MANUAL

TRIMBLE 4D CONTROL

Web Interface

4D Control version 4.5 – Web Manual

Contents

1 Introduction

A monitoring installation lets you detect displacement or movement in natural and manmade structures. It provides the data you need to understand the speed, direction and magnitude of any motion. The T4D Control suite is the core of your monitoring project. It controls the measurements, manages and analyzes the data, and provides decision support.

Getting started is easy with scalable monitoring solutions from Trimble. Trimble 4D Control provides analysis and management tools to help you start small and grow. As your expertise in monitoring increases, you can easily expand from post-processed deformation monitoring campaigns all the way to real-time systems that manage your projects and alert the operator of significant motion events.

Typical applications includes

- **Mining** – Trimble monitoring solutions can be used in open pit and underground mines for monitoring highwalls, tunnels, subsidence and stockpiles.
- **Construction** – Monitor motion in buildings and structures adjacent to construction sites. You can monitor cut and fill slopes and incomplete structures.
- **Engineering** – Track the motion of dams, bridges, buildings and other man-made structures.
- **Transportation** – Monitor transportation structures, cut and fill slopes and railways. You can also monitor structures close to transportation corridors during construction and operation.
- **Utilities** – Monitor pipelines, transmission structures, production and storage facilities.
- **Tunneling** – Monitor new and existing tunnels for deformation. Monitor for surface subsidence above tunneling projects.
- **Geotechnical** – Monitor dams and levees, landslides, landfills, subsidence, faults and natural structures.

This document represents a support manual for the web interface of the T4D Control suite.

1.1 TARGET USERS

The majority of users will most likely not have permissions to access all areas of the web interface and therefore not need all the information explained in this manual. User permissions will be explained in Section 19.3 on page 143. User permissions are completely customizable on this system and can differ from one installation to another. There is unfortunately no set manual for only certain types of users. This manual contain all the support material a user with full administration access will have.

Note: Trimble 4D Control security is automatically enforced both in the browser and on the server side, so there is no security risk in providing this manual to users with limited permissions. The manual can therefore be freely distributed as required.

1.2 MODULES AVAILABLE IN T4D

Different modules may be installed on different installations. The next page contains a list of all modules available in the Trimble 4D Control suite.

Sensors
Configure sensor data to be displayed in the web interface, view sensor properties, latest sensor readings and current sensor state.

Sensor Groups
Create sensor groups to refer to groups of sensors, or to define representative calculation sensors.

Map
View sensor location, data and state on an interactive map.

Custom Views
View sensor location, data and state on user supplied images, with data updates at specified time intervals.

Webcams
View webcams linked to the project.

3D Scenes
Create, maintain and view 3D Scenes representing your monitoring project.

Charts
View the selected data series of a single sensor in a simple chart.

Scatter Plot
Visualize and animate positional displacement over time for a particular sensor within to different planes.

Analysis
View selected data series of multiple sensors in a complex chart to graphically analyse the structural behaviour.

Composite Views
Create, maintain and view composite views by combining plan views, scatter plots and multiple analyses.

Alarms
Create Warning and Alarm Conditions against which the data series are monitored, with notifications being issued in the event that Warning or Alarm Conditions is met.

Logs
Record activities and items of interest either manually or automatically, append comments, group by Log Type and search by criteria.

Highrise
Manage Highrise construction sessions.

System Status
Monitor the system health by analysing sensor data delivery and alarm events. View either the current state or historic behaviour. Create scheduled system status reports that can be circulated to multiple users on a regular basis.

Framed Pages
Make external web sites or web pages available within T4D Control Web.

Account Settings
Create, manage and remove users of the web facility.

Mobile View
Switch to the mobile friendly view.

2 Navigation

When you log into The Trimble 4D Control Web Interface, the first page you see is the **Home Page**.

The Trimble 4D Control Web Interface can be navigated either via the icons with pictures on the Home Page or via the main menu at the top of the pages. Below is a typical display of the Trimble 4D Control Web interface. Note the different control areas: status bar, main menu, left panel (containing the project status), content panel (containing the Home Page content), and the notification right panel. Below we will present the areas used for navigation.

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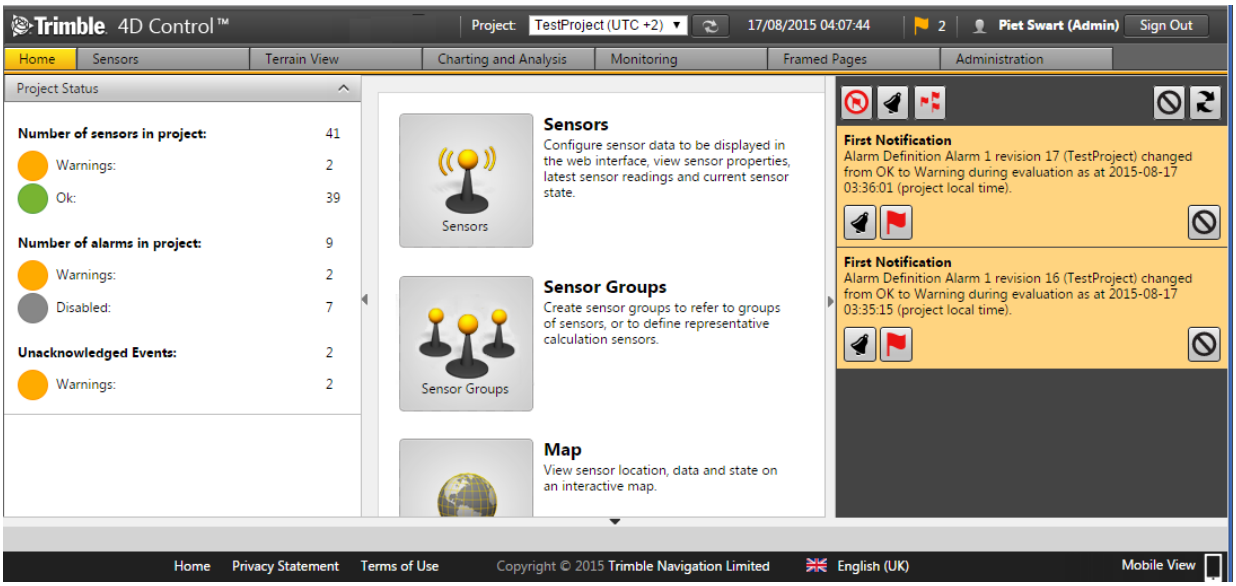
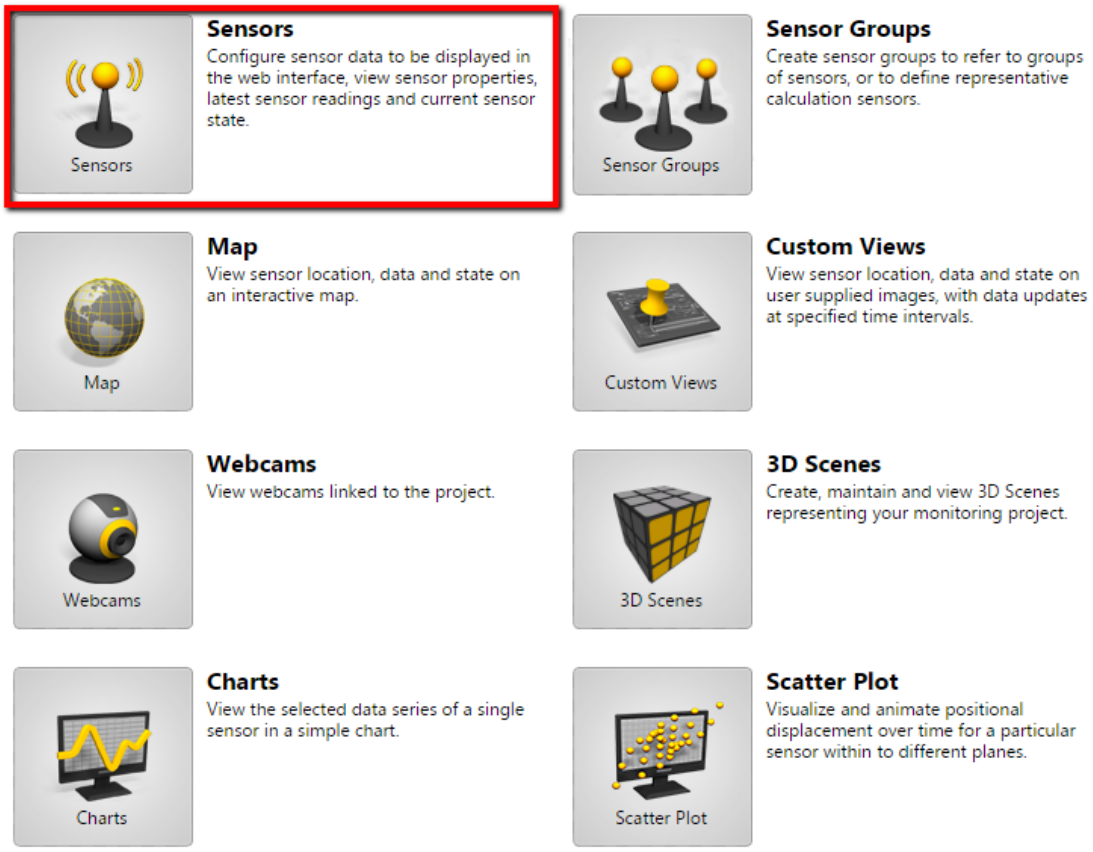


2.1 HOME PAGE

Here you will see icons which navigate you through the rest of the site pages; each with a short description of the purpose of the pages.


Sensors
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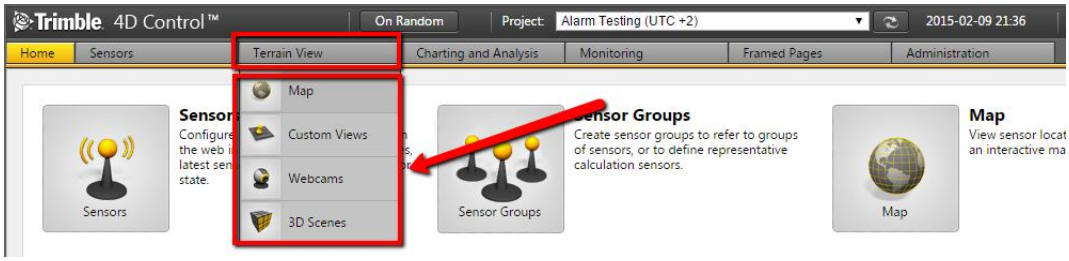
View the selected data series of a single sensor in a simple chart.
Charts
Scatter Plot
Visualize and animate positional displacement over time for a particular sensor within to different planes.
Scatter Plot

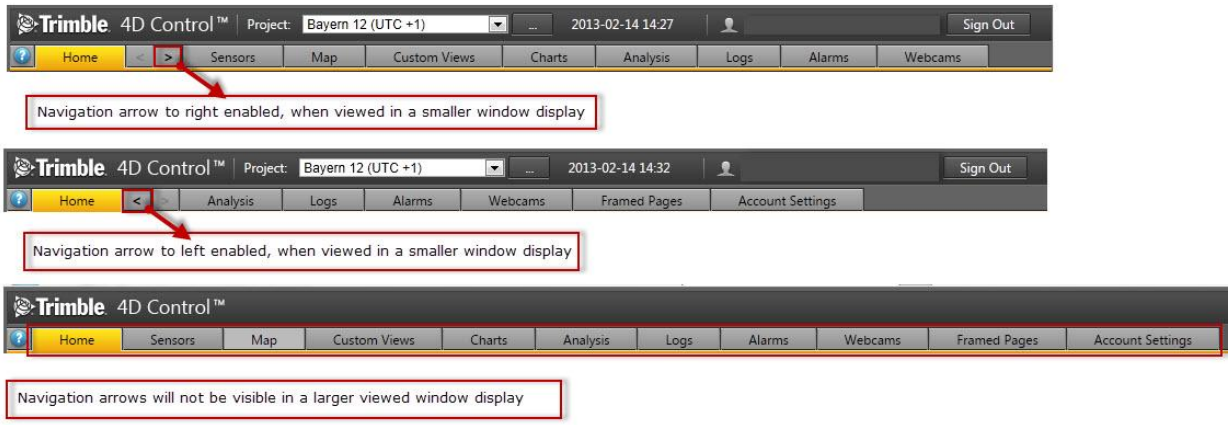
2.2 MAIN MENU

The Trimble 4D Control Web Interface can also be navigated via the main horizontal menu at the top of the **Page**.



Some items in the menu have drop downs.

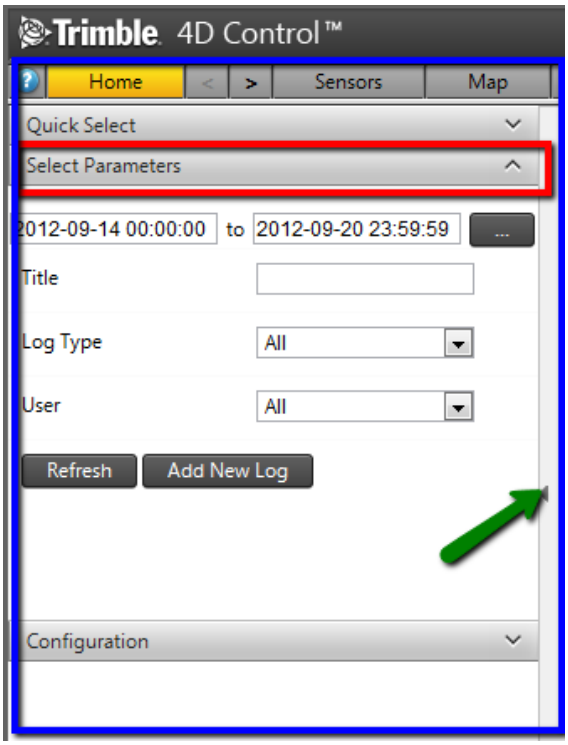
If the browser window is too small to display all the menu options at once, then menu navigation arrow buttons will become visible. The left and right arrows will become enabled and disabled based on whether or not there are unseen menu options available towards the left and the right.



2.3 PAGE CONTROL PANEL

Every Trimble 4D Control Web Interface page has a **Control Panel** in a left panel.

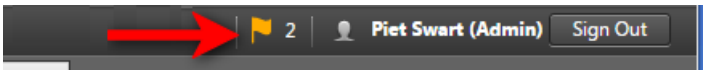
Let us consider for example the Logs Page Control Panel in the figure below. In the **Control Panel** there are bar tabs with additional options (red). These bar tabs may differ from **Page** to Page. The **Panel** can be hidden by clicking the panel collapse arrow (green).



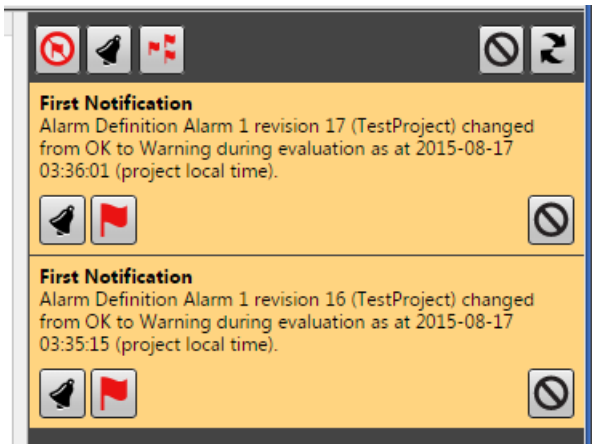
NB: If you are having trouble viewing all tabs in the Navigation Bar or Control Panel, be advised that it is dependent on the role of the User logged in. Administrators have more options available than Analysts etc. In other words if you do not see all the options, it is most likely because the logged in User does not have access to it.

2.4 WEB NOTIFICATIONS PANEL

The **Web Notifications Panel** is displayed on the right. Normally this panel is not visible. You can open or close the web notifications panel by clicking the flag icon on the main menu next to where you user name is displayed. The web notifications panel is usually displayed over the content area of the page you are viewing, so the intention of the web notification panel is not for it to be kept open.



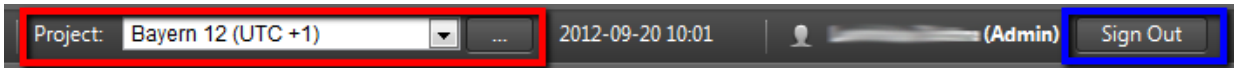
The web notifications panel shows alarms and events to the currently logged in user. You can click on the buttons presented by the web notifications panel to acknowledge or navigate to event related information.



2.5 SELECT A PROJECT

To select a project, use the dropdown menu (red) found above the main menu to the right hand side of the **Page**.

To Sign Out of the Trimble 4D Control Web Interface, click the sign out button (blue) in the top right corner of the Page.



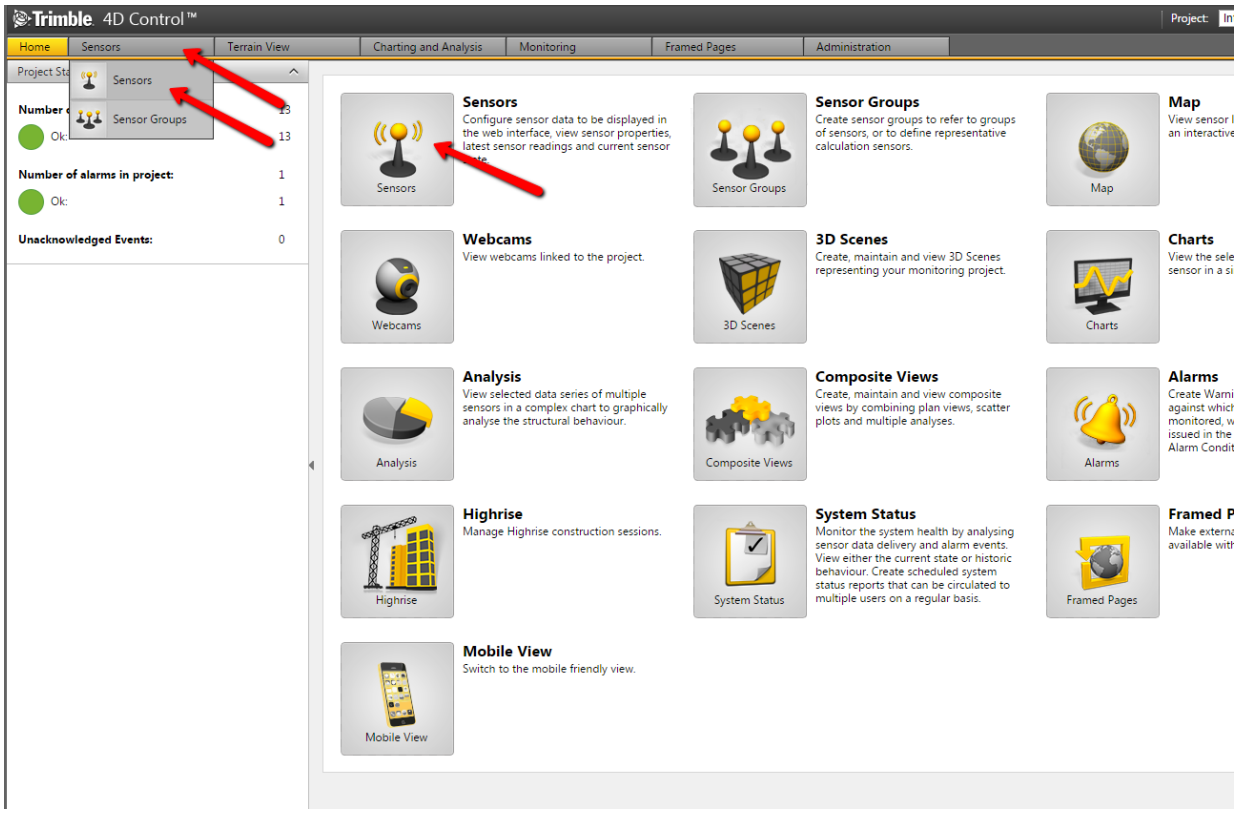
The time displayed adjacent to the project is the Project Local Time. This is the time at the physical site being monitored. Please note that you need to configure the daylight savings setting explained in section 3.5.1 on page 17 for the project time to take daylight savings into account.

3 Sensors

A sensor in Trimble 4D Control designates a position and related information to measurements taken at the particular location. Typically a sensor may be a hardware device taking automated measurements, or a device where manual measurements are regularly taken. A sensor can also designate only a beacon of which measurements are taken, such as a Total Station Measurement or a field collector collecting data with a portable device at the particular beacon. We use the term *observation* for data measurement of a sensor.

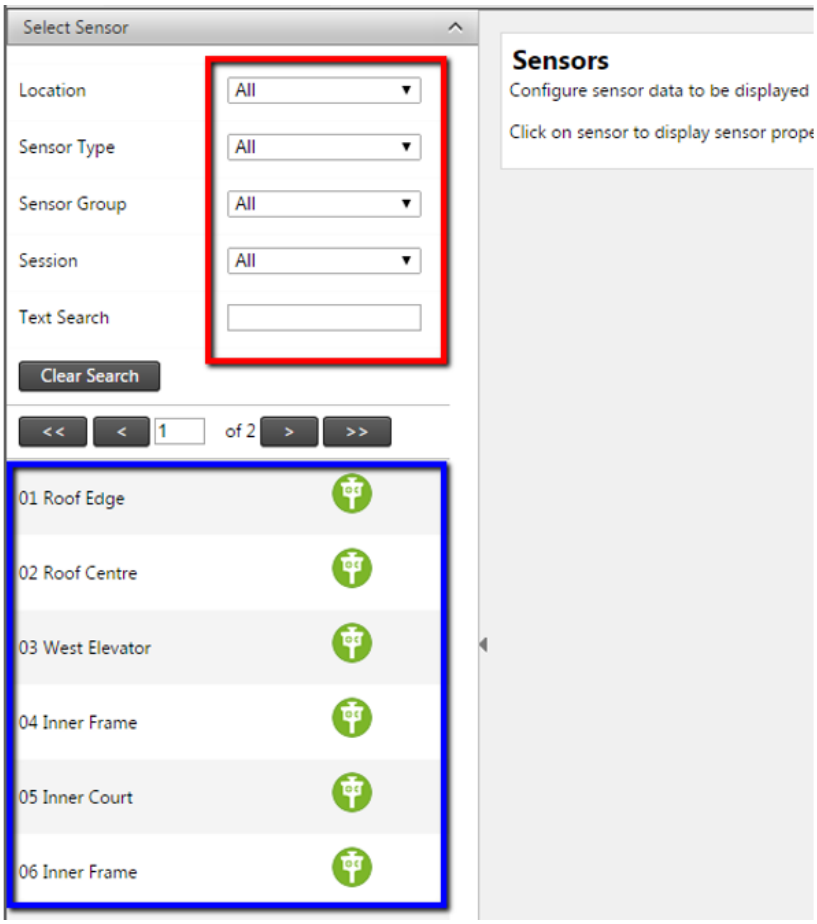
3.1 HOW TO DISPLAY SENSOR PROPERTIES AND LATEST READINGS

Step 1: Navigate to the Sensors Page by clicking Sensors Icon on the Home Page or by hovering the mouse over the Sensors top menu item and then clicking Sensors in the dropdown menu (as illustrated).

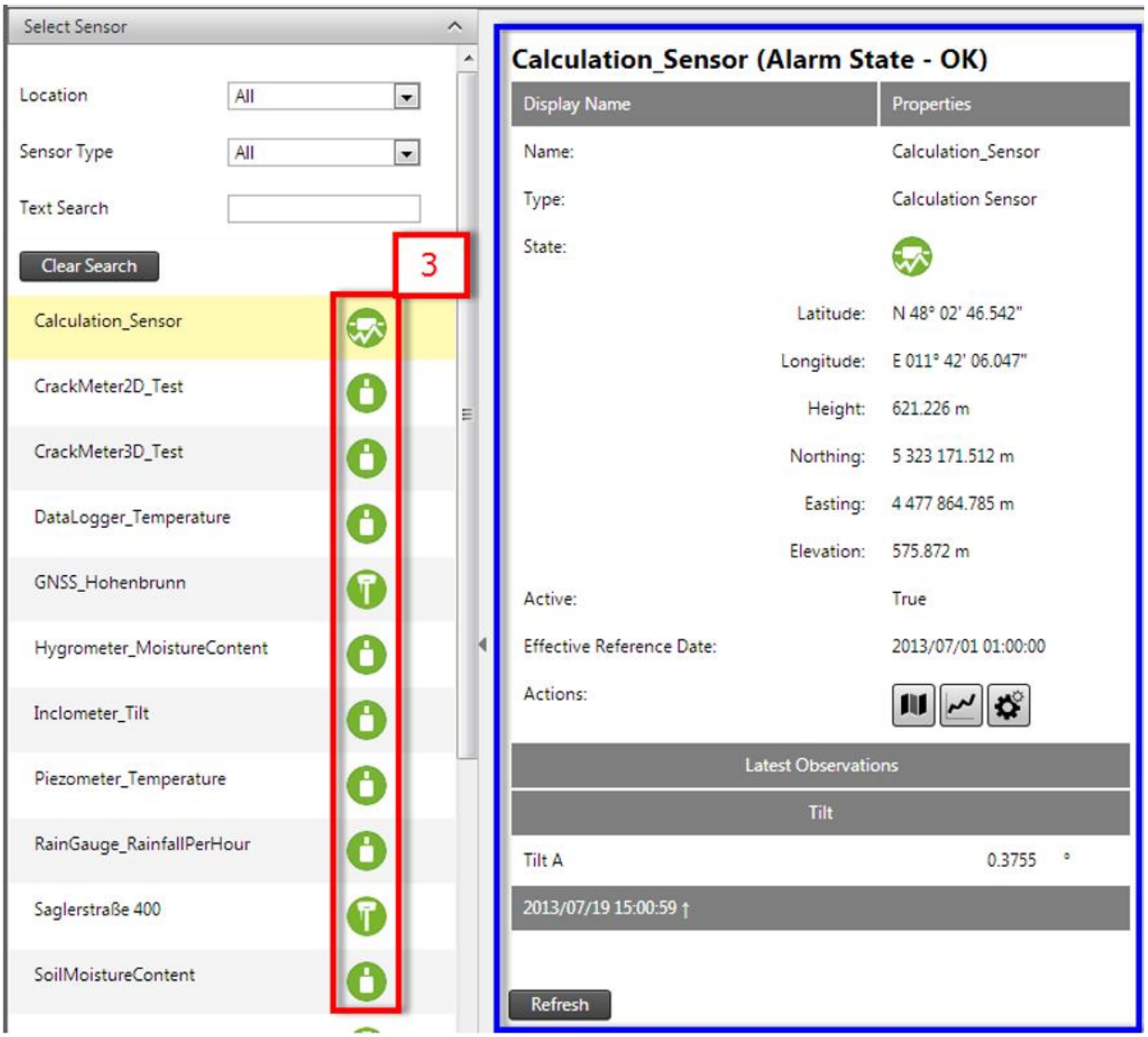


Step 2: Choose your sensor. The available sensors are listed in the area indicated in blue. If there are multiple sensors, the sensors can be filtered by any of the options indicated in the red area. Options are as follows:

- Sensor location: The physical location of the sensor.
- Sensor type: The type the sensor is associated with, e.g. Total Station.
- Sensor group: The group you have allocated the sensor to belong to (To be discussed in Sensor Groups on page 22).
- Sensor session: The specific session linked to the sensor (only applicable if the Highrise module is installed).
- Text search: Any text to filter out non-matching sensors. (E.g. a partial word in the name of the sensor.)

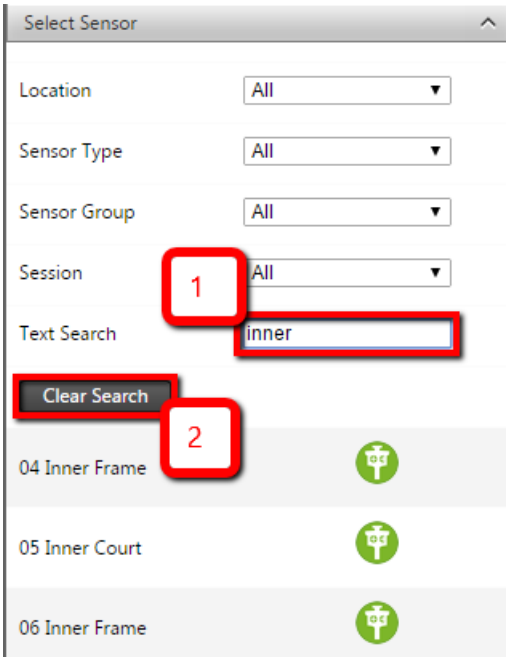


Step 3: Click on any Sensor icon (3) for information about the Sensor to be displayed. (Blue)



Your Sensor information will be displayed in the Display Window to the right.

Step 4: Alternatively, you can search for your sensor by using a text search (1) in the search box. You can clear all search criteria by clicking the Clear Search button (2).



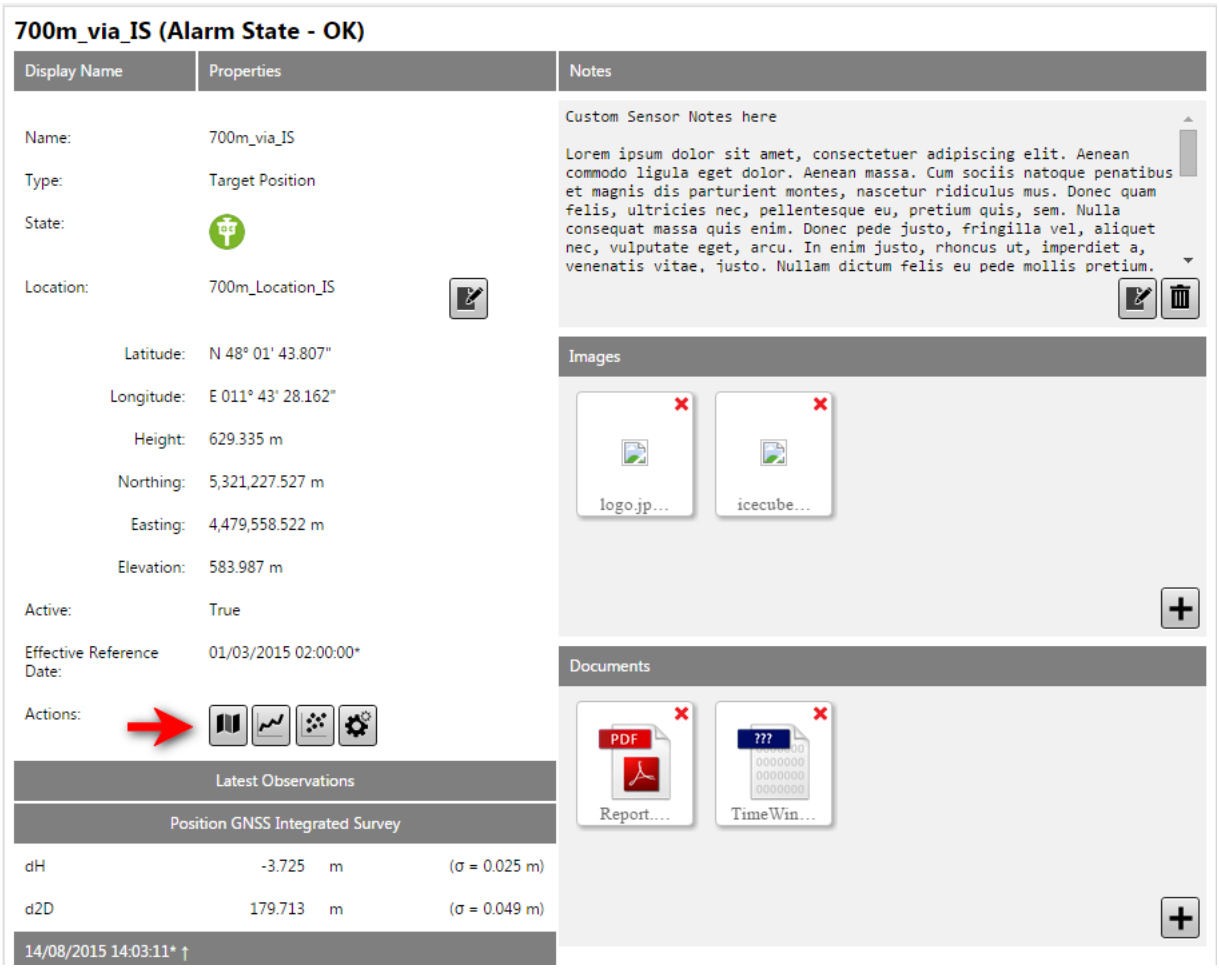
3.2 SENSOR PROPERTIES

On the Sensor properties page you can navigate to other sensor informational pages by clicking on any of the action buttons.

To view a Map of the selected sensor, select Map View button (1). To view a chart, select the Chart button (2). To view the Scatter Plot, select the dotted button (3). Lastly to configure the reference date, select the Configuration button (4). The buttons available on the sensor properties page may depend on the Sensor Type of the sensor.

3.3 SENSOR NOTES AND DOCUMENTS

Sensors can individually be associated with additional information. This includes the entry of notes or additional description as well as the upload of documents and images.

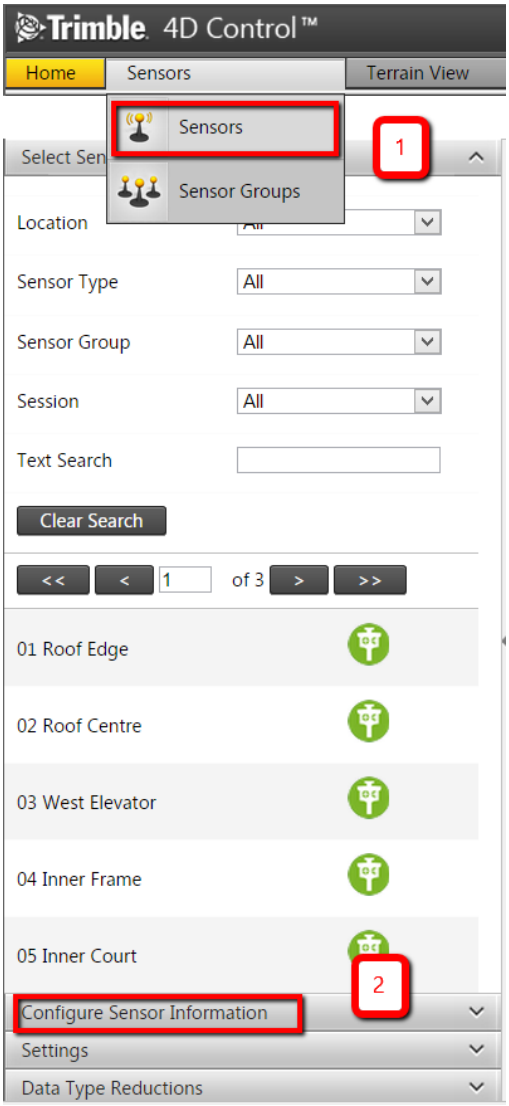


3.4 CONFIGURE SENSOR INFORMATION

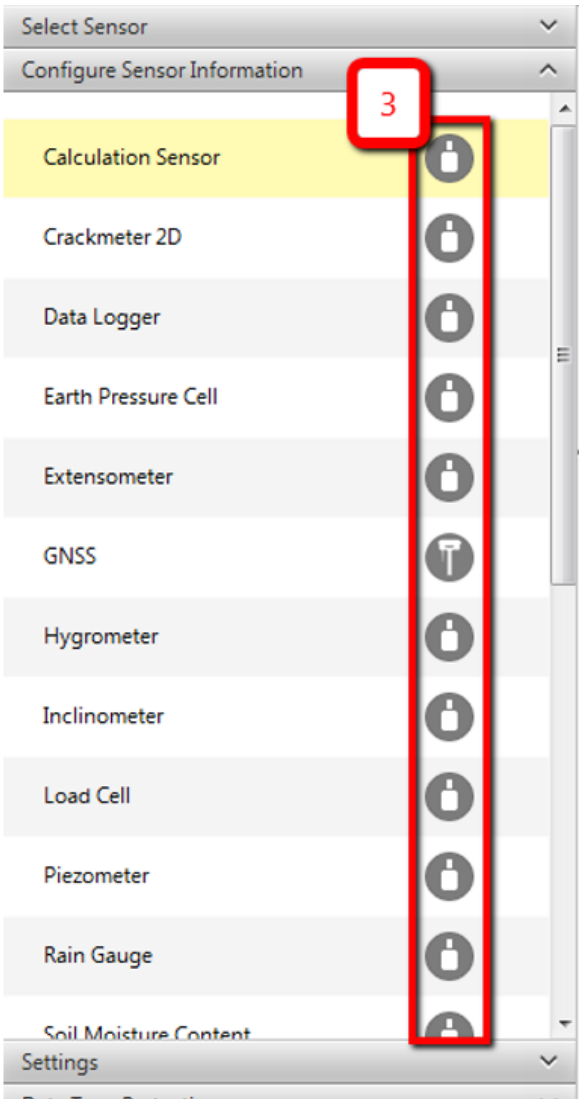
The information displayed by Sensors, Map, Custom Views and Chart pages are controlled by the configuration settings under the Configure Sensor Information section. Here the display settings are configured per Sensor Type.

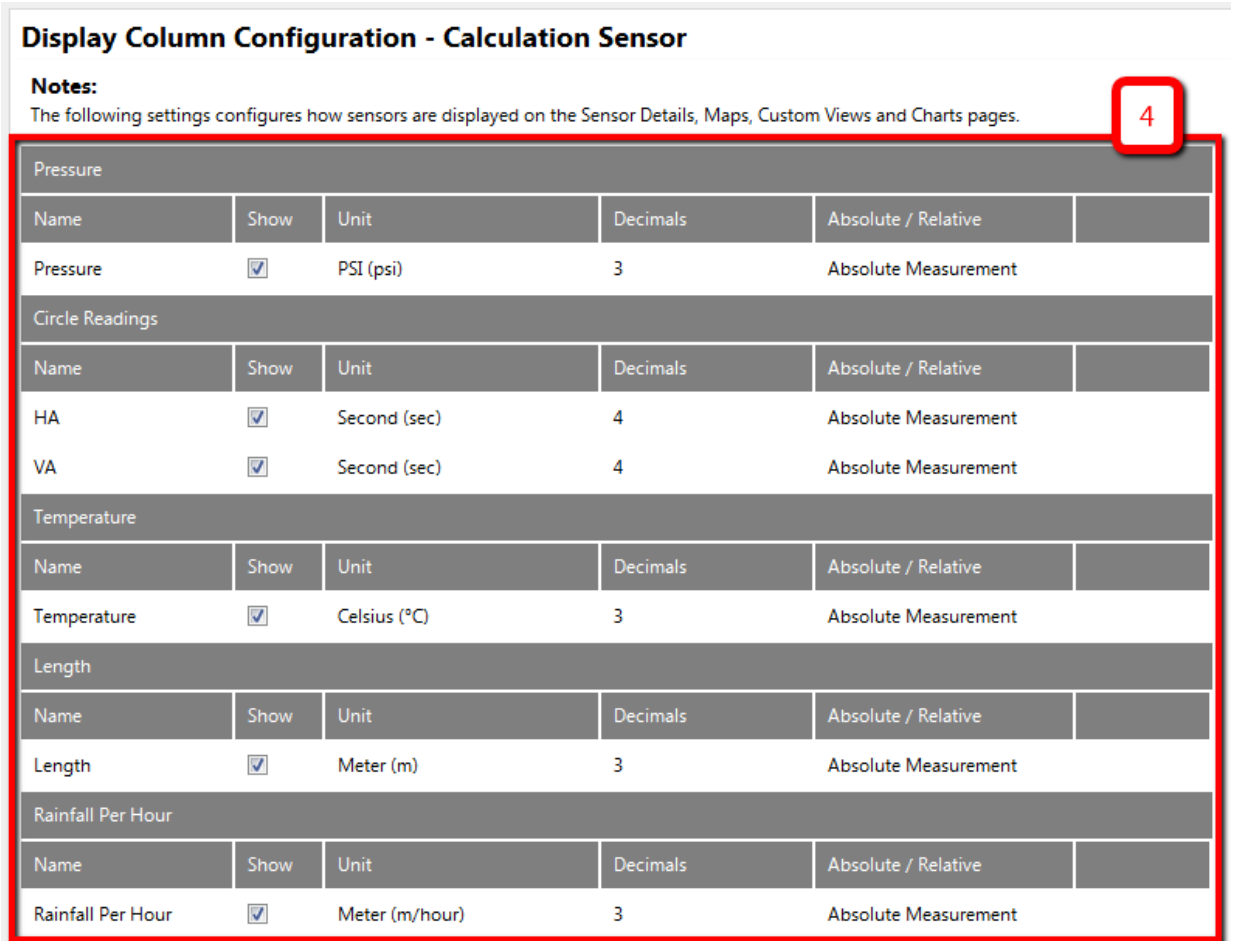
To configure your Sensor information, follow these steps:

Step 1: Navigate to the Sensors Page via the Sensors Menu (1) or Sensors Button on the Home Page. In the left window, select the Configure Sensor Information bar. (2).



Step 2: Select the Sensor Type you wish to configure by clicking on its name or its Icon (3). On the Display on the right side of the page you can select specific information to be displayed about your selected Sensor Type (4).





Display Column Configuration - Calculation Sensor

Notes:
The following settings configures how sensors are displayed on the Sensor Details, Maps, Custom Views and Charts pages.

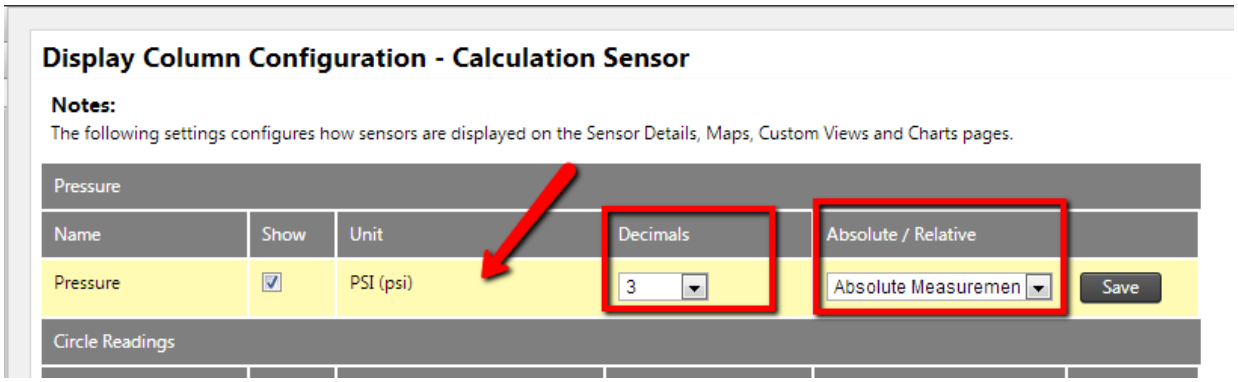
4

Pressure					
Name	Show	Unit	Decimals	Absolute / Relative	
Pressure	☑	PSI (psi)	3	Absolute Measurement	
Circle Readings					
Name	Show	Unit	Decimals	Absolute / Relative	
HA	☑	Second (sec)	4	Absolute Measurement	
VA	☑	Second (sec)	4	Absolute Measurement	
Temperature					
Name	Show	Unit	Decimals	Absolute / Relative	
Temperature	☑	Celsius (°C)	3	Absolute Measurement	
Length					
Name	Show	Unit	Decimals	Absolute / Relative	
Length	☑	Meter (m)	3	Absolute Measurement	
Rainfall Per Hour					
Name	Show	Unit	Decimals	Absolute / Relative	
Rainfall Per Hour	☑	Meter (m/hour)	3	Absolute Measurement	

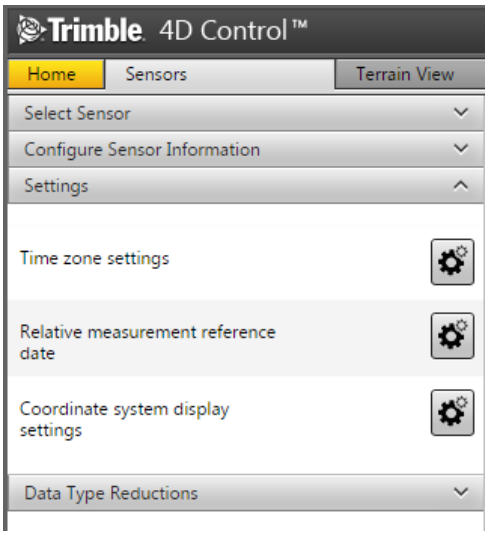
Clicking a Row will allow you to change Sensor Information.

Unit Column: The available Units will depend on the Project Unit Settings configured in the T4D Desktop Application.

Absolute/Relative Column: “Absolute Reading” will show the actual value measured. A “Relative Reading” will be denoted by a small delta (Δ) and depicts the change or difference between the actual reading and a reference reading.



3.5 SENSOR SETTINGS



Under Sensor settings you can change the way the Reference Date is used in Relative Measurements or change the way the Coordinate System Display for the current monitoring project.

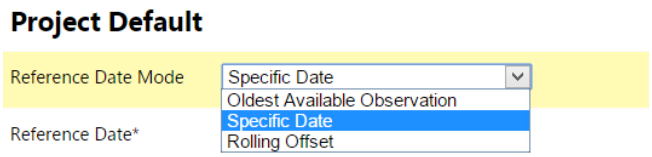
3.5.1 Time Zone Settings and Daylight Savings

Time zone information can be configured on the current project to take into account the difference of summer time and winter time. If the daylight saving time feature is enabled an asterisk (*) is shown whenever daylight savings time applies to any date time information displayed. This applies to the current project time, charts, scatter plots, alarm notifications or any other applicable time related information. The asterisk indicates that a particular date or time is displayed in terms of the configured daylight saving time.

3.5.2 Relative Measurement Reference Date Settings

Select your Reference Date Mode from the 3 possible options:

- Oldest Available Observation,
- Specific Date and
- Rolling Offset Days.



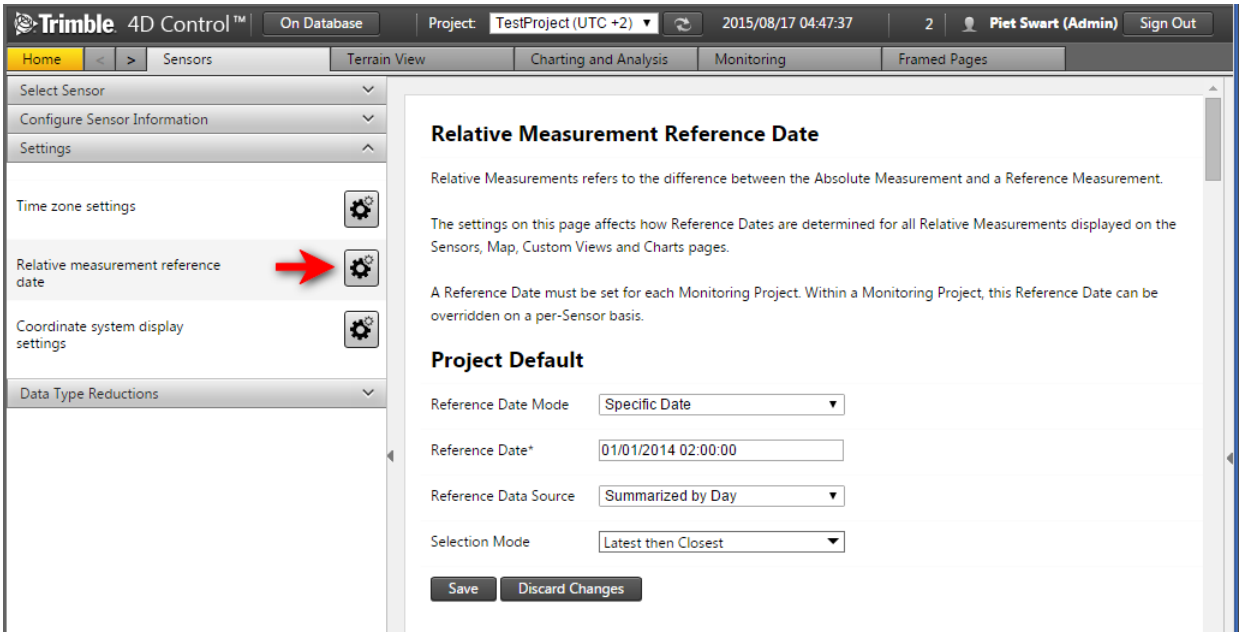
NB: Relative Measurements refers to the difference between the Absolute Measurement and a Reference Measurement.

The *Reference Measurement* will be the observation closest to the *Reference Date*. You can configure the *Reference Data Source* from which to select the reference value. This can either be the raw observation values or a **summarized source** available for the sensor (typically *Summarized per Day*).

You can configure how the reference value is selected from the discrete set of values in the reference data source by setting the *Selection Mode*. Typically this setting determines a preference for closest values before or after the *Reference Date*.

The settings on this page affects how *Reference Dates* are determined for all *Relative Measurements* displayed on the Sensor Details, Maps, Custom Views and Charts pages.

A Reference Date must be set for each Monitoring Project. Within a Monitoring Project, this Reference Date can be overridden on a per-Sensor basis.



3.5.2.1 *Sensor Reference Date Overrides*

Below the Project Default Reference Date you can specify Reference Dates for specific sensors that will override the previous setting, but only for that specific sensor.

1. Text Search:

User can filter the list of sensors by typing the name of the sensor they are looking for.

2. Sensor Type:

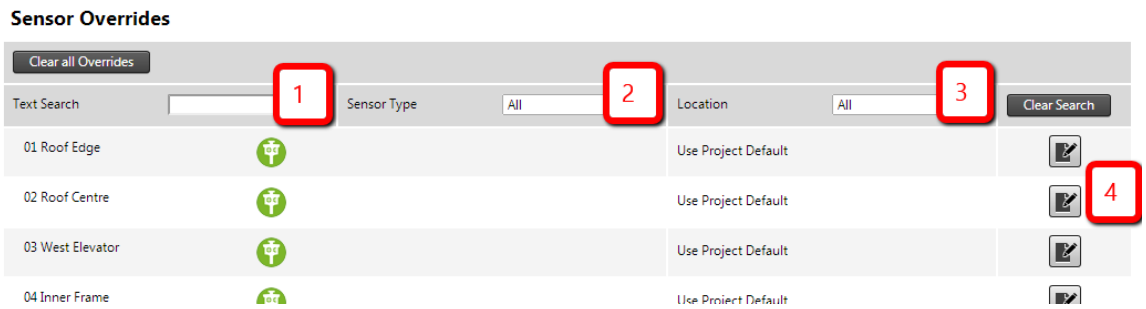
User can filter the list of sensors by selecting a specific sensor type.

3. Location:

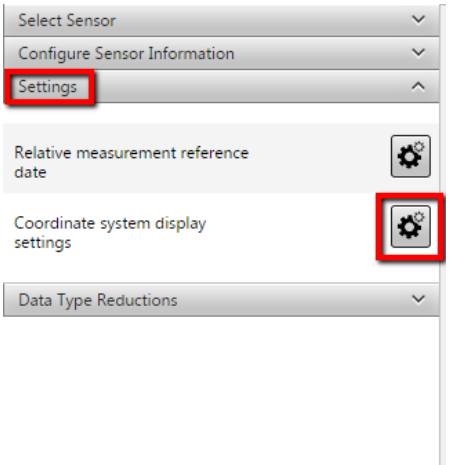
User can filter the list of sensors by a specifying the location in the monitoring project.

4. Calculation Sensor Button:

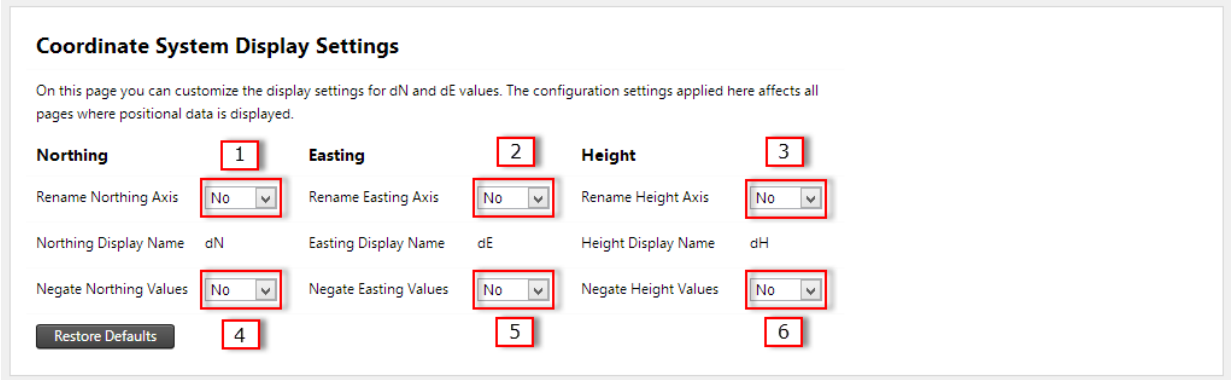
Click on the button to override the reference date mode for the Calculation Sensor.



3.5.3 Coordinate System Display Settings



Use the coordinate system display settings for the current monitoring project.



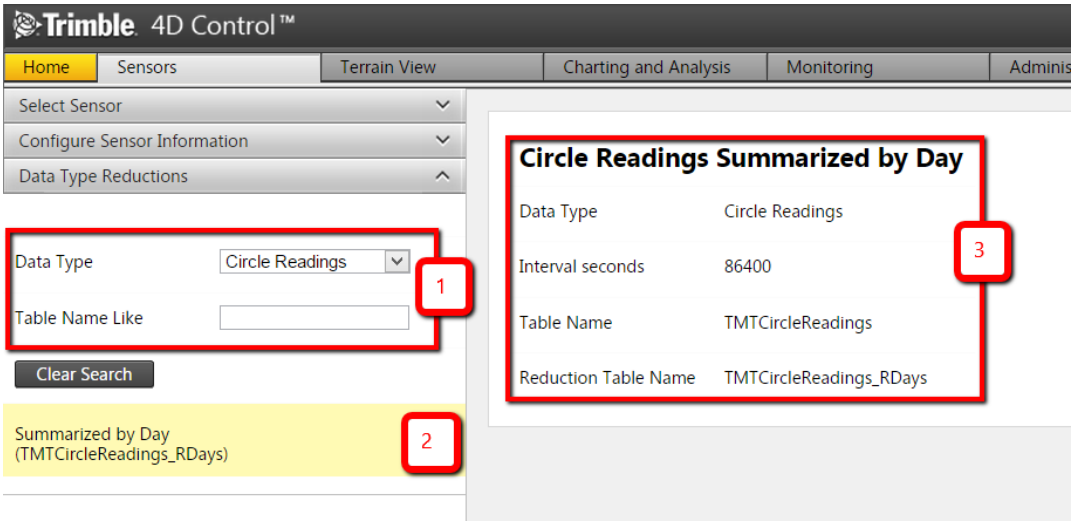
1. Specify if the Northing Axis should be renamed.
2. Specify if the Easting Axis should be renamed.
3. Specify if the Height of the Axis should be renamed
4. Specify whether the Northing measurement values should be multiplied by minus one.
5. Specify whether the Easting measurement values should be multiplied by minus one.
6. Specify whether the Height measurement values should be multiplied by minus one.

3.6 DATA TYPE REDUCTIONS

Open this section to view the different reduction or summary sets that are available for the various data types in the system. Please note this is a read-only section and therefore only provide information.

You can filter the list of available reductions or summary sets by either selecting a data type or by typing the name of reduction table (1).

Then click on any of the items (2) in the list to view the corresponding information (3).

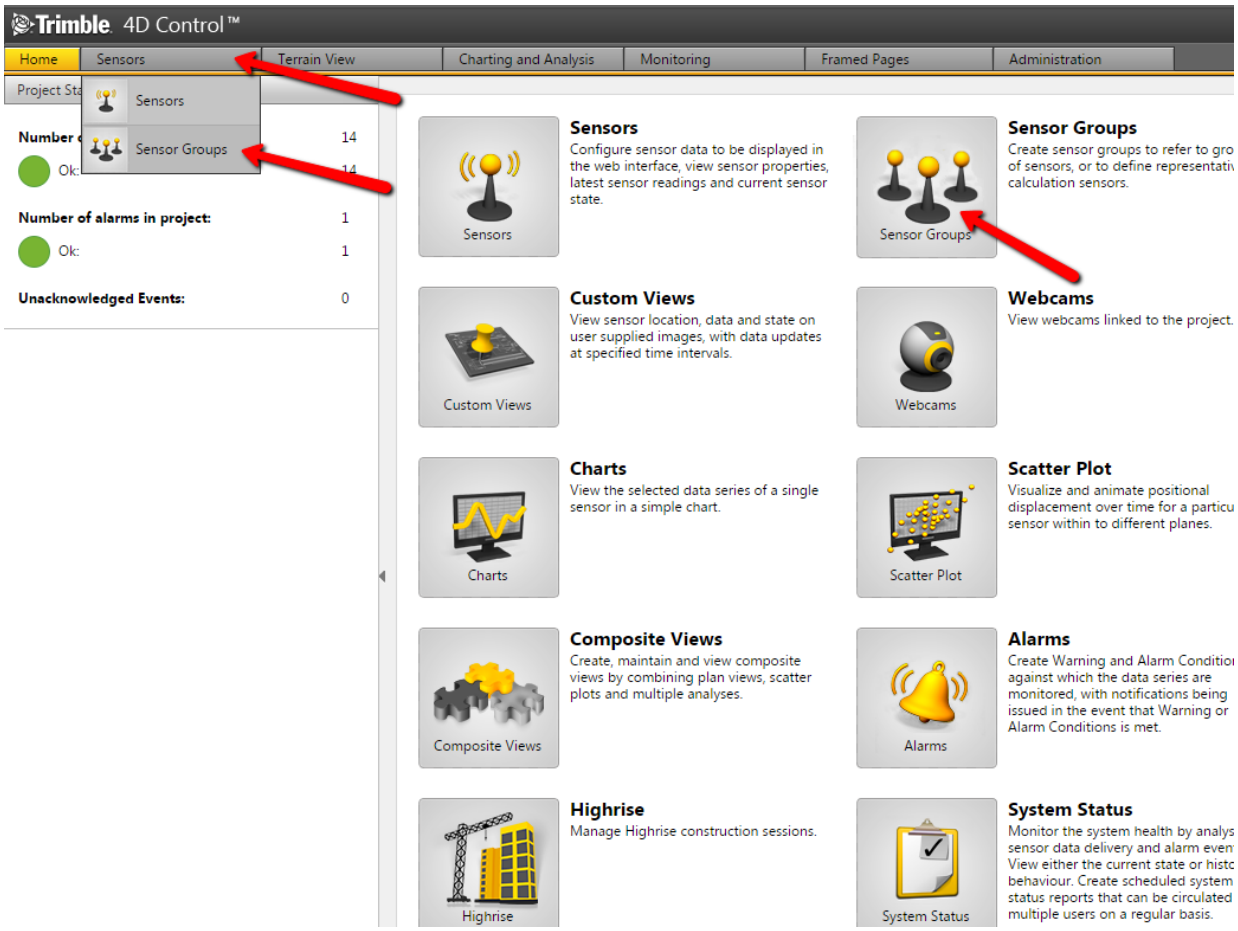


4 Sensor Groups

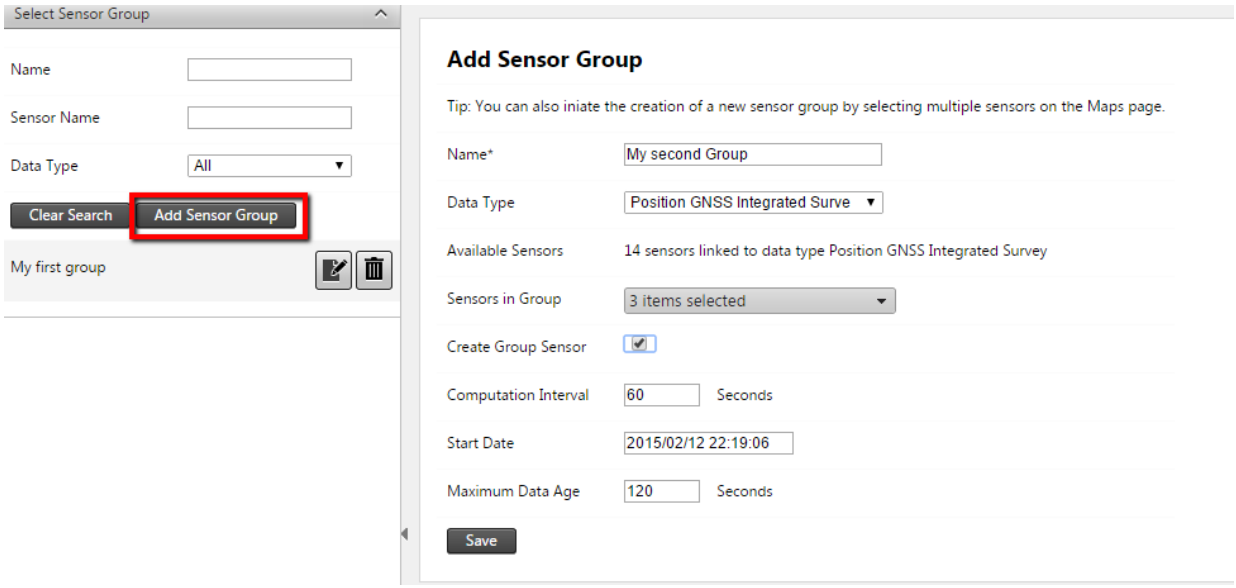
Sensor groups are useful to refer to groups of sensors and/or to define a representative sensor for example for mapping, charting or analysis purposes.

4.1 CREATE A SENSOR GROUP

Step 1: Navigate to the Sensor Groups Page by clicking Sensor Groups Icon on the Home Page or by hovering the mouse over the Sensors top menu item and then clicking Sensor Groups in the dropdown menu (as illustrated).



Step 2: Click on Add Sensor Group



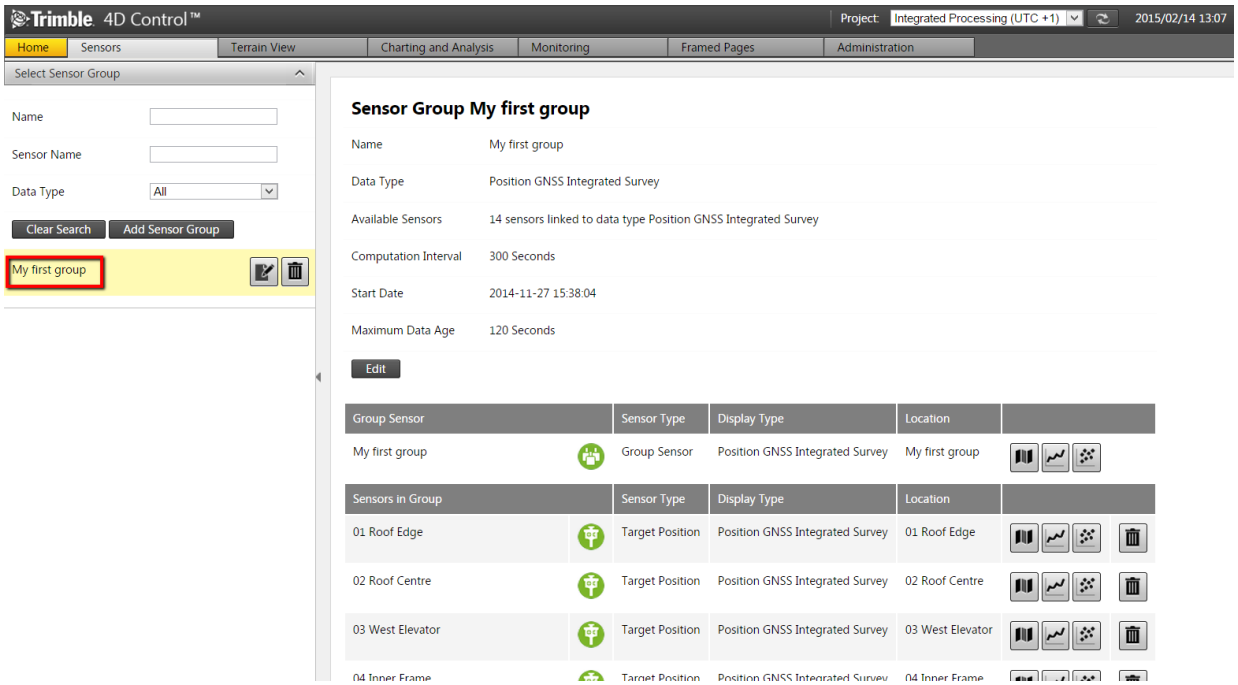
Step 3: Complete information on the right. The fields are as follows:

- Name: Any name by which to identify the group.
- Data Type: The type of data all the sensors are associated with, e.g. Pressure. The number of sensors in the Project with the selected Data Type will automatically be shown on the next line.
- Sensors in group: Simply click on the downwards arrow to open the list. Here you can add or remove the sensors chosen to be in the group. After opening the list simple drag items across, or select a sensor and click on the plusses (+) to add sensors, or minuses (-) to remove sensors.
- Create a group sensor: A group sensor can be created with calculated observations that represents all the sensors in the sensor group. Check this box to create a group sensor or to keep an existing group sensor linked to this sensor group. Uncheck this box to delete an existing group sensor and not have a group sensor linked to this sensor group. **Note that this option is only available for sensor groups with a positional Data Type.** Provided this option is selected, also complete the following three fields.
- Computational Interval: Specify an interval at which observations for the group sensor is sampled from the sensors in the sensor group.
- Start Date: Specify a start date from when observations for the group sensor should be calculated.
- Maximum Data Age: Specify the maximum age of observations to be included in calculations for the group sensor.

Click the Save button to create the Group and it will be added to the list of Sensor Groups.

4.2 MANAGE A SENSOR GROUP

Die sensor group can be viewed by simply clicking on its name in the list of sensor groups in the left panel.

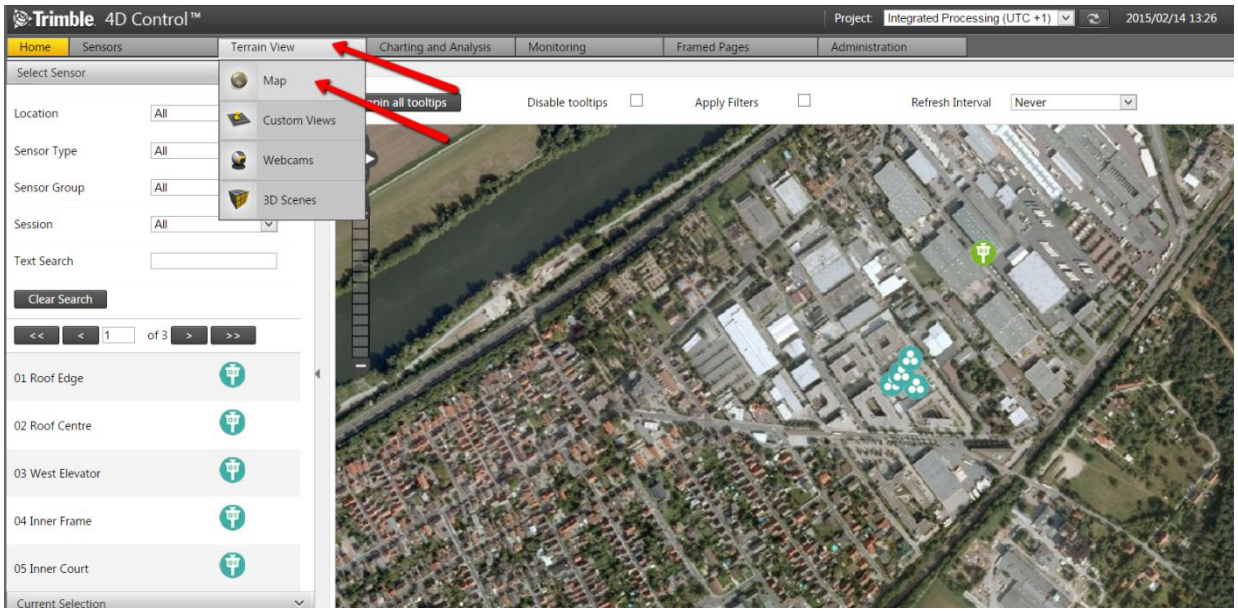


The sensor group view shows the configuration of the sensor group. Simply click the Edit button to modify and/or maintain some of these fields. From here you can also navigate to informational pages for the sensors in the sensor group or remove sensors from the Sensor Group.

The Sensor Group can be deleted by clicking on the trash can icon in the list of the left hand pane.

5 Maps

Navigate to the Maps Page by hovering the mouse over the Terrain View top menu item and then clicking on Maps in the dropdown menu (as illustrated). Alternatively simply click on Map Icon on the Home Page. **Note that the maps page is unavailable for Projects that are configured on a local coordinate system only.**



On the Maps Page you can click and drag on the map using the left mouse button to pan the map area in different directions. Use the mouse wheel to zoom in or out.

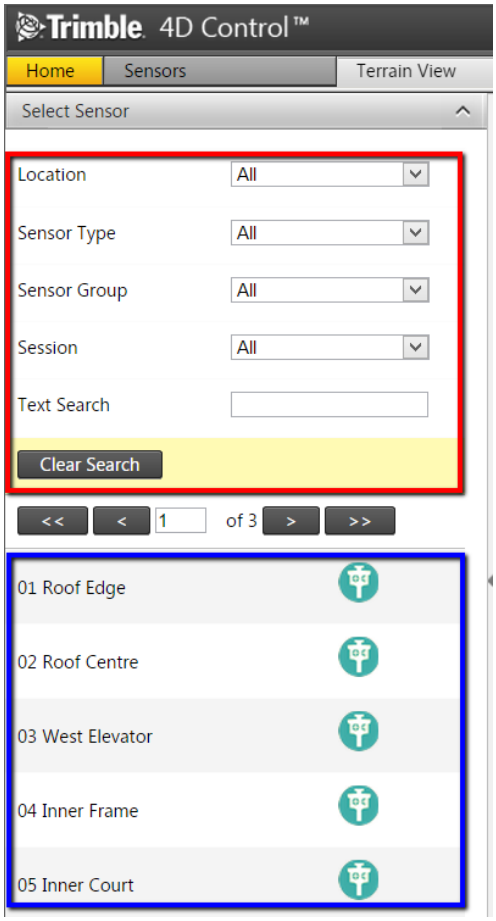
The settings at the top right of the map area can be used to hide and show available layers. (More discussed later)

5.1 SELECT SENSORS

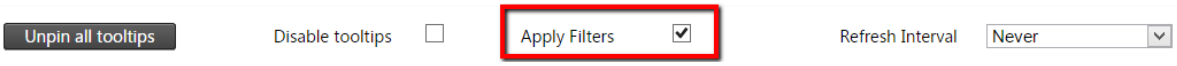
Upon opening the Map Page, all the available sensors on the map will be plotted by default. To select a sensor, click on any of the listed sensors (shown in the blue box). The map will navigate directly to the position of the sensor.

You can filter the sensors shown in the sensor list by using the options shown in the red area. These options are:

- Sensor location: sensors at a marked location.
- Sensor type: sensors of a specific Sensor Type, e.g. Total Station.
- Sensor group: sensors associated with a Sensor Group. (Was discussed in Sensor Groups on page 22.)
- Sensor session: sensors linked to a session (only related to the Highrise module).
- Text search: Any text to filter out non-matching sensors. (E.g. a partial word in the name of the sensor.)



The same filtering of sensors can also be applied to the sensors shown on the map by clicking the “Apply Filters” box above the map area. This is useful if you wish to view only a particular subset of sensors on the map.



5.2 SENSOR NODES

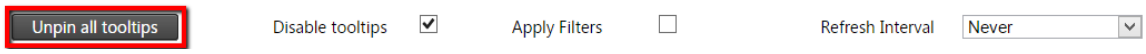
To display more information about any of the sensor nodes on the map, simply hover the cursor over the node on the map.

Sensors that are clumped up too close to each other (depending on how far the map is zoomed out) are collectively shown by a special icon as illustrated below.

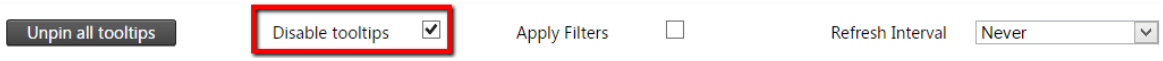
To keep the tooltip (pop-up) information visible, click on the node instead of just hovering over it. An anchor will appear next to the node to show that it will not disappear when the mouse cursor moves away.

Simply click on the anchor to close the tooltip.

To quickly clear all “anchored” pop-ups, click the Unpin all tooltips button.



In order to disable the auto tooltips (pop-ups) simply check the Disable tooltips box at the area above the map. Clicking on a node will still provide the tooltip but hovering over nodes will not show any tooltip, which would be useful if there are many icons on the screen causing too many pop-ups.

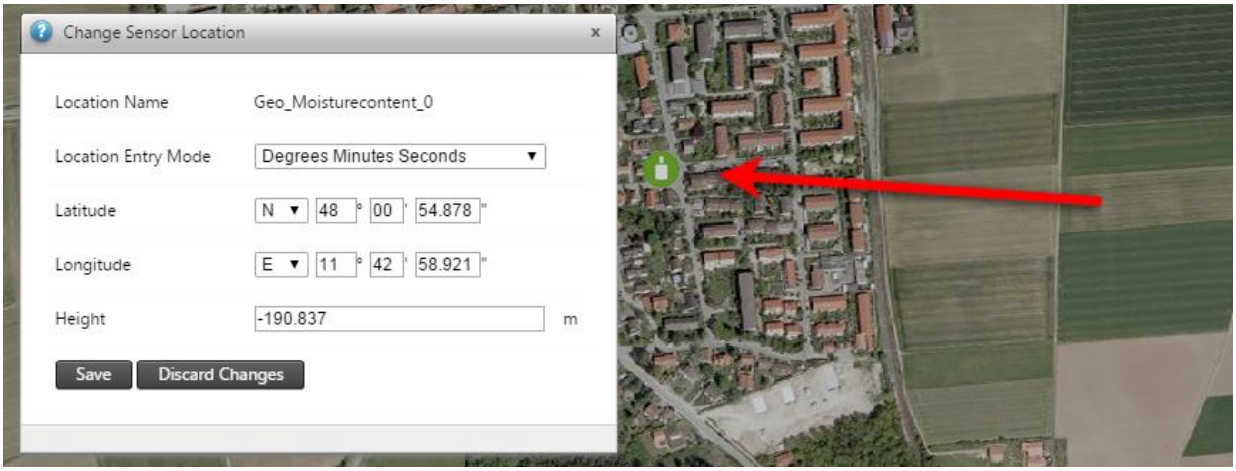


5.3 MOVE SENSOR TO CHANGE SENSOR LOCATION

You can use the map to change the location of a sensor. You cannot use this feature to move sensors that are clumped up too close to each other (depending on how far the map is zoomed out).

Simply hover your mouse cursor over a sensor and notice the mouse cursor change into a *move cursor*.

Click and drag the sensor to a new location on the map. When you have dragged the sensor to the new location on the map, simply release the mouse button. The C*hange Sensor Location* dialog will then appear:

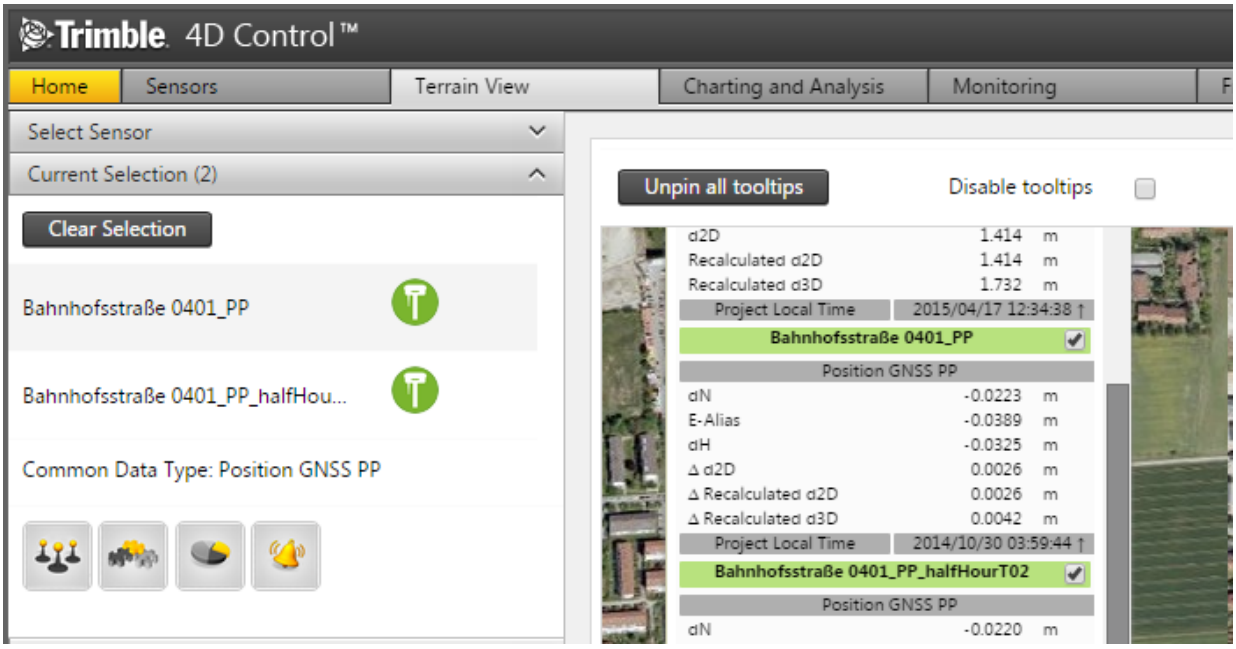


The C*hange Sensor Location* will show the new map coordinates where you have dragged the sensor. You can also edit these values. Confirm the change of sensor location by clicking the *Save* button or discard the change of sensor location by clicking *Discard Changes.*

5.4 MAP KICK START

You can use the map to kick-start creation of Analysis, Alarms or other entities in Trimble 4D Control.

Next to each sensor's name on the tooltip (pop-up) is an option to select that sensor.
When you select a Sensors, it will be added to the *Current Selection* section visible in the left hand pane.

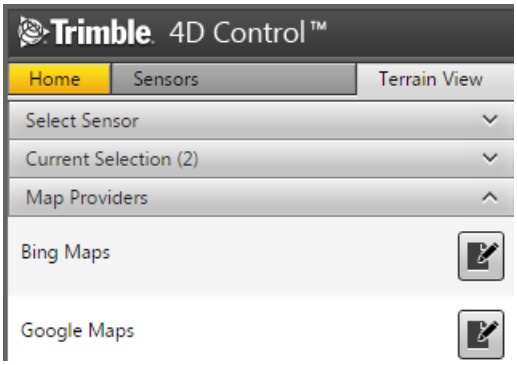


The *Current Selection* panel shows the sensors you selected and also the common Data Types. Displayed below this are a few icon buttons. You can click on any of these buttons to start creating any of the following:

- Create Sensor Group
- Create Composite View
- Create Analysis
- Create Alarm

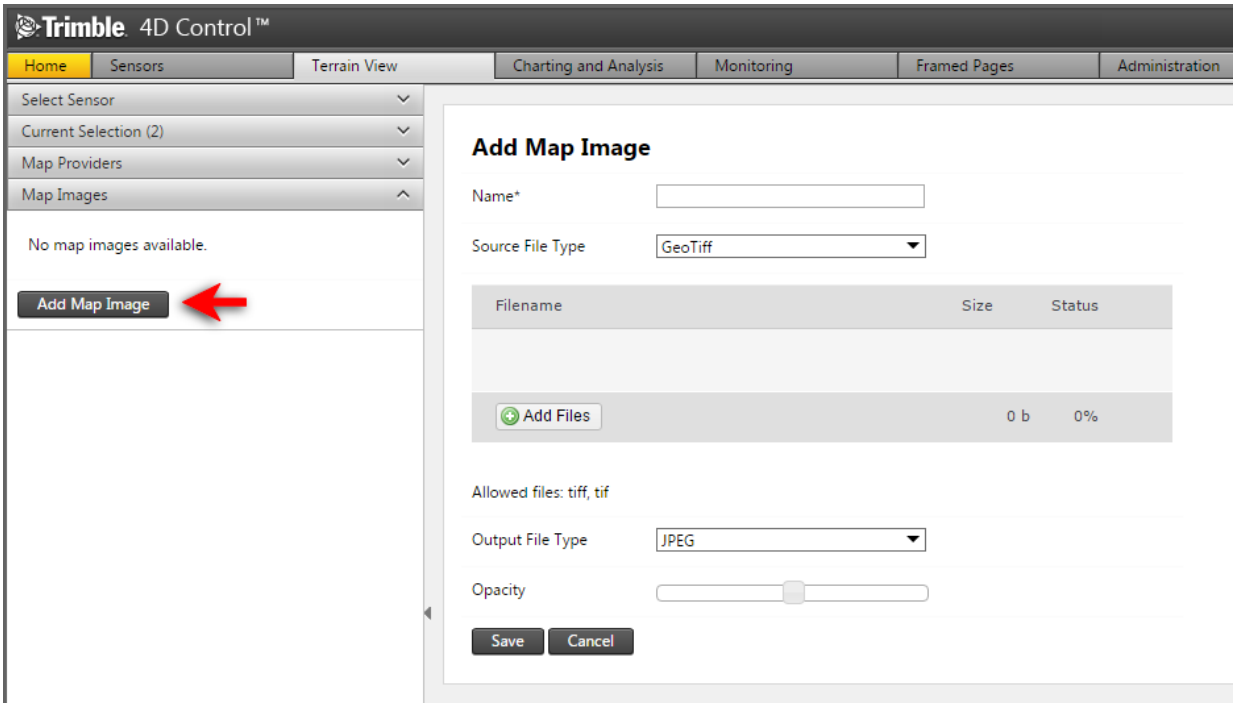
5.5 MAP PROVIDERS

By default Trimble 4D Control has some pre-configured free map providers, however the free map providers may not offer sufficient content. In addition to the free map providers you can utilize the map providers Bing Maps or Google Maps. By selecting the *Map Providers* panel you can configure your license for these map providers. The interface will provide you with instructions on how to acquire a key for each of these.



5.6 MAP IMAGES

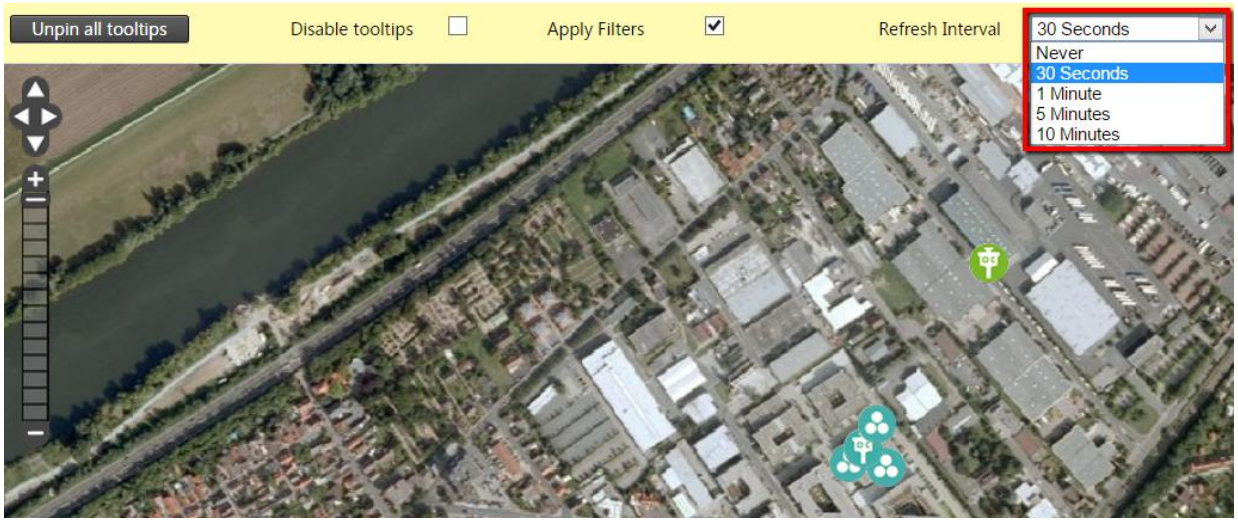
You can add your own images as a layer overlaying the map. Select the *Map Images* panel to start adding a map image. You can add GeoTiff images or other images. If your image is not geo-referenced, you will be required to specify a map extent onto which your image must be projected.



5.7 MAP REFRESH TIMER

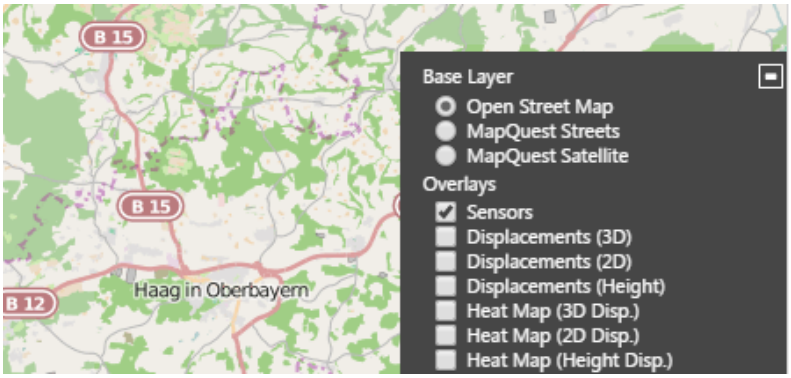
Select a time interval from the dropdown menu to refresh die map view.

The time selected will cause the map to refresh, for example every 30 seconds.



5.8 SENSOR MAP OVERLAY

On the right hand side of the map there are options of overlays to enable on the map.

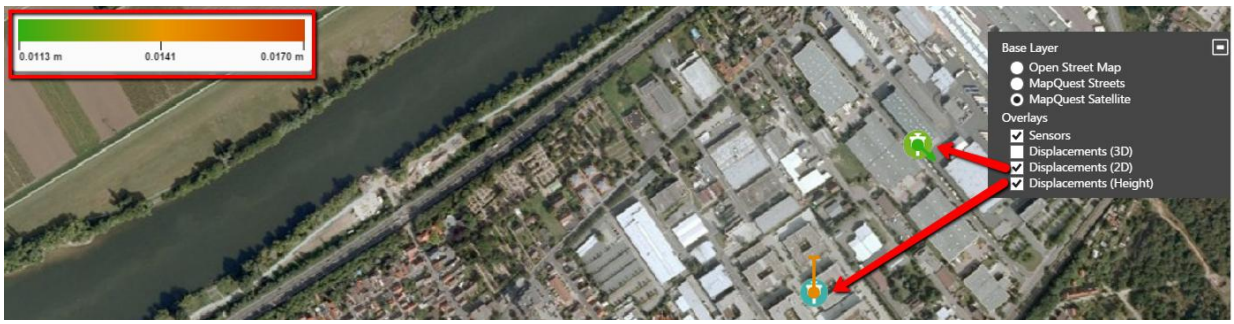


Among these are the Sensor map overlay which displays the icons of the sensors at the projected sensor location on the geographic map.

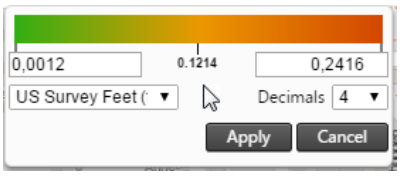
5.9 DISPLACEMENT VECTOR MAP OVERLAY

In addition to the sensor overlay you can show the displacement of sensors visualized as a *displacement vector layer*. The displacements shown is colour coded to indicate the severity of the displacement according to a colour scale.

A legend of the colour scale is also included to the left (which will only appear if a displacement overlay is enabled).



You can edit the displacement scale and display parameters by hovering your mouse cursor over the legend:



You can edit any of the following display parameters on the legend:

- Minimum displacement threshold: any displacement below this threshold will not be shown.
- Maximum displacement threshold: any displacement above this threshold will appear in a red colour and be a maximum length/size.
- Unit of Measure: change your unit of measure (if multiple ones are available for the particular metric)
- Decimals: the number of decimals to be used when displacement values are displayed.

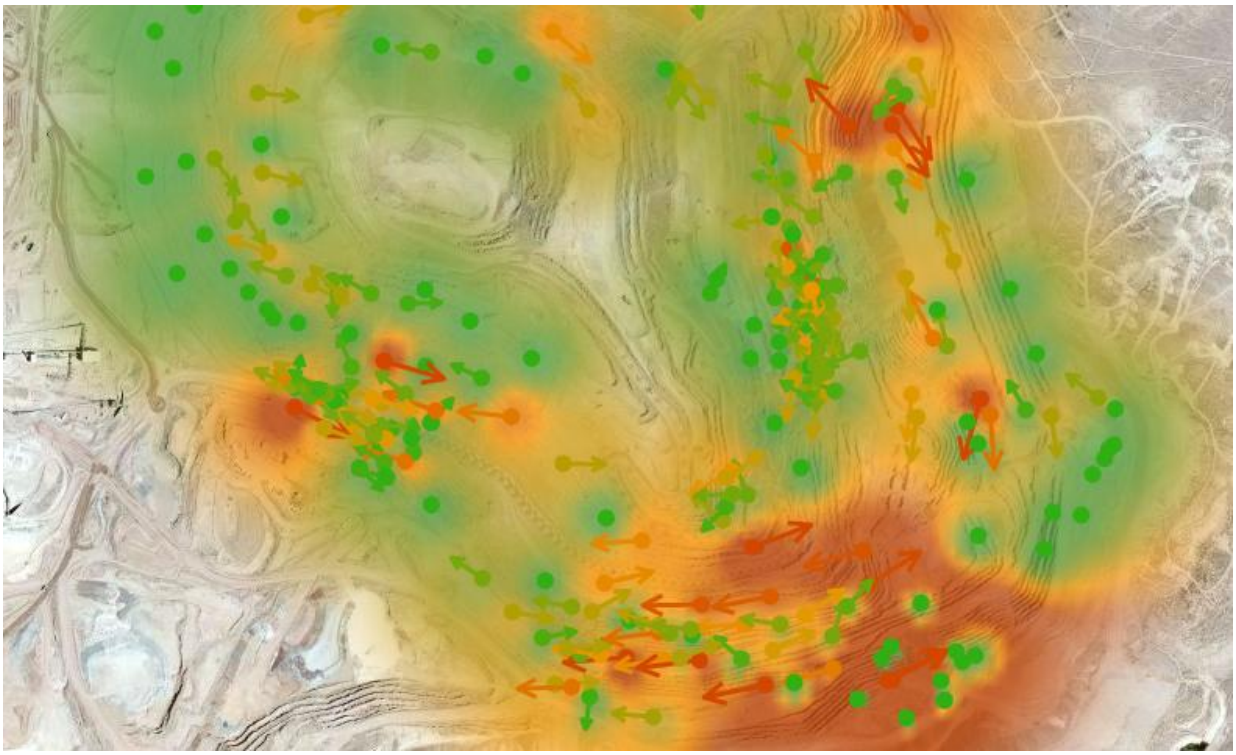
A sensor that measures Height (in the above map example the orange bar) shows the direction of the displacement by use of a bar pointing up or down and the severity of the displacement as the length and the colour of the bar.

A sensor that measures 2D (in the above map example the green arrow) shows the direction of the displacement by use of an arrow and the severity of the displacement as the length and colour of the arrow.

A sensor that measures 3D will use both the Height and 2D measurements to calculate a circle around the sensor and show the severity as the radius and colour of the circle. The direction of 3D displacements are not visualized here. The radius of the circle is equal to the 3D displacement vector length.

5.10 DISPLACEMENT HEAT MAP OVERLAY

In addition to the displacement vector layer, you can enable the displacement heat map overlay which visualizes the various vector displacement layers an interpolated colour maps. The colour map is colour coded with the same colour scale as the vector displacement layer.



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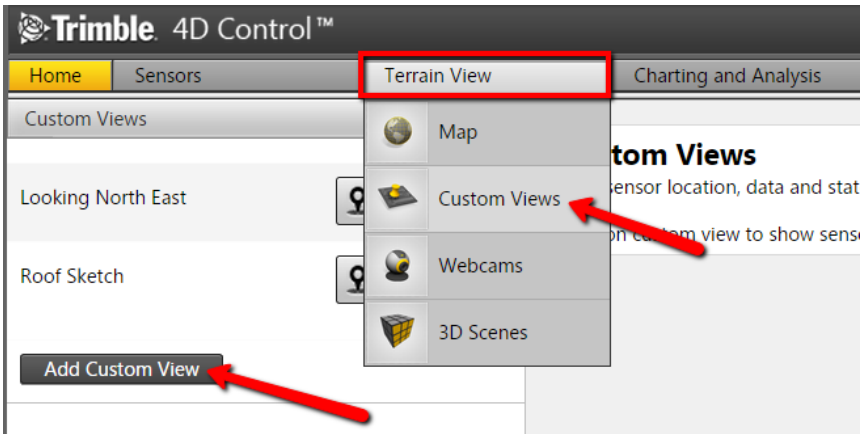
6 Custom Views

A Custom View allows sensors to be placed on a picture for context visualization. It can be a schematic plan (e.g. a blue-print) of a building/site/structure or even the actual photo of the location of the sensor or the sensor itself (as will be illustrated in the example later in this section).

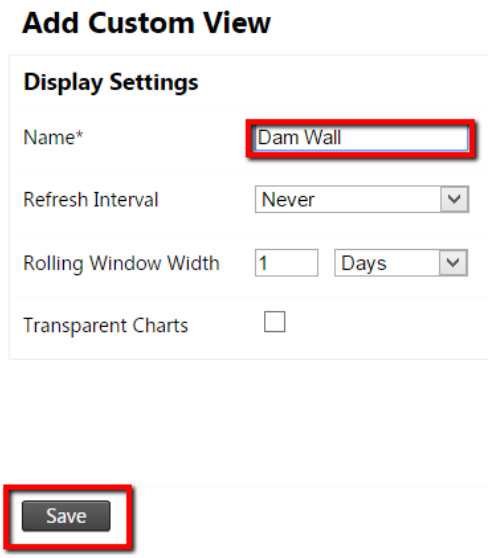
The Custom Views also provides the ability to show a Chart or Scatterplot in a tooltip.

6.1 ADD A BASIC CUSTOM VIEW

Step 1: Navigate to Custom Views. To add a Custom View, first click on the "Add Custom View" button.

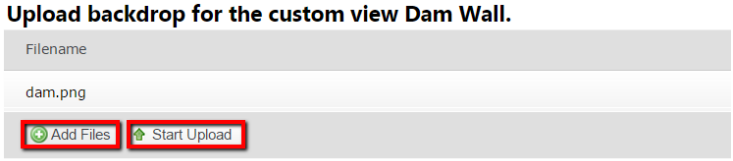


Step 2: Then enter a name. For now please ignore all the other options and click the Save button. (The other options are discussed in Section 6.2 on page 36)



Step 3: Click the Upload Image button

Step 4: Click the Add Files button, select a file from your computer and then click the Start Upload button.



Your Custom View will now be created and you can start adding sensor, which will be discussed in Section 6.3, page 37. First the previous Step 2 will be discussed in more detail.

6.2 A DETAILED CUSTOM VIEW

Follow the same steps as before, except with the previous Step 2 also provide the following information.

Display Settings:

- Refresh Interval: Specify the interval by which data should be refreshed. (Same effect as with Maps that are refreshed.)
- Rolling Window Width: Specify the time window which will determine the date range used by custom view charts. The effective date range will change on a continuous basis.
- Transparent Charts: Transparency allows tooltips to be both visible and not obscure the custom view background image.

Scatter Plot:

- Reference Observation: In T4D scatterplots always plot relative positions, which is the difference between and actual position and a reference position. You can either use the reference date of the selected sensor to obtain a reference position, use the first observation in the result set or use the average of the observation values within the result set.
- Scatterplot X Axis: Select the dimension to plot against the x axis of the scatterplot.
- Scatterplot Y Axis: Select the dimension to plot against the y axis of the scatterplot.
- Colour by Displacement: When this option is enabled, dots on the scatter plot will be colored green, yellow or red depending on the distance from the reference measurement. If this option is disabled, all dots will be blue.
- Shade by Data Age: When this option is enabled, a degree of transparency will be applied to each dot on the scatterplot. The latest observation will be solid and the oldest observation will be almost completely transparent. The use of this setting is only effective when you do not have multiple observations plotted on top of each other.
- Link Axis Scales: When this option is enabled, the two chart surfaces will be scaled identically. When this option is disabled, the scale of each chart surface will be optimized for the data that appears on that chart only.

Chart:

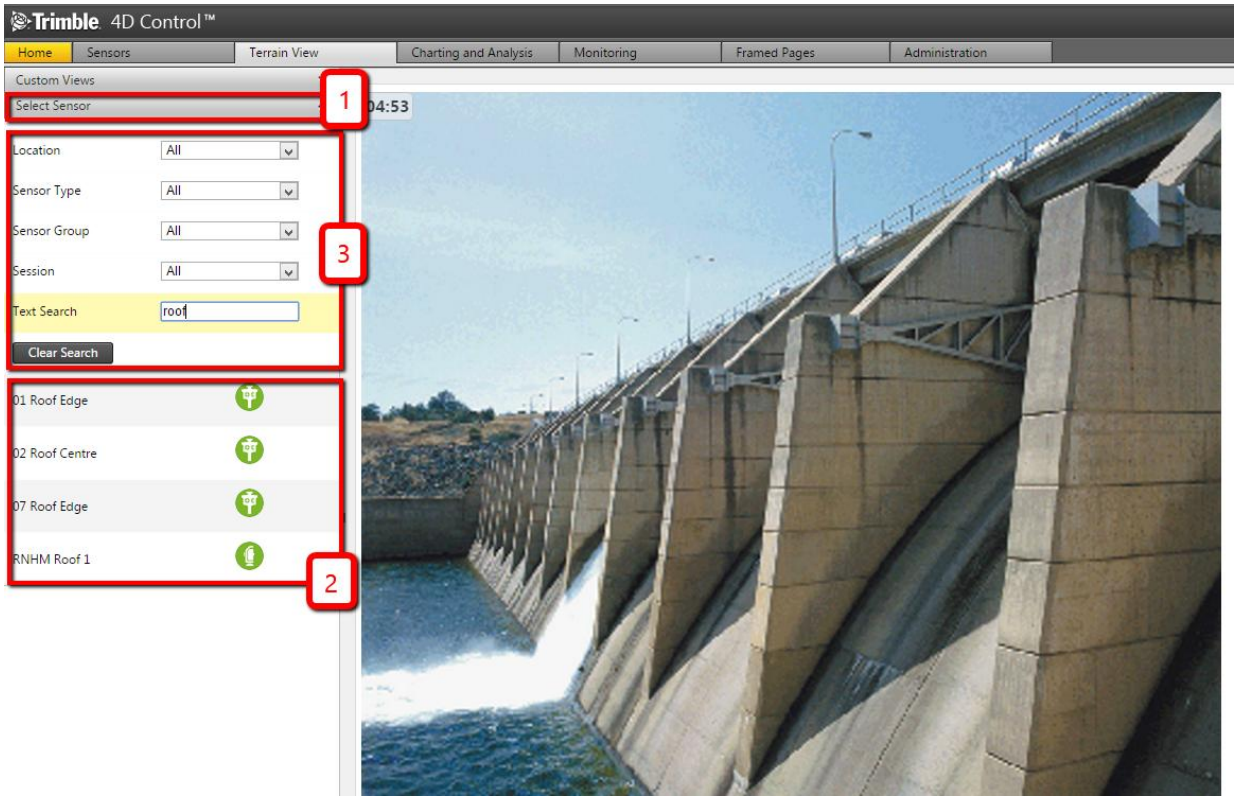
- Plot Summarized Values: This option has an effect on the time value (or x axis value) against which summarized values will be plotted. Each node in a summarized series typically reflect the average observation value over a period (such as 1 hour or 1 day). By adjusting this option, you can plot summarized values either at the beginning, in the middle or at the end of the time period over which the data was summarized.
- Line Type: This option controls how the data will be represented on the chart surface.

6.3 ADDING AND REMOVING SENSORS TO THE CUSTOM VIEW

The following section will guide you through the process of adding and removing sensors to the view.

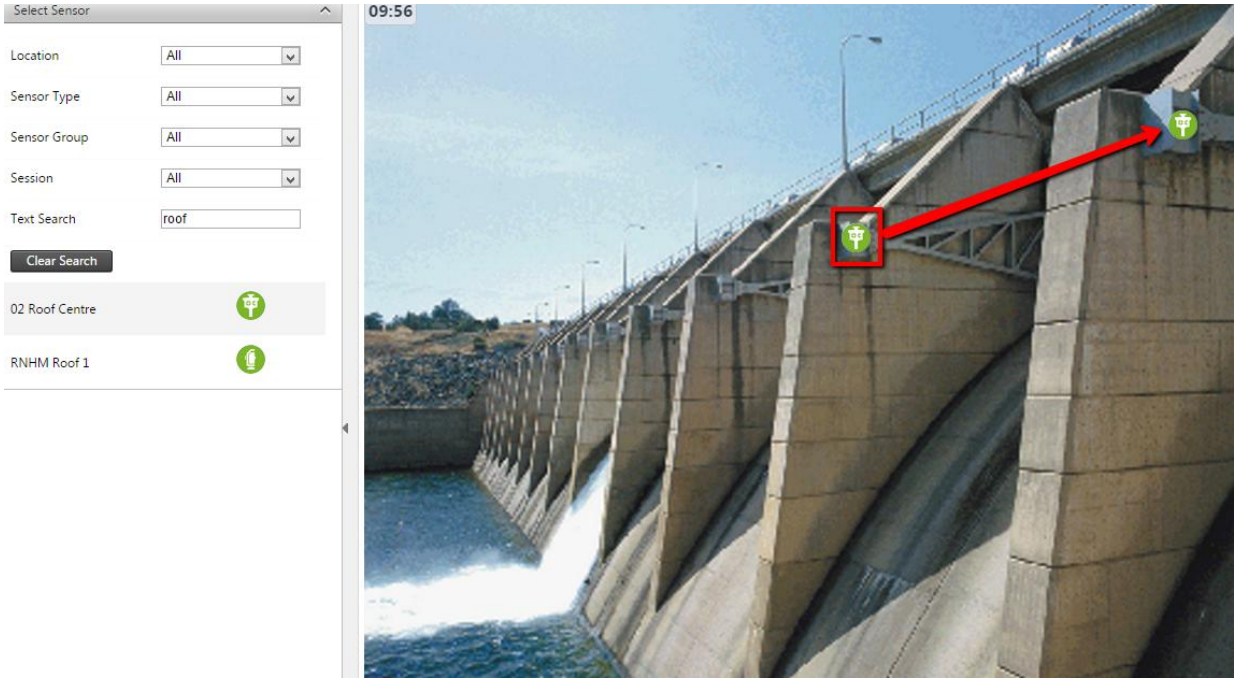
Important: This section does not explain how to create a new sensor that was handled in the section on Sensors.

Step 1: Make sure you have selected the Custom View you want to work with and then click on the Select Sensor sub-section (1). Here (2) you can add any of the available sensors to the Custom View. As before if there are many sensors, you can make use of the filters (3) to show only specific sensors.



Step 2: To add a sensor, click on the sensor icon and without letting go of the mouse button, drag it onto the image.

Step 3: If you are not happy with the placement of the icon, simply drag it to a new location on the image.



Step 4: To remove a sensor from the view, click on the sensor on the image and without letting go of the mouse button, drag the sensor to the trash can icon that will appear in the upper left-hand corner of the Custom View backdrop.

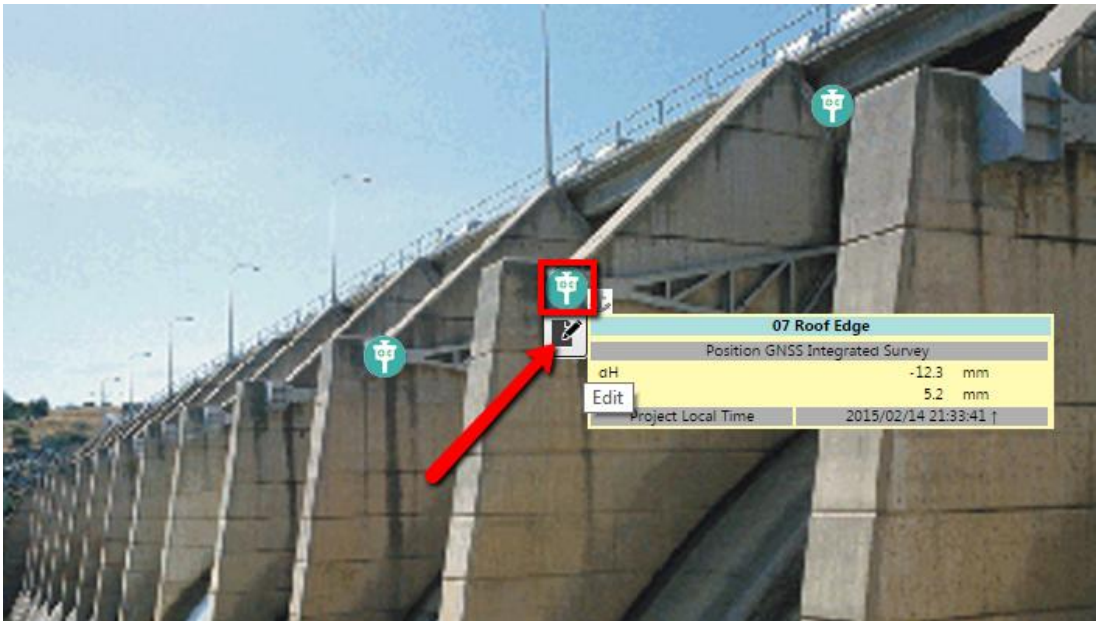
Please note that this will not delete the sensor, it will only remove the sensor from the current Custom View. To add the sensor to the Custom View again, simply drag it onto the image again.

6.4 CHARTS

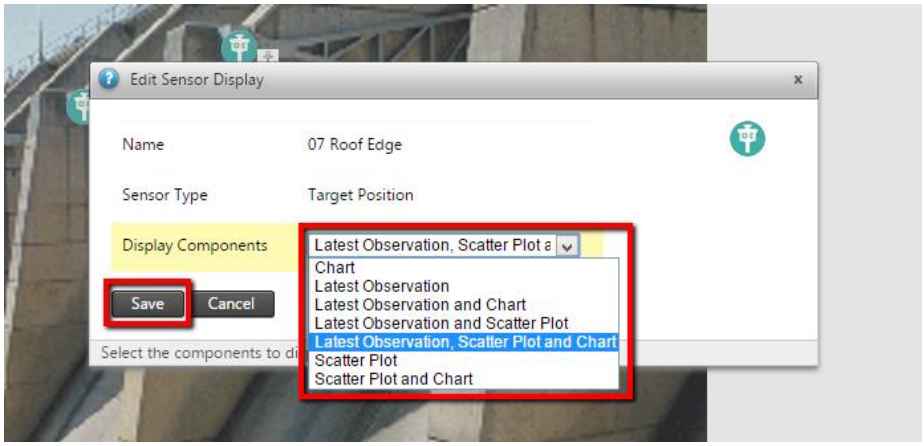
The tooltips (pop-ups) of sensors on Custom Views can provide up to three display components:

- Latest observations (same as in the Maps section)
- Chart
- Scatterplot

In order to enable these, simply click on the Edit icon that will appear of the mouse cursor hover over the sensor icon (as illustrated below):

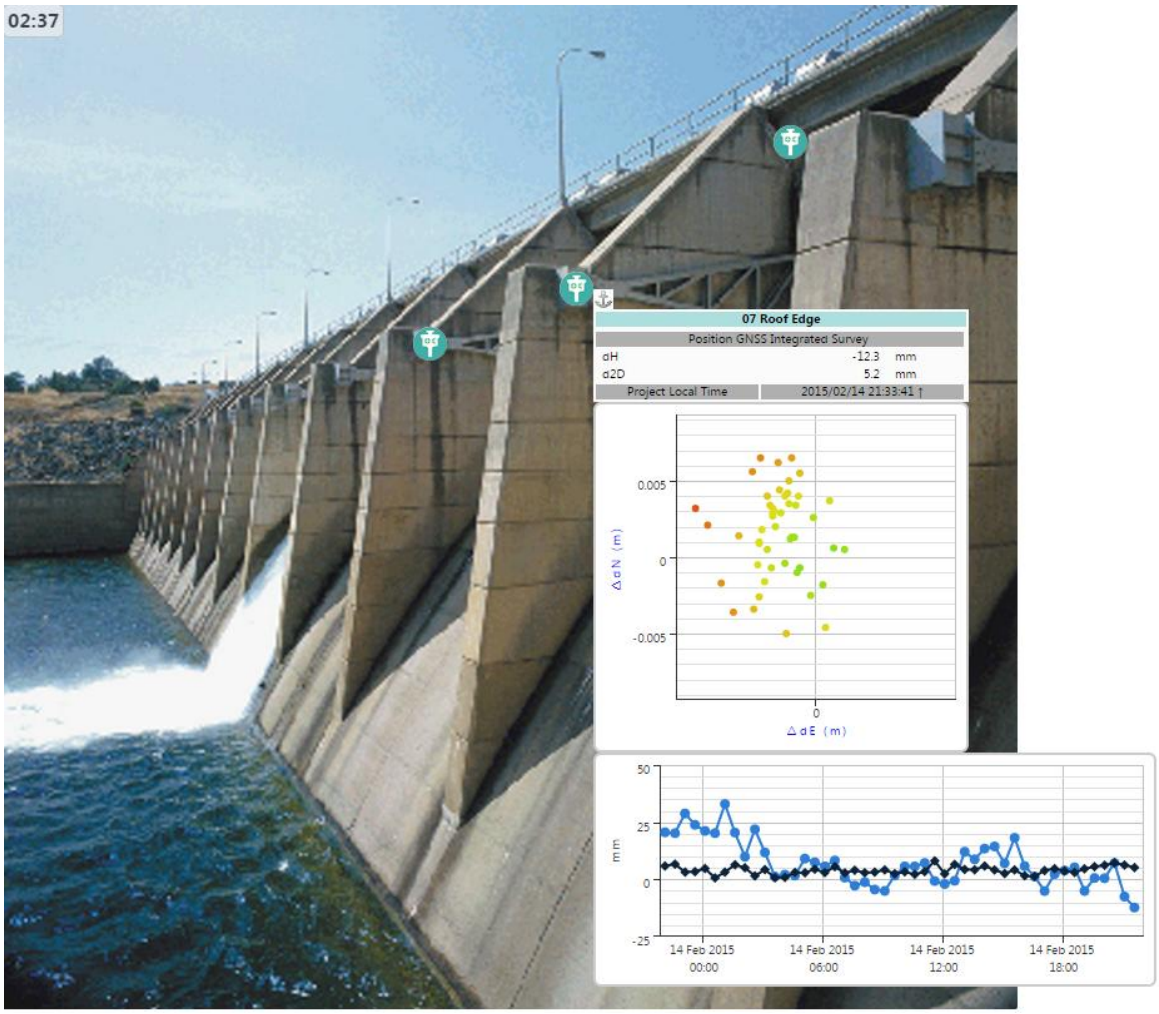


Select the specific option, or combination of options, or even all three options to be displayed in tooltip of the sensor on the on the Custom View.



The tooltip of a sensor will then display the configured components when shown. You can click on a sensor to anchor the tooltip to stay in place.

In the example below all three components were configured: latest observations, chart and scatterplot.

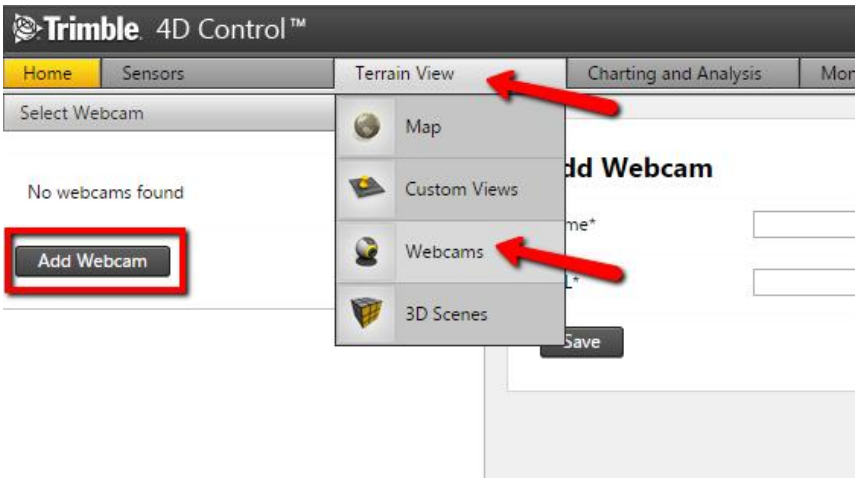


7 Webcams

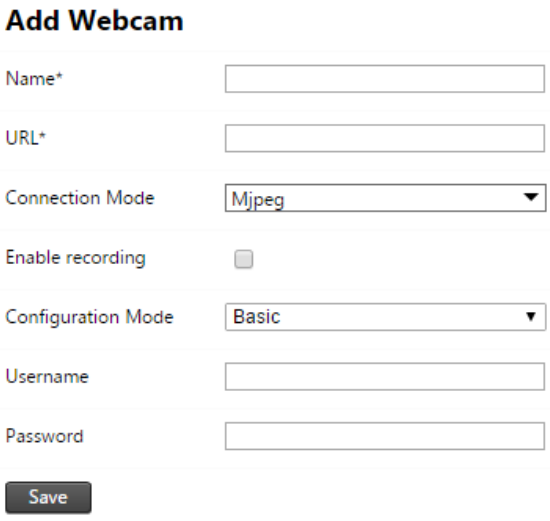
Some monitoring sites have cameras installed on site – e.g. for instance to monitor certain areas that are very remote. Some of these cameras support web cam technology, by outputting its video to an URL. The Webcam pages makes it useful to list such cameras in the T4D web interface.

7.1 CONFIGURE A WEBCAM

Navigate to the Webcam Page via the Menu (or the dedicated home page shortcut icon). Click the Add Webcam button.



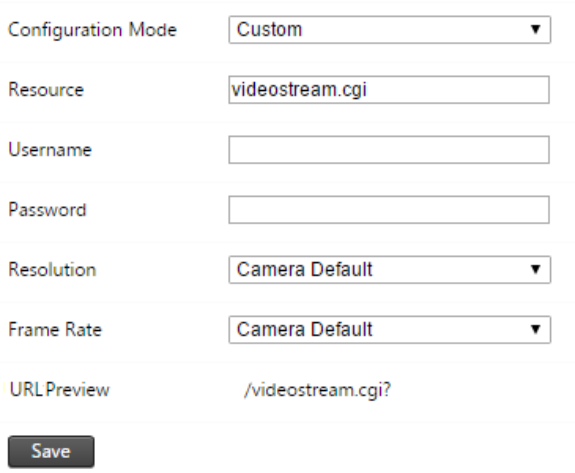
You will be presented with the Webcam configuration page.



You can fill in the different parameters for the webcam. Below we explain the different parameters:

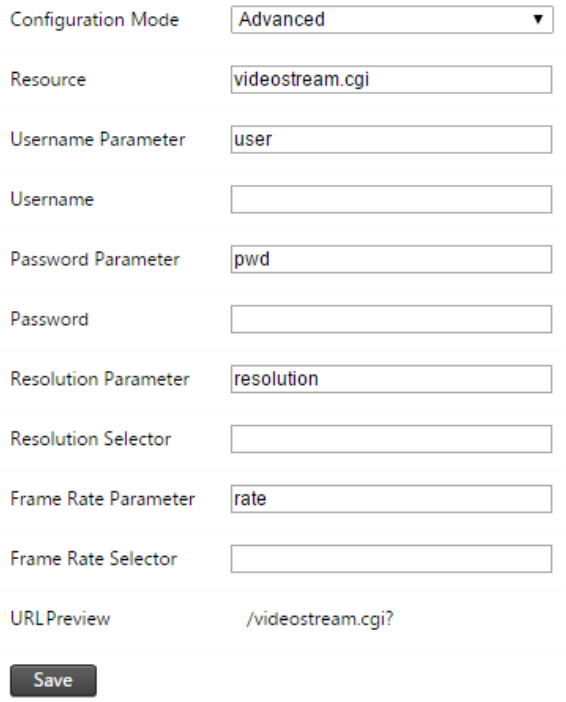
- Name: the display name of the webcam webcam.
- URL the location where the webcam feed can be accessed.
- Connection Mode: this can be FirmWare UI if you only want to view the webcam in the Trimble 4D Control interface, or set to Mjpeg if you wish to record information from the webcam.
- Enable recording: enable this setting if you wish to include video recorded from the webcam in alarm notifications. After you have setup the recording webcam, will then be able to add the webcam to an alarm definition (see section 14.5.4 on page 115). A short video clip covering the time period around the alarm event will then be attached to any alarm notification email sent to users.
- Configuration mode: you can set this option to determine the details level of parameters you wish to configure to control recording of the webcam video. Normally users will configure the *Custom* configuration mode to have more control over the webcam video recording.
- Username: the username to access the webcam UI or HTTP video stream.
- Password: the password to access the webcam UI or HTTP video stream.

You may need to consult your webcam manual for configuration modes other than *Basic*.
Below is a description of the additional available parameters if you select the configuration mode as *Custom*:



- Resource: the resource part in the web camera's URL for the video stream. This is typically something like "videostream.cgi" or "video.mjpeg".
- Username: the username to access the webcam UI or HTTP video stream.
- Password: the password to access the webcam UI or HTTP video stream.
- Resolution: the video pixel Width x Height dimension that should be used
- Frame Rate: the video frames per second that should be used. In order to preserve system resources we recommend setting the lowest feasible frame rate for your purposes.
- URL Preview: this is the webcam HTTP URL that will be used. It is created according to the preceding parameters you have configured.
  A typical URL Preview is: http://webcamserver:8080/?action=stream/?resolution=1&rate=11

We recommend using the *Advanced* configuration mode only if the *Basic* and *Custom* configuration modes are insufficient to configure recording of your webcam video.
Below is a description of the additional available parameters if you select the Configuration mode as *Advanced*

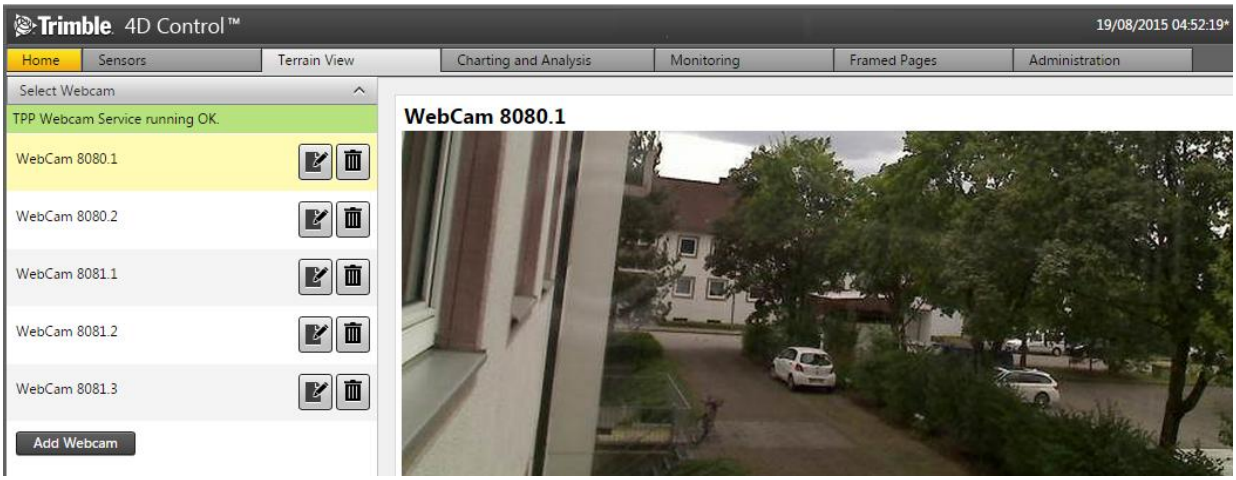


- Resource: the resource part in the web camera's URL for the video stream. This is typically something like "videostream.cgi" or "video.mjpeg".
- Username Parameter: specify the parameter name used in the URL for the username.
- Username: the username to access the webcam UI or HTTP video stream.
- Password Parameter: specify the parameter name used in the URL for the password.
- Password: the password to access the webcam UI or HTTP video stream.
- Resolution Parameter: specify the parameter name used in the URL for the resolution.
- Resolution: the video pixel Width x Height dimension that should be used
- Frame Rate Parameter: specify the parameter name used in the URL for the frame rate.
- Frame Rate: the video frames per second that should be used.
- URL Preview: this is the webcam HTTP URL that will be used. It is created according to the preceding parameters you have configured.

Click Save after configuring the webcam parameters.

7.2 VIEW A WEBCAM

If you select a Webcam on the left-hand panel, it will show the webcam video in the right-hand window pane of the Webcam Page.

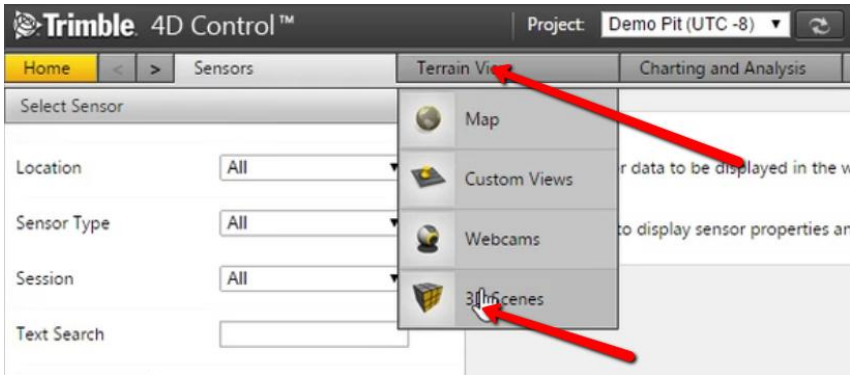


8 3D Scenes

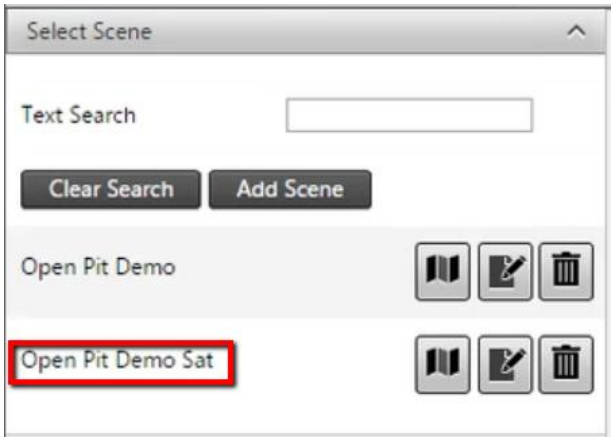
This section is used to create and view three dimensional scenes that represent real-world areas within your Monitoring Project. Depending on the quality of the input data, it can potentially render very impressive 3D scenes.

8.1 NAVIGATING A SCENE

Step 1: Navigate to the 3D Scenes Page via the Menu (or the dedicated home page shortcut icon).



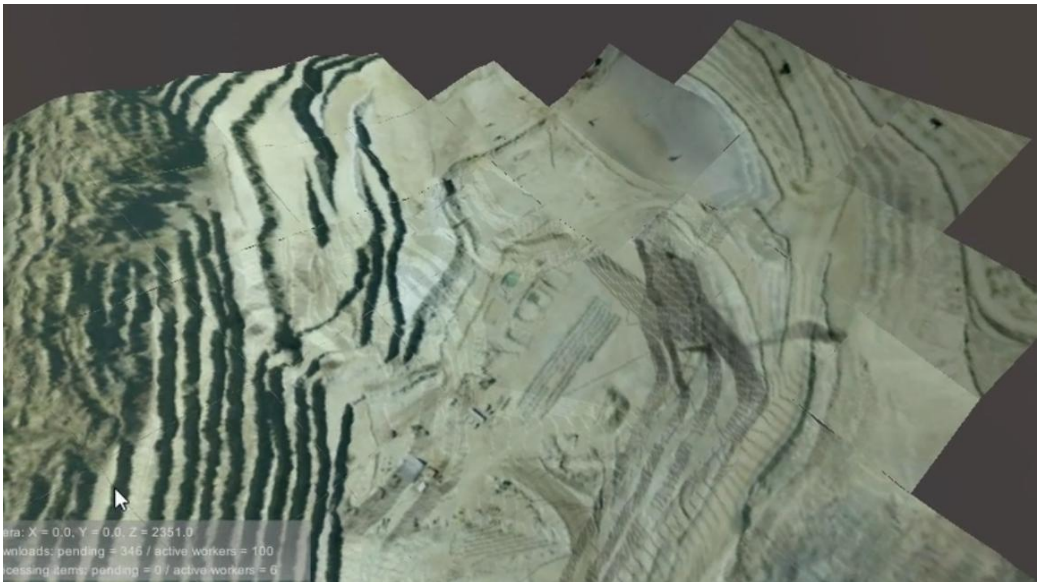
A list of Scenes will be listed in the left hand pane. Simply click on the scene that should be displayed.



Step 2: The scene will open on the right hand side. In this example an open pit mine will be displayed.

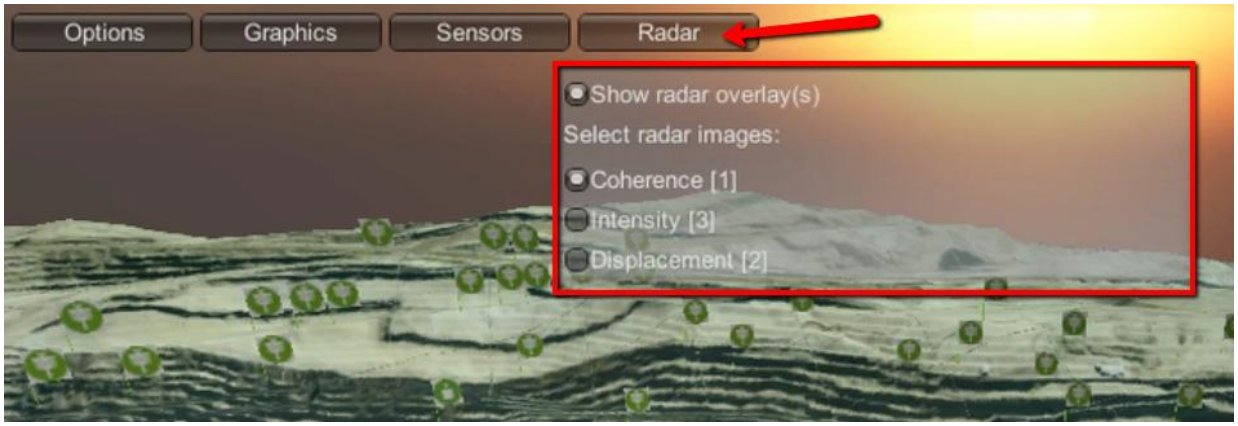
When opening the scene the camera position (that is your view) is by default across the horizon from a bird's eye perspective. To look downwards (towards the open pit mine) simply click anywhere in the scene, and without letting the mouse button go, push the mouse cursor downwards (or in any direction the camera should follow).

Use the mouse wheel to move the camera's position forward and backwards, relative to the current direction of viewing. This is useful for zooming the screen in and out, but can also be used to virtually move around in the 3D environment.



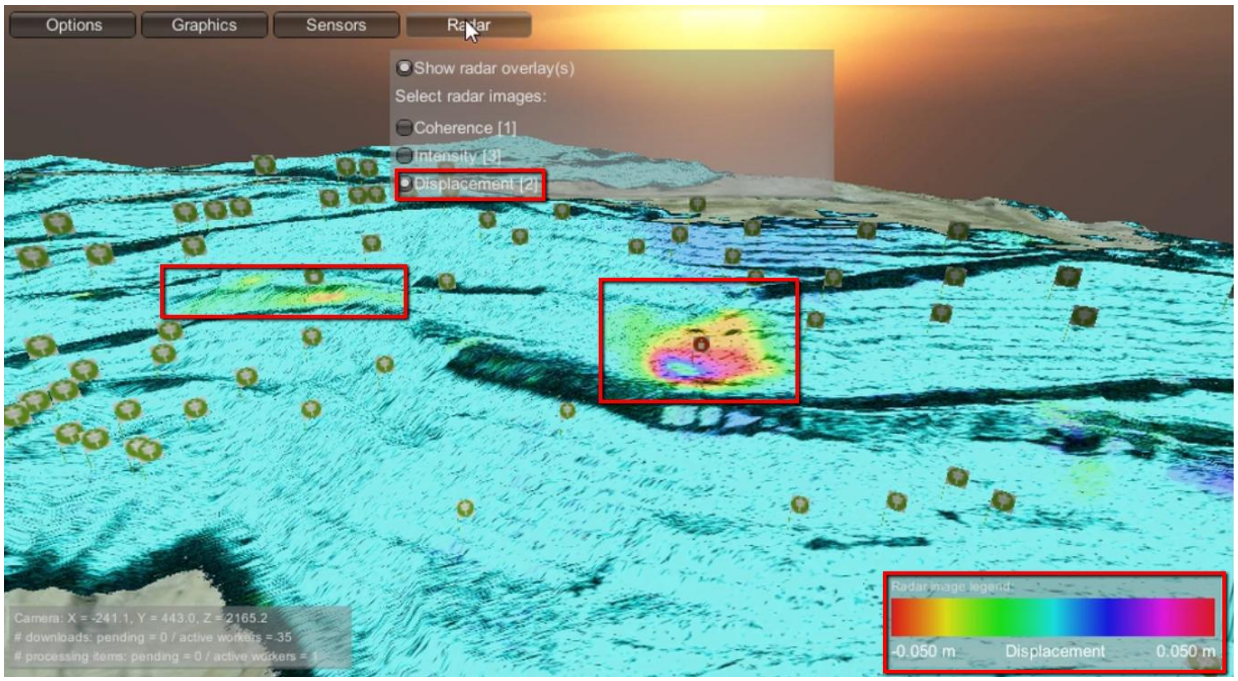
Step 3: Sensors' positioning flags on the site can be enabled/disabled by simply clicking on Sensors button in the top left corner of the scene and selecting or deselecting the Show sensor flags option.

Step 4: Different overlays can also be enabled/disabled by clicking on the Radar button and selecting or deselecting the applicable options.



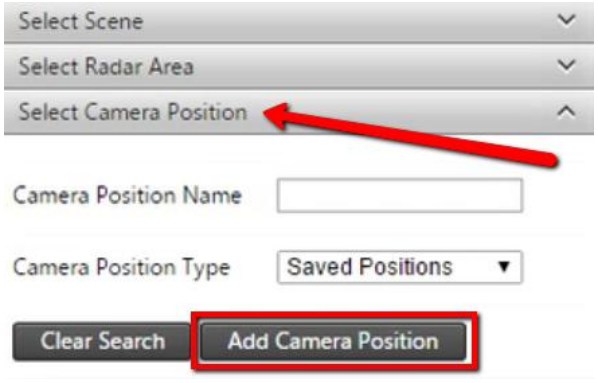
Step 5: For any overlay selected, a color coded legend will be added to the bottom right to indicate the severity of the measured overlay.

In the below example displacements are used as an overlay, and immediately two areas of interest can easily be noticed where slope failures (i.e. large displacements) occurred.



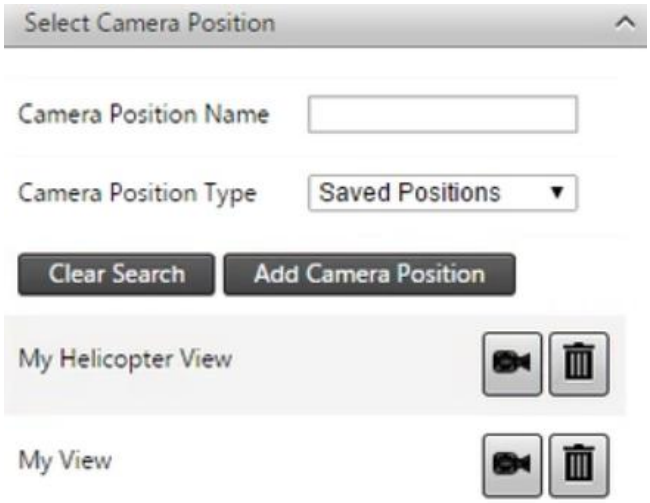
Note the displacements can be positive or negative, therefore the normal stationary point would be in the middle of the legend (indicated by the color of turquoise).

Step 6: In order to save the current camera position (and not have to virtually travel to the same position again), simply go to the Select Camera Position sub-section and click the Add Camera Position button.



Select a comfortable name to remember it by and click on the Save button.

The camera position will now be saved and you can simply click on it in the camera position list to immediately virtually teleport to the saved point of view. When there are many camera positions saved in the list, the filter can be used to quickly get to the specific item in the list.



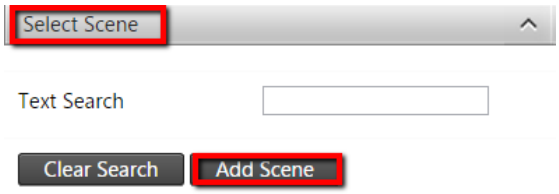
8.2 CREATING A NEW SCENE

In order to create a 3D scene you need to go through the following steps:

1. Define the scene name and extents
2. Define at least one "Height Map" (or DTM) asset
3. Define at least one "Overlay" asset

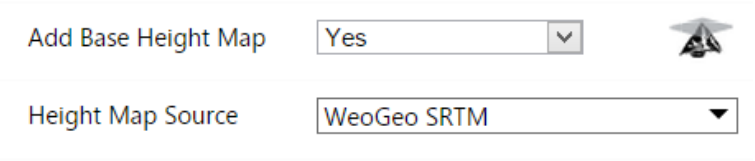
The scene and its assets will be submitted to the Scene Engine for processing. Asset processing may include file downloads as well as geo-referencing operations.

Step 1: In the Select Scene sub-section, click on the Add Scene button.

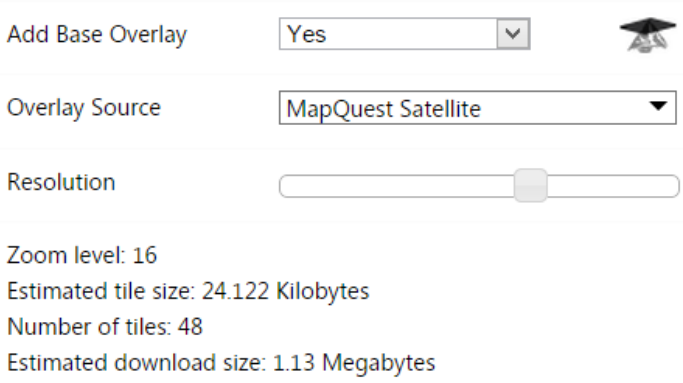


Step 2: Enter the scene property details.

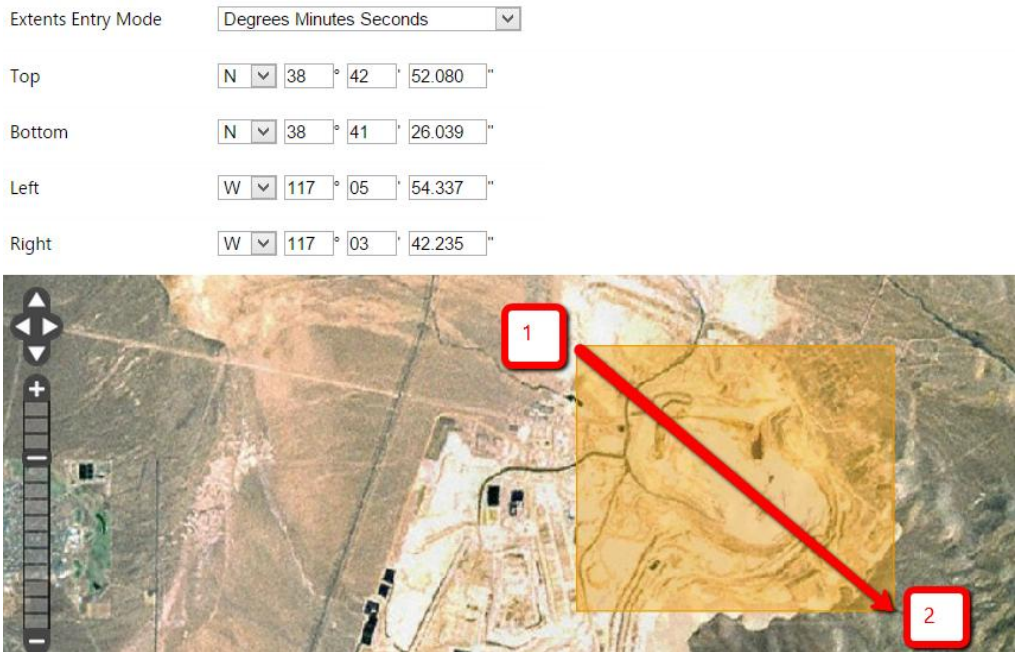
- Scene Name: A convenient name for the scene.
- Add Base Height Map: Enable this option to add a base height map to the scene. (You can still upload additional height maps to the scene regardless of whether or not this option is enabled.)
    - Height Map Source: Select the asset source that should serve as a base height map.



- Add Base Overlay: Enable this option to add a base overlay to the scene. (You can also still upload additional overlays regardless of whether or not this option is enabled.)
    - Overlay Source: Select the asset source that should serve as a base overlay. Take care not to select a Zoom level that causes a file download of a size too large (see Estimated download size below).



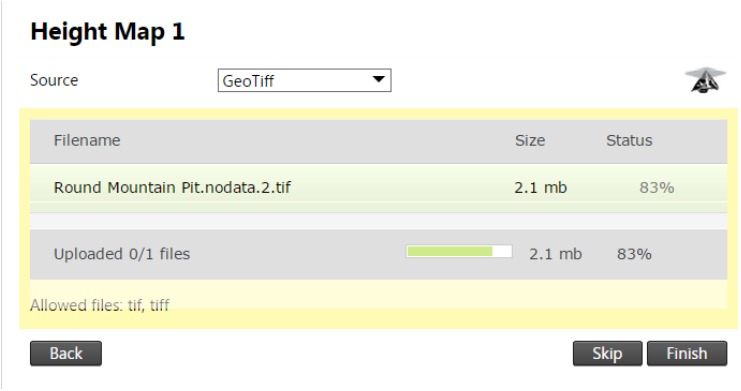
- Extents Entry Mode: Specify the preferred mode for entering the scene extents.
    - **Note:** You can also specify the scene extents on the map surface below. Simply hold down the shift key and then click (1) and drag the mouse pointer over the area of interest to (2)



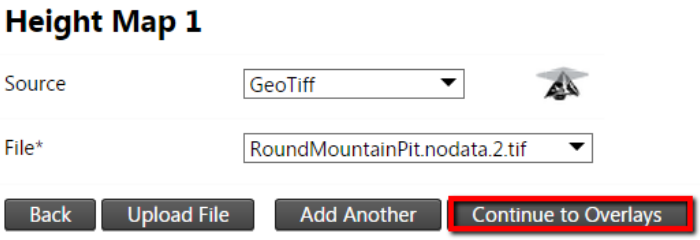
Click the Next button to go to the next step.

Step 3: Select the Height Map file to upload from your computer

After selection the file will automatically start uploading.

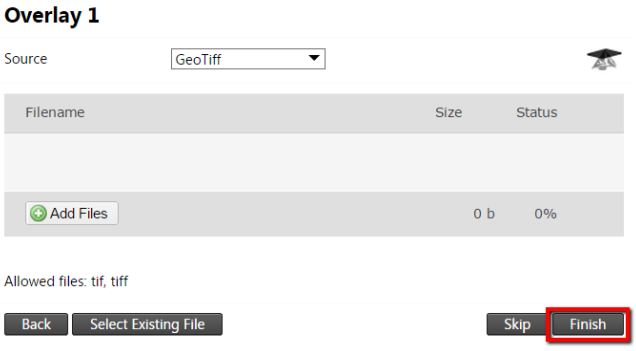


After upload the summary of the Height Map will be shown.



Click on the Continue to the Overlay button to go to the next step.

Step 4: If a map provider was selected in Step 1, simply click on the Finish button. (Else a Height Map file simply needs to be uploaded.)



Step 5: The scene will now be build. All the images will now be processed and/or downloaded where applicable.

After completion the scene will be available for viewing as discussed in section 8.1, page 46.

8.3 AREAS OF INTEREST

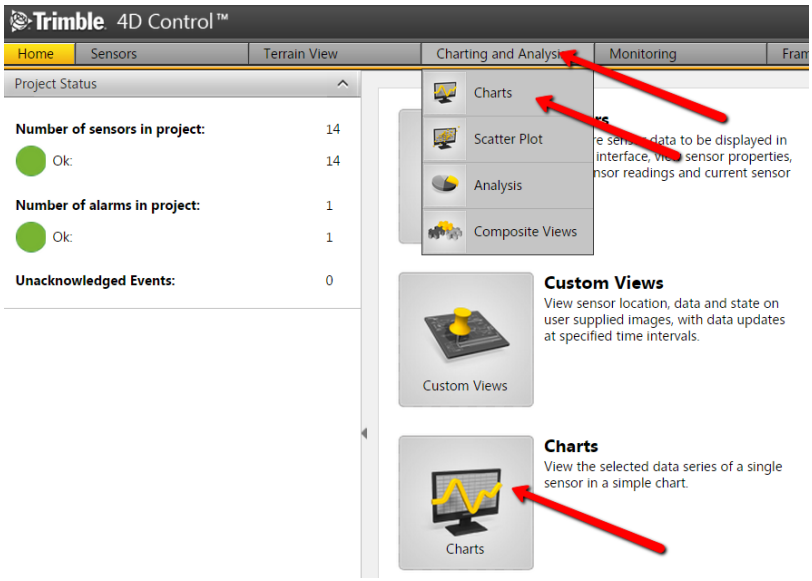
On the basis of the newly integrated eCognition system (http://www.ecognition.com/) the system operator gets an alarm if the automated radar image analysis detects a movement. Trimble 4D Web visualizes the so-called areas of interest as polygons on top of a previously configured 3D scene. The user has the option either to consider the area of lesser importance and decline the detected polygon or to create a radar sensor for continued alarming and analysis purposes.

If over time an area of interest associated with a radar sensor changes in the size or completely disappears, a system operator can optionally be notified as well. Trimble 4D Control allows an administrator to add recipients of radar notifications both based on user groups and specific users.

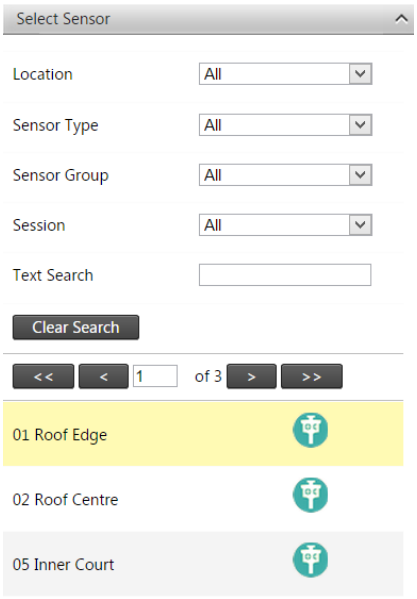
9 Charts

9.1 SIDEBAR NAVIGATION

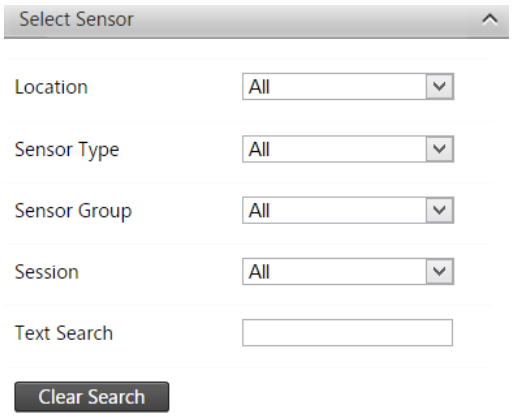
Navigate to the Charts Page via the Menu (or the dedicated home page shortcut icon).



All sensors and sensor groups will automatically be listed in the left sidebar navigation. The sensors' charts can be accessed through the sidebar navigation on the left.



If too many sensors are present the sensors can be filtered via the filtering options.



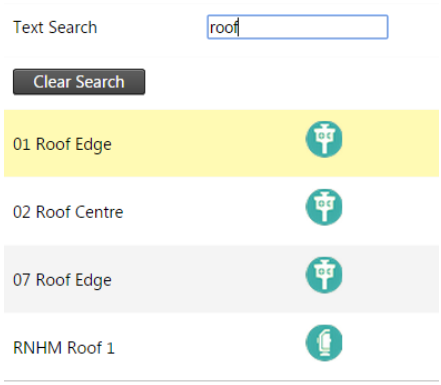
- Location: Depending on the available list of sensors, this dropdown list will be pre-populated with the locations of those sensors. By clicking on the dropdown list and selecting a location, the available sensors at the bottom of the section will refresh. Note that when selecting an entry in the dropdown field, the charts in the main content section will not change until selecting a new sensor at the bottom of the sidebar navigation section.

- Sensor Type: The sensor type allows one to filter the map on the right hand side according to the sensor selected. Note that clicking on one of the sensors in the dropdown, filters the sensors to display only the available sensors of the chosen type.

- Sensor group: The group you have allocated the sensor to belong to. (Discussed in Sensor Groups on page 22.)

- Sensor session: The specific session linked to the sensor (only applicable if the Highrise module is installed).

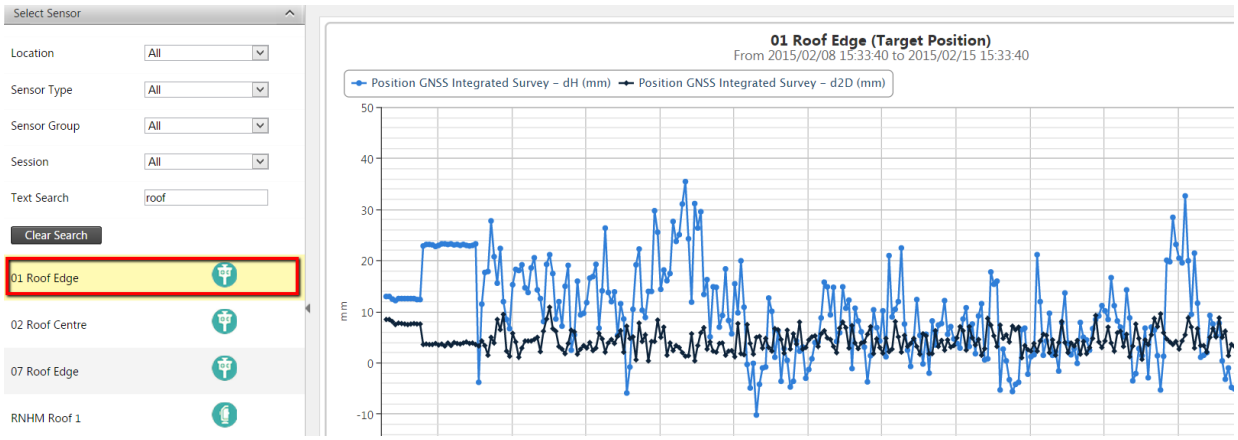
- Text Search: By typing the name or partial name of the desired sensor into the field provided and pushing enter, the system will perform a real-time search of the available sensors by that name.



- Clearing Searches: Clicking the Clear Search button will clear all search fields, thus resetting the page to its base values.

By default, this list of sensors includes all of the available sensors and/or sensor groups before filters are applied. These sensors are automatically filtered as soon as any of the filtering options above are used.

By clicking on any one of these sensors, the sensor data is displayed in the main content section on the right.



9.2 CHARTS

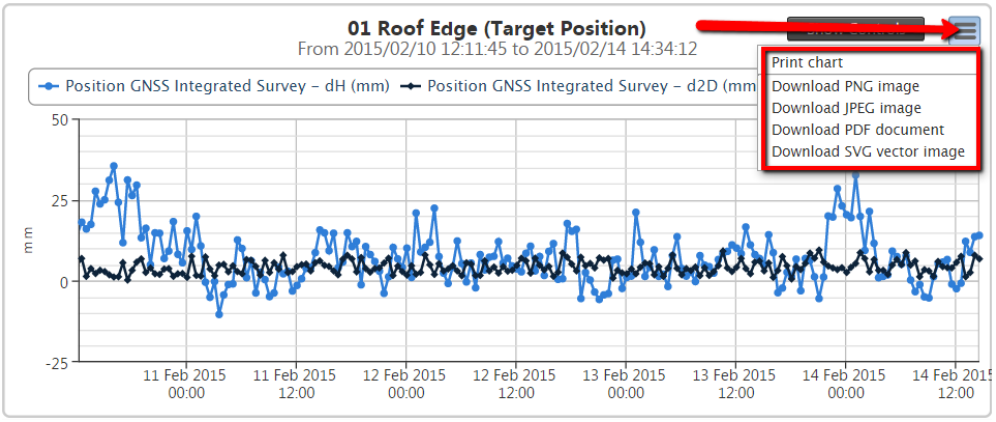
This is the main content section where you can find a visual representation of the data collected for each sensor. By default, there are multiple parameters displayed on each chart (depending on the sensor selected). In this section, it is possible to:

- Enable / Disable certain chart parameters
- Print the Selected Chart
- Save chart as an image (PNG, JPG, PDF, SVG)
- Change the heading / tagline of the chart
- Zoom / highlight a certain section of the timeframe
- Get detailed information on specific points in the charts

9.2.1 Manipulation

Clicking on the items in the legend of the chart, will enable/disable that section on the chart.

9.2.2 Print Chart

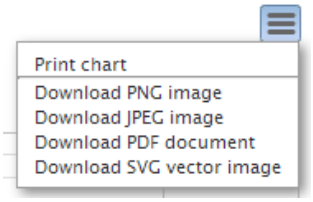


By clicking on the button in the top right-hand corner of the chart, the user is able to print the chart that is currently displayed on screen. Note that the printing result may vary between browsers / printers.

9.2.3 Save Chart Image

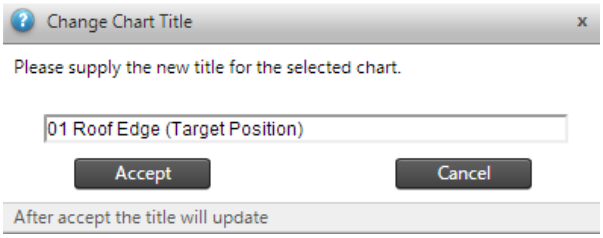
By clicking on the Button in the top right-hand corner of the chart (same as the print button), the chart can be downloaded in one of the following formats:

- JPG
- PNG
- PDF
- SVG



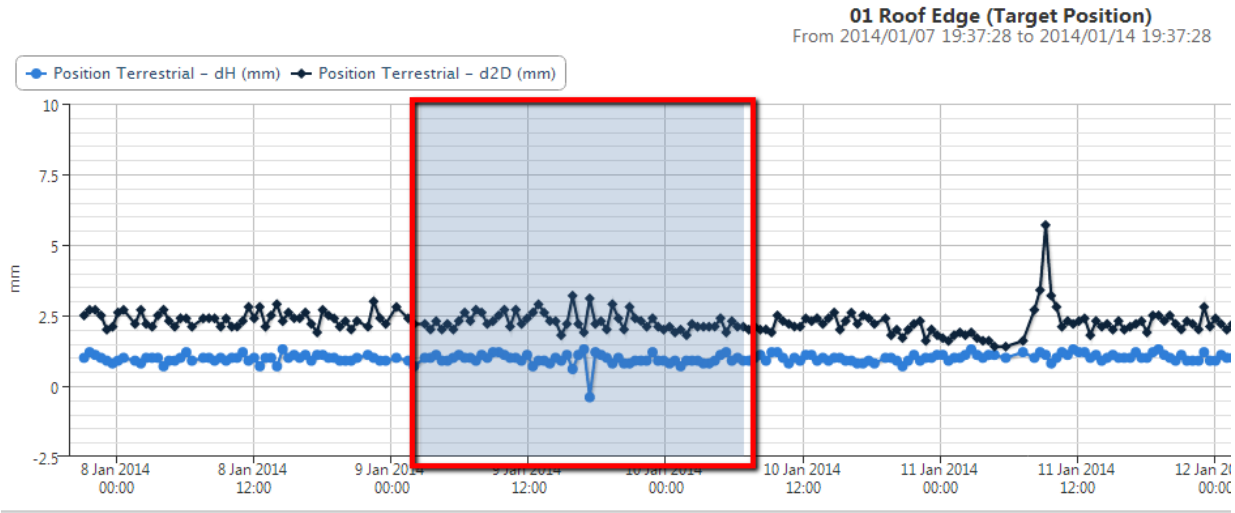
9.2.4 Change the heading / tagline of the chart

Simply click on the heading and a pop-up will appear making it possible to change it.



9.2.5 Zoom / highlight a certain section of the timeframe

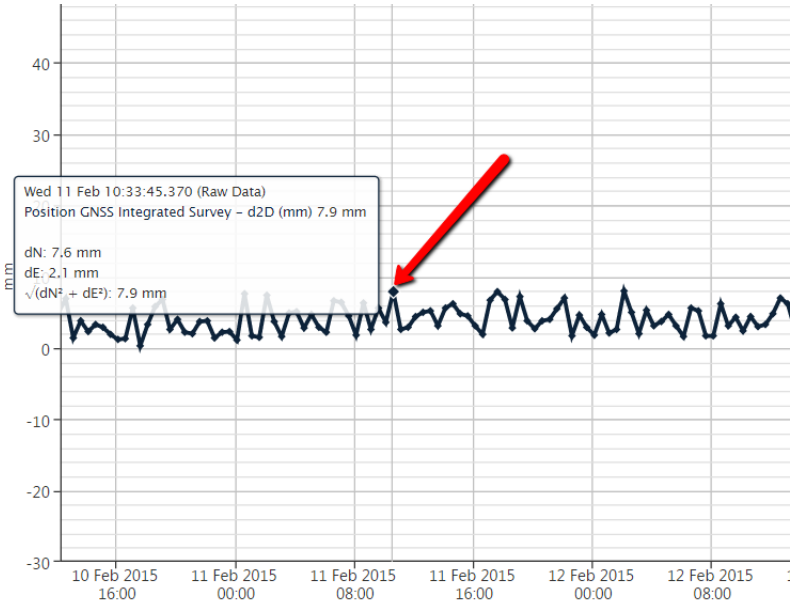
In order to zoom into a certain area, simply click on the chart and drag to the area which should be zoomed into (as indicated in the next figure).



The chat will now reload to zoom into the selected area. Please note it may load more data from the database. Also you can click the “Reset Y Axis Scaling” button below if the line becomes too flat (horizontally speaking), or additionally just unselect the checkbox before it to make this happen automatically.

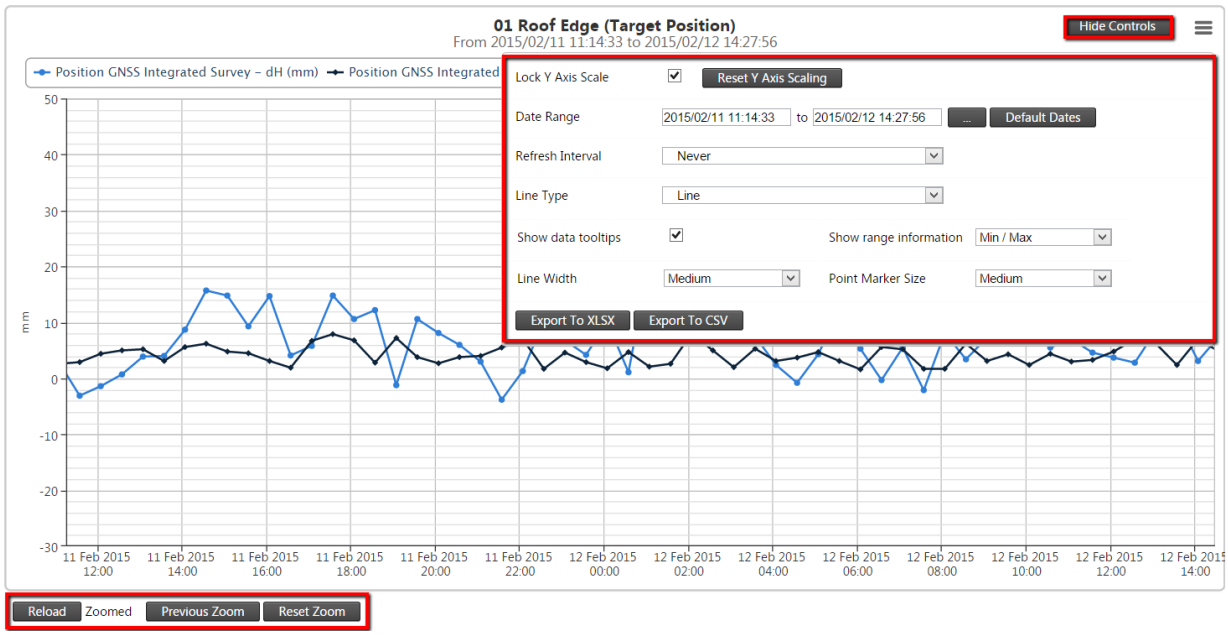
9.2.6 Get detailed information on specific points in the charts

Just move with your mouse over any part of the chart to get this information.



9.3 CHART SETTINGS

The Chart Settings is located in the top right part the chart, by clicking the Show Controls button (that will change to Hide Controls after clicked).



If the user selected a sensor to display, the content will contain the following configurable variables and/or actions:

- Lock Y Axis Scale
- Date Range
- Refresh Interval
- Line Type
- Show data tooltips
- Show range information
- Line Width
- Pointer Marker Size
- Export buttons

Additionally at the bottom left of the chart are two more control types:

- Reload
- Zoom Status

9.3.1 Zoom Status

The Zoom Status will update as you do zooming functions on the above chart. The status may vary between:

- Unzoomed - the default not zoomed chart.
- Zoomed - when zoomed in.
- Saturated – when zoomed in to such an extent that no additional data can be retrieved from the database.

9.3.2 Zooming

When you first run a chart, the status of the chart will be unzoomed. Each chart series may contain either “Raw Data” or “Summarized Data”, depending on the frequency of the sensor observation data and the selected date range.

You can click and drag on the chart surface to zoom. As you zoom in, the “Zoom Status” will change from “Unzoomed”, to “Zoomed”. You can use the “Previous Zoom” button to go to a previous zoom range, or you can click on the “Reset Zoom” button to zoom out completely.

The current zoom range as well as the stored “Previous Zoom” ranges are maintained when you select a different Sensor. Repeated Zooming, will lead to a “Zoom Status” that is “Saturated”. This status implies that the all series in the chart contain “Raw Data” and that further zooming will not reveal more detail. Attempts to Zoom via a click-and-drag under the “Saturated” Zoom Status, will lead to the chart being panned either left or right, without narrowing the date range.

9.3.3 Reload

If any changes has been made to the Chart settings, or simply if you expect the underlying sensor has suddenly received new significant data, simply click the Reload button in order to retrieve the latest data and update the Chart with the latest settings. Refreshing the page will also have the same effect.

9.3.4 Lock Y Axis Scale

The Lock Y Axis Scale can be used to re-calibrate the y axis scale based on the current chart. You can choose to check the box, when checked the y scale will retain between the zoom operations for the same sensor. When unchecked the y scale will recalibrate with each zoom operation.

9.3.5 Configure Y Axis Scale

You can specify min and max values for each y axis. The axis will be scaled to ensure that these values are included.

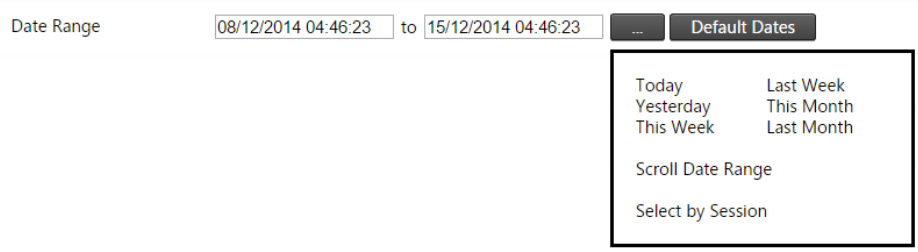
9.3.6 Date Range

This setting adjusts the time frame of the chart displayed underneath. The default setting when loading a new sensor is data from the past week. If you want to change the time frame, click on the [...] button which will present a pop-up with various settings. Inside this pop-up, the settings include:

- Quick Selections (incl. today, yesterday, this week, last week, this month or last month).
- Custom Selection where the user can set custom time frames by clicking on the input fields.
- Session where a current session in the system can be selected if needed (only applicable if the Highrise module is installed).

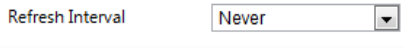
Clicking on the “Default Dates” button will cause the chart to automatically select a date range, based on the most recent data available for the selected sensor. This action will clear all stored zoom range and reset the “Zoom Status” to “Unzoomed.

If a custom time frame is selected, click on “Reload” to activate the changes.



9.3.7 Refresh Interval

It is possible to select the interval by which the data should be refreshed. This allows the system to periodically refresh the data displayed on the screen. In order to change the default refresh interval, click on the dropdown menu and select your desired interval.



You will notice a counter on the top left corner counting down the interval. After each “count down” the chart will reload automatically and the additional time period’s data will be added to the graph.

9.3.8 Line Type

The options to view the chart either by area, dots, lines, spline or area spline.

9.3.9 Show data tooltips

Use this checkbox to enable / disable the pop-up data indicators if you move with your mouse over the data points in the graph.

9.3.10 Show Range Information

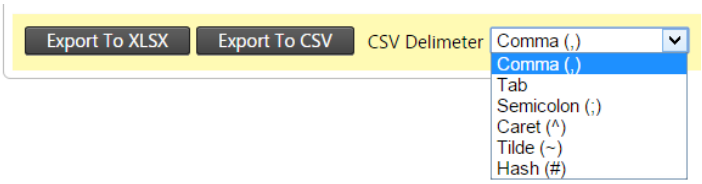
Some series have more data values that are available although only the moving averages are plotted in the graph. If these additional data are available this option can be used to plot certain range related information to get an idea of spread of the data. The options available are the standard deviation (1 sigma), more deviations (2 and 3 sigma) or the absolute minimum and maximum extreme points.

9.3.11 Line Width and Pointer Size

These options simply modify the graph line and data points’ size to be displayed.

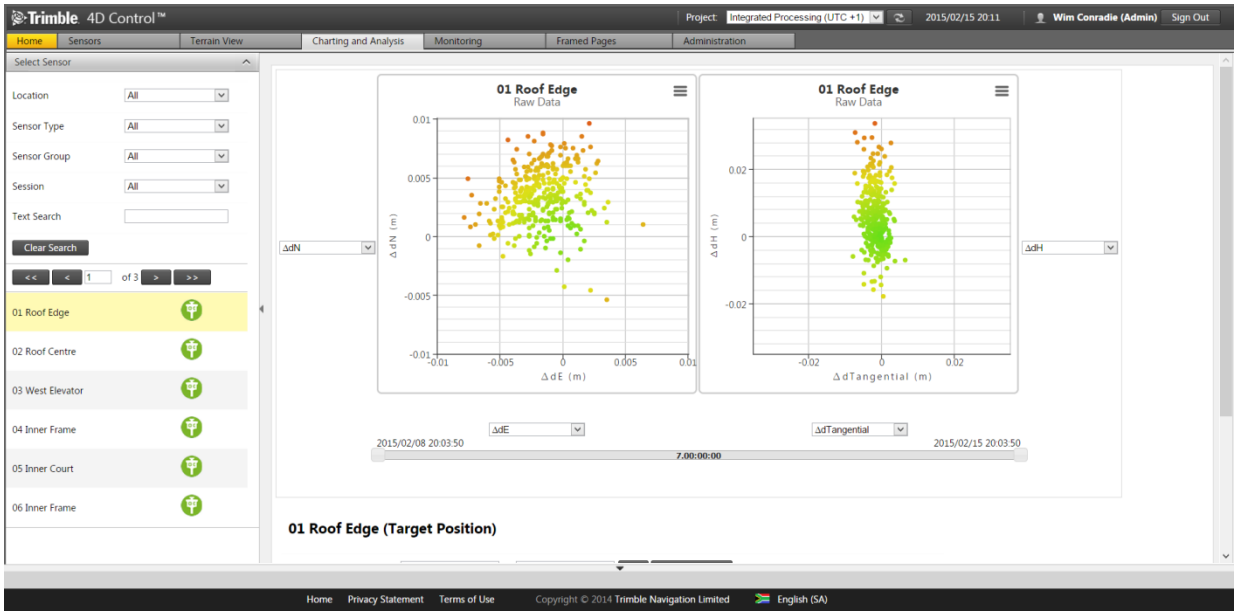
9.3.12 Export

To download the raw data of the chart, simply make use of the Export buttons.



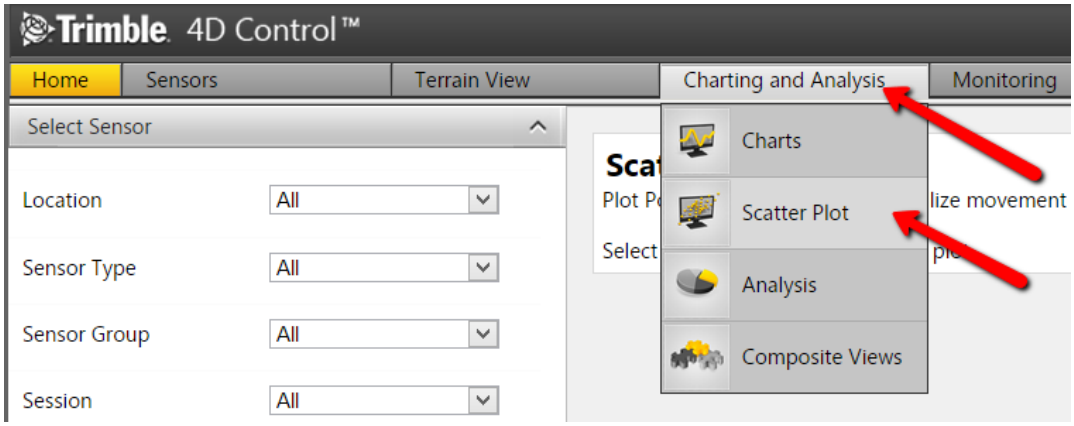
If you would like to make use of the CSV export, hover with your mouse over the button and then carefully move with the mouse to the right in order to select a specific delimiter such as a ‘Comma’.

10 Scatter Plot

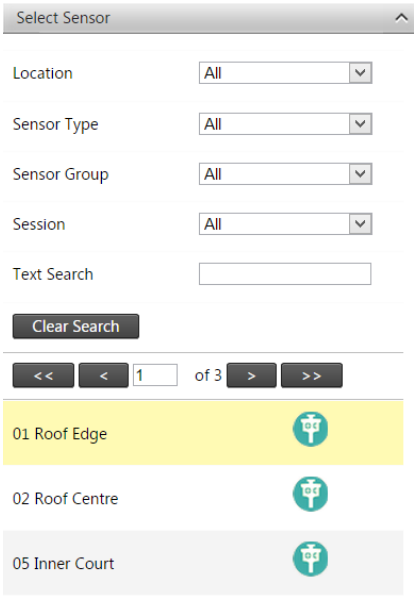


10.1 SIDEBAR NAVIGATION

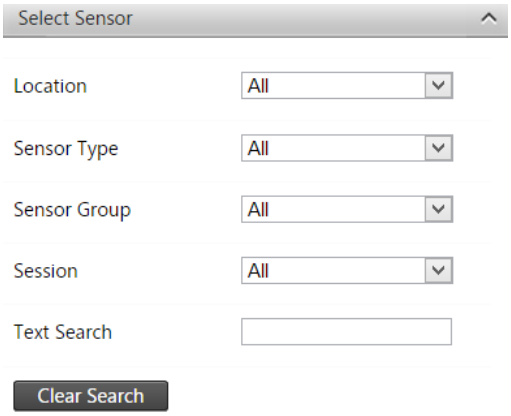
Navigate to the Scatter Plot Page via the Menu (or the dedicated home page shortcut icon).



All sensors and sensor groups will automatically be listed in the left sidebar navigation. These sensors' charts can be accessed through the sidebar navigation on the left.



If too many sensors are present the sensors can be filtered via the search options.



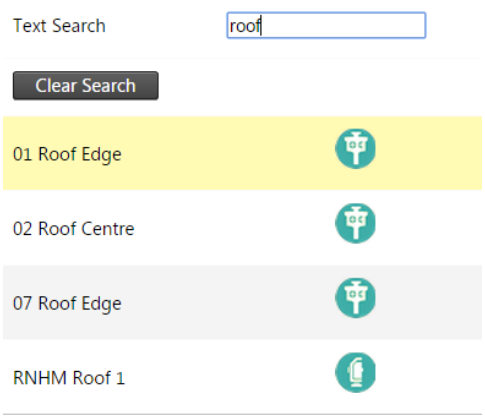
- Location: Depending on the available list of sensors, this dropdown list will be pre-populated with the locations of those sensors. By clicking on the dropdown list and selecting a location, the available sensors at the bottom of the section will refresh. Note that when selecting an entry in the dropdown field, the scatter plots in the main content section will not change until selecting a new sensor at the bottom of the sidebar navigation section.

- Sensor Type: The sensor type allows one to filter the map on the right hand side according to the sensor selected. Note that clicking on one of the sensors in the dropdown, filters the sensors to display only the available sensors of the chosen type.

- Sensor group: The group you have allocated the sensor to belong to. (Discussed in Sensor Groups on page 22.)

- Sensor session: The specific session linked to the sensor (only applicable if the Highrise module is installed).

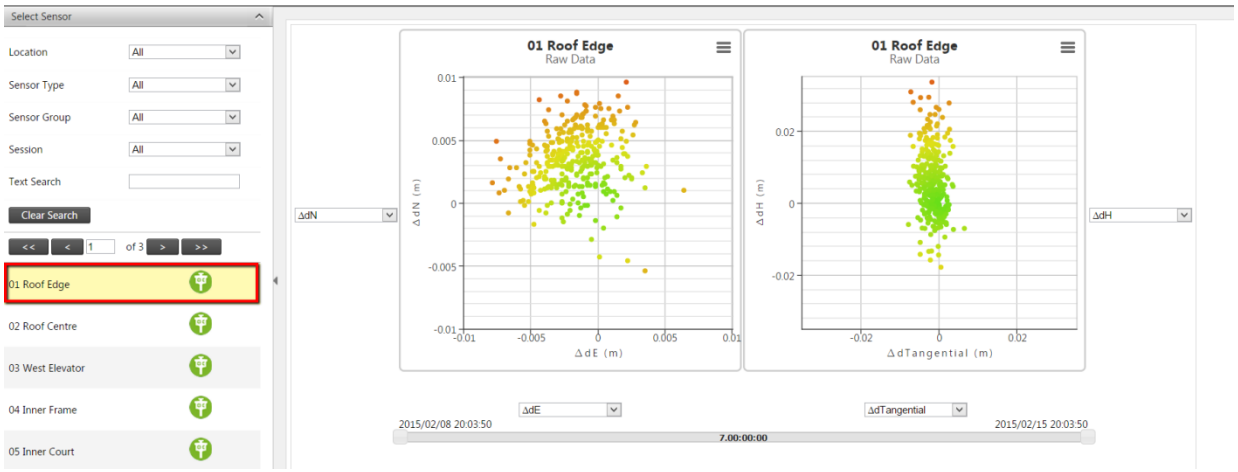
- Text Search: By typing the name or partial name of the desired sensor into the field provided and pushing enter, the system will perform a real-time search of the available sensors by that name.



- Clearing Searches: Clicking the Clear Search button will clear all search fields, thus resetting the page to its base values.

By default, this list of sensors includes all of the available sensors and/or sensor groups before filters are applied. These sensors are automatically filtered as soon as any of the filtering options above are used.

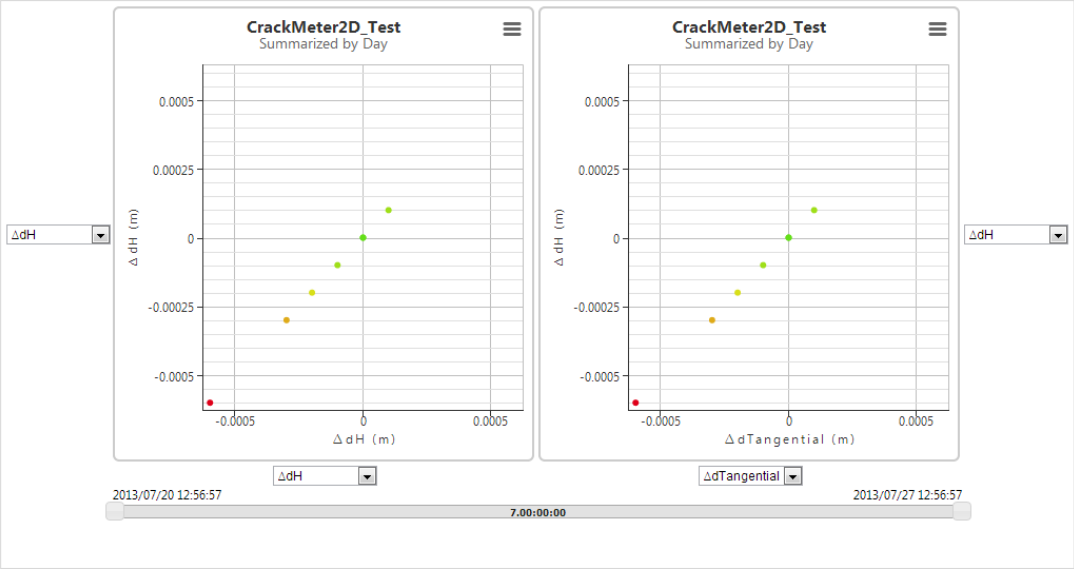
By clicking on any one of these sensors, the applicable scatter plot is displayed in the main content section on the right.



10.2 SCATTER PLOT CHART AREA

This is the main content section where you can find a visual representation of the scatter plot data collected for each sensor. By default, there are multiple parameters displayed on each chart (depending on the sensor selected). On the Scatter Plot, it is possible to:

- Print the a Chart
- Save chart as an image (PNG, JPG, PDF, SVG)
- Change the heading / tagline of the chart
- Zoom / highlight a certain section of the timeframe
- Get detailed information on specific points in the charts
- Change the source data for the X and Y axis selections
- Use selective time period via the Date range Slider



10.2.1 Print Chart

Refer to Section 9.2.2 on page 58.

10.2.2 Save Chart Image

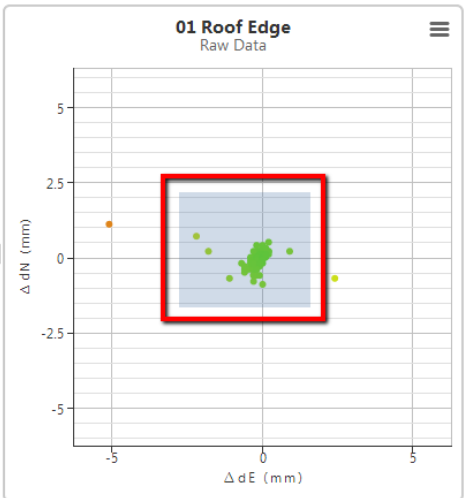
Refer to Section 9.2.3 on page 58.

10.2.3 Change the heading / tagline of the chart

Refer to Section 9.2.4 on page 58.

10.2.4 Zoom / highlight a certain section of the timeframe

In order to zoom into a certain area, simply click on the chart and drag to the area which should be zoomed into (as indicated in the next figure).



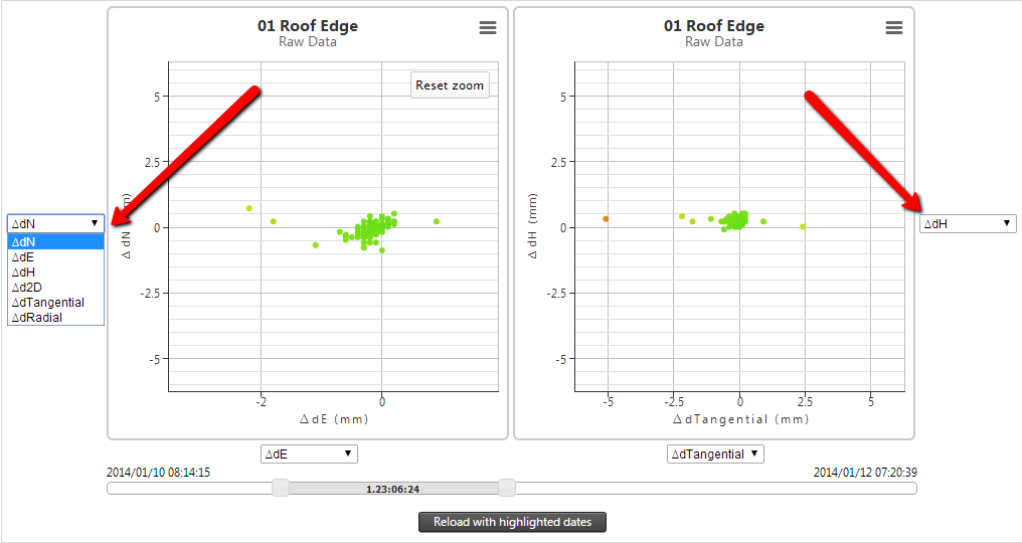
The chat will now reload to zoom into the selected area. On the top-right area of the chart there will appear a “Reset Zoom” button which you can simply click to go back again.

10.2.5 Get detailed information on specific points in the charts

Kindly refer to Section 9.2.6 on page 59.

10.2.6 Y Axis

Use the dropdown to select the dimension to plot against the Y axis on the charts.



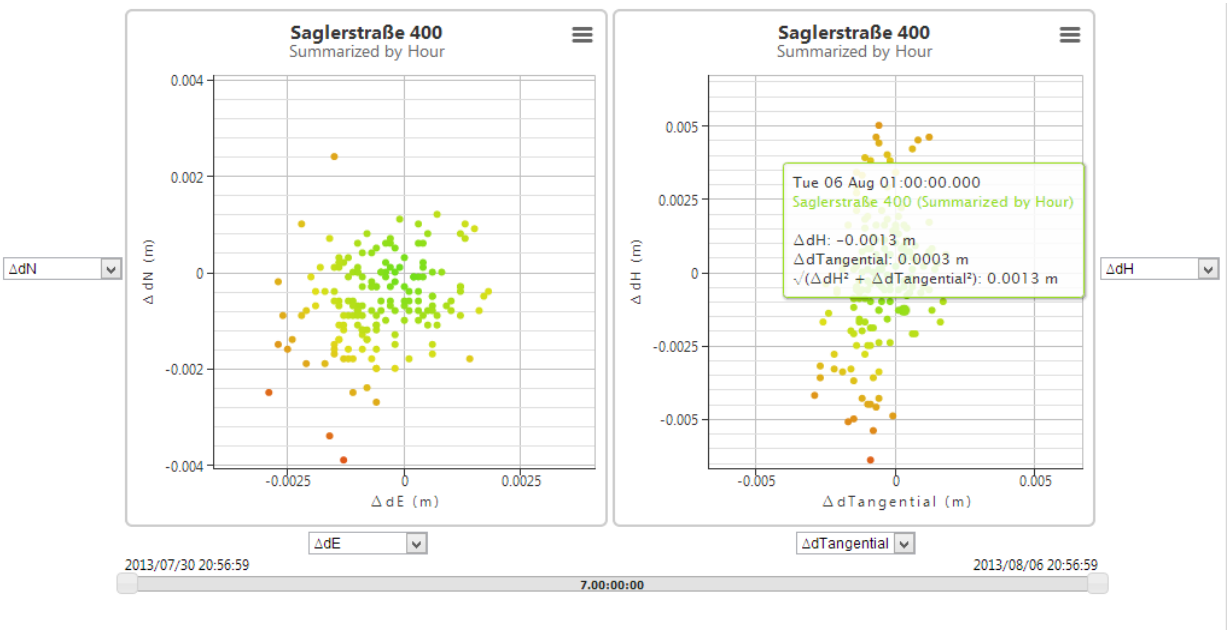
10.2.7 X Axis

Similarly as with the Y axis, simply use the dropdown to select the dimension to plot against the X axis on the charts.

10.2.8 Date Range Slider

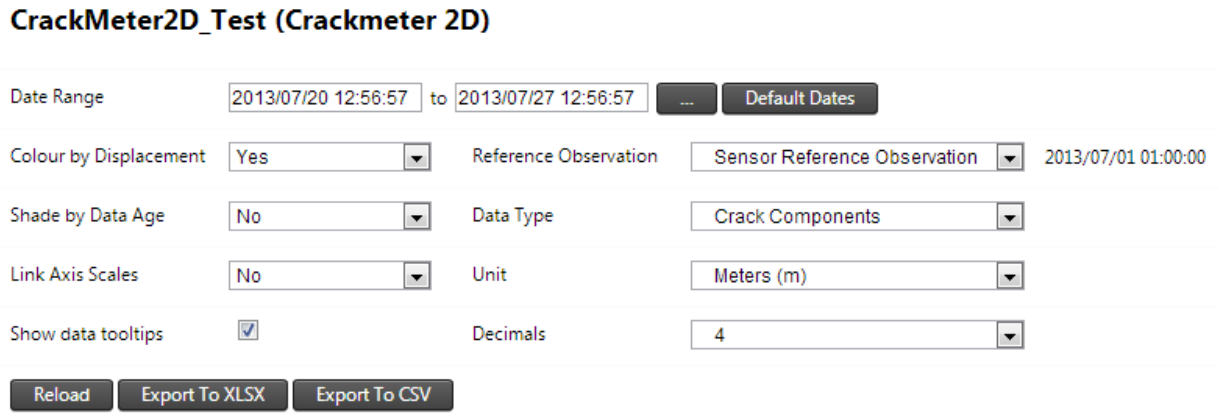
The Date Range Slider is located directly below the x axis drop down lists.

The date range can be narrowed by dragging either of the handles at the start and end of the slider. The updated duration value will be displayed in the center of the slider.



10.3 SCATTER PLOT SETTINGS

The Scatter Plot Settings is located below the two charts, as display in the next figure.



If the user selected a sensor to display, the Settings will contain the following configurable variables and/or actions:

- Date Range
- Color by displacement
- Shade by Data Age
- Link Axis Scales
- Show data tooltips
- Reference Observation
- Data Type
- Unit
- Decimals
- Reload and Export buttons

10.3.1 Date Range

Kindly refer to Section 9.3.6 on page 61.

10.3.2 Color by Displacement

When enabled, dots on scatter plot will be colored on a gradient scale from green to yellow to red depending on the distance measured (in order to reflect severity of the displacement). If disabled all dots will be blue.

10.3.3 Shade by Data Age

When enabled, a degree of transparency will be applied to each dot. The latest observation will be solid and the oldest completely transparent. This setting is only effective if you do not have multiple observations plotted on top of each other.

10.3.4 Link Axis Scales

When enabled, the two chart surface will scale identically. When disabled, the scale of each surface will optimize for the data that appears on the chart only.

10.3.5 Show data Tooltips

Use this checkbox to enable / disable the tooltip (pop-up) data indicators if you move with your mouse over the chart.

10.3.6 Reference Observation

Scatter plots always plots relative positions, this differs between actual and reference positions. User can either use reference dates of the selected sensor to obtain a reference position or simply use the first observation.

10.3.7 Data Type

If the selected sensor is linked to more than one positional data type, then the user will be able to select any of these data types from the dropdown.

10.3.8 Unit

This dropdown should be used for display purposes.

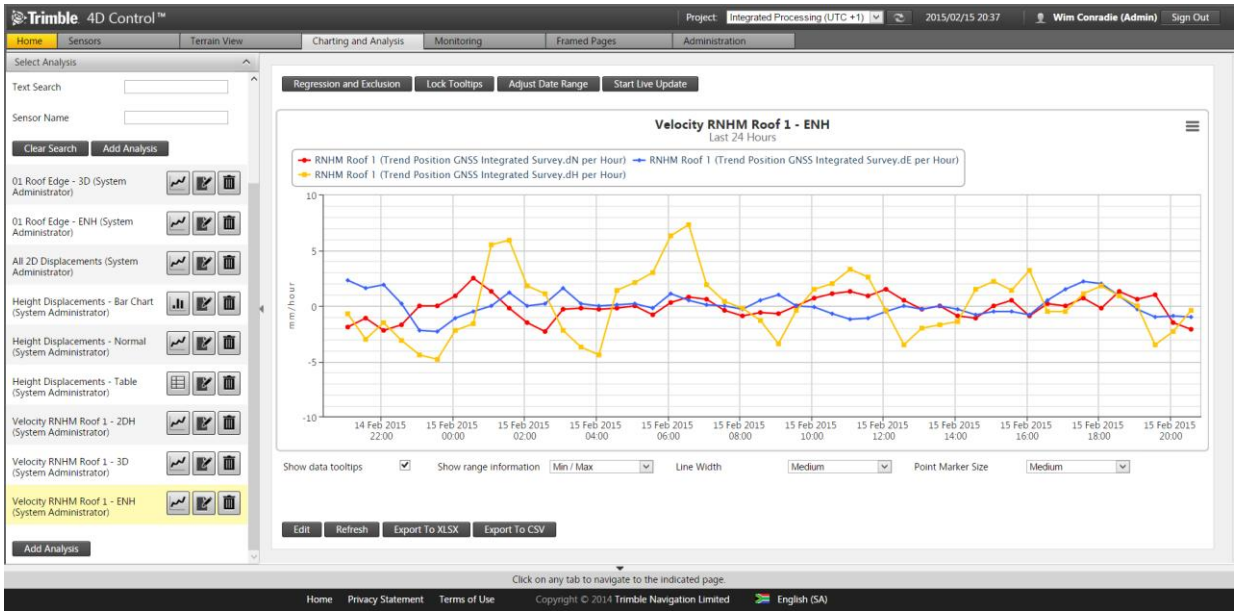
10.3.9 Decimals

This specifies the number of decimals that should be used.

10.3.10 Reload and Export buttons

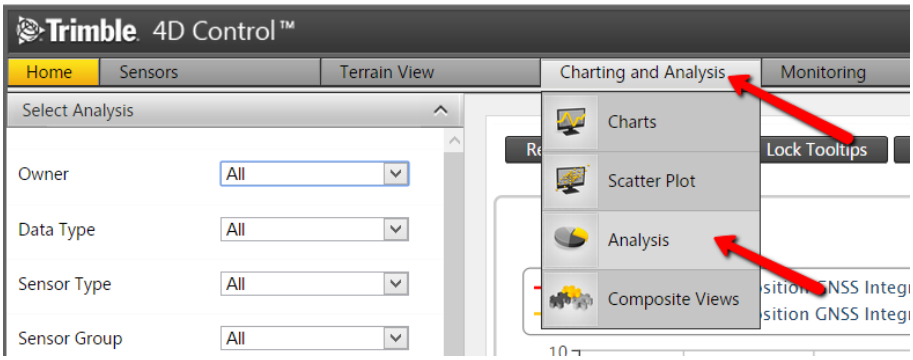
Kindly refer to Sections 9.3.12 on page 62.

11 Analysis



11.1 ACCESS ANALYSIS

Navigate to the Analysis section via the Menu or the dedicated home page shortcut icon.



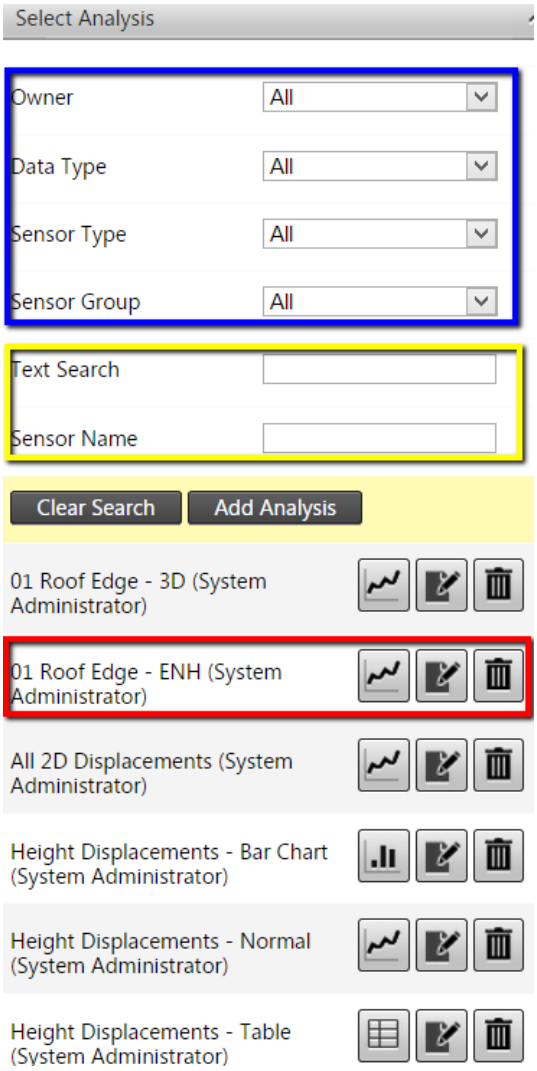
11.2 TO VIEW AN EXISTING ANALYSIS

Step 1: If too many analyses are present the analyses can be filtered by filling out the drop-down boxes (indicated in blue in the next figure).

Step 2: You can also do a text search (indicated in yellow).

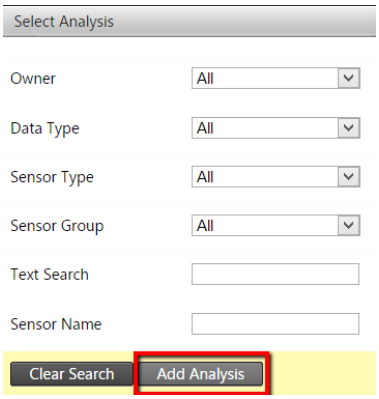
Step 3: Alternatively you may look for your analysis in the list below the search field (in red). This is also where your search results will appear.

Step 4: Once you have selected your analysis (by clicking either on its name or the pie chart icon next to its name), you can view it on the right-hand pane of the analysis page.

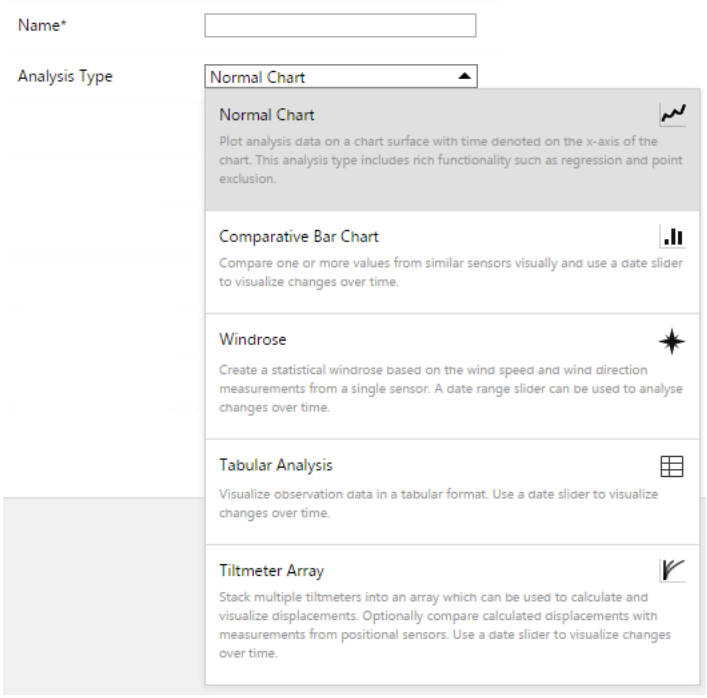


11.3 TO ADD AN ANALYSIS

Step 1: Under the Select Analysis sub-section you may add a new Analysis by clicking the Add Analysis button.

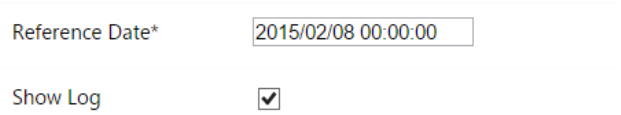


Step 2: Fill out the necessary information:

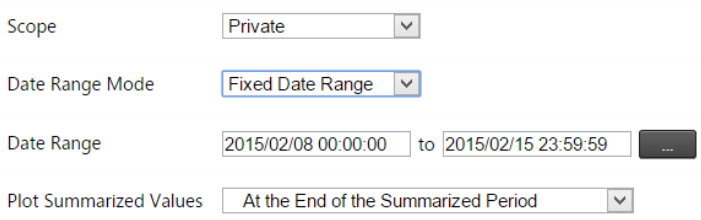


- Name: Specify a name for the analysis. Analysis names must be unique within a monitoring project.
- Analysis Types
    - Normal Chart: Plot analysis data on a chart surface with time denoted on the x-axis of the chart. This analysis type includes rich functionality such as regression and point exclusion.

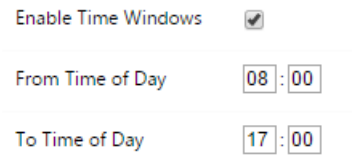
- Comparative Bar Chart: Compare one or more values from similar sensors visually and use a date slider to visualize changes overtime.
- Windrose: Visualize the change in wind direction and speed.
- Tabular Analysis: Visualize observation data in a tabular format. Use a date slider to visualize changes over time.
- Tiltmeter Array: Visualize the cumulative tilt as measured by an array of tilt meters.
- Heat Map: Generate geo-referenced interpolated image visualising particular sensor observation values.



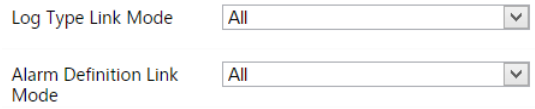
- Reference Date: This date is used to determine reference measurements for series configured to display relative measurements. Note that this date is in terms of project local time.
- Show log: Log entries that fall within the analysis date range can be visualized on the analysis charts surface by enabling this option.



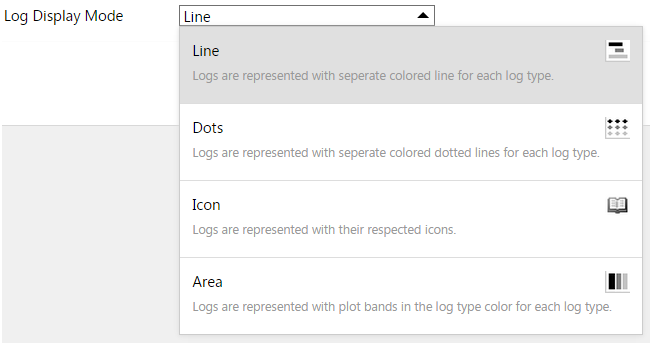
- Scope: You can make the analysis visible to other users by marking it as public. A private analysis can only be accessed by the user that created it.
- Date Range Mode: The date range of an analysis can be determined either by specifying a start and an end date, or by specifying the rolling time window width.
  - Fixed date range: Use these date and time inputs to specify the analysis date range in terms or project local time.
  - Rolling Window: Specify the time window which will determine the analysis date range. The effective analysis date range will change on a continuous basis. Note: Window widths of less than 1 minute may be affected by data latency.
- Plot Summarized Values: This option has an effect on the time value (or x axis value) against which summarized values will be plotted. Each node in a summarized series typically reflect the average observation value over a period (such as 1 hour or 1 day). By adjusting this option, you can plot summarized values either at the beginning, in the middle or at the end of the time period over which the data was summarized.



- Time Windows: Enable time windows if you only want to show observations in a particular time interval per day. If the *To Time of Day* is less than the *From Time of Day* then the interval wraps around midnight starting at the *To Time of Day* and ending on the *From Time of Day* of the next day. Only observations inside this daily interval will appear on the analysis chart.



- Log Type Link Mode: Specify the log type link mode.
- Alarm Definition Link Mode: Specify the alarm definition link mode.



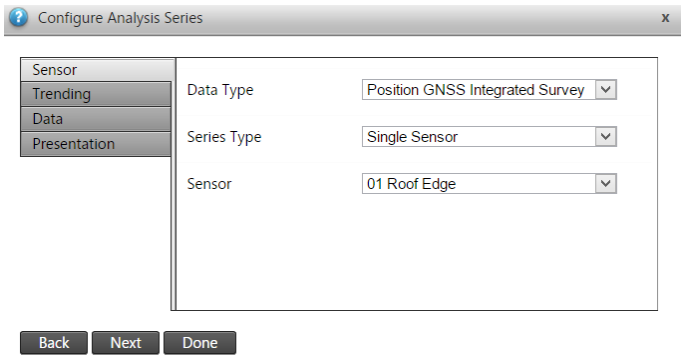
- Log Display Mode: Choose how logs are displayed on the chart.
    - Line: Logs are represented with separate coloured line for each log type.
    - Dots: Logs are represented with separate coloured dotted lines for each log type.
    - Icon: Logs are represented with their respected icons.
    - Area: Logs are represented with plot bands in the log type colour for each log type.

Step 3: Save your analysis by clicking the Save button.

Step 4: Once an Analysis had been created you, it's time to add some data to it, else there is nothing to display. Click the Add button to add data sources (called "Series") to the analysis chart.

Note: this can be repeated multiple times in order add more graphs to the same chart.

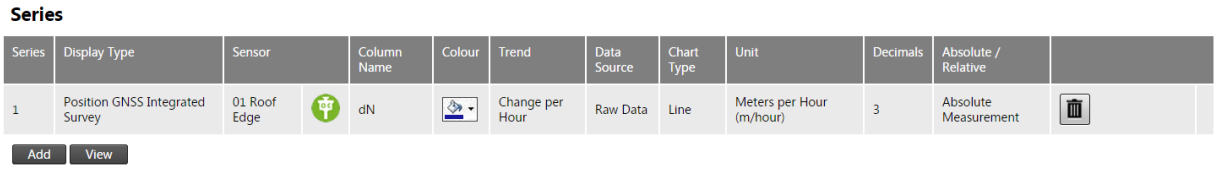
Step 5: Once you click Add, a Configure Analysis Series pop-up window will appear where you can select and customize your data source (as indicated in the next figure).



Switch via the tabs on the left (Sensor, Trending, Data & Presentation) or by clicking via the Next and Back buttons.

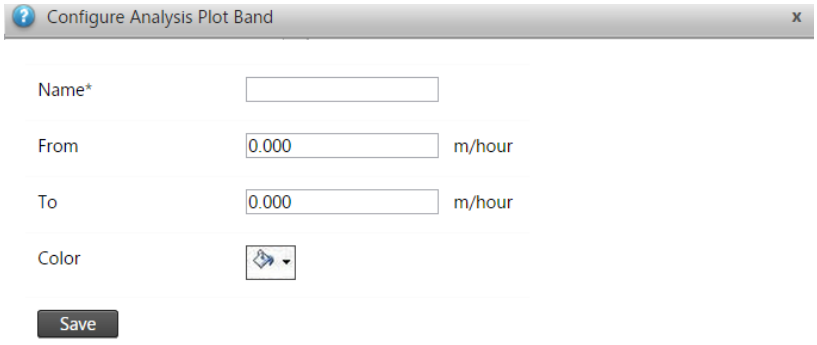
If you did not want to add a data source, you can cancel this step by closing the pop-up via the X in the top right corner.

Else, when done configuring the data series, click on the Done button to have it added to the Analysis.
The data series will now be added to the list of data series for the Analysis.



To delete a Series, simply click the trash can button on the right of it.

Step 6: Plot bands can also be added, which is useful for certain type of graphs (causing a shaded backdrop in certain 'band' areas). To add a Plot Band click the Add button below the Plot Band section.



Complete the required information:

- Name: Specify a name for the analysis plot band. This is the name that will be used.
- From and To: Specify the From and To values of the analysis plot band. This is the values from where to where the plot band will range.

- Colour: Specify a colour for the analysis plot band. This is the colour that will be used to render the plot band.

Click the Save button to store the plot band.

Step 7: Once at least one data Series was linked (added) to the analysis it can be viewed by clicking on its name or the chart icon in the list in the left hand pane of the screen. Note: the chart icon can be either a line chart icon (as below), a bar chart icon or a tabular icon depending on what type of analysis was specified.

11.4 MANIPULATING THE ANALYSIS CHART

Depending on which Analysis type is shown (Normal Chart, Comparative Bar Chart or Tabular Analysis) on the top of the Chart area you will see four buttons:

- Regression and Exclusion
- Lock/Hide Tooltips
- Adjust Date Range
- Start Live Update

These will be discussed soon in the next section.

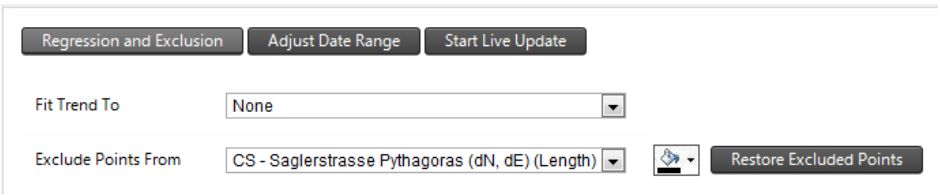
At the bottom (also dependent on the Analysis type), the following might be shown:

- Show data tooltips, Show range information, Line Width and Point Marker Size
  - Please refer to discussions in sections 9.3.9 to 9.3.11 on page 62.

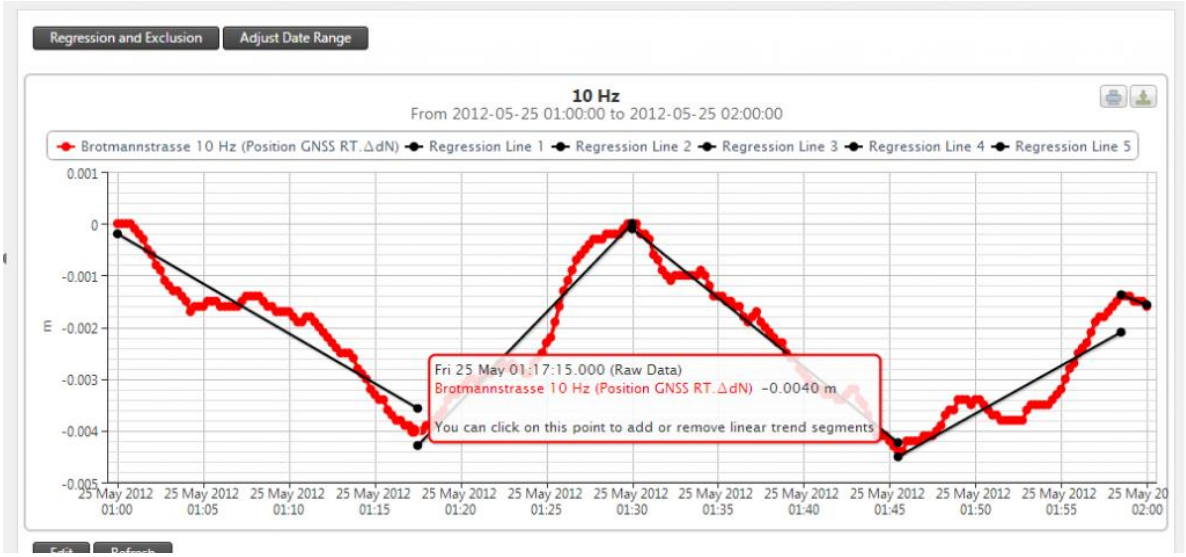
- Edit, Refresh, Export To XLSX and Export To CSV
  - Discussed in section 9.3.12 on page 62.

11.4.1 Regression and Exclusion

Clicking on this button will give you the two options illustrated in the next figure:



Fit to Trend: You can select a series here to which you want to fit a trend using linear regression.

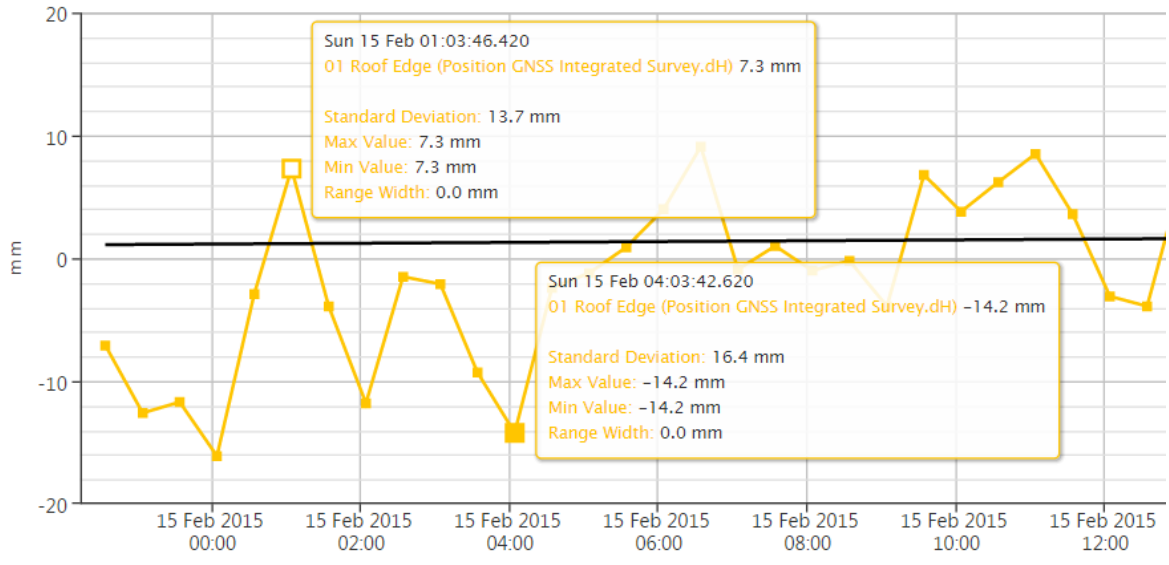


Note: In the event that some of the readings appear to be incorrect, you have the option of excluding these points from the analysis series. These points will no longer be displayed or taken into consideration when the regression line is fitted.

11.4.2 Lock/Hide Tooltips

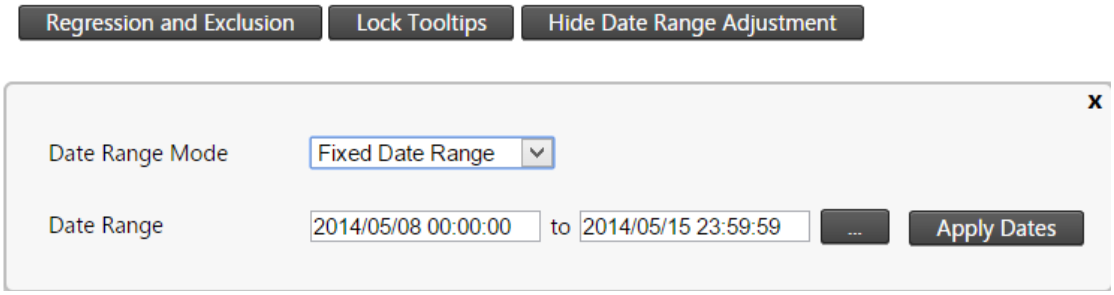
Locking tooltips is useful to make certain specific tooltips (pop-ups) stationary, e.g. for presentation purposes.

When enabled, simply click on the data point that must be shown (illustrated below). Clicking on the same data point again will minimize the tooltip again. Alternatively click on the Clear Locked Tooltips button to minimize all locked tooltips again.



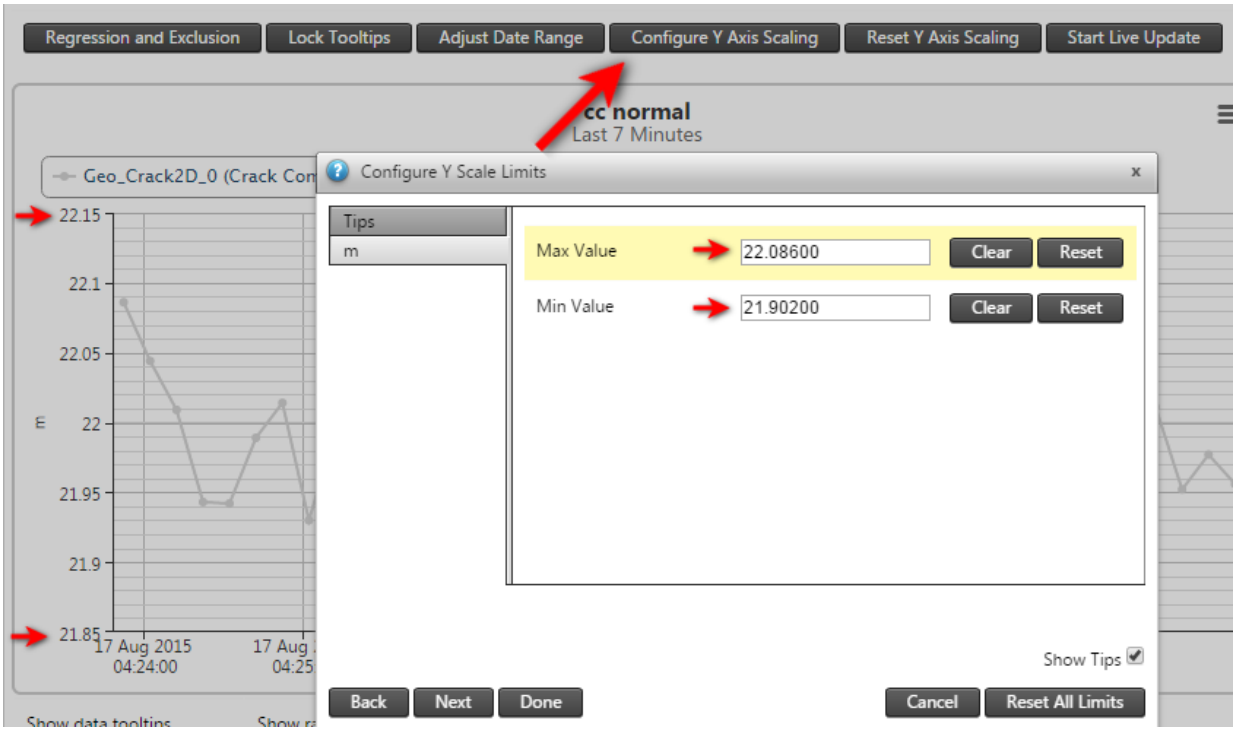
11.4.3 Adjust Date Range

This is another place to manipulate the same “Date Range Mode” that can be configured in the Analysis’ setting (discussed in section 11.3 near page 74, step 2).



11.4.4 Configure Y Axis Scale

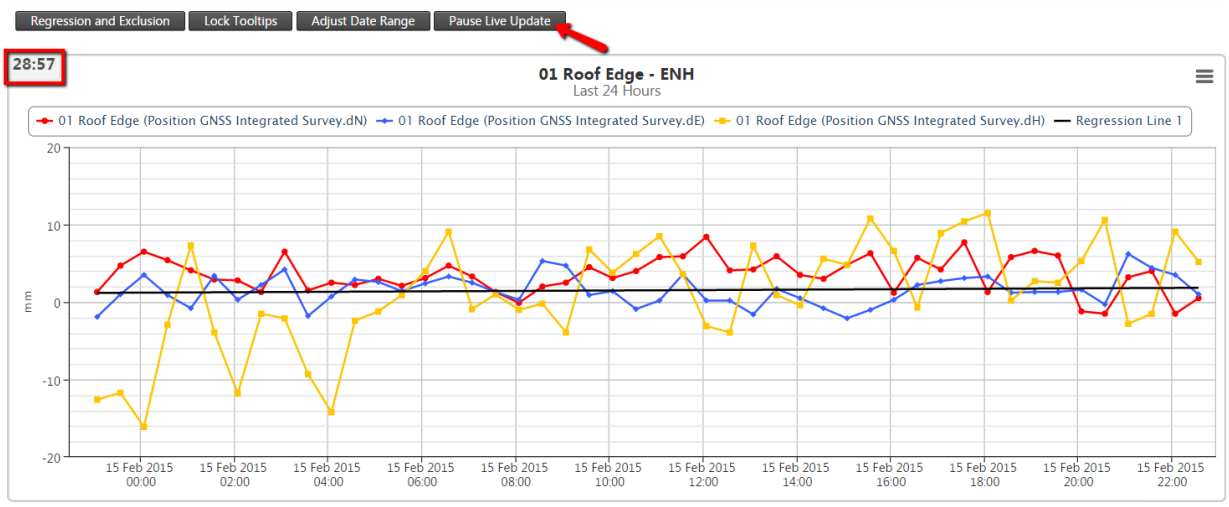
You can specify min and max values for each y axis. The axis will be scaled to ensure that these values are included.



11.4.5 Start Live Update

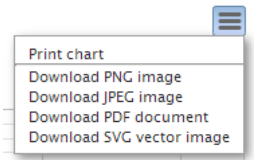
1. If your analysis is configured to use data range mode of “Rolling Window”, or if the End Date you define lies in the future, then the “Live Update” feature will be enabled on the Analysis.

2. When you click on the “Start Live Update” button, you will be presented with a timer which will indicate when the next update will take place. The countdown period will be dependent on the frequency of the data within the analysis.



11.4.6 Print an export an Analysis

Any chart can be printed or exported.



If more detail needed, kindly refer to Sections 9.2.2 and 9.2.3 on page 58 where this was discussed.

11.5 MATCHED DATA SERIES

The Matched Data Series feature on the Normal Analysis type was specifically requested by the mining industry.

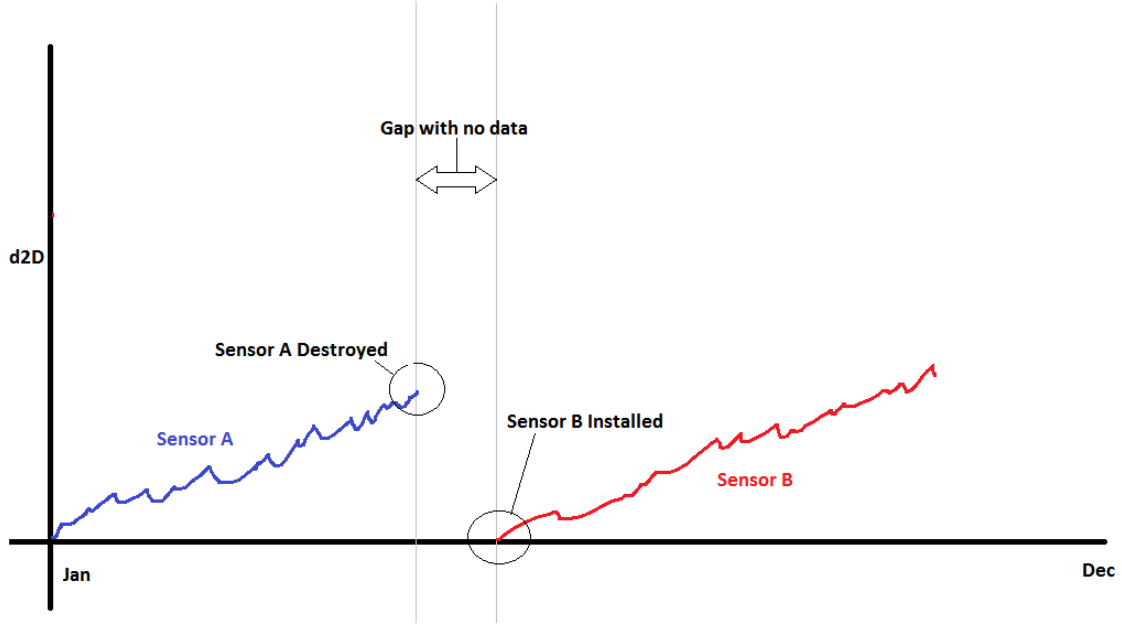
The reason for creating **matched series segments** is to fit a regression line and analyze the behaviour of a rock body over a period that is longer than the life of any particular sensor.

Of course this will only make sense of the different sensors are installed in roughly the same region. Below we explain the two typical use cases of this feature.

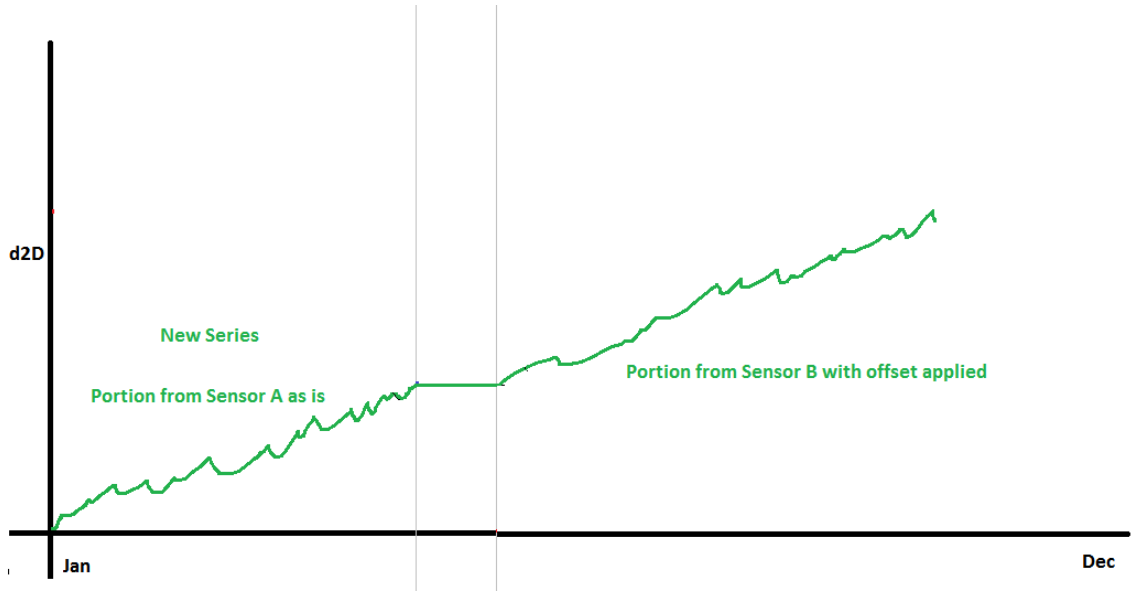
11.5.1 Typical use case 1

Sensor A and Sensor B were installed at approximately the same area, but not at the same time. The analyst wants to get an understanding of how the ground moved over the entire period, but the period in question is longer than the lifetime of either sensors.

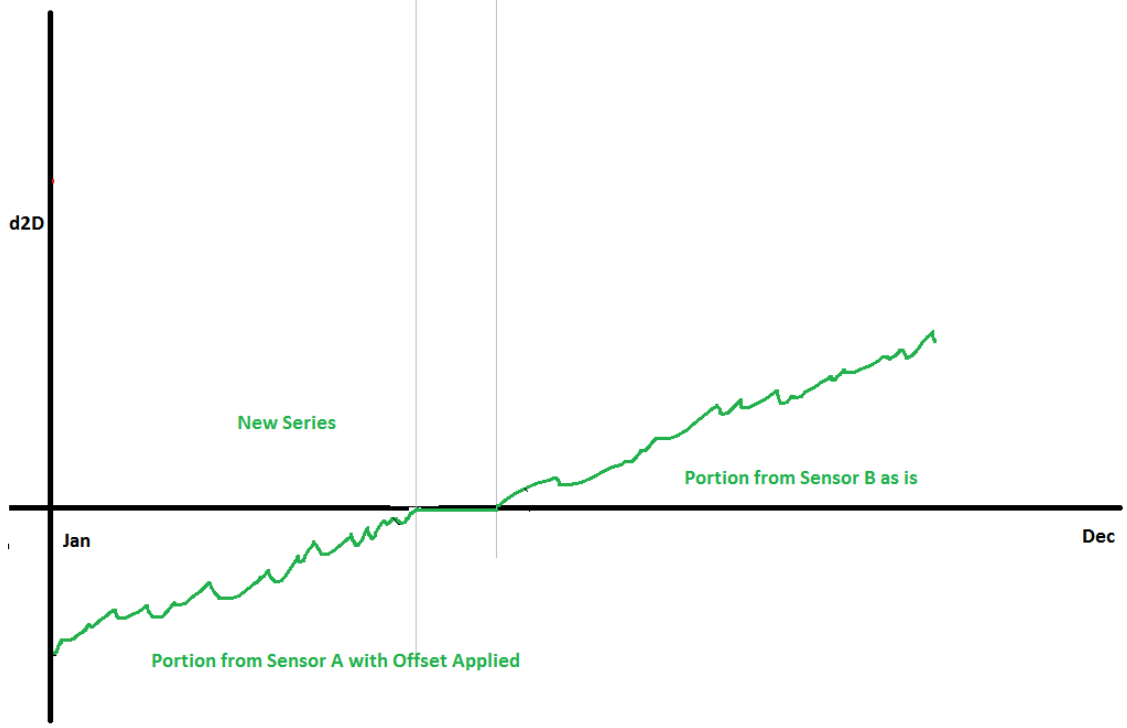
For setup reasons, Sensor A and B may have yielded displacement values that are not the same: for example it may have been that both sensors started at a displacement of zero.



The matched data series feature should enable the analyst to create a new series by joining the series of Sensor A and Sensor B together. In doing so, one of the two series will be kept fixed (not moved) and an offset will be applied to the other series (moved up or down).



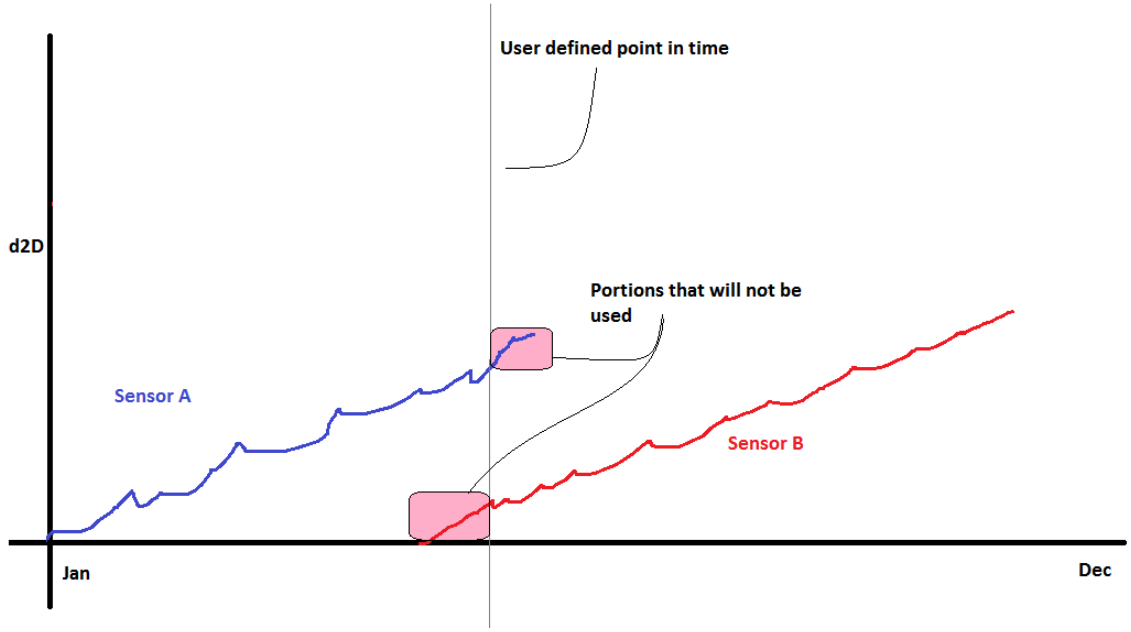
In the option above the series from Sensor A was fixed. A regression line can now be fixed to the new series.



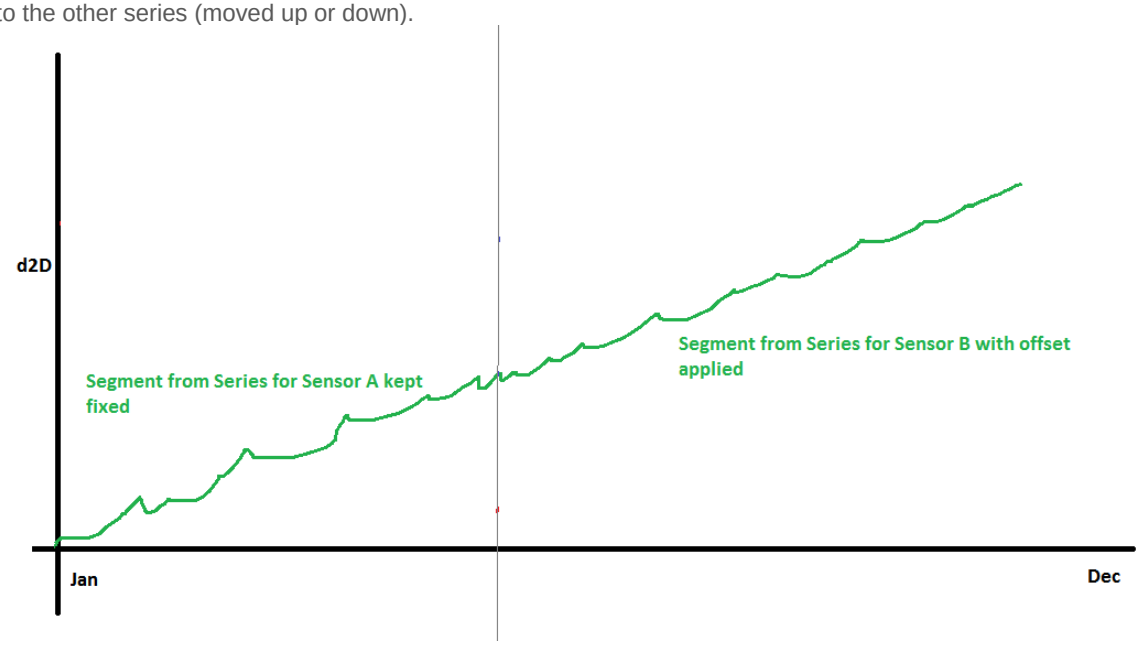
In the option above the series from Sensor B was fixed. A regression line can now be fixed to the new series.

11.5.2 Typical use case 2

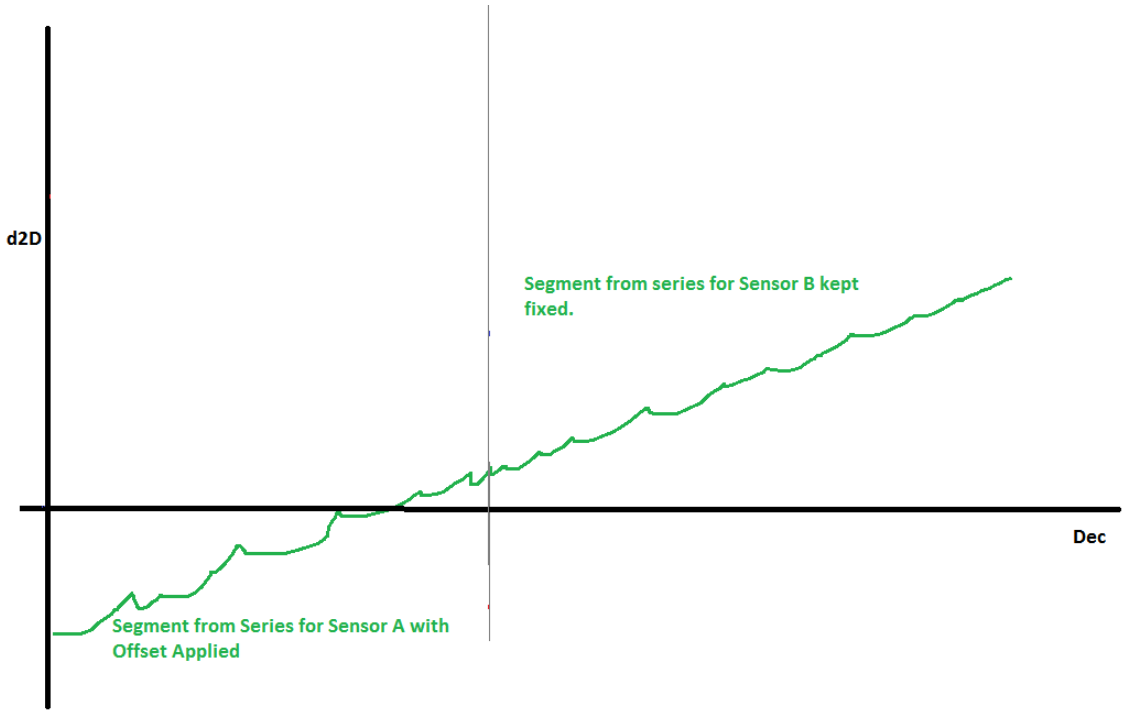
Sensor A and Sensor B are mounted on the same rock body, however Sensor A was installed before Sensor B and Sensor A may or may not have been destroyed at some point. The analyst want to merge these two series in order to fit a regression line and analyze the behaviour of the rock body. To do this, the user needs to specify the point in time that should be used for intersection purposes.



The matched data series feature should enable the analyst to create a new series by joining the series of Sensor A and Sensor B together. In doing so, one of the two series will be kept fixed (not moved) and an offset will be applied to the other series (moved up or down).



In the option above the series from Sensor A was fixed. A regression line can now be fixed to the new series.



In the option above the series from Sensor B was fixed. A regression line can now be fixed to the new series.

11.5.3 Prerequisites

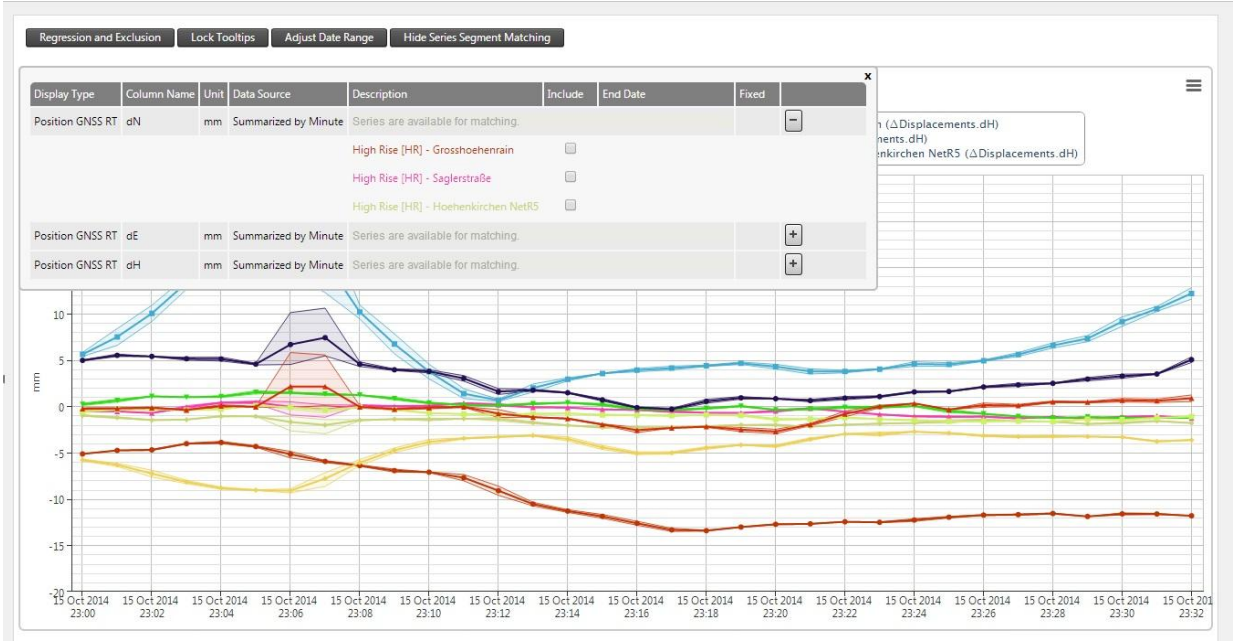
This functionality is seen as a historical analysis and is only available in **fixed date ranged mode**. Make sure your analysis is not configured to use a **rolling window** date range mode.

The functionality only becomes available if you have multiple series with the same Data Type, Value Column (or component) and Reduction. Typically you need to create an analysis with multiple Sensors of the same Sensor Type.

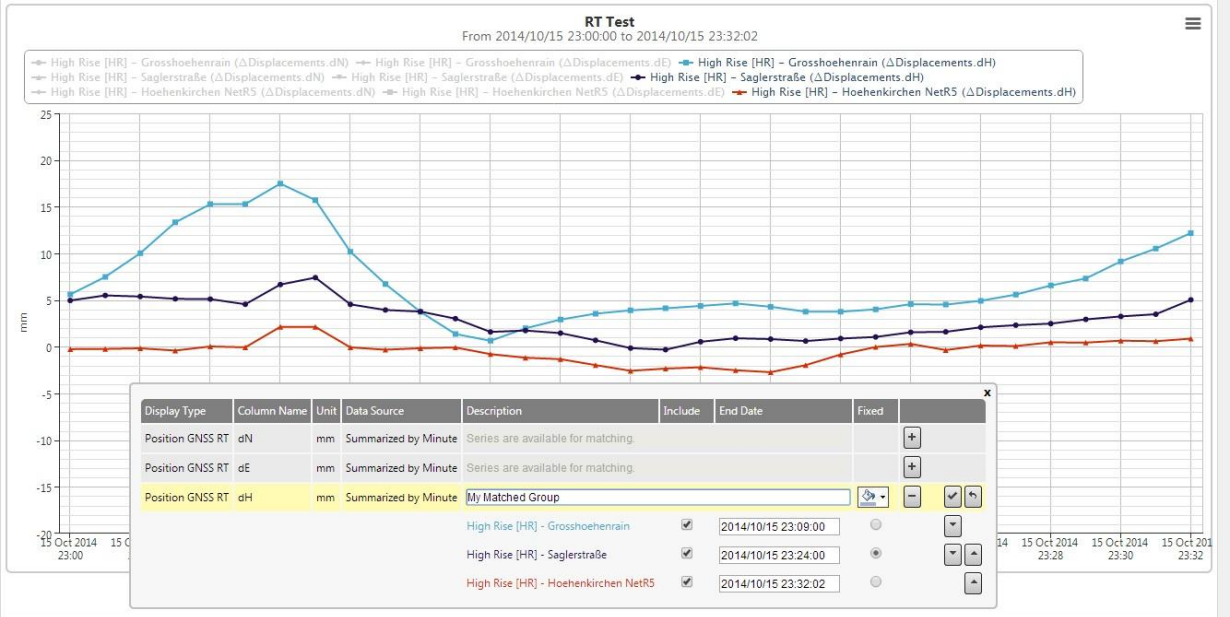
11.5.4 Example configuring of a matched data series

In this section we present an exhaustive example configuration of matching three series segments. Although in this example all three sensors have data over the entire period, the configuration can be applied in a similar fashion if some sensors only have partial data. The example configuration is more complicated that

Click on the **Show Series Segment Matching** button to expand the configuration grid.
Note that you can click and drag the expanded grid control in order to view the analysis chart area behind it.

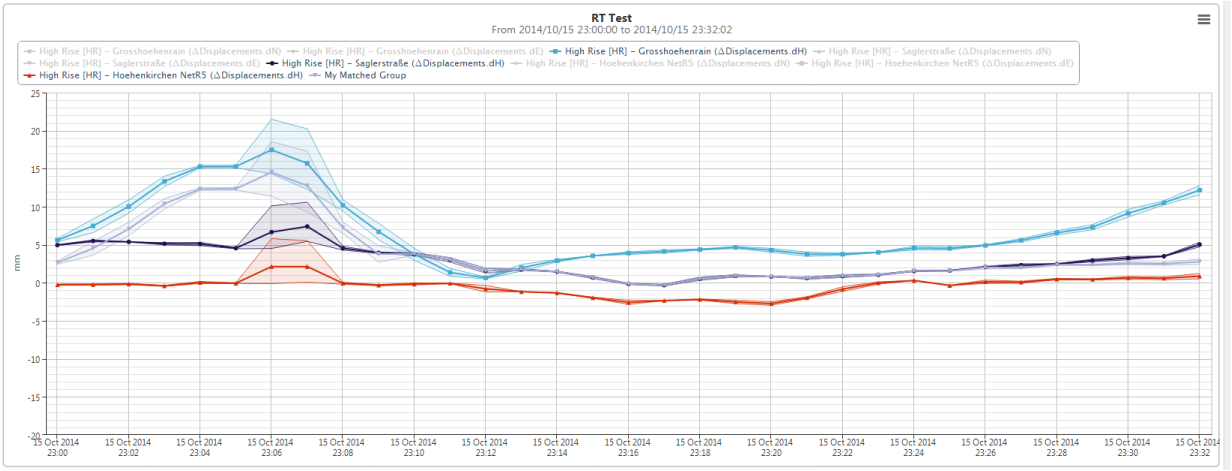


The grid will contain expandable groups. Each group contains series that could potentially be matched together. (You cannot merge dN with dE for instance).

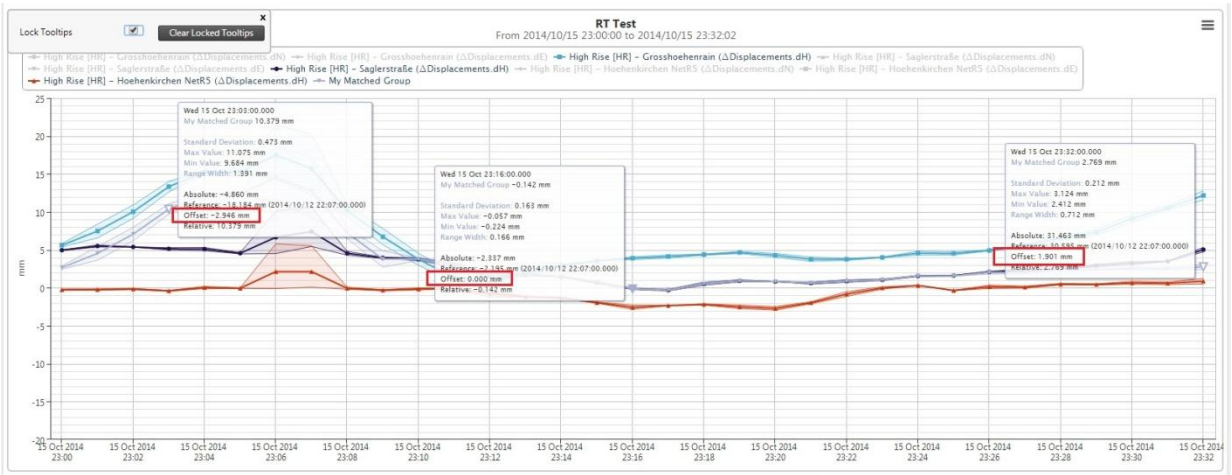


1. Expand the group you want to work with and pick two or more series. As soon as you pick the 2nd series, all other series which are not candidates to be matched will become temporarily hidden on the analysis chart area.

2. You can now specify a new name for the calculated series, or simply use the suggested name. You can also specify a colour for the new series that will be created.
3. Use the up and down arrows to indicate the order in which segments should be taken from each series. In our example above the order is the *light blue* series, *purple* series and *red* series.
4. Indicate which one of the series should be fixed (the first segment will be fixed by default).
5. For each series, indicate the end date for the segment. This is the point up to which data will be taken from that series to create a series segment. Normally this date would be the date of the last available observation in that series. You can do this by entering the date or by clicking on a particular point on the series on the chart surface. Note that the end date for the one segment also serves as the start date for the segment taken from the next series. When you are matching more than two series segments, then you need to ensure that the end dates for each segment is in the same sequence as the series themselves.
6. For the series order in this example (*light blue* series, *purple* series and *red* series), we must ensure that the end date for the *light blue* series segment is before the end dates of the other series segments. We also need to ensure that the end date for the *purple* series is before the end date of the *red* series. You will be presented with a validation error message if this is not the case.
7. You can now click on the ☑ button to save the newly created matched series group.



As seen above, the calculated series was added to the analysis.



Above we inspect the tooltips of the calculated series. You will note that an offset may be applicable. In our example the *purple* series was kept fixed and has an offset of zero. You can now fit a regression line to the calculated series, open the matched series configuration grid again to create other matched series segments (e.g. for dE or dN) or change the settings of an existing matched series.

It is important to note that if you edit the analysis and change certain aspects of either the analysis or the series (e.g. Data Type, Sensor, Reduction, Value Column etc) then the matched groups may be invalidated and deleted automatically.

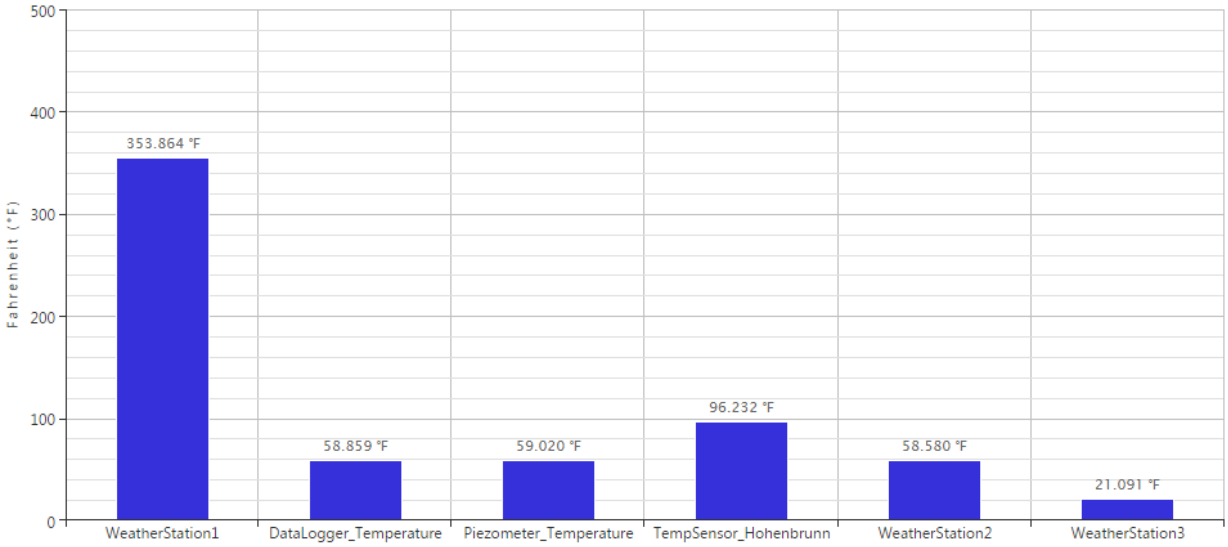
11.6 ANALYSIS TYPES

T4D Control have a variety of analysis types, some of these are designed to analyze specific sensor or data types. These specific analysis types will only become available for selection if you have a sensor in your project that satisfies the requirements for the analysis type.

Following are some examples of analysis types other than the Normal Analysis:

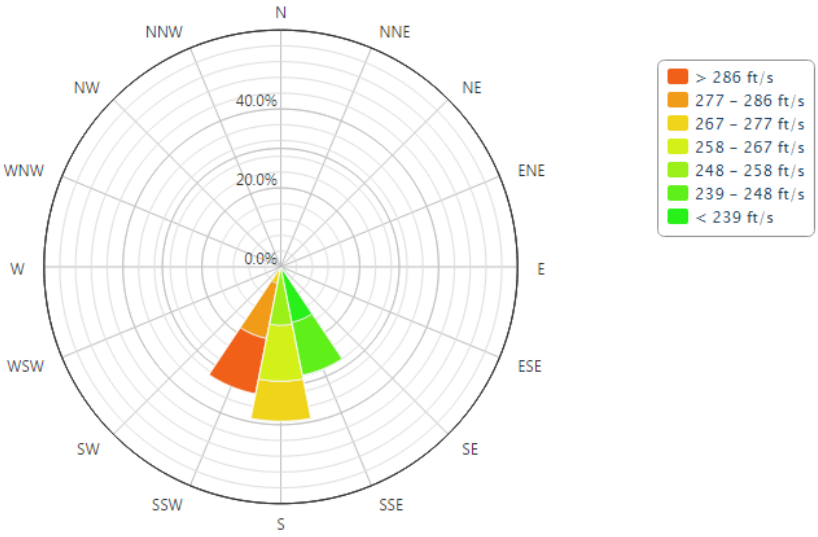
11.6.1 Comparative Bar

A Comparative Bar analysis shows a data type component from multiple sensors on a bar chart for comparison. You require sensors with a common data type component to be able to create a Comparative Bar analysis.



11.6.2 Windrose

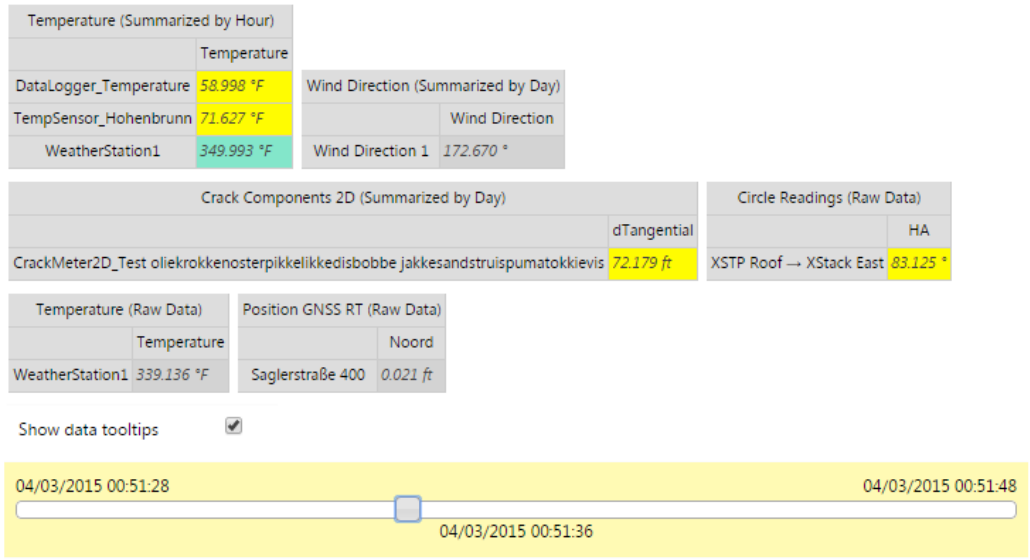
A Windrose analysis shows a diagram depicting the wind direction and wind speed over a particular period of time. This is helpful to determine the predominant wind direction and speed over particular periods. You require at least one sensor with data types **Wind Direction** and **Wind Speed** to be able to create a Windrose analysis.



11.6.3 Tabular Analysis

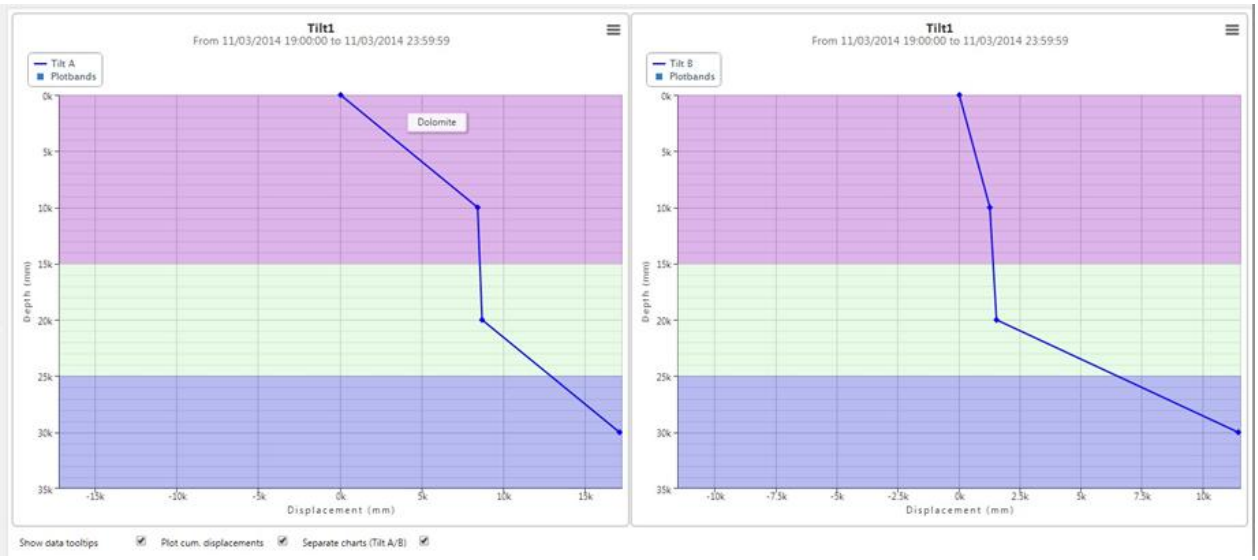
A tabular analysis groups data type components of different sensors together in tables and shows the various measurements on a single page. This is helpful to correlate observations between different sensors.

You are provided with a slider bar to scroll through the observation time period to visualize the observation changes over time.



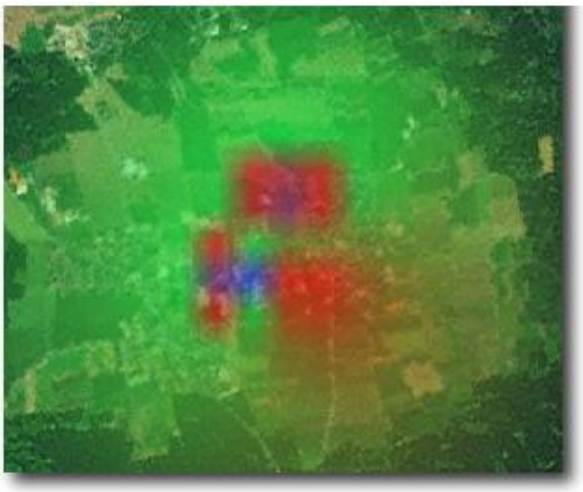
11.6.4 Tiltmeter Array

Tiltmeter array visualizes the tilt measured by an array of tilt meters. You require at least one sensor with the **Tilt** Data Type to be able to create a Windrose analysis.



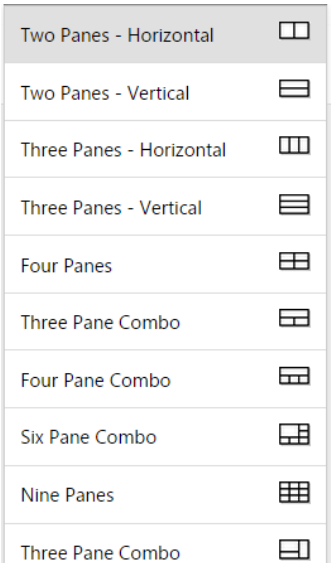
11.6.5 Heat Map Analysis

Heat Map Analysis allows you to display custom Heat Maps on the maps view using arbitrary data types. You can for instance create a Heat Map based on a length Data Type of sensors and define *Colour Stops* for interpolation purposes.



12 Composite Views

A Composite View provides multiple smaller “panes” on one page to view many of the different data visualization components previously discussed.



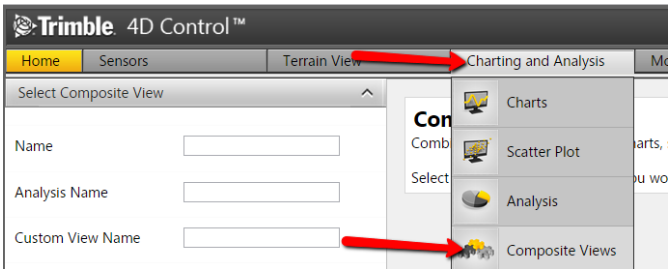
The following type of previously discussed information can be added in any of the smaller panes:

- Custom Views
- Charts
- Scatter Plots
- Web Cams
- Sensor Data Flow
- Current Alarm States
- Unacknowledged Alarm Events
- Analyses
    - Normal Chart
    - Comparative Bar Chart
    - Tabular Analysis

A Composite View is very useful in control room like environment where there are large monitors that requires multiple charts/analyses/etc. on a single monitor.

12.1 ACCESS COMPOSITE VIEWS

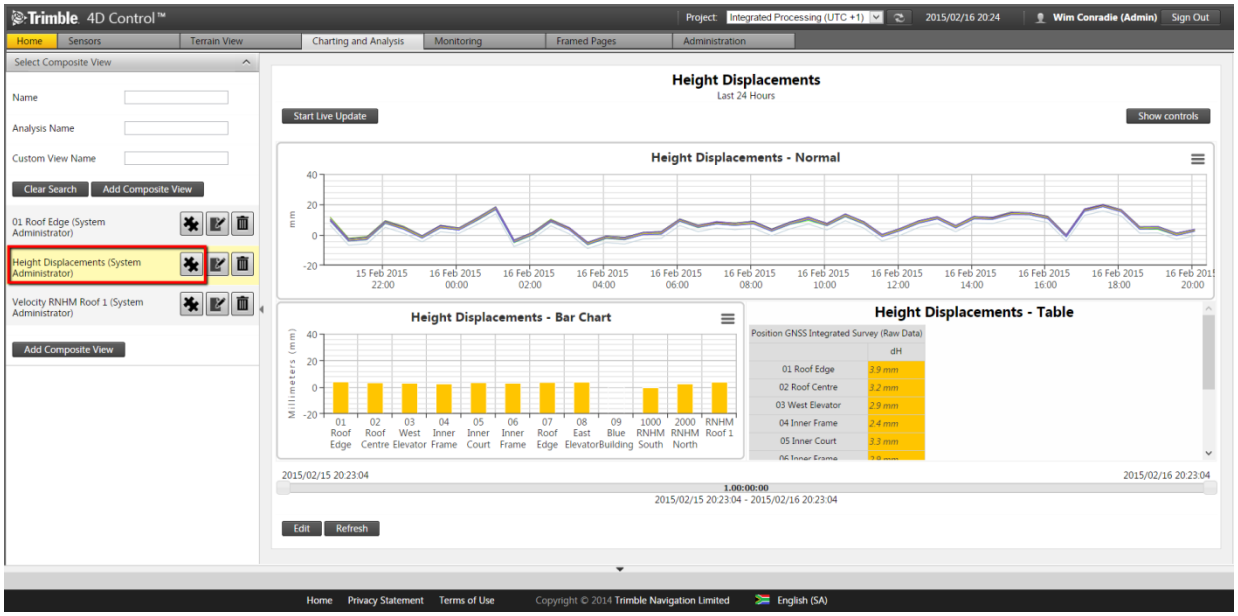
Navigate to the composite view section via the Menu or the dedicated home page shortcut icon.



12.2 VIEWING A COMPOSITE VIEW

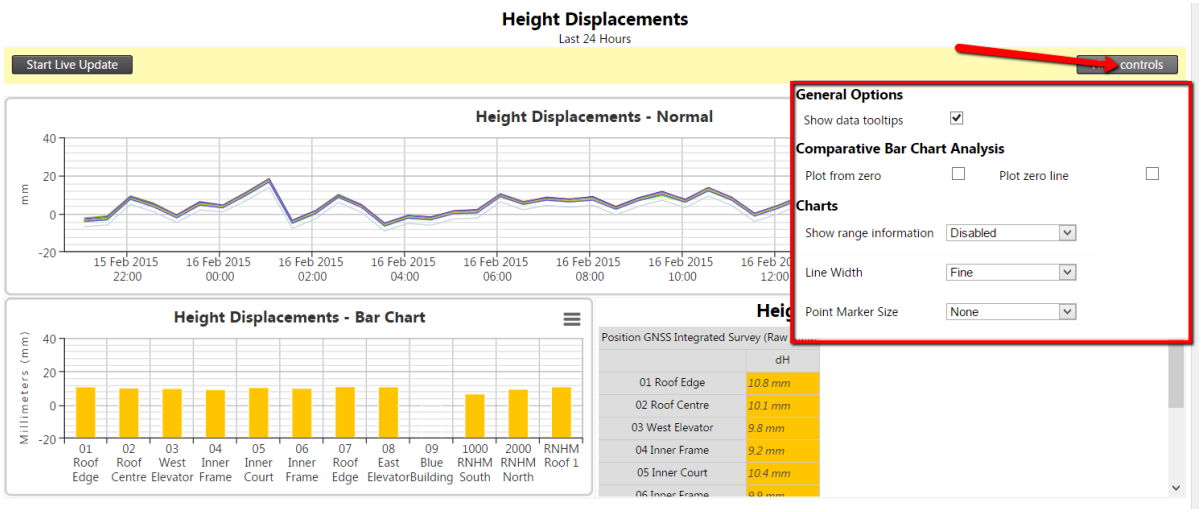
Composite views can be filtered by die options on the left hand side.

To view a composite view simply click on the composite view in any of the area illustrated below. The resulting view will be displayed on the right hand side main page.



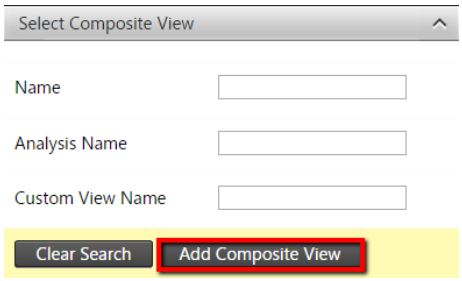
As all the viewing options for all different types of views and graphs were already explained in previous sections it will not be repeated here. If needed, for each view or graph kindly refer to previous applicable section.

It must just be added that some controls that affect multiple graphs have been moved to the top right. Simple click the Show controls button to have it expanded.

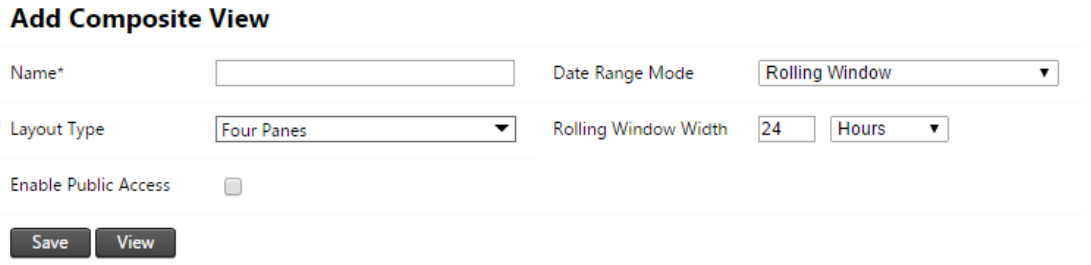


12.3 CREATING A COMPOSITE VIEW

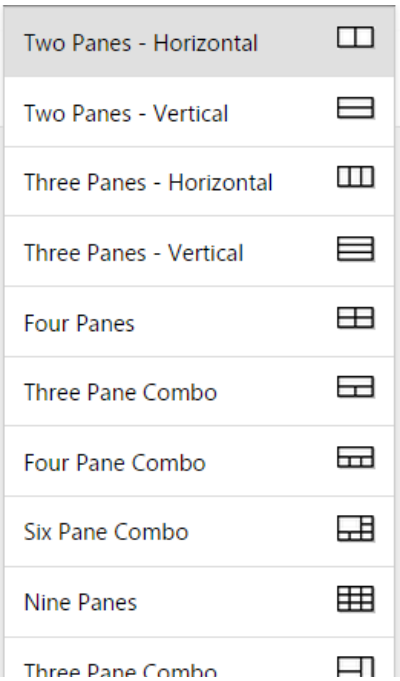
Step 1: Click on the Add Composite View button in the left hand side.



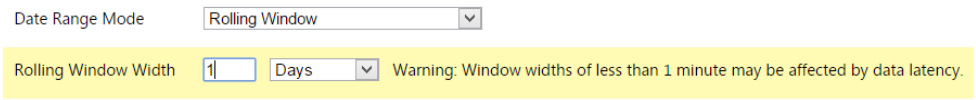
Step 2: Complete the necessary information:



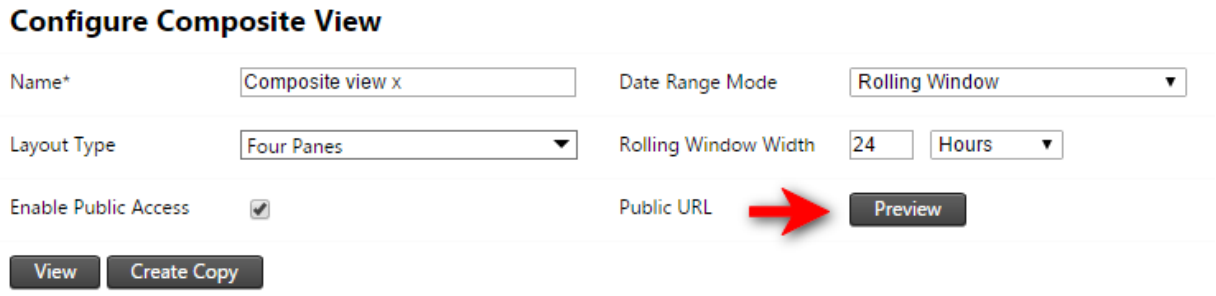
- Name: Specify a name for the composite view. Names must be unique within a monitoring project.
- Layout Type: The number of panes and layout of these panes for the composite view.



- Date Range Mode: The date range of an analysis can be determined either by specifying a start and an end date, or by specifying the rolling time window width.
    - Fixed date range: Use these date and time inputs to specify the analysis date range in terms or project local time.
    - Rolling Window: Specify the time window which will determine the analysis date range. The effective analysis date range will change on a continuous basis. Note: Window widths of less than 1 minute may be affected by data latency.

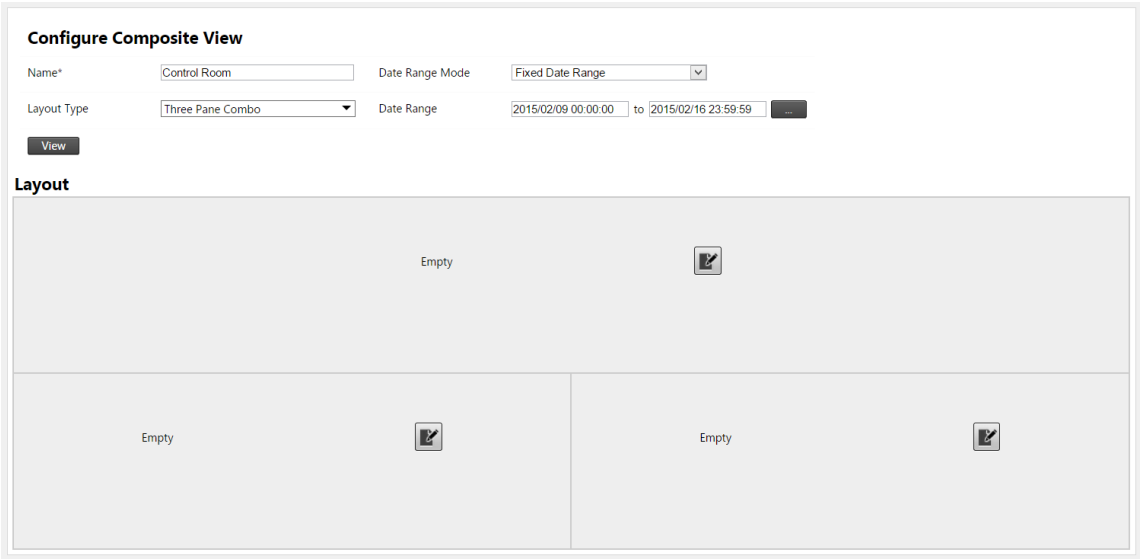


- Enable Public Access: You can select this option to make your composite view publicly accessible. This means that anyone with the particular public URL of the composite view will be able to view the composite view without having to log into Trimble 4D Control. Once saved, you can preview the public URL of your composite view by clicking on the *Preview* button. You can then copy and distribute the public URL.

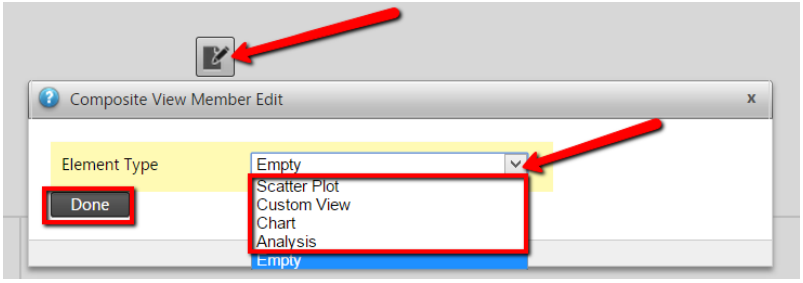


When you have configured all the setting click the Save button.

Step 3: The composite view will now be created and the chosen layout will appear below.



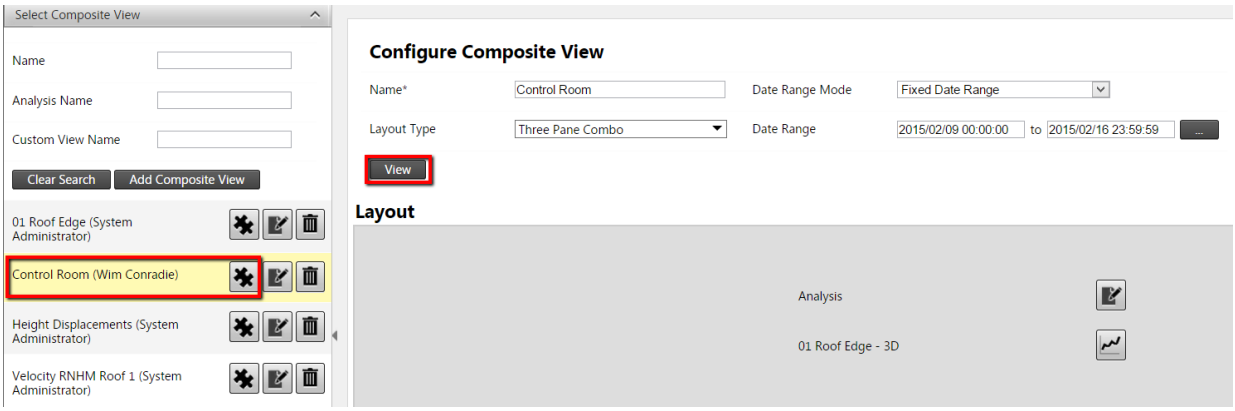
To add a view or graph to any pane, simply click the Edit icon on the specific pane and select an option from the dropdown list to display in the pane. Based on the option selected additional options will appear related to the specific view or graph. Kindly refer to the previous specific section in this manual about the view or graph for more detail about the options. Then simply click the Done button and the pane will be saved.



Step 4: Complete all the other panes in the composite view. (Note: Although of little practical use, it is not mandatory to fill all panes with information and therefore some panes can be left empty.)

Every time a pane is saved with content, a related icon to the view or graph will be displayed below the edit icon. Simply click on the icon to go directly to that individual view or graph.

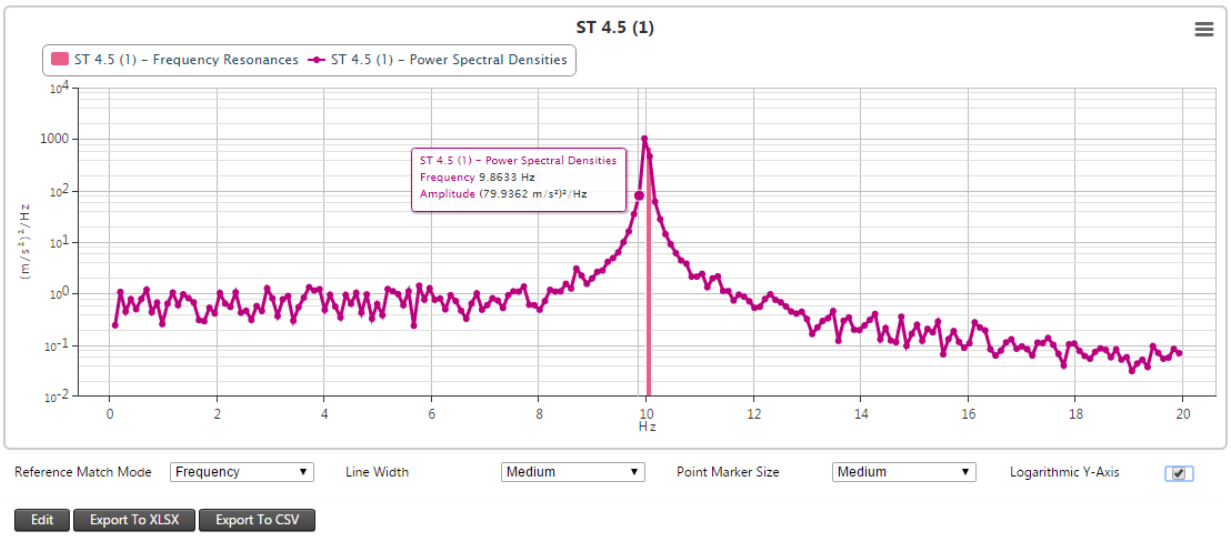
Step 5: Once all required panes are completed, simply click the View button or the composite view in the left hand side list (as shown earlier).



13 Fast Fourier Transform

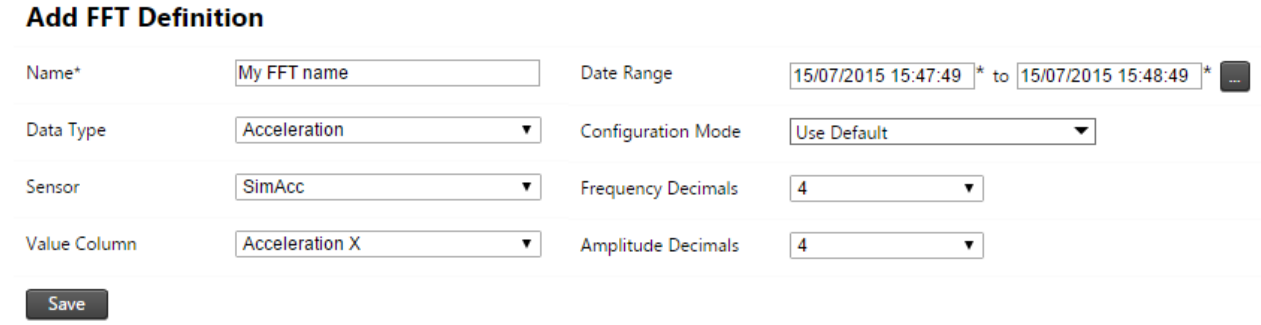
Structures are subject to vibration and has natural frequencies at which it resonates. Trimble 4D Control supports Fast Fourier Transform (FFT) calculation to transform a real time domain signal into a frequency domain representation. A modal analysis in the frequency domain allows detecting how the characteristic of a physical object changes over time and warns of impending failure. Frequency domain analysis can be calculated based on any type of input data and result in the determination of resonant frequencies.

Trimble 4D Web allows defining an FFT definition by choosing the data type and the sensor to be used as well as the data range for the calculation. In addition minimum and maximum frequencies along with the frequency resolution are configurable. The result of an FFT calculation can be viewed on a chart that shows power spectral density (PSD) against frequencies. By selecting a reference it is also possible to compare different FFT calculations.



13.1 ADD A FFT DEFINITION

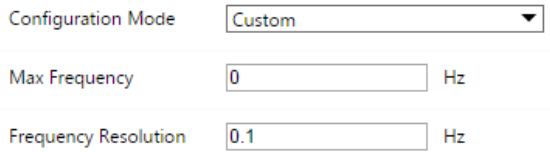
If your Trimble 4D Control installation is licensed to use the FFT feature you will be able to select the *Fast Fourier Transform* menu option from the *Charts and Analysis* menu.
Click on *Add FFT Definition* to begin configuring an FFT:



Complete the necessary information:

- Name: the name for the FFT. Names must be unique within a monitoring project.
- Data Type: the Data Type for which you wish to generate an FFT. This will determine the Sensor and Data Value Column selectable below.
- Sensor: the sensor from which an FFT will be calculated.
- Value Column: the value column of the Data Type of which an FFT will be calculated.
- Date Range: the observation date range over which the FFT will be calculated.
- Configuration Mode: select *Custom* to configure further parameters for the FFT
- Frequency Decimals: the number of decimals for the calculated frequencies
- Amplitude Decimals: the number of decimals for the calculated amplitude

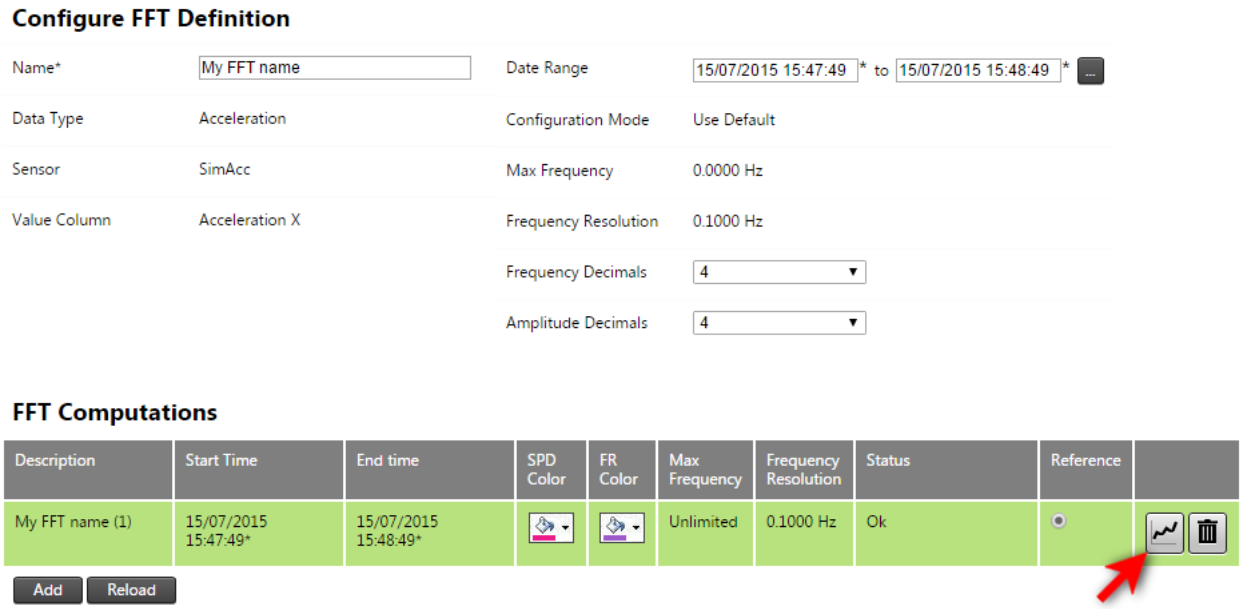
If you selected the *Custom* configuration mode you will be able to set the following additional parameters:



- Max Frequency: the maximum frequency calculated by the FFT. A value of 0 indicates no maximum.
- Frequency Resolution: the frequency resolution of the FFT. The actual frequency resolution may differ in the calculated FFT, depending on the data in the selected date range.

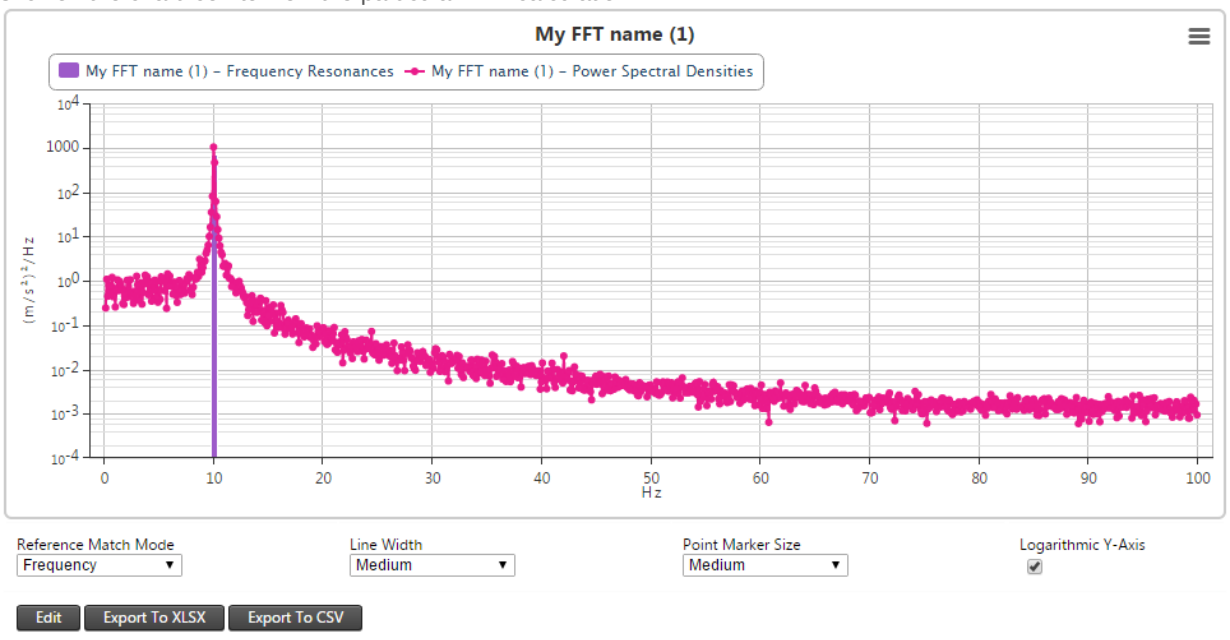
Click Save to create the FFT definition and start and FFT calculation for it.

The FFT definition page shows all the configured parameters for the FFT definition.



At the bottom you will see a list of FFT computations for the particular FFT definition. The calculation of an FFT may take a few seconds before it becomes available for viewing. The progress of an FFT calculation will be visible in the *Status* column. The calculation may appear with a gray background in the list of FFT calculations until it is ready to be viewed.

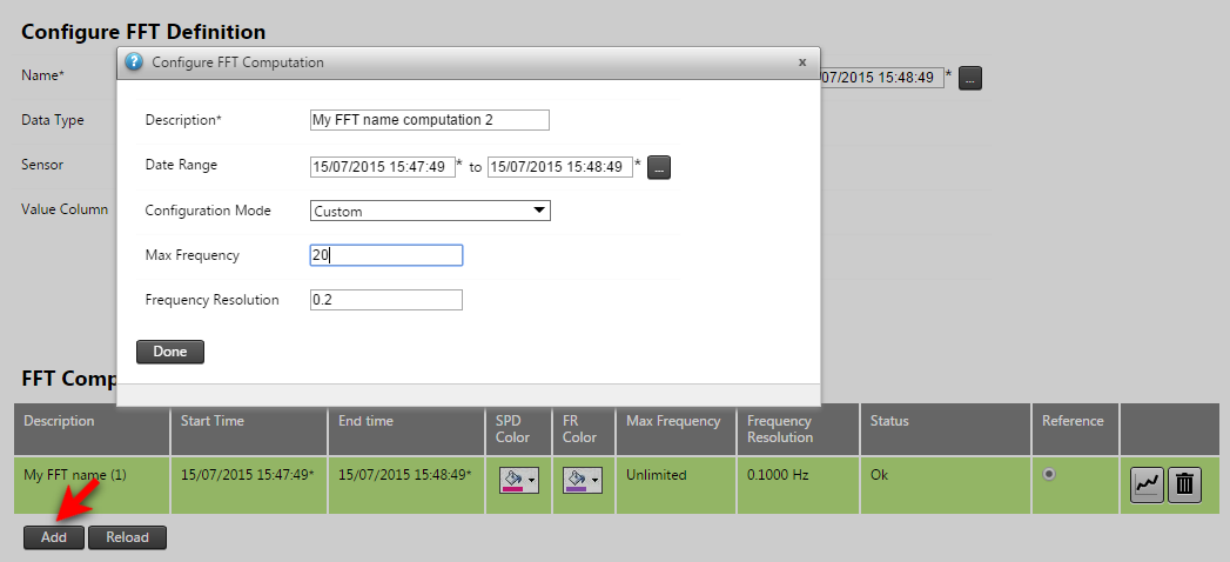
Click on the chart icon to view the particular FFT calculation.



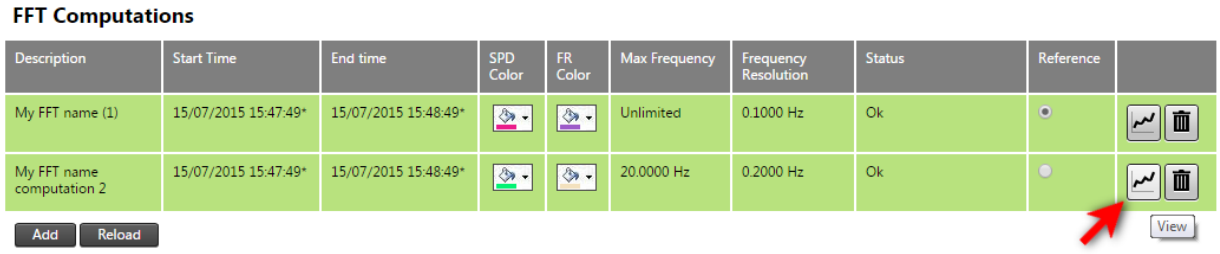
A chart of the FFT calculation will be displayed. There are a few viewing options for the FFT chart.

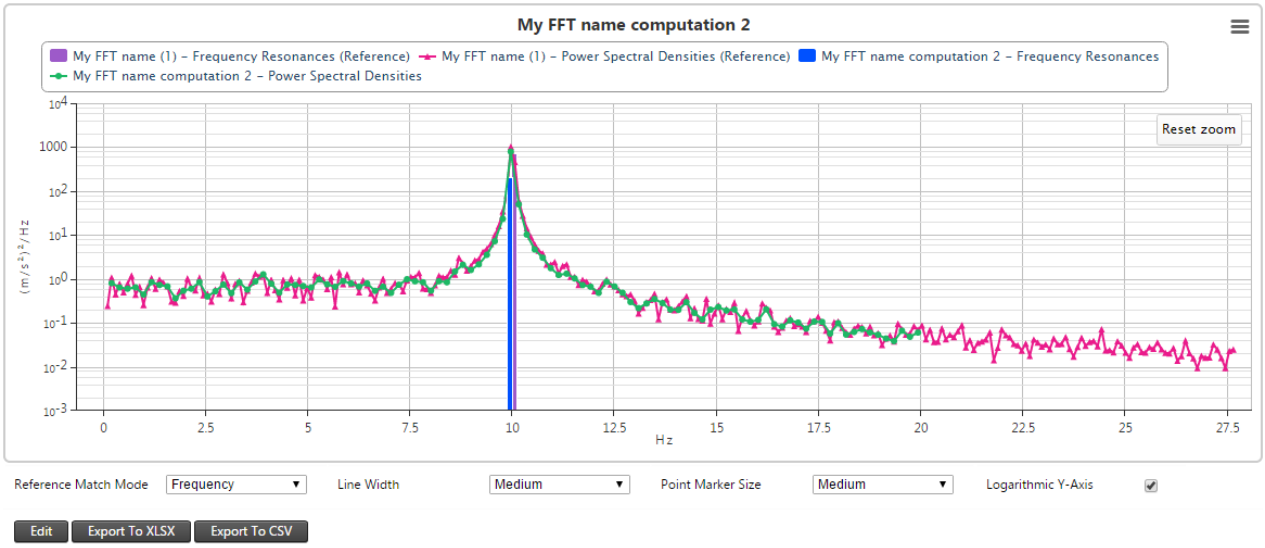
- Reference Match Mode: this will be explained later in the section.
- Line Width and Point Marker Size: these determine the line and point style used in the chart.
- Logarithmic Y-Axis: switch between a linear and logarithmic scale for the Y-Axis.

You can add more calculations to an FFT definition. The parameters on the FFT definition will be presented as defaults for the new FFT computation. You can alter these parameters and click *Done* to start the FFT computation.



After the second FFT computation is completed, you can select a FFT computation as a reference computation by clicking on the Reference column of the particular FFT computation. The reference FFT computation will then always be charted together with any other FFT computations of the FFT definition you are viewing.





Notice above the reference FFT computation is charted together with the FFT computation.

14 Alarms

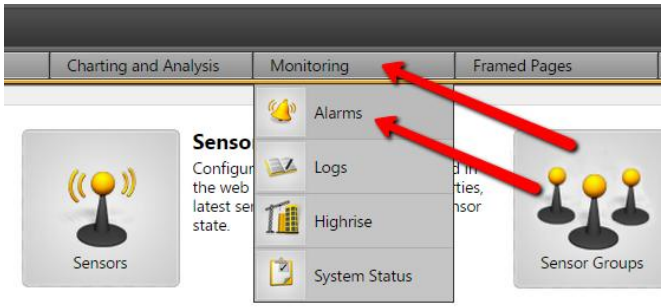
This section shows how to setup Alarms.

Alarm conditions are created against any data series that is monitored in the project.

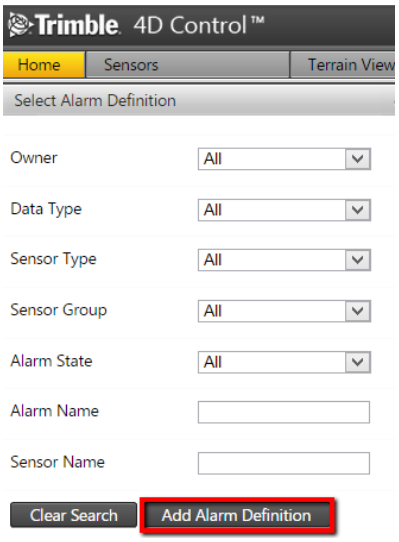
Notifications are being issued in the event that a warning or alarm conditions is met. Notifications can be escalated according to preset rules.

14.1 ACCESS ALARMS

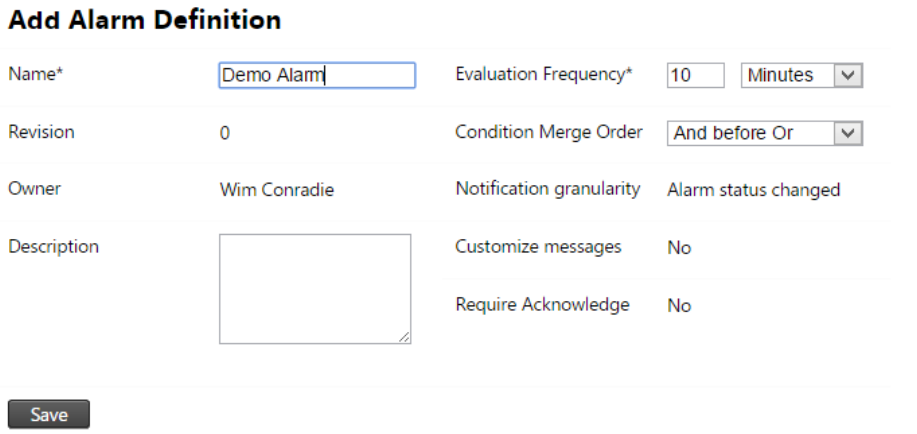
Navigate to the alarms section via the Menu or the dedicated home page shortcut icon.



14.2 ADDING A NEW ALARM



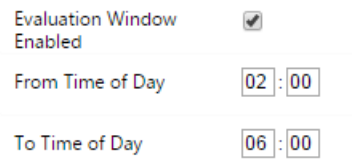
To add a new alarm, click on the Add Alarm Definition button and complete the “Add Alarm” form that appears on the right-hand side:



Below is a short elaboration of the fields shown in the form above:

- Name: The preferred name of the new alarm. This value serves as a logical identifier for the alarm definitions and must be unique within a monitoring project.

- Evaluation Frequency: The rate at which the alarm checks whether or not the conditions for the alarm are satisfied.

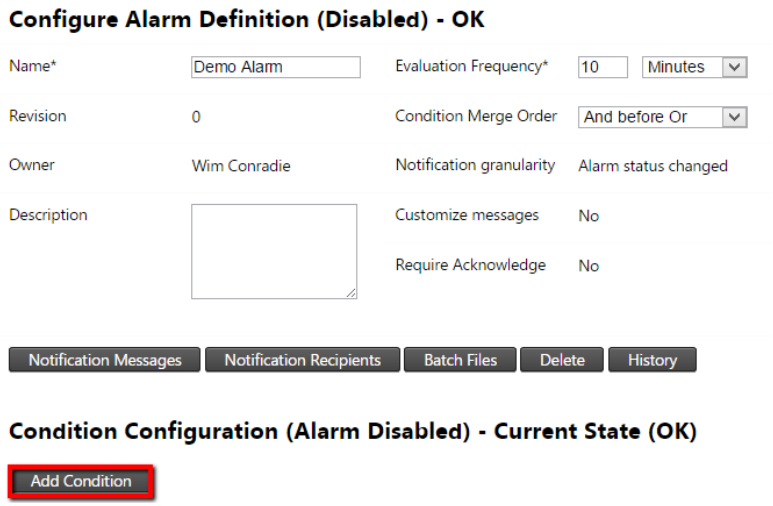


- Evaluation Windows: Enable an evaluation time window if you want your alarm to only evaluate observations in a particular time interval per day. If the *To Time of Day* is less than the *From Time of Day* then the interval wraps around midnight starting at the *To Time of Day* and ending on the *From Time of Day* of the next day. Only observations inside this daily interval will be evaluated by the alarm, any observations outside this time interval will be ignored by the alarm.

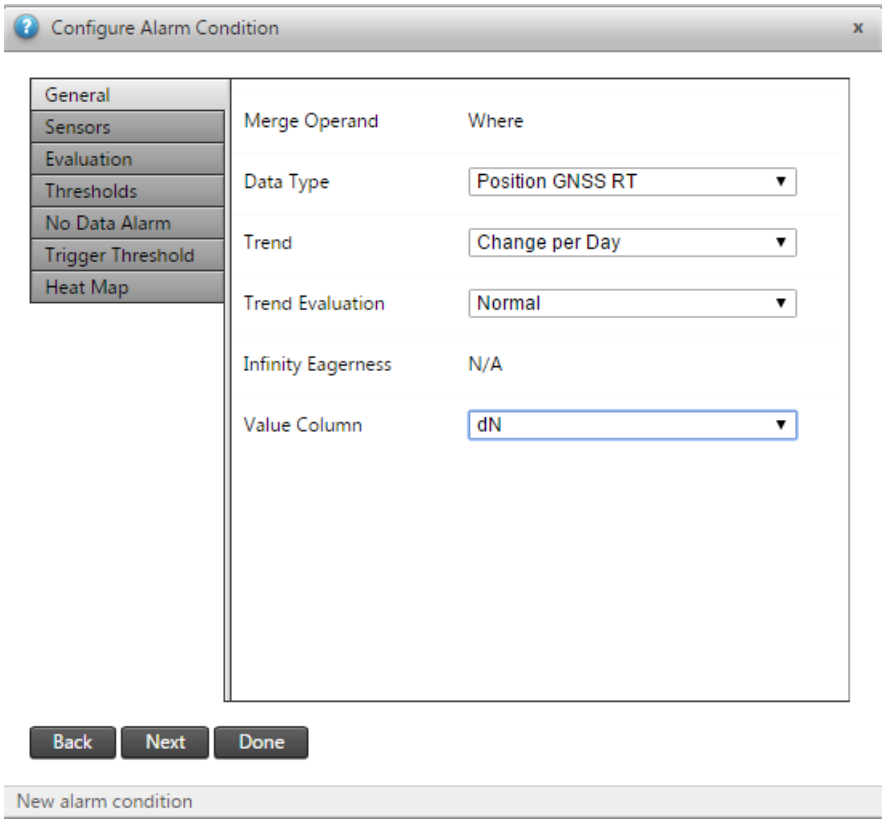
- Condition Merge Order: This option will determine how the statuses of individual alarm conditions belonging to this alarm definition are rolled up in order to determine a state for the alarm definition.

- Description: This field may contain descriptive information on the selected alarm definition.

Click on the Save button and the basic alarm will be created. As no conditions for the alarm exist yet, click on the Add Condition button.



14.3 ADDING CONDITIONS



Step 1: When creating or editing an alarm condition a pop-up will appear.

Complete the necessary fields as required.

- Merge Operand: The merge operand controls how condition evaluation results will be rolled up to determine an alarm evaluation result. For the first condition it is not applicable but any additional conditions can be concatenated via the logical Boolean operators “AND” or “OR”.

- Data Type: The data type. For Positional Data Types, trending options will be available.

- Trend: Specify whether you want to monitor actual data or trended data.

- Trend Evaluation: When creating a Trend Alarm Condition, the trend can be evaluated as either “Normal” (distance per time unit) or “Inverter” (time per distance unit).

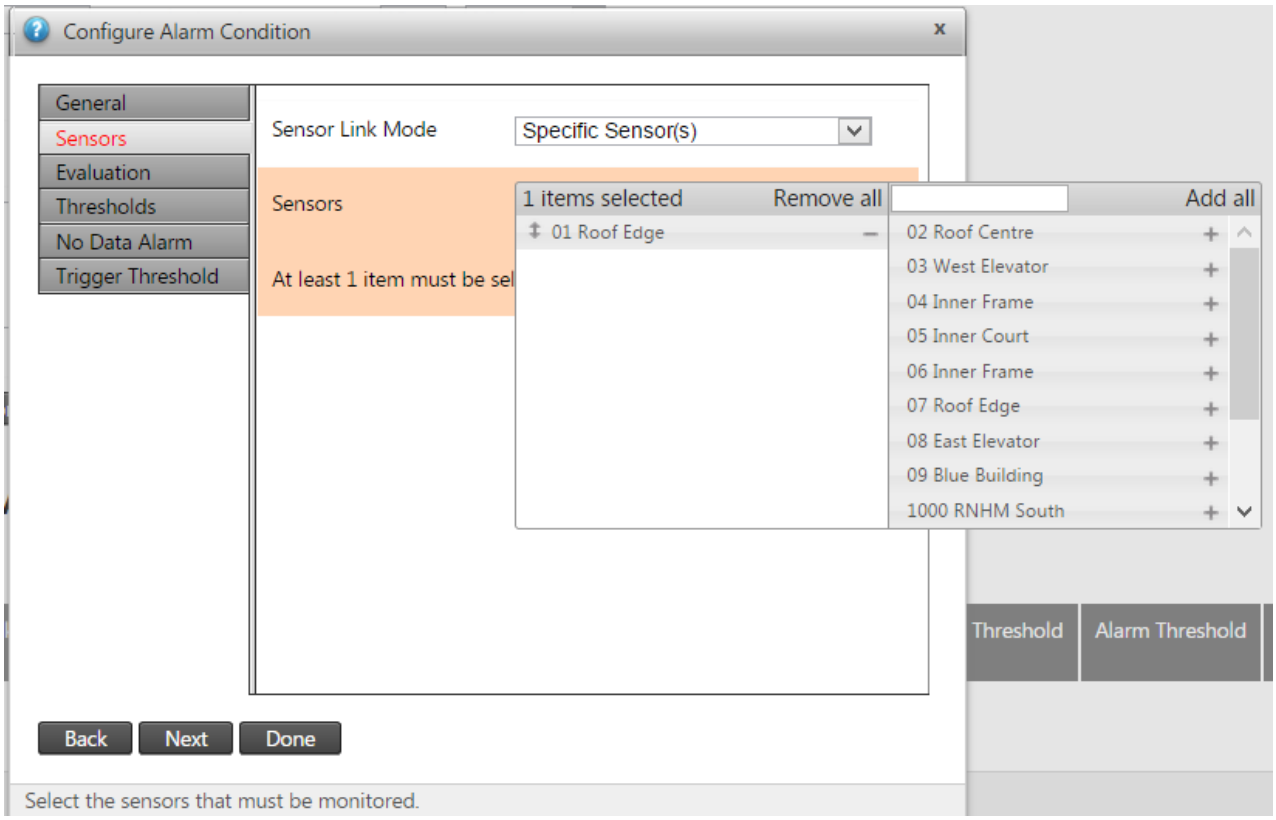
- Infinity Eagerness: When dealing with Inverted Trend Alarm Conditions, the user have to specify how soon infinity will be assumed when a very small value is inverted.

- Value Column: Select the value columns that should be monitored.

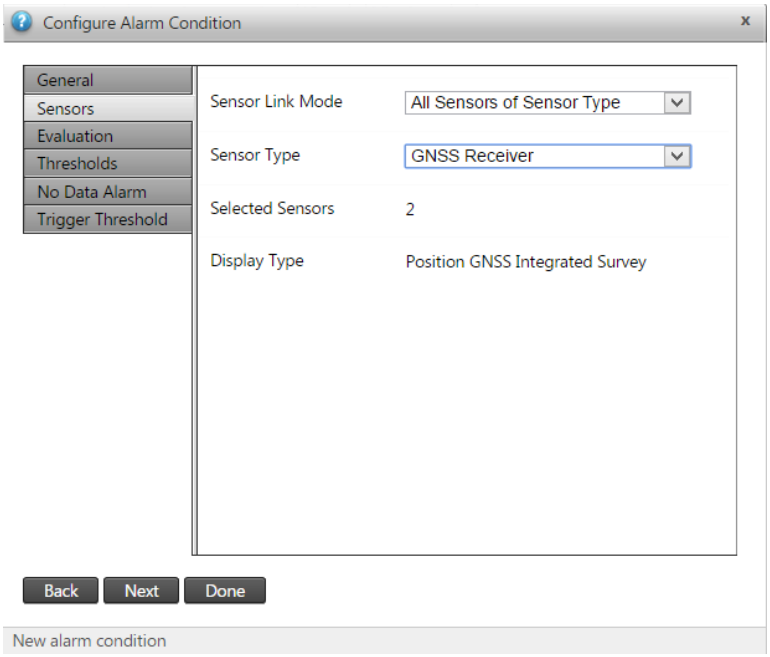
Step 2: Click the Next button to go the next screen and complete as required:

- Sensor Link Mode: The alarm condition can be configured to monitor specific sensor(s), all sensors of a specific sensor type, or a predefined sensor group (as discussed in section 4, page 22).

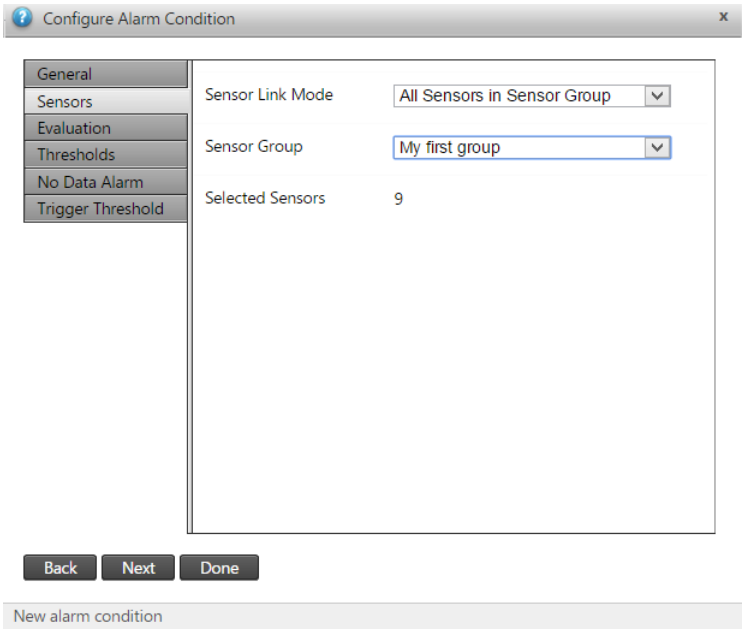
    - For specific sensor(s): Simply choose/drag the sensor(s) that needs to be evaluated.



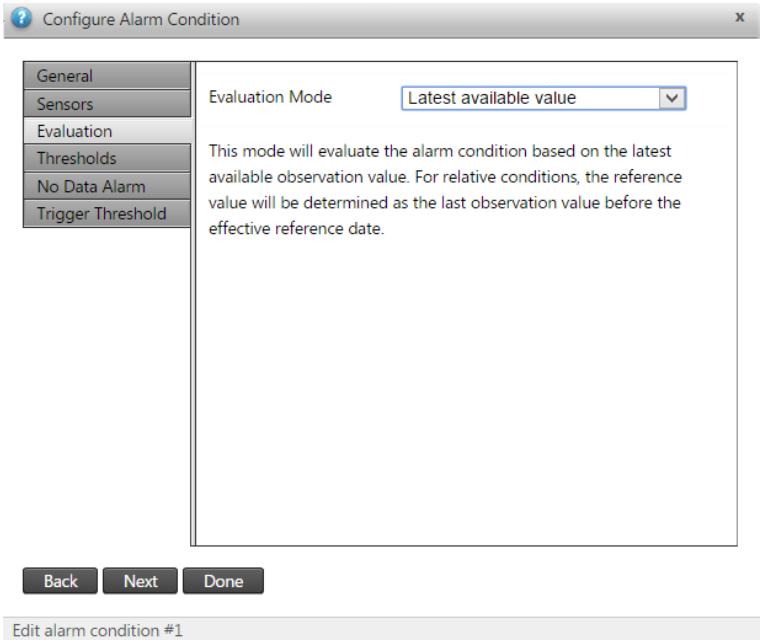
- For specific sensor types: Simply choose the type of sensors that needs to be evaluated.



- For specific sensor groups: Simply choose the predefined sensor group.



Step 3: Click the Next button to go the next screen and complete as required:



- Evaluation mode: This mode will evaluate the alarm condition based on the latest available observation value. For relative conditions, the reference value will be determined as the last observation value before the effective reference date. Else there are 4 other options that use a number of readings) to evaluate a better reading. There are:

    - Average of X latest values: This mode will evaluate the alarm condition based on the average value of the last X number of observations. For relative conditions, the reference value will be determined as the average of the last X observation values before the effective reference date.

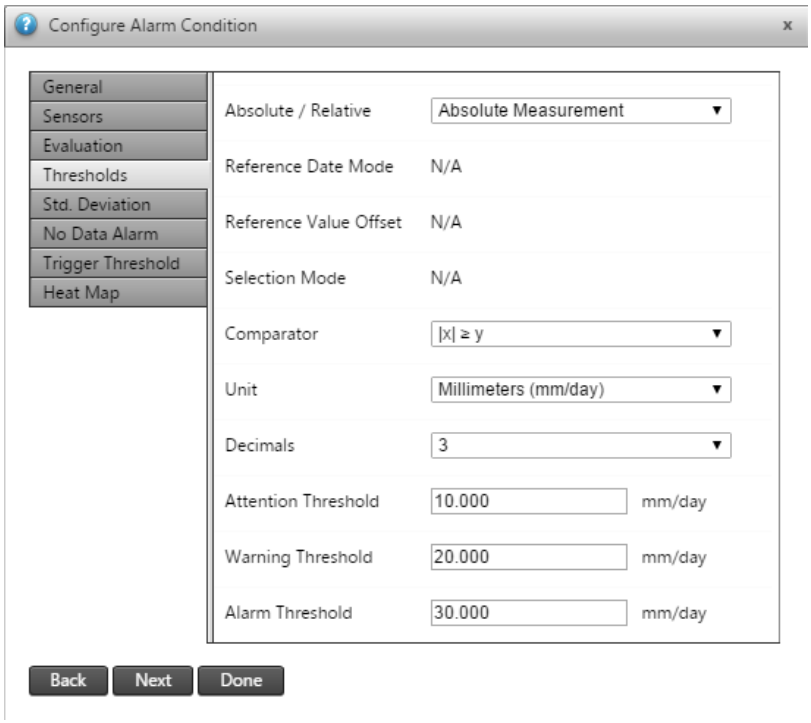
    - Peak (any): This mode will evaluate the alarm condition based on the most severe peak value (high or low) that occurred since the previous evaluation. For relative conditions, the reference value will be determined as the average of the last X observation values before the effective reference date.

    - Peak (local maximum): This mode will evaluate the alarm condition based on the highest value that occurred since the previous evaluation. For relative conditions, the reference value will be determined as the average of the last X observation values before the effective reference date.

    - Peak (local minimum): This mode will evaluate the alarm condition based on the lowest value that occurred since the previous evaluation. For relative conditions, the reference value will be determined as the average of the last X observation values before the effective reference date.

      For all of these last 4 options for relative conditions, the reference value will be determined as the average of the last X observation values before the effective reference date.

Step 4: Click the Next button to go the next screen and complete as required:



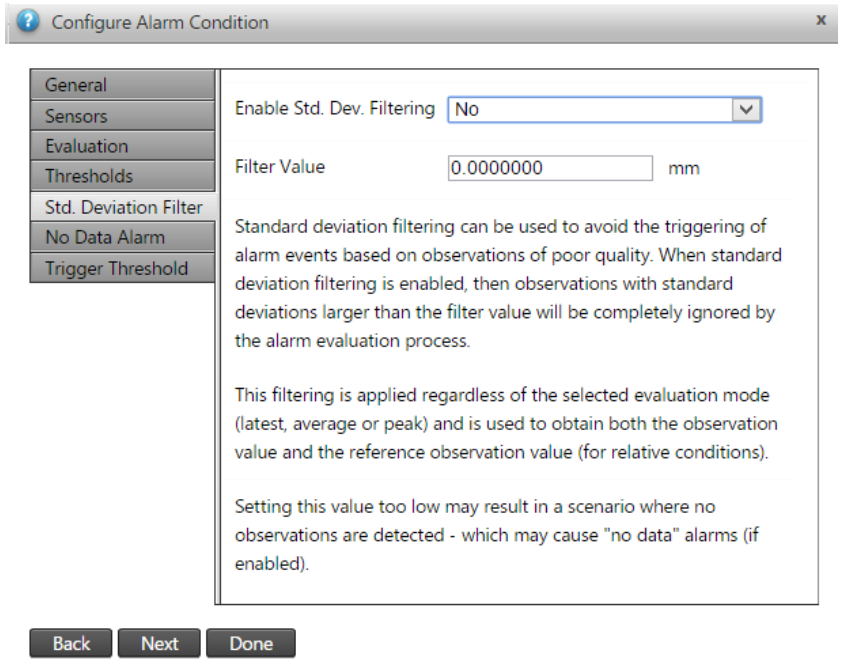
- Absolute / Relative: Indicate whether you want a monitor an absolute measurement or the change in measurement over time.
- Reference Date Mode: This option is enabled if a Relative measurement method was chosen. In that case simply specify the mode by which the reference date should be determined. This date will be used to obtain the reference measurement used to evaluate relative alarm conditions.
- Reference Value Offset or Date:
    - If at the previous option Rolling Offset was chosen this value specify the amount of seconds, minutes, hours or days to get a time window to determine an average reference measurement.
    - If at the previous option Specific Date was chosen this value specify the specific date that should be used to get a reference measurement.
- Selection Mode: This option is enabled if a Relative measurement method was chosen. You can configure how the reference value is selected. Typically this setting determines a preference for closest values before or after the Reference Date.
- Comparator: Specify the comparator that should be used to evaluate the alarm condition. X would be the measurement that might trigger the alarm and Y would be the threshold or specific value with which X is being compared.
- Unit: The alarm condition will be evaluated in terms of this unit.

- Decimals: Specify the number of decimals by which measurements should be rounded before the thresholds are evaluated.

- Thresholds: These specify the three states that the condition can trigger, starting at Attention, then Warning and finally Alarm. Obviously the threshold values must be set to reflect this logic (e.g. not trigger an Alarm when an Attention or Warning will not also triggered).

Click the Next button to go the next screen.

Step 5: When no Trend is enabled (Step 1 under the General tab) the Standard deviation filtering tab will be available.



Standard deviation filtering can be used to avoid the triggering of alarm events based on observations of poor quality. When standard deviation filtering is enabled, then observations with standard deviations larger than the filter value will be completely ignored by the alarm evaluation process.

This filtering is applied regardless of the selected evaluation mode (latest, average or peak) and is used to obtain both the observation value and the reference observation value (for relative conditions).

Setting this value too low may result in a scenario where no observations are detected - which may cause "no data" alarms if enabled (discussed in next Step 6).

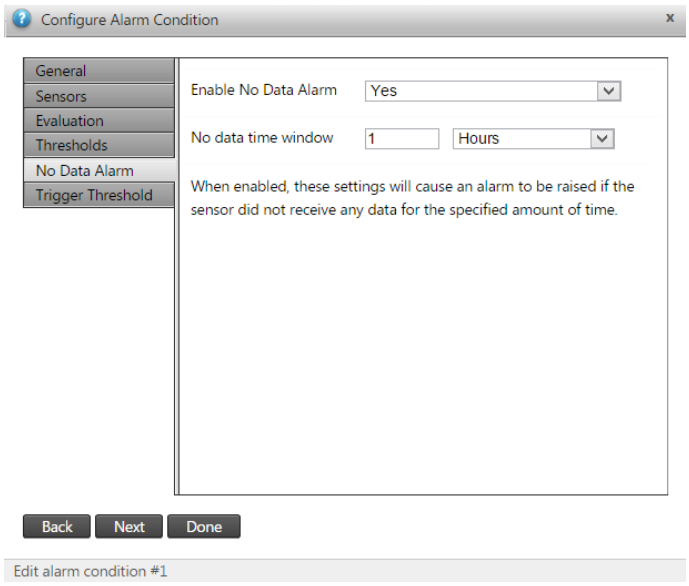
Complete the necessary fields as required:

- Enable Std. Dev. Filtering: Specify whether standard deviation filtering should be enabled on this alarm condition.

- Filter Value: When standard deviation filtering is enabled this value serves as a "cut-off' filter. Observations with standard deviations larger than this value will be completely invisible to the alarm evaluation process.

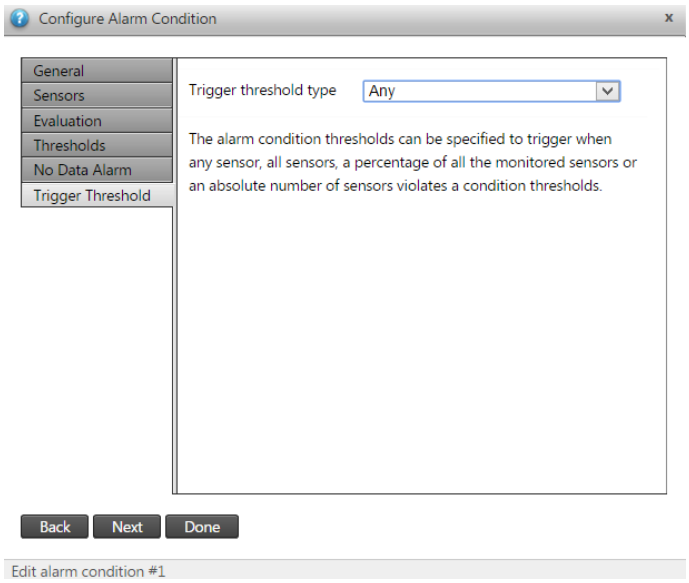
Click the Next button to go the next screen.

Step 6: The no alarm when enabled, will cause an alarm to be raised if the sensor did not receive any data for the specified period of time. This useful to make sure the sensors is working. Complete the fields as required:

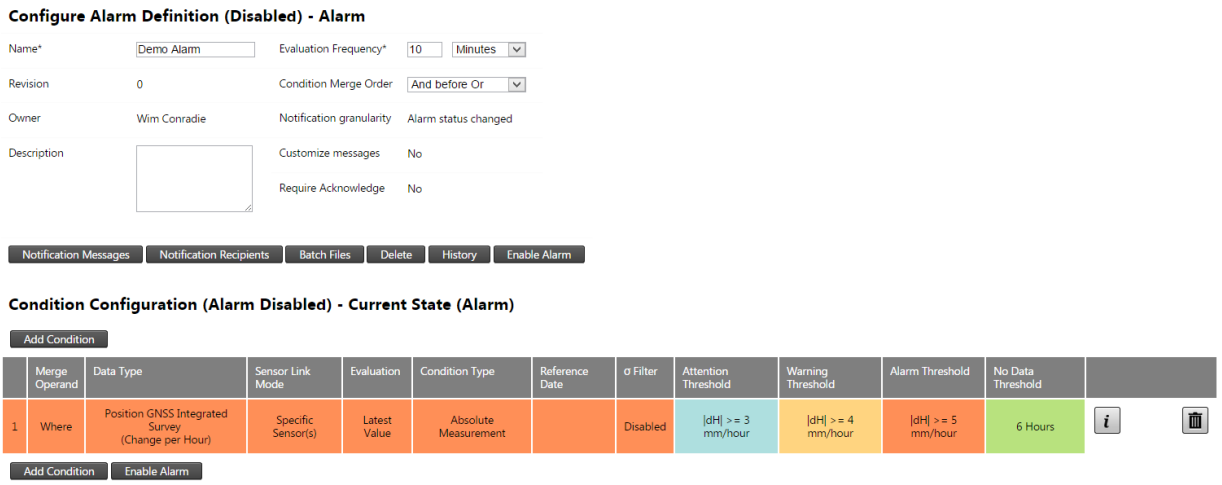


- Enable No Data Alarm: Raise an alarm if no data is received for the specified period of time.
- No data time window: Time quantity, measured in the configured time unit

Step 7: Click the Next button to go the final screen and select a trigger threshold if required.

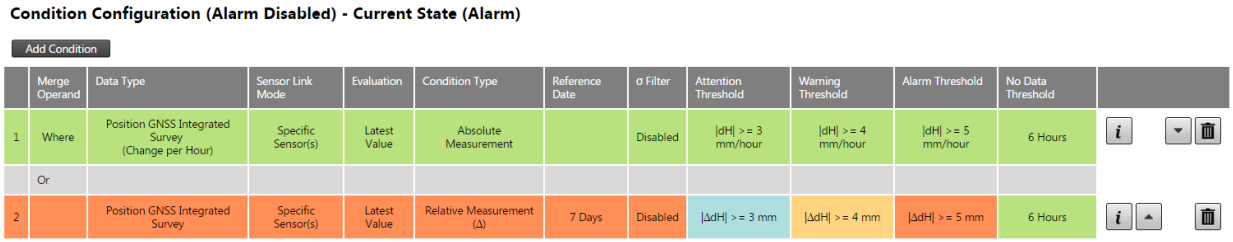


The alarm condition thresholds can be specified to trigger when any sensor, all sensors, a percentage of all the monitored sensors or an absolute number of sensors violates a condition thresholds. Click Done to save all changes.
Your first Condition is now created and you should see it immediately.



If needed you can add more conditions and concatenated the conditions together via logical Boolean operators “AND” or “OR”.

Any added conditions will add rows in table (as illustrated below). Note the Boolean operators (in grey) between the conditions.



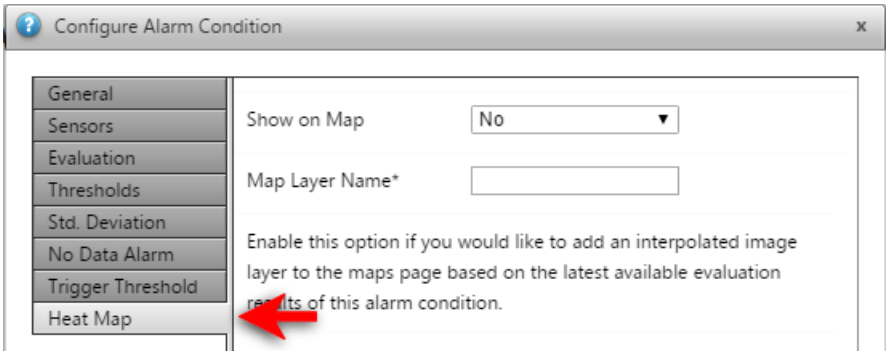
The colour of the conditions indicate the state of the condition.

- Green: All is well (state = OK)
- Blue: The first threshold has been triggered (state = Attention)
- Orange: The second threshold has been triggered (state = Warning)
- Red: The final and third threshold has been triggered (state = Alarm)

In the above example the first condition is in the OK state (green) and the second condition is in the Alarm state (red). Because the two conditions are joined with a logical OR, the alarm (existing out of two conditions) will be in the Alarm state.

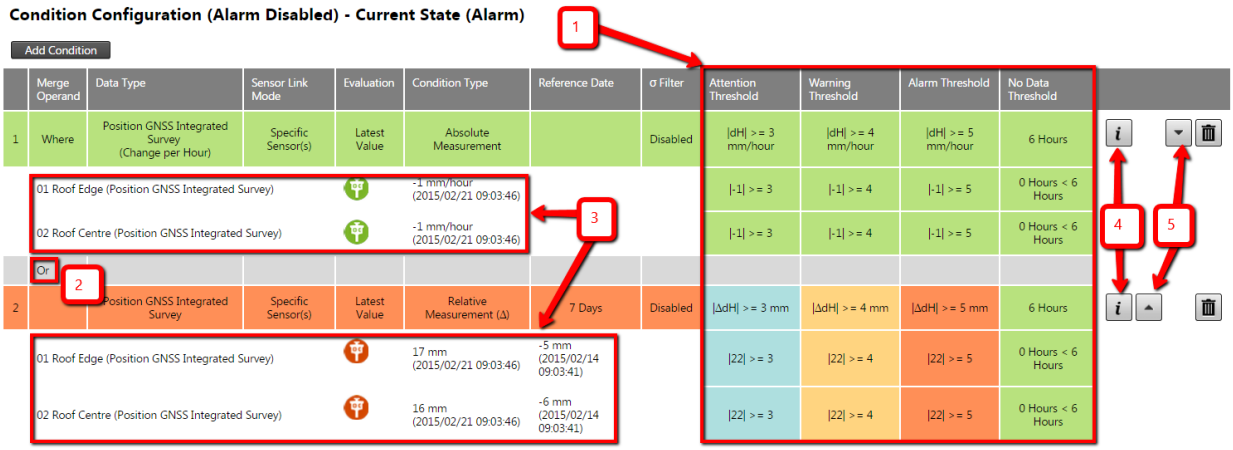
14.3.1 Alarm heat map overlay

An *Alarm Heat Map Overlay* can be enabled as part of a particular Alarm condition. A heat map generated from the alarm condition will then display as an optional map overlay. The alarm thresholds are used for the interpolation and the colouring of the heat map.



14.4 CONFIGURING CONDITIONS

This “Condition Configuration” section is used to add and remove conditions, modify existing conditions and finally enable the alarm.



Each alarm consist our of one or more “alarm condition(s)” (illustrated by 1), which are concatenated by AND or OR conditions (illustrated by 2). The “alarm conditions” are listed at the bottom right below the heading “Condition Configuration” on the right hand pane.

Each “alarm condition” can also consist out of one or more sensor reading conditions also (3), each with their own corresponding threshold conditions on the right (1). To collapse/expand these sensors simply click on the “i" button (4).

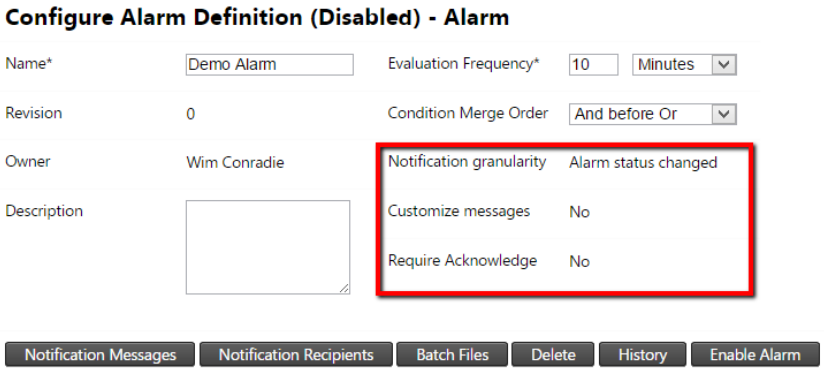
The “alarm conditions” can also be moved up and down (5) to order them, in order to build the required Boolean condition.

To edit and an “alarm condition”, simply click anywhere on it in the list where it is displayed. Or click on the “Add Condition” button to create a new one. (Note: the overall alarm needs be in a “disabled” mode to be able to edit its conditions).

In order to delete any “alarm condition”, simply click on the trash can icon on the far right of it.

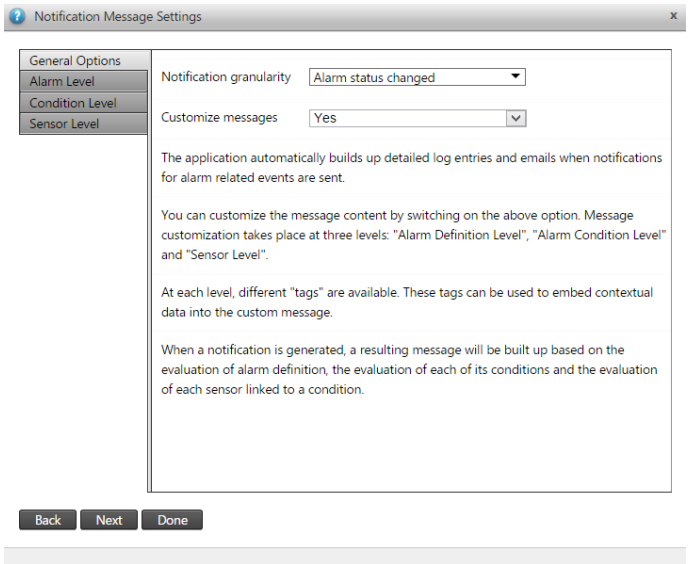
14.5 CONFIGURING AN ALARM

When Condition(s) ware added to the alarm more options (indicated below) will be enabled to configure. To modify, simply click on the option and a pop-up will appear.



14.5.1 Notification granularity

This setting controls the granularity at which changes in alarm states are sent.

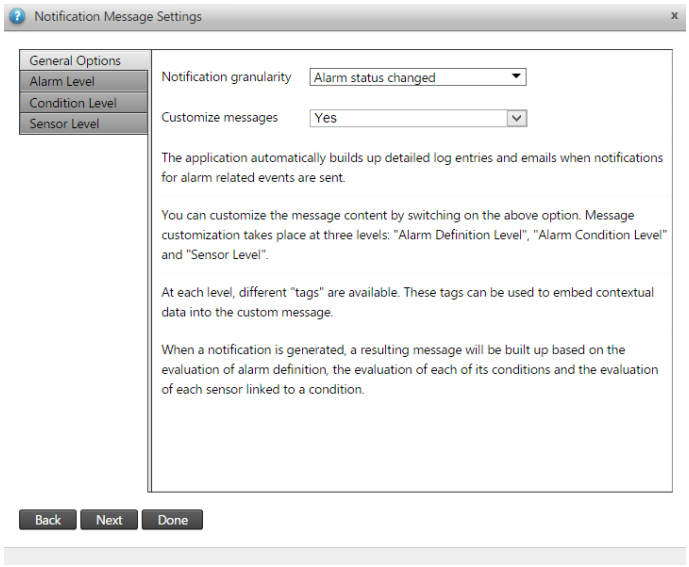


The application automatically builds up detailed log entries and emails when notifications for alarm related events are sent.

You can customize the message content by switching on the above option. Message customization takes place at three levels: "Alarm Definition Level", "Alarm Condition Level" and "Sensor Level". At each level, different "tags" are available. These tags can be used to embed contextual data into the custom message. When a notification is generated, a resulting message will be built up based on the evaluation of alarm definition, the evaluation of each of its conditions and the evaluation of each sensor linked to a condition.

14.5.2 Customize alarm messages

This setting determines whether standard notifications messages or custom notification messages will be used in log entries, SMS notifications and emails.

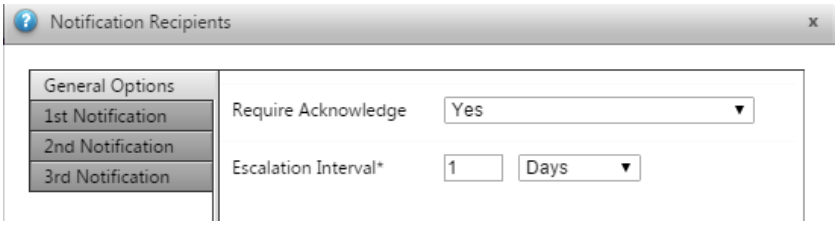


The application automatically builds up detailed log entries and emails when notifications for alarm related events are sent. You can customize the message content by switching on the above option. Message customization takes place at three levels: "Alarm Definition Level", "Alarm Condition Level" and "Sensor Level".

At each level, different "tags" are available. These tags can be used to embed contextual data into the custom message. When a notification is generated, a resulting message will be built up based on the evaluation of alarm definition, the evaluation of each of its conditions and the evaluation of each sensor linked to a condition.

14.5.3 Alarm Notification Requires acknowledgement

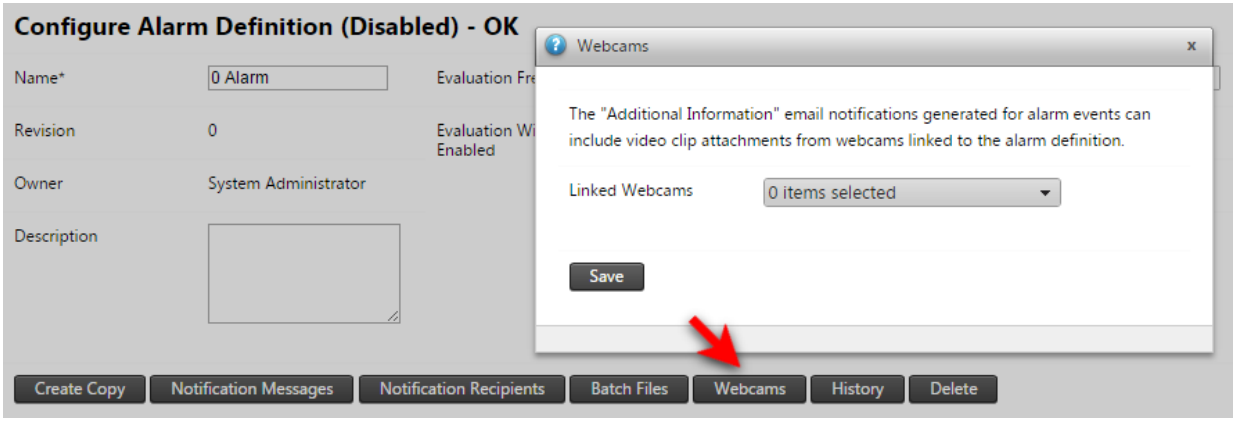
Alarm Notifications requires acknowledgement. If set to true 1st, 2nd and 3rd notifications will be sent out depending on whether the preceding notification has been acknowledged or not. It is important to note that alarms that requires acknowledgements will peg the alarm state of the sensors triggering the alarm at the particular alarm level until the alarm notification have been acknowledged.



14.5.4 Configure Webcam Video email attachment

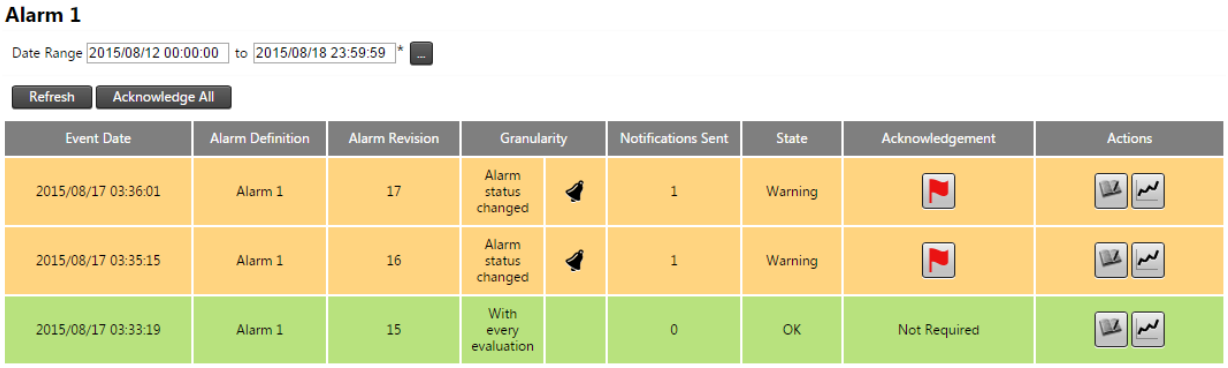
One or more video-capable webcams can be linked to an alarm definition. When an alarm event is triggered an additional notification email is sent and includes a video clip attachment. This clip originates from the associated webcam and covers the period before and after the event occurred.

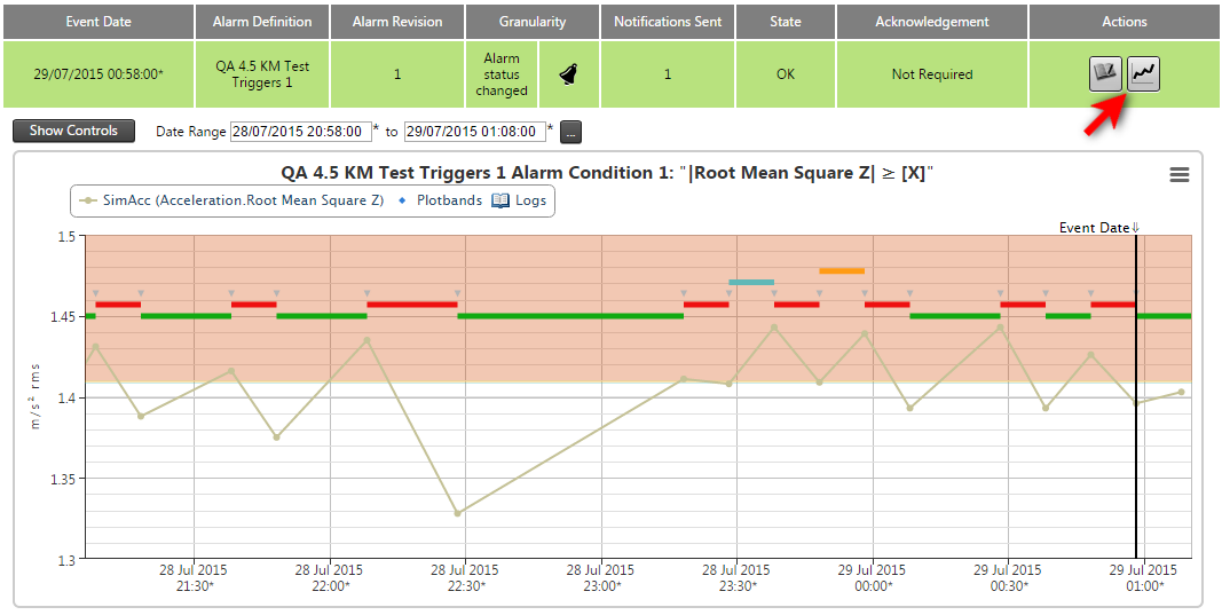
Next to the video clip an alarm chart can also be attached to email. The alarm chart illustrates the most relevant sensors observations involved in triggering the alarm together with other information relevant to the alarm. Typical illustrations are alarm events, notifications events and attention, warning and alarm thresholds.



14.5.5 View Alarm Event History and Alarm Charts

You can view the Alarm Event History by clicking on the *History* button next to the *Webcams* button.
Here you can view all the alarm events of the particular alarm.





You can also expand an alarm event by clicking on the Chart icon. The chart visualizes the alarm conditions and related information leading to the particular alarm event. This is helpful to analyze an alarm trigger event.
An alarm chart displays a black vertical line to indicate particular alarm event date and shows chart series for the most relevant condition values. Plot bands indicate the y-axis range where the alarm would evaluate as Attention, Warning or Alarm. You can also see the history of the alarm state leading up to the particular alarm event by looking at the green, orange, blue or red horizontal lines in the top of the chart area.

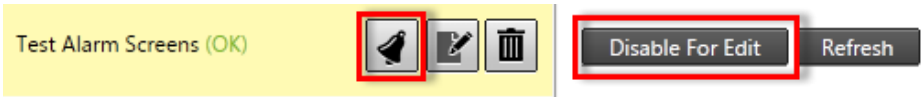
14.6 ENABLE & DISABLE ALARMS

Finally after all conditions and settings have been configure, the alarm can be enabled (or disabled later again).

When enabling an alarm, you will be given the option to update the alarm revision.

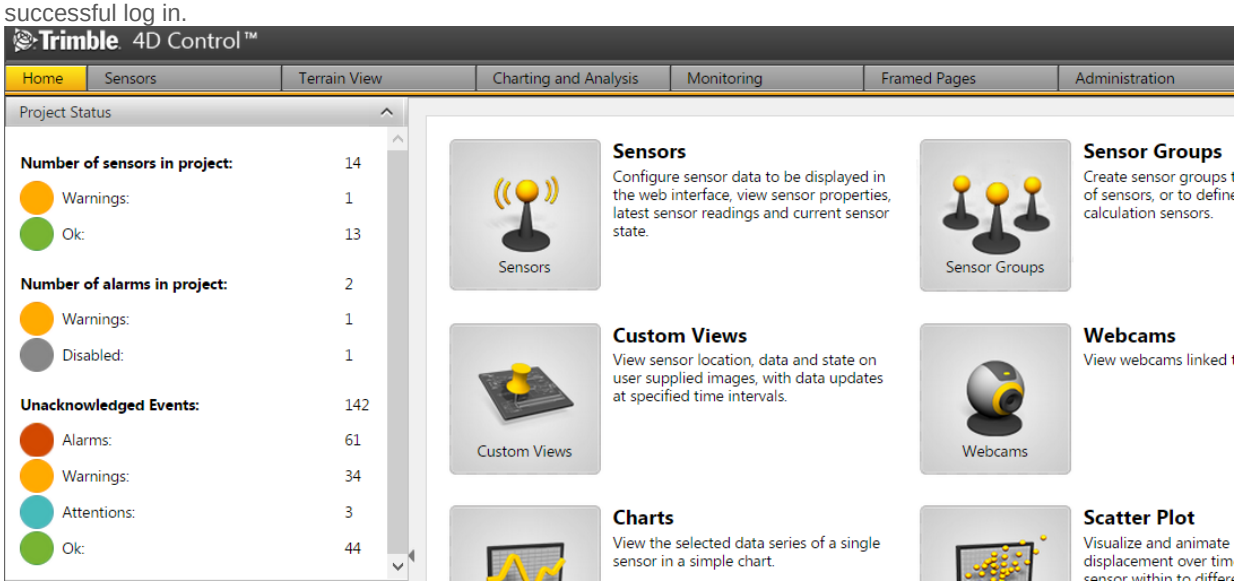
The alarm revision is mentioned in automated log entries end auto generated emails.

The user can disable the alarm by either clicking on the bell or on the disable for edit button.



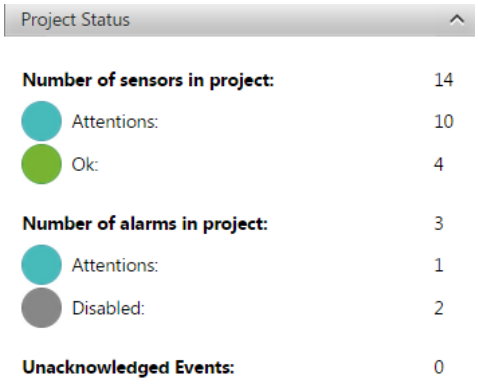
14.7 EVALUATING ALARM & CONDITION STATUSES

When alarms are activated a summary will also be displayed on the Home landing page of the system after successful log in.

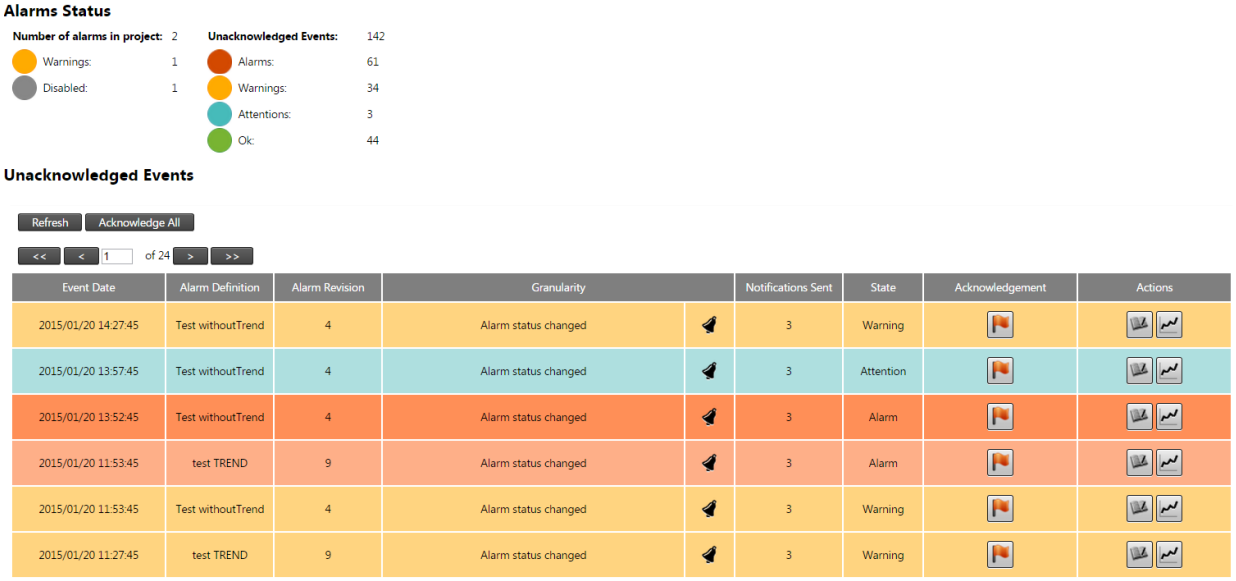


The number of unacknowledged events can potentially increase if actual events are not investigated and acknowledged.

A well maintained project should have many unacknowledged events

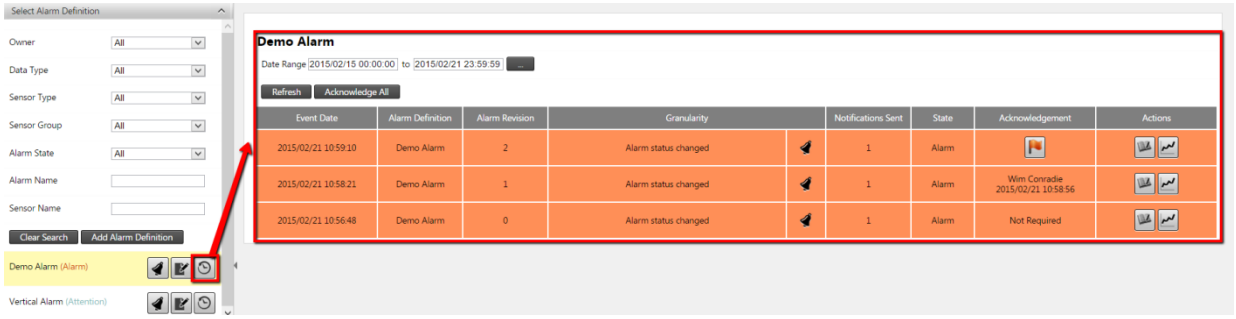


By simply clicking on any of these will navigate the user to the Alarm Status page



If you are in charge of responding to alarms that trigger, you can simply click on the flag to acknowledge that you have responded to the alert and resolved it or provided a reason. Reasons will be discussed in Logs (Section 15, page 121). All acknowledgements will also be added to the logs.

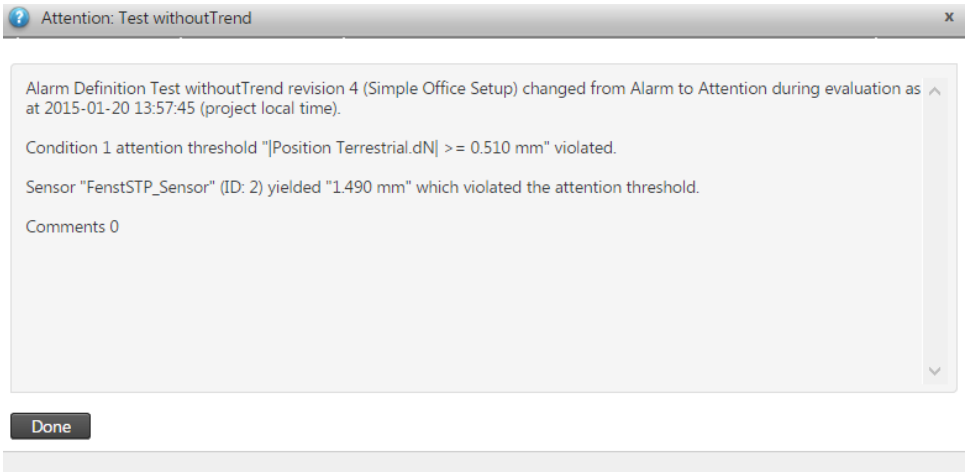
By acknowledging any alarm it will disappear from the list. If you want to review past (including active) events for a certain alarm, simply click on the History link next to the alarm in the left hand pane where alarms are listed by default (indicated by a clock icon).



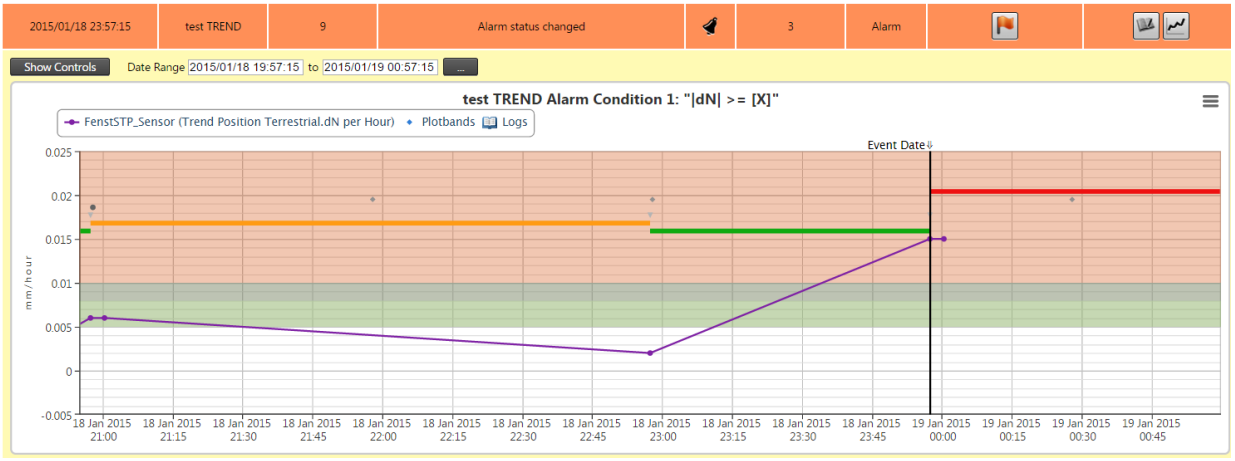
Using the buttons in the far right column (below the Actions heading) you can view more information about alarm events.

To view a text description click on the Log link (indicated by a log book icon)

A pop-up will show with the details about the event. If notifications settings were activated, you should also have received and email or SMS with this text.



For more detailed analysis it might be necessary to review the graphs that led to the trigger of the event. To do this simply click on the graph icon.



The purple line in the graph above indicates the effective sensor readings.

The vertical black line indicates when the event has happened.

The horizontal lines (orange => green =>red) indicate the change in alarm states. Normally it should be all green (which is the OK state), but for this example we used very sensitive (low) thresholds to trigger the states.

The starting point of each line is where the event happened that triggered the state. Note that the red line starts from the vertical black line, which is the time where the event happened that we are inspecting.

The dots on the graph at the event changes indicate the first, second and final notifications that were sent out (depending on the configuration and/or escalations that happened). By moving the mouse cursor over it more detail will be shown via pop-ups.

The white area on the graph indicates the OK state for the effective sensor(s) readings. The other three colored areas (plotbands) on the graph indicate the different threshold areas that will change the alarm states (Attention => Warning=> Alarm). To hide it, simply click on it on the graph legend.

This should provide insightful information about the event that happened. We will next discuss the other details that also appear in the log section.

14.8 SCHEDULED ALARM REPORT

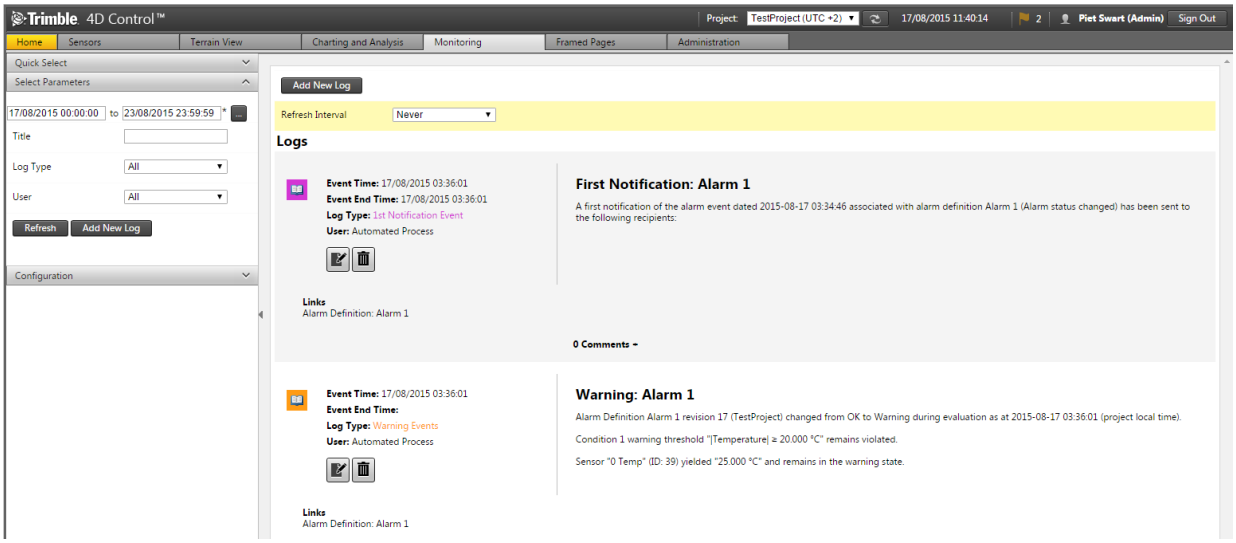
A scheduled alarm report shows the current alarm states of the sensors in a project. This report can be schedule to be generate and emailed periodically directly to a number of users (via PDF attachment in the email).

To create and preview a first report schedule simply:

1) Click on the Add Report Schedule button
2) Enter a Name for your report
3) Click the Save Button
4) Click the Preview Button

Your report will be generated and downloaded as a PDF. Simply click the edit button (pen and paper icon) on the left hand pane next to your report to further customize it. In order to delete the report schedule, simply click the trash can icon.

15 Logs



The Logs section shows information on events (or log entries), such as alarms, projects, hardware events, seismic events, accident events and blasting events.

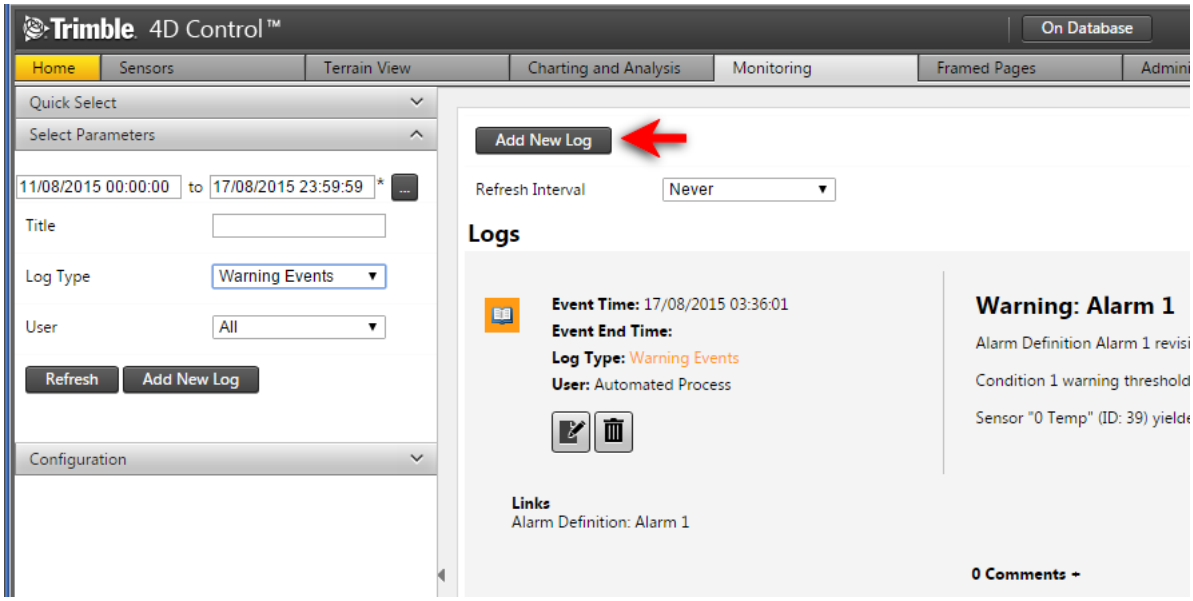
Alarm events (that was discussed in section 14 on page 102) are automatically inserted into the log entries. Other events are manually entered into the system and can be discussed by the users on the system.

When opening the logs section for the first time no log entries will be displayed on the right-hand side.

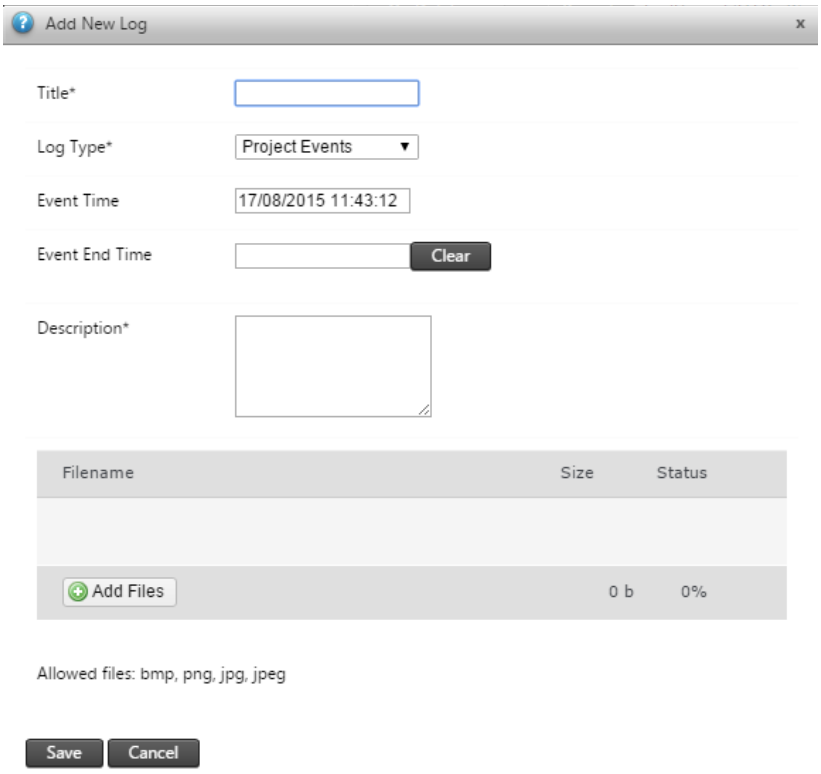
15.1 ADDING A NEW LOG ENTRY

Step 1: Navigate to the default log landing page.

Step 2: Click the Add New Log button.



Step 3: The following pop-up window will appear.



Complete the necessary fields as required.

- Title: Name of the event.
- Log Types: The type of event. You can configure the available “Log Types” if the best describing Type is not available (to be discussed in section 0 on page 125).
- Event Time: The date and time the event happened.
- Event End Time: The date and time it ended for the log entry. This field is optional.
- Description: An explanation of what happened.
- Image files: You can attach an image to a log event.

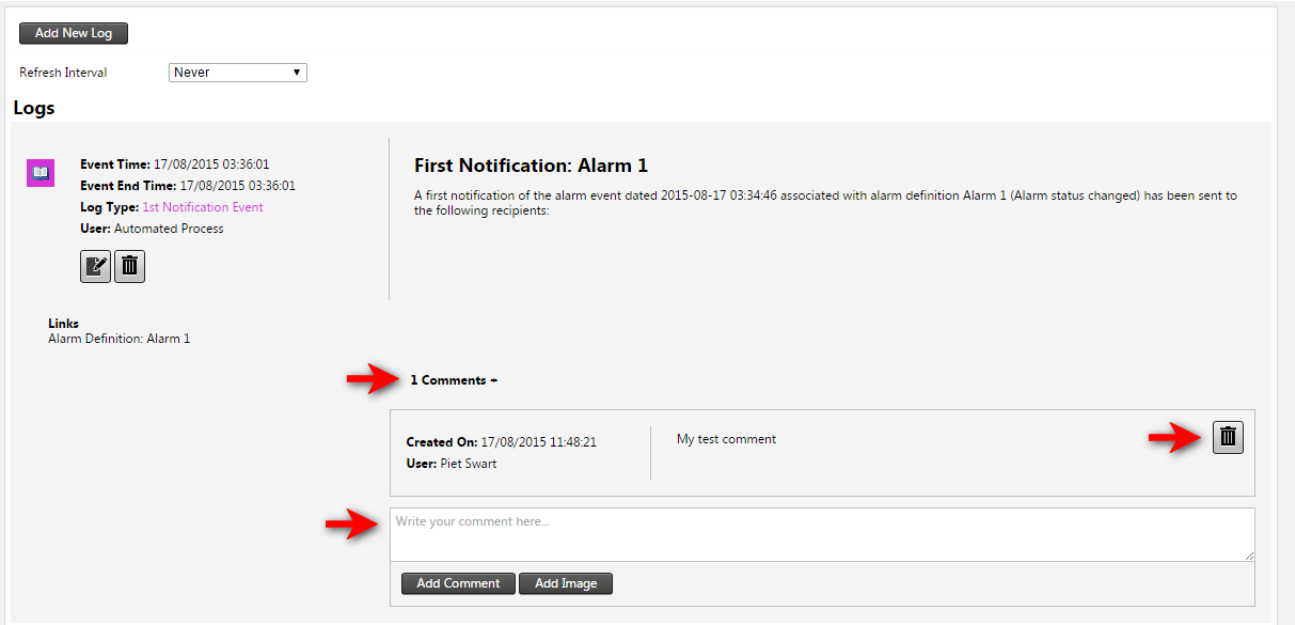
Click the Save button when completed.

Step 4: The log entry will appear in the log. We will discuss how to view the log entry in the next section.

15.2 ADDING COMMENTS TO LOG ENTRIES

Multiple comments can be added to a Log entry.

Simply click on the Comments area below each log entry to read or add comments to the entry

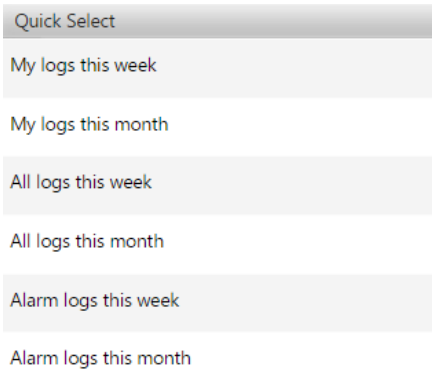


To delete a comment or log entry, simply click on the appropriate trash can icon.

15.3 VIEW LOG ENTRIES

Step 1: Navigate to the default log landing page.

Step 2: Select the “Quick Select” bar. Find the logs you wish to view by selecting the timeframe the log would have been created.



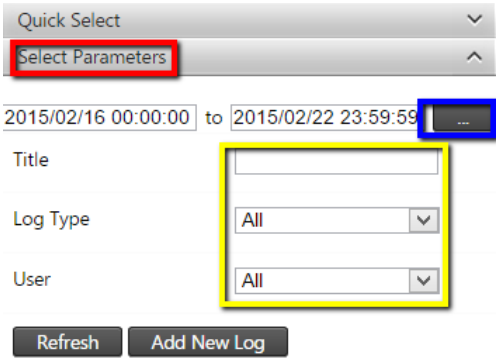
ALTERNATIVELY to find a specific log:

Step 1: Select the Select Parameters bar in the left pane (illustrated in red in the next figure).

Step 2: Select the timeframe of the log event you wish to view (illustrated in blue).

And / Or

Step 3: Enter information you have about the log in the given fields (in yellow).



Step 4: Finally click the Refresh button to update the log entries on the right.

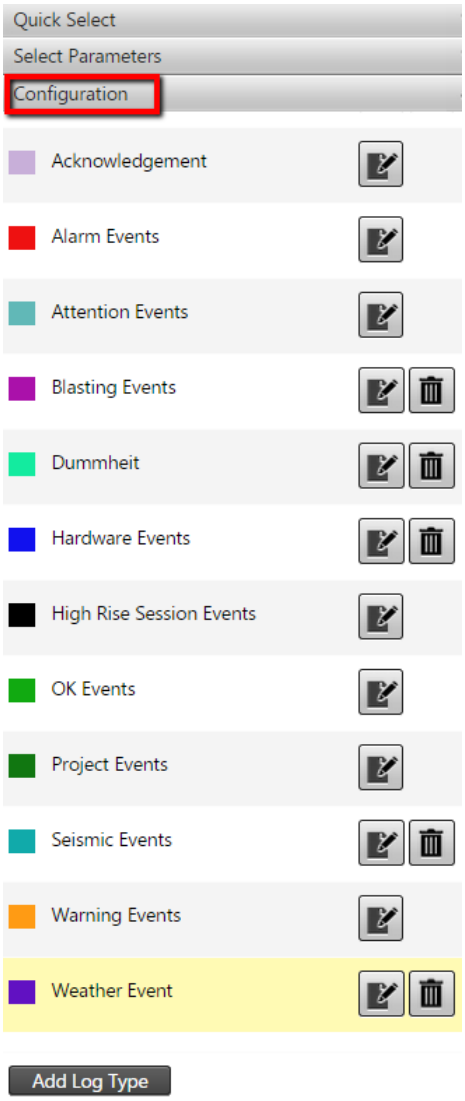
Note: The Add New Log button here does the same as the Add New Log button on the Default Log landing page in the main right hand side area.

15.4 LOG TYPES

15.4.1 Configure Log Types

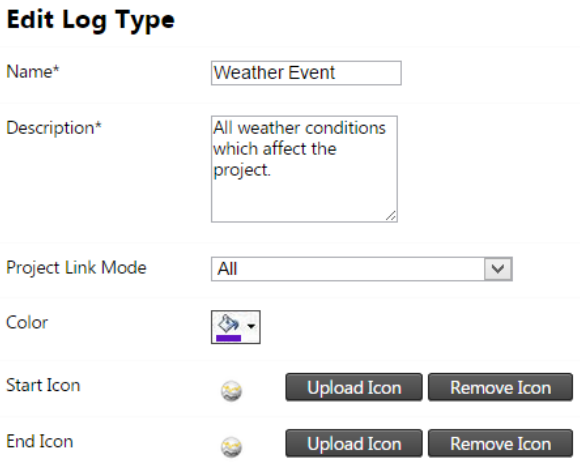
Step 1: Select the Configuration bar in the left pane.

Step 2: A list of Log Types will be displayed.



Step 3: Select the appropriate option to view the log type details. You can click on the paper-pen icon to edit the log type or the trash can icon to delete the log type. Only certain log types can be configured.

Step 4: If the edit icon was clicked. The details will be displayed on the right hand side area.



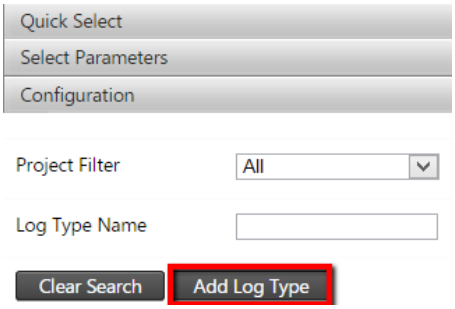
Update the necessary fields as required.

- Name: The display name for the log type.
- Description: Specify a description for the log type.
- Project Link Mode: The default option is all projects, but you can also specify here which projects this log type may only be available for if it should not be available for all projects.
- Color: The log type colour that will be used to represent the log on analysis charts.
- Start Icon: The log type icon that will be used to represent the start of a log on analysis charts.
- End Icon: The log type icon that will be used to represent the end of a log on analysis charts.

In order to save any changes that were made, click the Save button (that will appear after any changes were made). **Note that some log types offer only limited editing options.**

15.4.2 Add a new Log Type

Step 1: Click the Add Log Type button at the top (as illustrated) or bottom of the log type list.



Step 2: Enter the necessary fields as required which would the same as previously discussed. Click the Save button and your Log Type will be added to the list.

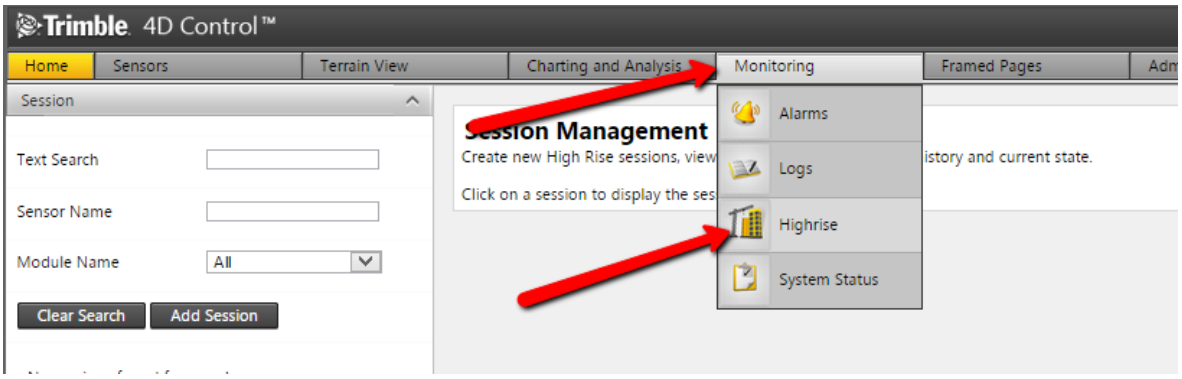
16 Highrise

Highrise is used to manage Highrise construction sessions.

It is a specialized module that if acquired will be accompanied by the necessary personal training.

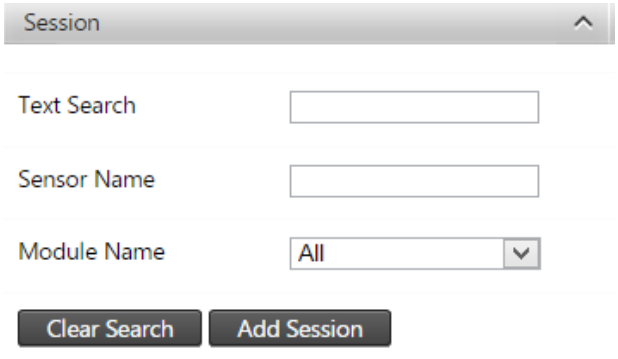
16.1 ACCESS COMPOSITE VIEWS

Navigate to the composite view section via the Menu or from the home page shortcut icon.



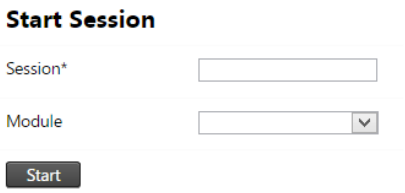
16.2 NAVIGATION AND CREATION

Use the filtes on the left hand side, to identify sessions



Step 1: To create a new session simply click on the Add Session button

Step 2: Provide a name for the session.



Step 3: Choose a module the session is linked to and click the Start button.

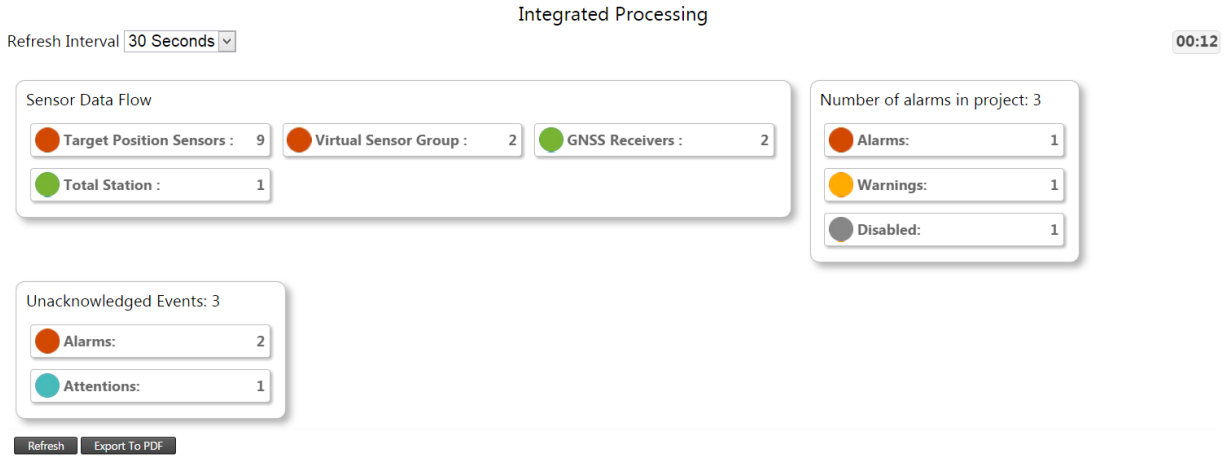
After the session was created it will be listed throughout the Charts, Analysis, Composite Views, etc. as an additional item with which to filter sensors.

17 System Status

The System Status section brings useful top level reporting within the T4D system together as well as provide means to link back to the respective sections in the system for more detailed drill down queries. It also provides the tools to generate detailed reports and notifications.

17.1 OVERVIEW

The overview displays a dashboard like page where one can get a general overview of the system.



By clicking on any item will navigate you to respective section about it:

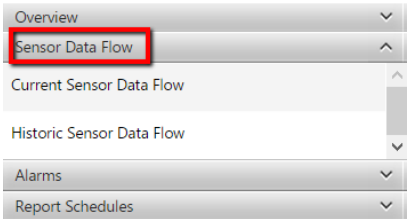
- Sensor Data Flow: Will be discussed in section 17.2, page 130.
- Number of alarms: Will be discussed in section 17.3, page 133.
- Unacknowledged Events: Was discussed in section 14.7, page 117.

The page can be auto refreshed by setting the Refresh Interval or manually by clicking the Refresh button.

The page can also be exported to a PDF file.

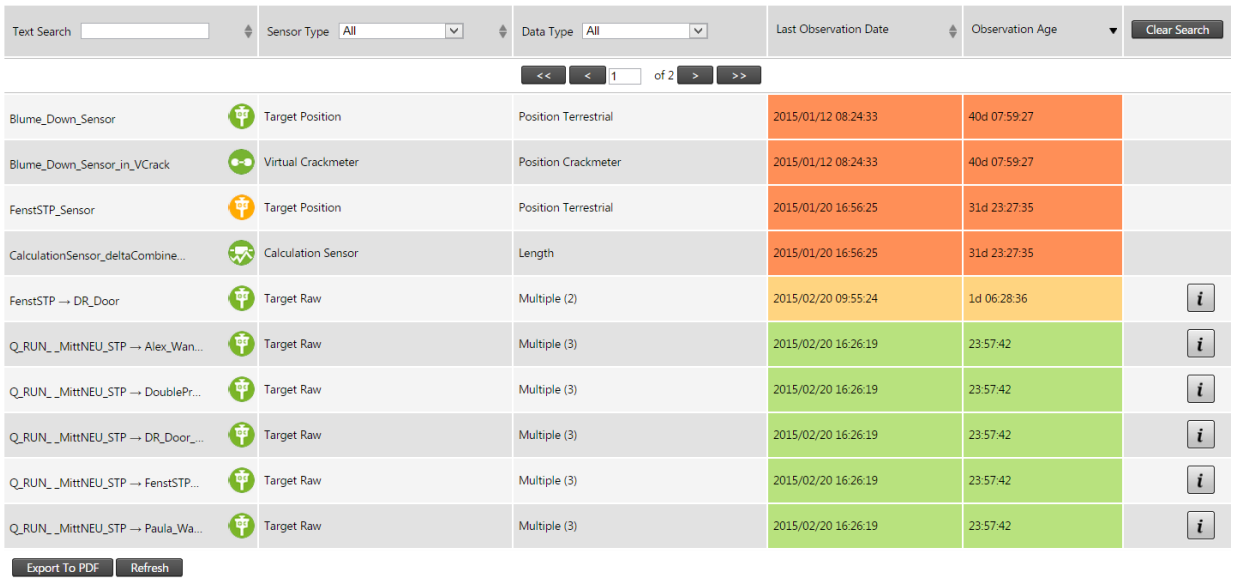
17.2 SENSOR DATA FLOW

Sensor data flow is located in the left hand side subsection.



The sensor data flow area is used to analyze the performance and age on the latest available observations for each sensor. This can be used to determine if data is currently being delivered for each sensor.

Current Sensor Data Flow



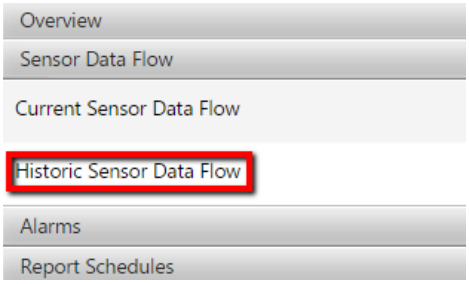
The following colour coded indications are provided:

- Green: Data delivery appears be healthy.
- Orange: Data delivery appears to be delayed.
- Red: Data delivery appears to have stopped.

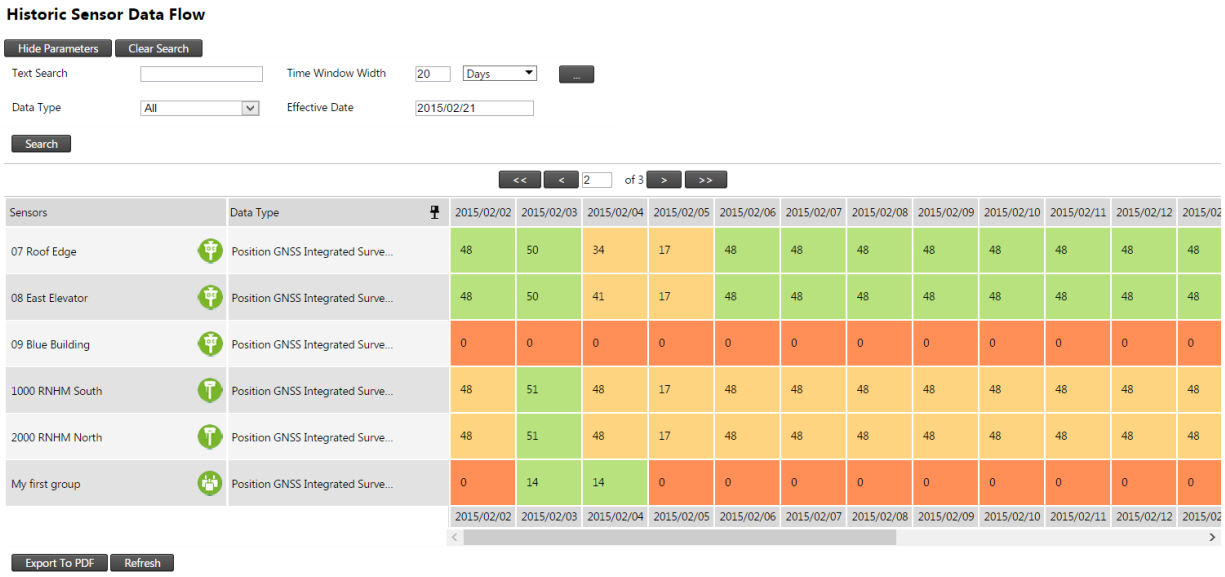
As previously the page can be refreshed or exported to PDF.

At the top of the page is also filters to assist with quickly navigating to sensors in case the project has many sensors.

In order to look at past availability of data observations simply click on the History Sensor Data Flow option in the left hand pane.

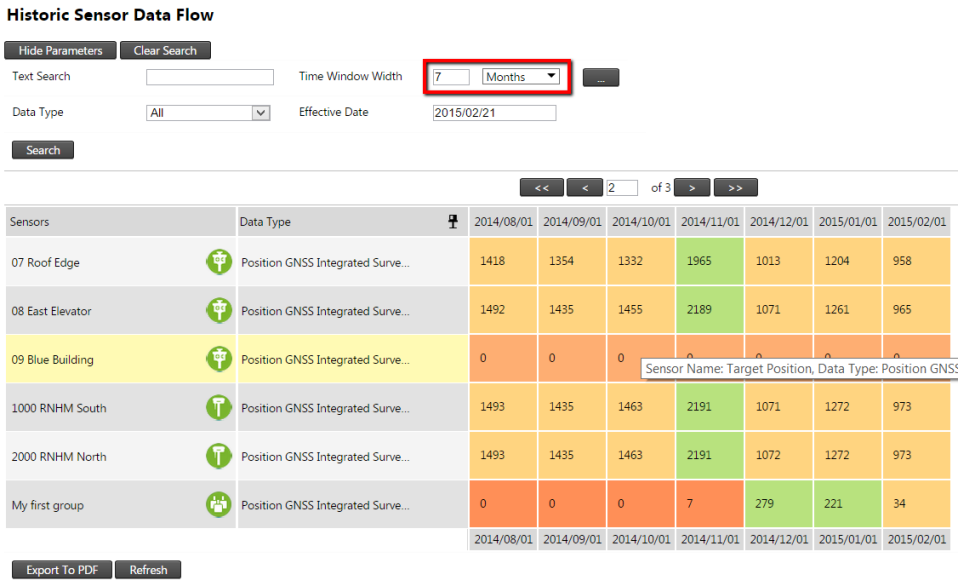


In the example below the sensor history are displayed for the past 20 days. Each cell represents a specific day for a specific sensor and the total observations that day. As can be seen the healthy green cells have more readings than the orange cells, which again have more than the red cells provided no observations.



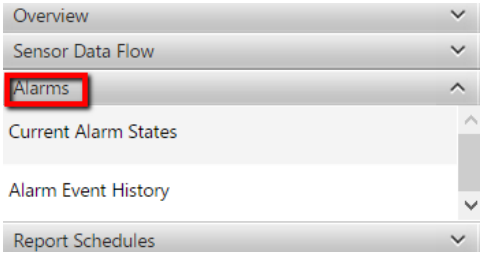
There is a useful pin that can be toggled in the Data Type column's heading to keep the Sensor details fixed if you would like to scroll to the right.

The "20 day" time window can easily be changed, let's say for example to 7 months, as indicated below.



17.3 ALARMS

Alarms data flow is located in the left hand side subsection.



As with sensor data flow, the Current Alarm States show active data.

Current Alarm States

Alarm Name	Alarm State	Last Ok Event	Last Attention Event	Last Warning Event	Last Alarm Event	Clear Search
Demo Alarm (Alarm)		Never	2015/02/21 14:03:45	Never	2015/02/21 14:33:42	
Vertical Alarm (OK)		2015/02/21 18:33:49	2015/02/21 17:03:47	2015/02/21 15:03:46	2015/02/20 20:03:44	

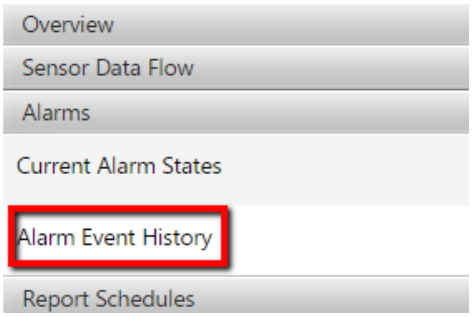
Export To PDF Refresh

The current state is showed in brackets next to the alarm's name. To drill deeper you can click on the clock icon (to the right of the alarm name and current state) to go the alarm history as discussed in section 14.7 on page 117.

The other columns in the table indicate the last time was that the four different alarm states triggered.

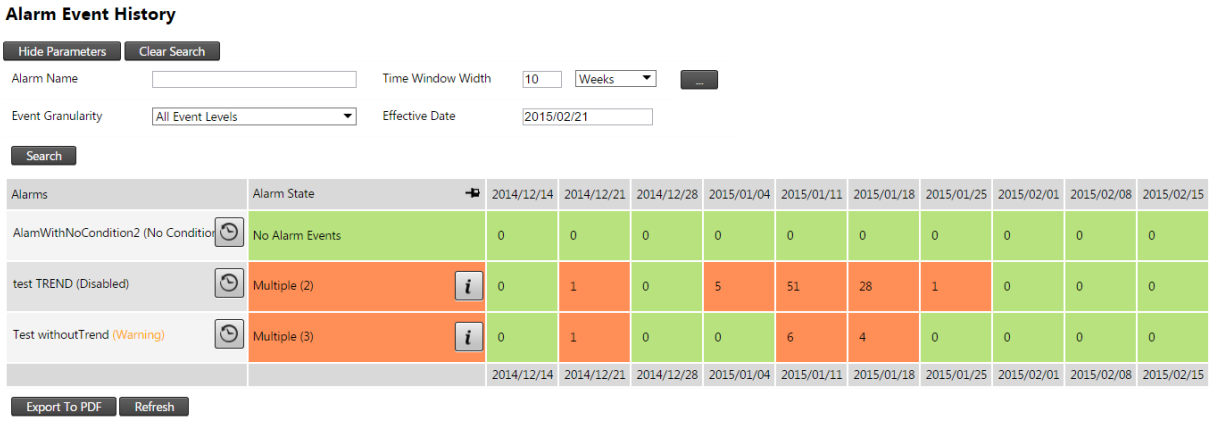
The report can be exported to PDF as by click the Export to PDF button.

In order to look at past event history of data observations simply click on the History Sensor Data Flow option in the left hand pane.

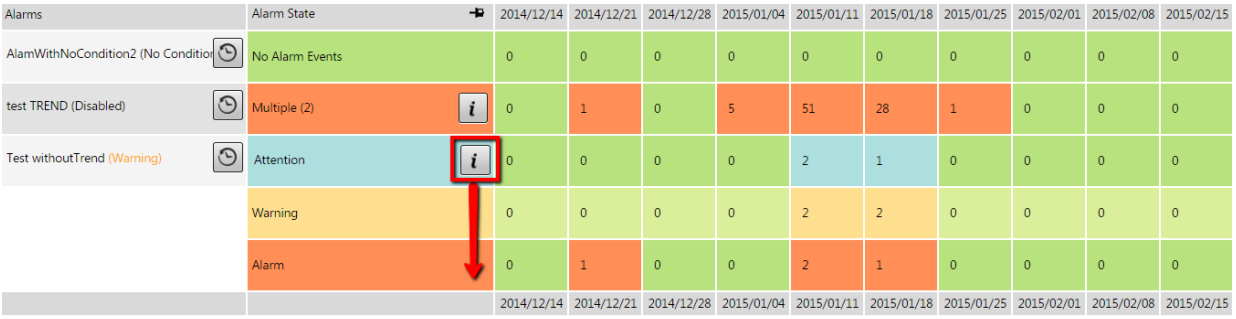


Example alarm history for the past 10 weeks is displayed below.

As can be seen most of the alarms happened roughly in the time window of 5-6 weeks ago.



Only the worst state is listed per alarm. To view all states that triggered (in the below case), simply click on the respective "i" in the alarm to expand.



As before to drill deeper you can click on the clock icon (to the right of the alarm name) to go the alarm history as discussed in section 14.7 on page 117. Just remember the time period you were evaluating before clicking on the icon, in order to specify it again in that section.

17.4 REPORT SCHEDULES

All the functionality in the previous section can be combined into a report schedule that will generate and email a report directly to a number of users (via PDF attachment in the email).

To create and preview a first report schedule simply:

1) Click on the Add Report Schedule button
2) Enter a Name for your report
3) Click the Save Button
4) Click the Preview Button

Your report will be generated and downloaded as a PDF. Simply click the edit button (pen and paper icon) on the left hand pane next to your report to further customize it. In order to delete the report schedule, simply click the trash can icon.

18 Framed Pages

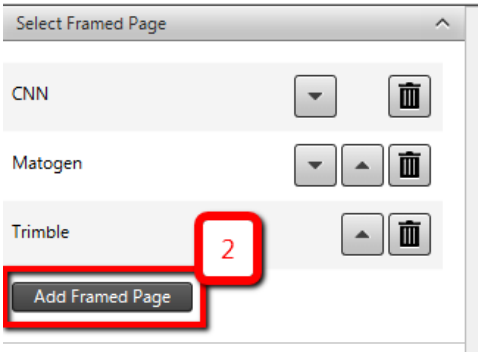
Framed pages offers functionality to show external websites inside T4D accessible via the main menu in T4D.

This is useful if certain internal web pages are important to the monitoring team using T4D.

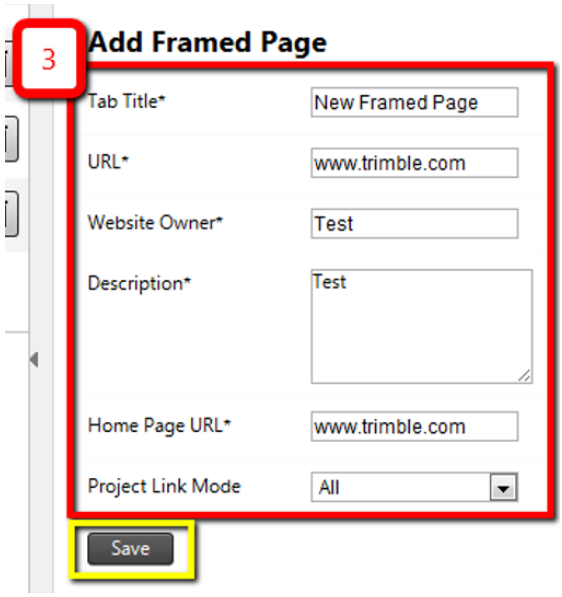
18.1 ADD A FRAMED PAGE

Step 1: Open the Framed Pages section from the top menu.

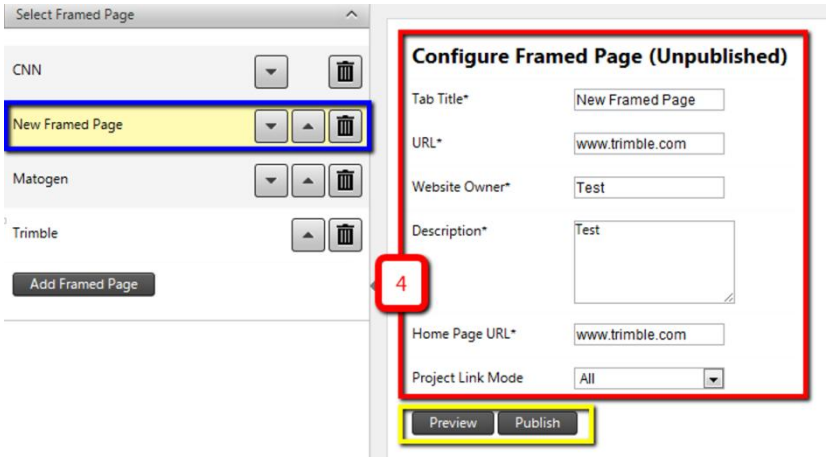
Step 2: Click on the 'Add Framed Page' button in the left hand side pane.



Step 3: Complete the form and select "Save" to save your new Framed Page.

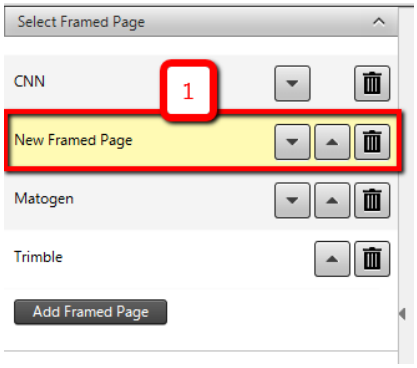


Step 4: Configure (red) or change the order in the main menu (blue) where your new Framed Page will be displayed before you preview and publish (yellow) it.

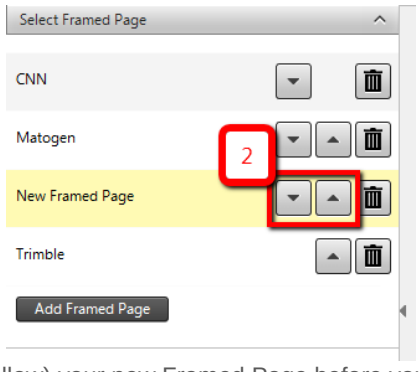


18.2 CONFIGURE A FRAMED PAGE

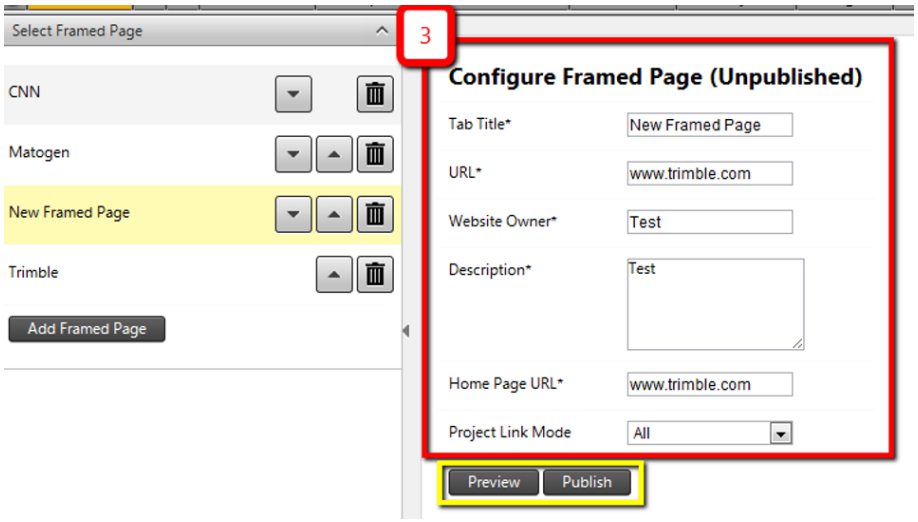
Step 1: Select the Framed page you want to configure (red).



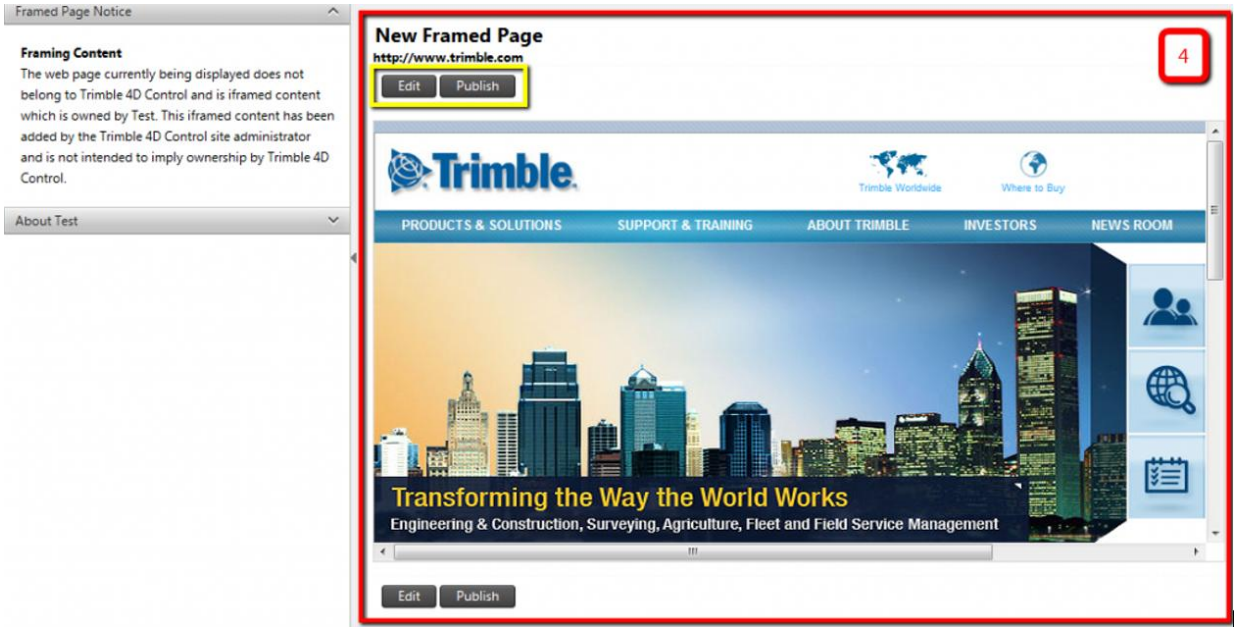
Step 2: Changing your Framed Page's page order (in the main menu) by using the arrow keys (red).



Step 3: Configure (red) or preview (yellow) your new Framed Page before you publish it (also Yellow).



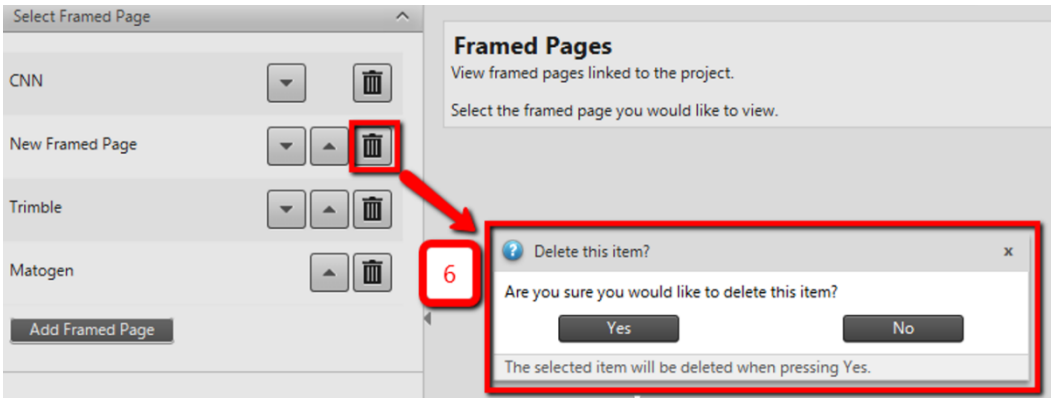
Step 4: Preview your page before Publishing and/or Edit (yellow) the Framed Page.



Step 5: Publish your Framed Page, it can now be viewed in the navigation bar.

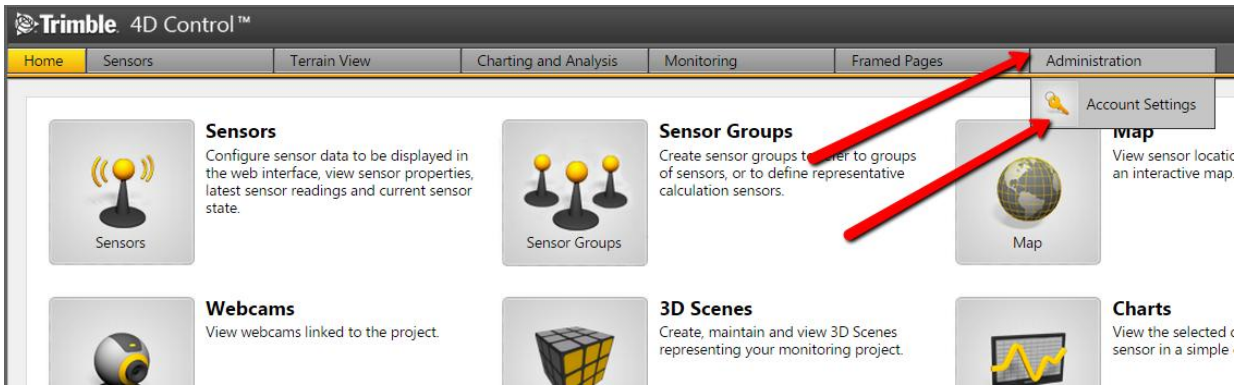
Note: The Edit and Publish buttons will only be visible to a user with the correct permissions. To other users this will look like a normal nicely integrated web page into the T4D Control web interface.

Step 6: Delete your Framed Page by clicking the trash can icon next to the name of your page.



19 Account Settings

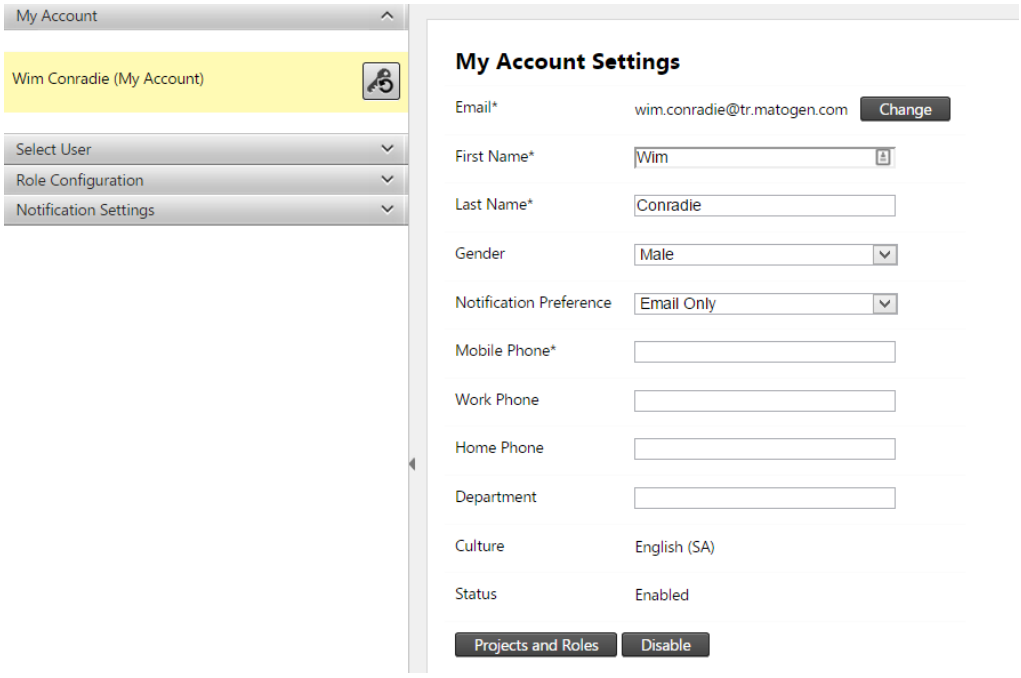
Account settings allows the user to change their account details. In addition, admin users can set user permissions, add, delete or change passwords for other user accounts.



19.1 MY ACCOUNT SETTINGS

In the 'My Account' tab on the left pane you can change your details or settings.

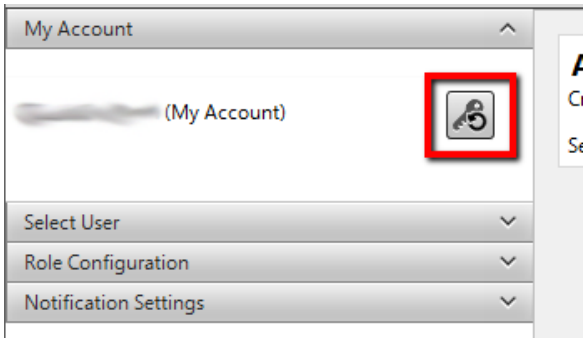
To change your settings, simply click on your name, to have your details be displayed on the right hand pane.



You can edit these and simply click on the "Save" button when done.

If you need to change your password, please follow these steps:

Step 1: Click on the Password button.



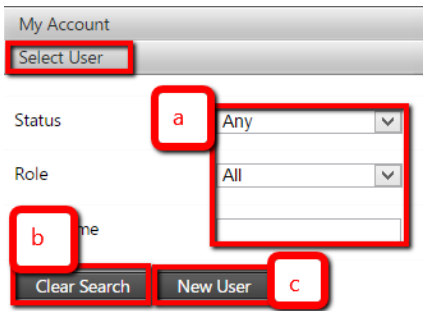
Step 2: You will be navigated away from the Account Settings dashboard to change your password.

Simply enter the passwords and click the Apply button to complete this password update.

19.2 USERS

You can view another user's settings similar to your own in the My Account tab by selecting another user in the Select User tab. Please remember you have to have to necessary privileges to be able to view and/or edit other users.

In order to navigate here, open the Select User tab.



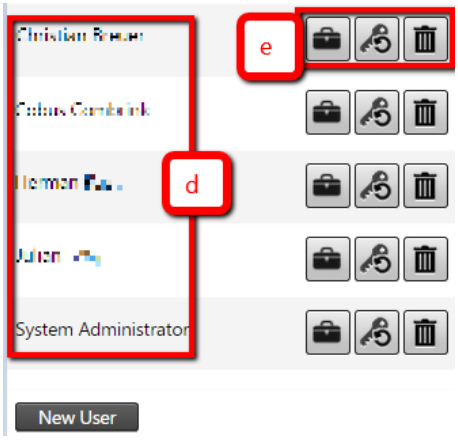
Additional options are available:

a. Search filters: Filter any of the users (shown in d. below) according to these filters.

b. Clear your search filter again.

c. Register a new user.

A list of users should be displayed below these options.

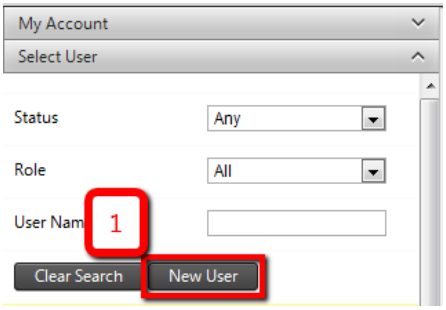


d. The users listed in your search filter (all of them if no filter is applied). You can click on anyone's name in order to view or edit their settings.

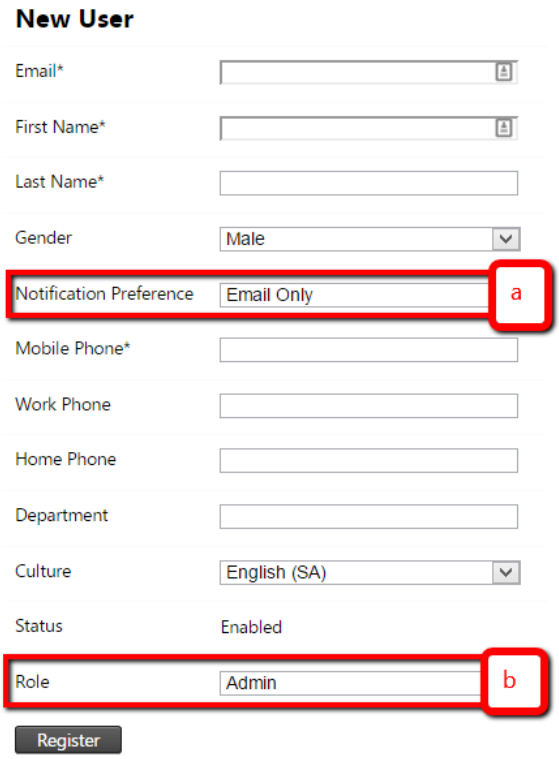
e. User controls (Project Access and Roles for user, Reset Password for user, Delete user) can also be clicked here.

19.2.1 Add, Edit or Delete Users

Step 1: Click on the “New User” button.



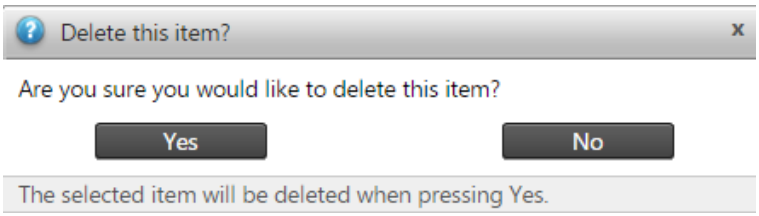
Step 2: Complete the form and click on the Register button.



Take note of the following:
a. Set the Notification type via Email and/or SMS or Disabled.
b. Be sure to choose the proper Role, e.g. do not assign Admin to somebody that should not have that privileges.
Note: Roles will be discussed later in section 19.3 on page 143.

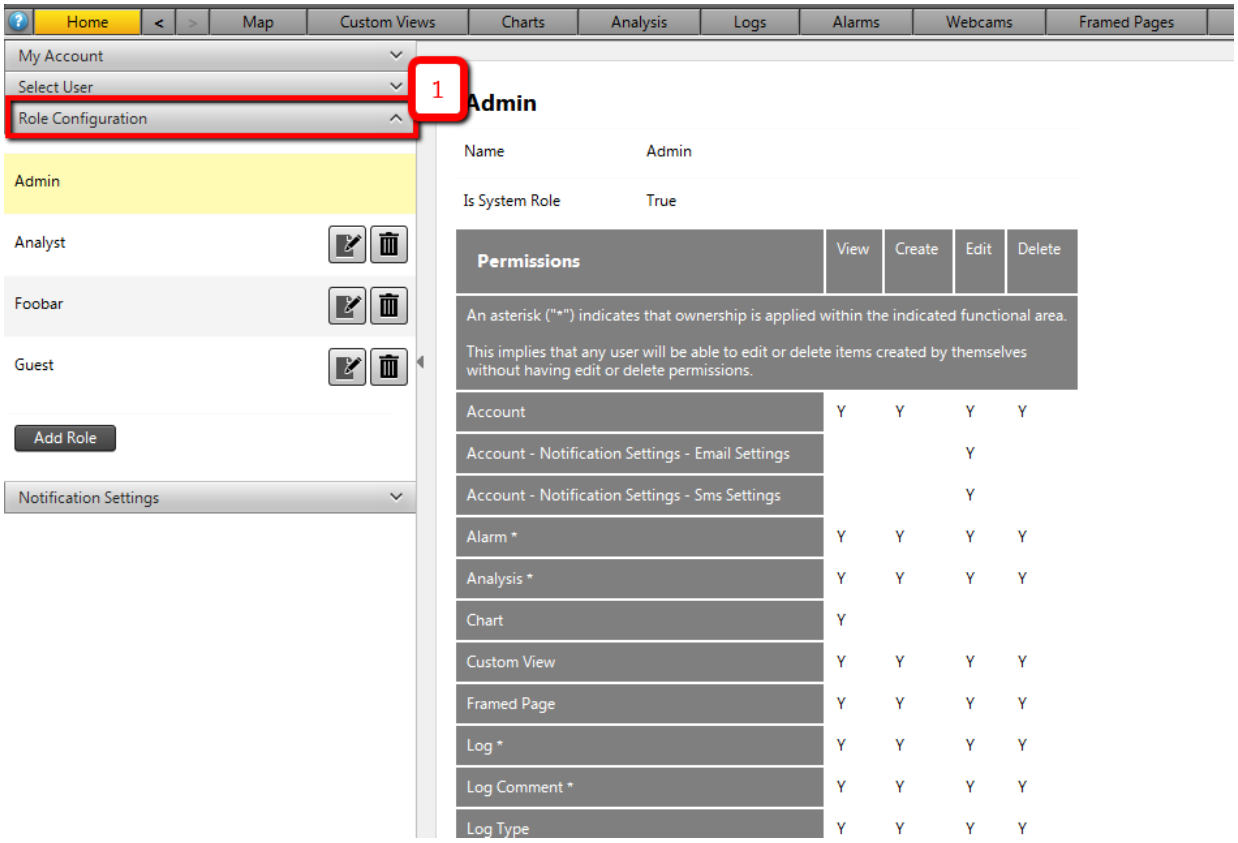
In order to edit a user’s settings, you must click on the user’s name. This will open a similar area as the previous registration pane where you can edit the user’s settings.

In order to delete a user, simply click on the trash can icon next to the user's name.



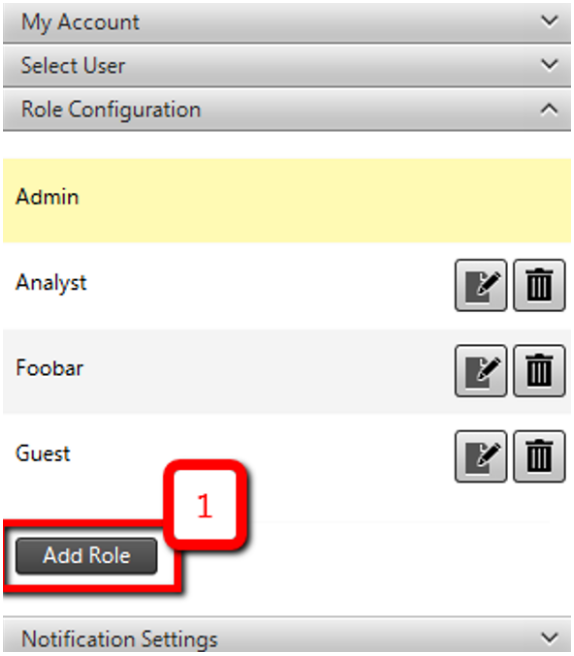
19.3 ROLE CONFIGURATION

Open the Role Configuration tab (1).

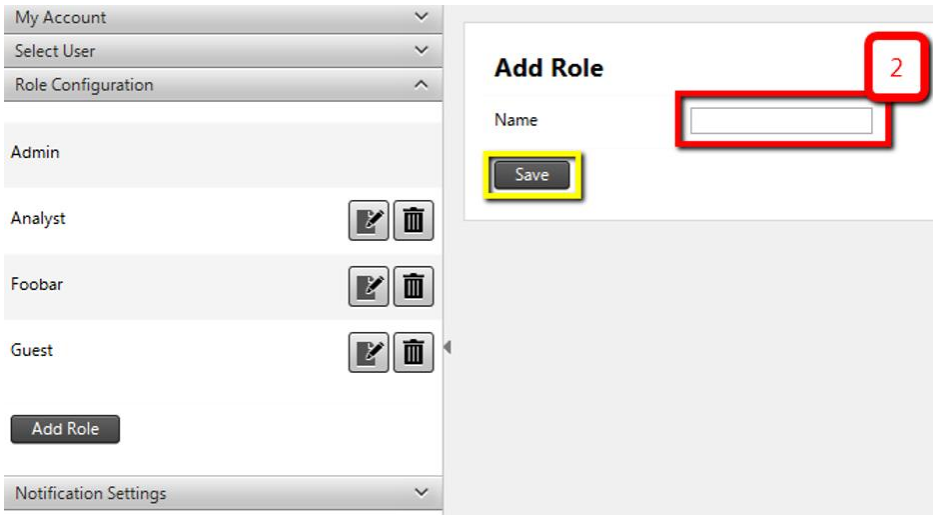


19.3.1 Setting up a Role

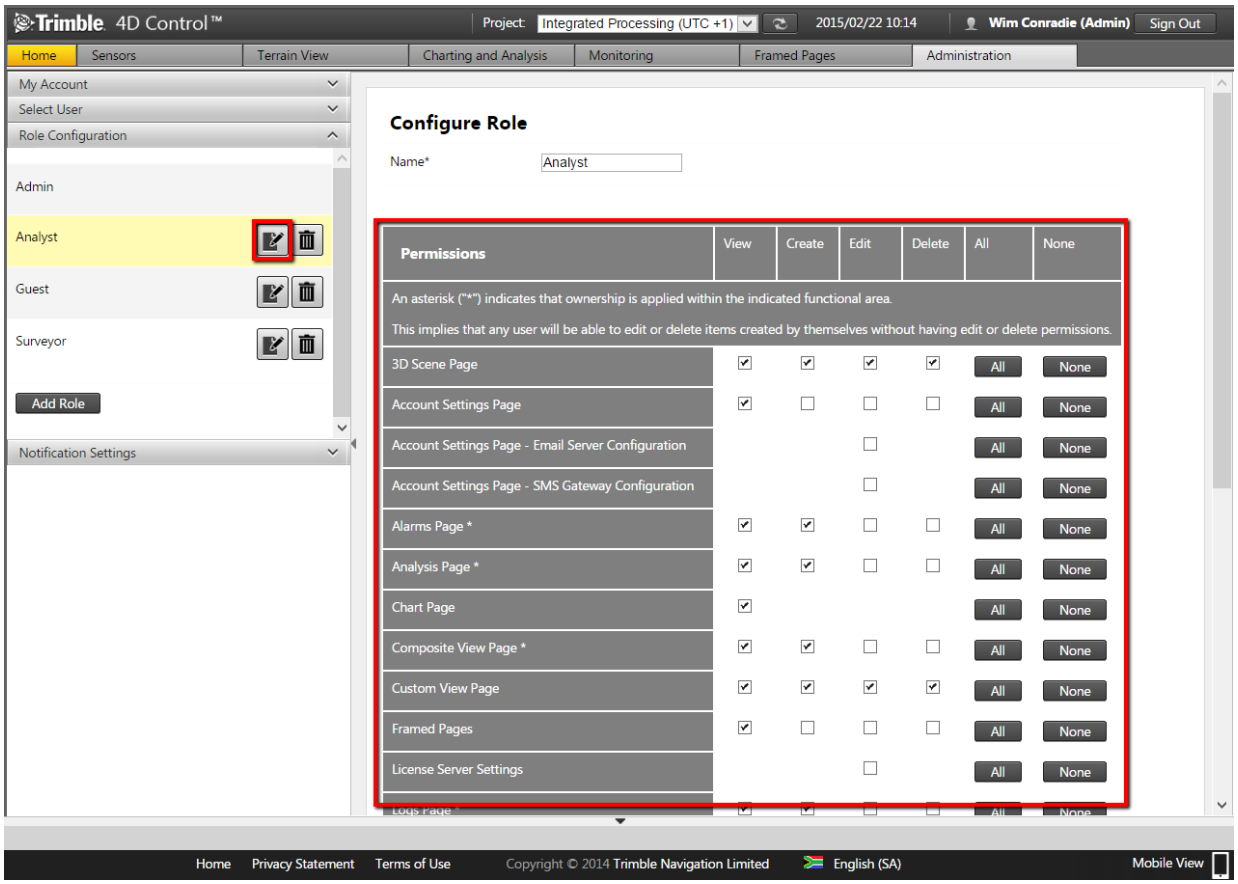
Step 1: Click on the Add Role button.



Step 2: Provide a descriptive name for the Role.



Step 3: Configure your Role by selecting the allowable permissions from the list available. You can later edit the Role's permissions again by clicking on the Edit button (pen and paper icon) next to the role's name in the left hand side pane.



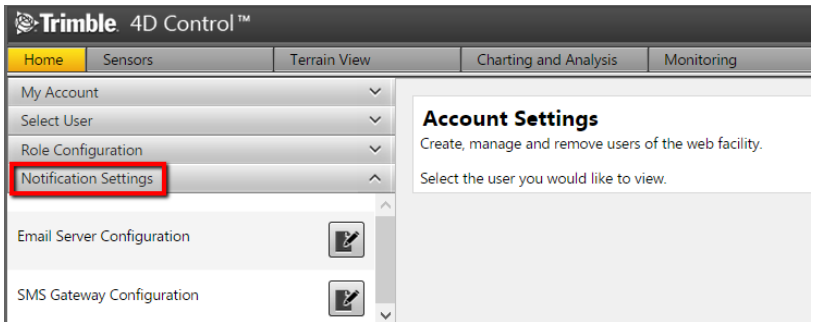
If you make any changes a Save button will appear. Simply click on the Save button and all the permissions you changed will be implemented to the Role.

Your Role is now ready and you can assign it to users.

If you would like to delete a Role later, simply click on the respective trash can icon next to its name.

19.4 NOTIFICATION SETTINGS

Open the Notification Settings tab on the left hand side pane.

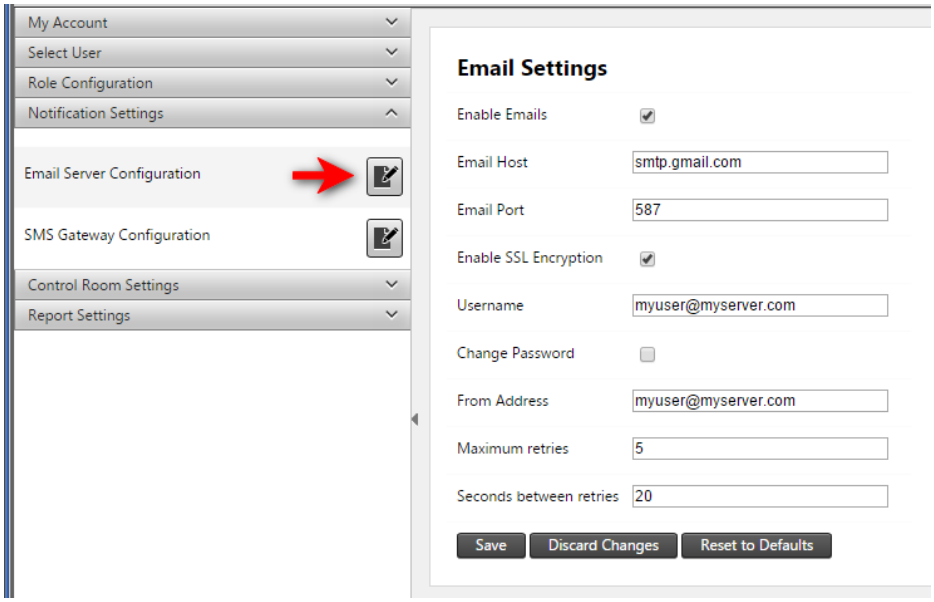


19.4.1 E-mail Notification Settings

The Trimble 4D Control Web application makes substantial use of Emails. More specifically, new users are invited to the system via email and Alarms/Reports in the system can be configured to notify specific users via Email.

Before you can continue to invite the first user to the system you need to ensure that the system emails are working. The Trimble 4D Control Web application ships with an email configuration that will work “out of the box”, provided that your firewall allows traffic through port 587. You can either leave this configuration as is, or you can change this configuration to send emails via another mail server. **We however advise that you change the default email settings since you may encounter throughput issues when sharing the same email infrastructure with other T4D installations.**

Edit the setting and test your settings afterwards (there is a Test button that you can use to send yourself and email). If you are unsure of the settings, please ask your system administrator for assistance.



19.4.2 SMS Configuration Settings

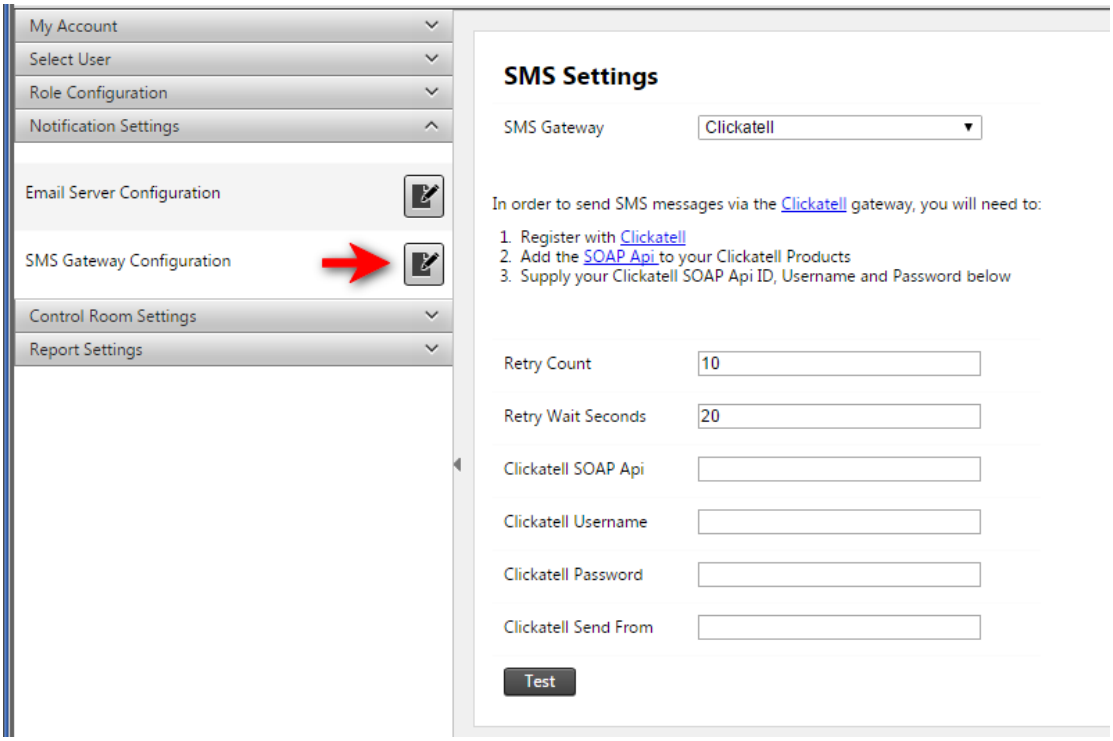
You can also receive notifications via a SMS gateway.

Step 1: Click Edit SMS Gateway Configuration icon.

Step 2: Fill in the information as required.

Step 3: Test your settings!

NB: Please register at Clickatell (www.clickatell.com) to obtain account details for SMS sending functionality.



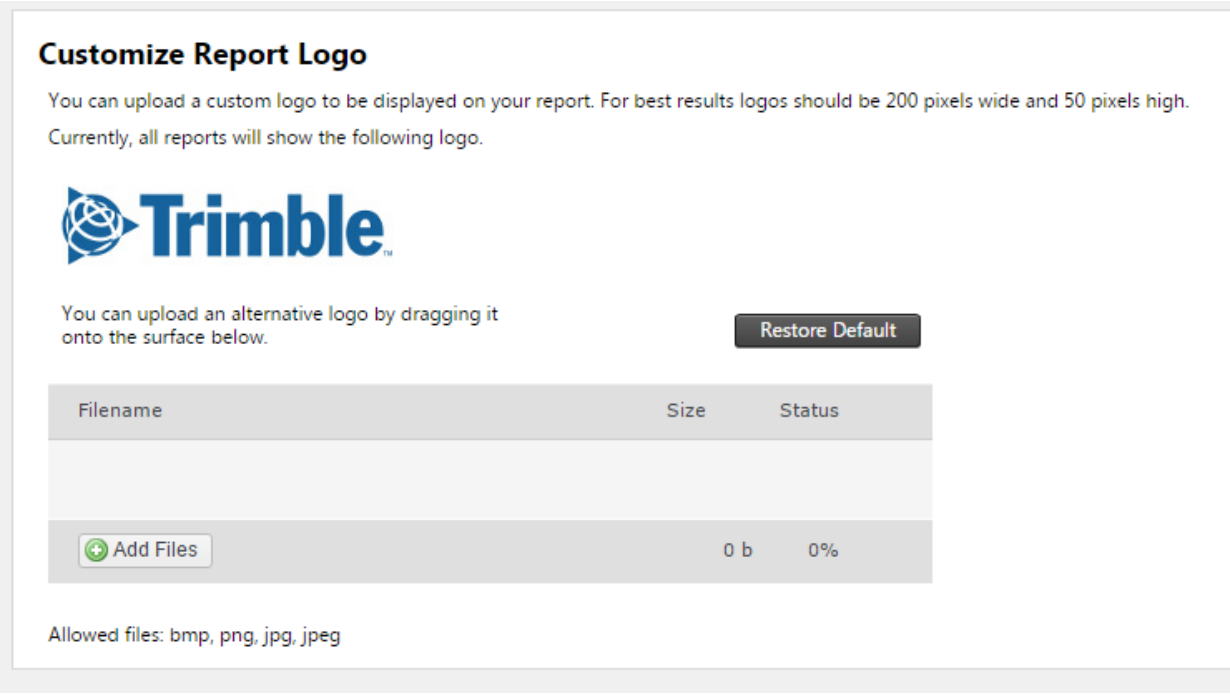
19.5 CONTROL ROOM SETTINGS

Open the Control Room Settings tab on the left hand side pane. Here you can enable *Seamless Transfer* from T4D Control Room Web if your installation is licensed to enable remote monitoring from T4D Control Room Web.

Users who access T4D Control Room Web may request to be redirected to a specific Trimble 4D Control installation. If a user uses the same username (or email) to log into both Trimble 4D Control and T4D Control Room Web, then it is possible to accept "proof of identity" from T4D Control Room Web. When this settings is enabled, such users will not have to specify a username and password to log into Trimble 4D Control.
This form of seamless transfer will not work for users logged on as "admin" - regardless of whether the feature is enabled or not.

19.6 REPORT SETTINGS

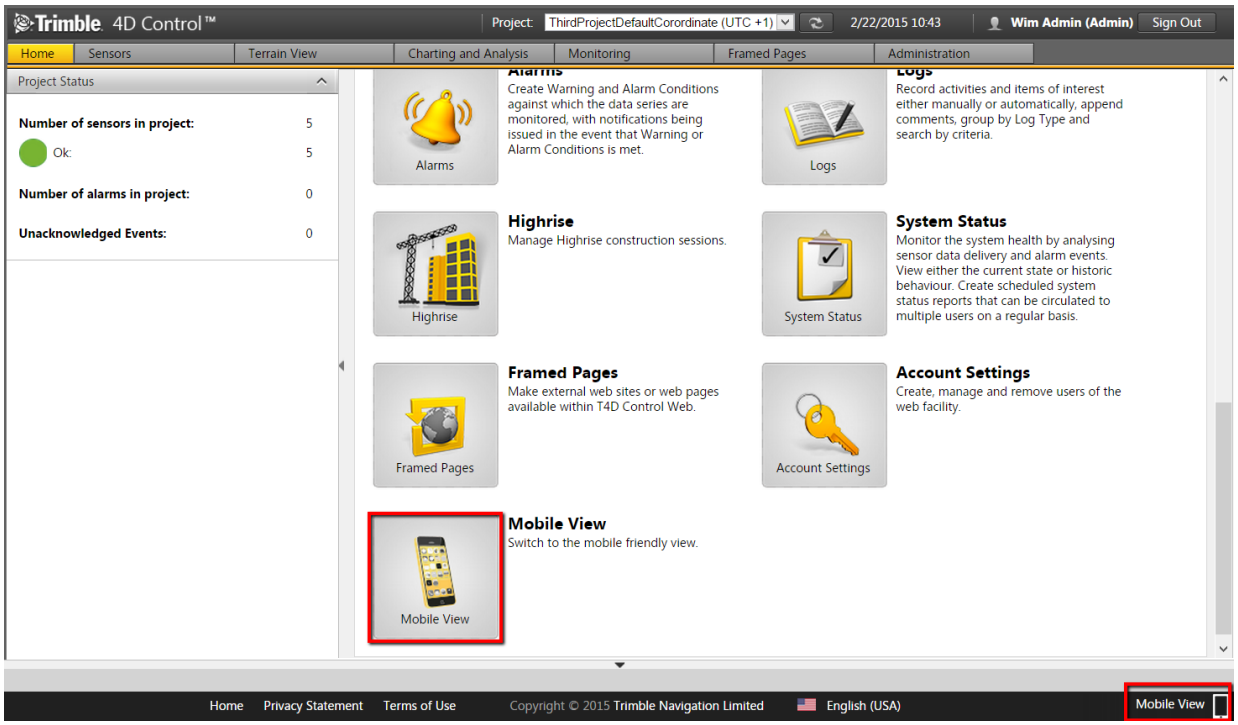
Open the Report Settings tab on the left hand side pane. Here you can upload a logo to be displayed at the top of all reports generated for the current Trimble 4D Control project.



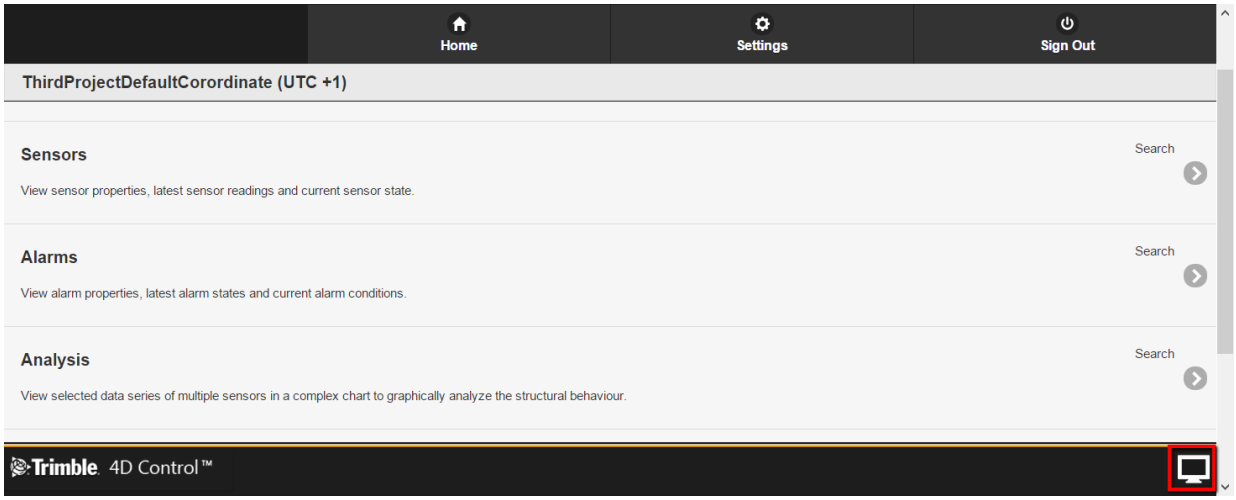
20 Mobile View

The T4D Control suite was also optimized to have a friendly interface for smaller screens such as mobile phones. T4D will automatically detect if you are using a mobile device and serve you with the mobile view. However you can elect to manually switch to the mobile view at any time.

To switch to the Mobile View, simply click in the far bottom right corner of the screen (or the mobile icon on the home page).



In order to switch back to the normal Desktop View, simply click again in the far bottom right corner of the screen.



The mobile view only offers a subset of the functionality available in the desktop view. The intention of the mobile view is to offer users a task-orientated slimmed down interface to perform tasks typical for users that only have mobile access to T4D Control.

21 Further reading

For information on how the install Trimble 4D Control please refer to our installation guide at:
http://setup-guide.web.t4d.trimble.com/version4.5

For information about Monitoring infrastructure please refer to the Trimble website at:
http://www.trimble.com/infrastructure/monitoring.aspx

There are quite a few details that we have not covered in this manual, nonetheless the user can explore the functionality of Trimble 4D Control by means of the **context sensitive help** provided on almost all interface controls of Trimble 4D Control. Context sensitive help will appear at the bottom of the page whenever the user hovers the mouse cursor over an interface control.

Below is an example of the context sensitive help provided for the "Plot Summarized Values" option of an Analysis: