



Sensori

IoT Sensor Platform



Version 1.32

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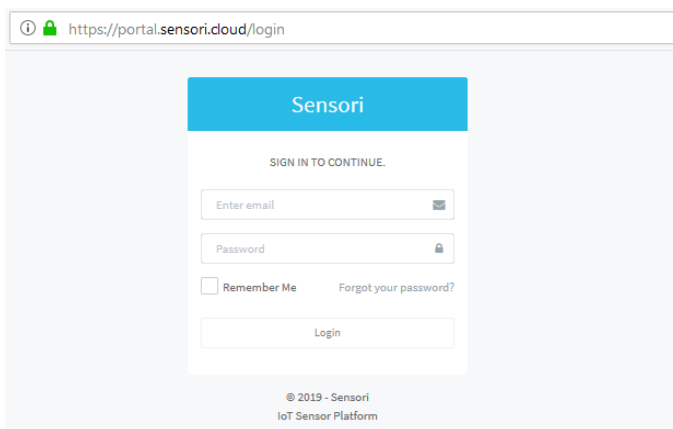
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1. Introduction

This manual provides details on how to use the Sensori Web / Cloud based presentation software.

The software has been developed by Process Monitor in the Netherlands.



2. Logging In to Sensori Server

Sensori allows you to access the system using conventional credentials (User Name and Password) or to go direct to a Dashboard using a “Direct Access Link”.

2.1. *User Name and Password Access*

To log in to the system enter the following URL in to your browser:

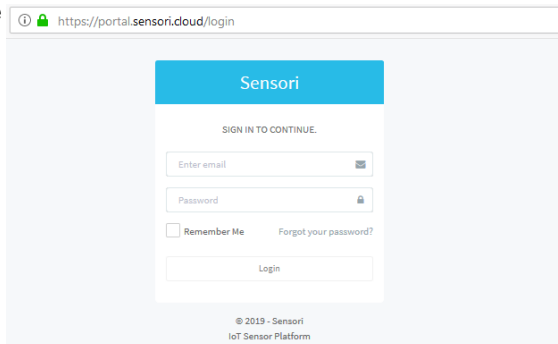
URL <https://portal.sensori.cloud>

User Name _____

Password _____

Your User Name will be your Email address. You will need to set a password when your account is first created. To set your Password, go to the login screen shown above and click on the “**Forgot your password**” link

- you will then be prompted to enter your Email address
- the server will then Email you a link which you can click on in order to set a new password
- after you have set the password you will be able to log on to the server.

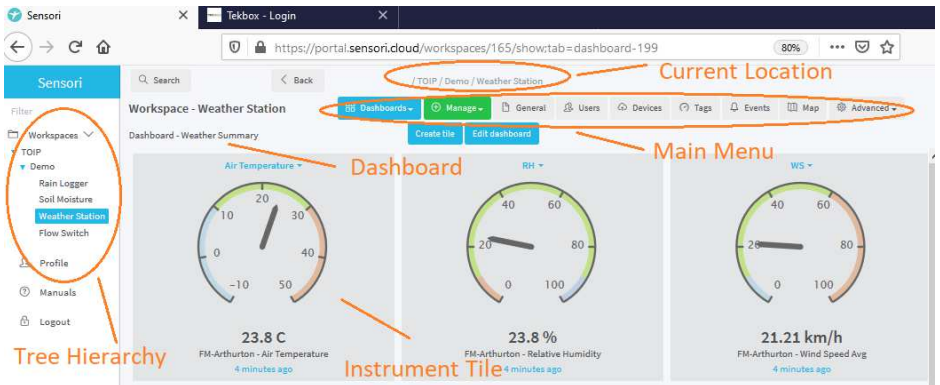


A demonstration login is available using the following credentials:

User name demo@toip.net.au

Password demodemo

After logging in you will be presented Sensori's User Interface.



The left side of the screen shows a tree style hierarchy of the sites which are available under your login. It shows the basic functions available to you:

- **Workspace:** this will contain a tree hierarchy showing all the devices to which you have access
- **Profile:** use this function to change your personal details and preferences
- **Manuals:** select this option to open the on screen help
- **Logout:** click on Logout to leave the system.

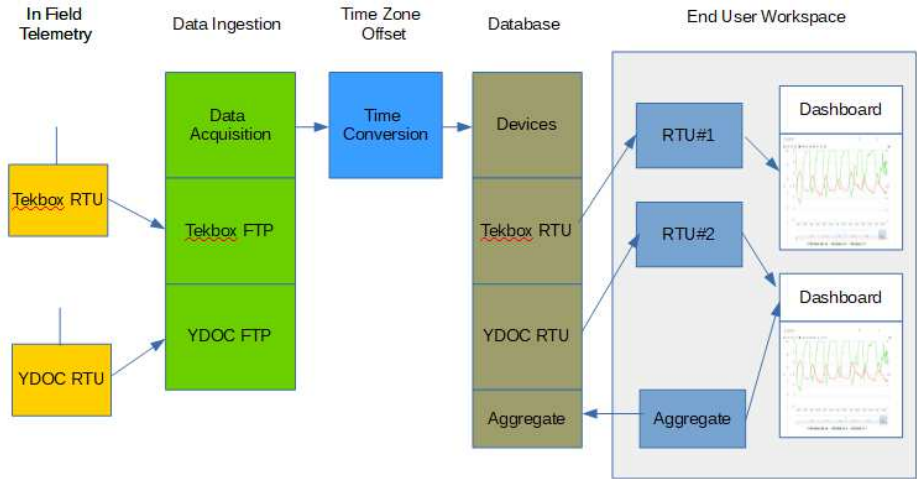
These act on the current Workspace. As a minimum you should see the following ITEMS:

- A hierarchical tree structure showing the Workspaces that you have access to
 - each telemetry unit is normally located in its own Workspace

- **Dashboards:** shows any dashboards available in the currently selected workspace
 - this is a list box from which you can select a dashboard from those available for the selected Workspace
- **General:** displays the basic properties of the Workspace. This tab is displayed by default
- **Users :** shows a list of the User accounts which have access to the current Workspace
- **Devices:** this tab shows a list of the telemetry devices you can access
 - any Aggregate (calculation) functions will also be visible here
- **Tags:** shows the sensor tags attached to the devices
- **Events:** shows any system generated alarms and events
- **Map:** used in conjunction with Locations to displays sites on a Map
- **Advanced:** if you have Editor or Admin access, you will also see an Advanced menu option from which you can see Aggregates, Locations and Rules
- **Manage:** the Manage option will be available if you have Edit or Admin access. It shows options for creating and editing workspaces, dashboards and devices

2.2. *Sensori Data Flow*

The image below shows the path of data through Sensori.



The telemetry units send data to the program's Data Acquisition module using FTP. Tekbox's telemetry units first send the data to the Tekbox IoT Broker: with the cellular (mobile phone) units, information is passed to the Broker via TCP/IP and with the Cellular units it is sent using the MQTT protocol.

Within the Database, each telemetry unit is represented as a Device, which will have a number of associated Tags. The data is then saved as a series of Time Stamped readings for each tag.

Tags can be used as an input to an Aggregation module, which performs a calculation and saves the result as a new tag.

Workspaces are used to view the hierarchy of customers, sites and devices. Within a Workspace, Users can create Dashboards on which they can display graphs and instruments.

To enable devices to be deployed in different time zones, Sensori saves sensor readings in UTC and then applies an offset when the data is viewed: with the offset determined by the setup of the device in Sensori. This approach means that you do not have to change the time in the device when daylight savings starts and finishes.

However if you have a device which is recording in local time, Sensori can apply a time offset when the readings arrive and will then save them in UTC

- for instance if you have a site located in South Australia, which is capturing the time in Central Standard Time, which is UTC + 09:30 you would set an offset of -09:30
- when new readings are received 9:30 is subtracted from the time before the values are saved
- when you view the data, the time will be offset once again according to the time zone set in your user preferences. Two users viewing the data from different time zones will thus always see the data at the correct time..

3. Using Sensori

This section provides an overview of the functionality which is used to view the data captured from the telemetry units. Some of the setup may have been completed for you by your distributor.

On screen Help



At any stage you can click on the Help button at the top of the screen to bring up the platforms On Line help system.

3.1. *Sensori Workspaces*

After you have logged in to the Sensori platform (Section 2) you will be taken to your home “Workspace”. The Workspace may contain one or more nested levels of child Workspaces which contain the information for each of your monitoring sites.

If you have set a Home Dashboard (as in Section 3.2.4) this dashboard will be opened as soon as you log in.

For example, if you log in using the Demonstration user credentials (User = demo, password = demodemo) you will see a workspace with a blue arrow alongside it:

▶ Demo

The left pointing arrow tells you that this Workspace is a “parent” and that it contains “child” workspaces.

▼ Demo

If you click on the Workspace name, the list will expand to show the child workspaces.

Rain Logger

Soil Moisture

The arrow changes to a downward pointer indicating that what follows are its Child workspaces.

Pasture Soil Mon

Weather Station

In the case of the “demo” login, the main or parent workspace is labelled “Demo” and the child Workspaces are “Pasture Soil Mon”, “Weather Station” etc.

Tekbox TBSL1 4G

Telemetry Unit

Flow Switch

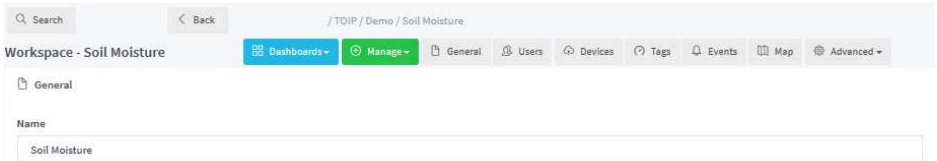
When setting up your login, your Distributor will create a primary workspace with your name or the property name.

If you operate multiple telemetry units, you should see a Workspace under it for each telemetry unit

To select the Workspace for a specific telemetry unit, click on its name in the list. The screen will then update to show all of the information for this Workspace

- Name: edit this field to change the name for the Workspace
- Set as Primary Workspace: click on this button if you have multiple Workspaces and you want this one to be the default when you log in
- Save: after making changes click on Save to activate them.

The Workspace Menu shows a list of all of the options available to you for the Workspace:



General: Gives you information about the Workspace

Users: Shows a list of the users who have access to the Workspace

Users can have 3 levels of access:

- Viewer: can view data but not save changes
- Editor: can create and update views
- Admin: reserved for high level users

If you have been given Viewer access but need to edit graphs, contact your distributor to have your access level increased to Editor.

You can have accounts created for different staff with different access levels. Each user logs in with their Email Address.

Devices: Shows the Devices attached to the Workspace

In the Workspace for a telemetry site there will typically only be a single Device. But if you want to create graphs in a Workspace which combine data from several telemetry sites, you add each device again to this Workspace. Note that this does not increase the amount of data stored: each “device” is simply a link to the real information stored in the underlying database.

Tags: Shows the tags or sensors on the telemetry unit(s)

You can use the Search option to reduce the number of items in the list.

Events: Used to display alarm events and warnings.

This could be to warn of say a low battery condition or the fact that no new readings have been received from a site.

If you have Edit or Admin Access, you will also see the **Advanced** menu tab. This includes the following:

Sources: Shows the data sources which are bringing data in to Sensori

This list will normally be empty as the data comes in via a single feed which users do not have access to.

Exports: This shows any exports which have been created

Exports are used to extract readings from the Sensori platform and export them as a file

Aggregates: Aggregates perform post processing on tag values

An aggregate may apply a calibration to a single tag or could run a formula which creates a new tag by combining values from several existing tags, or could be creating a time based summary (sum, max, min, average)

Locations: Used to record the GPS Coordinates for sites

Once locations are created, you can display the information on a Geo-referenced map.

Rules: Rules are used to test the state or value of sensor tags

A rule can be created to test for the value of a tag (above or below a threshold or out of a range) or to check if data has not been received for a period of time. Rules will then create Events of varying severity

Channels: Used to setup channels for the sending of alarms for example for advising users that a sensor value has crossed an alarm threshold

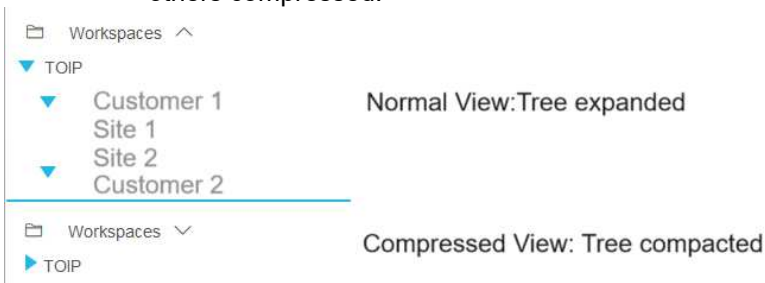
Workspaces: Shows a list of the available Workspaces. from the list you can then select, edit or delete a Workspace

Activity: Used to provide a log of changes made to the system by users.

3.1.1. Shrinking the Workspace “Tree”

Sensori displays Workspaces in a tree hierarchy. By default the system always opens with the Workspace hierarchy fully open / expanded. If you have a large number of sites and hence Workspaces, the tree can become quite long and it can take a while to navigate. You can shrink the tree so it mimises. And then expand only the branch you wish to follow:

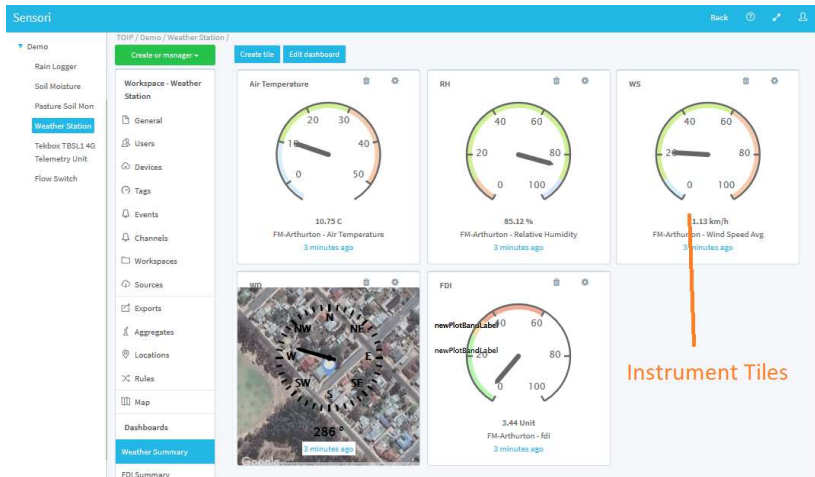
- Locate the “Workspaces” entry at the top of the left workspace section
- click on the Up Arrow
 - the Workspace tree will shrink and the arrow will invert
 - if you click on your highest level Workspace, it will expand, but all of the subordinate workspaces will remain shrunk
 - you can then expand the workspace of interest and leave the others compressed.



3.2. Dashboards

Most of the time users will interact with Dashboards which are added to a Workspace and which display instruments or graphs showing values from various sensors.

A dashboard on the workspace for a Demo Weather Station is shown below:



This dashboard contains a number of Instrument Tiles. The Instrument tiles show the current value of the sensor tag to which they are attached. They do not show any history.

The dashboard below shows a Time Series Graph which is added to a "Tile". Graph tiles are used to show historic information but there are a range of other Tile types which you can also add.



Dashboard tiles may also be used to display:

- an image such as a company logo
- a link to another html page, for example to display a weather forecast or data from another server from within Sensori
- reports showing summaries of sensor values over time.

3.2.1.1 Colour Themes

When they are created, dashboards will display with the program’s default colour scheme. At any stage you can change the “theme” or colour scheme which is being used:

- navigate to your workspace
- locate the Dashboard you wish to change
- click on the Edit Dashboard button
- click on the List Box in the section labelled Custom Style
- select your new colour theme from the list
- save the changes.

Custom style

To remove the custom style or go back to the default style, deselect the custom style by clicking the cross X icon in the field below

BlackDash - BlackDash X

Save

3.2.2. Navigation on Graphs

Graphs are a very flexible mechanism for viewing historic data. You can navigate around the graphs to control how much data is viewed.



Edit Option

Click on the Edit icon to edit the graph
This option will be greyed out if you are a “Viewer”

L & R Axis

A graph can contain one or more vertical or Y axes
Sensor tags will then be linked to display relative to one of the axes. The scaling can be manually set or automatic.

Time Span

The time span controls how much data is displayed
You can click on any of the preset time scales to display the corresponding amount of data

Time Sliders

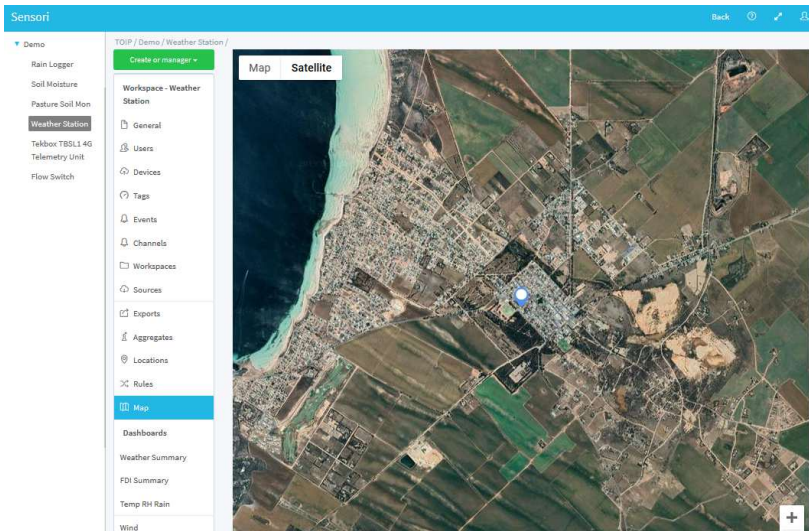
These allow you to view more of less of the overall data

When a graph is created, the user can control how much data is loaded. If a site has been operating for 3 years, loading all of the data to a graph can be very slow. So users can choose to load the last 6 months of data. Then when the data is viewed on a graph, the graph may be set to display 1 month of data. The slider bars will then show the 1 month period in dark grey to the right and 5 months in light grey to the left. Drag the sliders to change the time span which is being displayed.

For further information on how to select tags and control the graph properties refer to Section 5.1.6.1)

3.2.3. Map Display

Sensiori can display your information on a geo-referenced map. You can control which sites appear on a map and what sensor tags show for each site.



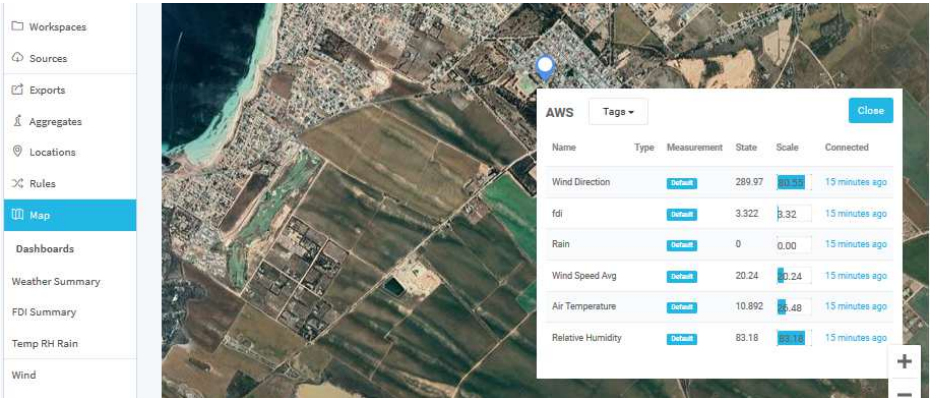
Locations are used to record the GPS coordinates of a site (Refer Section 5.1.9.1) and the Location can then be displayed on a Map page. The image above shows the Map Page for the demo weather station.

Map / Satellite
+ / -

Click on this button to change the map type
Click on the scale icons to zoom in or out

The icon which is plotted at the Device's location is interactive: click on it to display the current sensor or tag values

- you can also click on the drop down list to switch between a display of the “Tags” and the “Location” or coordinates of the site.

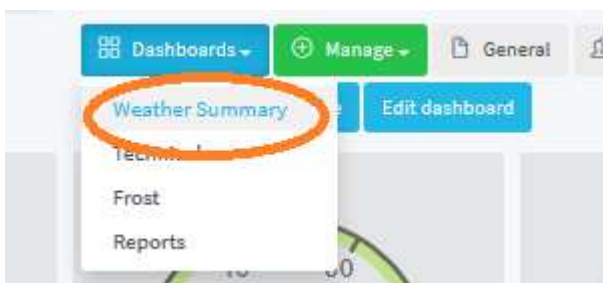


3.2.4. Setting a Landing or Home Page

By default, when you log in to Sensori, you will be presented with the General screen for the highest level Workspace you have access to. But if you have multiple Workspaces and each Workspace has multiple Dashboards, you can set the program to open on to a specific Workspace and when that Workspace opens to load a specific Dashboard.

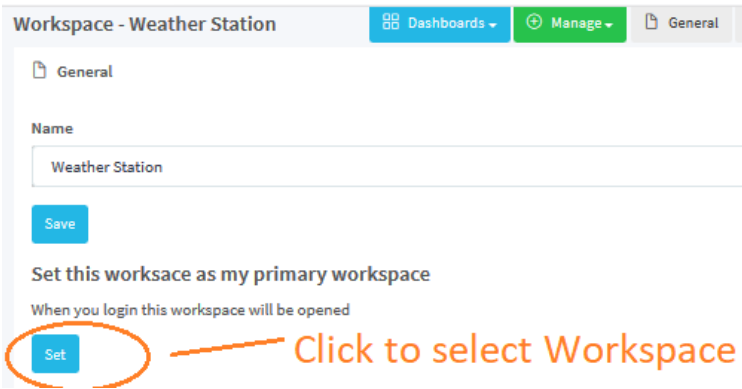
To set your Primary Workspace:

- after logging in, select the Workspace you want to select as your “landing” workspace
- make sure that the **General** tab is selected
- now click on the **Set** button which appears below the text “Set this workspace as my primary workspace”
- whenever you log in , this workspace will be opened.

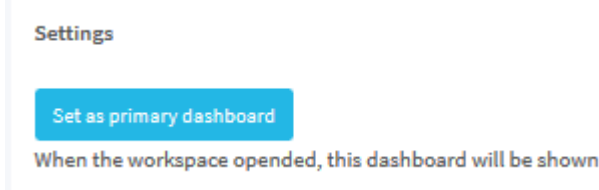


After choosing your primary Workspace, you can select a Default Dashboard:

- from the menu click on the **Dashboards** entry
- when the list of Dashboards opens, select the Dashboard you wish to set as your landing page



- with the Dashboard selected, click on the **Edit Dashboard** button
- in the Settings area, click on the button labelled **Set as Primary Dashboard**
- close the dashboard. You can then log out and confirm that this Dashboard opens when you log back in.



3.3. Direct Access Links

The Direct Access Links provide a way to access the system without the need to log in. This is the preferred method of access for Smart Phones which have a limited screen size, as the links can be saved as Shortcuts and accessed at any time without having to type in any credentials.

Direct Access links are tied to a Dashboard and include a security hashtag which is used in place of the User credentials. Because the links can be accessed by people located in different Time Zones, you can also control the time zone that will be used when the link is displayed.

A Direct Access Link for the Demo weather station is shown below:

<https://portal.sensori.cloud/public/dashboards/199/token/kJDPp>

To locate a Direct Access Link:

- select the dashboard and click on ***Edit Dashboard***
- scroll down the page until you see the section labelled **Direct Access Links**
- a default link should display
- from the ***Select Users to Use Settings From*** drop down list, choose a user whose time zone you wish to apply to the link and then click on ***Update***
 - to make additional links for other users, click on ***Create***
- you can then copy the link and paste it as a favourite in the Browser of your phone, portable device or PC.

4. Configuring Sensori

The following sections contain information on how to configure Sensori. Whether or not you can see the individual options, is controlled by your level of access to the platform:

- Admin: An Admin is the highest level of user. Some functions for instance are reserved for “Admin” users
- Editor: an Editor can change settings and create new Workspaces and dashboard.
- Viewer: a Viewer has read only access. They can open Workspaces and Dashboards but can not save changes to them.

4.1. *Importing Telemetry Data to Sensori*

Before the data for devices can be viewed within Sensori, you must configure them so that they send their readings to the program’s data input process. Most devices send data via FTP to Sensori – either directly or through an intermediary such as the Tekbox IoT Broker.

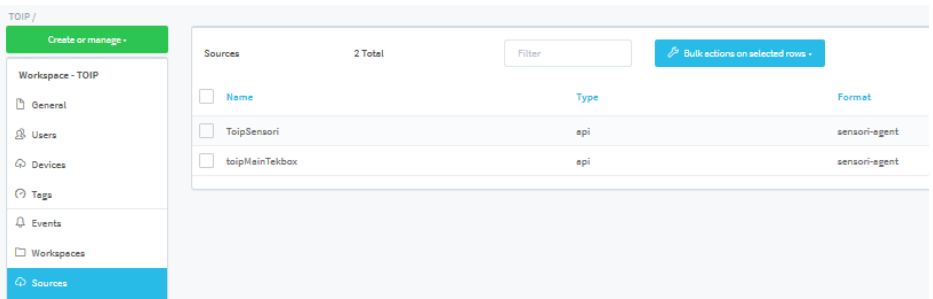
4.1.1. **Configuring Data Import (Data Acquisition)**

The data acquisition (DAQ) module in Sensori checks the input sources (FTP, HTTP etc) server every couple of seconds for new files to upload. When a new device has been detected, it will be automatically added to the list of Devices at the Administrator level. The system administrator (usually TOIP Pty Ltd) will then add any units under your control, to your Workspace.

Under normal conditions you will not need to add or alter a data source: it will be done for you by the System Administrator.

To check the Data Sources available to you:

- click on the **Sources** entry in the Workspace
- the available sources will be shown in the right pane



Each product type (YDOC, Tekbox etc.) has been allocated different TCP credentials so that the data can be loaded to specific directories and then processed using the correct handler.

4.1.2. YDOC RTUs - FTP

The export credentials for YDOC RTUs are as follows:

Server URL	ftp.sensori.cloud
User	toipM844
Password	GHWGPOzF
FTP Mode	Passive
FTP Port	21
FTP Directory	/
Data Format	Native (txt)

4.1.3. YDOC RTUs - HTTP

The HTTP import module may be used where you are unable to use FTP and when using the WiFi Option board on the YDOC. Select either the HTTP option under the Modem Output option or the HTTP Output under the WiFi Menu.

Set the credentials as follows:

Server URL	agent.sensori.cloud
------------	---------------------

Extended path	api/d/h/um844/tYhp/M3v
User	(not required)
Password	(not required)
Port	80
Security	Basic

Note:

- you must omit the “http://” from the start of the URL
- the user name and password are embedded in the extended path so the two fields should be left blank
- ensure that there is no “/” at the start of the extended path.

When you have completed the setup, run a HTTP Test.

4.1.4. YDOC RTU with Iridium Satellite Modem

When using an Iridium Edge satellite modem with the YDOC ML315/417 telemetry units, you will need to have the satellite data provider set up the Iridium back end to send data out via Email.

There are two email addresses available and you choose the one to use depending on whether the YDOCs are sending the data in plain text mode or compacted mode.

YDOC + Iridium – Plain Text Mode

toipYdocIridiumNoncompacted@agent.sensori.cloud

YDOC+ Iridium - Compacted Mode

toipYdocIridiumCompacted@agent.sensori.cloud

When using Iridium modems, make sure to follow the information provided in the YDOC ML417 RTU manual on how to name the parameters/tags.

4.1.5. Tekbox RTUs - FTP

The export credentials which must be set in the Tekbox Broker for Tekbox RTUs are as follows:

4.1.5.1 LoRa WAN RTUs

Server URL	ftp.sensori.cloud
User	toipMainTekbox
Password	XBHsIB1C

4.1.5.2 4G RTUs

Server URL	ftp.sensori.cloud
User	toipTekbox2
Password	GcSBS1cv

4.1.6. Other RTUs

As Import processors are added for other types of telemetry units, the credentials to use for the FTP export will be added in this section. If you are unsure whether your device is supported, contact TOIP.

4.1.6.1 Campbell Scientific CR310

Sensori supports import of data via FTP from Campbell Scientific with loggers which have been configured to send a *.dat file in the CR310 export format.

The credentials to use are:

Server URL	ftp.sensori.cloud
User	toipCampbell
Pass	3ZA0iRGo

4.1.7. Checking Uploaded Files

You can use an FTP client such as FileZilla to connect Sensori's FTP server to review the files which are being transferred:

- open the FTP Client
- create a new connection for the RTU type you are using, with the credentials shown above
- connect to the server
- new files will be shown in the root folder
- once they have been read, files will be transferred to the "processed" folder.

Note that after configuring a device to send data to Sensori, it may take up to 4 hours for the device to appear.

4.1.8. Restrictions on Uploaded File Size

To prevent the data ingestion process from becoming bogged down by processing of very large files, a maximum file size limit of 100 kBytes is imposed. Any files larger than this size will not be processed.

Sometimes it may be necessary to process a large file, for instance to import data after a site has been off line or to load historic data.

If this becomes necessary, contact TOIP and they will assist with the process of breaking the file into smaller files, setting them up with the right headers and naming convention and importing the files.

4.2. *Presenting RTU Information in Sensori*

When adding new telemetry sites you should give some initial consideration to how you want the data to appear.

Sensori displays data in a hierarchical structure of Workspaces. When you log in, your home screen will normally display the Highest level of workspace you have access to. You can then and all of the workplaces which are subordinate to it

- if you have multiple customers, create a Workspace for each of them

- as customers may have multiple farms, you can create a Workspace for each Farm or Property
- as most farms will have multiple monitoring stations (RTUs or sites) create a Workspace for each Site
- Devices or RTUs can then be attached to the Workspace for that monitoring site
 - devices can be added to multiple Workspaces. This allows you to include the data at the individual site level and then again in a summary view
 - this does not create multiple copies of the data, rather when you create a new Device it just links to the master device which is held under the highest level of the Workspace (available to Admin users only)
- users are then given either **Admin**, **Editor** or **Viewer** access to the Workspaces
- try and develop a logical format for your tag names. Especially try and make them consistent
 - try and stick with common abbreviations
 - SM Soil Moisture
 - ST Soil temperature
 - AT Air Temperature
 - RH Relative Humidity
 - WS Wind Speed
 - WD Wind Direction
 - SR Solar Radiation
 - PR Precipitation (Rainfall)
 - EC Electrical Conductivity

- when adding sensor depths, use a leading zero e.g. SM 020cm instead of SM 20cm. This ensures they sort correctly when in alphanumeric lists
- do not repeat information which is contained in the engineering units or sensor type.

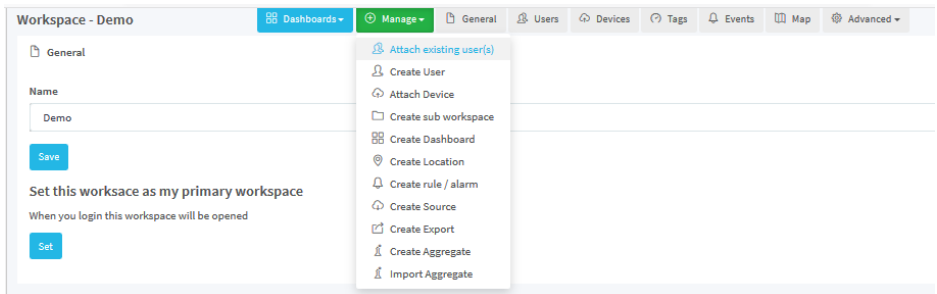
4.3. **Creating User Accounts**

A distributor will be added as an Admin level user for their Primary Workspace. They will then inherit Admin level access rights for all Workspaces created below that level.

An Admin level can create Users and assign them access to their individual workspaces.

To create a new user account:

- if you have not already done so, create a new Workspace for the customer
- select the Workspace by clicking on it with your mouse
- then click on the **Users** tab for the Workspace

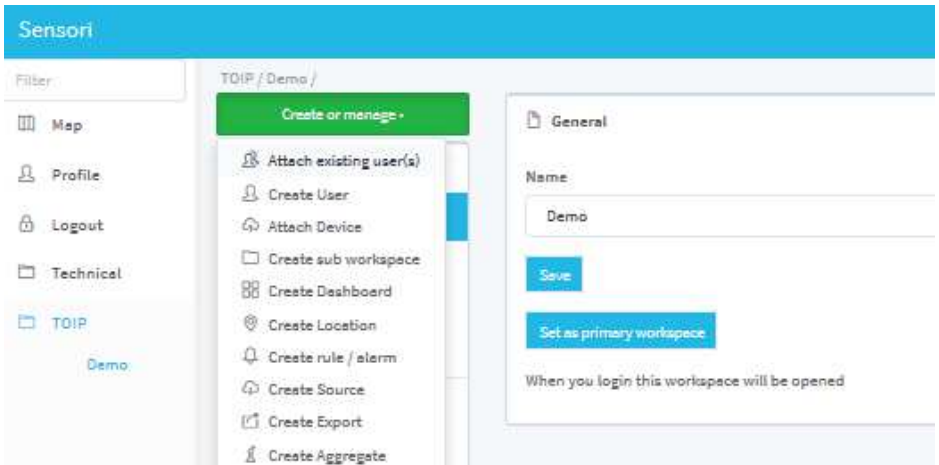


- now click on the **Create or Manage** menu and select add **Create User**
- the User Properties dialogue box will display. You can then set the properties for the user:
 - First Name: The user's first name
 - Last Name : The users's surname
 - Email: The Email address which this user will use when they log in. This must be a valid address as an email will be sent to it so that the user can set their initial password

- Mobile: The user's mobile phone number in the format 614xxxxxxx
- Language : set the language to English
- Time Zone: because the RTUs save the time in UTC, you need to enter the Time Zone in which the user is located, so that the time displayed on the tags will be adjusted to match the current time in that location. Make sure you set the time offset to the standard time zone, not the time offset during daylight saving (e.g. use 10:00 for Sydney, not 11:00)
- Apply daylight saving automatically : set this to **Yes** if daylight saving is used in the location. The time will then be automatically adjusted for daylight savings
- click on Save to save the user profile.

Once the User account is created, you need to give them access to each of the Workspaces they control:

- select the first workspace by clicking on it with the mouse
- when the **Workspace** Menu displays, click on the **Users** tab
- now click on the **Create or Manage** menu and select **Attach Existing User(s)**
- a list of the available users will display
- click on the check box next to the user account and then click on the **Attach** menu option
- the user account will then display in the list of users for the workspace
- if you want the user to receive alerts via EMail or SMS, you can then subscribe them to the Notification Channels for the relevant workspaces as per section 8.1.

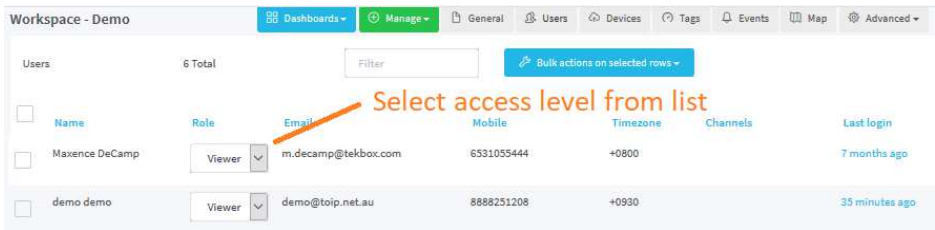


4.3.1. Setting a User's Access Level

After attaching a user to a Workspace (as shown in the previous section) you must set the level of access the user will have. The available options are:

- Admin
 - this should only applied for the person who will control the workspace. If you are a customer, the Admin level access may be held by your Distributor
- Editor
 - this level of access should be given to a user who needs to modify the data views. It should be someone who has had training and is competent in the use of the program
- Viewer
 - this level of access prevents the user from saving any changes to the setup. They can view data but not change it

Choose the appropriate access level from the drop down list box in the User list.



4.3.2. Notifying New Users of the Creation of their Account

Once you have configured the account, you can have Sensori send a welcome Email to the new User. The Email will include a link which they click on to acknowledge creation of their account and to set their initial password.

To send a User the Welcome Email:

- select the Workspace in which you created the User account
- from the menu click on **Users**
- when the list of Users with access to this Workspace displays, click on the Checkbox next to the name of the user
- now click on the **Bulk Actions on Selected Rows** button
- **from the menu which displays, click on** Send Welcome Email
- an Email will be sent to the user.

4.3.3. Changing a User's Password

Administrators can not set a new password for users. Instead, the system generates a Password Reset email, which includes a link which they can use to change their own password.

To enable a User Password Change:

- select the Workspace in which you created the User account
- from the menu click on **Users**
- when the list of Users with access to this Workspace displays, click on the Checkbox next to the name of the user
- now click on the **Bulk Actions on Selected Rows** button
- from the menu which displays, click on **Send Reset Password Email**
- an Email will be sent to the user.

Any User can also change their password at any time:

- go to the Sensori login screen <https://portal.sensori.cloud>
- when the welcome screen displays, click on the Forgot Your Password link
- a dialogue box will open which prompts you to enter your Email address
- enter the address and click on OK. An Email will be sent to this email address. The Email includes a link which, when clicked on, will allow you to set a new Password.

4.4. Adding RTUs

The process for adding RTUs is dependant on the type of units you are adding. In general, RTUs will be added automatically to the highest level Workspace as soon as they are added to the program's data import module:

- YDOC RTUs: once the RTU has been configured with the credentials shown in section 4.1.2 the unit will be added the first time it connects
- Tekbox RTUs: you must add the RTU to the Export in the Tekbox Broker, then add it to the Task Automation process for Sensori.

Once an RTU is added, you will be able to see it in the Devices tab under the highest level Workspace (if you can't see a device, you may not have permission to view this level).

A device can then be added to any number of Workspaces, This provides a simple mechanism for sharing data between users, or for creating different views of the data: for instance a private view and a public view

- adding a Device to multiple Workspaces does not create duplicates of the data
- the additional entries are just fed with the data from the primary unit
- this approach is useful if you want to be able to post summary data in a single Workspace
 - first off, create a Workspace for each Device (telemetry unit or RTU)
 - now attach the Device to the Workspace
 - you can then create Dashboards to display the data for that device in its Workspace
 - create an additional Workspace with a suitable name e.g. Summary or Overview
 - now attache all of the devicess again to this Workspace
 - you can now create Graphs and other Tiles which combine data form all of the RTUs.

4.5. Adding an RTU to a User's Workspace

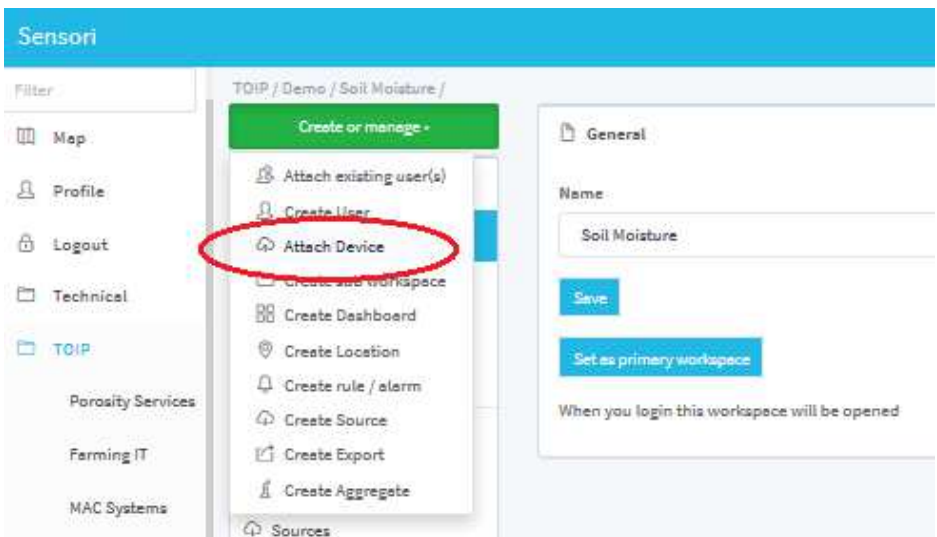
After you have added an RTU at the top level, you must then attach it to the Workspace for the required user. This should be done at the level of the Device e.g. <Distributor>/<Customer Name>/<Site Name>/<Device Name>

- if you have not already done so, create the additional Workspaces to hold the RTU

- select **Devices**
- click on the **+** symbol
- when the list of available Devices displays, click on the Checkbox next to the device/RTU name to select it
- then, at the top of the screen, click on the **Bulk Actions** drop down list box and select **Attach**
- the device and all its tags will now show in the workspace.

Adding a device to a workspace does not create a new “physical” device. Instead, it creates a new link to the actual device. An RTU can thus appear in many Workspaces without taking up more data.

Normal practice is to add a Device to a Workspace and to create graphs of the RTU’s data in that Workspace. But you can’t include data from tags on other RTUs in the graphs. The solution described above gets around this limitation.

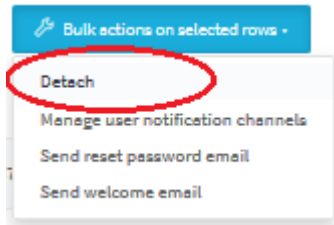


4.5.1. Removing a User’s Access

You can remove a user’s access to a Workspace at any time. To do this

- select the Workspace
- click on the **Users** tab
- when the list of users is displayed, locate the user and place a tick in the Checkbox next to their name

- then click on the **Bulk Actions on Selected Rows** button and select **Detach**



4.6. Time Zones

The Sensori platform saves all tag values in Universal Coordinated Time (UTC or GMT). All RTUs / Devices should thus have their time set to UTC. If this is not done, devices will end up with an hour gap each time the clock is changed at the start and end of daylight savings.

4.6.1. Time Zones and Users

When information is presented to users on graphs, tables etc., it will always be shown in their Local Time.

4.6.2. Time Zones and RTUs

If your RTU is reporting in UTC, set the **Time Offset** for the device to 00:00.

If your RTU is reporting in Local Time rather than in UTC, then you must apply an Offset when adding the Device to Sensori:

- if you are located in the Eastern Seaboard of Australia, which uses EST, the offset to UTC is +10:00 hours
- when you add the Device to Sensori, set the **Time Offset** to -10:00 so that it subtracts 10 hours from the time stamp prior to saving the values

4.6.3. Aggregate Functions and Time Zones

When entering Start times on Aggregate Functions, the time is set in UTC.

When an Aggregate function performs a calculation and creates a new tag, the values will also be saved in UTC. An offset will then be applied according to the time zone in which the user viewing the data is located.

4.6.4. Time Zones and Direct Access Links

When a Dashboard is created, a Direct Access Link is automatically added. The link can be viewed in the Dashboard properties (See Section).

You can create multiple Direct Access links, each which can get its time zone from a different user.

4.7. Configuring Sensor Tags

Sensori saves readings against a Tag. A telemetry unit will thus consist of a number of tags. Aggregate functions process the information from one or more source tags and then save the result as a new tag.

Once a device has been added to a Workspace, the Tags associated with it will appear in the Tags section. You should check that the names and other fields are correct and add any missing meta-data.

4.7.1. Setting a Tag Properties

Depending on the type of RTU you have added, some or all of the Tag properties may be automatically set to the required values: where possible the values will be set according to the meta-data defined for the tag. If they are not, or if you want to update them, you can edit the Tag properties as follows:

- from the Workspace, click on the **Tags** option to select the Tag list
- locate the tag to which you want to edit e.g. SM 010cm
- click on the tag to select it and view its properties
- select the **General** tab
 - Name This is the descriptive name for the tag. You can change this from the default value to something which you find more meaningful e.g. SM 010cm
 - Code This field is a unique identifier for the tag. It is system generated and can not be changed
 - UUID Not currently active, but will be used to allocate a unique type ID to each unit
 - Colour Select the colour which you want to be used when graphing this tag. Refer to the list of suggested colours in section 9

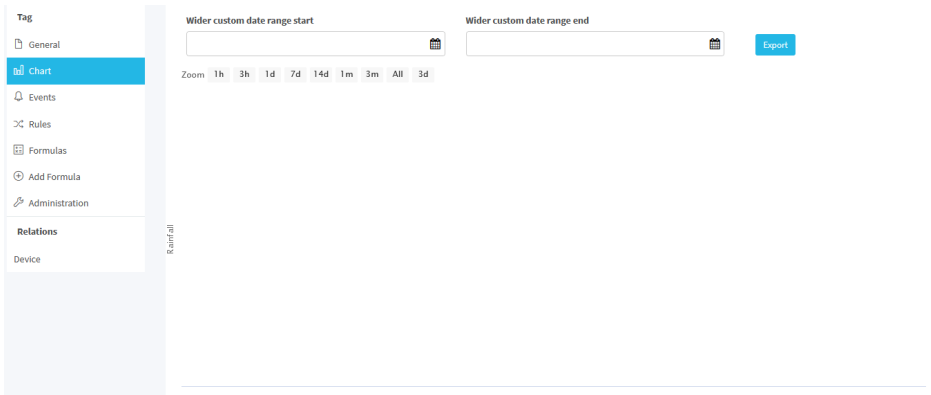
- Label Enter the default label to be used when the tag is added to a graph
- Type Choose the type of Sensor from the available list e.g. Soil Moisture %. If there is no matching entry, leave it blank
- Unit Set to the desired Engineering Unit e.g %
- Valid Measurement Range Min Set this to the smallest value which will be considered valid. Anything less than this will be excluded by the input validation process
- Valid Measurement Range Max Set this to the largest value which will be considered valid. Anything greater than this will be excluded by the input validation process
- click on **Save** to save the changes
- in the Configuration Section at the bottom of the screen
 - Min Set the minimum valid value for the tag
 - Max Set the maximum valid value for the tag
 - the Min and Max will be used to set the Y axis scaling any time this tag is added to a graph
 - the Min and Max must also be set in order to add Alarm notifications based on the value of the tag

4.7.2. Viewing Data for a Tag

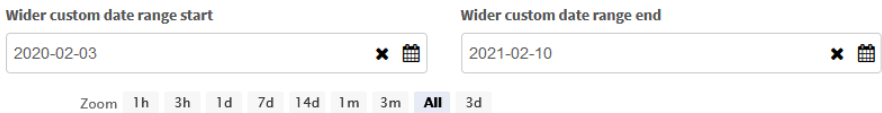
You can view the data from a tag in a workspace via a Chart or Instrument created on a Dashboard. But often you will need to simply preview the data for a tag to check for missing or noisy values.

To view data for a Tag:

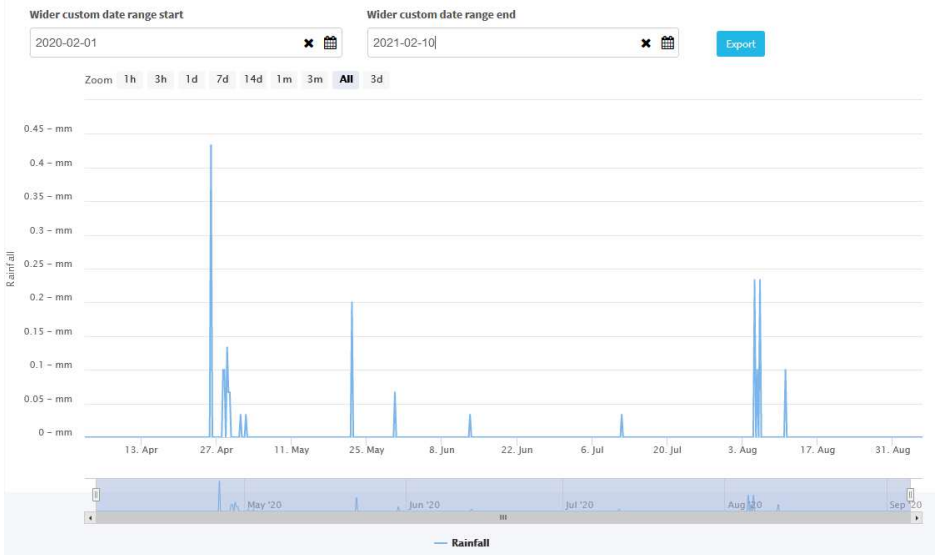
- from the Workspace, click on the **Tags** option to select the Tag list. Alternatively click on the Devices tab and then select Tags for that device
- locate the tag to which you want to apply the scaling e.g. SM 010cm
- click on the tag to select it and view its properties
- the screen will open to a Chart view of the tag's data



- to ensure the display opens quickly, Sensori defaults to displaying the last 7 days worth of data
- for tags such as Rainfall, there may not be any rain for the period, or you may wish to look back over a wider time range
- to do this you use the "Wider Custom Date Range" selection boxes



- initially the START and END dates will be blank
- click on the Calendar icon and select a date for which you want the viewed data to start and finish
- Sensori will then display all the data for that time range



- once you have the full view available, you can use the Slider bars on the bottom of the graph to restrict the view to a sub set of the data and to then scroll through the full time period.

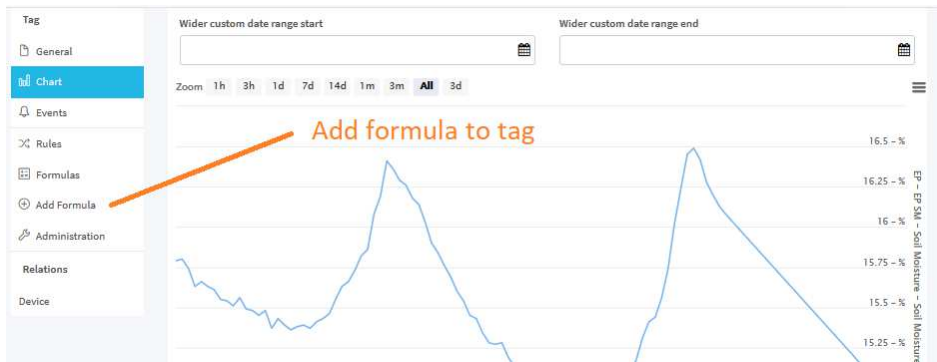
4.7.3. Applying Scaling (Calibration) to a Tag

You can apply Scaling to a Tag so that whenever a new reading is received, the scaling or calibration factor will be applied. This is important for products such as the EnviroPro (which reads high in clay soils) where it is not possible to apply calibrations on the probe and they must thus be applied at the software level.

This is done by applying a Formula to the tag. More complex functions can be performed in an Aggregate function.

To apply a scaling factor or calibration:

- from the Workspace, click on the **Tags** option to select the Tag list
- locate the tag to which you want to apply the scaling e.g. SM 010cm
- click on the tag to select it and view its properties
- locate the **Formula** option in the menu and click on the “+ **Formula**” icon



Now click on the Formulas menu option

- an entry will be added to the formula list, labelled “New Formula”
- you can then select the formula and edit it

The screenshot shows the 'Formulas' section of the interface. It includes a table with the following data:

<input type="checkbox"/>	Name	Order	Active	Expression
<input type="checkbox"/>	newFormula	1	true	m*1

Other elements include a 'Filter' button, a 'Bulk actions on selected rows' button, and a '1 Total' count. An orange arrow points from the text 'Select Formula to Edit It' to the 'newFormula' entry in the table.

Once the new formula entry has been added, you can select it to edit its properties:

- in the **General** section, click on Name and give the formula an
- appropriate name e.g. Scaling
- in the **Expression** field, enter the calibration equation you want to use
 - the tag value is represented by the character m
 - for an EnviroPro soil moisture probe you can use measurement * 0.5 which would be entered as $m*0.5$
 - see the section on Formulas for more details on how to make more complex calculations.

General

Name

Order

Expression

To use a measurement in the formula use the letter m as placeholder and enter it in the placeholder list

Place holder(s)

Enter all the placeholders of 1 letter you used in the formula comma seperated like a,b,c All placeholders must be listed in the placeholders below!

Save

5. Creating Data Views

Once you have added a Device and configured its Tags, you can then use Dashboards to display the data.

To prevent dashboards from getting too busy, you should think about creating multiple dashboards and grouping their content according to function: e.g. one for an Overview, one for Technical information etc.

For the benefit of users of Smart Phones, which have limited screen size, Sensori automatically creates a “Direct Access Link” which can be used to go straight to a dashboard. Dashboards will automatically resize to suite the display resolution.

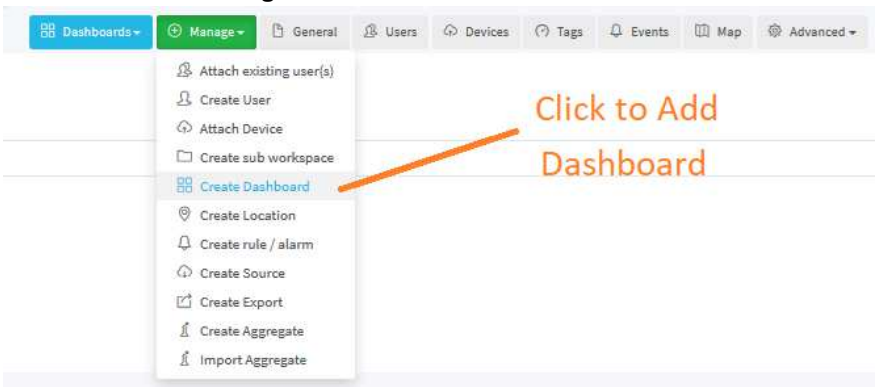
5.1. Creating Dashboards

Dashboards can be created from scratch or by copying from an existing Dashboard.

5.1.1. Creating a Blank Dashboard

To create a new Dashboard:

- work down the Workspace Hierarchy until you locate the Workspace to which your Device is attached
- click on the **Manage** menu and select **Create Dashboard**

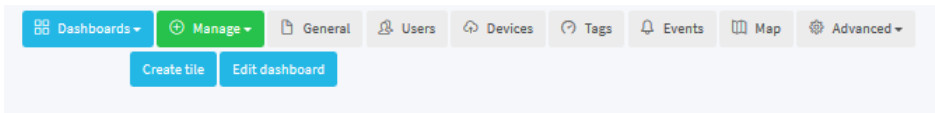


A new Dashboard will be added

- click on the “New Dashboard” entry to view it.

Once created, a Dashboard will have two buttons:

- Create Tile: click on this to add a Graph or Instrument
- Edit Dashboard: click on this to edit the dashboard properties
 - when the Dashboard properties display, click on the General tab
 - you can then give the dashboard a new name
 - a number of pre-defined dashboard styles are available for selection from the drop down list box.



5.1.2. Setting a Default Dashboard

You can set a Dashboard so that it automatically opens when you select a Workspace. To do this:

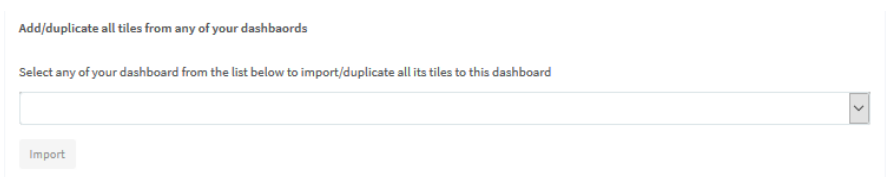
- select the Workspace
- select the Dashboard you wish to set as the default and select **Edit Dashboard**
- in the Dashboard properties, click on the **Set as Primary Dashboard** button.

5.1.3. Copying an Existing Dashboard

You can create a new dashboard using an existing dashboard as a template. All of the Tiles (graphs, Instruments) on the source dashboard will be reproduced on the copy.

To create from a Copy:

- work down the Workspace Hierarchy until you locate the Workspace to which your Device is attached



- click on the **Create or Manage** menu and select **Create Dashboard**
- A new Dashboard will be added

- click on the “**New Dashboard**” entry to view its Properties
- locate the “**Add/duplicate all tiles from any of your dashboards**” section at the bottom of the screen
- click on the List Box and then choose the dashboard whose contents you wish to copy
- all the tiles and settings on the source dashboard will be replicated in the copy.

Hint:To make sure that the copied dashboard functions correctly, always refresh your browser by pressing **F5**, before you edit the new dashboard.

5.1.4. Direct Access Links

Direct Access Links provide an easy way to access information from Sensori, without having to log in with a user name and password.

When each Dashboard is created, Sensori will automatically create a Direct Access Link. This is a URL which contains the ID of the dashboard and a “hash tag” token. The hash tag provides security and is used instead having to embed the user name and password in the URL.

Direct access links

Links contain settings like timezone and language from the user that created the dashboard or link. But can also be set to some workspace user its settings with the form below.

https://portal.sensori.cloud/public/dashboards/791/token/O8c9l

Select user to use settings from

Update

Create

If you have users viewing the dashboard from different time zones, click on the Create button to create a new link, then select the users whose time zone is to be used. The user’s time zone will then be applied when the dashboard is viewed.

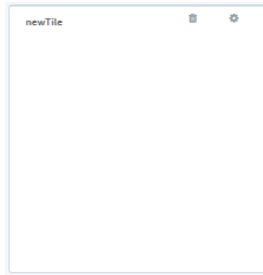
5.1.5. Adding Tiles

Graphs and Virtual Instruments are added to Tiles.

Click on the **Create Tile** button to make a new tile

- the new tile will be created with the default dimensions
- click on the **Rubbish Bin** icon to delete a tile

- click on the **Poperties** icon to edit the tile properties



From there you can select the type of tile to use and then configure the Tile.

The available tile types are:

Time Series Chart	Shows tags on a graph
Gauge Chart	Shows the tag on a virtual instrument
Solid Gauge	A variation on the gauge with a solid infill
Table	Shows the current value of one or more tags in tabular format
Map	Shows the tag on a Map at the location set for the tag in the Location field
Percentage Bars	Shows the tag value as a percentage of the range between the Min Value and Max Value set in the Tag configuration
VMI Table	Used for tanks with level to volume calculation
VMI Gauges	Used for tanks with level to volume calculation
State	Used to show the state of a Digital (Boolean) signal
Wind Direction	Used to draw a wind direction compass
Reports	Used to show a tabular summary of sensor values
Bar	Shows the sensor on a bar which runs form 0 to 100%
HTML	Used to display a web page generated from another server
Image	Used to embed an image on the page, such as a company logo

5.1.5.1 Changing the size of a Tile

At any stage after adding the tile you can change the size at which it will display on the Workspace:

- if the Tile properties are open, close them
- click on the Tile in the Workspace to select it
- you can then drag the corners or edges of the tile to re-size it
- you can also move the whole tile to different positions on the dashboard.

5.1.6. Adding a Time Series Chart

After creating a new Tile and setting the type to Time Series Chart, click on the Save button to activate the selection. You can then set all of the properties for the chart/graph.

5.1.6.1 Time Series Chart Section

This is where you set the basic properties for the chart

- Name : set this field to the Name you want to give the graph
- Time period to load measurements for
 - this setting controls how much data loads in to the graph
 - Choose one of the settings from the list e.g. Days and then 7
 - if you want to start the display from a particular time of day, select it in the **Time Period Start Point**
 - the longer you make this span, the longer it will take to open a graph
 - but a long time span is necessary if you want to be able to view all of your history
 - as a result you may need to compromise and change the default span when needed or create two graphs: one with a short span and one with a long span
- Optionally select a zoom on the loaded data : use this setting to set the span in more detail
 - you can select All of the data or a subset
 - when you open the graph, this window will be displayed
 - you can then use the slider bars to move through the full set of loaded data

5.1.6.2 Plot Bands

Plot Bands are used to break the graph up in to regions, each with a different colour. Plot bands make it easy to quickly identify when a tag value is out of the normal range. They are often used in conjunction with the Events

functionality, which raises an alert (by Email or SMS) when an alarm condition occurs.

Plot Bands will always display relative to the values of Axis Group 1.

To add a colour band:

- in the Plot Band section, click on the **Add Row** button
- the properties for the new band will be displayed
- From Value : set this to the lowest value for the band (e.g. 0)
- To Value : set this to the upper limit for the band (e.g. 20)
- Colour : click on the Colour chooser and then pick the shade to use and the depth of colour. Because the colours are saved as Hex RGB values, you can copy and paste the selection from other graphs
- click on the **Save** button at the bottom of the Time Series Chart section to save the changes

- refer to the list of preferred tag types and colour settings in section 9 for further information on tag colours

The screenshot shows a configuration form for a plot band. It has a title 'Plotbands' and an 'Add row' button in the top right. The form contains four input fields: 'From value' with '1', 'To value' with '10', 'Label' with 'newPlotBandLabel', and 'Color' with a yellow color swatch and the hex code '#DDDF0D'. A 'Delete row' button is located to the right of the color field.

5.1.6.3 Plot Lines

Plot Lines are used to put horizontal markers at fixed Y Axis levels. They can be used instead of, or in conjunction with, the Plot Bands. They are useful for showing Agronomic Lines.

Plot Lines will always display relative to the values of Axis Group 1.

The screenshot shows a configuration form for a plot line. It has a title 'Plotlines' and an 'Add row' button in the top right. The form contains three input fields: 'At value' with '1', 'Label' with 'newPlotLineLabel', and 'Color' with a yellow color swatch and the hex code '#DDDF0D'. A 'Delete row' button is located to the right of the color field.

To add a Plot Line:

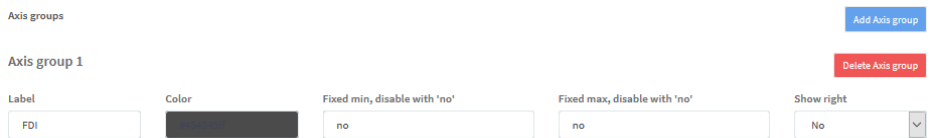
- in the Plot Line section, click on the **Add Row** button
- the properties for the new line will be displayed
- At Value : set this to the Y Axis value at which you want the line to display (e.g. 20)

- **Colour** : click on the Colour chooser and then pick the shade to use and the depth of colour. Because the colours are saved as Hex RGB values, you can copy and past the selection from other graphs
- click on the **Save** button at the bottom of the Time Series Chart section to save the changes

5.1.6.4 Axis Groups

Tag values are graphed against one of the available Y Axis Groups. Every chart will as a minimum have one Y axis, which is referred to as Axis Group 1. Plot Bands and Plot Lines are always shown respective to Axis Group 1.

If tags share the same engineering unit and range, they can share the same Axis Group. But you should add Axis Groups for each new tag type or engineering unit (or if two tags with the same unit will have very different ranges).



For Axis Group 1 and for any new Axis Groups you add, you can set the properties for the Axis:

- **Label** : set this to the name you wish to appear against the vertical axis
- **Colour** : click on this and select the colour you wish to use for the Axis and label
- **Scaling** : the vertical axis can be set to manual or automatic scaling
 - **Automatic scaling** : to use Automatic Scaling, set the “Fixed min” and “Fixed Max” values to “no”
 - **Manual scaling** : to manually set the scaling, set the Fixed Min and Fixed Max values to the lower and upper limits you wish to use
- **Left or Right Axis** : if you want the axis to display on the left of the screen, set the Show Right list box to No. If it is set to Yes, the axis will show on the right of the screen.

5.1.6.5 Adding Tags

After you have created an Axis Group, you can add tags to the group. Tags with the same engineering unit and type should appear in the same Axis Group.

Tags

Tags: FDI fdi - YDOC Field Mon Field Mon AWS 5170768

Type: Line

Color: Green

Delete row

Add Tag

If multiple selection is possible, just keep searching and selecting after the first item

Order: 1

Stack: No

Period:

Operation:

To add a Tag to a chart:

- first select the Axis Group to which the tag will belong
- then click on the Add Tag button
- you can continue to select Add Tag until all of the tags are added
- now click on the Tag chooser and select the tag from the list
 - if the list is very long, you can type text in to the list box to reduce the search to tags which contain those characters
- Type : click on the Type list box and then choose the display type
 - Line : used for values such as temperature
 - Bar : used for tags with a quantity, such as rain
- refer to the list of preferred tag types and colour settings in section 9 for further information on tag colours

5.1.7. Adding a Gauge Chart

Gauge charts allow sensor values to be displayed as a “virtual instrument” and show the last value received for the tag.

To add a new Gauge Chart:

- select the Dashboard in the Workspace to which you wish to add the Gauge Chart
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **Gauge Chart**
- in the Gauge Chart Properties section, set the parameters for the gauge
 - Name give the gauge a suitable name
 - Tags click on the Tag Chooser and select the tag you wish to display
- if you want to add colour bands on the gauge, click on **Add Row**

- set the From Value and To Value to the lower and upper limits for the band

Gauge chart

Name
Battery Voltage

Tags
100093248 - 3304985 - 0 Battery Voltage - 00B1E1EE27EF2347 00B1E1EE27EF2347

If multiple selection is possible, just keep searching and selecting after the first item

Take note that the tag properties min and max values will be used, Or if not preset default to 0 and 100

Plotbands

From value 0	To value 2.5	Color #df2a0d3d	Delete row
From value 2.5	To value 4.5	Color #96df0d6e	Delete row
From value 4.5	To value 6	Color #df620d53	Delete row

Add row

Save

- then pick an appropriate colour from the Colour palette chooser
 - note that you can pick both the colour and depth of colour
 - until templates for items are available you may find it helpful to create a text document with a list of the colours you use for various sensor types and ranges
- if the gauge range does not display correctly, go back to the configuration for the tag and check the Min and Max values set for it



5.1.8. Adding a Table

The Table Chart shows the last value for a tag along with supporting information such as the tag type and range.

To add a new Table:

- select the Dashboard in the Workspace to which you wish to add the Gauge Chart
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **Table**

Table

Name

Battery Status

Tag

100093248 - 3304985 - 0 Battery Voltage - 00B1E1EE27EF2347 00B1E1EE27EF2347

If multiple selection is possible, just keep searching and selecting after the first item

Save

- in the Table Properties section, set the parameters for the gauge
 - Name give the gauge a suitable name
 - Tags click on the Tag Chooser and select the tag you wish to display
- you may need to drag the corners of the table to adjust its size so all the fields display correctly

Name	Measurement	State	Scale	Connected
100093248 - 3304985 - 0	4.161 V	Default	69.33 %	an hour ago

5.1.9. Adding a Map

The Map functionality allows you to position your Devices on a map according to the GPS coordinates you record for the site. The **Map** function works in conjunction with the **Locations** section. The colour of the icon for locations drawn on the map will change according to the status of the attached device : Default, Warning or Danger. These are in turn controlled by the Tag Range settings and any actions you create in the **Rules** tab.

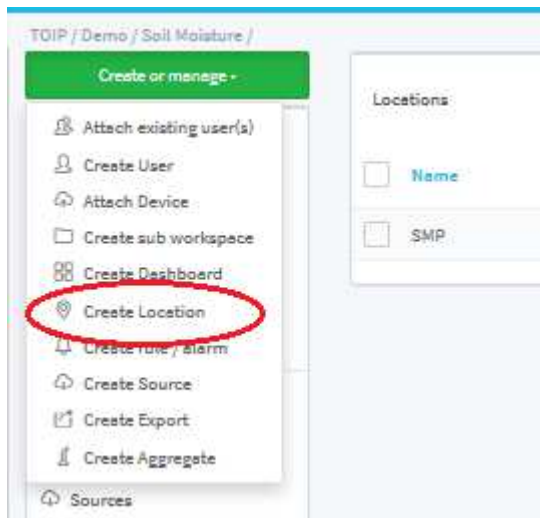
5.1.9.1 Adding Locations

Locations should be created in the same Workspace as the Devices: for instance if you have a Workspace called “Jones” and it has 3 subordinate Workspaces, each with a Device in them, create a Location in the Workspace for each Device.

If you want Devices to be available at a higher level Workspace (for example so you can create summary views of the data from multiple sites) attach the devices a second time in this Workspace: this does not duplicate the data so does not have an impact on database size. It just makes the devices available to the Workspace. You can then add Locations at this level and attach Tags from the Devices to each Location.

To give devices a Location:

- first you must create a Location entry for each Device you wish to display on the Map
- to do this, select the Device’s parent workspace
- then click on the **Create or Manage** menu and select **Create Location**
- to edit the location, click on the **Advanced Menu** and select **Locations**
- when the Location list opens, select the Location to edit it
- when the Properties display, set the Name (ID) and Description
- if you have the GPS coordinates for the site enter them



- if you don't have the coordinates, enter the property address and the system will search for the GPS coordinates which match that address

The figure below shows the details for a new location

The figure shows a web form for creating a new location. The form is titled "General" and contains the following fields:

- Name: MOONTA-DEMO_SM
- Description: Moonta Demo Soil Moisture Site
- Latitude: -34.06877430000001
- Longitude: 137.58747870000002
- Country: AUSTRALIA
- City: MOONTA
- Street: Henry St
- Street number: 24
- Zipcode: 5558

Below the fields is a blue "Save" button. A small note above the Latitude and Longitude fields states: "The latitude and longitude can be automatically loaded when clicking save by inputting at least the city and country. Otherwise you can just manually fill the two fields."

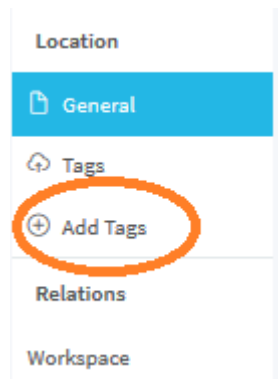
GPS Coordinates:

- if you have the GPS coordinates for a site, enter them in the Latitude and Longitude fields
- if you do not have the coordinates, enter the address: the system will then go to the address finder utility and try and retrieve the GPS coordinates for the site
 - if you enter the GPS coordinates, leave the address blank.

Once you have created the Location, you can then choose which Tags you wish to associate with it: these will then appear in the Tag list when you view the Map.

To add Tags to the Location:

- select the location from the Location list
- the Location properties will display



- click on the “+” icon next to the TAGS entry in the Location menu
- the Tag list will display
- in the Filter field, type a few characters from the name of the site you wish to choose the tags from so the list is reduced to tags from this device e.g SM
- then click on the check box next to the tags you wish to select
- then click on the **Bulk Actions** Menu and select **ATTACH**
- press Save to save the changes.

Tags		22 Total		Filter	Bulk actions				
<input type="checkbox"/>	Name	Description	Type	Measurement	Scale	Connected	Device serial	Device name	
<input checked="" type="checkbox"/>	FDI	fdi		5.064 Unit		en hour ago	5170768	YDOC Field Mon	
<input type="checkbox"/>	DT	Delta-T		8.628 C	Default	45.42 %	en hour ago	5170768	YDOC Field Mon
<input checked="" type="checkbox"/>	WD	Wind Direction		60.88 Degrees	Default	1st	en hour ago	5170768	YDOC Field Mon
<input type="checkbox"/>	AVGVG	Average voltage		4.81 V	Default		en hour ago	5170768	YDOC Field Mon
<input type="checkbox"/>	AVRMS	Average Current		1.98 mA	Default		en hour ago	5170768	YDOC Field Mon

When you click on the Map tab, a map will display showing this site as an icon in the correct position. The tags you select in the step shown above will display in the table when you click on the icon.

To create a Map as an Instrument on a Dashboard:

- select an existing Dashboard or create a new one to hold the Map
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **MAP**
- set the Name/ID and Description for the map
- then select the Location which will be plotted on the map
 - you can select multiple locations by adding them one at a time
- set the Zoom level so the map opens with a suitable scale
 - 5 is the default or lowest scale
 - 17 is the highest zoom level
- once you have saved the Map, you can drag the edges of the Icon on the Dashboard to set it to the required size.

The image shows two panels of a configuration interface. The top panel, titled 'General', has a 'Type' dropdown menu currently set to 'Map' and a blue 'Save' button below it. The bottom panel, titled 'Map', contains three input fields: 'Name' with the value 'AWS Map', 'Map zoom, a number generally between 5 - 17' which is currently empty, and 'Location' with the value 'MIDONTA-AWS - moonte'. A blue 'Save' button is located at the bottom left of the 'Map' panel.

- this map will then be available on the Dashboard
- you can pass on the Direct Access Link for the dashboard so that people can go to the Map without needing to log in.

5.1.10. Adding Percentage Bars

The Percentage Bars chart type allows you to represent the current sensor value as a scaled percentage between the Min and Max values set for the tag in the Configuration settings.

This can be useful for representing soil moisture: if you create a Soil Moisture Sum and then set the Min and Max values to match the Refill and Full points, the current moisture will display as a percentage of the capacity.

To create a Percentage Bar Instrument on a Dashboard:

- select an existing Dashboard or create a new one to hold the instrument
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **Percentage Bar**
- give the icon a name
- from the Tag chooser, select the tag whose value you want to represent
- click on Save to save the instrument

General

Type

Percentage bars

Save

Percentage bars

Name

SM Status

Tag

SM Sum SM Sum - Aggregator SM Sum AG-U4RESFB

If multiple selection is possible, just keep searching and selecting after the first item

Save

- if the range does not display the way you want, go back to the Tag properties and adjust the Min and Max values

5.1.11. Adding a State Display

The State Display chart type can be used to represent the value of tags which are Boolean or have only two states : ON and OFF. It can also be used to display different text messages according to the value of a tag.

5.1.11.1 Displaying Boolean Tags

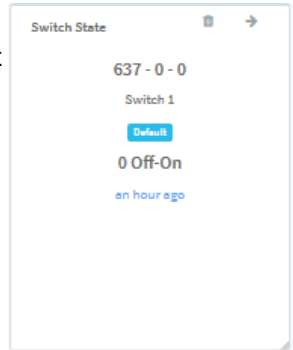
To create a State Display Instrument on a Dashboard:

- select an existing Dashboard or create a new one to hold the instrument
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **State Display**
- give the icon a name
- from the Tag chooser, select the tag whose value you want to represent
- click on Save to save the instrument

The image shows two screenshots of a configuration interface for a 'State' instrument. The top screenshot shows the 'General' tab with 'Type' set to 'State' and a 'Save' button. The bottom screenshot shows the 'State' tab with 'Name' set to 'Switch State', 'Tag' set to '637 - 0 - 0 Switch 1 - 0000000008C35BB TBS12FS Flow Switch 0000000008C35BB', and a 'Save' button.

When you go back to the Dashboard, the instrument will be displayed.

Note that this type of display only works with Boolean or On-Off tags.



5.1.11.2 Displaying Messages According to a Sensor Range

The State Display instrument can be used to control the display of messages according to the value of the input tag. This is very useful if you want to display messages to users prompting them to take specific action or if you want to provide some interpretation for the tag values.

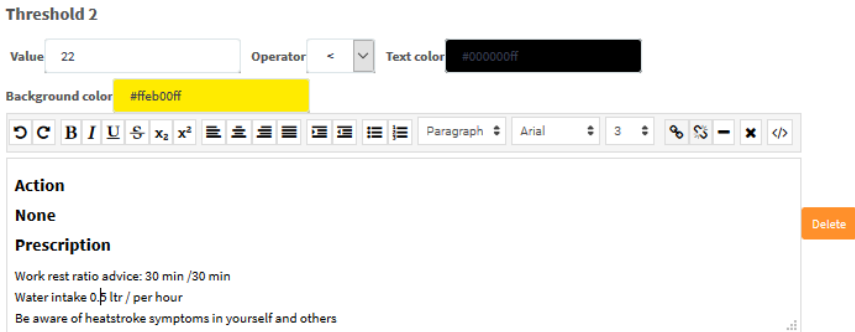
The best starting point is to prepare a table like the one below which shows the range of tag values and the messages you want to display for each range.

The example is for display of the Wet Bulb Globe Temperature (WBGT) which is a measure of apparent temperature and can be used to indicate if conditions are safe for outdoor activity or sports. The thresholds are those recommended by Sports Medicine Australia.

Range	Colour	Message
0 – 20	Green	Low Risk
21 - 25	Yellow	Moderate to High Risk
26 - 29	Amber	High to very High Risk
30 and above	Red	Extreme Risk

You can now create a State Display to display this information:

- select an existing Dashboard or create a new one to hold the instrument
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **State**
- give the icon a name e.g. **WGBT**
- from the Tag chooser, select the Tag you are going to use as an input: if you have created Aggregate modules to calculate the WGBT, select the output from the Aggregate
- the dropdown list box labelled “Change or use measurement and unit somehow” lets you control how you process the tag range
 - for this example, select **Threshold Rich Text**
 - you could also use the predefined entry “Celsius to WGBT categories and colour
 - if you were processing wind data you can convert the values to text from the Beaufort scale
- when the “Threshold rich text” dialogue box opens, you can start to add a Row for each of your thresholds
 - click on Add Row and a new entry will be created
 - if the first range is 0 to 26, set the Value to 26 and the Operator to “<”
 - from the “Text Colour” box, select the colour to use for the text (e.g. black)
 - from the “background colour” box select the colour to use for the background (e.g. green)
 - in the Text area, type the message to be displayed e.g “Low Risk”
 - You can set the font, text size and apply attributes such as bold and italics



- repeat this step for each row in the table.

When you have finished, check the value of the tag (in the Tag list) and then confirm that the State Display shows the correct message according to the tag value

- if the SAVE button is inactive, go back and check that all of the fields are filled in: if any are blank, you will not be able to save the settings.

If you want to also display the current tag value, go to the “Custom style” section and set the “Show measurement area” option to YES. You can then set the area available for the value and the size and colour of the text to display it with.

5.1.12. Adding a Wind Direction Compass (wind rose)

The Wind Direction Compass is a variation of the Gauge Chart which is customised for display of wind direction.

To create a State Display Instrument on a Dashboard:

- select an existing Dashboard or create a new one to hold the instrument
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named “new tile”
- click on the Properties button for the tile
- from the Type drop down list box select **Wind Rose**
- give the icon a name
- from the Tag chooser, select the tag for the wind direction sensor

Type
Wind direction

Save

Wind direction

Name
WD

Tag
WD Wind Direction - YDOC Field Mon YDOC MLN417 4G AWS 5170768

If multiple selection is possible, just keep searching and selecting after the first item

Select a location to get google maps behind the wind direction. Remove the location to get no google maps anymore.

Location
MOONTA-AWS - moonta

Map zoom, a number generally between 5 - 17
17

Map type
Satellite

Custom style
To remove the custom style or go back to the default style, deselect the custom style by clicking the cross X icon in the field below

Search a type

Save

- if you want to use the instrument on a Map, select the Location to use for the icon, then set the Zoom level (e.g. 17) and the Map type
- click on Save to save the instrument



5.1.13. HTML Tile Type - Embedding a HTML Page

A Tile can also be used to embed html code in order to add a page from another web site. The latter must be include in an IFRAME.

After adding a new tile to your Dashboard, Edit the tile and set the type to “HTML”

You can then add the HTML for the required content

- if adding a link to another page, embed it in an IFRAME
e.g. `<iframe src="http://toip-server.net.au:8080/trend/graph?panel=22806&public=true&showLegend=true&locale=en_AU&units=metric" frameborder="0" style="width: 100%;height: 400px"></iframe>`

Save the Tile and test that it displays correctly.

5.2. **Creating Report Tables**

You can use Report Tables to show summary information in tabular form. This is useful for instance if you want to show the daily max, min and average temperature for the last week.

To create a Report on a Dashboard:

- select an existing Dashboard or create a new one to hold the instrument
- in the Dashboard select **Create Tile**
- a new tile will be created on the dashboard. It will be named "new tile"
- click on the Properties button for the tile
- from the Type drop down list box select **Reports Table**
- give the report a name.

After creating the report you can customise it to control what information is displayed:

- Time Period to load: select the Time Period Type (e.g. Days) and the number of time units (e.g. 7)
- Tags: click on the Add Row button to add a new line for each tag whose values you wish to include
 - each tag will be allocated a Column in the table
 - now click on the Tag Chooser and select the tag to display for each row
- Period: select the frequency for which summary rows are to be written
 - if you select Day, a row will be written for each day
 - to produce a daily summary for the current week, select 7 days in the Time Period and set the Period to either Week Starting Monday or Week Starting Sunday
- Operation: click on the Operation list box and choose the statistical operation you wish to perform
 - As Is: writes the current value
 - Max: extracts the highest value
 - Min: extracts the lowest value
 - Sum: totals the values for the period
 - Mean: takes the average of the values for the period

- Forward Difference: this subtracts the value of a counter at the end of the period from the value at the start. Use this to calculate the flow or rain for the period
- Reversed Difference: this subtracts the value of a counter at the beginning of the period from that at the end. Use this if your totaliser is decrementing
- Threshold 1, 2, 3: if you enter values for the thresholds, the colour of the field will change as the value of the tag crosses each threshold. This can be useful if you want to give users a visual alert based on the value of a tag
 - type in a value for each threshold
 - click on the box below the threshold to activate the Colour Chooser and then select the colour you wish to use for the threshold
 - Inverse: select Yes if you want the display to reverse i.e. black background with white text
 - Colour mode: select TEXT to have the colour of the text change according to the value; select CELL if you want the background colour to change according to the value

Tag: Air Temperature AT - FM-Arthurton 5170768

Period: Day

Operation: Mean (Average)

Threshold 1: 10 (#7ef0de75)

Threshold 2: 25 (#7de57a75)

Threshold 3: 35 (#e77c7c81)

Inverse: No

Color mode: [empty]

Footer operation: Mean (Average)

- Footer Operation: if enabled, this option allows you to add a summary row to the bottom of the table
 - Disabled: no summary row is shown
 - Min: shows the lowest value
 - Max: shows the highest value
 - Sum: shows the sum of the values
 - Mean: shows the average value

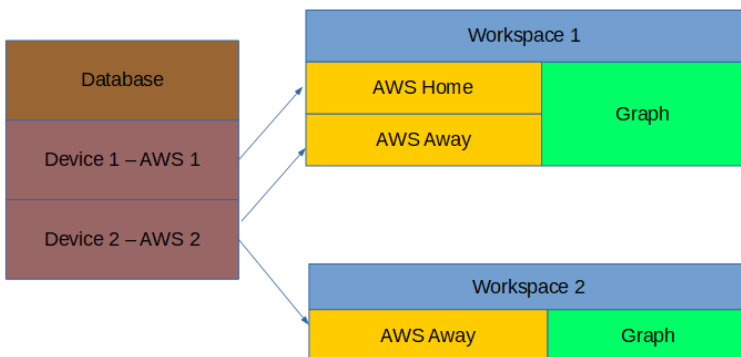
Summary						
Timestamp	Air Temperature - C day - max	Air Temperature - C day - min	Air Temperature - C day - avg	Relative Humidity - % day - max	Relative Humidity - % day - min	Relative Humidity - % day - avg
13-09-2019 00:00	21.743	8.782	14.6159	99.92	39.98	76.9324
14-09-2019 00:00	27.677	8.624	18.7355	100	30.71	62.9471
15-09-2019 00:00	29.373	11.982	20.621	98.3	21.3	47.7584
16-09-2019 00:00	14.26	2.684	9.5901	96.71	55.23	81.1066
17-09-2019 00:00	15.323	0.561	7.4167	95.07	34.83	70.8224
18-09-2019 00:00	21.932	5.148	14.2305	76.37	17.46	36.5022
19-09-2019 00:00	26.695	12.941	20.3224	71.07	14.01	26.8178
20-09-2019 00:00	16.338	11.466	13.9228	94.48	73.99	86.3905
			avg			avg
			14.9180875			61.15967500000001

5.3. Graphing Data From Multiple Devices

The need often arises to create graphs which combine data from multiple devices. This may be to provide a customer with a comparison of key parameters from different stations on their farm, or to aggregate data from sensors such as water meters, which are installed at different sites.

When you add Devices to a Workspace in Sensori, you are not creating a new copy of the data: rather you are simply linking in the tags from the source device (which is kept at the highest level in the database) so that they are visible in the Workspace. You can thus add Devices to as many different workspaces as you need – it does not take up any more storage space.

For this reason Devices can be considered as Virtual rather than Physical entities. This approach gives you considerable flexibility in how you use and share the information from your devices.



So if you need to create a graph which brings in data from different Devices do the following:

- locate a suitable point in the hierarchy in which to place the new graphs
 - to make things clearer, you may wish to make a new Workspace to hold the combined graphs
- go to the Devices tab and add each device
 - click on the “+” icon next to the Devices entry
 - when the Device List displays, activate the check box next to each of the devices you wish to add
 - then from the Bulk Actions action menu select Attach
- create a new Dashboard and give it a suitable name
- add your Graphs to the Dashboard
 - when you add tags to the Graphs, you will see that all of the tags are now available
 - to make the process of choosing tags easier, you can limit the display to specific tags by typing text in to the Search bar

6. Other Functions

This section describes how to use some of the other functionality provided in the Sensori platform.

6.1. *Copying Data from one Tag to Another*

This function allows users to copy all of the historic data from one tag to another. The copy function will not overwrite existing data: you must first delete the data for the existing tag, then import the new data.

The import function is available under the "admin" tab for the tag - you will need to be an "Admin" level user for the Workspace to have access to this function.

To import data from another tag:

- open the Workspace which holds the RTU / Device and select the Devices tab, then in the Device menu click on the Tags option. Alternately, if it is the only device in the Workspace, go straight to the Tags tab
- once the tag properties are displayed, click on the Admin option in the tag menu
- in the Admin screen, locate the entry which is labelled "Import all measurements from some other tag"
- then, from the tag chooser, locate and select the tag whose data you wish to import
 - You can reduce the list of tags displayed in the list by typing characters from the name in to the list box.

6.2. *Moving a Workspace*

At any stage you can move a Child Workspace from its current Parent to another Workspace.

To move a Workspace:

- select the Workspace
- click on the **General** tab to show the Workspace's properties
- scroll down to the **Administration** section
- the Workspace's parent is displayed alongside the text "This child workspace is part of the billable workspace"
- click on the List Box below the entry labelled *Change to which billable workspace this child workspace belongs*
- select the Workspace to move it to.

This child workspace is part of the billable workspace: Field Monitors

Change to which billable/parent workspace this child workspace belongs

Change

6.2.1. Deleting a Workspace

Workspaces (along with their contents) can be deleted at any time.

To delete a Workspace:

- select the Workspace
- click on the **General** tab to show the Workspace's properties
- scroll down to the **Administration** section
- click on the **Delete** button.

6.3. Creating Aggregate Functions (Calculated Tags)

Sensori provides two mechanisms for performing calculations on tags:

Formulas and Aggregates:

- Use a Formula if you want to change the value of a single tag, for example to apply a scaling or correction factor. In this instance the Formula is attached directly to the tag
- Use an Aggregate if your calculation involves more than 1 tag. In this instance, the function is saved as an Aggregate.

The Aggregate function allows you to create new tags which are based on the application of a formula to more than one source tags. Aggregates may be nested so that one Aggregate function uses a tag created by another Aggregate function as an input.

Aggregates are very flexible:

- simple functions such as Average, Max, Min and Sum can be calculated from within the Aggregate
 - for example, a soil moisture sum calculation is made in this way, using the SUM function provided within the aggregate

- complex calculations will be wrapped up in a Formula which is then linked to the Aggregate
- you can create and save a Formula separately to the Aggregate
- it is then linked in to the Aggregate function
- the formula is also available for re-use in other Aggregates

When selecting tags to process in an Aggregate function make sure that the tags share the same time stamp (i.e. they are logged at the same rate).

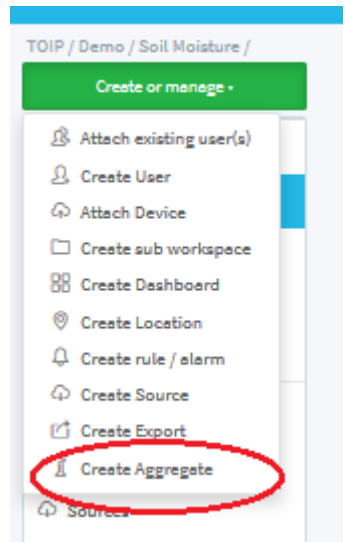
You can create an Aggregate in two ways:

- using a new blank aggregate function
- using an existing aggregate as a template.

6.3.1. Create a New Aggregate

To create a new Aggregate:

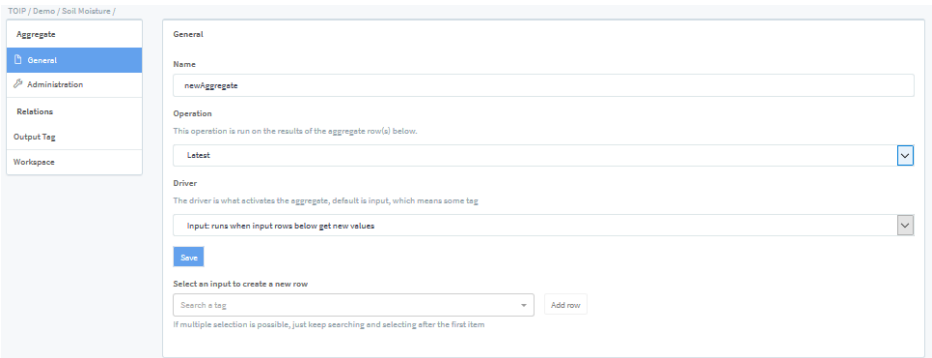
- Locate and select the Workspace which holds the Device whose tags you wish to include in the Aggregate calculation
- Click on the **Create or Manage** menu and then select **Create Aggregate**
- A new Aggregate will be created in the Aggregates list: it will be named "newAggregate"
- Click on the entry to select it and edit its properties



When the Aggregate Properties display, you can edit the settings

- Name give the function a suitable name
 - Note that this is the name for the calculation itself, not for the output tag
- Operation the Operation controls the function to be applied. Select an option according to what you want to do with the tag

- Latest: selects the last value from the tag
 - this is the most commonly used operation as it works on the latest value from the tag
- Formula applies a formula to the tag(s)
 - use this option for complex calculations
- Min selects the lowest value for the tag
- Max selects the highest value for the tag
- Avg selects the average value for the tag
- Sum calculates the sum of the tag values



- Driver: the Driver determines when the function will be run
 - Input: use this option if you want the calculation to be performed whenever new values are available
 - Tasks: use this option if you are going to create statistical summaries which run at a set interval
- Select an input: the tag chooser is then used to add one or more tags to the Aggregate.

6.3.2. Creating an Aggregate From a Template

Any existing Aggregate function can be used as a template for creation of a new Aggregate function. All of the key properties of the template will be copied over to the new function.

To create an Aggregate from a Template:

- select the Workspace in which you want to create the Aggregate
 - this should hold the RTU/Node whose tags you will be using
 - if the node is not already in the Workspace, Attach it as shown in Section 4.4
- from the Menu select **Create or Manage**
- then click on **Import Aggregate**
- a list box will display, showing all of the existing Aggregates
 - to narrow the list, type characters in to the “Filter” search box
 - for example to search only for Aggregates with the word “Sum’ in the name, type “Sum” into the box
- click on the Check box next to the Aggregate you wish to copy
- then click on the **Bulk Actions on Selected Rows** menu
- from the menu select **Import**

The following section builds on this foundation to show how to perform a number of specific calculations.

6.3.3. Creating a Soil Moisture Sum

The Soil Moisture Sum calculation is widely used in soil moisture monitoring and calculates the arithmetic sum of the values of the individual sensors on the probe. It may be plotted in that form, or may be processed further to derive a figure for the Plant Available Water (PAW).

$$\begin{aligned} \text{SM Sum} &= \text{SM 010cm} + \text{SM020cm} + \dots \text{SMnncm} \\ \text{PAW} &= \text{SMsum} - \text{Refill Point} \end{aligned}$$

To create a Soil Moisture Sum calculation:

- locate the **Workspace** in which the soil moisture probe is located
- create a new **Aggregate** as shown in the previous step
- select the Aggregate to edit its properties
- Name: give the aggregate a suitable name e.g Probe 1 SM Sum
- Operation from the list box select **SUM**
- Driver select “Input” so the function will run every time new data is received
- click on Save to save the settings to this point

The screenshot shows the 'General' configuration page for an aggregate. On the left is a sidebar with 'Aggregate' selected, containing sub-items: 'General', 'Administration', 'Relations', 'Output Tag', and 'Workspace'. The main area has a 'General' tab. Fields include: 'Name' (OttoSMSum), 'Operation' (Sum), and 'Driver' (Input runs when input rows below get new values). A 'Save' button is present. Below it is a section 'Select an input to create a new row' with a search box and an 'Add row' button. A note states: 'If multiple selection is possible, just keep searching and selecting after the first item'.

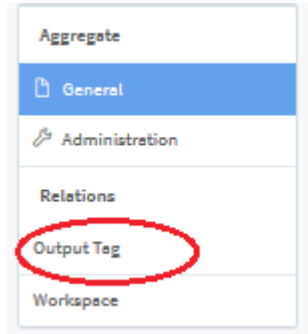
- now from the drop down list box labelled “Select an input to create a new row”, select the first soil moisture tag and then click on the ADD ROW button
 - repeat this for the remaining tags
 - when you have added all of the tags, check that they all show up in the list of Aggregate Rows
 - check that the TYPE list box entry is set to Latest
 - in the “Formula Placeholder” field, you can give a working name to each Aggregate Row (e.g. SM010, SM020 etc)
 - click on the SAVE button in each row to save the changes

The screenshot shows the 'Aggregate row' configuration page. It has three main sections: 'Type' with a dropdown set to 'Latest'; 'Input' with a text field containing '675 - 629 - 1 - 00B1E1EE27EF234...'; and 'Formula placeholder' with a text field containing 'SM020'. There is a 'Save' button on the left and a 'Delete row' button on the right. A note under 'Formula placeholder' says: 'Only needed if the operation on top is of type formula and the formula has some placeholders.'

Once you have added all the Tags, you need to configure the Output Tag:

- if the Aggregate tag properties are not currently being displayed, select the tag from the list
- the **Properties** will display
- click on the **Output Tag** menu option to display the properties for the new tag which the Aggregate function will create
- now click on the **General** tab

- do not change the Name (this will be renamed as an ID tag in future releases and will be locked so it can not be changed)
- set the **Description** to a suitable name e.g. Probe 1 SM Sum
- Type select the Type to use for this sensor from the drop down list. If a suitable type does not exist, leave it blank
- Unit enter the engineering unit to use for the sensor e.g. mm
- click on Save to save the changes
- now click on the **Configuration** tab
 - you should then set the MIN and MAX values for the tag
 - initially you may not know what these are and may have to enter default values. You can always come back and adjust them once the site has collected some data.



6.4. *Creating Periodic Summaries*

The Sensori platform allows you to create summary data at a couple of different levels:

- Within Graphs: this is useful if you wish to create a summary which will be viewed and not processed further,
- Using Aggregates: Under this option, a new tag is created to store the summary information.

6.4.1. **Creating Statistical Summaries on Graphs**

You can create your summaries on an existing graph or add a new graph for the purpose. These may be considered as “on the fly” statistics.

The charting tool allows you to set the time frame for the calculation and the operation to perform. For instance, to show the Max, Min and Avg values for a tag, you add the tag 3 times and then set the Operation for each instance to the required operation.

6.4.1.1 To Display the Average, Max or Min Value for a Time Period

Open the Chart on which you wish to display the new summary. With the Chart Properties open:

- select the Axis Group to which you will be adding the Tag
- click on the Add Tag button: if you are adding Max, Min and Avg, click on the button 3 times
- select the new tag and use the Tag Chooser to select the tag whose raw data you will be using
- click on the **Period** drop down list box and select the period over which you want to perform the summary e.g. 1 day
 - if you are creating a weekly summary you can select whether you want the week to start on Sunday or Monday
- click on the **Operation** drop down list box and choose the function you wish to use e.g. Avg
- set the Colour for the tag
- if you want to apply fixed minimum and maximum Y axis scaling, set the values in the **Fixed Min** and **Fixed Max** boxes
- save the changes to the chart.

The screenshot shows the 'Axis groups' configuration window. At the top, there is a header 'Axis groups' and a blue 'Add Axis group' button. Below this, 'Axis group 1' is selected, with a red 'Delete Axis group' button. The configuration is organized into three rows, each representing a tag. Each row has the following fields: 'Label' (text input), 'Color' (color picker), 'Fixed min, disable with 'no'' (text input), 'Fixed max, disable with 'no'' (text input), and 'Show right' (checkbox). Below these are 'Tags' (a dropdown menu), 'Type' (a dropdown menu), and 'Color' (a color picker). At the bottom of each row are 'Order' (text input), 'Stack' (checkbox), 'Period' (dropdown menu), and 'Operation' (dropdown menu). The first row has 'Temp C' as the label, a black color, '-5' for fixed min, '45' for fixed max, 'Yes' for show right, 'AT Air Temperature - YDOC Field Mon YDOC MLN417 4S AWS S170765' as the tag, 'Line' as the type, '#E5212F' as the color, '1' as the order, 'No' for stack, 'Day' as the period, and 'Max' as the operation. The second row has the same tag, 'Line' as the type, '#E0921F' as the color, '2' as the order, 'No' for stack, 'Day' as the period, and 'Min' as the operation. The third row has the same tag, 'Line' as the type, '#E9826F' as the color, '3' as the order, 'No' for stack, 'Day' as the period, and 'Avg' as the operation. A blue 'Add Tag' button is located to the right of the first row's 'Show right' checkbox. A red 'Delete row' button is located to the right of the 'Color' picker in each row. Small text below each 'Tags' dropdown reads: 'If multiple selection is possible, just keep searching and selecting after the first item'.

6.4.1.2 To Display the Sum for a Time Period

Open the Chart on which you wish to display the new summary. With the Chart Properties open:

- select the Axis Group to which you will be adding the Tag
- click on the Add Tag button: if you are adding Max, Min and Avg, click on the button 3 times
- select the new tag and use the Tag Chooser to select the tag whose raw data you will be using
- click on the **Period** drop down list box and select the period over which you want to perform the summary e.g. 1 day
- click on the **Operation** drop down list box and choose Sum
- set the Colour for the tag
- if you want to apply fixed minimum and maximum Y axis scaling, set the values in the **Fixed Min** and **Fixed Max** boxes
- set the plot **Type** to Bar
- save the changes to the chart.

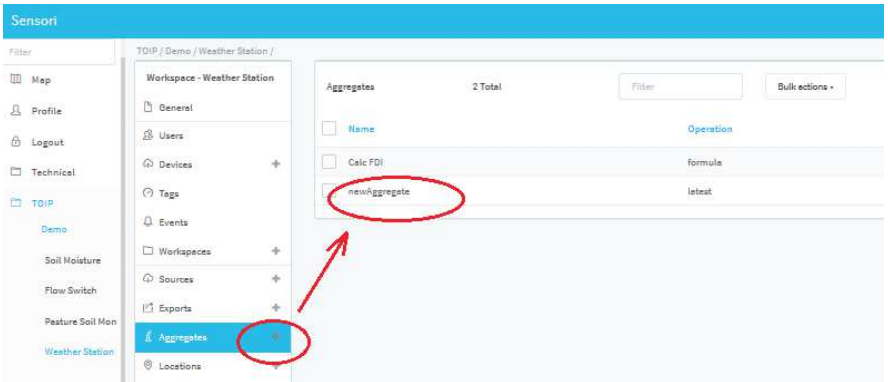
The screenshot displays the 'Axis groups' configuration page. At the top, there are buttons for 'Add Axis group' and 'Delete Axis group'. Below this, the 'Axis group 1' configuration is shown with fields for 'Label' (Temp C), 'Color' (black), 'Fixed min, disable with 'no'' (-5), 'Fixed max, disable with 'no'' (45), and 'Show right' (Yes). Below the axis group configuration, there is a 'Tags' section with an 'Add Tag' button. Three tags are listed, each with its own configuration row. Each tag row includes fields for 'Type', 'Color', 'Period', and 'Operation', along with a 'Delete row' button. The first tag has Type 'Line', Color '#e9228f', Period 'Day', and Operation 'Max'. The second tag has Type 'Line', Color '#99523f', Period 'Day', and Operation 'Min'. The third tag has Type 'Line', Color '#9b625f', Period 'Day', and Operation 'Avg'.

6.5. ***Creating Statistical Summaries Using Aggregates***

The Aggregates function allows you to create summaries which will be saved as new tags in the database. These can then be displayed or used in other calculation.

Whenever you are using an Aggregate function to create a new summary, the first step is to create the new Aggregate:

- First off, locate the Workspace which holds the Device whose tags you want to use in the Aggregate module
- then from the **Create or Manage** menu select **Create Aggregate**
- a new aggregate will display in the list.



- You can then select the Aggregate and set its properties
 - on the General tab, give the function a suitable name
 - then select an Operation according to the calculation you wish to perform: see the following sections for which to set for the various calculations

6.5.1. Creating a Daily Rain Total

To create a Daily Rain Total, create a new Aggregate as shown in section 6.5 then select the Aggregate in order to edit its properties

- set the name to “Calculate daily rain”
- set the Operation to Sum
- set the Driver to Task
- click on Save to update the Aggregate

General

Name

newAggregate

Operation

This operation is run on the results of the aggregate row(s) below.

Latest

Driver

The driver is what activates the aggregate, default is input, which means some tag

Input: runs when input rows below get new values

Save

Select an input to create a new row

RAIN Rain - YDOC Field Mon YDOC MLN417 40 AWS S170768

Add row

If multiple selection is possible, just keep searching and selecting after the first item

Now click on the Tag Chooser and locate the tag whose rainfall is going to feed the calculation

- click on **Add Row** to add the tag to the module
 - the tag will now appear in the list of Aggregate Rows
- set the **Type** to **Time Range** and click on the **SAVE** button
 - after clicking save, some additional options will be added
 - set the **Operation** to **Sum**
 - set the **Offset Type** to **Days**
 - set the **Offset Value** to **1**
- click on the **SAVE** button again

The screenshot shows a configuration form with the following sections:

- General**: A text input field for "Name" containing "newAggregate".
- Operation**: A dropdown menu with the text "This operation is run on the results of the aggregate row(s) below." and the selected option "Latest".
- Driver**: A dropdown menu with the text "The driver is what activates the aggregate, default is input, which means some tag" and the selected option "Input: runs when input rows below get new values".
- Save**: A blue button labeled "Save".
- Select an input to create a new row**: A search bar containing "RAIN Rain - YDOC Field Mon YDOC MLN417 4G AWS 5170768" and a blue "Add row" button.
- Footer**: A small note: "If multiple selection is possible, just keep searching and selecting after the first item".

6.6. **Complex Formula Calculations**

When a Formula is created under an Aggregate module, the formula can combine values from multiple tags. When you write a formula, add the single character value for the placeholder for each tag. Use brackets to enforce the order of a calculation or to make the formula easier to read.

Re-calculation:

- you can re-start a calculation from the Admin tab under the Aggregate properties
- an Aggregate which works on a single tag will re-calculate from the beginning of the data-set
- but an Aggregate which uses multiple tags (FDI, ET) will only re-calculate from the current time.

6.6.1. **Available Functions**

The following functions are available for use within your Formulae:

Trigonometric functions”

Arguments in radians

sin cos tan cot

Arguments in degrees

sind cosd tand cotd

Inverse trigonometric functions

arcsin arccos arctan arccot

Exponentials and logarithms

exp log ln lg

Powers

sqrt returns the square root of the value (e.g. $\text{SQRT}(16) \rightarrow 4$)

a^b returns a to power of b (e.g. $16^{0.5} \rightarrow 4$)

Hyperbolic functions

sinh cosh tanh coth

Inverse hyperbolic functions

arsinh arcosh artanh arcoth

abs returns the value without a sign (e.g. -342 → 342)

sgn returns the sign of the value (e.g. -342 → '-')

Rounding functions

round rounds a number to the nearest integer

floor rounds down to next lower integer

ceil rounds up to next highest integer

6.6.2. Creating a Formula

Setting up complex formulae requires a few steps:

- first off write out the expression using single letter constants for the parameters
 - for instance the Wet Bulb formula may be expressed as follows

$$(-5.806+0.672*a-0.006*a^2+(0.061+0.004*a+0.000099*a^2)*h+(-0.000033-0.000005*a-0.0000001*a^2)*a^2)$$

- where a = Air Temperature and h = Relative Humidity
- always use a single lower case character for codes or “placeholders”
- do not use “m” as that is reserved for the tag value in calculations which operate on a single tag
- where possible replace any terms with equivalent functions (e.g. a*a* → a^2)
- create an Aggregate function and add the required inputs
- leave the formula blank
- give each input a “Placeholder” which is the same letter as you used in the formula
- create a Formula : the formula will then be available for re-use with the name you allocate for it
 - click on the + Formula button to add a formula

- when the formula displays, give it a suitable name, and then paste in the formula
- save the formula then re-open it and check that the placeholders are all shown in the placeholder list
- go back to the Aggregate and select the formula from the drop down list.

6.6.3. Wet Bulb Temperature Calculation

Continuing with the Wet Bulb Example, first create the Aggregate Function

- drill down to the Workspace which holds the Device
- Click on **Manage** menu and then select **Create Aggregate**
- select the “new aggregate” to edit its properties
 - set the Name field to “Calculate Web Bulb”
 - set the Driver field to Input and click on Save
 - leave the Formula blank
- select the Inputs using the Tag Chooser and select the inputs to use
 - from the chooser select the Air Temperature tag and then click on **Add Row**, then click on **Save**
 - from the chooser select the Relative Humidity tag and then click on **Add Row**, then click on **Save**

General

Name

Calculate Wet Bulb

Operation

This operation is run on the results of the aggregate row(s) below.

Formula

Driver

The driver is what activates the aggregate, default is input, which means some tag

Input: runs when input rows below get new values

Save

Formula

Required formula placeholders

Save

Select an input to create a new row

Search a tag

Add row

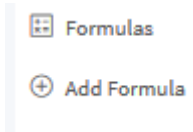
If multiple selection is possible, just keep searching and selecting after the first item

- now go to the Aggregate Rows you have just created and configure them
 - first select Air Temperature
 - set the Typefield to Latest
 - set the Placeholder to a
 - click on Save
 - now select the second Aggregate Row i.e. Relative Humidity
 - set the Typefield to Latest
 - set the Placeholder to h
 - click on Save

The image shows two screenshots of the 'Aggregate row' configuration interface. Each screenshot has three main sections: 'Type', 'Input', and 'Formula placeholder'.
- The top screenshot is for 'Air Temperature'. The 'Type' dropdown is set to 'Latest'. The 'Input' dropdown is set to '887 - 844 - 1 - 00E480298AD14CD...'. The 'Formula placeholder' text box contains the letter 'a'.
- The bottom screenshot is for 'Relative Humidity'. The 'Type' dropdown is set to 'Latest'. The 'Input' dropdown is set to '887 - 844 - 0 - 00E480298AD14CD...'. The 'Formula placeholder' text box contains the letter 'h'.
Both screenshots have a blue 'Save' button on the left and a red 'Delete row' button on the right.

Now you need to create the Formula:

- within the Aggregate, click on the “+” option in the Add Formula menu option
- a new Formula will be created
- Click on the Formulas menu entry again
- in the list you should now see an entry called New Formula. Select it so you can edit it
- when the Formula properties display, set the Name to the name you want to use for the formula e.g. Wet Bulb: the formula will later be available to other Aggregate functions using this name
- set the Order field to 1
 - you will only need to use a higher order number if you have a formula which requires multiple steps



- in the Expression field, type or past the formula in the format you created it earlier on (i.e. with a single character representing each parameter)
 - e.g.
$$(-5.806+0.672*a-0.006*a*a+(0.061+0.004*a+0.000099*a*a)*h+(-0.000033-0.000005*a-0.0000001*a*a)*h*h)$$
 - or
$$(-5.806+0.672*a-0.006*a*exp(2)+(0.061+0.004*a+0.000099*a*exp(2)*h+(-0.000033-0.000005*a-0.0000001*a*exp(2)*h*exp(2))$$
- in the Placeholders section, type in the Letter corresponding to each input placeholder in turn, pressing Enter to activate each
 - i.e. for the wet bulb type `t` and press Enter, then type `h` and press Enter again
- click on the Save Button
- this formula will now be available to this and other Aggregate functions.

Update the Formula selection in the Aggregate function

- go back to the Aggregate list (Advanced / Aggregates) and select your Aggregate function again so the Properties are displayed
- click on the Formula list box and select the Name you gave the formula in the previous step e.g. Wet Bulb
 - the two Formula Placeholders (t & h) should then be shown in the list of Required Formula Placeholders
- the aggregate function should now look like the image shown below

General

Name

Operation

This operation is run on the results of the aggregate row(s) below.

Driver

The driver is what activates the aggregate, default is input, which means some tag

Save

Formula

Required formula placeholders

- T
- H

Save

Select an input to create a new row

If multiple selection is possible, just keep searching and selecting after the first item

6.6.4. Delta-T Calculation

The Delta-T is defined as the difference between the Dry Bulb (Air Temperature) and Wet Bulb temperature. Continuing with the placeholders used above:

$$d = t - b \quad \text{Where } d = \text{Delta-T and } b = \text{Wet Bulb}$$

You can hence perform the Delta-T calculation using the Wet Bulb as an input or can copy and past the Wet Bulb formula then add “a - (“ in front of it and then close with an en brace “)”.

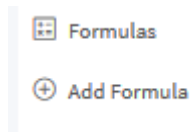
To create the Delta-T Formula:

- drill down to the Workspace which holds the Device
- then from the **Create or Manage** menu select **Create Aggregate**
- select the “new aggregate” to edit its properties
 - set the Name field to “Delta-T”
 - set the Driver field to Input and click on Save

- leave the Formula blank
- Note that if you need to go back to the list of Aggregates at any stage, click on **Advanced** and then **Aggregates**
- select the Inputs using the Tag Chooser and select the inputs to use
 - from the chooser select the Air Temperature tag and then click on **Add Row**, then click on **Save**
 - from the chooser select the Relative Humidity tag and then click on Add Row, then click on Save
- now go to the Aggregate Rows you have just created and configure them
 - first select Air Temperature
 - set the Typefield to Latest
 - set the Placeholder to a
 - click on Save
 - now select the second Aggregate Row i.e. relative humidity
 - set the Typefield to Latest
 - set the Placeholder to h
 - click on Save

Now you need to create the Formula:

- within the Aggregate, click on the “+” option in the Add Formula menu option
- a new Formula will be created
- Click on the Formulas menu entry again
- in the list you should now see an entry called New Formula. Select it so you can edit it



- when the Formula properties display, set the Name to the name you want to use for the formula e.g. Delta-T: the formula will later be available to other Aggregate functions using this name
- set the Order field to 1
- in the Expression field, type or past the formula for the wet bulb temperature
 - e.g. $a - (0.006*a*a+(0.061+0.004*a+0.000099*a*a)*h+(-0.000033-0.000005*a-0.000001*a*a)*h*h)$
- in the Placeholders section, type in the Letter corresponding to each input placeholder in turn, pressing Enter to activate each
 - i.e. for the wet bulb type a and press Enter, then type h and press Enter again
- click on the Save Button
- this formula will now be available to this and other Aggregate functions.

Update the Formula selection in the Aggregate function

- go back to the Aggregate list (Advanced / Aggregates) and select your Aggregate function again so the Properties are displayed
- click on the Formula list box and select the Name you gave the formula in the previous step e.g. Delta-T
 - the two Formula Placeholders (a & h) should then be shown in the list of Required Formula Placeholders
- Save the updated Aggregate
- the Output tag can now be used in Graphs and Instruments.

6.6.5. EvapoTranspiration Calculation

You can perform daily ETo calculation within Sensori, with the method selected to match the sensors available on your weather station:

- Air Temp, RH, Wind, Solar radiation: Valiantzis (Simplified Penman Monteith model)
- Air Temp, RH, Wind : Penman

Inputs:	Tag name
Avg Daily air temp	t
Avg daily RH	h
Avg daily wind speed	w
Avg daily solar radn	s (Valiantzas only)

- both models return the ETo on a daily basis. Set the calculations to run once per day. When adding the input parameters, set the Aggregate Type to TIME RANGE, set the OFFSET TYPE to Days and the OFFSET to 1
- go to the Output tag for the aggregate and set the output tag as follows:
 - Name ETo
 - Unit mm
 - Display Range 0-10 Validation range 0-20

6.6.5.1 Valiantzas ETo

After creating the Aggregate and adding the parameters as tags, create a new formula for the model:

- name Penman ETo
- Placeholders t, h, w, s
- Formula

$$0.0393*(s*0.0864)*((t+9.5)^{0.5}) - ((0.1786*s^{0.6})^{0.94}) + (0.048*(t+20)*(1-0.01*h)*(u/3.6)^{0.7})h$$
- save the formula

6.6.5.2 Penman Aerodynamic ETo

After creating the Aggregate and adding the parameters as tags, create a new formula for the model:

- name Penman ETo

- Placeholders t, h, w
- Formula
 $(0.35+0.084*w)*(1-0.01*h)*0.6108*EXP(17.27*t/(t+237.7))$
- save the formula.

6.6.6. Fire Danger Index (FDI) Calculation

Calculation of the Fire Danger Index requires the following sensors: Air Temperature, Relative Humidity, Wind Speed.

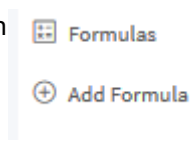
To create the FDI Formula:

- drill down to the Workspace which holds the Device
- then from the **Create or Manage** menu select **Create Aggregate**
- select the “new aggregate” to edit its properties
 - set the Name field to “Fire Danger Index”
 - set the Driver field to Input and click on Save
 - leave the Formula blank
- select the Inputs using the Tag Chooser and select the inputs to use
 - from the chooser select the **Air Temperature** tag and then click on **Add Row**, then click on **Save**
 - from the chooser select the **Relative Humidity** tag and then click on **Add Row**, then click on **Save**
 - from the chooser select the **Wind Speed** tag and then click on **Add Row**, then click on **Save**
- now go to the Aggregate Rows you have just created and configure them
 - first select Air Temperature
 - set the Typefield to Latest
 - set the Placeholder to t
 - click on Save

- now select the second Aggregate Row i.e. Relative Humidity
- set the Typefield to Latest
- set the Placeholder to h
- click on Save
- now select the third Aggregate Row i.e. Wind Speed
- set the Typefield to Latest
- set the Placeholder to w
- click on Save

Now you need to create the Formula:

- within the Aggregate, click on the “+” option in the Formula menu option
 - a new Formula will be created
- select the formula from the list
- when the Formula properties display, set the Name to the name you want to use for the formula e.g. FDI: the formula will later be available to other Aggregate functions using this name
- leave the Order field set to 1
- in the Expression field, type or past the formula in the format you created it earlier on (i.e. with a single character representing each parameter)
$$2*\exp(-0.52805+(0.0281*a)-(0.226*\text{sqrt}(h))+0.633*\text{sqrt}(w))$$
 - any Functions which you use (e.g. sqrt) must be written in lower case characters and the parameter enclosed in braces
- in the Placeholders section, type in the Letter corresponding to each input placeholder in turn, pressing Enter to activate each



- i.e. for the FDI type a and press Enter, then type h and press Enter then type w and press Enter
- click on the Save Button
- this formula will now be available to this and other Aggregate functions.

Update the Formula selection in the Aggregate function

- go back to the Aggregate list (Advanced / Aggregates) and select your Aggregate function again so the Properties are displayed
- click on the Formula list box and select the Name you gave the formula in the previous step e.g. FDI
 - the Formula Placeholders (a, h, w) should then be shown in the list of Required Formula Placeholders
- Save the updated Aggregate
- the Output tag can now be used in Graphs and Instruments.

6.6.7. NDVI Calculation

NDVI measurement is available from paired sensors which measure incoming and reflected radiation in two bands: red and near infra red. As the greenness of a crop increases it absorbs more red radiation and hence looks greener, but the level of absorption of infrared radiation does not change. So the relationship between the level of incoming and reflected red and infrared radiation can be used to determine the NDVI.

To create an Aggregate for NDVI:

- add the NDVI sensors to the telemetry node
- name the sensors using the format shown below
- create a new Aggregate function and select these tags as the inputs
- give each tag a placeholder as follows:
 - a Incoming NIR
 - b Incoming Red,

- c Reflected NIR
- d Reflected Red

- add a new formula and set the equation up in the form:

$$((c/a)-(d/b)) / ((c/a)-(d/b))$$

- then set up the parameters for the output tag
- use the Activity tab under the formula to check that the aggregate is calculating properly.

6.6.8. Soil Moisture Probe Temperature Compensation

Capacitance soil moisture probes infer moisture content of soil by measuring changes in the energy stored in the soil. By its nature, this “dielectric” behaviour is temperature sensitive. But most probe manufacturers have failed to account for it in their sensor design. The result is moisture readings which display a strong temperature effect – which at times can be high enough to render data unusable. Temperature compensation can be applied within Sensori through the use of Aggregate functions. At present an aggregate must be created for each individual sensor and needs to be fed with the soil temperature and soil moisture values.

Temperature compensation is usually applied by selecting a reference temperature (e.g. 20 degrees), subtracting the current temperature from it and then multiplying the result by a fraction of the soil moisture:

$$SM\ Comp = SM + (Tref - T) * TCfactor * SM$$

Where TCfactor is the temperature compensation factor e.g. 0.01

- as an example if the current moisture is 34% and the temperature 25 degrees,
 $SM\ Comp = 34 + (20 - 25) * 0.01 * 34 = 34 + (-1.7) = 32.3\%$

In the Sensori platform, this is done by adding an Aggregate function for each input tag. To do this:

- select your Device and then click on the Advanced menu and select Aggregates

- click on the Manage menu and select Create Aggregate
a new Aggregate function will be added and Sensori will open its properties
- set the name to "SM comp 010cm"
- set the operation to Formula
- in the Input Tags section, select the 10cm soil moisture and soil temperature tags (locate and select the tag from the list, then click on Add Row)
- in the Formula placeholder section for each tag, set a 1 character name: "m" for the soil moisture and "t" for the soil temp
now click on "+ Add Formula" to add a new formula. When the "New formula" entry is added to the formula list, select it to edit its properties
give the formula a name e.g. SM Temp Comp
- in the Placeholders section, make sure that "m" and "t" are added
set the formula to $m + ((20 - t) * 0.01 * m)$
save the formula
- reselect the Aggregate function
- click on the Output Tag tab and change the name to "SM010cm TC"
set the units to % or mm depending on your preference
set the measurement range to 0 to 120 and the display range to 10 to 60
- make sure the formula you just created is selected in the "formula" section: you can reuse this formula at any time
check and save the aggregate
- now repeat this process for each of the other soil moisture tags. As you create the new Aggregates, you can reuse the formula you created for the first tag.

6.7. Duration Calculation

You can use the duration calculation in a Time Series Graph to display the length of time a sensor value has been above or below a threshold.

To display a duration:

- open the graph you wish to add the Duration to, or create a new graph
- add the tag whose Duration you wish to display
 - if the tag is going to be graphed as a value, then the tag will be added twice: once for the raw value display and then again for the duration calculation

Tag: Air Temperature AT - FM-Arthurton 5170768

visualization: Line Color: #2889e9ff Delete row

If multiple selection is possible, just keep searching and selecting after the first item

Advanced options: general.showMarkerDots: 2 Stack: No Period: [dropdown]

Time in minutes above/below threshold: Yes Operation: Below Threshold: 2

- in the Advanced Options section for the tag, set the Period to the period over which you want to totalise e.g. 1 day
- from the “Time in minutes above/below threshold” list box, select Yes
- select the Operation list box and then choose
 - Above to display the time above the threshold
 - Below to display the time below the threshold
- then set a value to use for the Threshold
- if for instance you want to show the amount of time the temperature is below a frost threshold, set the Period to 1 day and the Operation to Below and then enter a value for the threshold e.g. 2 degrees

6.7.1. Wet Bulb Globe Temperature (WBGT)

Like other measures such as Apparent Temperature, Wet Bulb Globe Temperature converts the air temperature reading in to something which is a better indicator of the temperature felt by humans. It is being adopted by some sporting clubs to provide warnings on whether conditions are safe for the sport to be played outdoors.

6.7.1.1 Simplified Calculation

The simplified formula used by the BoM ignores solar radiation and wind so over reports in some conditions. The information here reproduces the calculation used by the BoM. For details see:

http://www.bom.gov.au/info/thermal_stress/index.shtml

$$WBGT = 0.567 \times Ta + 0.393 \times e + 3.94$$

where:

- Ta = Dry bulb temperature (°C)
- e = Water vapour pressure (hPa)
- rh = Relative Humidity [%]

The vapour pressure is calculated from the temperature and relative humidity using the equation:

$$e = rh / 100 \times 6.105 \times \exp (17.27 \times Ta / (237.7 + Ta))$$

To calculate the Vapour Pressure:

- select Advanced and then Aggregates
- from the menu select Manage / Create Aggregate
- set the new aggregate's name to Calc Vapour Pressure
- set the Operation to Formula
- scroll down to the Aggregate Rows section and add the sensors to be used
 - the first input should be Air Temperature
 - leave the type as Latest
 - set the placeholder to a
 - click on Save
 - now add Relative Humidity
 - leave the type as Latest
 - set the placeholder to h
 - click on Save
- now go back to the menu and select "Add formula"
- when the new formula displays, set the name to Calc-Water-vapour-pressure
- leave the order on 1
- set the Expression to $(h/100)*(6.105*\exp((17.27*a)/(237.7+a)))$
- in the Placeholders enter a , h
- click on Save
- now select Back to go back to the Aggregate function
- select the Output Tag section
 - select the General tab
 - set the name to Water-Vapour-Pressure
 - set the units to hPa
 - set the Validation Min and Max to 0-2000
 - set the display Min and Max to 800 to 1200

Now add another function for the WBGT:

- from the menu select Manage / Create Aggregate
- set the new aggregate's name to Calc WBGT
- set the Operation to Formula
- scroll down to the Aggregate Rows section and add the sensors to be used
 - the first input should be Air Temperature
 - leave the type as Latest
 - set the placeholder to a
 - click on Save
 - now add Water-Vapour-Pressure
 - leave the type as Latest
 - set the placeholder to e
 - click on Save
- now go back to the menu and select "Add formula"
- when the new formula displays, set the name to Calc-WBGT
- leave the order on 1
- set the Expression to
$$0.567 \times Ta + 0.393 \times e + 3.94$$
- in the Placeholders enter a e
- click on Save
- now select Back to go back to the Aggregate function
- select the Output Tag section
 - select the General tab
 - set the name to WBGT
 - set the units to C
 - set the Validation Min and Max to -40 to 60
 - set the display Min and Max to -10 to 50

6.7.1.2 Full Calculation

To calculate WBGT using the full calculation you need the following sensors: air temperature, relative humidity, wind speed and solar radiation. You must first calculate the Wet Bulb Temperature (from air temp and RH) and Black Globe Temperature (from air temp and solar radiation) and then combine these to get the WBGT.

Wet Bulb Temperature

- refer to section 6.6.3 for details on the Wet Bulb calculation

Black Globe Temperature Calculation

- select Advanced and then Aggregates
- from the menu select Manage / Create Aggregate

- set the new aggregate's name to Calc Black Globe Temperature
- set the Operation to Formula
- scroll down to the Aggregate Rows section and add the sensors to be used
 - the first input should be Air Temperature
 - leave the type as Latest
 - set the placeholder to a
 - click on Save
 - now add Relative Humidity
 - leave the type as Latest
 - set the placeholder to h
 - click on Save
 - now add Solar Radiation
 - leave the type as Latest
 - set the placeholder to s
 - click on Save
- now go back to the menu and select "Add formula"
- when the new formula displays, set the name to Calc-Black-Globe-Temp
- leave the order on 1
- set the Expression to $(0.01498*s) + (1.184*a) - (0.0789*h) - 2.739$
- in the Placeholders enter a h s
- click on Save
- now select Back to go back to the Aggregate function
- select the Output Tag section
 - select the General tab
 - set the name to BGT
 - set the units to C
 - set the Validation Min and Max to -40 to 60
 - set the display Min and Max to -10 to 50

Now create a new Aggregate for the Wet Bulb Globe Temperature Calculation

- select Advanced and then Aggregates
- from the menu select Manage / Create Aggregate
- set the new aggregate's name to Calc WBGT
- set the Operation to Formula
- scroll down to the Aggregate Rows section and add the sensors to be used
 - the first input should be Air Temperature
 - leave the type as Latest
 - set the placeholder to a
 - click on Save

- now add Wet Bulb Temperature
- leave the type as Latest
- set the placeholder to w
- click on Save
- now add Black Globe Temperature
- leave the type as Latest
- set the placeholder to g
- click on Save
- now go back to the menu and select “Add formula”
- when the new formula displays, set the name to Calc-WBGT
- leave the order on 1
- set the Expression to $(0.77*w)^*(0.2*g) * (0.1*a)$
- in the Placeholders enter a w g
- click on Save
- now select Back to go back to the Aggregate function
- select the Output Tag section
 - select the General tab
 - set the name to WBGT
 - set the units to C
 - set the Validation Min and Max to -40 to 60
 - set the display Min and Max to -10 to 50

You can now add the WBGT to your graphs and instruments. The thresholds used vary from one sector to another and the following table gives some examples for outdoor work:

Category	WBGT (°C)	Flag color
1	≤ 26	White
2	22 - 29	Green
3	20 - 31	Yellow
4	31 - 32	Red
5	≥ 32	Black

6.8. Checking Formula Calculations

Sensori provides a Formula Activity table which you can use to monitor the progress of calculations and hence check to see if they are running correctly or generating errors.

To view the Activity Table for a Formula:

- open the Aggregate function which contains the formula
 - select the Workspace and then select Advanced / Aggregates
 - when the list of Aggregate functions displays, click on the Aggregate you wish to check
- when the Aggregate properties display, click on the Formula menu option
- when the list of formulae displays, click on the Formula you wish to check
- now click on the **Activity** menu entry
- the Activity table displays the result of recent calculations performed by the function



Description	Subject	User	Data	Timestamp
Formula for resulted in 6.436639 from following placeholders and values	black-globe-temperature		a 14.71 s 1 h 79.29	13 minutes ago
Formula for resulted in 6.174581 from following placeholders and values	black-globe-temperature		a 14.49 s 1 h 79.31	28 minutes ago
Formula for resulted in 7.875425 from following placeholders and values	black-globe-temperature		a 14.24 s 1 h 79.35	43 minutes ago
Formula for resulted in 7.592843 from following placeholders and values	black-globe-temperature		a 14 s 1 h 79.33	58 minutes ago

The fields in the table hold the following information:

- Description: the status of the calculation and, if it succeeded, the last value
 - the error messages which appear here will assist you with trying to work out why a Formula failed
 - changed: the formula was edited by a user
 - formula failed and got disabled: likely to be caused by one of the inputs having an incorrect value
- Data: the value of each of the Placeholders (input variables) used by the formula

- if you are using the output of another formula as an input to this formula, check that the corresponding Placeholder has a legitimate value. If not, go back and inspect activity on that formula
- Timestamp: the time that the event was recorded
 - you can note the timestamp and then go back and have a look at the raw values for the tags to see if any are out of range or in error.

6.9. **Creating a Technical Monitoring Map**

You can combine Rules and Locations to create a summary map with icons to show the status of the tags on various RTUs. You could use this to create:

- a Battery Voltage Map which showing the status of the battery on each RTU
- a Scheduling Map which shows the status of each Soil Moisture Sum Tag
- an FDI Summary map showing the status of the Fire Danger Index across a region.

If you want to tie in the Rules with sending notifications, refer to section 8.1.1 for details on how to enable User Notifications.

There are several steps in this process:

- first off choose or create the Workspace in which the map will appear
- then go to the Menu and Attach the Devices whose data will be displayed
 - this can be either RTUs (for battery voltage) or Aggregate extensions (for FDI monitoring)
- for the Rules to apply the Tags on which you are going to alarm, must have valid values set for the MIN and Max values
 - you can check this by going to the TAGS section, selecting each tag in turn, choosing the General tab and then setting values for MIN and MAX
- now go to the Menu and create a Location for each device (RTU or Aggregate)
 - select **Advanced / Locations**
 - select **Manage / Create Location**
 - set the name and properties for each Location
 - enter the GPS Coordinates for the location
 - then select + Add Tag and choose the tag to attach to the location
 - you can use a single tag or attach multiple tags
- now create a Rule for each location
 - select **Advanced / Rules**
 - select **Manage / Create Rule/Alarm**

- set the name for the Rule e.g Shiraz 04 Battery Mon
- set the Rule Type to **Thresholds**
- in the Thresholds section, select the Tag to use as the source for this rule e.g. Battery Voltage
- select the type of Rule
 - for low battery use **Low Level**
 - for high FDI use **High Level**
- set a Hysteresis level: hysteresis stops the alarm from being triggered multiple times. If you have a low battery alarm at 3V and the voltage goes into alarm and then starts to rise again, a hysteresis of 10% means it needs to go above 3.3V before a new low alarm will be recognised again
- if you want a delay to apply before a new alarm is triggered (e.g. to wait for 4 hours before a data gap is recognised) enter the delay to apply
- the TAG section will display the current stats of the tag
- then configure the **Setpoints** section
 - Value Set this to the alarm value to use
 - Severity Select a severity value
 - if you are monitoring battery voltage you may wish to have a MINOR alert at 3.2V and a MAJOR alert at 3.0V
 - choose a Name to apply for the alert. This Name will then be written to Email and on screen alerts
 - you can continue adding as many setpoints for the alert as you need
- once you have added the Location and Rules, you can create a Dashboard on which to display the icons for the Locations
 - you can preview the map by clicking on the **Map** menu option
 - with the Workspace selected, choose **Manage / Create Dashboard**
 - Edit the Dashboard and Add a Tile
 - set the Tile type to **Map**
 - give the Tile a Name e.g. Battery Monitoring
 - you can choose a zoom level now or view the map then come back and adjust it: 5 is low, 17 is max zoom
 - in the Location field, click on the drop down list and select each Location whose icon will be shown on the Map
 - once you have finished, select Save
 - once the Map tile displays, review it and then go back and make any adjustments
- the icons for the locations will change colour according to the status of the tag in relation to the rules:
 - No alert OK Blue

- Minor Alert Yellow
- Major Warning Amber
- Critical Alarm Red

6.10. *Displaying Camera Images*

The YDOC RTUs may be fitted with a camera and although Sensori does not yet include native functionality for viewing camera images, you can embed the images using the viewer from YDOC Insights.

To display the camera images:

- add the camera to the configuration of your YDOC
- leave the RTU set so that the data is sent via FTP to Sensori
- in the Camera settings, set the transfer mode to TCP and then in the Modem Output / TCP Settings, set the RTU to send data via TCP to the nominated YDOC Insights server. If you are using TOIP's server set the credentials for:
 - Server 120.150.31.37 Port 37
 - User toip
 - Password p10t
- on the YDOC Insights server move the RTU to a workspace created for the customer and ensure that there is a User created which has access to this workspace/Location
- create a new Report using the template "Slide Show"
 - give the report a suitable name e.g Camera Image Viewer
 - set the image size to a value just larger than the size of image you selected for the camera
- now log in to Sensori and select the Workspace in which the data from the RTU will be viewed
- create a Dashboard for the camera image and give it a suitable name
- add a new tile to the Dashboard and select Edit Tile
- set the type to "HTML"
- in the html, add the code for the Map view for the report

```
<iframe
src="http://120.150.31.37:8585/report.htm?
itemid=<report_code>&locid=<location_code>&groupBy=5&
amp;viewMode=0&width=800&height=600&user=<Use
r Name>&password=<Password>" style="width:800px;
height:600px;"allowtransparency="true" frameborder="no"></iframe>
```

 - report_code: this is the "Report ID" field shown in the reports list
 - location_code: this is the "LocationCode" for the RTU site which is available in the Location Properties
 - UserName & Password: are the login credentials used to access this site
- Save the Tile and test that it displays correctly

- if your browser settings are set to block Insecure content (http) on a secure (https) page, the report will not display
- if your security policy allows it, change the browser setting to allow it
- if not, create a separate html page on a web server which holds a table in which is contained the iframe. Contact TOIP for assistance with this as the page can be hosted on the toip's servers.

7. Exporting Information From Sensori

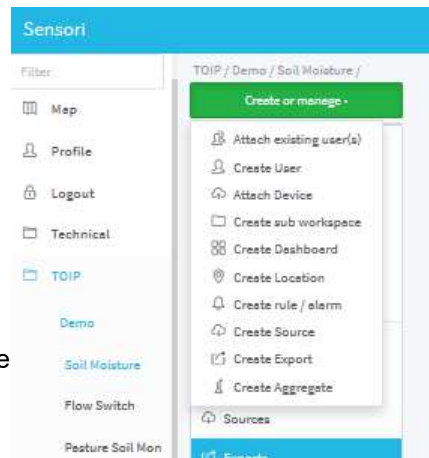
Any of the data recorded in Sensori can be exported for use in other systems. The Export functions are divided in to several sections:

- General settings: where you set the export name and type as well as the amount of data to export
- Output: where you set the settings specific to the type of export such as the ftp server IP address and credentials
- Task: where you set when and how often the report will run.

7.1. Creating an Export

To create a new Export:

- locate the **Workspace** which contains the **Devices** whose data you wish to export
 - if the data will come from tags on multiple Devices, you may wish to create a new Workspace and add in all the required Devices (refer Section 5.3 for details on how to add multiple Devices to a workspace)
- click on the **Exports** option in the menu for the Workspace to display any existing Exports
- from the **Create or Manage** menu select **Create Export**
- a new export will be added to the list of Exports.



Exports			
1 Total		Filter	
Bulk actions on selected rows			
<input type="checkbox"/>	Name	Type	Format
<input type="checkbox"/>	newExport	email	standard-json

7.2. Configuring the export

Click on the Export to configure it:

- Name: give the function a suitable name
- Type: exports can send their data using any of several methods. Select the one which you wish to use:
 - Email: sends the data via Email to the selected Email address. The data will be held in the body of the email
 - Email as Attachment: the data will be sent in an attachment to the email
 - FTP: sends the data to an FTP server
 - Downloadable: creates a file which can be downloaded from your browser
 - HTTP URL Encoded Form: sends the data to an HTTP server from where it can be downloaded
 - HTTP URL with base 64 encoded string: sends the data to an HTTP server in Base 64 format, from where it can be downloaded
- Format: the data may be written in several different formats. Select the one which you wish to use
 - Standard Json: Writes the file in JSON format
 - Standard CSV: Writes the file in comma separated values text format
 - Previous format: provided to maintain compatibility with the old Sensori platform
 - Vertical timestamp table (CSV): This is the format you will use most of the time: it places the tags in a table format with one row per timestamp
 - VMI SAP EDI DC40: a format used by the SAP Enterprise Information System (EIS) for importing data
 - Key Value Pairs (JSON): writes the data out in JSON format as pairs of keys (IDs) and sensor values
 - e.g. {"KEY1": {"NAME": "XXXXXX", "VALUE": 100}, "KEY2":

```
{"NAME" : "YYYYYYY", "VALUE" : 200}, "KEY3" :  
{"NAME" : "ZZZZZZ", "VALUE" : 500}
```

- Time Range: Controls how much data to include.
 - Time units: select Months, Hours, Minutes or Days as needed e.g Days
 - Time Range Value: enter the number of units e.g. 7
- TimeZone: readings stored in the database are timestamped in UTC. When you export the data you can choose what time zone to have them exported in
 - for instance if the site is located in an area within Central Standard Time, select a time zone of +09:30
- Apply Daylight Saving Automatically:
 - Set to yes if you want the report to automatically be adjusted with daylight savings
 - but if the time span overlaps a change between daylight saving and normal time, you may wish to set this to OFF to avoid the 1 hour data gap which will otherwise occur at the time of transition
- Custom Export File Name:
 - enable this box if you want to be able to set your own file name
 - If this is disabled, Sensori sets the file name
- Export File Name: if you have selected **Yes** in the Custom Export File Name list box, then type the name in this field
- Custom Export file Name Timestamp:
 - the file name is normally made up of two parts: the name specified above and the time stamp
 - select this option if you do not want the timestamp to be appended to the name
- Timestamp format: selects the format to be used for the timestamps
- Tag column format:
 - by default the Tag Name which is exported has the Device name appended to it
 - You can choose to export just the name, the name and unit or the Device name, tag and unit
 - for most applications you want just the "tag name"

7.3. Set the Output options

Depending on the output method you have selected, you must then set the required options:

- FTP:
 - set the URL, Port, User name, password and destination directory (path)

- if you are not sending to a specific directory, set the directory to "/"
- Email:
 - when Email output is selected, the data will appear in the body of the email
 - enter the Email address to which the email will be sent
 - if a password is required to connect to the server, enter it
- Email Attachment:
 - is this method is selected, the data will be sent as an attachment to the email
 - enter the Email address to which the email will be sent
 - if a password is required to connect to the server, enter it
- Downloadable:
 - if you select this format the exported file will be available for download from the server
 - after the report is run, you will see an additional field below the General report properties
 - this shows the list of downloadable files

Downloadable

Refresh the page to see new results

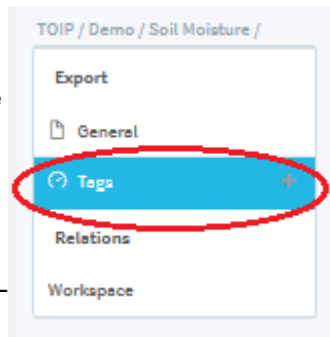
Name	Created	
sensori-export-newExport-xQMonaCG-2021_02_09_22_45_02.csv	8 hours ago	Download
sensori-export-newExport-QMclYRZy-2021_02_09_22_40_04.csv	8 hours ago	Download

- click on the file of interest to download it to your PC and open it.

7.4. Selecting Tags to Include

The next step is to choose the **Tags** whose data you wish to include in the export

- you will only be able to add tags from Devices which are contained in the same Workspace as the Report
- if you have not already done so, go back and Attach any Devices whose data you wish to include in the export, to the Workspace
 - note that Tag chooser shows you ALL of the tags that you have access to
 - to limit the display to only the Device in this workspace, type the Device EUI or Serial Number in the FILTER field
- after selecting the required tags, save the report.



7.5. **Controlling When the Export Runs**

The **Task Settings** control how often and when the export will run

- Interval Type: select the type of interval to use - Months, Hours, Minutes or Days
- Interval Value: after selecting the Interval Type, enter the value for the Interval
e.g. Days and 7 to run it weekly
- Next Run Date: enter the date and time on which you want the report to start running
- click on **Save** to save the changes.

If you want a report to run immediately, set the Date to a date earlier than today. The report will run and you will see it added to the list of recent report runs.

If you don't want the report to run automatically, click on the box labelled "Run once and now".

Note that the export currently works back from the current date and time

- if you set a report to extract 14 days worth of data and to run every day, each run of the report will contain the last 14 days data
- there is currently no way of nominating a start date and selecting a period from that date forward
- if you want to export data for a long time period you will have to set up multiple reports, each containing only a couple of tags.

8. Technical Monitoring – Alarms and Events

Within Sensori you can create rules which will generate an Alarm if the values of a tag go above or below a threshold. You can set multiple thresholds for each alert. The Rules can be created at the Tag or Device level.

Rules can be selected from one of the following types:

- Thresholds: check the value of a tag and issue an alert if it is out of the nominated range
- VMI Actuation date: used with level sensors in tanks to test when the low level alarm will be issued
- Device Connection Checker: used to signal that a telemetry unit has not connected to send data i.e Delayed Data alerts
- Measurement Validation and Correction: allows you to test whether a sensor reading is in range and if needed, to apply a correction.

Notifying users of alarms requires two steps:

- firstly that of creating the alarm (via Rules)
- secondly controlling who will be notified of the alarm and how they will receive the notification (Email or SMS) and these are visible in the Channels.

8.1. *Users and Notifications*

Alarm and Event Monitoring work in conjunction with the Notification settings that you establish for each user in the given workspace: if a User has access to multiple Workspaces, you need to set them to receive alerts for each one.

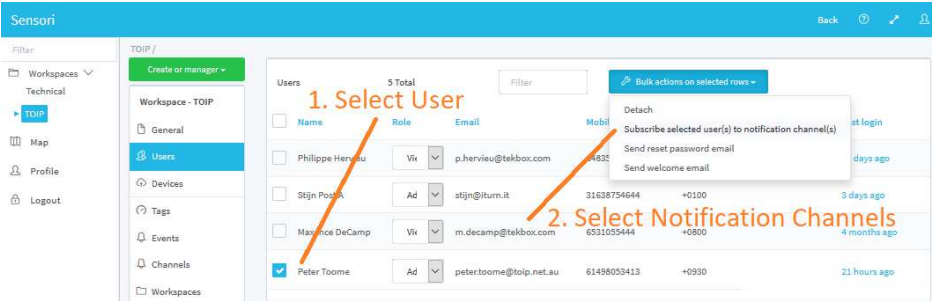
The Channels allow to you view and change the types of notifications a user will receive.

8.1.1. Turning on Notifications for a User

To set the Notification Preferences for a User:

- from the main menu, locate and Select the **Workspace** which holds the User Account you wish to modify
- click on the **Users** option and a list of the Users able to access that Workspace will display

- click on the Check Box next to the desired User in the User List to activate it
- then, from the **Bulk Actions on Selected Rows** menu, select **Subscribe Selected User to Notification Channels**.



The Notification settings for the user will be shown

- the settings are broken in to two areas: Alarm Type (Channels) and Notification method
- Alarm Type or Channel: the left side of the screen has a list of the alarm types that can be notified. Activate the check box to select that type
 - Alarm: From tests on tag values
 - Hardware: From delayed connections
 - Acknowledged: Tells you an alarm has been acknowledged
- Notification Method: the right side of the screen allows you to choose how the user will receive the Notifications
 - SMS: the server sends the alert by SMS. This is an extra cost option
 - Email: the server sends the alert by Email to the email address set for the user i.e. the user name

- Stop Notifications: disables notifications

Search < Back / TOIP / Profile Ag / Marjimus Truffles / Orchard 483

Select below to which channels and via which medium you want to subscribe the selected users

Select channel(s)

alarm

hardware

acknowledged

Select one or more medium

SMS

Email

Optionally select a minimum severity level

If another option is selected then Any, no notifications will be send for events with a lower then selected severity level

Any

Save

- to receive Delayed Data and Sensor alarms, the user should have the Alarm check box set and the notification type set to Email.
- you can also choose whether the User will receive all alerts or just those above a certain level. In the section labelled **Optionally select a minimum severity level**, click on the Checkbox and choose a level
 - All : the user will receive all alerts (the default)
 - Minor: the user will only receive Minor and above
 - Major: the user will receive major and above
 - Critical: the user will receive only critical and failure
 - Failure: the user will only receive failure notifications
- click on the Save button to activate the changes

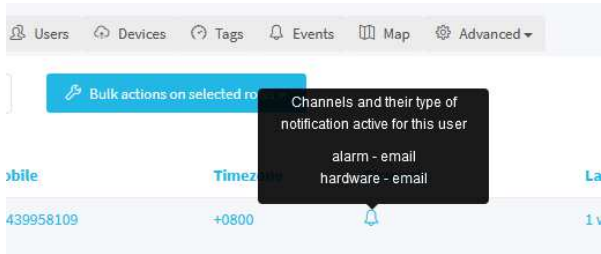
Please use caution when selecting SMS alerts as the number of SMS messages (and hence cost) can get very high. You should always try and use Email instead of SMS.

8.1.2. Viewing Notification Channels for a User

You can quickly view which notification channels are set for a user in a given workspace as follows:

- open the **Workspace** of interest and click on the Users tab

- locate the column labelled **Channels**
 - this will have a bell symbol in it if a user is subscribed to any notification channels
- hover your mouse over the bell symbol and a window will open showing the subscribed channels and how the notifications will be sent.

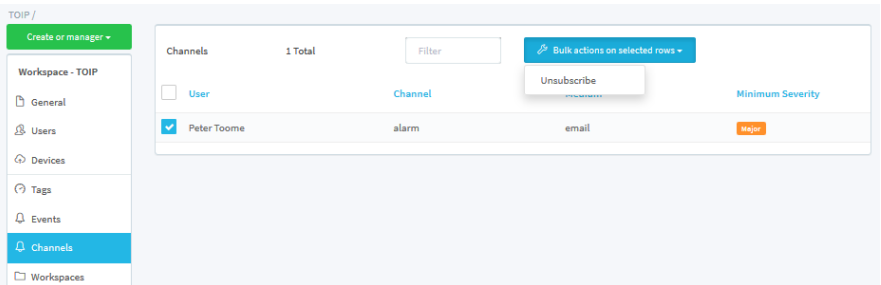


8.1.3. Turning Off Notifications for a User

Although you can see the Notifications a User is subscribed to in the User tab, you can only turn the notifications off from the Channels tyab,

To stop a User getting the notifications:

- select the **Workspace** in which the User is active
- click on **Channels**
- now activate the Check Box next to the user account you wish to change the Alarm notifications for



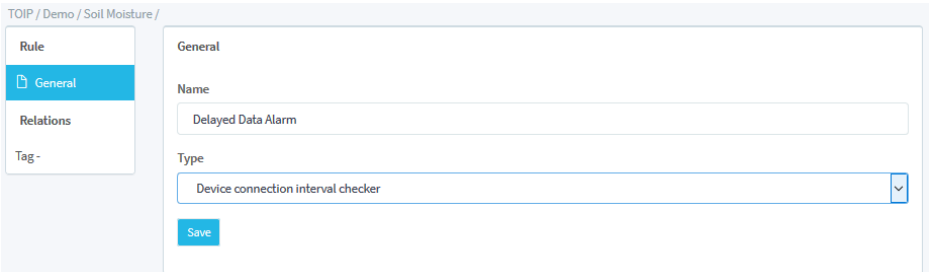
- from the blue "bulk actions on selected rows" menu option at the top of the screen, select "Unsubscribe"

8.2. Creating a Delayed Data Alert

The LoRa WAN and Cellular RTUs will connect at regular intervals and send data to the Tekbox Broker, which in turn exports the data to Sensori. Sensori can issue an alert if data has not been received within a set time frame. For instance if a site is sending new readings every 15 minutes, you may wish to raise an alarm if data has not been received for 1 hour. This may also be referred to as a “Connection Time Alert”.

To create an alert:

- first off, make sure that the Device you wish to alarm on is included in the Workspace in which you want to create the alert
- scroll down to the Workspace which contains the device which you wish to alert and select the Workspace
- now click on the **Advanced** menu and then select **Rules**
 - if there are any existing rules, they will display in the Rules list
 - if not, the list will be empty
- now click on **Manage** menu and select **Create Rule/Alarm**
 - a new rule will be created and the platform will take you to the Rule Editor



The screenshot shows a web interface for creating a rule. At the top left, the breadcrumb path is "TOIP / Demo / Soil Moisture /". On the left side, there is a vertical menu with four items: "Rule", "General" (highlighted in blue), "Relations", and "Tag-". The main content area is titled "General" and contains two input fields. The first is labeled "Name" and has the text "Delayed Data Alarm" entered. The second is labeled "Type" and is a dropdown menu with "Device connection interval checker" selected. Below these fields is a blue "Save" button.

- Name: give the rule an appropriate name e.g. Delayed Data Alarm
- Type: from the drop down list box select “Device connection interval checker”
- click on **Save** to save the changes
- an additional properties box will be added, with settings for the interval checker
- Device: from the Drop Down list, select the Serial Number or EUI for the device to which you want to add the rule
- Time in Minutes: set this field to the number of minutes which must elapse before an alert is raised
 - this should be a multiple of the connection interval e.g. for devices on 15 minute logging use 60 minutes as the delay

- click on **Save** to save the changes.

Device connection interval checker

Device

00B1E1EE27EF2347 00B1E1EE27EF2347

Time in minutes

60

Save

8.3. **Setting Up Alarms Based on Tag Values**

In order to send alarms to a user you must:

- subscribe the user to notification channels (Refer Section 8.1.1)
- ensure the tag has Min and Max values set (Refer Section 4.7.1)
- create a rule which tests the values and generates the alert

8.3.1. **Setting Thresholds on a Tag**

Alarms will only be active if the Tag you are testing has valid MIN and MAX values set in the tag properties. To check this:

- click on the **Tags** tab to show the list of tags
- locate the tag which you will use to generate the alarm and select it
- when the Tag's properties display, click on the **General** tab
- in the Configuration section at the bottom of the page, enter values for the Max and Min range
 - the alarm values you set must fall within this range. For instance if you set the range for Min and Max to 0 and 60, your alarm must be within this range – you can not alert on say a figure of 70.

To create an alarm on a Tag Value:

- select the Workspace which houses the RTU for which you wish to create the alarm

- from the **Manage** Menu, select **Create Rule / Alarm**
- a rule will be created and you will be taken straight to the Properties settings for the rule
 - if the rule properties do not display or if you wish to come back to it later, click on the **Advanced** menu and then select **Rules**. A list of the Rules in the current Workspace will be displayed
- give the rule a name e.g. Flow alarm
- set the Type to Thresholds
- click on Save
- the Threshold properties will then show at the bottom of the screen
- click on the **TAG** list box and choose the switch tag you wish to alarm e.g. Switch 1
- set the Type according to whether you want a high or low alarm
 - High Level: triggers when the value exceeds the threshold
 - Low level: triggers when the value falls below the threshold
- set the Hysteresis to a suitable value
 - hysteresis refers to the level a high alarm must drop back to before a new alarm can be triggered
 - for instance, if you have an alarm set to trigger at 1V, you may wish the voltage to fall back to below 0.8V before a new alarm can be sent. This prevents the system from sending multiple alarms if the value is hovering around the alarm point
 - a Hysteresis of 20% on the 1V alarm means the voltage has to fall to 0.8V before a new alarm can be sent
- in the **Setpoints** area, click on ADD ROW and a new alarm setting line will be added
- set the value to the level you wish to alarm at
- set the Severity according to the urgency of the alarm

- Minor a low level alarm
- Major an alarm with serious consequences
- Critical a catastrophic event
- alarms will be sent to users whose Notification level has been set to the level in the Severity list box
- set the Name to something suitable e.g. End Bay alarm
- click on Save
- you can continue adding Setpoints if you have multiple alarm points: each can have a different severity.

Any alarms which occur will display in the Events list

When an alarm triggers, the users who have subscribed to **Notifications** for the events from this Workspace will be sent the Alerts via Email or SMS

- There will be a link in the Email from which you can Acknowledge the alarm (or you can do it from Events)

9. Tag Colour and Value Ranges for Graphing

For consistency and to make using the system more intuitive we recommend that you use a standard set of colours for the tags on your graphs. If you This makes it easier for users to identify the tags on the graph: for instance the first tag displayed is always blue and the second red.

Similarly if you are using colour bands, we suggest using a standard set of colours for each type of tag.

Sensori Graph Colours

Tag		Colour	Parameter
1		#2889e9ff	RH
2		#e95a28ff	Air Temp
3		#20912fff	Leaf Wetness
4		#e99a28ff	
5		#888c90ff	Wind speed
6		#9c278cff	
7		#e9d428ff	SR
8		#494a4cff	Signal Strength
9		#28bce9ff	Daily Rainfall
10		#ef447bff	Wind Direction
11		#c7e928ff	Current
12		#e96128ff	Battery Voltage

Plot Ranges

Parameter	Level	Colour	Value Range
Default	Low	#dddf0d29	
	Normal	#8ddf0d4a	
	High	#df620d53	
Air Temperature	Low	#0d99df29	-5 - 5
	Normal	#96df0d6e	5 - 35

	High	#df620d53	35 - 45
Battery Voltage	Low	#df2a0d3d	#df2a0d3d
	Normal	#96df0d6e	#96df0d6e
	High	#df620d53	#df620d53
Delta-T	0 - 2	#ddd0d	
	2 - 8	#2adf0d60	
	8 - 10	#df840d56	
	10 - 25	#df690dad	
PAW	Wet	#0d5cdf29	
	Normal	#26df0d53	
	Dry	#df360d6d	
RH	Low	#df620d5U+0 033	0 - 10
	Normal	#96df0d6e	10 - 90
	High	#0d5cdf29	90 - 100
Soil Moisture	Low	#df620d53	
	Normal	#96df0d6e	
	High	#0d5cdf29	
Soil Tension		#df900d48	-60 to -50
		#0ddf1541	-50 to -8
		#0d65df4f	-8 to 0
Wind Speed	Low	#0d99df29	0 - 10
	Normal	#96df0d6e	10 - 60
	High	#df620d53	60 - 100