RealiteQ™

Real Time Remote Control and Monitoring

# RealiteQ User Interface (UI)

## User manual

## PC version


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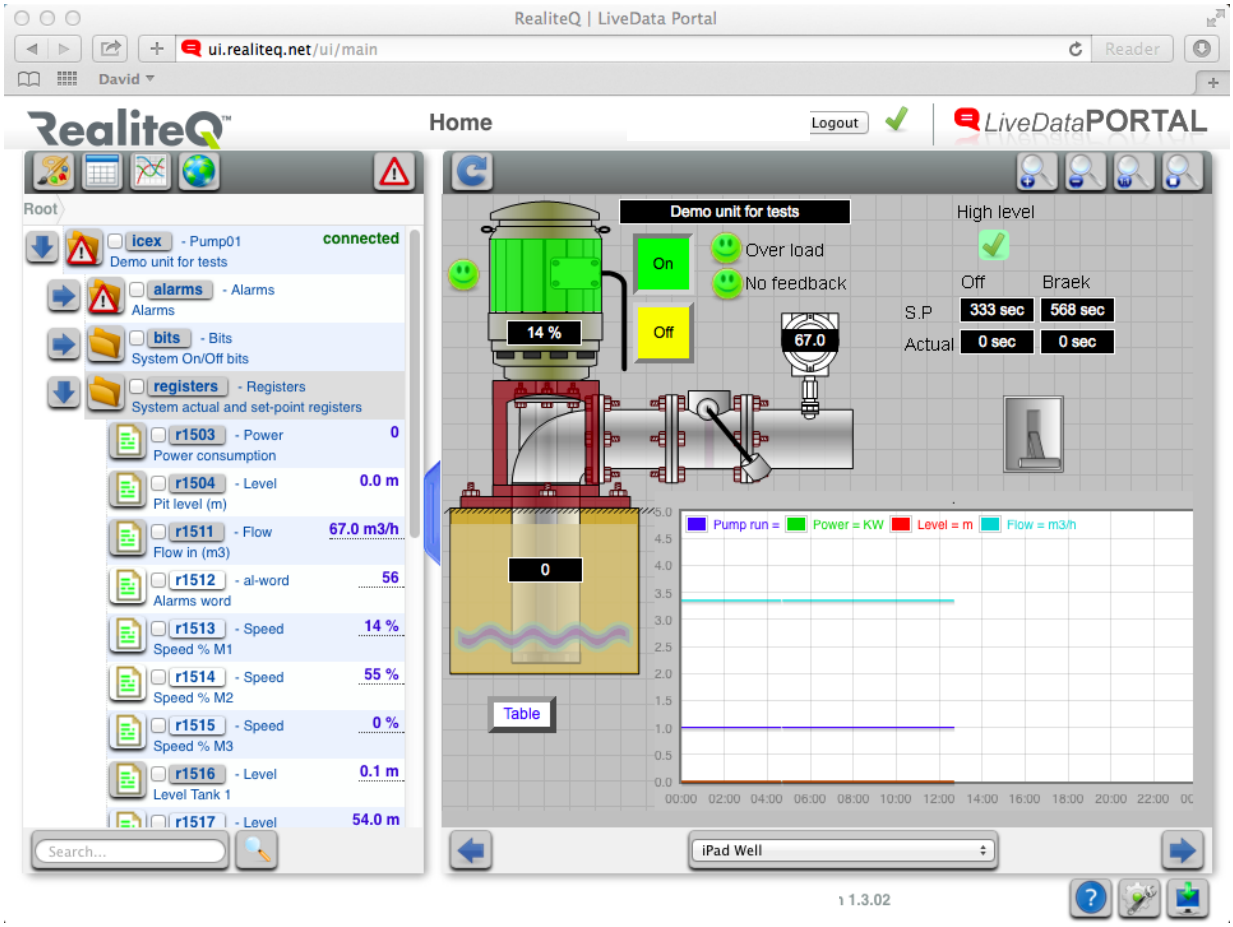
## Version changes

| | | |
|---|---|---|
| 1.0.00 | 2011-10-15 | First draft |
| 1.1.01 | 2012-02-01 | Updates new functionalities |
| 1.2.01 | 2013-05-01 | Updates new functionalities |
| 1.3.01 | 2015-01-01 | Updates new functionalities |
| 1.4.01 | 2018-01-25 | Updates new functionalities |
| 1.5.00 | 2018-10-11 | Added Special functions to appendix |
| 1.6.5 | 2019-11-05 | Improved daily/monthly reports functionalities |
| 1.6.24 | 2020-07-01 | Impruved security; Added: voice alarm messaging; “Forgot password?”; added more expressions to provde Boolean opertaions on registers; improved Special functions |

# 1. Introduction

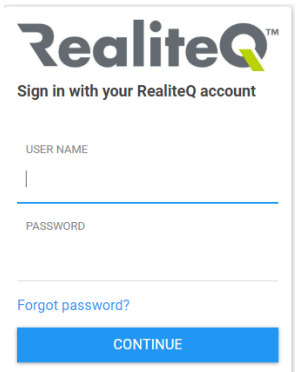
The UI (User interface) can be run on any modern browser such as MS Edge or Explorer, Fire-Fox, Chrome, Safari etc. that are running on computer, tablet or smart-phone. The UI pages can include real-time and historical data received from the RealiteQ COMP (Central Online Management Portal).




# 2. Getting Started

## 2.1. Login:

Open your browser and type URL. In this manual we will work with demo project http://ui.realiteq.net. Login with username = **ui** and password **ui**.

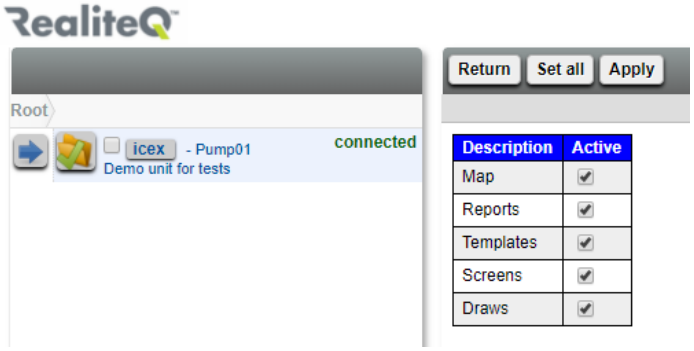


After successfully login to the COMP, the screen will change, and the communication status will change to ok.


The login is valid for one hours of working. The page keeps the last security key even if you are going out for a short period (10 minutes) so you can browse back the page without re-login. For security reasons do not forget to logout before you are closing the page permanently.


## 2.2. Download UI project configuration:

Click on  button (You will find it on the right bottom corner of the screen) to open the download-project screen.




Click on **Set All** button, then, when all options are checked, click on **Apply**, Confirm with **OK** and then click on **Return** button.

## 2.3. User interface (UI):

The UI consists of two parts:

- On the left side is the project *nodes tree*.
- On the right side, you can view process graphic screens, unit's location map, alarms status, alarms historical log, variable historical log in a table or trend format.

One way to determine what is shown on the right is using the *navigate buttons*:


**Navigate buttons**:

 Map button - Displays unit's location on map.


Screens button - Displays process screens


Reports button - Displays project table reports


Trend graph button- Displays project trend graph reports

Show silenced alarms


Current alarm buttons - Display project current active alarms table

**Note**: The image button displays a textual tooltip when the mouse moves over it. The background color of the pointed button will change to dark gray too. The tool-tip yellow text window is shown in a delay of one second and disappears after maximum five seconds. The tool-tip window disappears also when you click on the button or the mouse is out of the button area.

## 3. Working with Node Tree


You can control the tree side width by dragging the splitter. You can close/open the window side by clicking on the splitter button.

**Nodes:**

Typical project data structure:

project
    unit 1
        group1
            item 1
            …….

item n
group n
unit n

A *node* is a single variable that has a single state at any given time. A node is referenced using a node path (much like a directory path in a computer). All the project nodes are related to each other and are arranged in a hierarchical tree-like structure called the namespace, at the top of which is the root node. A node can have zero or any number of sub-nodes.

There are three types of nodes:

- Group – (Group of nodes). Use to improve projects displaying performance.
  A unit sign-in the COMP and takes ownership of a group of nodes, for instance /unit1. All sub-nodes residing under /unit1 will henceforth to be updated by the unit.
- Point - A variable or manipulated value.
- Alarm – Unit alarm or manipulated alarm node.

The components of a node path are delimited by forward slashes. Node's paths make it easy to refer to a node by providing a uniform and universal format.
*Example: /unit1/alarm/hhlevel*
A node includes:

- Path – (Node path). One word, only standard letters and numbers are allowed. For node that reflects variables from a producer, only names of producer variable are allowed.
- Tag-name – (Node tag-name). Normally one descriptive word.
- Description – Node description.
- State **–** Includes: value, quality, type and stamp.

**States:**

A node state represents the condition of a node at a specific time. A state has the following attributes:

- Value – The node's value.
- Quality – The condition of the value:

| **Text** | **Color** |
|---|---|
| Unknown | gray |
| Good | Green |
| Bad | Red |
| Invalid | Red |
| forced | Gray |
| Simulated | Gray |

- Data type – An optional number denoting the value's data type: text, number (integer or float) or Boolean

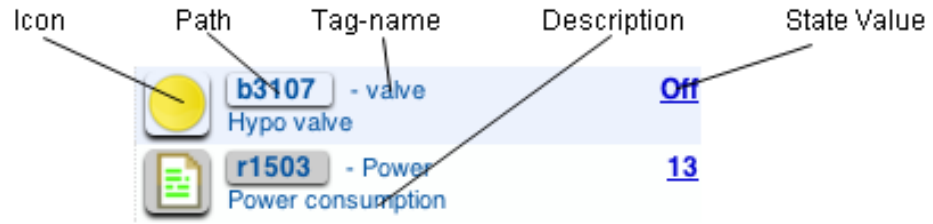
(On\Off).

- Stamp – The time and date the item state was encountered.

All state transitions can be recorded on a historical states table and can be displayed by the historical trend\table displays.

## 3.1 Tree strip structure

Each project node is displaying in a separate strip.



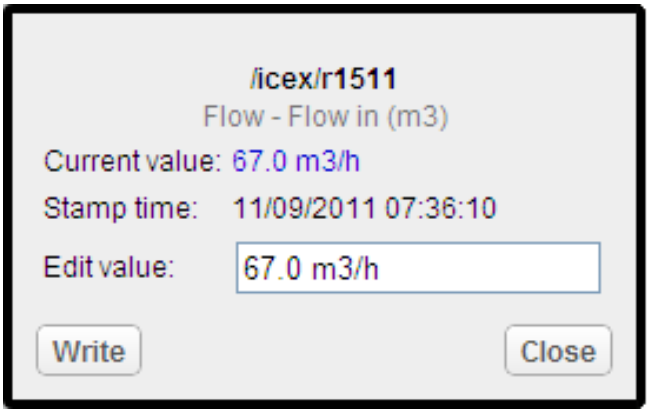

Gray button means: "node has a history" and clicking on its icon button will open node history on the right side of the window.

Click the icon button or the node button load different history tables or screens:

- Clicking on icon button of:
  - Group node – Displays group graphic screen (if available).
  - Alarm node – No function.
  - Point node – Node with history, displays log history in trend format. Node without history no function.

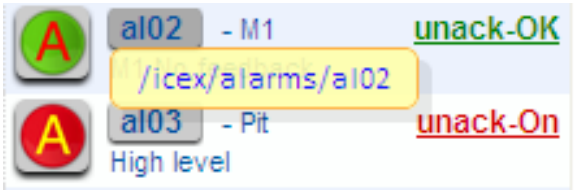
- Clicking on path button of:
  - Group node – Displays group current alarms table.
  - Alarm node – Displays node alarm history.
  - Point node – Node with history, displays log history in table format. Node without history - no function.

Writeable node state value appears to underline. Clicking writeable node value opens write dialog box. There are two kinds of write dialog window one for numerical value and one for On/off set value. The upper part displays the online current node state. The lower part is used to modify the node state value.




The icon button, path button and value display a textual tooltip when the mouse moves over them. The cursor type and the background color of the pointed button will change too. The tool-tip yellow text window is shown in a delay of one second and disappears after maximum five seconds. The tool-tip window disappears immediately if you click on the button. Moving to point on the tool-tip window area will keep the tool-tip window open.

Pointing over the path opens the tooltip window displaying the full path.




You can copy the full path by moving inside the tooltip to keep it open and then just do a simple select and copy.
Pointing over the node icon or value opens the tool-tip window displaying the node description and status.


Moving over the tool-tip windows will keep it open.

Navigate buttons:

Map - Displays unit's location map. It appears only in the group node tools-tip. The button will appear only for groups that set to appear on the map. The map center will be located on the group location.

Screens - Displays process screens. It appears only in the group node tools-tip. The button will appear only for groups that got process screens.

Reports - Displays project table reports. In group node tooltip: The button will appear only for groups that got predefines reports. In point or alarm node tooltip: The button will appear only for nodes that preset to collect history.

Trend graph - Displays project trend graph reports. In group node tooltip: The button will appear only for groups that got predefines reports. In the point node tooltip: The button will appear only for nodes that preset to collect history.

Current alarm- Displays project current active alarms table. Appears only in group node tooltip.


Alarm history – Displays node alarm history. The button always appears in a group node tooltip and for alarm node that preset to collect history.


Generate daily/monthly report in CSV or PDF format

Buttons in the node icon tooltip displays the information in the window right side buttons in the node value tool-tip display's information inside the tool-tip window.

## 3.2. Group strip



- Show/hide group node.


Group - Group of nodes

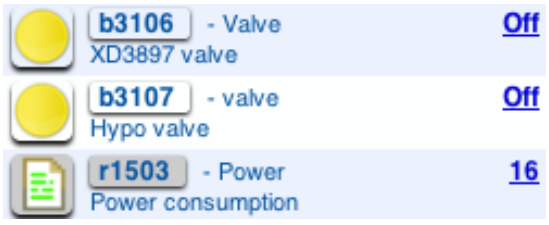

Connected unit - Unit group connection ok. Quality status = good. Text status appears in green color.


Disconnected unit - Unit group not connected. Quality status bad or unknown. Text status appears in red color.


Alarms group or unit with alarms - Quality status = good. Text status appears in green color.

Available unit node values: connected (green color), unconnected (red/brown color). Clicking the group icon opens the group process screen (if there is) and the tree focuses to display only the unit tree.
Clicking the node path opens the group current active alarms table.

## 3.3. Point strip





Unknown - On\Off point in "unknown" or "bad" state value. Text appears in gray.

Off - On\Off point in "Off" state value. Text appears in yellow.

On - On\Off point in "On" state value. Text appears in green.

Unknown - Numerical point in "unknown" state value. Text appears in gray

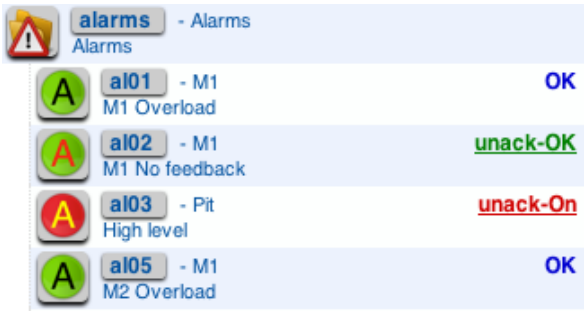
Good - Numerical point in "good" state value. Text appears in green.

Bad - Numerical point in "bad" or invalid state value. Text appears in red.

If "point has a history" sign appears, clicking on the node icon displays the *node history trend* graph and clicking on the path button displays the *node history table*.

## 3.4. Alarm strip

**Alarms are events that can be set to be triggered upon a certain condition which requires the attention of the operator. The alarm's conditions are set, in RealiteQ-COMP during the project setting. The alarm's conditions are constantly evaluated by the RealiteQ-COMP. When a new alarm occurs, the COMP updates the RealiteQ - Consumer (Viewer).**




Unknown - Alarm in unknown status. Value = unknown in gray color

Inactive - Alarm inactive. Value = OK in blue color.

Inactive unack - Alarm inactive and unacknowledged. Value = unack-OK in green color.

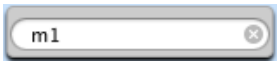
Active ack - Alarm active and acknowledged. Value = ack-On in red color.

Active unack - Alarm active and unacknowledged. Value = unack-On in red color.

If "alarm has a history" sign appears, clicking on the alarm icon or path will display the alarm history.
If the alarm was defined for user acknowledge the alarm value will appear to underline. Click the value will be acknowledges the alarm.

Alarms that were set to silent will appear with a "silent" suffix.

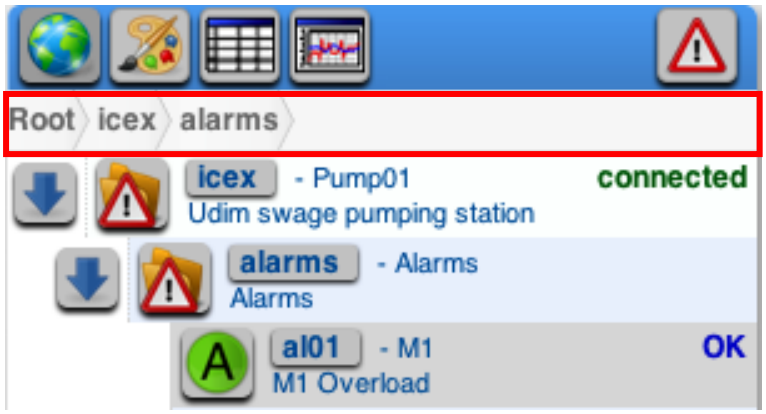
## 3.5. Searching the nodes tree


Search shows all the tree nodes that their path, tag-name or description included the search criteria. The system displays the first fifty nodes. To view more scroll to the end of the list and click on the "View more". To search nodes, enter the search criteria 

and then click  the search button. To return to display the normal tree click the Breadcrumbs root button.

## 3.6. Working with the Breadcrumbs

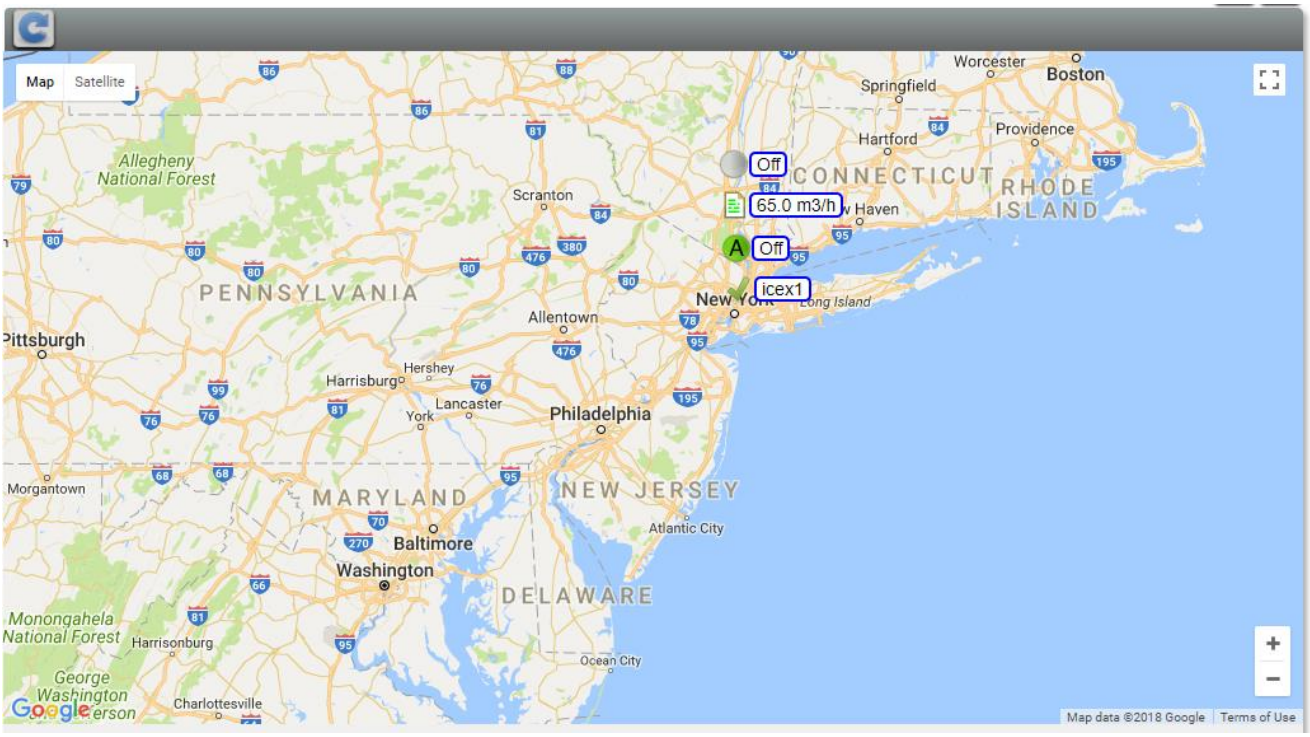
The Breadcrumbs provide an easy way to see where you are on the tree and allow you to jump back to any stage in the tree with a single click.




## 4.  Map

**The map shows the location and status of the project stations. The map can be displayed in a street or satellite format (see upper left corner of map display). The user can control the map zoom with mouse wheel or with the + and – buttons in lower left side of display. You can drag the map display to any direction. You also can expend the map to full display (upper right corner icon). In this case ESC will return to normal view.**

On map you can see also status of some of the nodes and alarms.




**Station status**:

 Disconnected

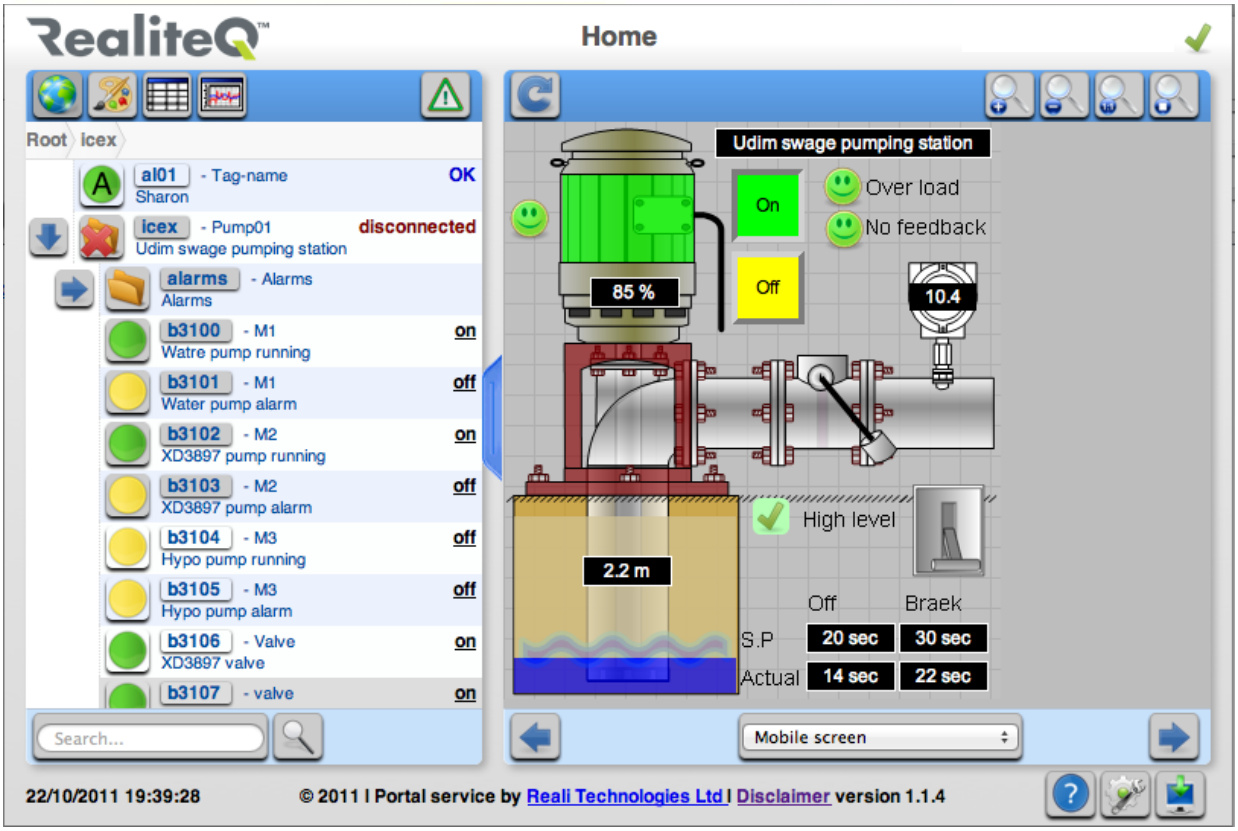
 Connected

 Connected with at least one active alarm.

Clicking station status icon shows the station process screen on the right side (If such a screen available). The tree side displays the specific station tree. Move over a station's icon open group tool-tip window (for more details see paragraph 3.1)

## 5.  Process screen

**RealiteQ-UI screens are the primary elements of the User interface. They present the operator real-time information in a graphical form and allow him to change and control field values. This can be done by either entering numerical values using the keyboard or by direct manipulation using the mouse, clicking and dragging graphical elements.**




RealiteQ-UI offers a powerful screen engine capable of presenting rich, high-quality graphics to the operator. Graphical elements can be connected to real-time values by means of links. Links can be programmed in a variety of ways to control every aspect of the display, including changing colors, visibility, position, etc. Links can be used to define actions related to mouse operations, such as changing a value, opening windows etc.

A project may contain any number of screens which can be shown on a request.
The top bar contains a zoom panel on the right, allowing the operator to zoom in and zoom out the displayed picture.

 Redraw – Redraw the current screen.

 Zoom in

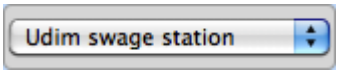
 Zoom out

 Actual – Reset to actual size.

 Fit – Fit to the container size.

Bottom bar button: Select the display screen.

 Previous – Display the previous screen.

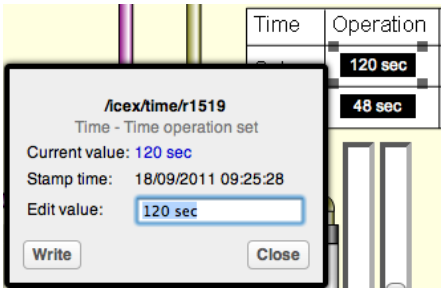


- Select – Display the selected screen

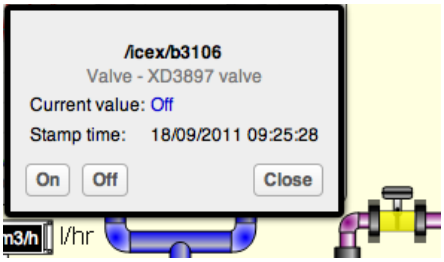
Next – Display the next screen.

Positioning the mouse over a link displays tooltip with the current node state.


Positioning the mouse over writeable graphical elements will change the mouse cursor to a hand cursor.
A hand cursor indicates that clicking the element will perform an action, such as set, reset and toggle an element, switching to a screen, or opening a edit dialog window.




Clicking writeable node value opens write dialog box. The current edit node marks with four black squares. There are two kinds of write dialog window - one for numerical value and one for On/Off set value. The upper part displays the online current node state. The lower part is used to modify the node state value.

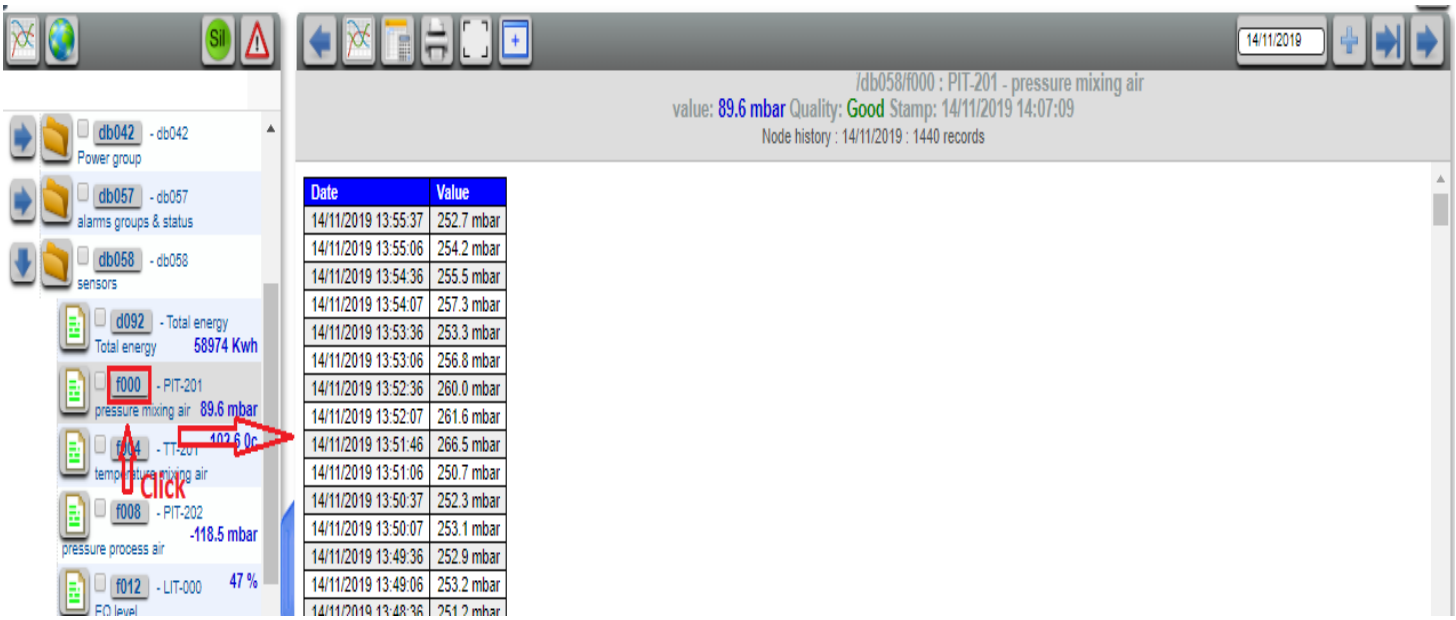


# 6. Node reports

**Node report is built in COMP. The user doesn't need to make any special settings to obtain it. The only condition to get historical data for specific node is this node to be defined as History.**

## 6.1.Node reports as table

To access node report as table, on Project tree click on node name:




On opening the UI displays the current-day samples log. The data is displaying in descend order - the end date displays on top of the table.

**Header:**

First row: Item path, tag-name and description.

For example:

/db058/f000 – PIT-201 – pressure mixing air

Second row: Item last sample: Value, Quality, Stamp.

For example:

Value = 89.6 mbar, Quality = Good, Sample 14/11/2019 1440 records

Third row: Type of the table, Start and end date and number of records of the displayed period

**Button functions**:

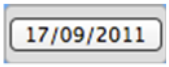

Previous – change end date to previous day


Trend – display current data in trend graph format


Export - Exports displaying data


Print – Prints table


Tabs – display table in new tab or window



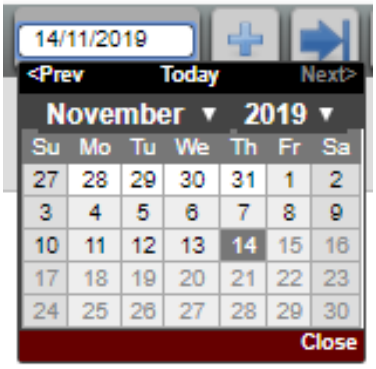
Date – select end date from calendar dialog


More – Retrieve and attach to the end table data for another day

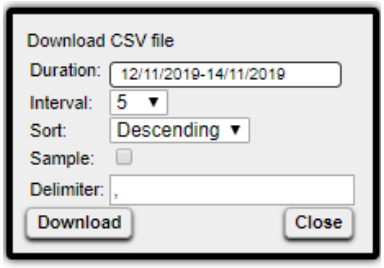

Now – change End Date to Now


Next – change End Date to Next day

Click on the date button opens a date picker dialog box:



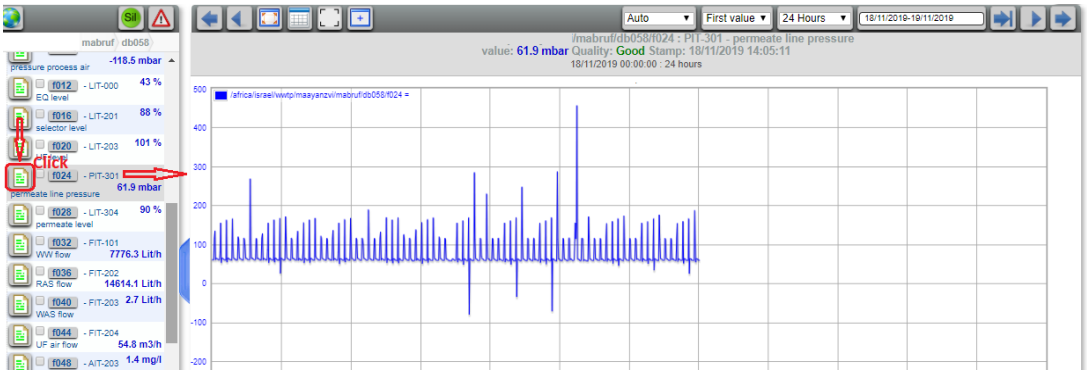

Click on the export button opens a dialog window as following:



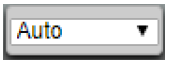
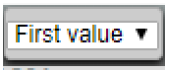
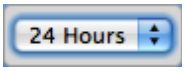
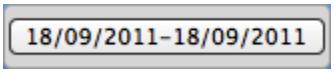

| | |
|---|---|
| **Duration** | Report interval |
| **Interval** | time between two table lines in minutes |
| **Sort** | Select in drop down menu data order – Decreasing or Increasing |
| **Sample** | Click on this box set automatically node sample time as interval |
| **Delimiter** | Excel delimiter defined in your Excel |

## 6.2. Node reports as trends

To access node report as trend, on Project tree click on icon left to node name:




**Buttons function:**

| | | |
|---|---|---|
|  | Previous | Scroll backward, full timescale duration. |
|  | Half previous | Scroll backward, half timescale duration. |
|  | Adjust | Redraw trend adjusting to the space size. |
|  | Table | Switch to table display. |
|  | Full screen | Switch to full screen |
|  | Tab | Display trend graph in new tabs or window. |
|  | | Period duration picker – Select period between two points in trend |
|  | | Value within picker - Select which value to take within picker period |
| | | **Options**: first value; minimum; maximum; average |
|  | | Time scale – Select display timescale duration |
|  | | Jump & timescale – Select date and time scale duration |
|  | Now | Display the current time trend. |
|  | Half next | Scroll foreword, half timescale duration. |
|  | Next | Scroll foreword, one full timescale duration. |

Moving pointer left or right will show specific value on this specific moment in time .

**Note**: Y axis is selected automatically by RealiteQ.

## 7. Alarm reports

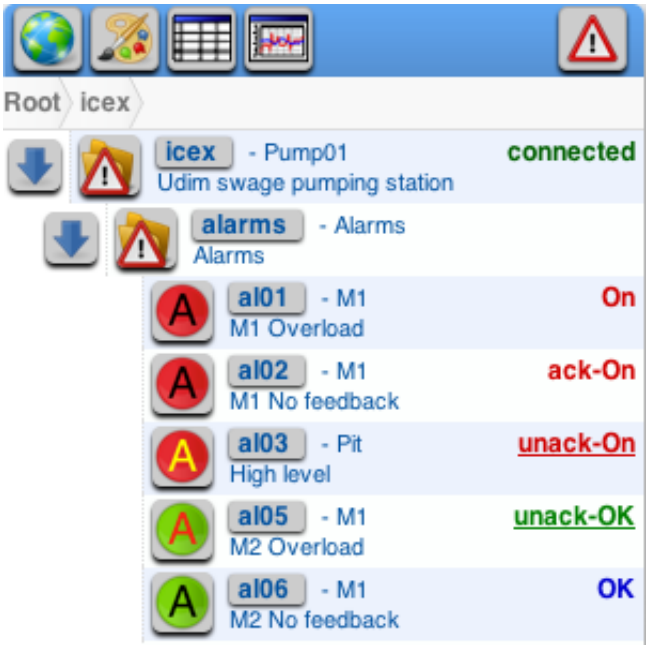
**Alarms are events that can be set to be triggered upon a certain condition which requires the attention of the operator. The alarm's conditions are set, in Reality-COMP during the project setting. The alarm's conditions are constantly evaluated by the Reality-COMP. When a new alarm occurs, the COMP updates the Reality-Consumer (Viewer).**

The project current active alarm button can appear in two icons:

 Alarms OK - No active current alarms

 Alarms active - At least on active alarm

Clicking the button displays the current project active alarms tables.




Clicking on a group item path button opening the group active alarms table.

The screen shot above is showing four open alarms:

Al01 – On, the alarm was not setting to user acknowledge.

Al02- On and already acknowledged by the user.

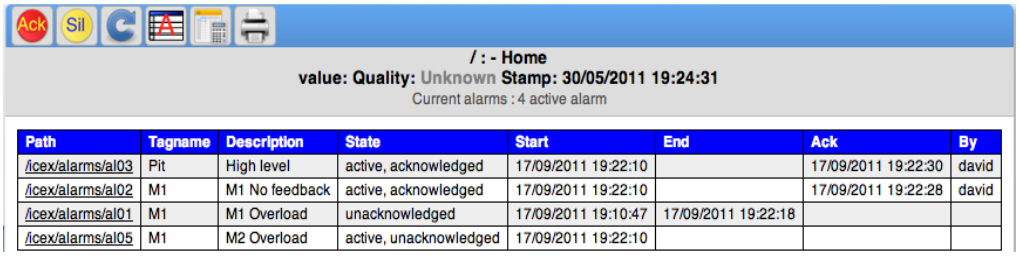
Al03- On but still do not acknowledged by the operator.

Al04 - Off and not acknowledged by the operator yet.

Al05 – Off.

The project active current alarm button in active status and the icon of the parent group of the alarms are appearing in alarm active icon.

The Current alarms window provides a summary of all currently active alarms.




| Path | Tagname | Description | State | Start | End | Ack | By |
|---|---|---|---|---|---|---|---|
| /icex/alarms/al03 | Pit | High level | active, acknowledged | 17/09/2011 19:22:10 | | 17/09/2011 19:22:30 | david |
| /icex/alarms/al02 | M1 | M1 No feedback | active, acknowledged | 17/09/2011 19:22:10 | | 17/09/2011 19:22:28 | david |
| /icex/alarms/al01 | M1 | M1 Overload | unacknowledged | 17/09/2011 19:10:47 | 17/09/2011 19:22:18 | | |
| /icex/alarms/al05 | M1 | M2 Overload | active, unacknowledged | 17/09/2011 19:22:10 | | | |

## 7.1. Current alarms

**A current alarm is an alarm which condition evaluates to be true. Alarms which must be acknowledged will be displayed as current even after their condition no longer evaluates to be true, if they are not acknowledged.**

The user can use the silence feature to get rid of alarms, which are of no interest at the moment. Clicking the Refresh button will restore all active alarms to the list. Acknowledging alarms can be done for all active alarms or for individual alarms.

The Current alarms displays the following information for each alarm:

**Path** The alarm path. Click the path switch to display specific alarm log.

**Tag-name** The Alarm tag Name.

**Description** The alarm description.

**Status** The alarm status: active, active unacknowledged, active unacknowledged inactive and inactive unacknowledged.

**Started** The date and time the alarm started.

**Ended** The date and time the alarm ended.

**Ack.** The date and time the alarm acknowledged.

**By** The username who acknowledge the alarm.

The latest alarm is displayed at the top of the window. Alarm will disappear from the Current alarm window only after alarm ended and acknowledged.

**Buttons:**

For details about history table standard buttons see **Node report paragraph 6.1.**


Refresh – Refresh display. Force to read alarm status from the Reality-COMP.

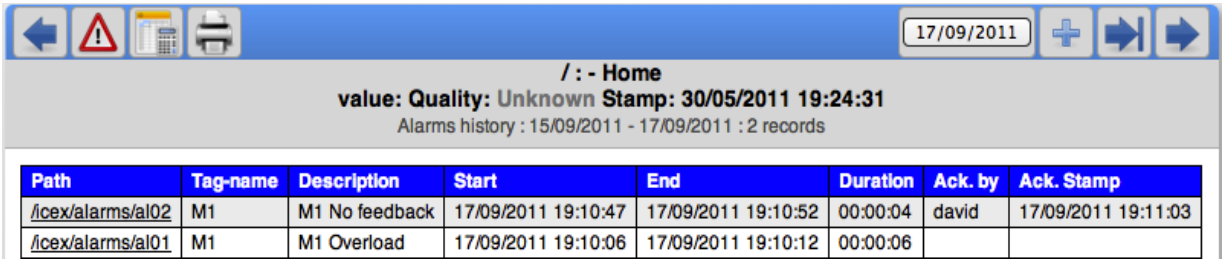
Acknowledge all - Acknowledging alarms can be done for all alarms, or for specific alarms. To acknowledge all alarms, click acknowledges-all buttons. To acknowledge a specific alarm, can be done in the alarm log display or from the tree display.

Un-silence – Un-silence all alarms. Specific alarms can be silenced; silence is removing the alarms from the Current alarm window. Silence specific alarms can be done in the alarm log display.


History table - display alarms log history table

## 7.2. Group alarms historical log

**Alarms can also be logged to the alarm log, a database table automatically maintained by Reality-COMP The alarm logged maintains information such as alarm start and end times, acknowledge time and the duration of the alarm.**

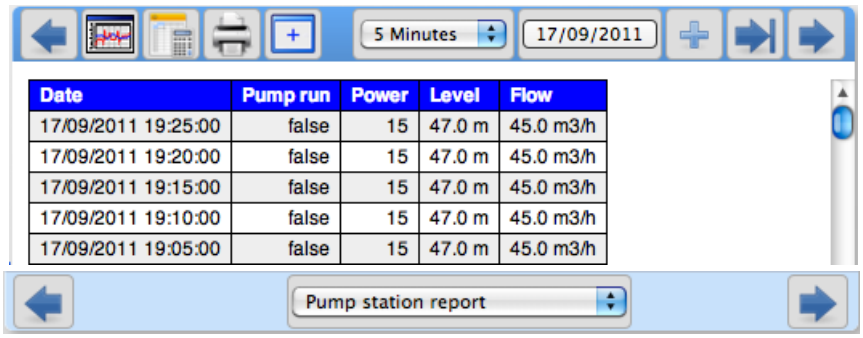



| Path | Tag-name | Description | Start | End | Duration | Ack. by | Ack. Stamp |
|---|---|---|---|---|---|---|---|
| /icex/alarms/al02 | M1 | M1 No feedback | 17/09/2011 19:10:47 | 17/09/2011 19:10:52 | 00:00:04 | david | 17/09/2011 19:11:03 |
| /icex/alarms/al01 | M1 | M1 Overload | 17/09/2011 19:10:06 | 17/09/2011 19:10:12 | 00:00:06 | | |

The alarms historical log displays the following information for each alarm:
Path - The alarm path. Click the path switch to display specific alarm log.

**Tag-name** The Alarm tag Name.
**Description** The alarm description.
**Start** The date and time the alarm started.
**End** The date and time the alarm ended.
**Duration** The alarm duration.
**Ack. by** The acknowledge username.
**Ack. Stamp** The date and time the alarm acknowledged.

**Buttons**:
For details about alarm history table standard buttons see **in node report paragraph 6.1**.
The user can define reports containing up to eight variables. The UI will display the report in the selected interval. The RealiteQ-COMP supplies for each stamp the last-known value. See paragraph 12 how to define a report template and how to configure the reports list.

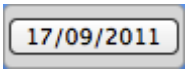



| Date | Pump run | Power | Level | Flow |
|---|---|---|---|---|
| 17/09/2011 19:25:00 | false | 15 | 47.0 m | 45.0 m3/h |
| 17/09/2011 19:20:00 | false | 15 | 47.0 m | 45.0 m3/h |
| 17/09/2011 19:15:00 | false | 15 | 47.0 m | 45.0 m3/h |
| 17/09/2011 19:10:00 | false | 15 | 47.0 m | 45.0 m3/h |
| 17/09/2011 19:05:00 | false | 15 | 47.0 m | 45.0 m3/h |

Clicking the table button on the tree toolbar displays the current report log history in the right pane of the screen.
On opening the UI displays the current-day log. The data is displaying in descend order - the end date displays on top of the table.

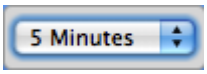
**Buttons**:

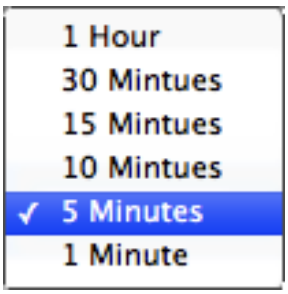
For details about history table standard buttons see in node report paragraph 6.1.




Interval – Set the interval between the display sample

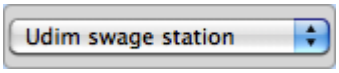
To select interval between display samples, click on interval button and select the right interval.




**Bottom bar button**: Select the display report.

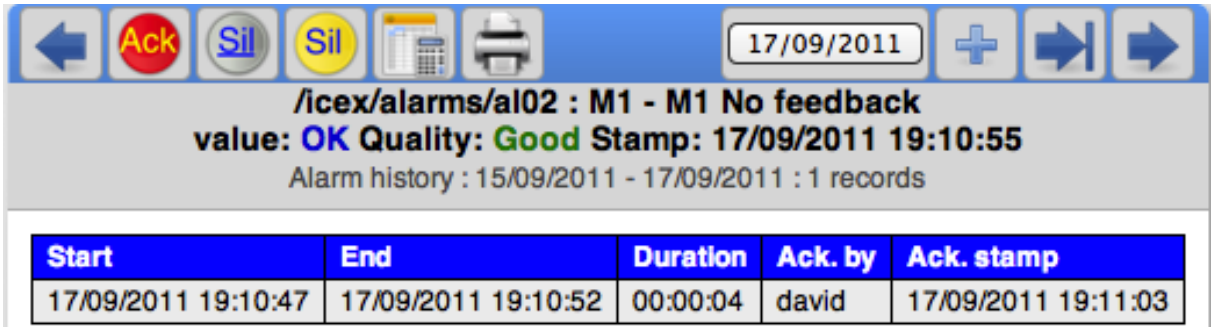
Previous – Displays the previous report.




Select – Displays the selected report

Next – Displays the next report.

## 7.3. Node alarm historical log




The alarms node historical log displays the following information for each alarm:

| | |
|---|---|
| **Start** | The date and time the alarm started. |
| **End** | The date and time the alarm ended. |
| **Duration** | The alarm duration. |
| **Ack. by** | The username who acknowledge the alarm. |
| **Ack. Stamp** | The date and time the alarm acknowledged. |

**Buttons**:

For details about alarm history table standard buttons see in node report, paragraph 6.1


Acknowledge - Acknowledging specific alarm.


Silence – Silence specific alarm. silence is removing the alarms from the Current alarm window.


Un-silence – Un-silence specific alarms.

## 8. Predefined reports

**Each preselected node with "Save to History" setting can be visualized in tables or charts. Up to 8 items can be added in a report. The item logs stores in the RealiteQ-COMP and can display by the RealiteQ-UI.**

**Note: To view predefined report, it needs to be defined already by authorized user. See chapter 11 for details.**

Predefined reports can be added to any HMI screen. There is no limit of number of reports that can be added to each screen.

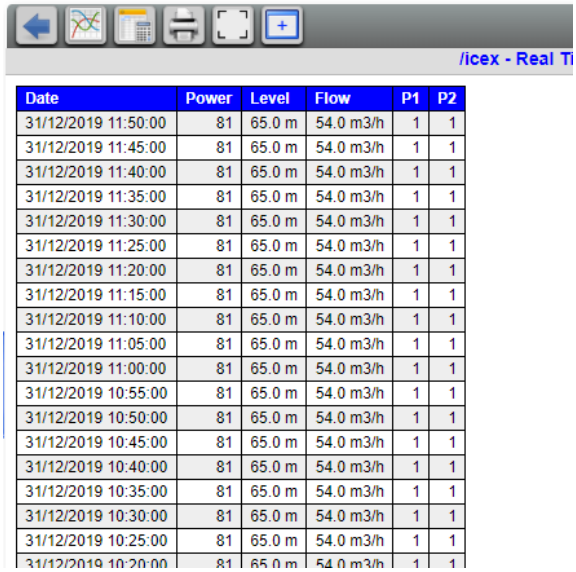
Predefined reports can be added to screens both as table and/or as trends.


Click on Report buttons to view predefined reports.

There are two types of predefined reports:

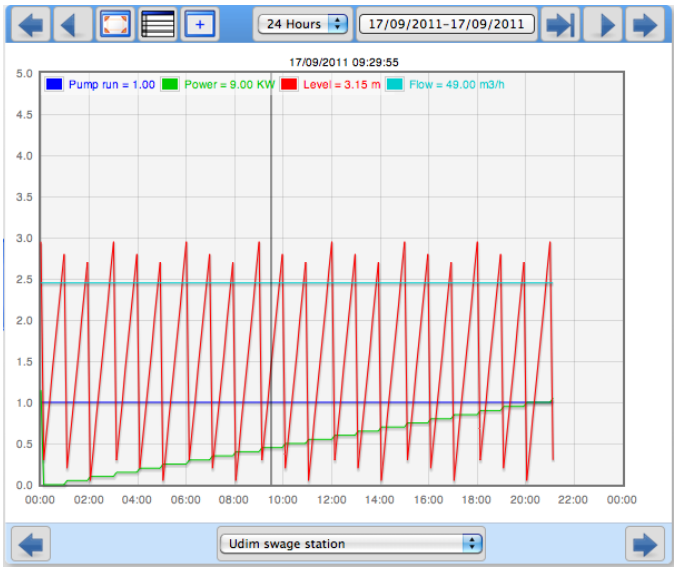
**Table** – Display defined nodes historical data in time stamp table.

**Trend** – Display predefined nodes historical data in trend.



/icex - Real T

| Date | Power | Level | Flow | P1 | P2 |
|---|---|---|---|---|---|
| 31/12/2019 11:50:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:45:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:40:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:35:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:30:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:25:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:20:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:15:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:10:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:05:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 11:00:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:55:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:50:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:45:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:40:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:35:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:30:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:25:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |
| 31/12/2019 10:20:00 | 81 | 65.0 m | 54.0 m3/h | 1 | 1 |



Drag inside the graph box measures values at specific points in time.

**Buttons function**:

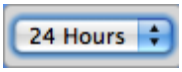
 Previous – Scroll backward, full timescale duration.

 Half previous – Scroll backward, half timescale duration.

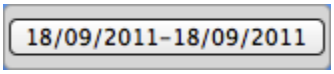
 Adjust - Redraw trend adjusting to the space size.

 Table – Switch to table display.

 Tab - Display trend graph in new tabs or window.



- Time scale – Select display timescale duration



Jump & timescale – Select date and time scale duration

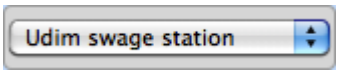
 Now – Display the current time trend.

 Half next – Scroll foreword, half timescale duration.

 Next – Scroll foreword, one full timescale duration.

For report trend display there is a bottom toolbar to select the display report trend graph.

 Previous - Display the previous trend graph.



- Select – Display the selected trend graph

 Next – Display the next trend graph.

# 9. Daily/monthly reports

**User can define daily or monthly reports. The report can include as much nodes as needed. It can be sent as CSV attachment to users' mails. It can be generated by users at any time too – in CSV or PDF format.**

**Daily/monthly reports can include statistical information too – as min, max, average, difference and sum. Statistics can be defined both for report interval and for summary.**

## 9.1. Define Daily/monthly report.

Parameters of daily/monthly report are set in Nodes → Group node definition

| | | |
|---|---|---|
| | Alarm-escalation-interval | 0 |
| | Report-nodes | movealot,movealot:avg,movealot:min,movealot:m |
| | Report-recipients | report |
| | Report-period | day |
| | Report-interval | 15 |
| | Report-summary | movealot:min!max!avg!diff,sinalot:min!max!avg |
| | Report-title | UI Test Report |
| | Report-font-size | 1em |
| | Report-paper | A4 portrait |
| | Report-delimiter | , |

**Report nodes** Define the nodes to appear in the report. If the nodes are in the same group, just type node address, for example **r000**. If the node is in another group, state the path, for example **/registers/cv/r000.** Divide nodes by coma (,).
You can set also which value want to display at the end of report-interval. You can select between:

- current value at the end of the interval;
- min. value during interval (**min**);
- max. value during interval (**max**);
- average value within interval (**avg**);
- difference from value of previous interval (**diff**);

Add column (:) after the node and then desired value. For ***example***: **r000:avg**

**Report Recipients** users to receive report on predefined interval (day/month). No limit of number of users. If more than one user, divide them by coma (,)

**Report-period** from drop down menu select **day** or **month**.

**Report-interval** time in minutes between two lines in the report;

**Report-summary** Summary of data for report period. You can leave it empty (no need for summary) or you can select for each defined in report node between min, max, average or difference. After defining the node, add column (:) and then relevant type of summary (**min**, **max**, **avg** or **diff**). In case you want more than one summary value for specific node, divide summary type by exclamation mark

(!). For ***example***: **r000:min!max!avg** will give you min, max and average values of r000 for defined period.

**Report-title** free text in any language, which will appear as report title

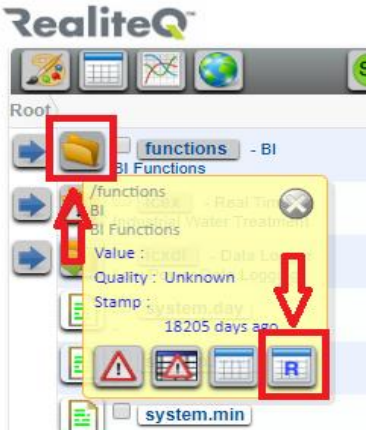
**Report-font-size** valid only for PDF version of report. Not editable at this stage

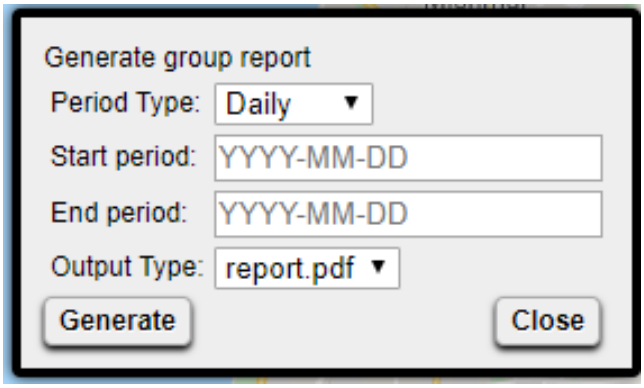
**Report-paper** select in drop down menu the report list orientation – **portrait** or **landscape**.

**Report-delimiter** nodes data columns delimiter, as set for your Excel. Relevant only for CSV report.

## 9.2. User generated report

**In addition to reports, generated and automatically sent by email, the user any time can create report too.** Pointing over the group icon of the group where the report is defined opens the tooltip window displaying the node description and status. Click on Report icon on tooltip to open Report generation box.




Period Type – **Daily** or **Monthly**.
**Start period** – day or month to start report. Follow example format
**End period** – day or month to end report. Follow example format
Select type of report from drop down menu – **PDF** or **CSV**. Click on **Generate**.

### 9.3. Example of report, defined according to capture in point 8.1 (PDF):

# UI Test Report
## BI Functions

RealiteQ™

Tagname: BI
Period: 2019-09-25 00:15 to 2019-09-26 00:00
Interval: 15 minutes

| Time | Value Gen. | Value Gen. ↔ | Value Gen. ↓ | Value Gen. ↑ | Sin. Wave | Sin. Wave ↔ | Sin. Wave ↓ | Sin. Wave ↑ |
|---|---|---|---|---|---|---|---|---|
| 2019-09-25 00:15:00 | 1.894 | 1.690 | 0.000 | 2.294 | 88.477 | 51.837 | 12.345 | 88.779 |
| 2019-09-25 00:30:00 | 0.000 | 2.005 | 0.000 | 3.760 | 12.345 | 7.965 | 4.133 | 56.356 |
| 2019-09-25 00:45:00 | 3.760 | 7.649 | 0.000 | 10.362 | 4.133 | 40.464 | 4.133 | 77.158 |
| 2019-09-25 01:00:00 | 10.362 | 12.278 | 7.614 | 13.955 | 77.158 | 88.102 | 36.722 | 97.679 |
| 2019-09-25 01:15:00 | 13.955 | 11.974 | 10.362 | 13.955 | 97.679 | 60.000 | 19.255 | 97.679 |
| 2019-09-25 01:30:00 | 12.288 | 10.599 | 9.121 | 12.288 | 19.255 | 11.594 | 4.891 | 64.688 |
| 2019-09-25 01:45:00 | 9.121 | 8.748 | 7.914 | 12.288 | 4.891 | 34.184 | 4.891 | 74.160 |

---

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2019-09-25 12:15:00 | 26.476 | 23.498 | 21.056 | 28.181 | 7.011 | 40.770 | 7.011 | 74.565 |
| 2019-09-25 12:30:00 | 21.056 | 22.976 | 21.056 | 24.656 | 74.565 | 85.824 | 37.383 | 95.676 |
| 2019-09-25 12:45:00 | 24.656 | 21.410 | 20.174 | 24.656 | 95.676 | 66.807 | 31.193 | 95.676 |
| 2019-09-25 13:00:00 | 23.365 | 21.458 | 19.789 | 23.365 | 31.193 | 16.647 | 3.919 | 71.718 |

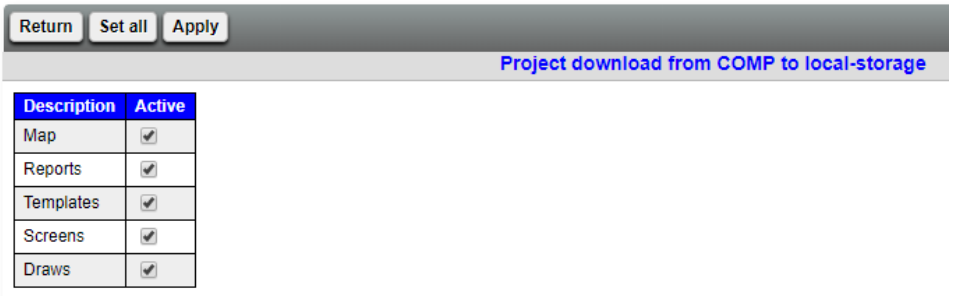




| Time | Value Gen. | Value Gen. ↔ | Value Gen. ↓ | Value Gen. ↑ | Sin. Wave | Sin. Wave ↔ | Sin. Wave ↓ | Sin. Wave ↑ |
|---|---|---|---|---|---|---|---|---|
| 2019-09-25 13:15:00 | 19.789 | 21.778 | 19.789 | 24.275 | 3.919 | 31.414 | 3.919 | 69.709 |
| 2019-09-25 13:30:00 | 24.275 | 24.275 | 24.275 | 24.275 | 69.709 | 69.709 | 69.709 | 69.709 |
| **Minimum** | **0.000** | | | | **2.626** | | | |
| **Maximum** | **28.181** | | | | **97.868** | | | |
| **Average** | **12.731** | | | | **49.747** | | | |
| **Difference** | **22.380** | | | | | | | |

## 10.  Project download and setting

The modern browser allows web applications to synchronize data into a local data store (Local storage) and then allow the web applications to use this data online. The UI application use these features to keep the user project setting locally. The project managers normally prepare the general project screens and reports and then upload them to the COMP. The project UI clients can now at any time download the project setting to their browser local storage. The UI clients can change their screens, reports and other setting locally.




**Notes**:

- Only user with administrator privilege can upload the project to the COMP.
- User will need to load the settings once, **only the first time you log in to the project**.
- All the further user modification affects only his project setting in his browser local storage.
- **Caution**: the download data will erase your local project private setting.
- Each project saves in a different local storage. (there is private storage for each URL).

**Caution**: Some browsers clear the local storages too when you ask to clear the browsing history.
Always keep the export backup of your private project setting.

**Download**

Map – Download map center, map type and unit's path, location and description.
Reports – Download reports/trends template and reports/trend list.
Templates – Downloads Report and trends templates
Screens – Download screens template and screens list
Draws – Downloads graphical displays of the project

To download set the necessary option and then apply.

**Note**: When you download project, especially for first time you log on it, you can use button Select All 

to download all elements of the project with one click.

**General**

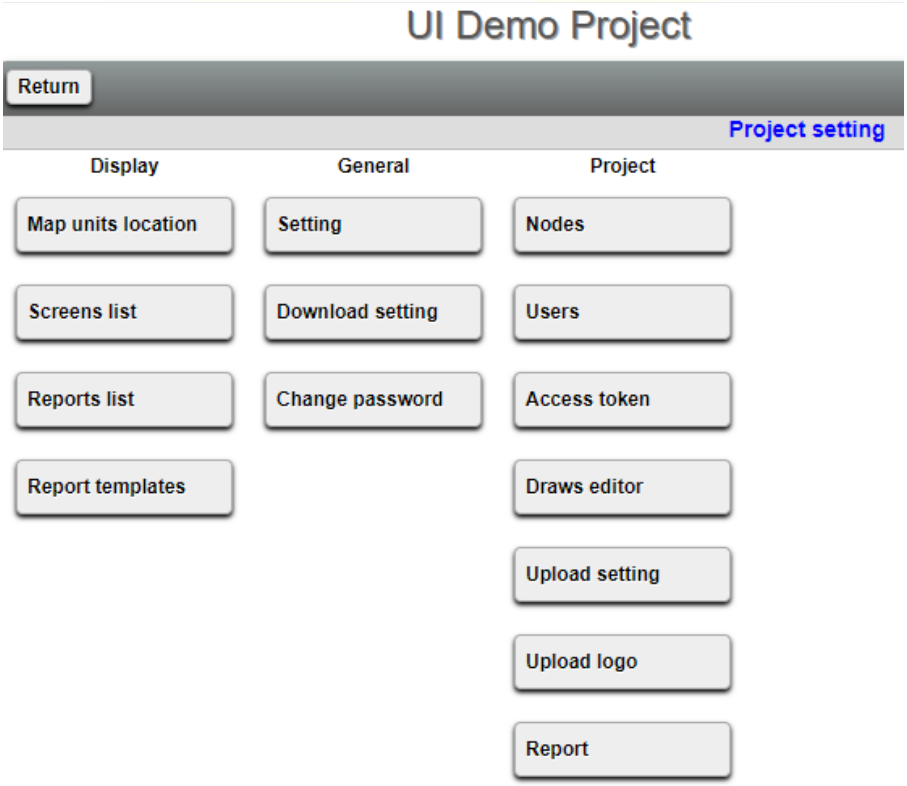
Clean local storage: Check to clear the project local storage.
Root path: Set according to the user read path privilege. Remarks:

- The root-path will affect the way the project node's tree is displayed. The root button in the crumbs-bread bar is showing the root-path.
- The root-path will affect the download procedure too. The UI will download only the authorized user screens, reports and units.

If your privilege only on part of the project you should first need to set the node path, then apply and reload and only then set the necessary option and apply.

## 11.  Project configuration and edit

While on main display, click on Project configure and edit  icon in bottom right corner of display. Project settings display opens

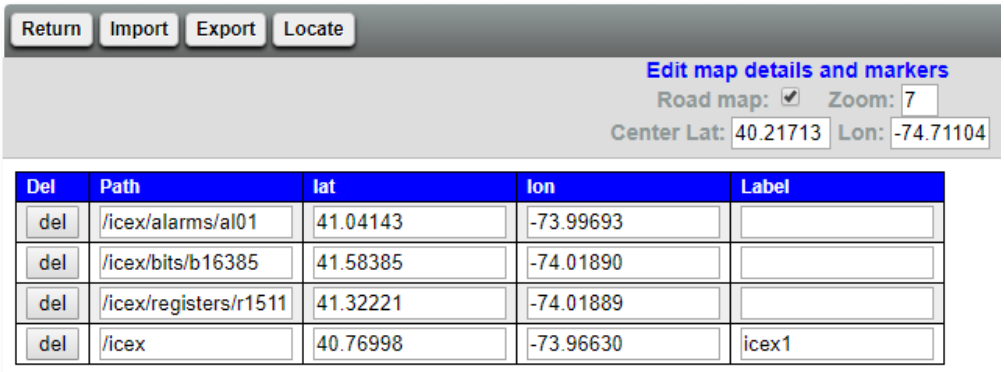



**Map unit location:** Configure the map type and center. Set the unit's location path and description.
**Screen list:** Configure the screen's list, included: path offset, description and draw template.
**Report list:** Configure the report's/trend's list, included: path offset, description and report template.
**Report templates:** Configure report templates.
**Nodes:** Add, delete and modify project nodes.
**Users:** Add, delete and modify project users.
**Access token:** Get COMP generated access token for communication with specific iCEX. Copy the code in iCEX web UI, in Token field

**Draws Editor:** Draw graphic editor.
**Upload settings:** Upload project setting to the COMP.
**Upload logo:** Upload user's company logo. Contact Reali Technologies or your local distributor for details

## 11.1. Edit map and stations location

The map shows the location and status of the project stations. The map can be display in a **street** or **satellite** format. The user can control the map zoom with + and - buttons and can drag the map display to any direction.




| Del | Path | lat | lon | Label |
|---|---|---|---|---|
| del | /icex/alarms/al01 | 41.04143 | -73.99693 | |
| del | /icex/bits/b16385 | 41.58385 | -74.01890 | |
| del | /icex/registers/r1511 | 41.32221 | -74.01889 | |
| del | /icex | 40.76998 | -73.96630 | icex1 |

General map setting:

**Road map:** Map types: road map or satellite picture.

**Zoom** Set the initial map zoom.

**Center LAT, LON** Latitude and Longitude of the map center location. The locate button opens the map and allows the user to drag and set the map center to their exact location.

All map parameters can change online: switching between road map and satellite, zooming in or out and dragging the map center. The runtime restores button displays the map in the initial parameters.

The map configuration table displays the following information for each unit:

**Path** Unit path. You can set the path of alarm or point node too to see their values on map

**LAT, LON** Latitude and Longitude of the unit's location. The locate button opens the map and allows to drag and set the units to their exact location.

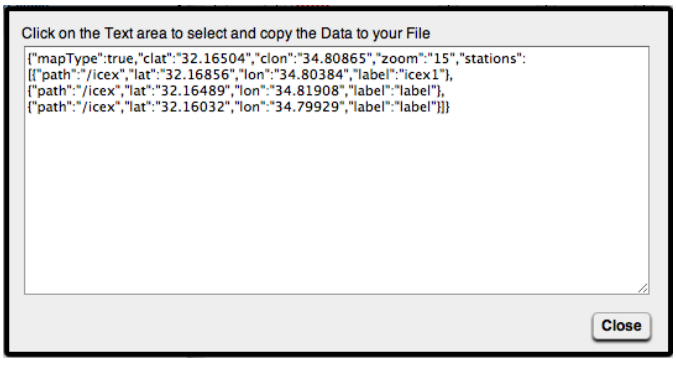
**Label** Unit description appears below the unit icon.

Buttons:

**Return** Return to the main edit menu

**Import** Import map details from a text file. You can use this option to restore the map details from a backup text file.

**Export** Export the map details to a text file for backup, text edits or for sharing setting with other users.

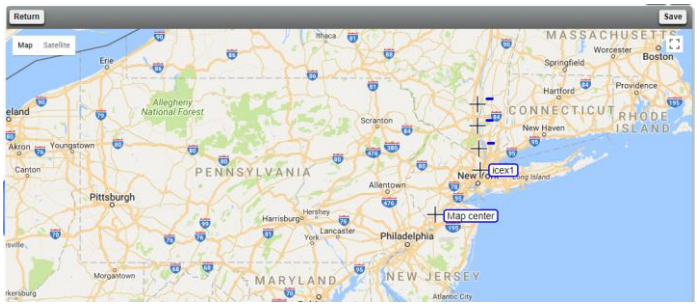



Click on the text area to select and copy the data to your text editor. You also can edit the export text file: add,

delete and modify rows. Caution: Keep the data structure otherwise you will not be able to import the data to the UI.

**Locate** Open map for dragging the unit to their exact location.
**Add** Add unit row.
**Delete** Delete unit row.
**Save** Save changes to local storage.

### 11.2. Locate

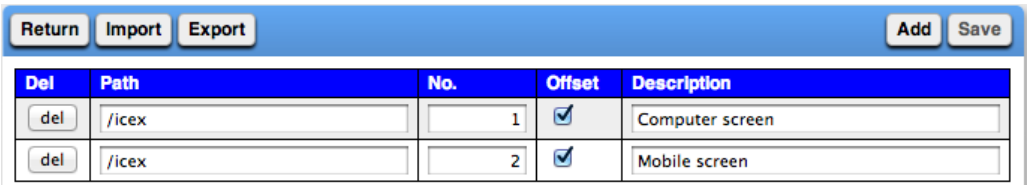



Locate screen allow dragging the units to their exact location, to drag the map center to the right position and to set the suitable map resolution.
Buttons:

**Return** Return to map menu
**Save** Save changes to local storage.

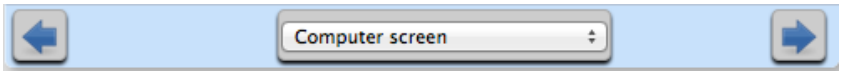
## 12. Edit Screens list

The screens list ties between the screens and their prefix **Path** (unit), draw **No**. and their **Description**.




The screens list configuration table displays the following information for each screen:

**Path** - The offset screen path.
**No.** – Draw tempelte number
**Offset** – When checked - Add the path field as a prefix to each draw template link path. For example: if the screen offset path = /icex1 and offset = check and link item variable path = r1501 then the online item full path will be: /icex1/r1501.
**Description** – The screen description will appear at the bottom bar of the screen.




Buttons:

**Return** Return to the main edit menu.

**Import** Import screens list from a text file. You can use this option to restore the screens list from a backup text file.

**Export** Export the screens list to a text file for backup, text edits or for sharing setting with other users.

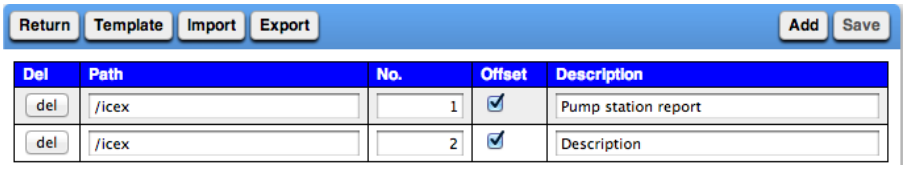
**Add** Add screen row.

**Delete** Delete screen row.

**Save** Save changes to local storage

## 13. Edit Predefined Reports list

The reports list ties between the reports and their path (unit), template and description.



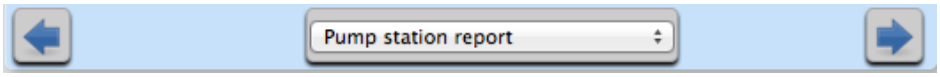

The reports list configuration table displays the following information for each report:

**Path** The offset report path.

**No.** Report template number.

**Offset** Check - Add the path field as a prefix to each report template variable path. . For example: if the report offset path = /icex1 and offset = check and item variable path = r1501 then the online item full path will be: /icex1/r1501. .

**Description** The report description will appear at the bottom bar of the report or trend.




**Buttons**:

**Return** Return to the main edit menu.

**Import** Import report list from a text file. You can use this option to restore the reports list from a backup text file.

**Export** Export the reports list to a text file for backup, text edits or for sharing setting with other users.

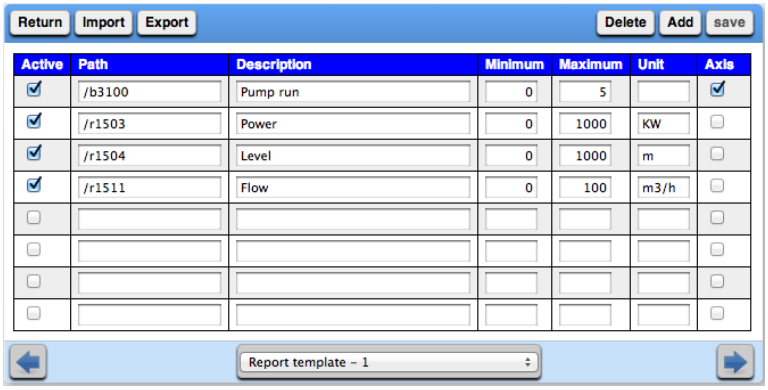
**Add** Add report row.

**Delete** Delete report row.

**Save** Save changes to local storage

## 13.1. Report Template

The user can define reports and trends containing up to eight variables. The UI will display the report in a selected interval and up to 8 items can be plotted at once against time.




The template configuration table displays the following information for each report's item:

**Active** Check to display the item.

**Path** Item variable path. The full item path will build from the report offset path as a prefix and the item variable path. For example: if the report offset path = /icex1 and offset = check and item variable path = r1501 then the online item full path will be: /icex1/r1501.

**Description** The item description will appear at the header row of the report.

**Minimum, Maximum** Define the item axis limit in trend display.

**Unit** Delfine the item unit to display in the item trend legend.

**Axis** Check to display item axis in trend display.

**Buttons**:

**Return** Return to the edit reports menu

**Import** Import templates from a text file. You can use this option to restore the templates from a backup text file.

**Export** Export the template to a text file for backup, text edit or for sharing setting with other users.

**Add** Add template.

**Delete** Delete current template.

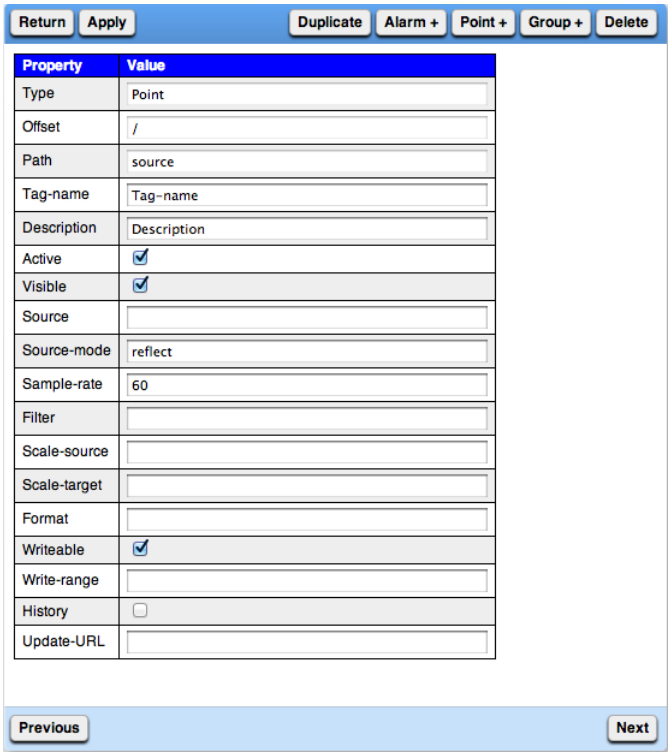
**Save** Save template changes to local storage

**Bottom bar navigate toolbar** – Next, pervious and select list to navigate between the template.

# 14. Edit project nodes

There are three types of nodes:

- **Group** - Group of nodes.
- **Point** - a variable or computed value.
- **Alarm** - unit or computed alarm node.




Node properties:

**Type** Node type: Group, point, alarm. Read-only.

**Offset** The node path offset initializes with the node group path. The full node path is a result of the offset field as a prefix and the variable filed.

**Path** Variable path. One word, only standard letters and numbers are allowed.

For variable nodes use the unit addresses space as specified in the appendix.

***Example***: Offset field = /iCEX/variable/, variable = r1501 the full node path will be /icex/variable/r1501

**Tag-name** Node tag-name. Normally one word that describing the node. Like: TE1101 for temperature element 1101 or LS2314 for level switch 213.

**Description** Node description.

**Active** Default checked, un-checked: the node will not update. The COMP will not subscribe the node for updating.

**Visible** Default checked: always display. Un-checked: display node only if user login as administrator.

**Source** - Default empty. Node values can be computed from others node value. Examples:

- {/analog/r1401} + {/analog/r1402} - Node value will be sum of r1401 and r1402. Remark node path must be close with patterns
- {/analog/r1401}[3] - Node value will be the status of bit 3 of r1401. Bits count start form zero (0).
- {/analog/r1401} [3] = 1 or {/analog/r1401}[3] >= 80 - Node value will be the boolean result of the source expression.

**Note**: In Source field you can add Special functions too. For more details see the appendix.

**Source Mode** Default reflect. Reflect/Transfer. Reflect – reflect value of source expression,

**Transfer** Transfer (whenever value change) value of source expression to producer who owns the node.

**Sample Rate** Default 60. Set the node sample rate in a second. Normally 10 seconds for alarms and 60 second and above for other variables.

**Filter** Default empty. Node's value filter used by the unit when update the node value. Adjust sample rate and filter to get the optimal network traffic. For more details see the appendix.

**Scale-source** Default empty. Source to target scaling. Example: 0..4095 to 0..100.

**Scale-target** Default empty. Source to target scaling. Example: 0..4095 to 0..100.

**Format** Default empty. Display format. Example:

- %2.1f - 23.5.
- %2.1f psi – 23.5 psi

For more details see the appendix.

**Writeable** Default unchecked. Checked: Node's value can be modifying by user.

**Write range** Default empty. Limit the user write range. Example: 40..50.

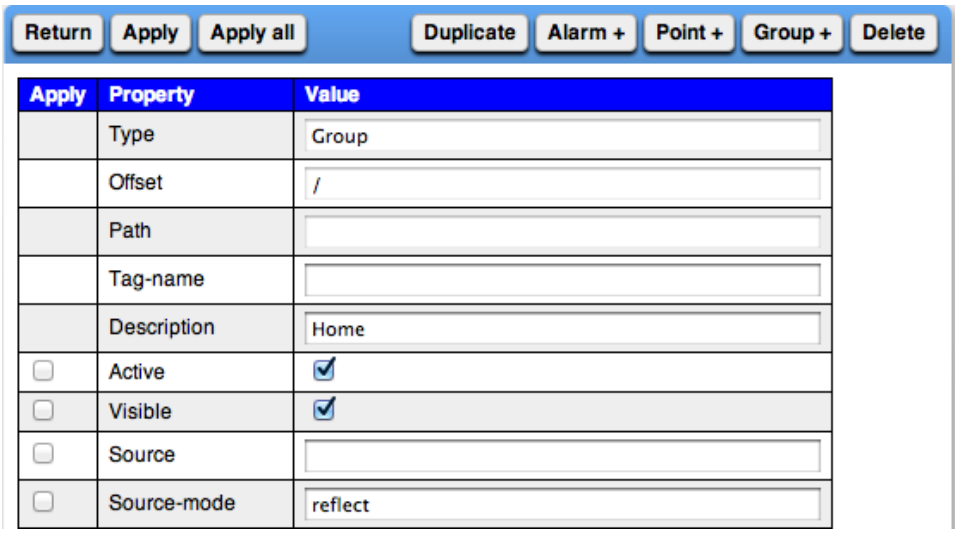
**History** Default unchecked. Checked: Keep Node value changes to history. Also keep user node value change.

**Acknowledgment** Default unchecked. Checked: alarm node need user acknowledgement.

**Alarm Recipients** Default empty. List of SMS/Email alarm recipients separate by comma.

**URL Updates** Default empty. URL address for online node state updates.

The UI includes an interface for changing setting of individual node or group of nodes. The COMP will update the setting of the group and its sub-nodes according to the marked properties. The COMP will update the node owner (Producer) "on the fly" with the updated properties.



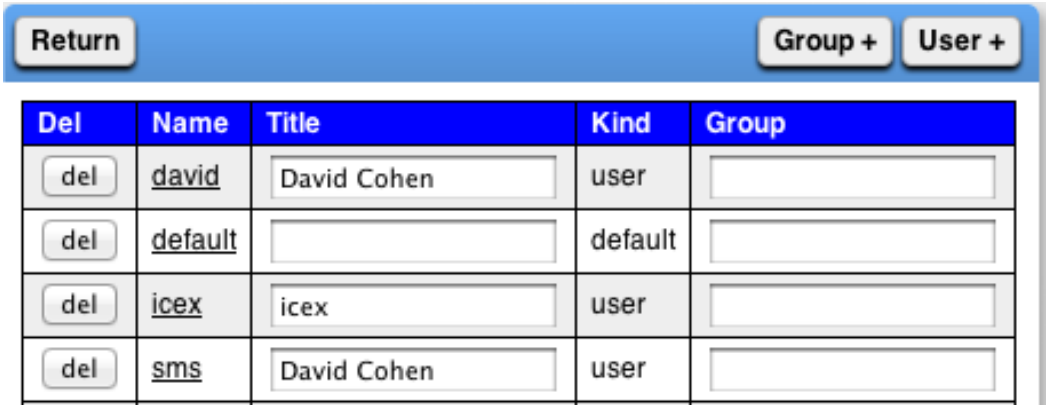

When you edit a group node, you can apply specific fields change to all the group sub-node. The apply button effect only the group itself, by checking the necessary apply check-box and clicking the "apply all" button the setting in the check rows will affect the group and its sub-nodes too.

Buttons:

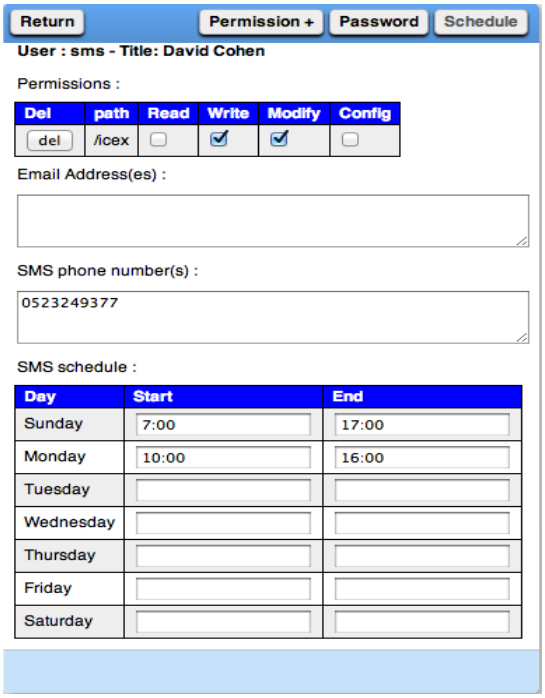
**Return** Return to the main edit menu
**Apply** Apply the edit function.
**Apply all** It appears only for group modify. Apply the selected rows to the group and its sub-nodes.
**Duplicate** Duplicate the current display node under the current offset.
**Alarm +** Add alarm under the current offset.
**Point +** Add point under the current offset.
**Group +** Add group under the current offset.
**Delete** Delete the current display node.
**Next, Pervious** Navigate between group nodes. To edit a specific node or group use the tree display to select and display the necessary node.

## 15. Edit Users

Edit user's privilege and details.




The user configuration table displays the following information for each user:
**Name** – User or unit name.
**Title** – User title \ description, editable.
**Kind** – user kind: default, user or group.
**Group** – User privileges group. You can create users group set the group privilege and later just assign user to a group.
Buttons:
**Return** – Return to the main menu.
**Group +** – Add user group. Open a dialog box for entering the new group name.
**User +** – Add user. Open a dialog box for setting the new username and password.
**Delete** – Remove user and its privileges and properties.
**Remark**: create a user entry for each unit you want to connect to the system and set the privilege to write, read and config on the unit path. Before creating the unit entry, you should first have to create the unit path.
Click on the username switch to edit user privileges and properties window.




**Buttons**:

**Return** – Return to users edit window.

**Permission +** – Add a permission row. Add button opens a dialog box for entering the permission path like: "/" for project root or "/iCEX" for a unit path. Permission includes: Read – Checked - User allows reading path items value.

**Write** – Checked - User allows modifying path item value.

**Modify** – Checked - User allows modifying path item properties.

**Config** – Checked - User allows modifying item's properties, adding and deleting an item.

For project administrator configuration: Path to "/" and check read, write and config option. For unit configuration: Path to unit path "/unit path" and check read, write and config options.

**Password** – Open a dialog box for replacing user password.

**Schedule** – Update COMP with the SMS schedule.

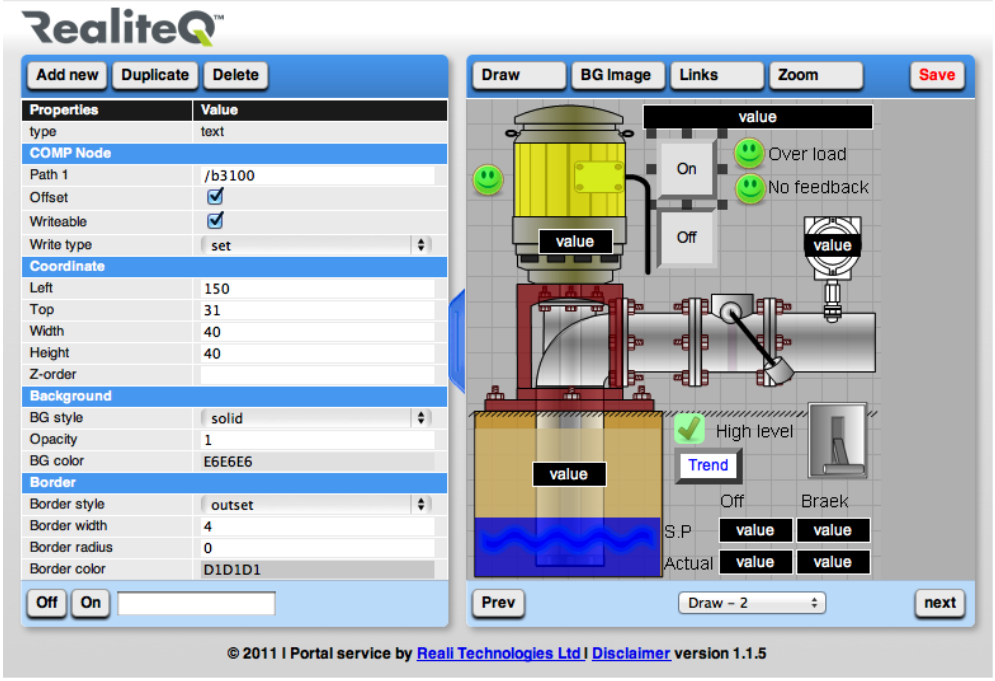
**Email address(es)** – Enter emails addresses separated by commas for receiving email alarm messages. The RealiteQ-COMP will send alarm messages if the user's name appears in the recipients list. Click enter key to apply.

**SMS Phone numbers** – Enter phone numbers separated by commas for receiving alarm messages as SMS messages. The RealiteQ-COMP will send alarm messages with the recipient phone numbers to the iCex SMS center if the users name appears in the recipients list. Click enter key to apply.

**SMS schedule** – No start and stop hour set, the system will send SMS all day. If you set: start = 08:00 and end = 17:00 the system will send SMS to the user only between 08:00 to 17:00. If you set start = 17:00 and stop = 08:00 the system will send Alarm SMS messages between 00:00 to 08:00 and between 17:00 to 24:00. Click Schedule button to apply.

# 16. Draw editor

**The draw template editor included in RealiteQ UI simplifies project draws design by providing a rich set of drawing and manipulation tools. Changes to object appearance and placement can be applied easily using the link properties panels. You can switch between a design mode and operator mode with a single key stroke.**




Designing draw is a process which involves two stages:
Prepare and place the screen background. The background is an import JPG or PNG format picture.
Locate the links on the screen background. The elements can be schematic or figurative and can also incorporate text or value.
Use links to modify the graphical elements at runtime in correspondence to changes in real-time values.
For setting the links stage, RealiteQ UI offers a comprehensive suite of tools in order to make the process of screen design as easy and fast as possible. How to ties the draws template to the screens **see paragraph 11**.

## 16.1. Draw menu

(To be defined)

## 16.2. Background image

(To be defined)

# 17. Upload to COMP

The modern browser allows web applications to synchronize data into a local data store (Local storage) and then allow the web applications to use this data online. The UI application use this features to keep the user project setting locally. The project managers normally prepare the general project screens and reports and upload them to the COMP. The project UI clients can now at any time download the project setting to their browser local storage.


**Notes**:

- Only user with administrator privilege can upload the project to the COMP.
- User will need to load the settings once, only the first time you log in to the project.
- All the further user modification affects only his project setting in his browser local storage.
- Each project saves in a different local storage. (There is private storage for each URL).

Always keep the export backup of your private project setting.

**Upload**

**Map** – Upload map center, map type and unit's path, location and description.

**Reports** – Upload reports/trends template and reports/trend list.

**Screens** – Upload screens template and screens list.

**Draws** – Upload screens design.

To upload set the necessary option and then apply.

# Appendixes

## 1. Address space

The iCEX supports a wide variety of data representations for PLC variables. The general address format recognized by the iCEX is: <type><memory offset>. Memory offsets are in the range 0 to 65565. For individual bits the format changes to R<memory offset><bit offset>, where <bit offset> is a number between 1 and 16.
The following address types are supported for Modbus:

| | |
|---|---|
| I | Input (Modbus opcode 02) |
| O,B | Output and internal flags (Modbus opcodes 01/05) |
| R | 16-bits register (Modbus opcodes 03/06) |
| D | 32-bits register (Modbus opcodes 03/0x10) |
| F | 32-bits floating point (Modbus opcodes 03/0x10) |
| P | 64-bits floating point (Modbus opcodes 03/0x10) |
| A | 16-bits analog input (Modbus opcode 04) |
| L | 32-bits analog input (Modbus opcode 04) |
| N | 32-bits floating analog input (Modbus opcode 04) |

The following address types are supported for GE SNPX:

| | |
|---|---|
| I | Input |
| O | Output |
| B | Internal flags |
| R | 16-bits register |
| D | 32-bits register |
| F | 32-bits floating point |

The following prefixes can be added before the type:

| | |
|---|---|
| U | Unsigned value (by default integer values are signed) |
| X | Value is stored in BCD format |

Examples:

1. R1000 - 16-bit signed integer at offset 1000.
2. XR1000 - 16-bit BCD integer at offset 1000.

**Stations**

If multiple PLC's are connected to the iCEX (using RS-485), they can be accessed by creating groups for each. The iCEX recognizes subgroups with their name formatted as st<station id>. For example, **st4** refers to a PLC with station ID 4. The iCEX will sample all sub-nodes within the subgroup, e.g. st4/r1028, from the corresponding PLC.

## 2. Filter

iCEX supports a variety of dead-band types in order to provide a rich set of filters for unstable measurements:

| Type | Example | Behavior |
|---|---|---|
| None | (empty) | Value is always transmitted to the server. |
| Never | never | Value is transmitted only when forced by status/b12 |
| Value | 2.5 | Value is transmitted if change is greater than the specified value. |
| Percentage | %3 | Value is transmitted if change is greater than the specified percentage. |
| Greater than | >10 | Value is transmitted if it is greater than the specified value. |
| Greater than or equal | >=10 | Value is transmitted if it is greater than or equal to the specified value. |
| Less than | <10 | Value is transmitted if it is less than the specified value. |
| Less or than equal | <=10 | Value is transmitted if it is less than or equal to the specified value. |
| In range | 8<>12 | Value is transmitted if it is within the specified value range. |
| Out of range | 8><12 | Value is transmitted if it is outside of the specified value range. |
| Equal | =8.5 | Value is transmitted if it is equal to the specified value. |
| Out of range | <>8.6 | Value is transmitted if it is not equal to the specified value. |

## 3. Formats

Format specifiers have the following form: "%" ["-"] [width] ["." prec] type

A format specifier begins with a % character. After the % come the following, in this order:

- An optional left justification indicator, ["-"].
- An optional width specifier, [width].
- An optional precision specifier, ["." prec].
- The conversion type character, type

The following table summarizes the possible values for type:

d, i Decimal. The value is converted to a string of decimal digits. If the format string contains a precision specifier, it indicates that the resulting string must contain at least the specified number of digits; if the value has fewer digits, the resulting string is left-padded with zeros. Like %4d => ' 34'

u Unsigned decimal. Similar to 'd' but no sign is output.

e Scientific. The value is converted to a string of the form "-d.ddd...E+ddd". The resulting string starts with a minus sign if the number is negative. One digit always precedes the decimal point. The total number of digits in the resulting string (including the one before the decimal point) is given by the precision specifier in the format string—a default precision of 15 is assumed if no precision specifier is present. The "E" exponent character in the resulting string is always followed by a plus or minus sign and at least three digits. Like %1.3e => '1.263 E+3'

f Fixed. The value is converted to a string of the form "-ddd.ddd...". The resulting string starts with a minus sign if the number is negative. The number of digits after the decimal point is given by the precision specifier in the format string—a default of 2 decimal digits is assumed if no precision specifier is present. Like %2.1f bar => '15.1 bar'

g General. The value is converted to the shortest possible decimal string using fixed or scientific format. The number of significant digits in the resulting string is given by the precision specifier in the format string—a default precision of 15 is assumed if no precision specifier is present. Trailing zeros are removed from the resulting string, and a decimal point appears only if necessary. The resulting string uses fixed point format if the number of digits to the left of the decimal point in the value is less than or equal to the specified precision, and if the value is greater than or equal to 0.00001. Otherwise the resulting string uses scientific format.

n Number. The value is converted to a string of the form "-d,ddd,ddd.ddd...". The "n" format corresponds to the "f" format, except that the resulting string contains thousand separators. Like %5.2n => '1,234.45'

x Hexadecimal. The value is converted to a string of hexadecimal digits. If the format string contains a precision specifier, it indicates that the resulting string must contain at least the specified number of digits; if the value has fewer digits, the resulting string is left-padded with zeros. Like %04x => '0A45'

o Octal. The value is converted to a string of octal digits. If the format string contains a precision specifier, it indicates that the resulting string must contain at least the specified number of digits; if the value has fewer digits, the resulting string is left-padded with zeros. Like %04x => '0745'

b The value is converted to a string of zeros and ones of binary number. Like %08b => '00101101'

A width specifier sets the minimum field width for a conversion. If the resulting string is shorter than the minimum field width, it is padded with blanks to increase the field width. The default is to right-justify the result by adding

blanks in front of the value, but if the format specifier contains a left-justification indicator (a "-" character preceding the width specifier), the result is left-justified by adding blanks after the value.

# 4. Source field

## 4.1. Expressions

You can write any expression using mathematical operators and constants (strings, numbers and Booleans). String constants are given using single or double quotes. Real-time point values can be referenced using curly brackets, for example:

{/icex1/r412}
{/icex1/r412} + {/icex1/r413}
"R414:" + {/icex1/r414}
{/icex1/r412} >= {/icex1/r413}
{/icex1/r412}[1] && {/icex1/b20}

Here is a list of the arithmetical operations that can be used in source filed

| | |
|---|---|
| + | addition |
| - | subtraction |
| * | multiplication |
| / | division |

In order to evaluate a comparison between two expressions you can use the relational and equality operators. The result of a relational operation is a Boolean value that can only be true or false, according to its Boolean result. You may want to compare two expressions, for example, to know if they are equal or if one is greater than the other is. Here is a list of the relational and equality operators that can be used in source filed:

| | |
|---|---|
| == | Equal to |
| != | Not equal to |
| > | Greater than |
| < | Less than |
| >= | Greater than or equal to |
| <= | Less than or equal to |

Here is a list of the Boolean operations that can be used in source filed

| | |
|---|---|
| ! | Perform the Boolean operation NOT. It returns the opposite Boolean value of evaluating its operand. |
| \| | Boolean logical operation OR. This operation results true if either one of its two operands is true.<br>Function can be performed on registers too |
| & | Boolean logical operation AND. This operation results true if both its two operands are true.<br>Function can be performed on registers bit by bit too |
| ~ | Not – changes status of bits within register |
| ^ | XOR – preforms Boolean logical operation XOR of bits of two registers |
| << | Shift left bits of a register by defined number of bits |
| >> | Shift right bits of a register by defined number of bits |

**Examples**:

!{/icex1/i1) - The node will have status On when the input is Off
{/icex1/i1} | {/icex1/i2} - The node will be On if one of the inputs will be On
{/icex1/r1} | {/icex1/r2} - Performs Boolean OR bit by bit of r1 and r2
{/icex1/r1} & {/icex1/r2} - Performs AND bit by bit of r1 and r2.
{/icex1/r1} & 0xFF00 - Performs AND of r1 with constant number 0x00FF. This operation resets LSB to 0
{/icex1/r1} ^ 0xFFFF - Performs XOR of r1 with 0xFFFF. This operation reverts all bits of r1.
{/icex1/r1} >> 8 - Shifts bits of r1 by 8 right

Bits can be referenced by using the standard array subscript notation (with bits starting at 0):

{/icex1/r412}[0]
{/icex1/r412}[1] || !{/icex1/r412}[2]‘``

Also supported are functions for converting types:

{/icex1/r412}.to_s => converts to string
{/icex1/r412}.to_bool => converts to Boolean
{/icex1/f412}.to_i => converts to integer

Boolean expressions are also possible, especially useful for alarms:

{/icex1/r412} > 50

Also supported is a special system object which supplies global information. Currently system.time is supported:

system.time => the current system time of the server

### 4.2. Special Functions

**Any node that uses one or more of these functions will be recalculated at regular intervals according to its configured sample rate.**

# 1. active_alarms_count(group)

Returns the number of currently active alarms for the given group.

### Arguments

- group: a reference to a group. This is given by either a string (i.e. '/group1'), or a regular node reference followed by .ref (i.e. {/group1}.ref).

### Example usage

A group reference with string:

**func.active_alarms_count('/site1')**

A group reference with .ref method:

**func.active_alarms_count({/site1}.ref)**

# 2. active_alarms_duration(group, unacked_only)

Returns the average duration of currently active alarms in the given group (time elapsed since alarm start).

### Arguments

- group: a reference to a group. This is given by either a string (i.e. '/group1'), or a regular node reference followed by .ref (i.e. {/group1}.ref).
- unacked_only (default: false): an optional argument. If true, the function will calculate the alarm duration for acknowledged alarms as the time period between alarm start and alarm acknowledge.

### Example usage

Average duration for currently active alarms:

**func.active_alarms_duration('/site1')**

Average duration for unacknowledged alarms:

**func.active_alarms_duration({/site1}.ref, true)**

# 3. alarm_history_avg_duration(group, period)

Calculates the average duration of alarms occurring in the given period for the given group. The duration is calculated as the time elapsed between alarm start and alarm end.

### Arguments

- group: a reference to a group. This is given by either a string (i.e. '/group1'), or a regular node reference followed by .ref (i.e. {/group1}.ref).
- period: an optional argument denoting the time period in seconds, going back from the present moment. By default, the period consulted is the last 24 hours (86400 seconds).

### Example usage

Average duration of alarms occurring in the last 3 days:

**func.alarm_history_avg_duration('/site1', 86400 * 3)**

## 4. alarm_history_count(group, period)

Calculates the number of alarms occurring in the given period for the given group.

### Arguments

- group: a reference to a group. This is given by either a string (i.e. '/group1'), or a regular node reference followed by .ref (i.e. {/group1}.ref).
- period: an optional argument denoting the time period in seconds, going back from the present moment. By default, the period consulted is the last 24 hours (86400 seconds).

### Example usage

Number of alarms in the last week:

**func.alarm_history_count('/site1', 86400 * 7)**

## 5. avg(expr, period)

Calculates a running average on the given expression over the given period.

### Arguments

- expr: an expression evaluating to a number.- period: the time period for the running average in seconds.

### Example usage

Calculate a running average over one hour:

**func.avg({/site1/registers/r1504}, 3600)**

(Note: the running average will be updated according to the target node's sample rate).

# 6. integrate(ref, period:, units:, mode:)

Calculates time-based integral of given reference over the given period, either for the current period, or for the previous period. This function can be used to calculate e.g. total flow based on flow rate.

### Arguments

- ref: a reference to a point node. This is given by either a string (i.e. '/group1/registers/r1504'), or a regular node reference followed by .ref (i.e. {/group1/registers/r1504}.ref).
- period (default :day): the period over which to integrate the value, either :month, :week, :week_sunday, :day, :hour, :minute, :second or a number indicating time period in seconds (60 for one minute, 3600 for one hour, etc). Weekly periods start on monday. For weekly periods starting on sunday use :week_sunday.
- units (default :hour): the units to use for the integral, either :day, :hour, :minute, :second or a number indicating time period in seconds (60 for one minute, 3600 for one hour, etc).
- mode (default :previous): one of the following:
  - :previous - calculate integral for previous rounded time period. Note that in this mode the result of the function will be updated once per time period. For example, for an hour-based integral, the result of the function will signify the integral for the previous hour.
  - :current - calculate integral for current rounded time period (projected up to the end of the current time period).
  - :realtime - calculate integral for current rounded time period up until present moment.
- Hour offset (optional, default 0) – defines time offset 0-23 hours for value reset from local time 00:00:00 (midnight) for defined period – month, week, week_sunday, day.

### Example usage

Calculate total flow in flow/hour units for yesterday:

**func.integrate('/r1442', period: :day, units: :hour, mode: :previous)**

Calculate total flow in flow/minute units for today up until now:

**func.integrate('/r1442', period: :day, units: :minute, mode: :realtime)**

Calculate total flow in flow/minute units for yesterday with value update at 6:00PM

**func.integrate('/r1442', period: :day, units: :hour, mode: :previous: hour_offset: 6)**

# 7. prev_period_value(ref, period:, mode:)

Calculates historical value for the previous time period given node reference according to given period and mode.

### Arguments

- ref: a reference to a point node. This is given by either a string (i.e. '/group1/registers/r1504'), or a regular node reference followed by .ref (i.e. {/group1/registers/r1504}.ref).

- period: symbol indicating period (:day, :hour, :minute, :second) or a number indicating time period in seconds (60 for one minute, 3600 for one hour, etc).
- mode: one of the following:
  - :first: first value for the previous time period
  - :last: last value for the previous time period
  - :delay: value at period seconds ago
  - :avg: weighted average for the previous time period
  - :diff: difference between first value and last value over the previous time period
- Hour offset (optional, default 0) – defines time offset 0-23 hours for value reset from local time 00:00:00 (midnight) for defined period – month, week, week_sunday, day.

### Example usage

Calculate weighed average for the previous day:

**func.prev_period_value('/r1442', period: :day, mode: :avg)**

Calculate first value for the previous hour:

**func.prev_period_value('/r1442', period: 3600, mode: :first)**

Calculate weighed average for the previous day with value updated at 12:00 PM:

**func.prev_period_value('/r1442', period: :day, mode: :avg, hour_offset: 12)**

## 8. pulse_count(ref, period:, mode:)

Calculates total pulses (transitions from 0 to 1) of given reference over the given period, either for the current period, or for the previous period.

### Arguments

- ref: a reference to a point node. This is given by either a string (i.e. '/group1/io/b12'), or a regular node reference followed by .ref (i.e. {/group1/io/b12}.ref).
- period (default :day): the period over which to count pulses, either :day, :week, :month, :minute or a number indicating time period in seconds (60 for one minute, 3600 for one hour, etc).
- mode (default :previous): one of the following:
  - :previous: calculate pulse count for previous rounded time period. Note that in this mode the result of the function will be updated once per time period. For example, for an hour-based pulse count, the result of the function will signify the pulse count for the previous hour.
  - :current: calculate pulse count for current rounded time period.
- Hour offset (optional, default 0) – defines time offset 0-23 hours for value reset from local time 00:00:00 (midnight) for defined period – month, week, week_sunday, day.

### Example usage

Calculate pulse count for yesterday:

**func.pulse_count('/b12', period: :day, mode: :previous)**

Calculate pulse count for current rounded hour:

**func.pulse_count('/b12', period: :hour, mode: :current)**

Calculate pulse count for yesterday with refresh value at hour 2:00 AM:

**func.pulse_count('/b12', period: :day, mode: :previous,hour_offset: 2)**

# 9. rate_of_change(expr, period:)

Calculates the rate of change of the given expression over the given time period.

**Arguments**

- expr: a numeric expression.
- period (default :day): the period over which to count pulses, either :day, :week, :month, :minute or a number indicating time period in seconds (60 for one minute, 3600 for one hour, etc).

**Example usage**

Calculate rate of change per hour

**func.rate_of_change({/r1032}, period: :hour)**

Calculate rate of change per minute

**func.rate_of_change({/r1032}, period: 60)**

# 10. runtime(ref, period: , units:, mode:)

Counts running time based on Boolean given expression.

**Arguments**

- ref: a reference to a point node. This is given by either a string (i.e. '/group1/io/b12'), or a regular node reference followed by .ref (i.e. {/group1/io/b12}.ref).
- period: time period for resetting running time, one of: :daily, :hourly (default is :daily).
- units: unit for expressing time, one of: :day, :hour, :minute, :second (default is :hour).
- mode (default :previous): one of the following:
  - :previous: calculate pulse count for previous rounded time period. Note that in this mode the result of the function will be updated once per time period. For example, for an hour-based pulse count, the result of the function will signify the pulse count for the previous hour.
  - :current: calculate pulse count for current rounded time period.
- Hour offset (optional, default 0) – defines time offset 0-23 hours for value reset from local time 00:00:00 (midnight) for defined period – month, week, week_sunday, day.

**Example usage**

By default, `func.runtime` measures running time in hours and resets the running time daily (at midnight):

**func.runtime('/site1/bits/b33')**

To change the default behavior add more arguments:

**func.runtime({/site1/bits/b33}.ref, period: :hour, units: :second, mode: :current, hour_offset: 4)**