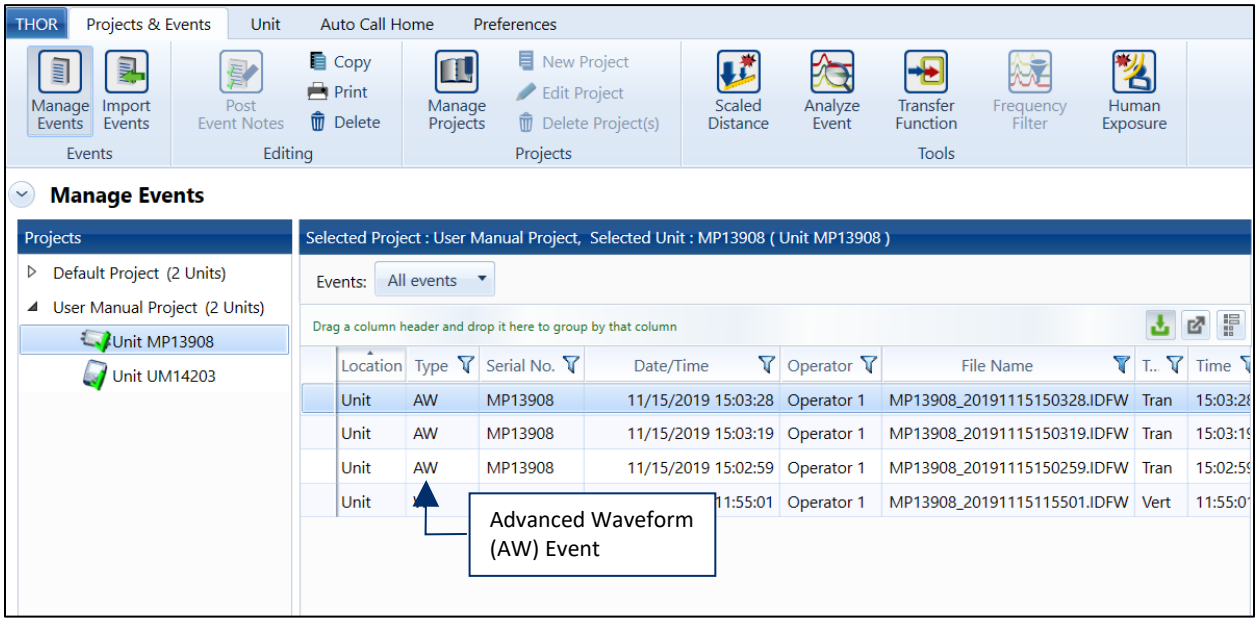
To access the Advanced mode:

1. Click on the THOR tab
2. Click on the License icon
3. Click on the "Enter new License key" link
4. Enter the 28-character alphanumeric key for your advanced license
5. Click the Refresh License button



8.3 ADVANCED EVENTS

Minimate Pro units that are configured with an Advanced Unit Setup File can record Advanced Waveform (AW) and Advanced Histogram (AH) events.



Using THOR, you can work with advanced events in the same way as you do with regular events. You can:

1. View advanced events
2. Import advanced events to a computer
3. Browse advanced events
4. Delete events
5. Group and filter events
6. Print and export events

You can also create reports on advanced events.

For more information about reports, see section 5.9 Reports on page 113

When event monitoring data is loaded into THOR, it is added to a project. Using projects to organize events is optional, in the absence of any projects, all events are stored in the default project.

The purpose of creating projects is to group related events, such as on a single job, or location.

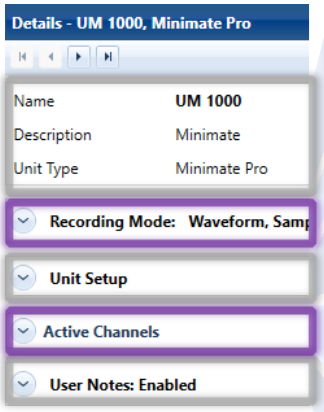
8.4 MANAGING UNIT SETUP FILES ADVANCED

The setup file is composed of 5 parts, shown here for a quick overview. These parts can collapse for ease of use. The Advanced setup contains different fields from the Compliance setup.

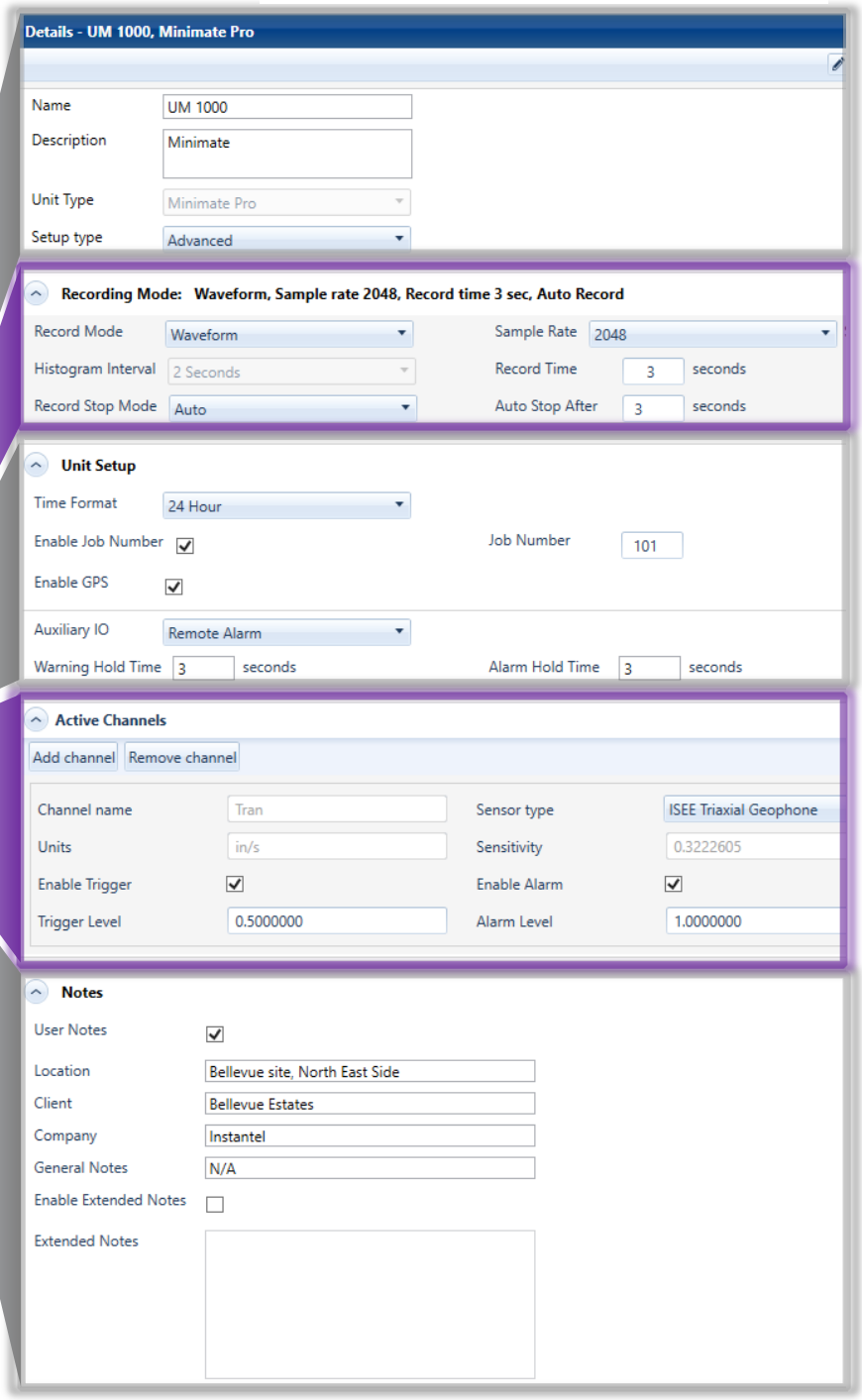
All components are described in detail in the following tables.

1. Name, Description and Unit type
2. Recording Mode
3. Unit Setup
4. Active Sensors
5. User Notes

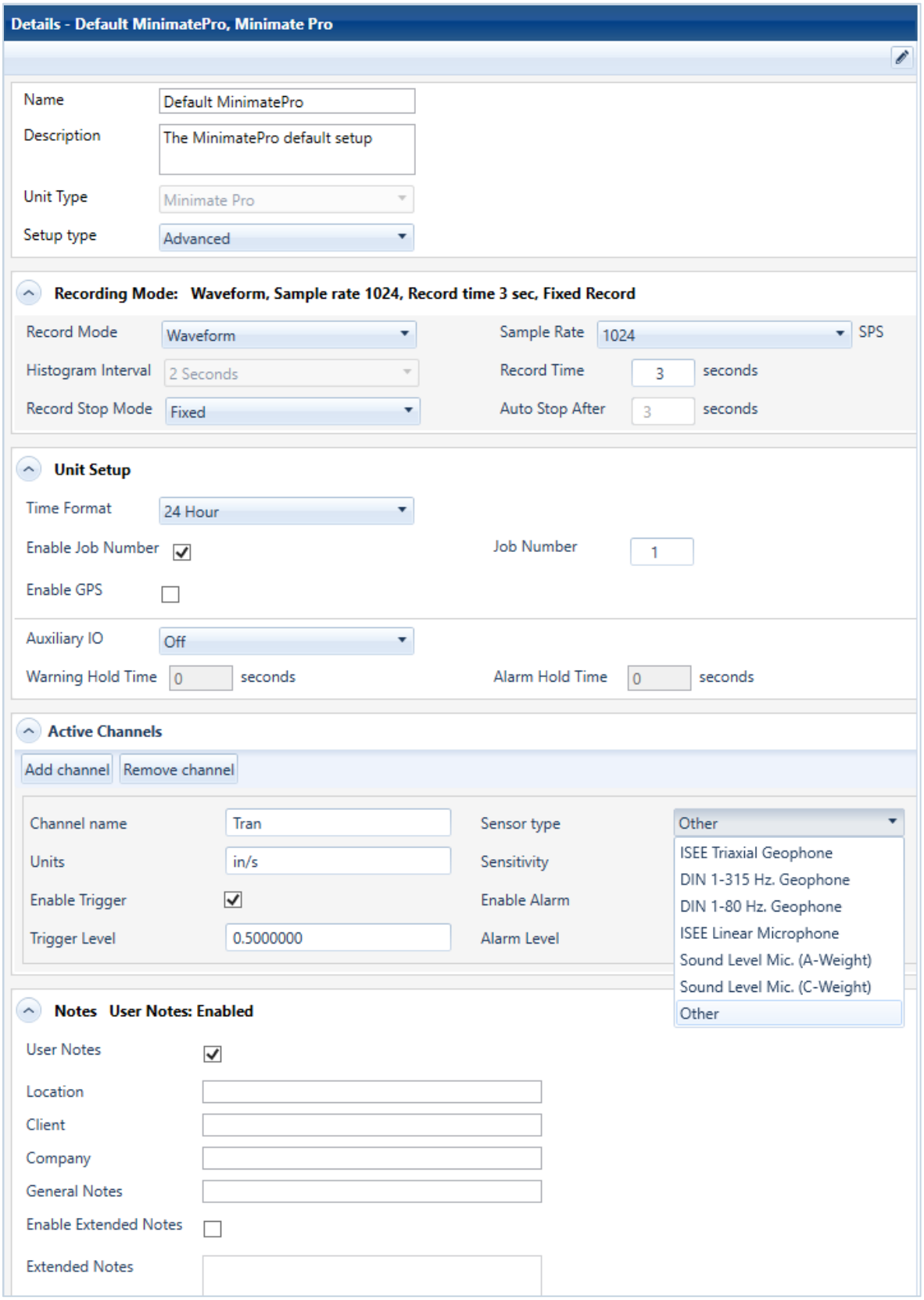
Condensed View



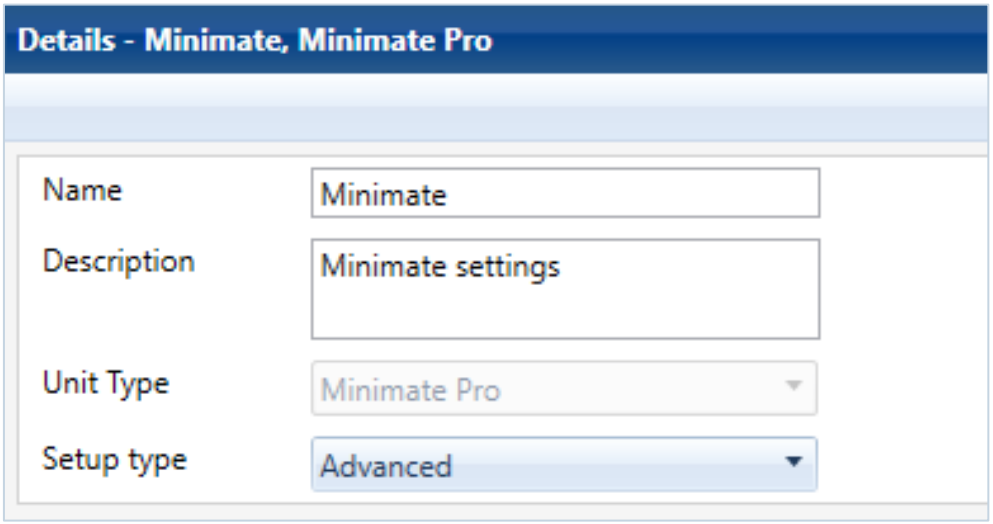
Expanded View (also on next page)



Expanded View - Minimate Pro Advanced



8.4.1 DETAILS – NAME, DESCRIPTION AND UNIT TYPE



FEATURE	VALUE	DESCRIPTION
Name	Text	Choose a name that will easily identify the unit. (E.g. “Waveform Series IV” for waveform monitoring)
Description	Text	Describe the unit for reference purposes (E.g. Quarry 2)
Unit Type	Minimate Pro	Only Minimate Pro units can be configured with the advanced feature. (E.g. Choosing Unit Type = Micromate will not give the option to choose Setup type)
Setup type	Compliance	The Standard Compliance setup.
	Advanced	You must have an extended license to use the advanced features. It offers possibilities to define the active sensors per channel. (Only available for Minimate Pro units.)

8.4.2 DETAILS – RECORDING MODE

FEATURE	VALUE	DESCRIPTION
Record Mode	Waveform	To record multiple events automatically without missing any time between events. (Ex: Blasting) The unit records an event, displays the results, and continues to monitor for events exceeding the trigger level to record.
	Waveform Manual	Used when automatic triggers are unreliable due to high wind or nearby vehicle activity. Used also to record background noise levels near a site.
	Histogram	For long-term recording periods. (Ex: Pile driving) The unit stores summary information in intervals. The unit gathers continuous data based on the sample rate but only registers relevant peaks for the interval. (This reduces the recorded data and increases the storage capacity.) For each **interval**, the unit calculates the maximum peaks, the largest peak frequency, and the peak vector sum. For each **channel**, the unit calculates the maximum peak and its frequency. It also calculates the largest peak vector sum over the entire event, displaying the peak of each interval in a bar chart.
Histogram Interval	2 sec to 60 minutes	Defines the sample interval for Histogram/Histogram Combo mode
Record Stop Mode	Fixed / Auto	Sets how the unit stops recording once triggered**.** **Fixed record** time sets the recording time to a specified length. **Auto record** continues to record event activity as long as the activity remains above the trigger level (sufficient memory and battery power must be available). Recording stops a specified period after the event activity falls below the trigger level. Used when there is an uncertainty of the actual event duration.
Sample Rate	512, 1024, 2048, 4096, 8192, 16384, 32768, 65536	Increasing the sample rate increases the accuracy of the waveform recording. ***NOTE:*** Higher sample rates use more battery and memory resources.
Record Time	1 – 32400 seconds, depends on Sample Rate and number of channels used	When an event is triggered the unit will record for this defined length of time. The upper value depends on the Sample Rate. E.g. For a Sample Rate of 512 SPS and 6 channels, the maximum record time = 32400 seconds.
Auto Stop After	1-9 seconds	When in Record Stop Mode – Auto Record: Recording stops a specified period after the event activity falls below the trigger level.

8.4.3 DETAILS – UNIT SETUP

FEATURE	VALUE	DESCRIPTION
Time Format	24 Hour / 12 Hour (AM/PM)	Displays time in either 24 hours or 12 hours (AM, PM).
Enable Job Number	Checkbox	Used by THOR to keep track of recorded events. (Optional, and must be between 1 and 9999)
Job Number	1 - 9999	Helps keep track of recorded events.
Enable GPS	Checkbox	Used for time synchronizing event data. ***NOTE:*** The GPS is a factory-installed option.
Auxiliary IO	External Trigger	The unit will record an event based on an external trigger instead of exceeding a threshold measurement value.
	Remote Alarm	The auxiliary port will send a signal that can be used for activating an alarm (siren, beacon or other)
	Off	The Auxiliary port is not used.
Warning Hold Time	2 sec to 300 sec	Only used when the Auxiliary IO port is set to “Remote Alarm” This defines how long a warning signal is active.
Alarm Hold Time	2 Sec to 300 sec	Only used when the Auxiliary IO port is set to “Remote Alarm” This defines how long an alarm signal is active.

8.4.4 DETAILS – ACTIVE SENSORS / CHANNELS

This section defines the various sensors available, they can be added one at a time. Each sensor has different default settings and options that appear when selected. (Though the setup parameters may be identical, sensors are specific to the unit type. This means that units cannot interchange their physical sensors as they have different connectors.)
The following table describes the sensor options.

<table>
<tr><th>FEATURE</th><th>VALUE</th><th colspan="4">DESCRIPTION</th></tr>
<tr><td>Add channel</td><td>Button</td><td colspan="4">A channel is defined and then a sensor is attributed to that channel.
(Advanced setup feature only for Minimate Pro units)</td></tr>
<tr><td>Remove channel</td><td>Button</td><td colspan="4">Removes a defined channel with an attributed sensor.
(Advanced setup feature only for Minimate Pro units)</td></tr>
<tr><td>Channel name</td><td>Based on the sensor type</td><td colspan="4">The Channel name will automatically populate when a sensor is selected in the “Sensor type” field. When “Other” is selected you can define an arbitrary Channel name.</td></tr>
<tr><td rowspan="8">Sensor Type

(predefined sensor settings based on sensor type)</td><td colspan="2"></td><td>Channel Name</td><td>Units</td><td>Sensitivity</td></tr>
<tr><td colspan="2">ISEE Triaxial Geophone</td><td>Tran/Vert/Long</td><td>in/s
or
mm/s</td><td>0.3222605 in/s
0.0126774 mm/s</td></tr>
<tr><td colspan="2">DIN 1-315 Hz Geophone</td><td>Tran/Vert/Long</td><td>in/s
or
mm/s</td><td>0.3222605 in/s
0.0126774 mm/s</td></tr>
<tr><td colspan="2">DIN 1-80 Hz Geophone
(Complies with the DIN 45669-1 Class I standard.)</td><td>Tran/Vert/Long</td><td>in/s
or
mm/s</td><td>0.3222605 in/s
0.0126774 mm/s</td></tr>
<tr><td colspan="2">ISEE Linear Microphone
(Complies with the DIN 45669-1 Class I standard.)</td><td>MicL</td><td>psi
or
pa</td><td>44.4496536 psi
0.0064452 pa</td></tr>
<tr><td colspan="2">Sound Level Mic.
(A-Weight)
Records air overpressure. Frequency range: 2 – 250 Hz, Amplitude 2 – 500 Pa,</td><td>Mic</td><td>Pa</td><td>0.0038000</td></tr>
<tr><td colspan="2">Other</td><td>Choose any 5 characters to define a channel name</td><td>Choose any 6 characters to define your units</td><td>Define your own sensitivity</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Enable Trigger</td><td>Checkbox</td><td colspan="4">A defined threshold before monitoring can begin. This should be set high enough to prevent monitoring noise and low enough to catch all events. (Histogram Combo mode triggers will initiate waveform recording)</td></tr>
<tr><td>Enable Alarm</td><td>Checkbox</td><td colspan="4">Use the selected sensor as a trigger source. (Once triggered, all channels will begin to record data.) When enabled it will send a warning signal to the Auxiliary port (if the trigger level is surpassed).</td></tr>
</table>

FEATURE	VALUE	DESCRIPTION	
Trigger Level	Ranges depend on selected Sensor type	ISEE Triaxial Geophone	0.005 to 10 in/s
			0.128 to 254 mm/s
		DIN 1 – 315 Hz. Geophone	0.005 to 10 in/s
			0.128 to 254 mm/s
		DIN 1 – 80 Hz. Geophone	0.005 to 10 in/s
			0.128 to 254 mm/s
		ISEE Linear Microphones	0.256 to 500 pa
			0.00029 to 0.0725 psi
		Sound Level Mic. (A-Weight)	0.448 to 100 pa
		Sound Level Mics (C-Weight)	0.01424 to 25 pa
Alarm Level	Ranges depend on selected Sensor type	ISEE Triaxial Geophone	0.5 to 10 in/s
			12.7 to 254 mm/s
		DIN 1 – 315 Hz. Geophone	0.5 to 10 in/s
			12.7 to 254 mm/s
		DIN 1 – 80 Hz. Geophone	0.5 to 10 in/s
			12.7 to 254 mm/s
		ISEE Linear Microphone	68.95 to 500 pa
			0.01029 to 0.0725 psi
		Sound Level Mic. (A-Weight)	40 to 100 pa
		Sound Level Mics (C-Weight)	1 – 25 pa

8.4.5 DETAILS –NOTES

Notes are included with every event recorded by the unit using that particular setup file.

FEATURE	VALUE	DESCRIPTION
User Notes	Checkbox	Enable/disable the use of notes
Location	Text box	Field to define the location where the unit is recording data. Max 40 Characters
Client	Text box	Field to define the Client where the unit is recording data. Max 40 Characters
Company	Text box	Field to define the name of the Company to whom the unit belongs. Max 40 Characters
General Notes	Text box	Field for custom purposes. Max 40 Characters
Enable Extended Notes	Checkbox	Enable/disable the use of extended notes
Extended Notes	Text box	Field to include supplementary information with the recorded data. Max 640 characters

8.4.6 ADD/EDIT/DELETE/COPY, UNIT SETUP FILES

1 Click the **Unit** tab.

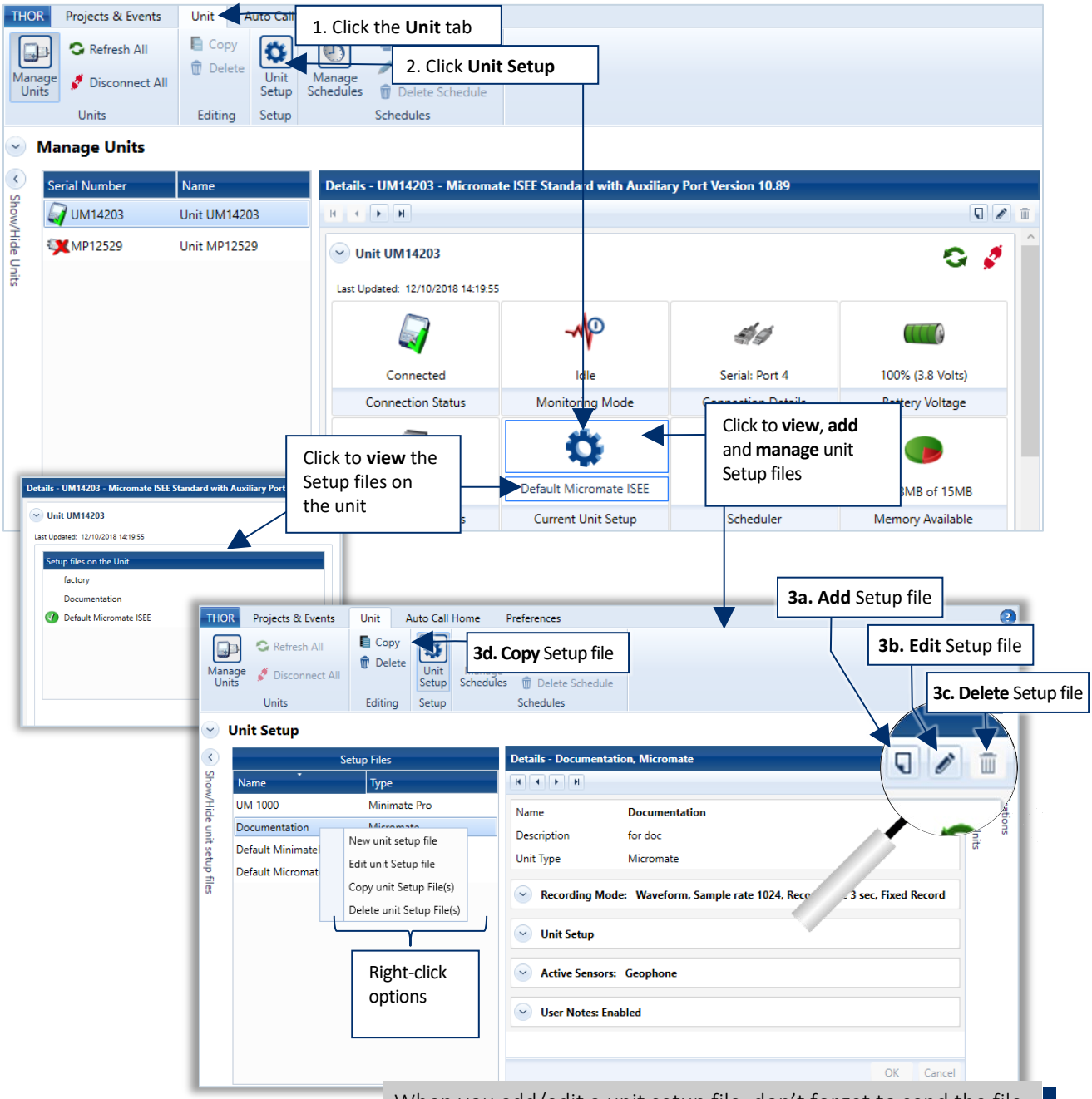
2 Click the **Unit Setup** button on the menu bar or in the Dashboard

3a. To add a setup file click the **Add** icon (or right-click the unit and **New Unit Setup File**)

3b. To edit a setup file click the **Edit** icon (or right-click the unit and **Edit Unit Setup File**)

3c. To delete a setup file click the **Delete** icon (or right-click the unit and **Delete Unit Setup File**)

3d. To copy a setup file click the **Copy** icon (or right-click the unit and **Copy Unit Setup File**)



When you add/edit a unit setup file, don't forget to send the file to the unit! It will automatically become the active setup file.

see Transferring Setup Files on page 179.

8.4.7 TRANSFERRING SETUP FILES

Loading a setup file will copy a unit's setup file to THOR. This can then be edited and sent back to the unit. The setup file may also be used as a template to send to other units.

Procedure to Load or Send a Setup file

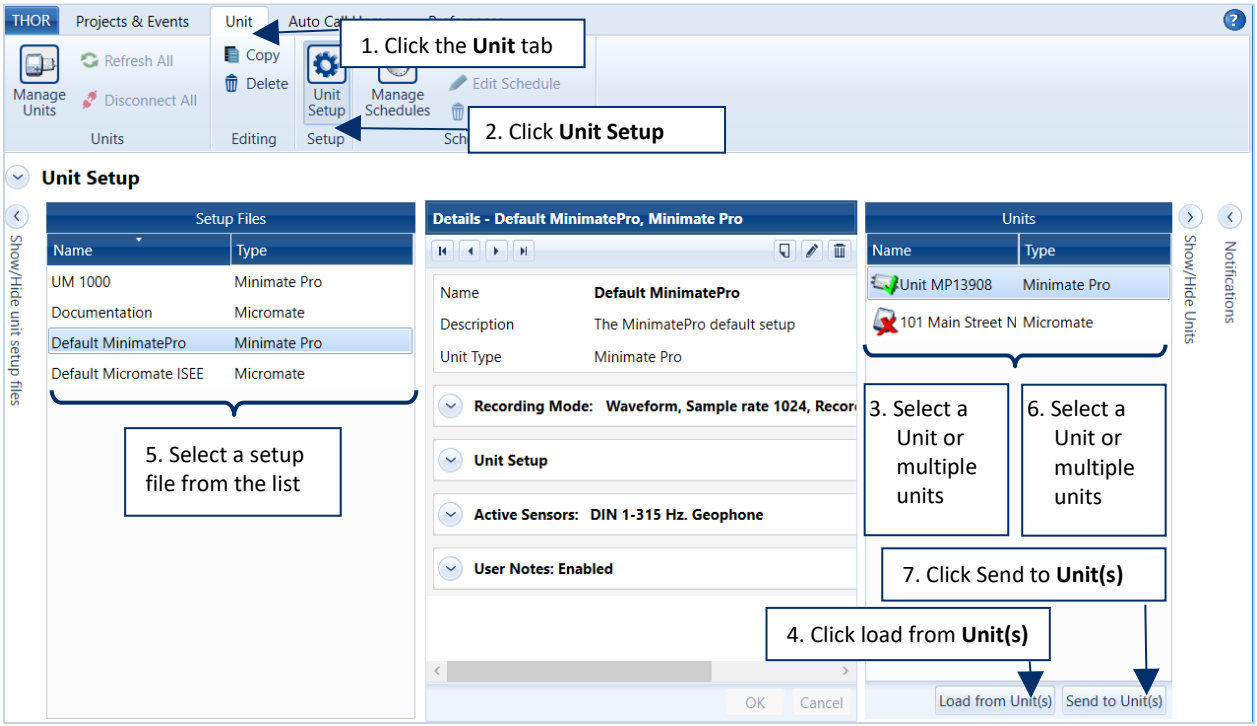
1. Click the Unit tab.
2. Click the Unit Setup button.
3. Select a unit or multiple units.
4. Click **Load from Unit(s)** to download the unit's setup file into THOR. (You can also select multiple connected units and import them in one shot.)

Or:

5. Select a setup file from the list.
6. Select one or multiple Units to send the file.
7. Click **Send to Unit(s)** (to transfer a single setup file to one or multiple units).

WARNING

When THOR sends a **Unit Setup** file to a unit, it becomes the current setup on the unit. If the unit setup happens to have the same name as the unit setup of the existing unit, it will overwrite the file.



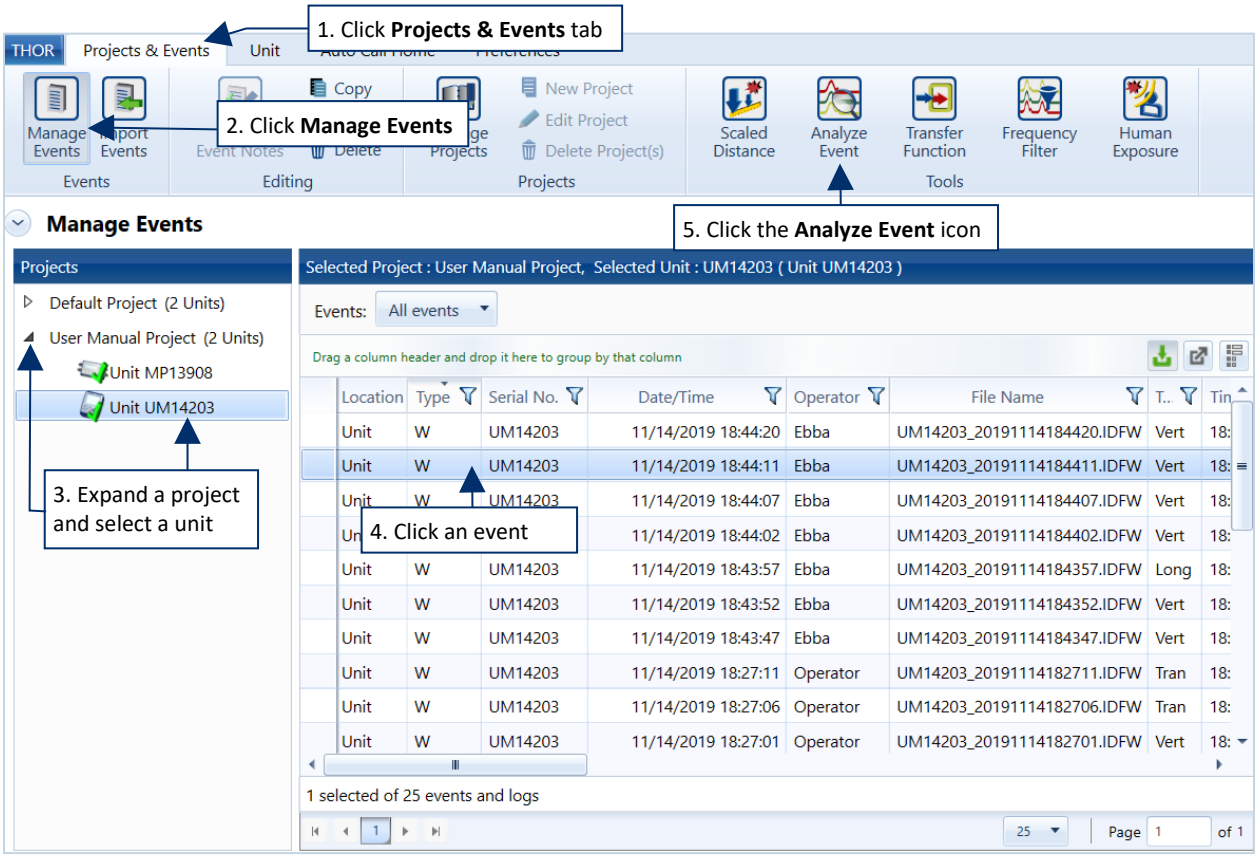
NOTE Once a setup file is loaded into THOR, it will appear in the Setup files list, ready to edit. If the setup file has a name conflict, you must decide to overwrite the existing file or rename it.

8.5 ANALYZE EVENT TOOL

THOR's built-in Analyze Events Tool can perform various operations to isolate Waveform event data of interest. (Not applicable to histogram events).

To access the Analyze Event Tool

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Expand a project and select a unit to view events and logs associated with the unit.
4. Click an event.
5. Click the **Analyze Event** icon



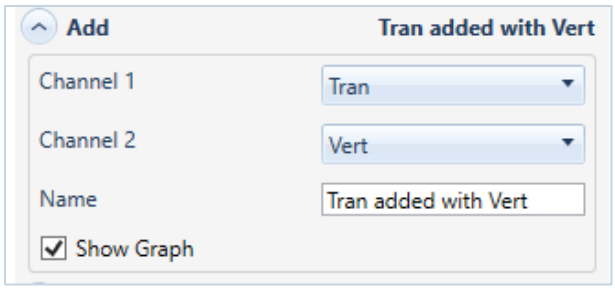
The following table outlines the lists of operations THOR can perform on Event data.

OPERATION	DESCRIPTION
Add	This operation adds two waveforms together in one Event.
Create Waveform	With this operation, you can enter amplitudes and frequencies of one or more sinusoidal waveforms, which are then combined to create a complex waveform.
Differentiate	This operation differentiates a velocity waveform to obtain the acceleration values along the waveform.
Fast Fourier Transformation (FFT)	Use this Fast Fourier Transform (FFT) operation when you want to break down a complex time-domain waveform into its individual frequency domain components.
Filter	The Filter operation can perform a series of functions to condition waveforms. The Low Pass, High Pass, and Bandwidth Pass perform filtering on waveform data in the frequency domain.
Human Exposure	Use this operation to calculate frequency-weighted Vibration Dosage Value (VDV) and Root Mean Square (RMS). This operation helps understand the effects of different frequencies on people nearby.
Integrate	This operation integrates a velocity waveform to obtain displacement values along the waveform.
Interval Analysis	This operation produces a color plot with the frequency displayed on the x-axis, delay interval on the y-axis, and a measure of the energy content (y-axis value of a standard FFT plot) represented using different color bands.
Linear Super Position	Use this operation to shift and superimpose a source waveform event linearly. This operation applies the timeline file you select to the source file to produce a simulated waveform.
Octave Data Conversion	Use this operation for advanced waveforms, to calculate the Root Mean Square (RMS) of a channel, with or without conversion to dB. This operation shows the frequency weighted values from an unfiltered event.
Peak Hold	The Peak Hold command allows you to remove negative excursions from waveforms. Use this operation to show the maximum amplitude of a waveform. This operation holds the channel peaks steadily until the next peak
Remove Offset	Use this operation to remove the offset from a waveform centering in on the X-axis.
Scale	This operation changes the measurement units and offset value for a waveform. Use this operation to scale a waveform up or down, depending on the scale factor you select.
Shift	This command shifts the currently selected waveform forward or backward on the time axis. The waveform's absolute time does not change. This changes the waveforms trigger offset.
Signature Hole	Signature Hole Analysis Operation is used to create and analyze theoretical blast vibration data based on your input range of blast timing parameters and a Signature Hole Waveform.
Smooth	The Smooth operation is used to average consecutive data points of a waveform.
Sound Calculations	Use this operation to recalculate channel data using sound specific criterion.
Subtract	Use this operation to subtract two waveforms.
Third Octave Band	The Third Octave is a frequency band tool that has a width that is only 1/3 of the width of an octave, displayed in Hz.
Timeline Overlay	Use this operation to show the blast timing on a waveform. This operation applies the timeline file you select to the channel.
Truncate	This command truncates a waveform by removing unwanted sections.
Vector Sum	The Vector Sum operation performs a point by point vector addition of selected waveforms. Vector sums can be calculated for two or three waveforms.

8.5.1 ADD OPERATION

This operation adds two waveforms together in one Event.

To **Add** waveforms, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration click on the **Edit Preset** icon or add a new preset. Click the **Add New** dropdown menu and select the **Add** operation. The following dialog box appears.



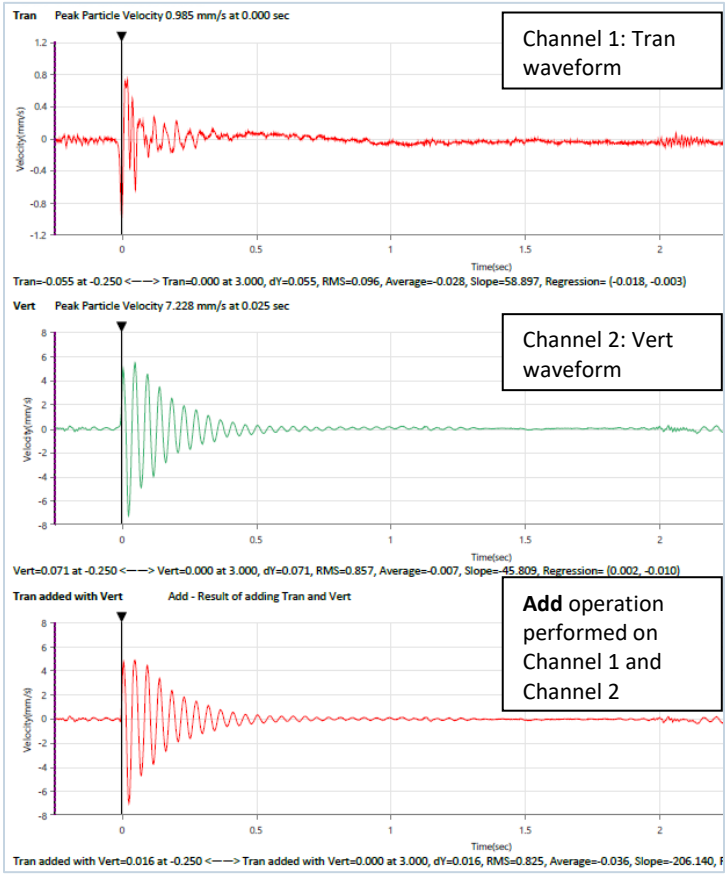
Select the two waveforms to add together in the first two drop-down menus (**Channel 1** and **Channel 2**). The waveforms can come from channel data (E.g. Tran, Vert, Long) or from other previous operations.

Choose a **Name** to assign to the newly created waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **OK.**

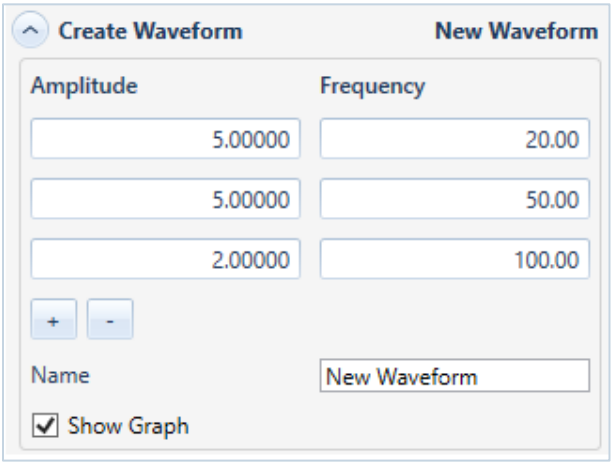
Click **Analyze** to calculate the operation.



8.5.2 CREATE WAVEFORM OPERATION

Use this operation when you want to create a custom waveform. With this operation, you can enter amplitudes and frequencies of one or more sinusoidal waveforms, which are then combined to create a complex waveform.

To **Create a Waveform**, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Create Waveform** operation. The following dialog box appears.



Enter from one to five amplitude and frequency (Hz) components for the new waveform. Use the plus and minus buttons to add or remove a component.

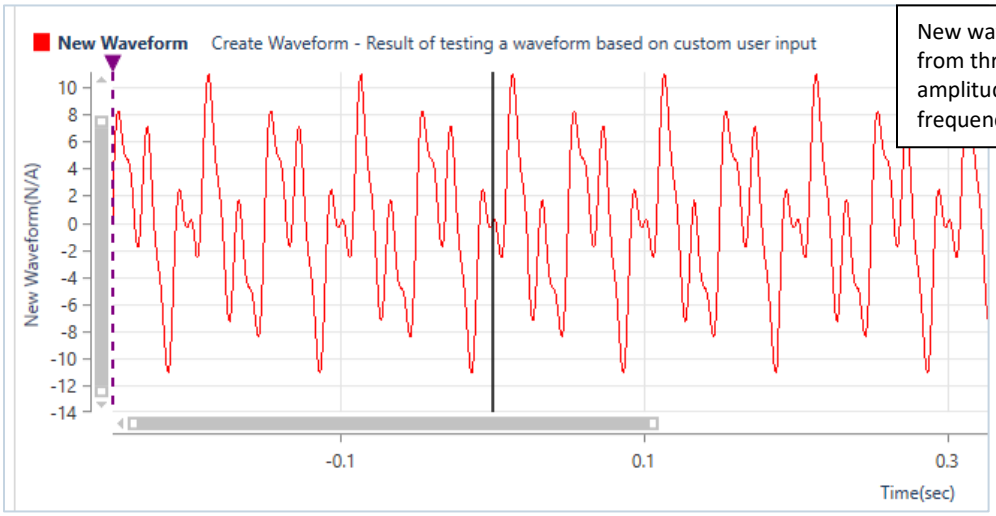
If you need more than 5 waveforms, you can create a second set and then Add them together.

Choose a **Name** to assign to the newly created waveform (E.g. New Waveform).

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **OK.**

Click **Analyze** to create the new waveform.

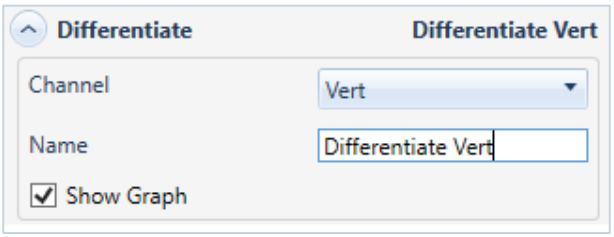


New waveform from three amplitude and frequency values

8.5.3 DIFFERENTIATE OPERATION

This operation differentiates a velocity waveform to obtain the acceleration values along the entire waveform.

To differentiate a waveform, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Differentiate** operation. The following dialog box appears.



Choose the waveform to be differentiated in the Channel drop-down menu.

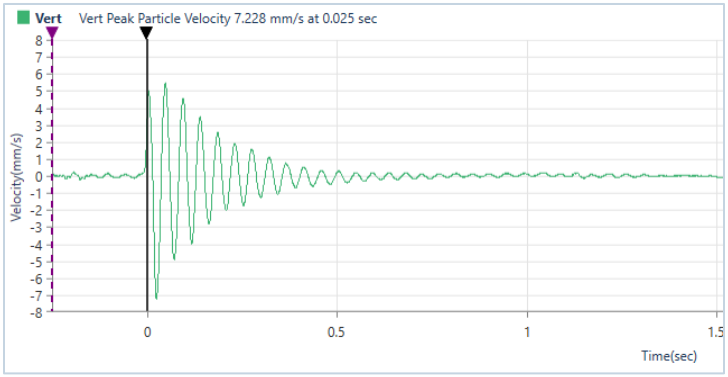
Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

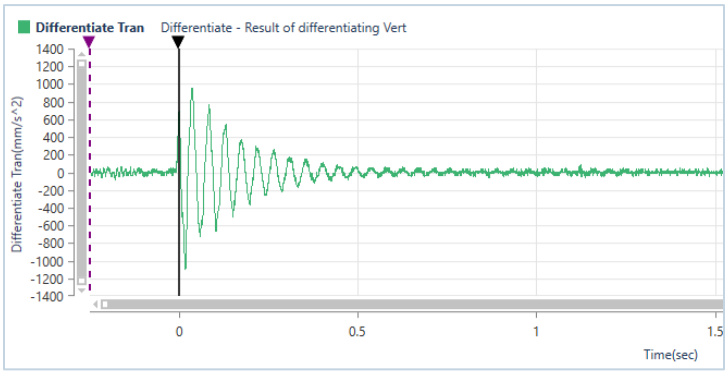
Click **OK**.

Click **Analyze** to create the new waveform.

Channel Vert waveform



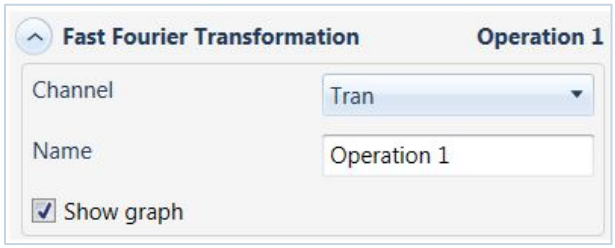
Vert waveform Differentiated



8.5.4 FAST FOURIER TRANSFORMATION OPERATION

Use this Fast Fourier Transform (FFT) operation when you want to break down a complex time-domain waveform into its individual frequency domain components.

To perform an FFT, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Fast Fourier Transform** operation. The following dialog box appears.



FFT calculations can be CPU intensive and may require some time to complete. The time required depends upon the size of the waveform and the speed of the computer.

Choose a **Name** for the new waveform.

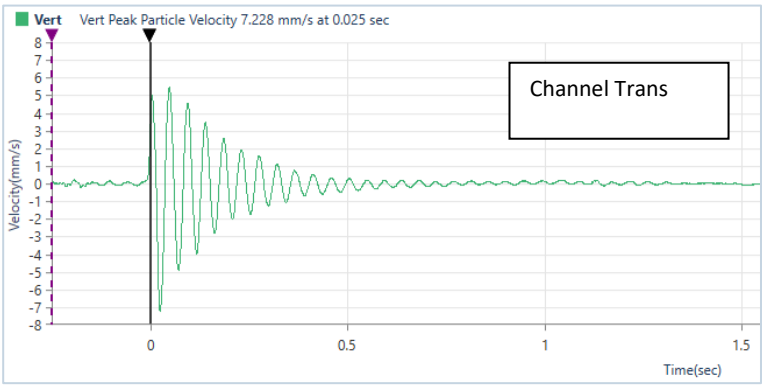
Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

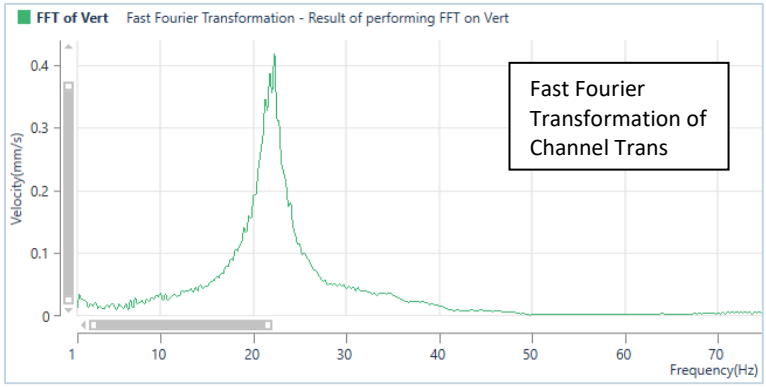
Click **OK**.

Click **Analyze** to create the new waveform.

NOTE FFT Analysis Limitations

In simple waveforms, not composed of many different frequencies, the dominant frequency may be at the peak particle velocity of the waveform. In more complex waveforms, the dominant frequency is not necessarily the frequency at the peak particle velocity but at the frequency with the greatest amplitude. Whether or not this frequency contributed to the peak particle velocity value and by how much must be extrapolated by examining the original signal closely. The frequency at the peak of a complex wave is usually not a single frequency rather it is a series of waves of different frequencies superimposed. It is intended that the frequency spectrum data be used as a tool in conjunction with the velocity versus time waveform.





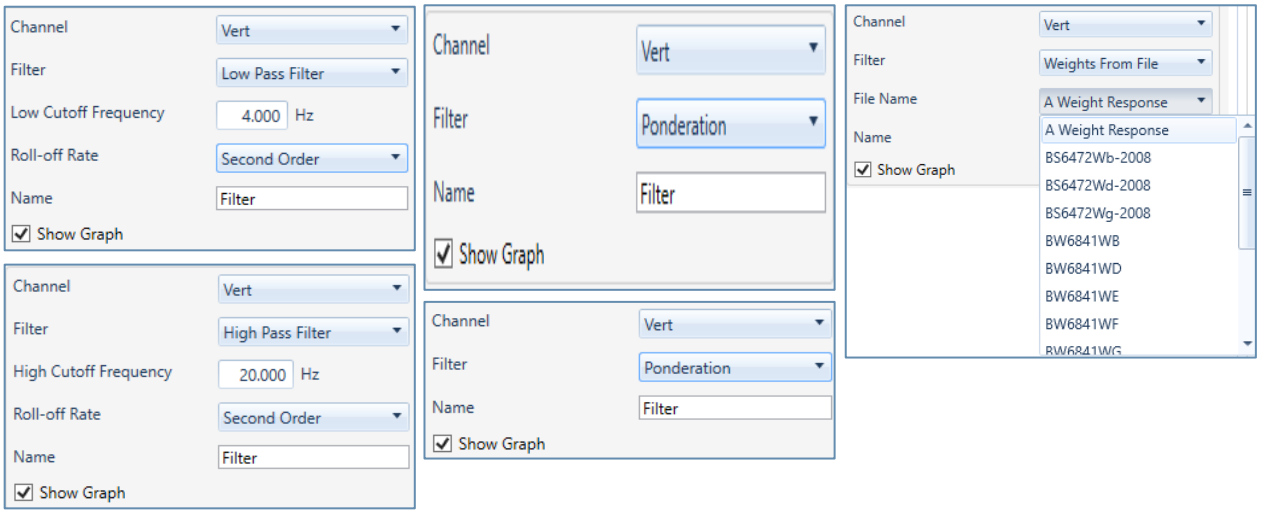
Due to the digital nature of the FFT process, some smearing or broadening of the spectrum may occur. The algorithm used to represent the original waveform with a series of weighted sine and cosine curves does so with discrete frequency increments. A 25.5-hertz signal, for example, may not be represented by one frequency category alone and may, therefore, be represented by the next closest frequencies, 25 and 26 hertz, with possibly some small residual leakage into neighboring frequency categories. This is referred to as the "Picket Fence Effect".

8.5.5 FILTER OPERATION

The **Filter** operation can perform a series of functions to condition waveforms. The **Low Pass**, **High Pass**, and **Bandwidth Pass** perform filtering on waveform data in the frequency domain. The **Low Pass** filter removes frequencies above the corner frequency, while the **High Pass** filter removes frequencies below the corner frequency.

WARNING
Applying a Filter distorts the original waveform.

To perform a Filter operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Filter** operation. The following dialog box or one of its variations depending on the filter type appears.



Choose the **Channel** waveform from the drop-down list to filter for the new waveform.

Choose a **Filter** from the available filter types:

Low Pass Filter: Passes low frequencies and attenuates (reduces amplitude and intensity of the signal) frequencies higher than the Cutoff Frequency. This filter provides a smoother form of a signal which removes the short-term oscillations, leaving only the long-term trend.

High Pass Filter: Passes high frequencies and attenuates (reduces amplitude and intensity of the signal) frequencies lower than the Cutoff Frequency.

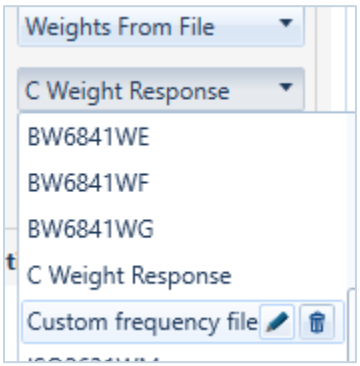
Band Pass Filter: This combines High Pass and Low Pass filtering. The High and Low Cutoff Frequencies reject both low and high frequencies keeping all frequencies in between. The High Cutoff Frequency is the rejected value for frequencies above this value; while the Low Cutoff Frequency is the rejected value for frequencies below this value. The Low Pass filter removes frequencies above this value. The High Pass filter removes frequencies below this value.

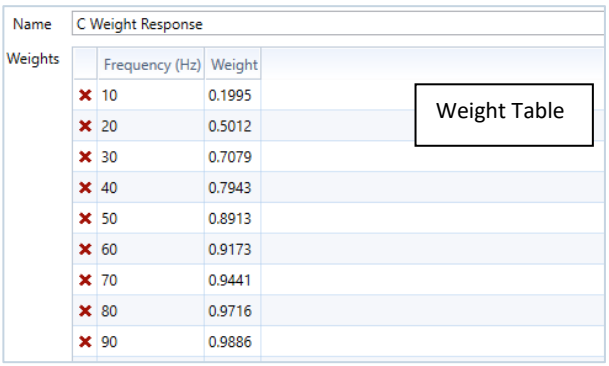
Ponderation: The Ponderation filter is used for compliance monitoring according to France's National Standards. It is a frequency filter similar to the perception of the human ear.

Define the **Low Cutoff / High Cutoff Frequencies**

Define the **Roll-off Rate**: *Second-Order* roll-off is characteristic of a greater attenuation slope (-40dB/decade) than first-order roll-offs. The *No Roll-off (Ideal)* setting is a square 90-degree corner.

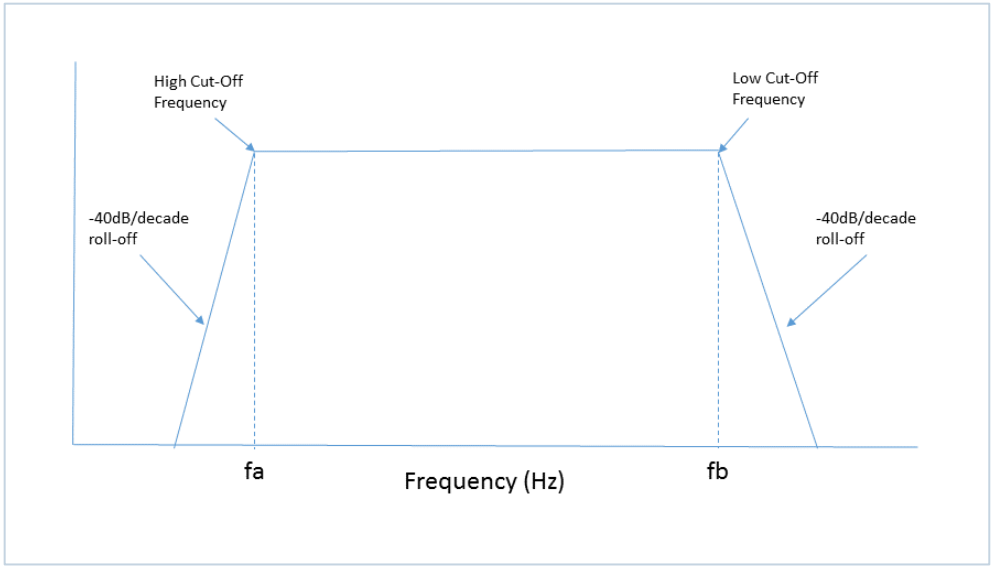
Filter Weights from File: Performs filtering of frequency weighting from a file containing a weights table (.fwt file). Select a file from the list, you can also edit the values by clicking on the edit icon, or create your own by selecting *"Create Timeline File"*





Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.
Click **OK**.
Click **Analyze** to create the new waveform.

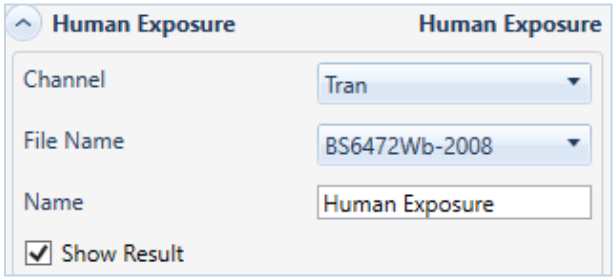
The following illustration shows an example of the **High** and **Low Cutoff** frequencies, with a -40 dB per decade roll-off.



8.5.6 HUMAN EXPOSURE OPERATION

Use this operation to calculate frequency-weighted Vibration Dosage Value (VDV) and Root Mean Square (RMS). This operation helps understand the effects of different frequencies on people nearby.

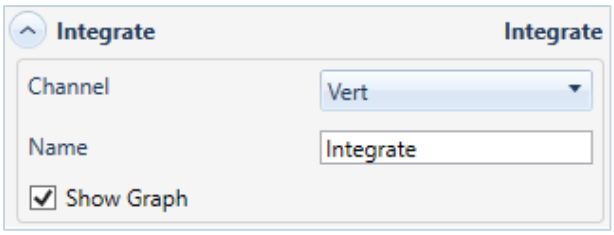
See section 8.9 Human Exposure Reports on page 217 for a detailed description of this operation.



8.5.7 INTEGRATE OPERATION

This operation integrates a velocity waveform to obtain displacement values along the entire waveform.

To perform an integration operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Integrate** operation. The following dialog box appears.



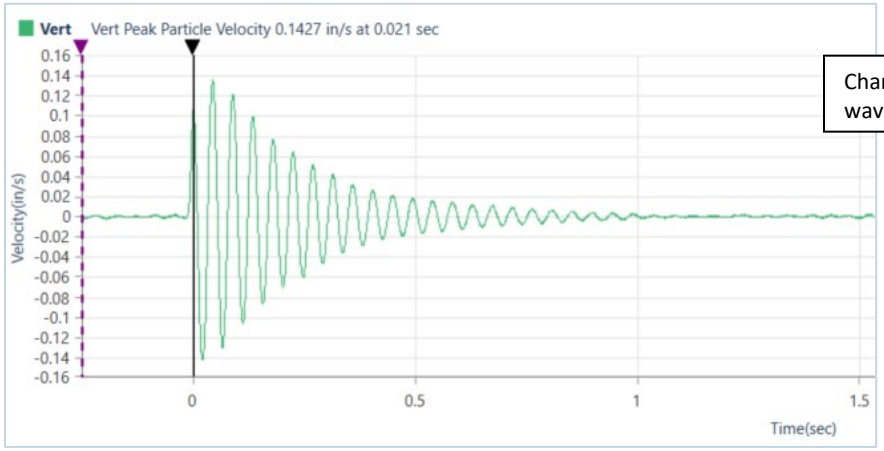
Note it is always a good idea to remove any offset prior to running this operation.

Choose the **waveform Channel** to integrate from the first drop-down menu.
Choose a **Name** for the new waveform.

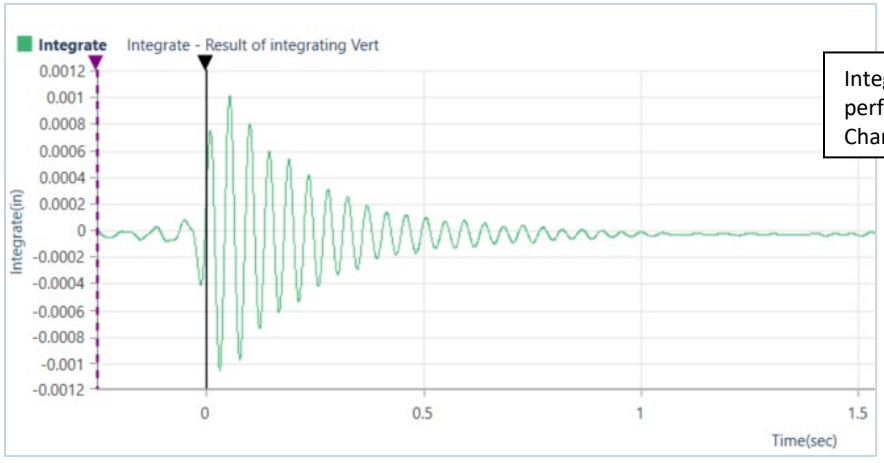
Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **OK**.

Click **Analyze** to create the new waveform.



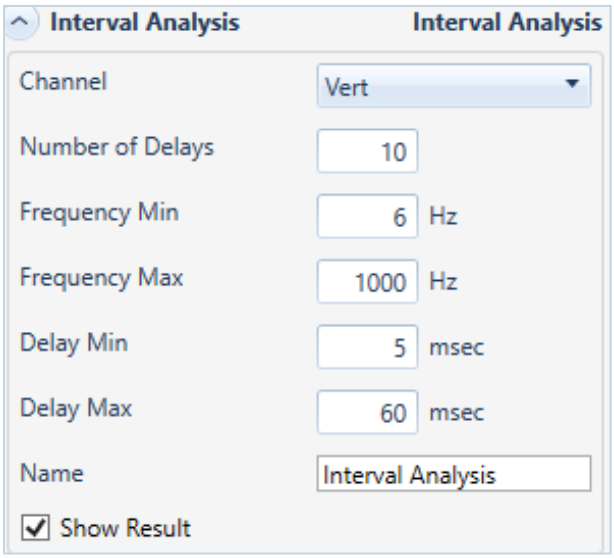
Channel Vert waveform



Integrate operation performed on Channel Vert

8.5.8 INTERVAL ANALYSIS OPERATION

This operation produces a color plot with the frequency displayed on the x-axis, delay interval on the y-axis, and a measure of the energy content (y-axis value of a standard FFT plot) represented using different color bands. The recorded signals must be the same length as the desired resultant signal or larger.



WARNING This is a modeling tool only. Actual results will vary depending upon site particularities including geology, and explosives type, among other factors.

Choose the **waveform Channel** on which to perform the interval analysis in the first drop-down menu.

Enter the **Number of Delays** by inputting a number between 1 and 1000. This setting delimits the number of times the waveform will be linearly offset by the delay interval and super-positioned.

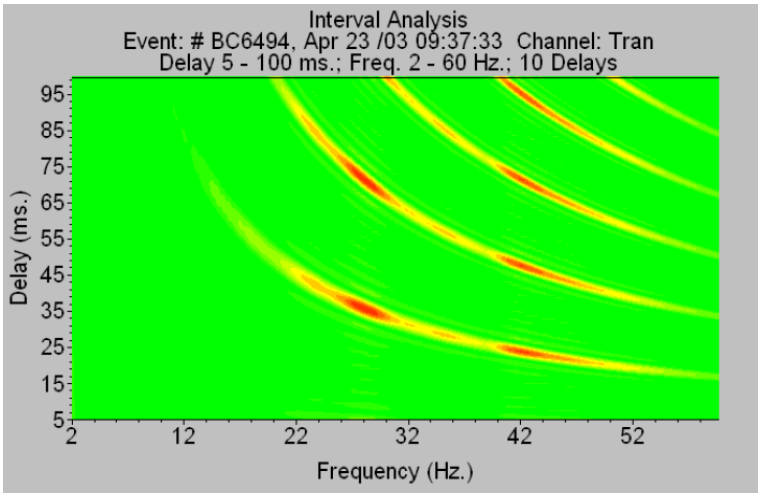
Input a frequency range, from **Frequency Min** of 1 Hz to a **Frequency Max** of 1024 Hz to plot.

Input the delay range. This range can be from **Delay Min** of 1 msec to a **Delay Max** of 500 msec. The delay range that was previously calculated is shown to the right of each entry. If you input a new delay range that is within the previously calculated range, the Interval Analysis will not need to be recalculated.

Choose a **Name** for the new waveform.

Enable the **Show Results** checkmark to display the result in the form of a graph on the right side of the window.

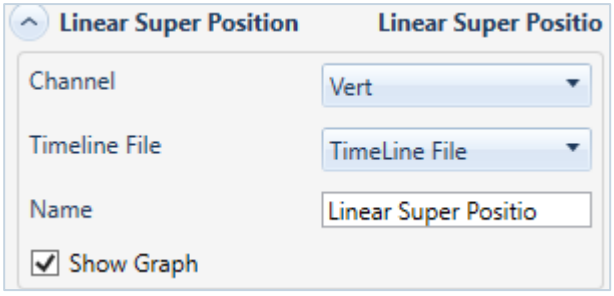
Click **Analyze** to create the new waveform.



Example of the output from an Interval Analysis

8.5.9 LINEAR SUPER POSITION OPERATION

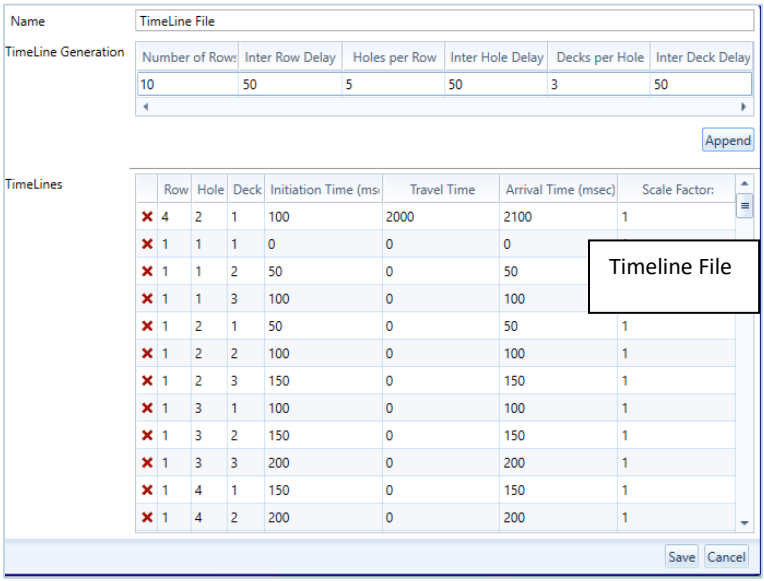
Use this operation to shift and superimpose a source waveform event linearly. This operation applies the timeline file you select to the source file to produce a simulated waveform.



WARNING This is a modeling tool only. Actual results will vary depending upon site particularities including geology, and explosives type, among other factors.

Choose the waveform **Channel** to use in the analysis in the first drop-down menu.

Choose a **Timeline File** from the dropdown menu, if there doesn't exist one then you can create a new one by clicking on *"Create Timeline File"*. The timelines represent the number of shots and delays. Enter the *Number of Rows, Inter Row Delay, Holes per Row, Inter Hole Delay, Decks per Hole,* and *Inter Deck Delay* values then click on the **Append** button. The Timeline Table will populate. You can select any value in the Table to edit or delete the value.

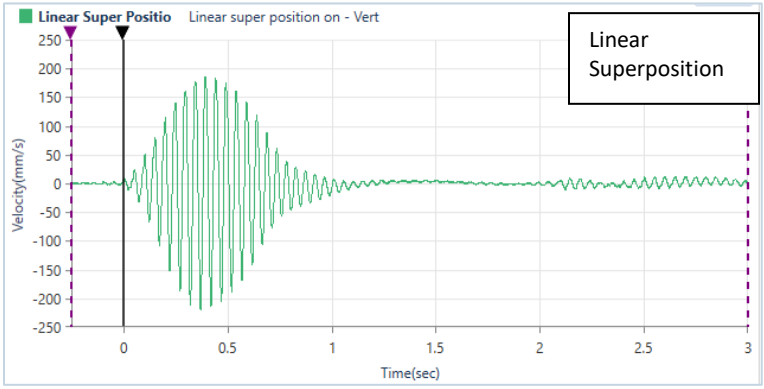


Click the **Save** button.

Choose a **Name** for the new waveform.

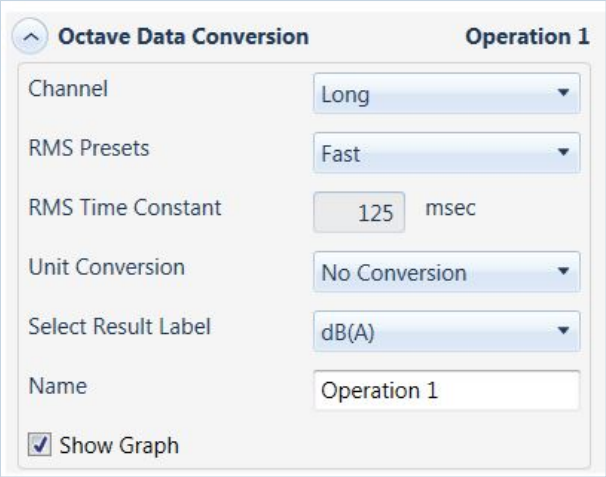
Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to generate the Linear Superposition Analysis waveform.



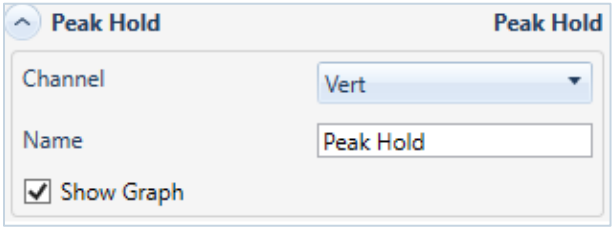
8.5.10 OCTAVE DATA CONVERSION OPERATION

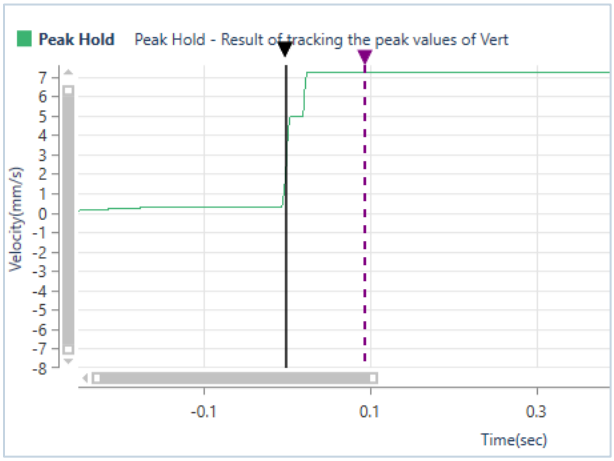
Use this operation for advanced waveforms, to calculate the Root Mean Square (RMS) of a channel, with or without conversion to dB. This operation shows the frequency weighted values from an unfiltered event. Convert the unfiltered data to A-Weighted or C-weighted data, with a Fast or Slow response.



8.5.11 PEAK HOLD OPERATION

The Peak Hold operation will hold the channel's positive peaks of the waveform until a new peak is found. It will not look at negative peaks. Use this operation to show the maximum positive amplitude of a waveform.





Choose the waveform **Channel** to perform the Peak Hold operation in the first drop-down menu.

Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform.

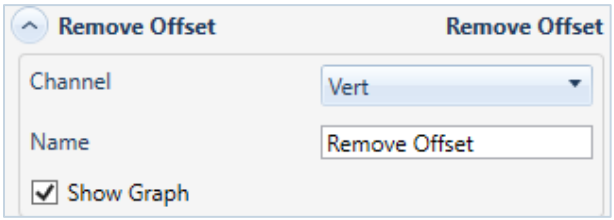
8.5.12 REMOVE OFFSET OPERATION

Use this operation to remove the offset from a waveform centering in on the X-axis.

Some recorded waveforms may contain a DC offset. Visually, a waveform containing an offset appears to be shifted a constant value above or below the X-axis. The system does not automatically remove all offsets as a user may purposely wish to include them. THOR removes an offset by subtracting the average.

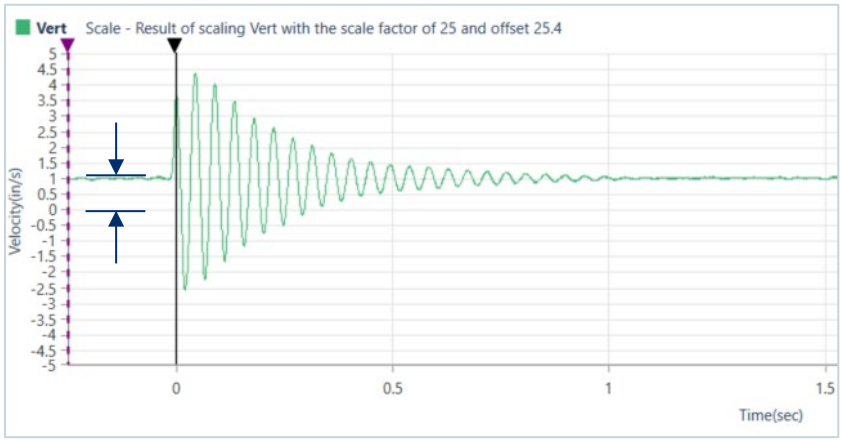
NOTE You can manually adjust the offset using the scale command.

To perform a **Remove Offset** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Remove Offset** operation. The following dialog box appears.

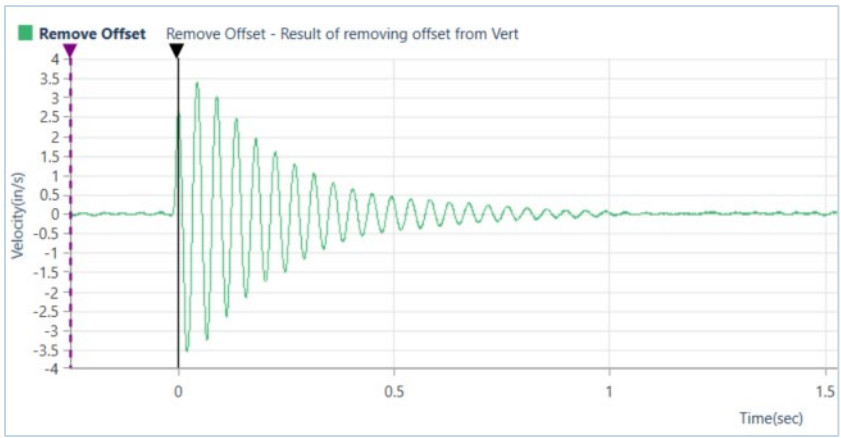


Select the waveform **Channel** on which to perform the Remove Offset operation in the first drop-down menu.
Choose a **Name** for the new waveform.
Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.
Click **Analyze** to create the new waveform.

Offset of 1 in/s



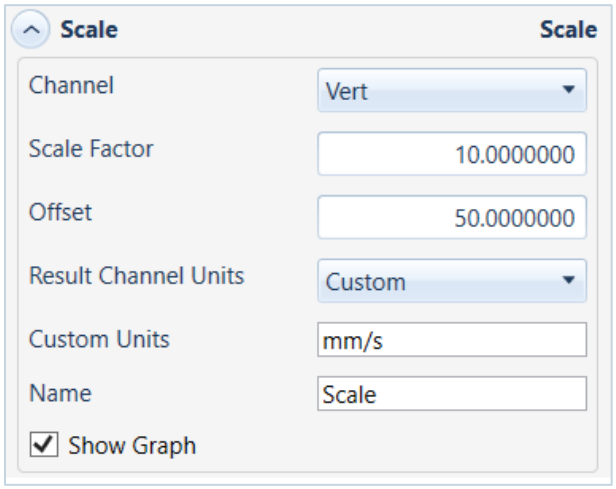
Offset Removed



8.5.13 SCALE OPERATION

This operation changes the amplitude units and offset value for a waveform. Use this operation to scale a waveform up or down, depending on the scale factor you select.

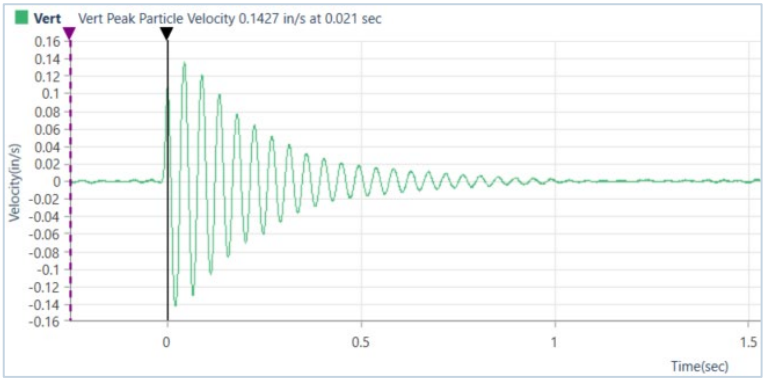
To perform a **Scale** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Scale** operation. The following dialog box appears.

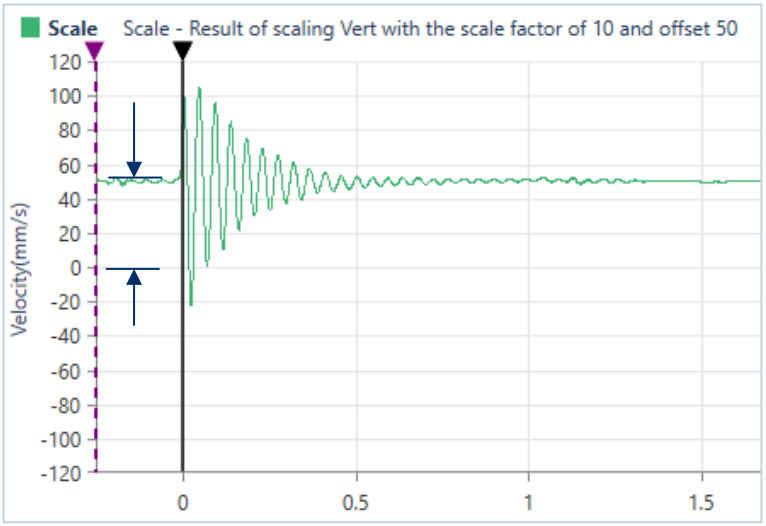


The Result units text box names units only, it does not check to ensure the actual waveform result units match the units named in this box.

Select the waveform **Channel** on which to perform the Scale operation in the first drop-down menu.
Enter a **Scale Factor** to be applied to the waveform. (1.1 would increase the amplitude of the waveform by 10% where 0.9 would decrease the amplitude of the waveform by 10 %)

Enter an **Offset** value, if required.
Enter the **Result Channel Units** to represent the measurement units of the resulting waveform or keep the units the *Same as Source*.
Choose a **Name** for the new waveform.
Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.
Click **Analyze** to create the new waveform.



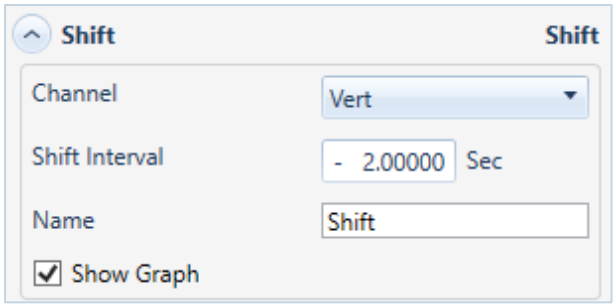


To Convert from acceleration in mm/s^2 to g you would scale the waveform by 0.0001019 as 9810 mm/s^2 = 1g.

8.5.14 SHIFT OPERATION

This command shifts the currently selected waveform forward or backward on the time axis. The waveform's absolute time does not change. This changes the waveforms trigger offset.

To perform a **Shift** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Shift** operation. The following dialog box appears.



Select the waveform **Channel** on which to perform the Shift operation in the first drop-down menu.

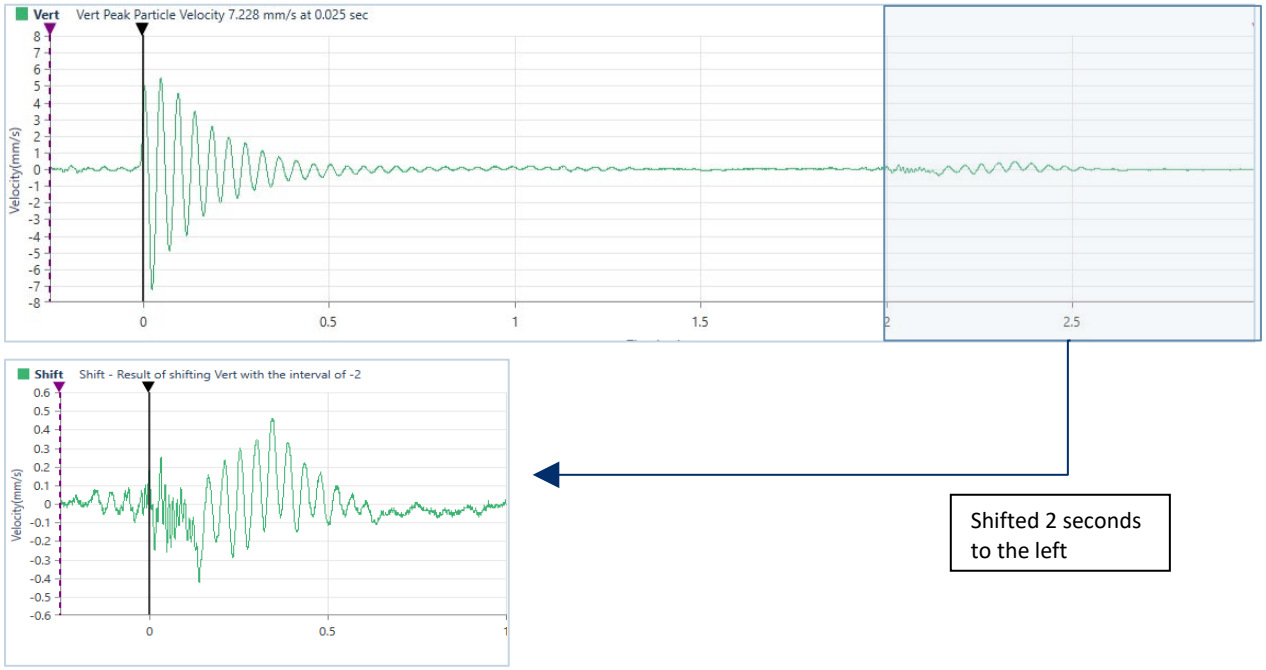
Enter a **Shift Interval** in seconds to be applied to the waveform. To shift the waveform to the left, enter a minus sign (-) in front of the second's input.

Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform.

NOTE You can only shift waveforms within the Events recorded time frame. You cannot shift the Event outside this time frame.



8.5.15 SIGNATURE HOLE ANALYSIS OPERATION

Signature Hole Analysis Operation is used to create and analyze theoretical blast vibration data based on your input range of blast timing parameters and a **Signature Hole Waveform**. The signature hole waveform can also be **Band Pass Filtered** to remove any unwanted frequencies it might contain. The theoretical waveform produced by this tool can then be sorted with a wide range of options and stored in a user-defined project directory.

This tool first creates all the blast **Timeline** file combinations, based on your input parameters for the range of different time delays to simulate. Then for each channel in the signature hole waveform, it shifts the waveform in time according to these timeline files and adds them together to produce a simulated waveform. These simulated waveforms are conveniently listed in a **Signature Hole Analysis Table** with the delays used to create them, the resulting **Peak Particle Velocities** (PPV), **Peak Vector Sum** (PVS), **Dominant FFT frequency** and the **Upper** to **Lower frequency** ratio for each channel. This table along with all the timeline files and simulations can be exported to a CSV, XML, ASCII, or PDF file.

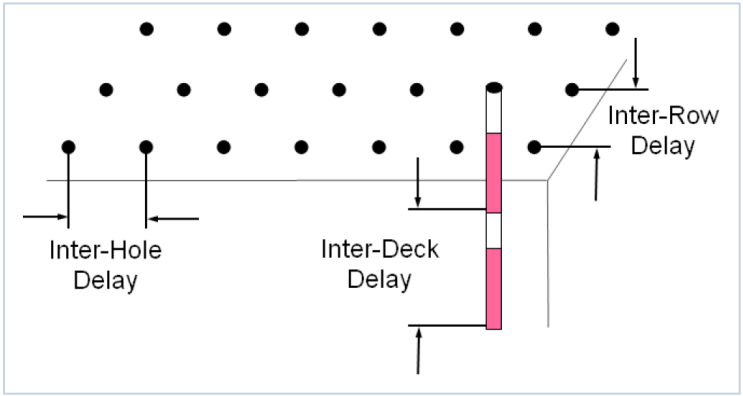
WARNING This is a simulation tool to help you optimize and improve blast performance, it does not replace standard blasting practices and experience.

Signature Hole Waveform can be:

1. A single hole of explosives coming from a single deck used in the production blast.
2. A single hole of explosives coming from a production shot and contains inter-deck delays.
3. A single row of holes coming from a production shot.

Timeline Files:

A timeline file contains all the time delays, relative to time zero (the actual initiation time) for the entire blast. These delays are derived from the *Inter-Deck delays*, *Inter-Hole delays* and *Inter-Row delays*. (Shown in the diagram below representing a Production Shot.) These are the typical delays used in the design of a blast. They will be used during the signature hole analysis process.



Frequency Ratio:

This is a ratio of the content of the lower frequency range to the content of the upper-frequency range.

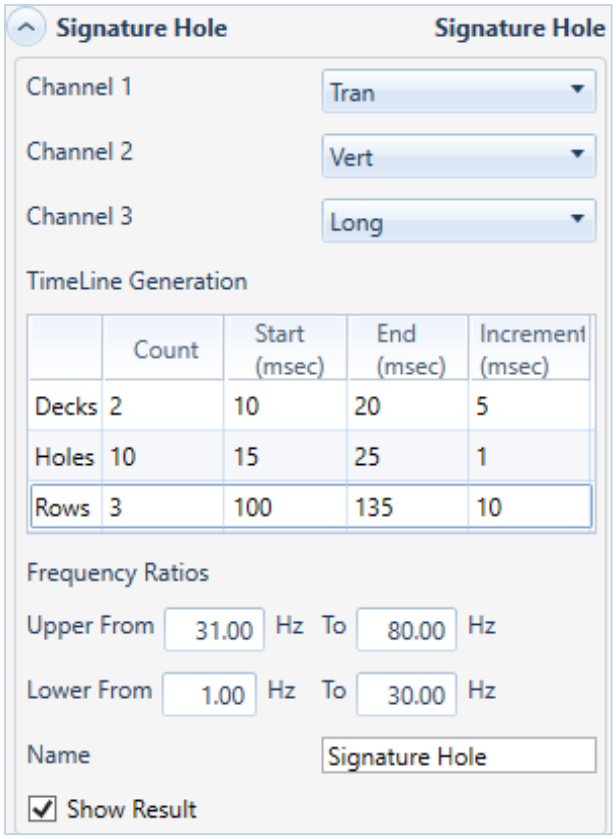
Signature Hole Waveform Parameters

The Signature Hole Waveform must be representative of the actual production blast. The hole(s) must be:

1. Fully burdened, free-face, and a corner blast.
2. A Single-Deck, Multi-Deck, Entire-Row.
3. Must have the same diameter and depth as the Production Blast.
4. Completed with the same type of explosive.
5. For consistent results, ensure that the Signature Hole and Production Blast are monitored from the same location.

Basic assumptions to use the Signature Hole Analysis operation are: that the geology across the Signature Hole and the Production Blast will remain constant, that each hole will produce identical vibration results, and that the monitoring unit's geophone was consistently positioned and correctly installed.

To perform a **Signature Hole Analysis** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Signature Hole** operation. The following dialog box appears.



This allows you to simulate your different delay patterns.

1. Select the waveform Channels**: Channel 1, Channel 2, and Channel 3** on which to perform the Signature Hole Analysis operation using the drop-down menus.

2. Fill in the *Timeline Generation* section. This lets you determine the timings to be used. The number of simulation files that will be generated will be equal to:

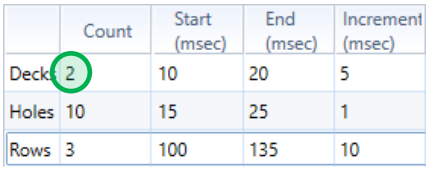
(# of *Deck delays*) x (# of *Hole delays*) x (# of *Row delays*).

To reduce the number of simulations and avoid lengthy computer calculations, increase the *Increment number*.

NOTE Removing any frequency from the signature hole waveform will also remove them from the simulation results. It is always a good idea to look at the results before filtering to fully understand the potential impact of filtering.

Number of Decks per Hole

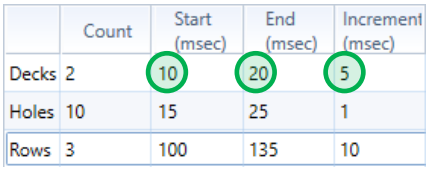
Enter the proposed number of Decks per Hole in your production blast. This assumes your signature hole waveform was a single hole without any inter-deck delays. If your signature hole waveform had inter-decks delays then enter 1 for the number of decks, 0 for the Start, 0 for the End and 1 for the Increment values.



	Count	Start (msec)	End (msec)	Increment (msec)
Decks	2	10	20	5
Holes	10	15	25	1
Rows	3	100	135	10

Inter-Deck Delay

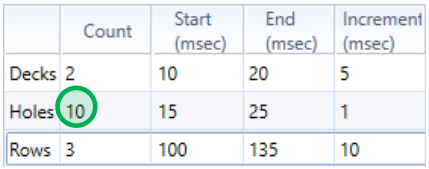
Enter the Start, End, and Increment values in msec for the number of Decks per Hole. ie 2 decks and a range from 10 to 20 msec. The increment number allows you to reduce the number of simulations and quickly narrow in on the desired delays.



	Count	Start (msec)	End (msec)	Increment (msec)
Decks	2	10	20	5
Holes	10	15	25	1
Rows	3	100	135	10

Number of Holes per Row

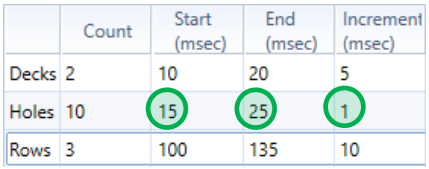
Enter the proposed number of Holes per Row for your production blast. This assumes your signature hole waveform was a single hole. If your signature hole waveform was an entire row of holes then enter 1 for the number of holes per row and skip the Inter-Hole Delays.



	Count	Start (msec)	End (msec)	Increment (msec)
Decks	2	10	20	5
Holes	10	15	25	1
Rows	3	100	135	10

Inter-Hole Delay

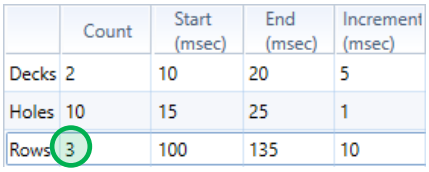
Enter the Start, End, and Increment values in msec for the number of Holes per row. ie 10 holes per row and a range from 10 to 30 msec. Again, the increment number allows you to reduce the number of simulations and quickly narrow in on the desired delays.



	Count	Start (msec)	End (msec)	Increment (msec)
Decks	2	10	20	5
Holes	10	15	25	1
Rows	3	100	135	10

Number of Rows

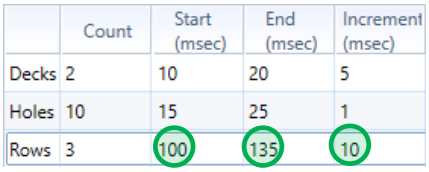
Enter the proposed number of Rows in your production blast.



	Count	Start (msec)	End (msec)	Increment (msec)
Decks	2	10	20	5
Holes	10	15	25	1
Rows	3	100	135	10

Inter-Row Delay

Enter the Start, End, and Increment values in msec for the Number of Rows. ie 5 rows of holes and a range from 120 to 150 msec. Again, the increment number allows you to reduce the number of simulations and quickly narrow in on the desired delays.



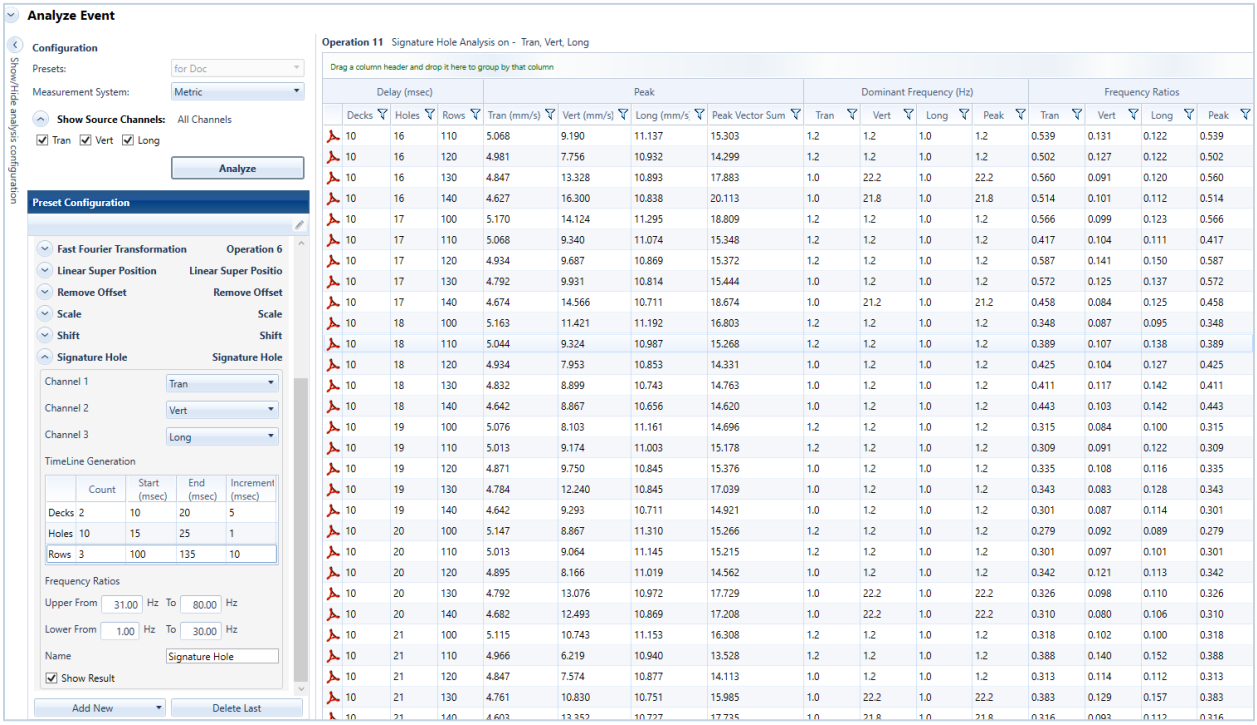
	Count	Start (msec)	End (msec)	Increment (msec)
Decks	2	10	20	5
Holes	10	15	25	1
Rows	3	100	135	10

3. Fill in the Frequency *Ratios* section. This indicates the concentration of the Upper and Lower ranges (in Hz). To remove any unwanted frequencies in your signature hole waveform it is recommended to first perform a **Band Pass Filter** operation.

4. Choose a **Name** for the new waveform.

5. Enable the **Show Result** checkmark to display the resulting data table on the right side of the window.

6. Click **Analyze** to generate the **Signature Hole Analysis Table.**



Sample: Section of a Signature Hole Analysis Table viewed within THOR

Signature Hole Signature Hole Analysis on - Tran, Vert, Long

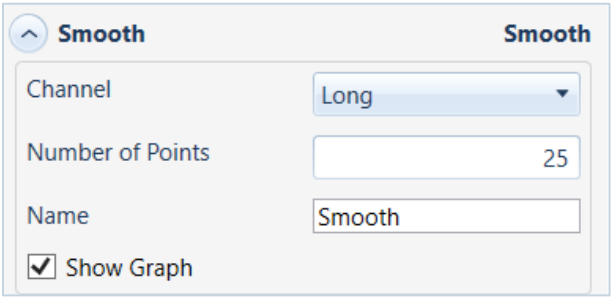
Decks	Delay (msec) Holes	Rows	Peak Tran mm/s	Vert mm/s	Long mm/s	PVS mm/s	Dominant Frequency (Hz) Tran	Vert	Long	Peak	Frequency Ratios Tran	Vert	Long	Peak
10	15	100	5.178	10.081	11.350	16.039	1.2	1.2	1.0	1.2	0.420	0.135	0.099	0.420
10	15	110	5.068	10.948	11.192	16.456	1.2	1.2	1.0	1.2	0.463	0.137	0.105	0.463
10	15	120	4.981	11.437	11.035	16.654	1.2	1.2	1.0	1.2	0.509	0.142	0.116	0.509
10	15	130	4.784	16.575	10.940	20.428	1.0	22.2	1.0	22.2	0.526	0.136	0.120	0.526
10	15	140	4.627	12.485	10.790	17.138	1.0	22.2	1.0	22.2	0.566	0.138	0.121	0.566
10	16	100	5.131	12.564	11.334	17.681	1.2	1.2	1.0	1.2	0.516	0.091	0.108	0.516
10	16	110	5.068	9.190	11.137	15.303	1.2	1.2	1.0	1.2	0.539	0.131	0.122	0.539
10	16	120	4.981	7.756	10.932	14.299	1.2	1.2	1.0	1.2	0.502	0.127	0.122	0.502
10	16	130	4.847	13.328	10.893	17.883	1.0	22.2	1.0	22.2	0.560	0.091	0.120	0.560
10	16	140	4.627	16.300	10.838	20.113	1.0	21.8	1.0	21.8	0.514	0.101	0.112	0.514
10	17	100	5.170	14.124	11.295	18.809	1.2	1.2	1.0	1.2	0.566	0.099	0.123	0.566
10	17	110	5.068	9.340	11.074	15.348	1.2	1.2	1.0	1.2	0.417	0.104	0.111	0.417
10	17	120	4.934	9.687	10.869	15.373	1.2	1.2	1.0	1.2	0.587	0.141	0.150	0.587
10	17	130	4.792	9.931	10.814	15.444	1.0	1.2	1.0	1.2	0.572	0.125	0.137	0.572
10	17	140	4.674	14.566	10.711	18.674	1.0	21.2	1.0	21.2	0.458	0.084	0.125	0.458
10	18	100	5.163	11.421	11.192	16.803	1.2	1.2	1.0	1.2	0.348	0.087	0.095	0.348
10	18	110	5.044	9.324	10.987	15.268	1.2	1.2	1.0	1.2	0.389	0.107	0.138	0.389
10	18	120	4.934	7.953	10.853	14.331	1.0	1.2	1.0	1.2	0.425	0.104	0.127	0.425
10	18	130	4.832	8.899	10.743	14.763	1.0	1.2	1.0	1.2	0.411	0.117	0.142	0.411
10	18	140	4.642	8.867	10.656	14.620	1.0	1.2	1.0	1.2	0.443	0.103	0.142	0.443
10	19	100	5.076	8.103	11.161	14.696	1.2	1.2	1.0	1.2	0.315	0.084	0.100	0.315
10	19	110	5.013	9.174	11.003	15.178	1.2	1.2	1.0	1.2	0.309	0.091	0.122	0.309
10	19	120	4.871	9.750	10.845	15.376	1.0	1.2	1.0	1.2	0.335	0.108	0.116	0.335
10	19	130	4.784	12.240	10.845	17.039	1.0	1.2	1.0	1.2	0.343	0.083	0.128	0.343
10	19	140	4.642	9.293	10.711	14.921	1.0	1.2	1.0	1.2	0.301	0.087	0.114	0.301
10	20	100	5.147	8.867	11.310	15.266	1.2	1.2	1.0	1.2	0.279	0.092	0.089	0.279
10	20	110	5.013	9.064	11.145	15.215	1.2	1.2	1.0	1.2	0.301	0.097	0.101	0.301
10	20	120	4.895	8.166	11.019	14.562	1.0	1.2	1.0	1.2	0.342	0.121	0.113	0.342
10	20	130	4.792	13.076	10.972	17.729	1.0	22.2	1.0	22.2	0.326	0.098	0.110	0.326
10	20	140	4.682	12.493	10.869	17.208	1.0	22.2	1.0	22.2	0.310	0.080	0.106	0.310
10	21	100	5.115	10.743	11.153	16.308	1.2	1.2	1.0	1.2	0.318	0.102	0.100	0.318
10	21	110	4.966	6.219	10.940	13.528	1.2	1.2	1.0	1.2	0.388	0.140	0.152	0.388
10	21	120	4.847	7.574	10.877	14.113	1.0	1.2	1.0	1.2	0.313	0.114	0.112	0.313
10	21	130	4.761	10.830	10.751	15.985	1.0	22.2	1.0	22.2	0.383	0.129	0.157	0.383
10	21	140	4.603	13.352	10.727	17.735	1.0	21.8	1.0	21.8	0.316	0.093	0.112	0.316
10	22	100	5.068	12.903	11.105	17.762	1.2	1.2	1.0	1.2	0.333	0.102	0.108	0.333
10	22	110	4.997	6.101	10.924	13.473	1.2	1.2	1.0	1.2	0.456	0.164	0.173	0.456
10	22	120	4.926	8.828	10.790	14.786	1.0	1.2	1.0	1.2	0.415	0.150	0.141	0.415
10	22	130	4.871	8.607	10.672	14.550	1.0	1.2	1.0	1.2	0.461	0.149	0.176	0.461
10	22	140	4.808	10.625	10.648	15.792	1.0	21.2	1.0	21.2	0.415	0.120	0.145	0.415
10	23	100	5.076	8.717	11.074	14.980	1.2	1.2	1.0	1.2	0.465	0.144	0.137	0.465
10	23	110	4.942	6.518	10.948	13.666	1.0	1.2	1.0	1.2	0.522	0.181	0.162	0.522

Sample: Section of a Signature Hole Analysis Table when exported to PDF

8.5.16 SMOOTH OPERATION

The Smooth operation is used to average consecutive data points of a waveform.

To perform a **Smooth** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Smooth** operation. The following dialog box appears.



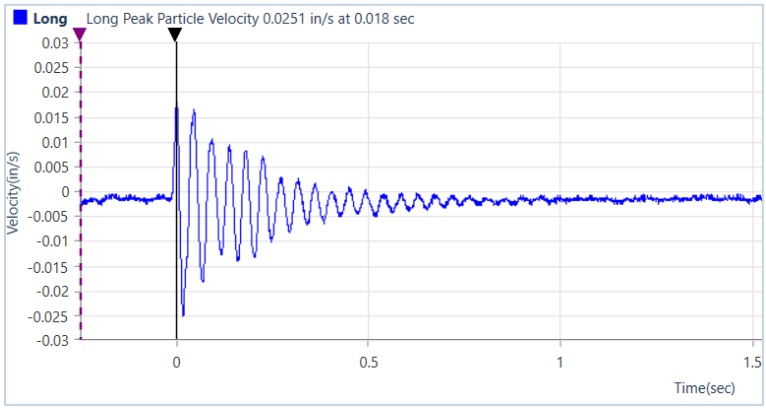
Select the waveform **Channel** on which to perform the Smooth operation in the first drop-down menu.

Enter a range of points to average within the **Number of points** window.

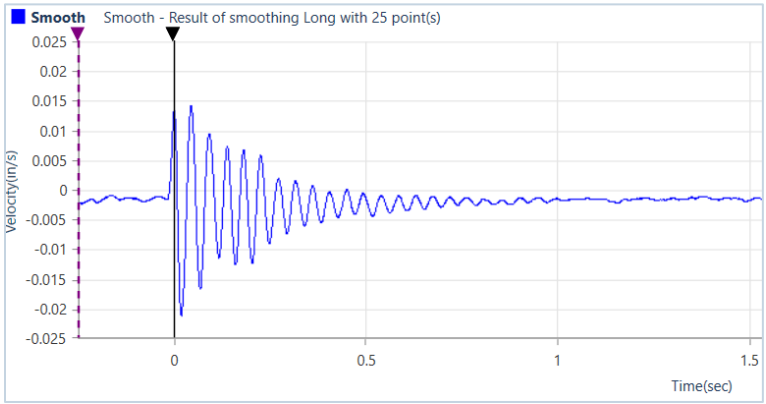
Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform.



Channel Long

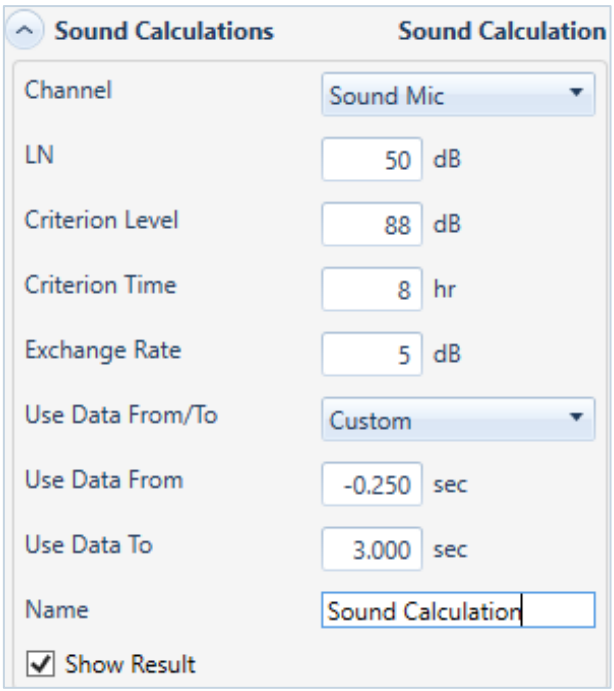


Channel Long after Smooth operation

8.5.17 SOUND CALCULATION OPERATION

Use this operation to recalculate channel data using sound specific criterion. For example, if you wanted to calculate an L75 value, change the **LN** number from 50 to 75 and click **Analyze**. The calculations will be performed on the entire event or any portion of it. This is done by changing the *Use Data From/To* and choosing **Custom**, then enter a portion of the recorded time in the fields *Use Data From* (Start Time) seconds and *Use Data To* (End Time) seconds.

To perform a **Sound Calculation** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Sound Calculation** operation. The following dialog box appears.



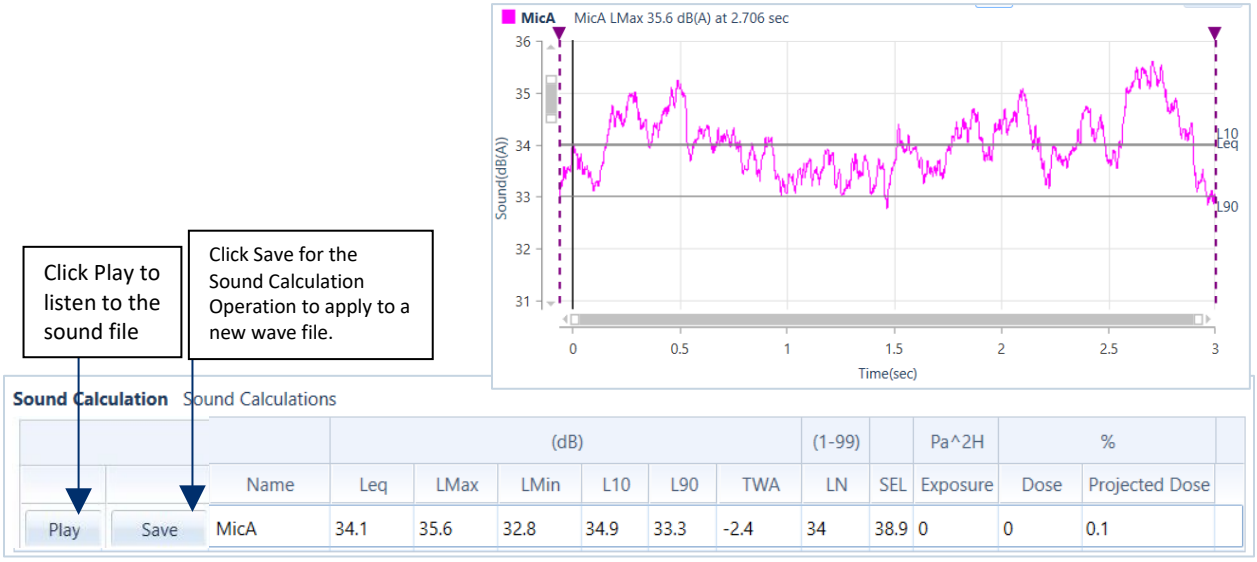
Select the waveform **Channel** on which to perform the Sound Calculation operation in the first drop-down menu.

Enter an LN value, Criterion Level, Criterion Time, Exchange Rate and the Data From/To time interval.

Choose a **Name** for the data set.

Enable the **Show Result** checkmark to display the result in the form of a Data Table on the right side of the window.

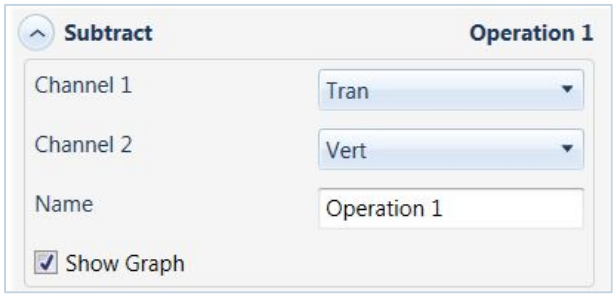
Click **Analyze** to create the new waveform.



8.5.18 SUBTRACT OPERATION

Use this operation to subtract two waveforms.

To perform a **Subtract** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Subtract** operation. The following dialog box appears.



Select Channel 1 and Channel 2 waveforms to subtract in the first two drop-down menus.

Choose a **Name** for the new waveform.

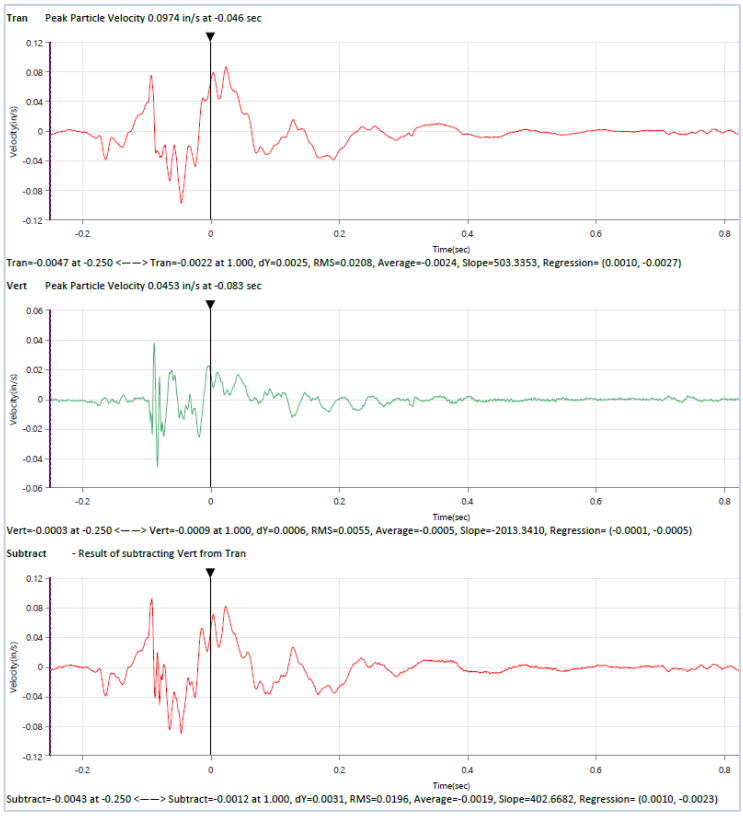
Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform.

Channel 1: Tran

Channel 2: Vert

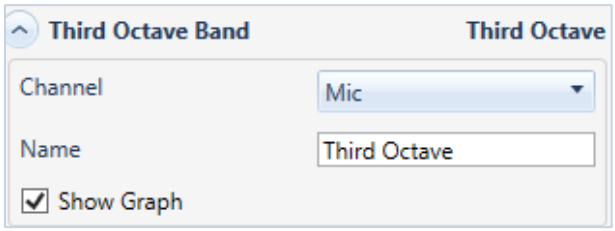
Subtract Operation:
Channel 1 – Channel 2



8.5.19 THIRD OCTAVE BAND OPERATION

The Third Octave is a frequency band tool that has a width that is only 1/3 of the width of an octave, displayed in Hz. Thirty-one, one-third octave bands are required to encompass the entire range of human hearing. One-third octave frequency bands are used when analysis does not provide the required resolution in the frequency domain. Preferred center frequencies and passbands are defined in ISO R 266 and ANSI S1.6-1984.

To perform a **Third Octave Band** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Third Octave Band** operation. The following dialog box appears.

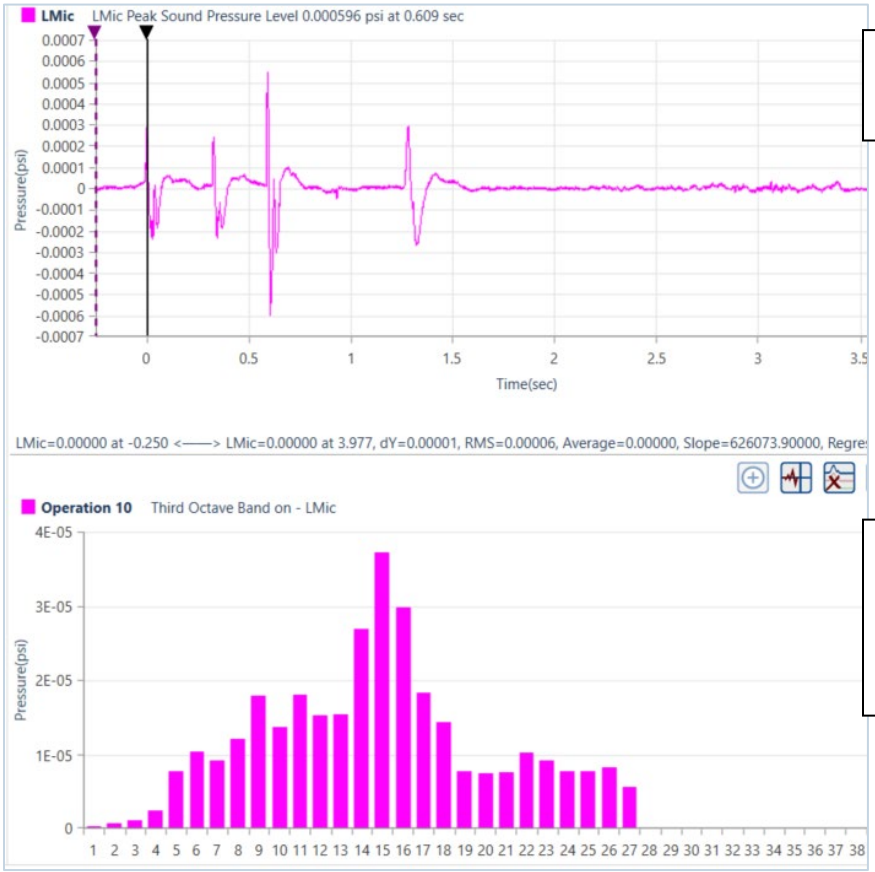


Select the Channel waveform to view using the Third Octave operation from the drop-down menu.

Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform.



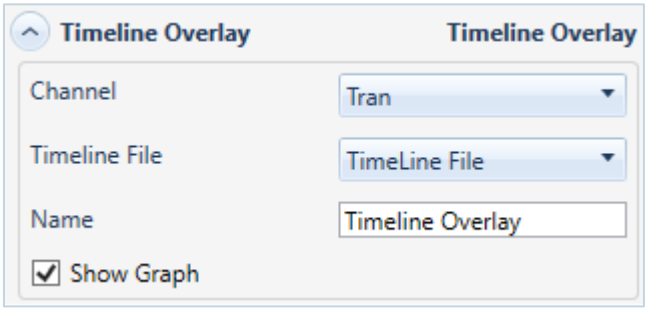
Microphone waveform

Third Octave operation performed on the Microphone waveform

8.5.20 TIMELINE OVERLAY OPERATION

Use this operation to show the blast timing on a waveform. This operation applies the timeline file you select to the channel.

To perform a **Timeline Overlay** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Timeline Overlay** operation. The following dialog box appears.



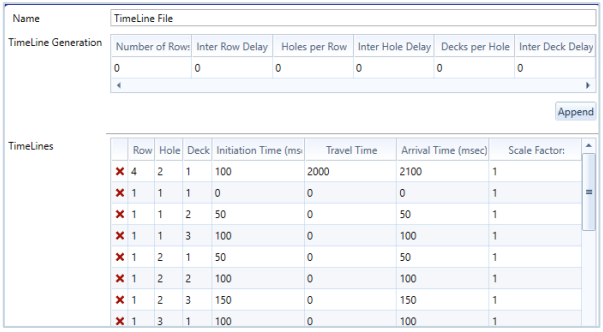
Select the **Channel** waveform on which to perform the Timeline Overlay operation from the drop-down menu.

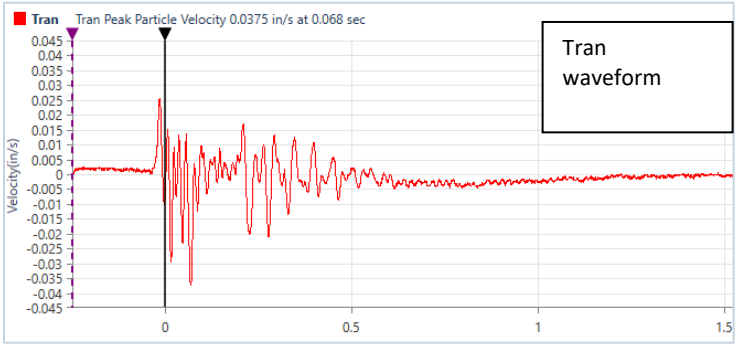
Select or create a new **Timeline File** from the drop-down menu.

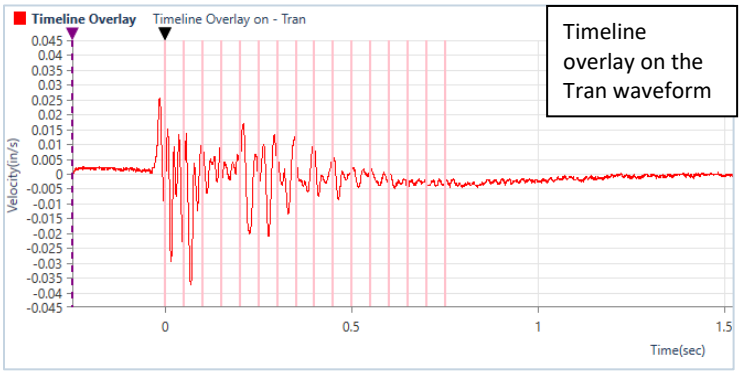
Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform.



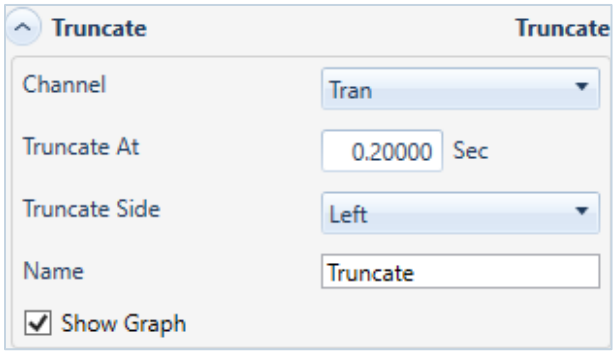




8.5.21 TRUNCATE OPERATION

This command truncates a waveform by removing unwanted sections.

To perform a **Truncate** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Truncate** operation. The following dialog box appears.



Select the **Channel** on which to perform the Truncate operation from the drop-down menu.

Enter a time in the **Truncate At** box.

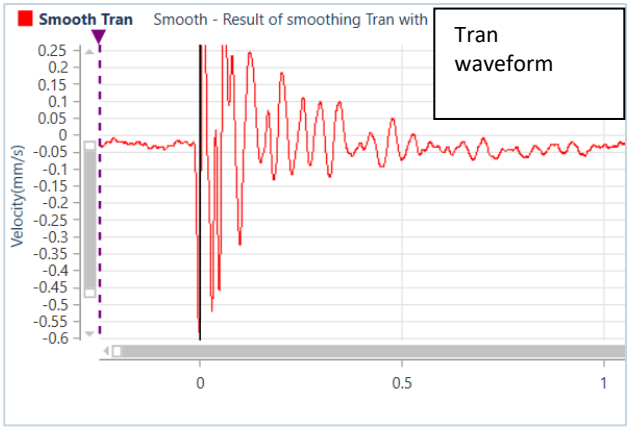
Enter a value for **Truncate Side**

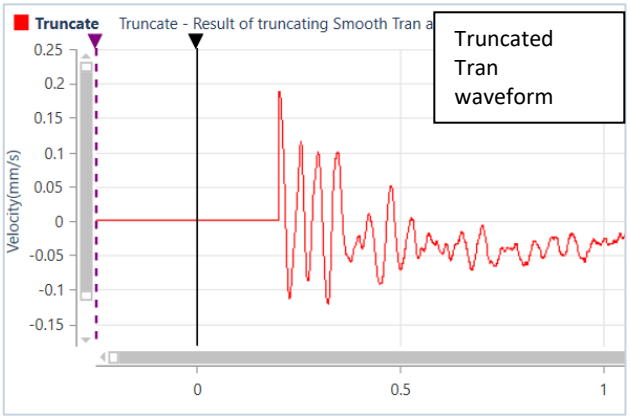
This indicates on which side to truncate the waveform. *Left* will remove information before this time. *Right* will remove information after this time.

Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform

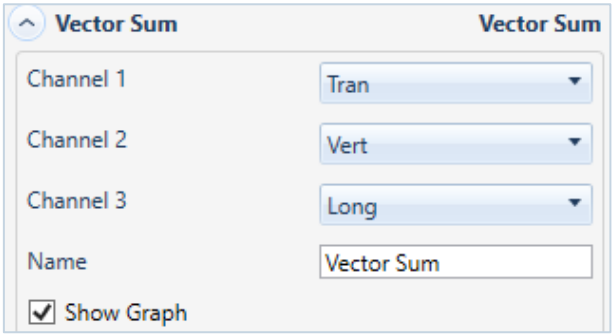




8.5.22 VECTOR SUM OPERATION

The Vector Sum operation performs a point by point vector addition of selected waveforms. Vector sums can be calculated for two or three waveforms.

To perform a **Vector Sum** operation, select an event from the **Event Table** and click the **Analyze Event** icon. In the Preset Configuration, click on the **Edit Preset** icon and click on the **Add New** dropdown menu. Select the **Vector Sum** operation. The following dialog box appears.

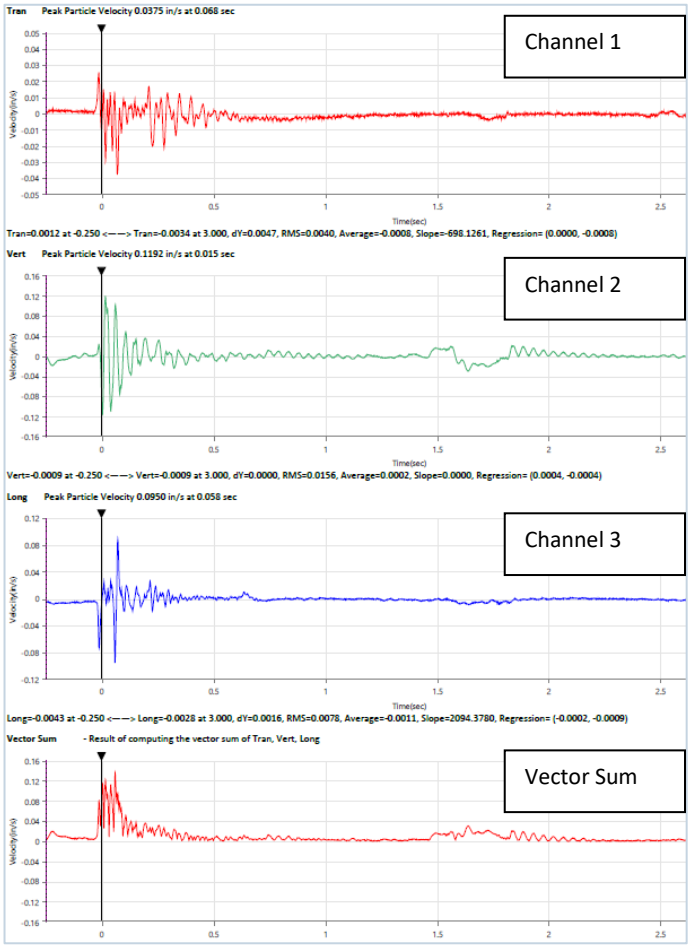


Choose the waveforms to sum in the first three drop-down menus (**Channel 1**, **Channel 2**, **Channel 3**).

Choose a **Name** for the new waveform.

Enable the **Show Graph** checkmark to display the result in the form of a graph on the right side of the window.

Click **Analyze** to create the new waveform



8.6 THE TRANSFER FUNCTION

8.6.1 TRANSFER FUNCTION TOOL

The Transfer Function Tool calculates the structural response based on a comparison of waveforms recorded inside and simultaneously outside the structure. The Transfer Function works on a single axis at a time. This means you need to perform three Transfer functions to compile the Transverse, Vertical, and Longitudinal axes.

A six-channel Minimate Pro could use two geophones to monitor an event. In this configuration, one geophone would be placed at the exterior of the building (this would be the Ground Channel). The other geophone would be placed inside the building (this becomes the Structure Channel) Both geophones record the triaxial response during an event. The transfer function will then compare one axis on one geophone to the same axis on the second geophone. The resulting graph is the frequency response of the building or otherwise known as the Transfer Function.

The same example using Micromate units will attribute one Micromate to the Ground Channel and a second Micromate to the Structure Channel. Each unit will record the event (this creates two separate event files that are synchronized in time) These two event files are then selected and their axes are compared using the Transfer Function Tool.

This function assumes that the start of the event “Time 0” is the same on each channel. If two separate seismographs are used, they should be synchronized with a wire trigger.

For more information, refer to the following publications for a complete explanation of natural frequencies and related calculations.

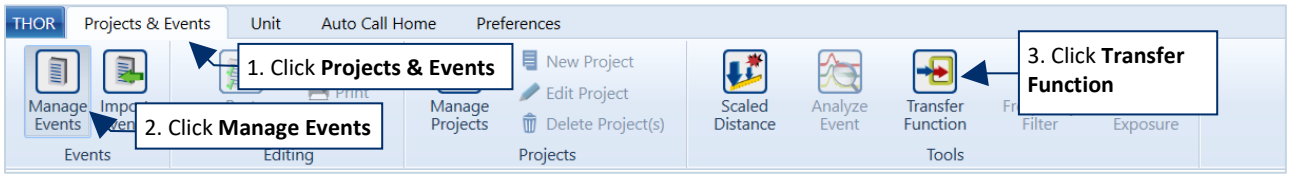
Dowding, C.H., 1985, —Blast Vibration Monitoring and Control,‖ chapters 5 and 7, Prentice-Hall, Inc., Englewood Cliffs, N.J.

Siskind, D.E., Stagg, M.S., Kopp, J.W., and Dowding, C.H., 1980, —Structure Response and Damage Produced by Ground Vibrations from Surface Blasting,‖ U.S. Bureau of Mines, Report of Investigations 8506.

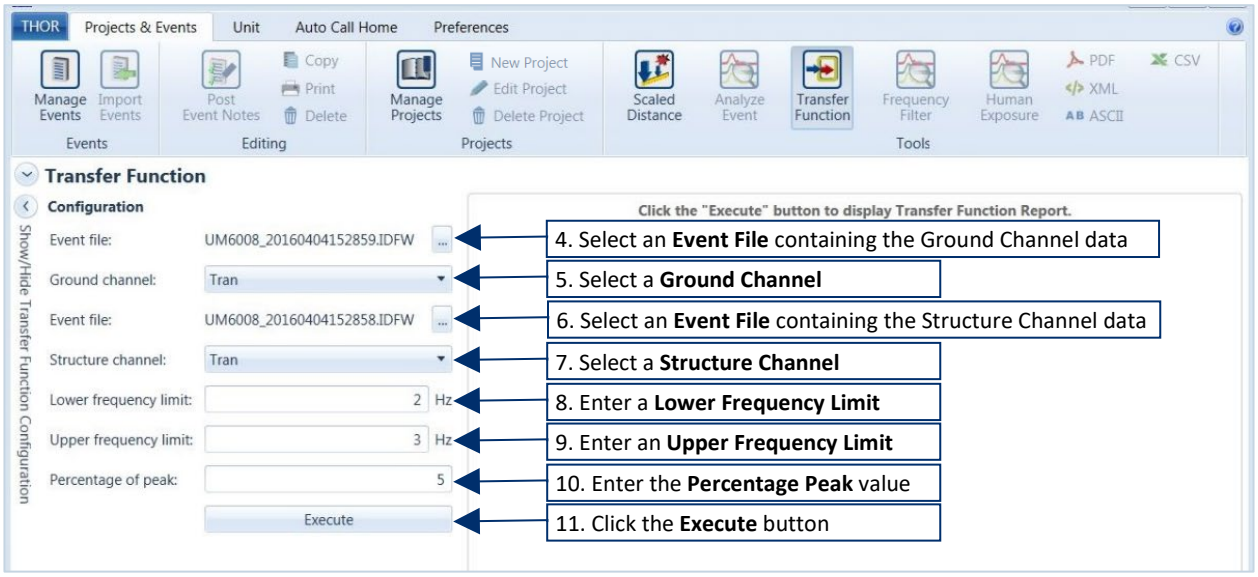
8.6.2 USING THE TRANSFER FUNCTION TOOL

To use the Transfer Function tool, you must select two event files to compare, you can then configure the parameters for the Transfer Function calculation.

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Click on the **Transfer Function** button.

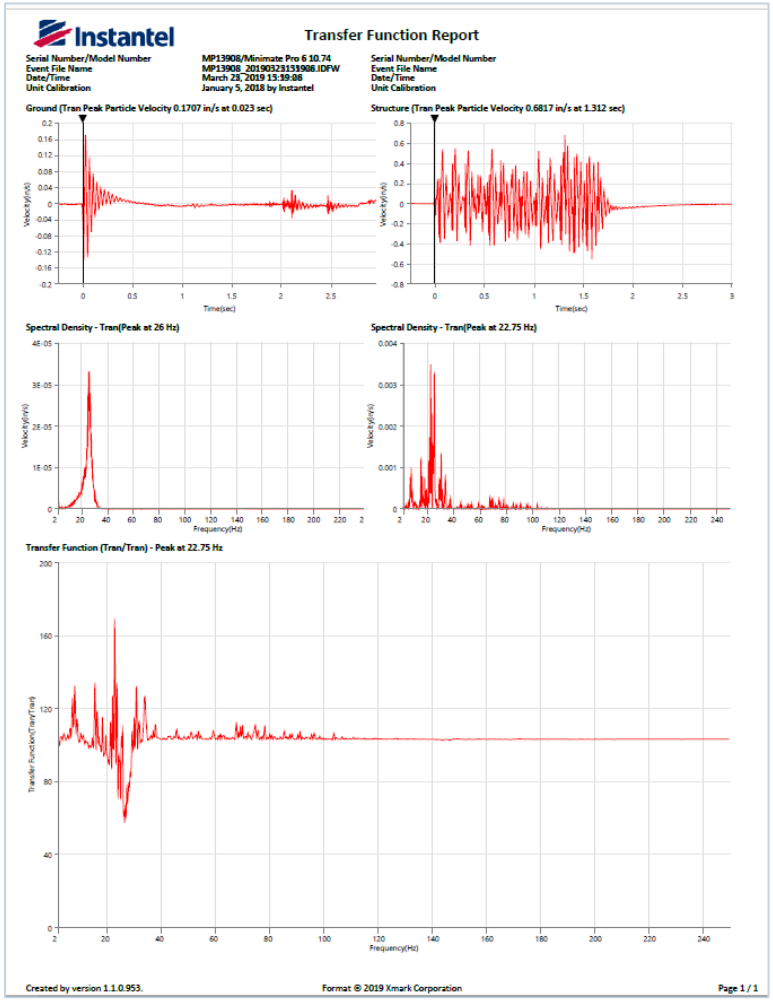


4. Select an **Event File** containing the event's Ground Channel data.
5. Select a **Ground Channel**.
6. Select an **Event file** containing the event's Structure Channel data.
7. Select a **Structure Channel**. (This should be the same axis as the Ground Channel)
8. Enter the **Lower Frequency Limit** (from 1 Hz to 315 Hz), must be below the Upper-Frequency Limit.
9. Enter the **Upper-Frequency Limit** (from 1 Hz to 315 Hz), must be above the Lower Frequency Limit.
10. Enter the **Percentage of Peak** value (between 0 and 100). This prevents low-level noise from creating false peaks. A higher Percentage of Peak value will lower the sharp peaks.
11. Click the Execute button to perform the Transfer Function calculation.



The result is displayed in a graphical form. Scroll the window to view all calculations.

3 To export a PDF report of the Transfer Function, click the **PDF** icon. Below is an example report PDF



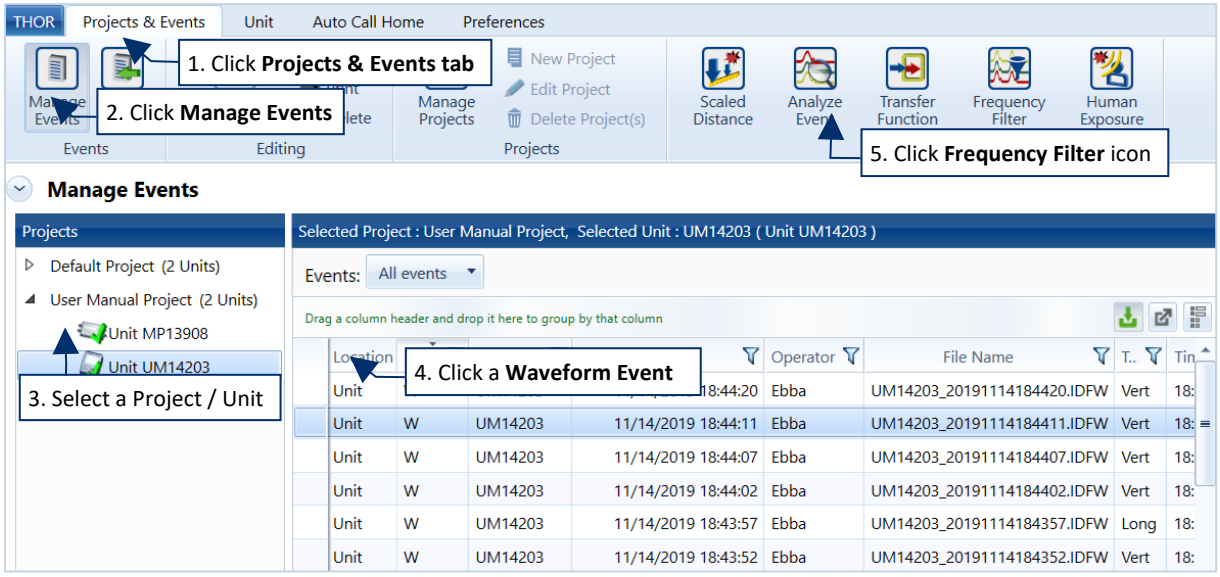
8.7 THE FREQUENCY FILTER

8.7.1 FREQUENCY FILTER TOOL

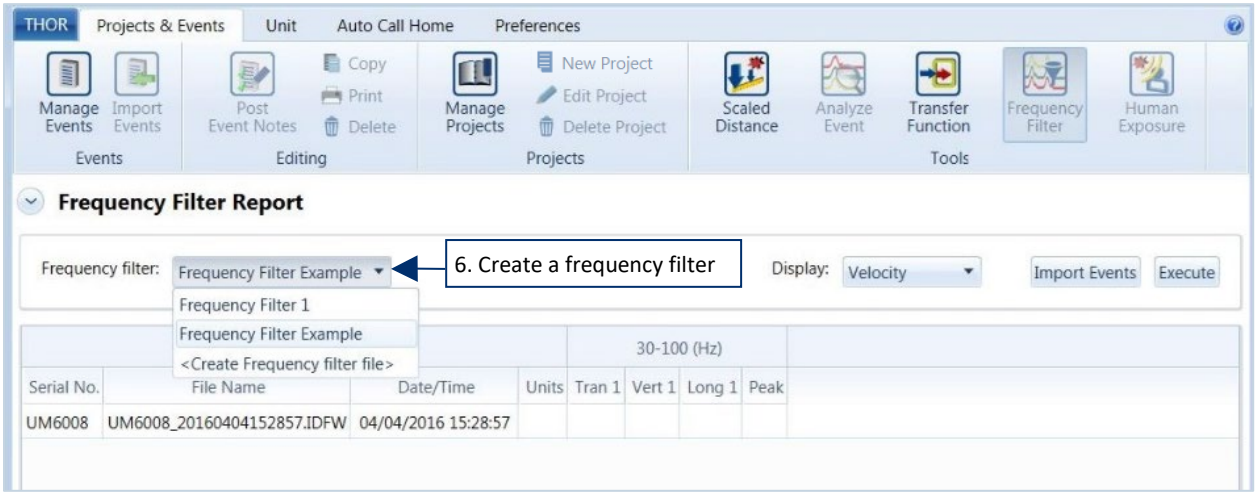
The Frequency Filter Tool, filters events based on the selected frequencies. First set up a Frequency Filter File which defines the filters frequency range. Once set up the tool will generate a report showing the peak, acceleration, and displacement of the filtered results.

Choose at least one waveform event from the event management window and click on the Frequency Filter button. You can also import more events from within the report view.

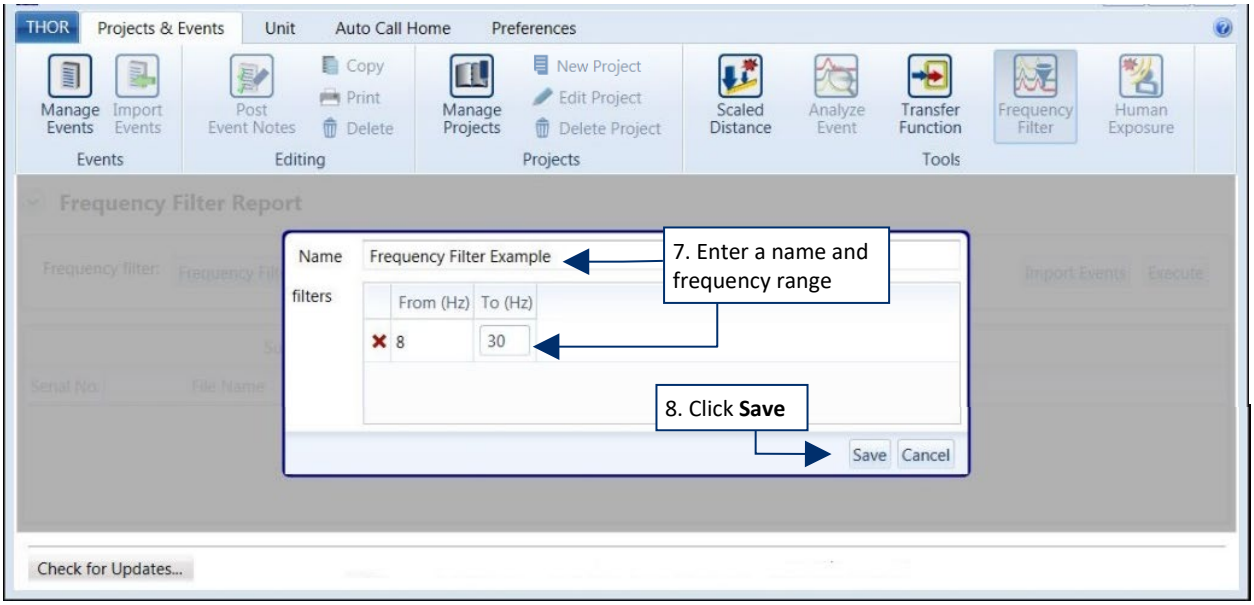
1. Click the **Projects & Events** tab.
2. Click the **Manage Events** icon.
3. Select a **Project/Unit**



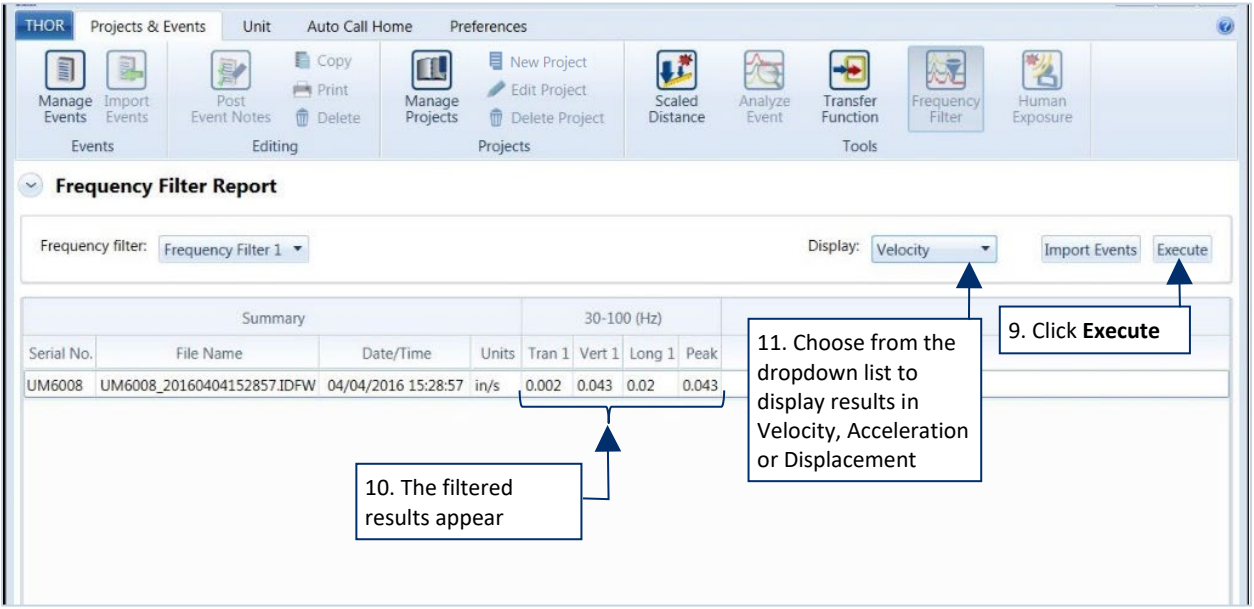
4. Click at least one **Waveform Event** from the list of events.
5. Click on the **Frequency Filter** icon.
6. Create a **Frequency Filter** from the drop-down menu (or choose an existing one and skip to step 10).



7 Enter a name and frequency range.



8 Click the **Save** button.



9 Click the **Execute** button.

10 The filtered results appear.

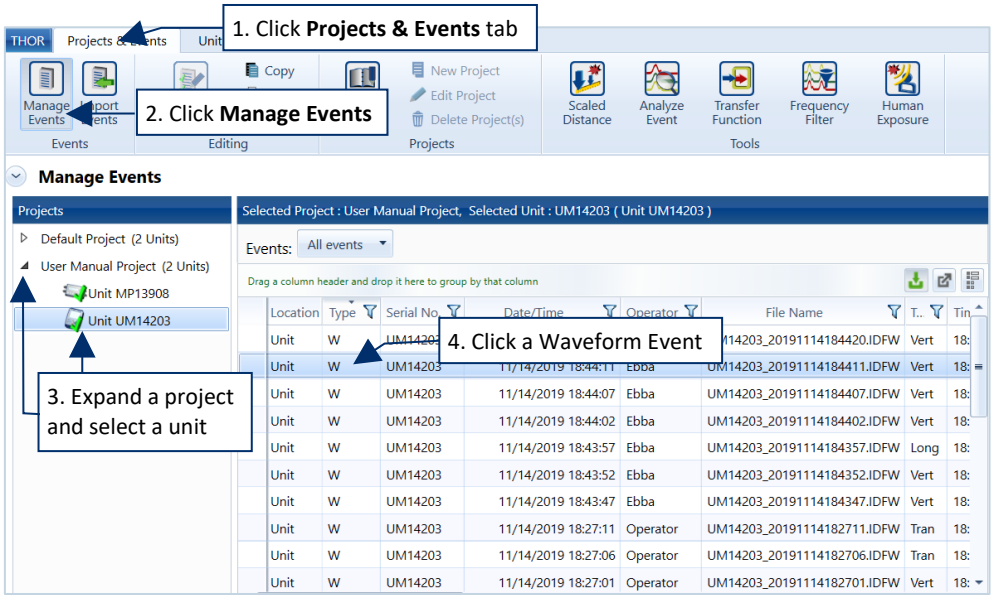
11 To change the display, choose from the dropdown list.

8.7.2 SETUP CONFIGURATION PRESETS

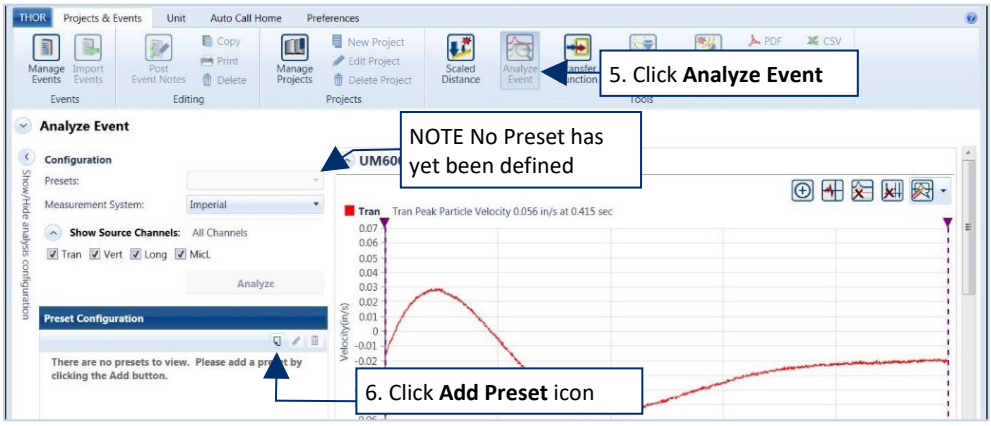
To analyze an event, there must be an existing **Configuration Preset** which defines the analysis operations to perform on the event.

To set up a Configuration Preset:

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.

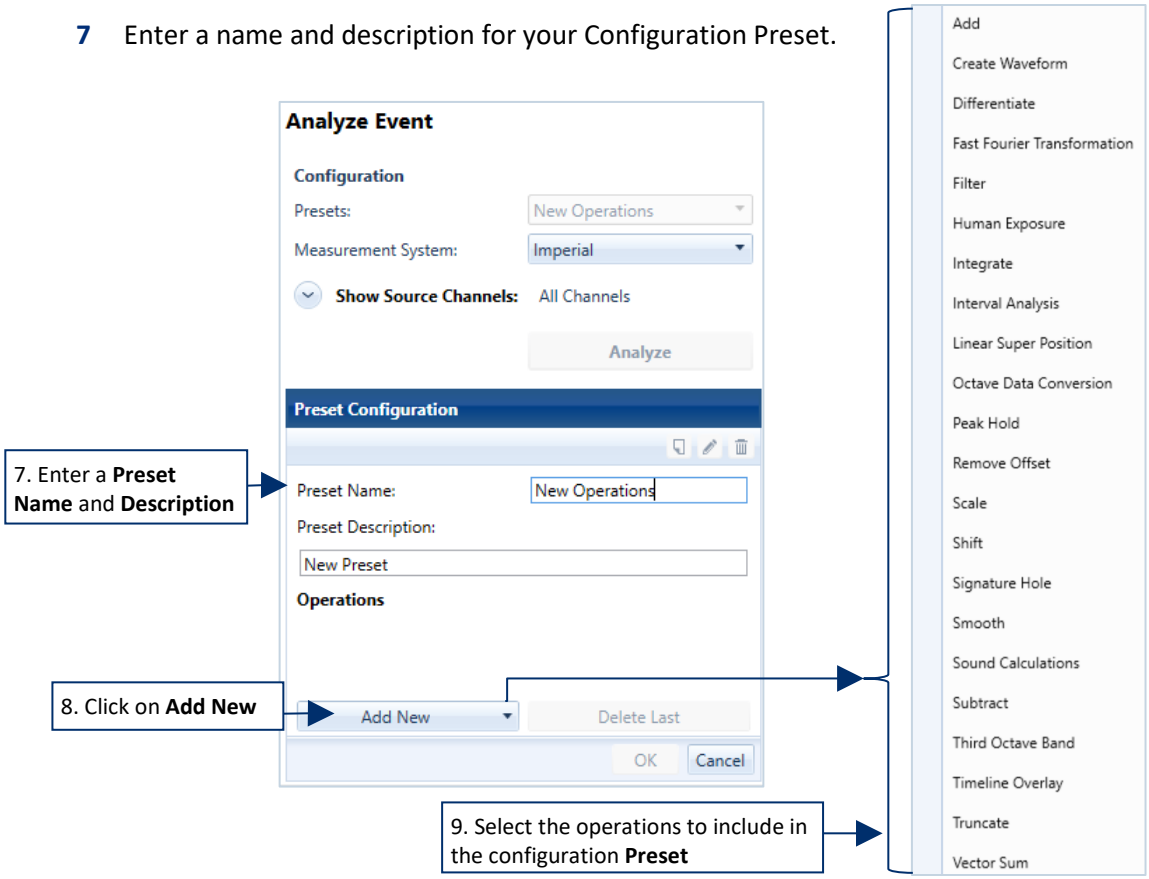


3. Expand a project and select a unit to view events and logs associated with the unit.
4. Click a **Waveform** or **Advanced Waveform** event.
5. Click the **Analyze Event** button.



6. Click the **Add Preset** icon.

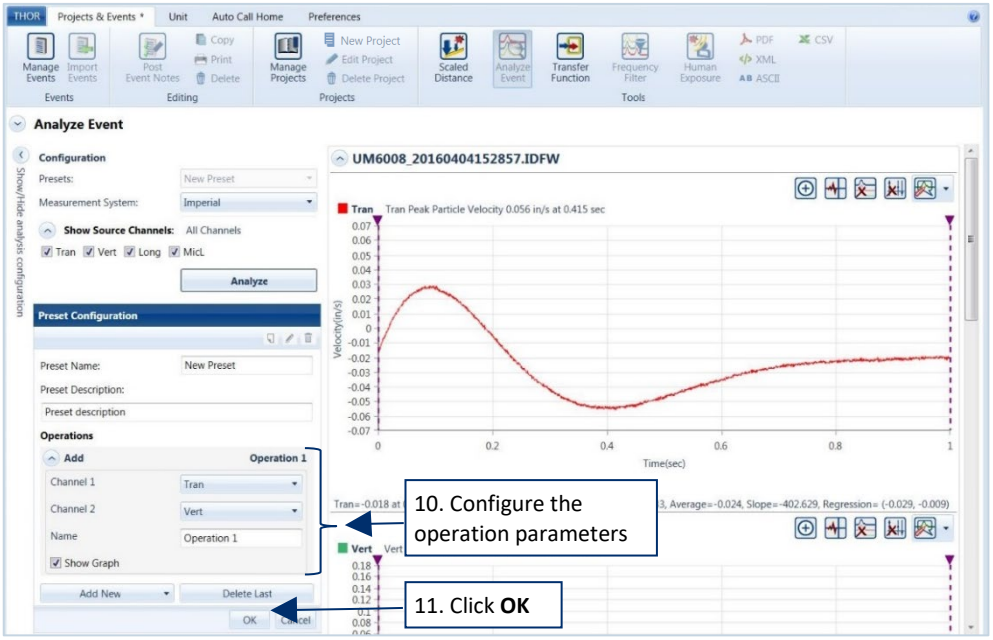
7 Enter a name and description for your Configuration Preset.



Click the **Add New** button to add new operations to your **Configuration Preset**.

8 Select the operations to include in the configuration **Preset**.

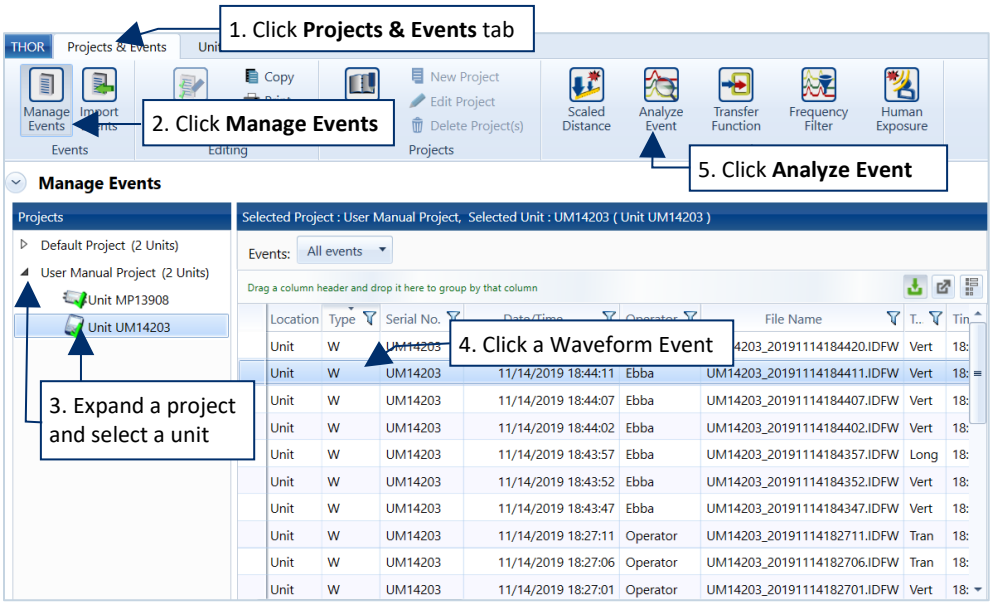
Configure the operation parameters.

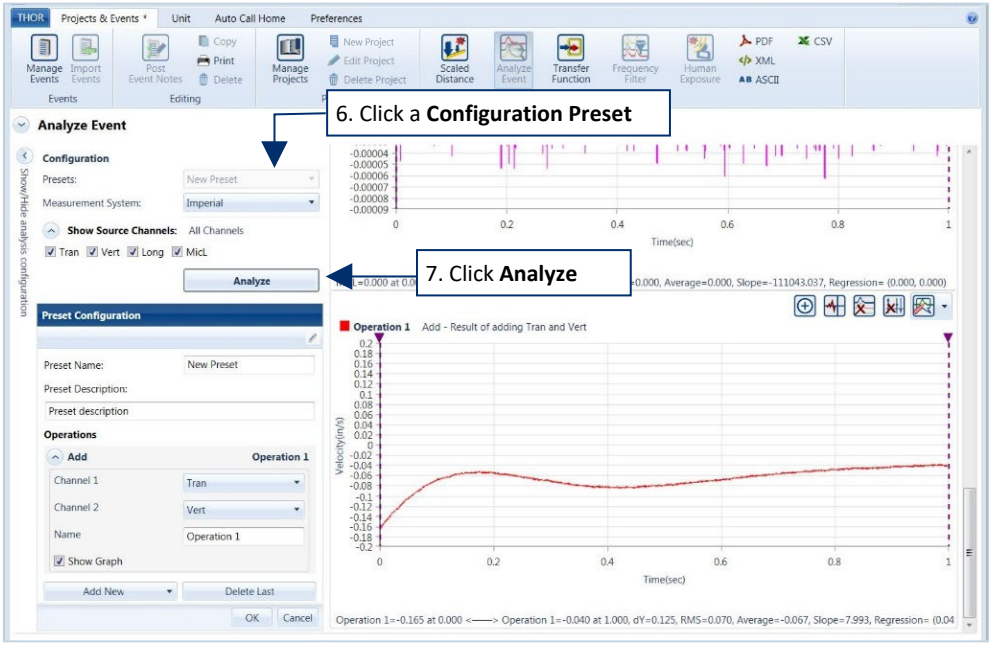


Click the **OK** button to save the changes

8.7.3 ANALYZE AN EVENT

1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.
3. Expand a project and select a unit.
4. Click a **Waveform** or **Advanced Waveform** event.
5. Click the **Analyze Event** button.





6. Click a **Configuration Preset**
7. Click the **Analyze** button.

The Analysis graph appears at the bottom right of the window, with the name of the Operation at the top of the graph. The original event waveforms are also accessible using the scrollbar.

8.8 WORKING WITH EVENT ANALYSIS GRAPHS

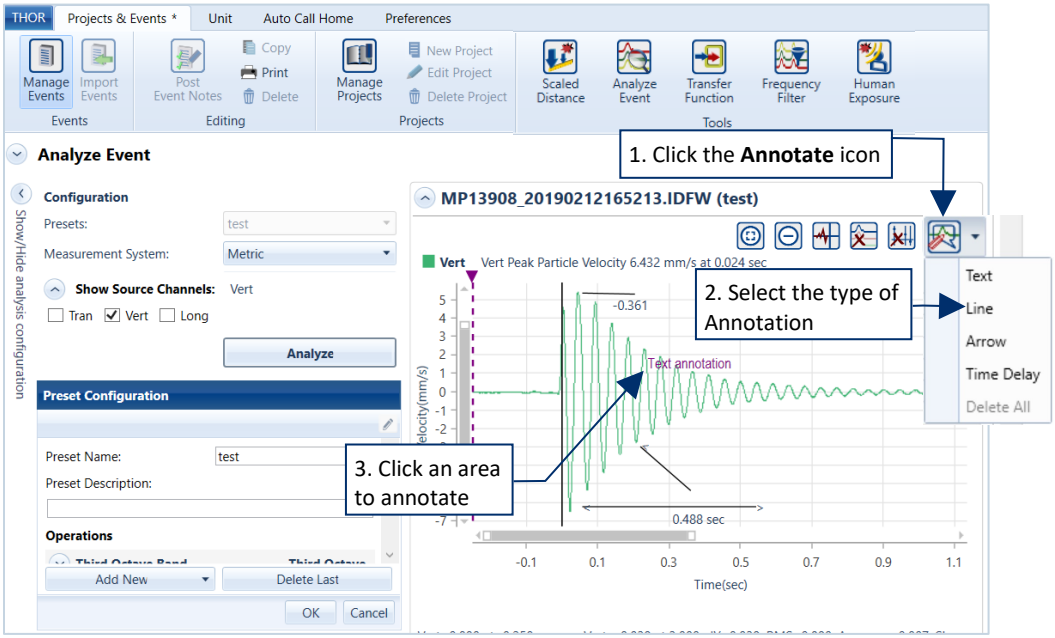
Event Analysis graphs have the same functionality as Event Reports plus the ability to annotate an Event Analysis Graph.

See *section 5.9.1.3 Add a Crosshair* on page 116
See *section 5.9.3 Export Reports* on page 123

8.8.1 ANNOTATE AN EVENT ANALYSIS GRAPH

When viewing Event Analysis Graphs, you can annotate a portion of the graph.

1 Click the Annotate icon. 



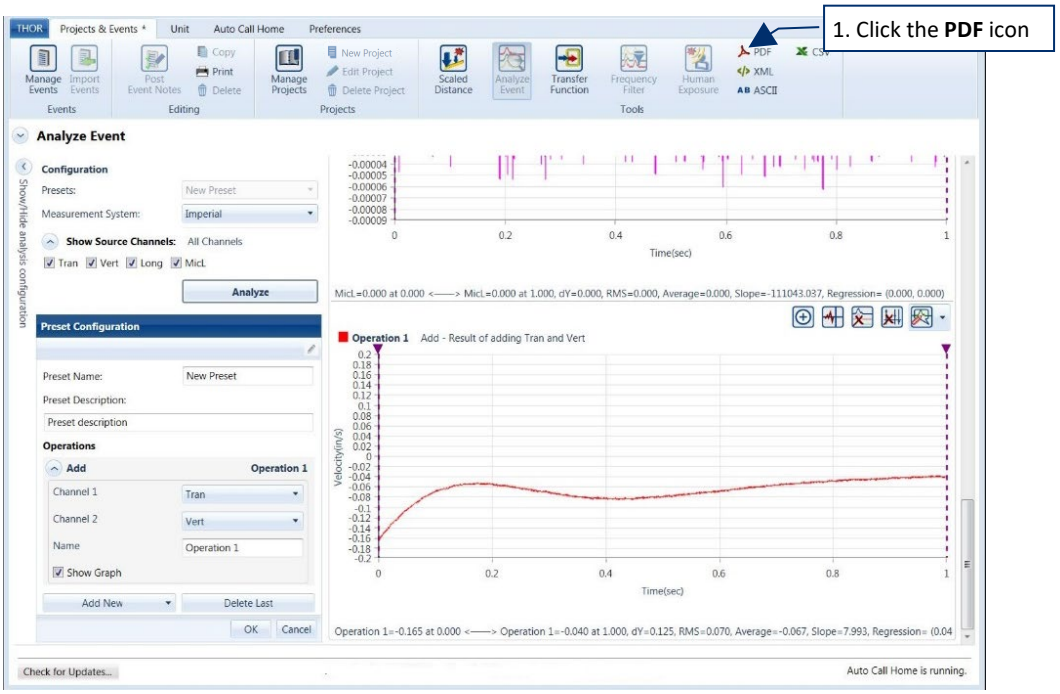
2 Select the type of annotation:

- Text (Place simple text on the graph, then double-click to edit, this allows you to select font, text size and color.)
- Line (Add a line between two points on the graph, double-clicking the line gives the option to delete the line. Click an end section to adjust the line.)
- Arrow (Point out a section on the graph, click the point of the arrow to delete, click the end section to adjust the arrow.)
- Time Delay (Measures the time between two points on the graph, click the end section to adjust the line.)
- Delete All (Removes all annotations.)

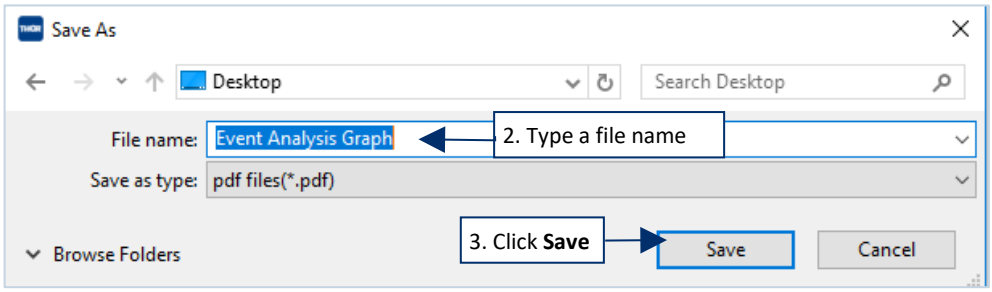
3 Click the area of the graph to annotate.

8.8.2 EXPORT AN EVENT ANALYSIS GRAPH

1 While viewing an Event Analysis Graph, click the PDF icon.



You can only export an event once it has been analyzed, it will not work if you only add text annotations and flags.



2 In the **File Name** field, type a file name.

3 Click **Save**.

8.9 HUMAN EXPOSURE REPORTS

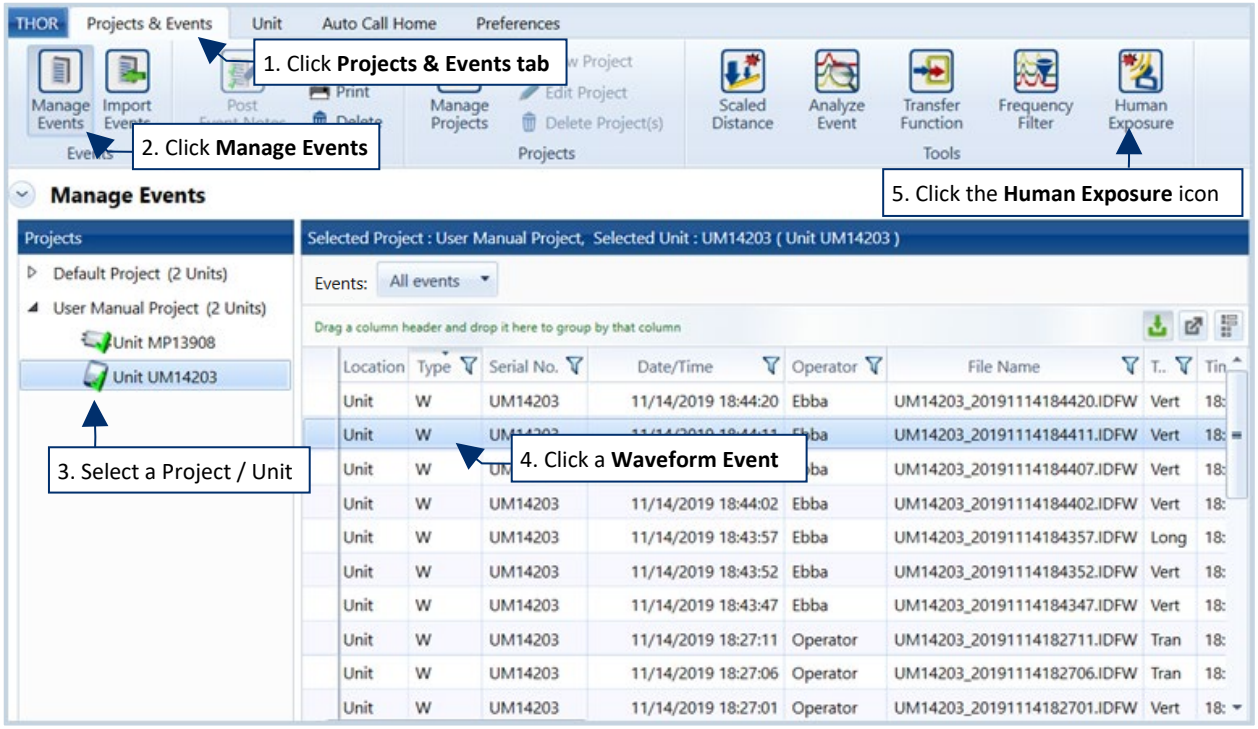
The Human Exposure tool calculates frequency-weighted Vibration Dosage Value (VDV) and the Root Mean Square (RMS) on one or more events. The generated report helps determine the effect of a blast on humans in the surrounding area.

8.9.1 GENERATING A HUMAN EXPOSURE REPORT

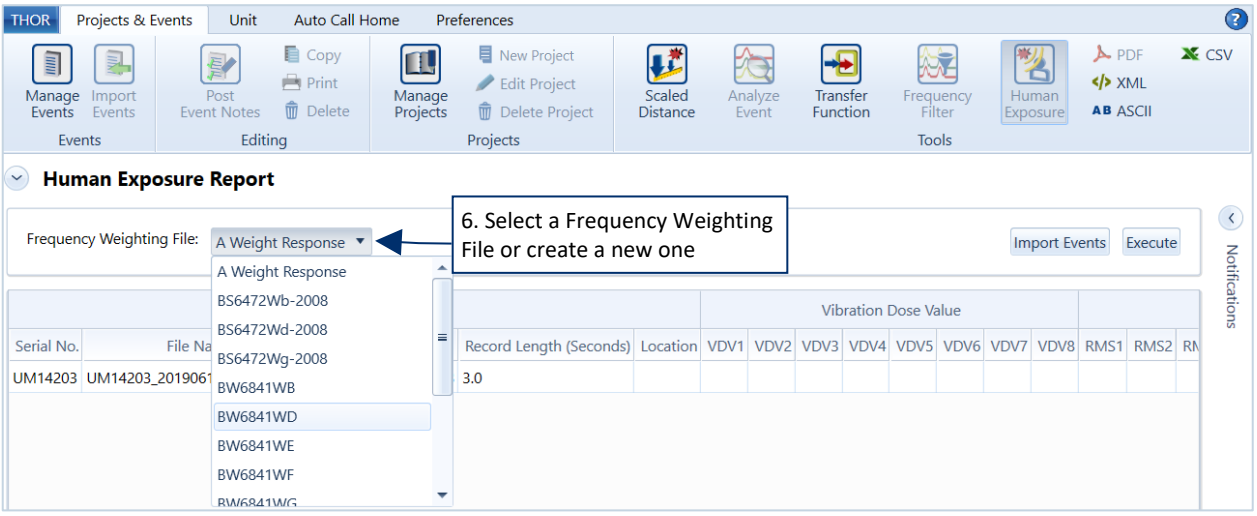
To generate the Human Exposure Report, choose at least one waveform event from the event management window and click on the Human Exposure button. You can also import more events from within the report view.

Before you can view the human exposure report, first do the following to set up a frequency weight file.

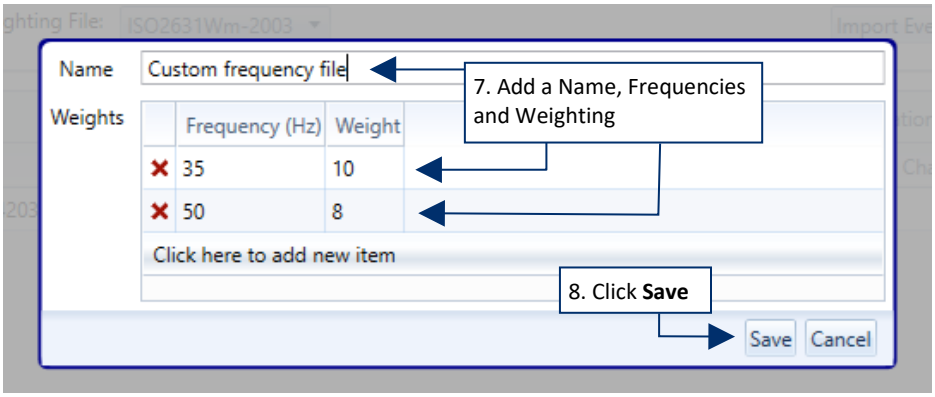
1. Click the **Projects & Events** tab.
2. Click the **Manage Events** button.



3. Select a Project / Unit.
4. Click at least one waveform event from the list of events.
5. Click on the **Human Exposure** icon.



6 Select a Frequency Weighting File from the dropdown menu or create a new one.

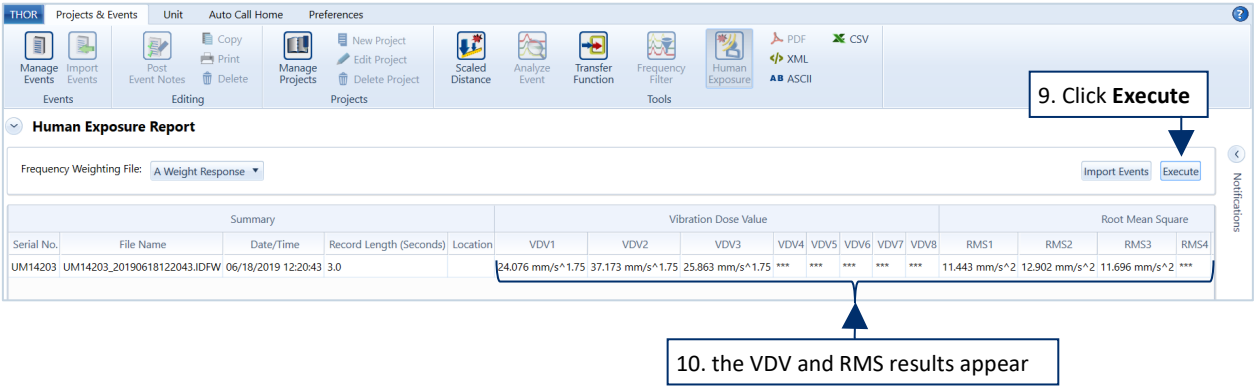


7 To customize your frequency file, add a Name then add frequencies and assign a weighting to them.

8 Click the **Save** button

9 Click the **Execute** button.

10 The **VDV** and **RMS** results appear.



9. INDEX