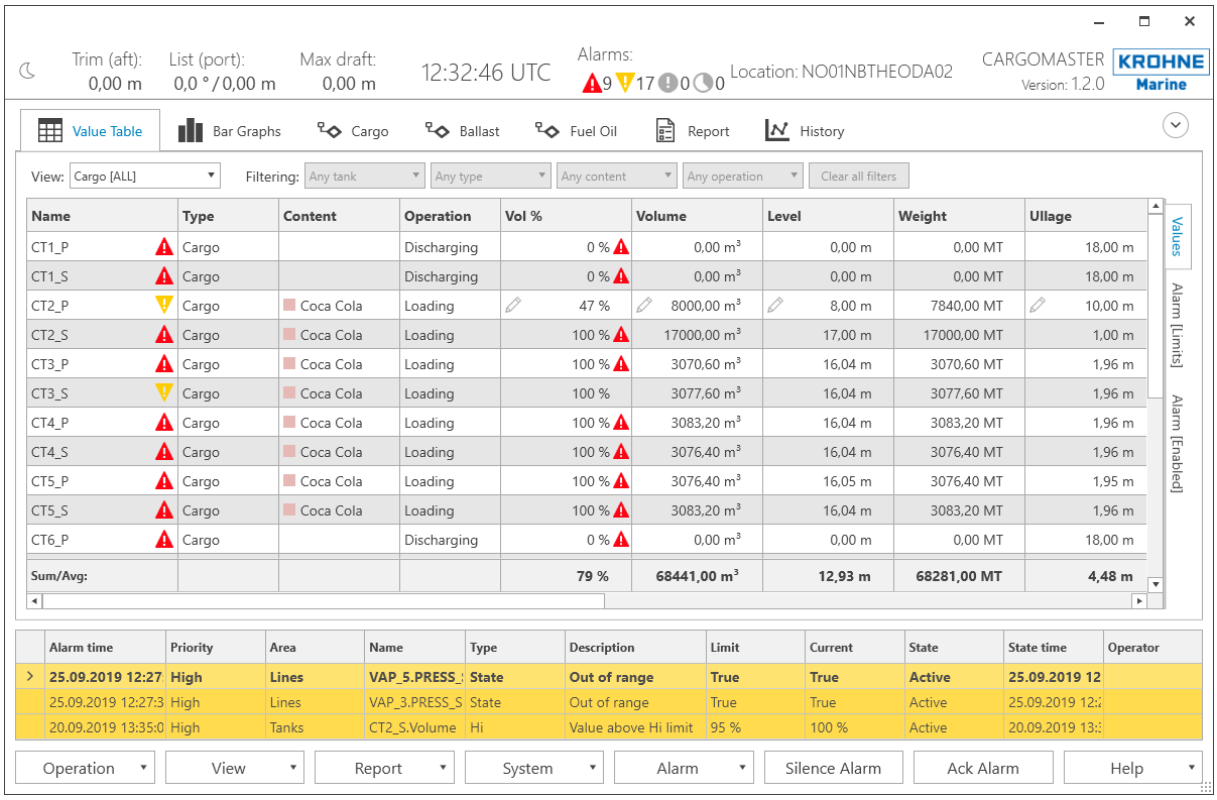
CARGOMASTER® V6



User Manual

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Version List

Version	Date	Changes	Changed	Approved
1.0	24.09.2019	Initial version	AT	
1.1	21.11.2019	Added more alarm details	AT	
1.2	20.01.2020	Fix typos, added tooltip info, added keyboard shortcuts and replaced wrong screenshots.	AT	
1.3	17.06.2021	Updated text regarding density expansion coefficient and added chapter for testing of alarms.	AT/MKN	
1.4	10.01.2022	Updated for version 1.2.11: • Add information on Density and Weight in Vacuum vs Air • Update report chapter • Auto zero tank sensors • Value Table setup	AT	

CONTENTS

1 INTRODUCTION

This document describes the Human Machine Interface (HMI) and run-time operation of the CARGOMASTER® system for tank gauging and valve remote control from KROHNE Marine.

Start the application by clicking the “Monitoring System Client” icon on the desktop.

1.1 System Overview

A complete CARGOMASTER® system includes quite a few components. There are both mechanical and electrical parts, as well as computer programs involved in the process of monitoring the various tanks on your vessel. (See Figure 1-1) presents the most common parts of such a system and indicates a few different options. CARGOMASTER® is a modular system so all these options may not be configured and installed on your vessel.

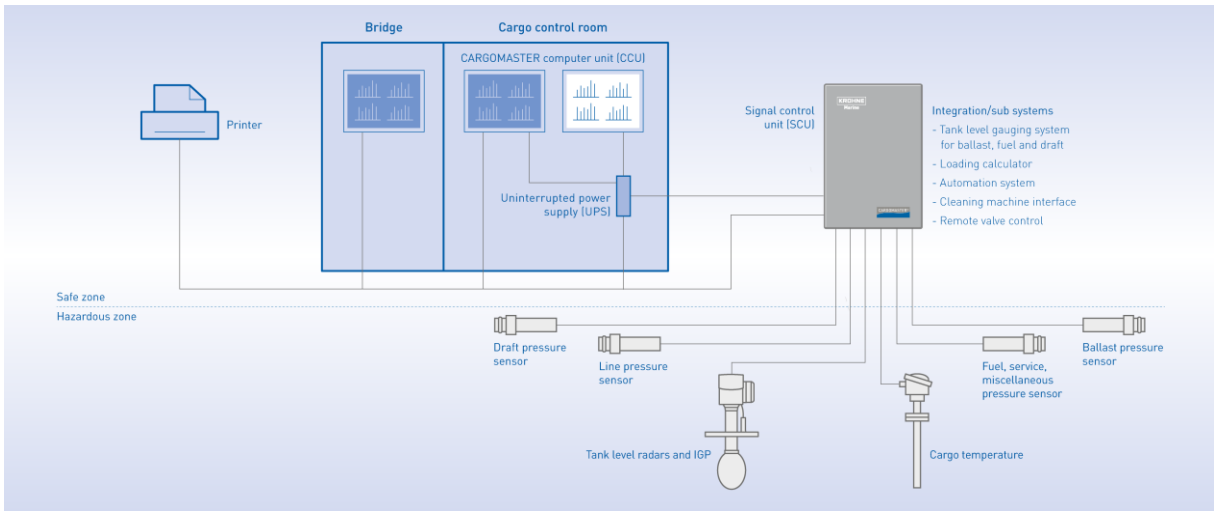


Figure 1-1: CARGOMASTER® system overview

A few words on some of the various system parts:

CCU Short for CARGOMASTER® Computer Unit. Ordinary PC type computers, however configured and type approved for maritime use. Normally, these computers are powered via an UPS – Uninterruptable Power Supply. A laser printer is also handy and is needed for printed reports. The CCU is connected to the SCU to retrieve measurement data.

SCU Short for Signal Control Unit. This is where all data is collected from the various transmitters or instruments and forwarded to the CCU.

Other systems: CARGOMASTER® supports an array of protocols to communicate with other vessel systems, usually trough a RS232 or RS485 serial interface.

Sensors: CARGOMASTER® can utilize a variety of sensors/transmitters, primarily the native CARGOMASTER® types. The range includes ballast/line pressure sensors, radar transmitters, various temperature transmitters, and various 4-20 mA transmitters. CARGOMASTER® can also retrieve data from 3rd party systems.

Junction boxes: Some of the CARGOMASTER® junction boxes, normally the ones fitted on cargo tanks, host electronic equipment like AD cards. The boxes are designed to withstand rough weather conditions and should not be opened except for required servicing. Also, boxes placed inside trunks, engine room etc. may have electronics inside. Please consult the electrical drawings for the system installed on your vessel for further details.

AD/TI cards: The Analogue/Digital cards, commonly placed in the various junction boxes, converts analogue signals from the cargo and ballast sensors into digital data and transmits these to the TI (Tank Input) cards placed inside the SCU. The TI card receives the data, and feeds them through Zener-barriers, necessary for safe electrical connection between Safe and Hazardous areas.

PLC IO: A PLC (Programmable Logic Controller) with several intrinsically safe IO modules. Used for interfacing radars and pressure sensors.

1.2 Precautions

Although the mechanical and electrical parts of CARGOMASTER® are virtually free of maintenance, they are vulnerable to certain physical impacts. So, even though it may seem obvious- please:

- Do NOT expose sensors/transmitters to sandblasting!
- Do NOT overpaint sensors/transmitters!
- Please take care when cleaning tanks – even small strokes or impacts on the sensor diaphragms may alter the sensors characteristics in such a way that it will become unusable!
- Do NOT replace any seals, O-rings or gaskets with parts that are not clearly specified for this equipment!

1.3 Weight & Density in vacuum vs air

The system normally presents all weight and density values in vacuum. Depending on the user preferences this can be changed in the following way:

- Density:
  - Density unit without any suffix (such as *kg/m3*) means density in vacuum
  - To display density in air select a different unit (2.5) such as *kg/m3 (air)*
- Weight:
  - Weight in vacuum and air uses the same unit (MT, kg, etc) but weight in air are shown with the text *Weight (air)* (Weight in vacuum is shown as just *Weight*)
  - For the reports the user can select *Weight in air*
  - In the value table the user can select *Weight* or *Weight (air)* (or both) column(s)
  - For the Tank faceplate both *Weight* and *Weight (air)* are displayed.

2 OVERVIEW & NAVIGATION

2.1 User Interface layout

The main user interface of the CARGOMASTER® program consists of four areas (Figure 2-1):

1. **Top area**
   Shows key data such as: trim/list, number of active alarms in each category and the name of the CCU.
2. **Main navigation area**
   Shows various views of the application such as: value table, bar graphs, mimics, etc.
3. **Alarm overview**
   If alarms are present, the 3 most important are shown here (See Chapter 5).
4. **Menu**
   Used to navigate to various views and operate the system.

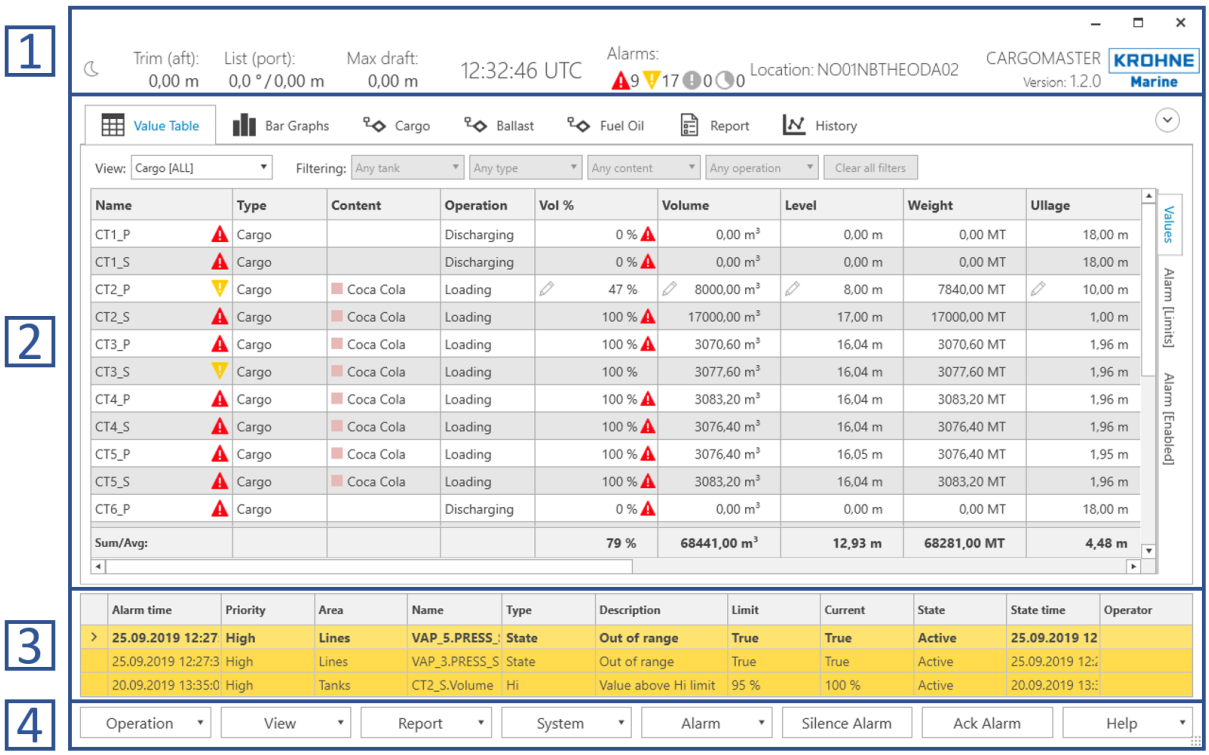


Figure 2-1: User interface layout

2.2 Navigation

Navigating the user interface can be done using mouse/trackball or keyboard shortcuts.
Using the keyboard is the fastest way to navigate the CARGOMASTER® program, utilizing the keyboard shortcuts built into the program. The keyboard shortcuts are listed in the Reference chapter. When pressing the Alt key all menu buttons that have an underscored letter are accessed by pressing that letter while holding down the Alt key. E.g. the Operation menu is accessed by pressing and holding the Alt key, then press and release the O key.

Navigating between views can be done using the 'View' menu options, or the following keyboard shortcuts:

Shortcut key	View
Alt+F3	Value Table – Numerical spreadsheet display
Ctrl+F3	Bar graph – Vertical bars displaying key tank values
Shift+F3	Layout – Custom layout views depending on configuration. If multiple views are configured pressing the shortcut keys will cycle thru the layout views.

2.3 Mouse Over (Tooltips)

In general, the user interface provides additional information by placing the mouse over icons, values, etc. Figure 2-2 shows the tooltip for an alarm icon.

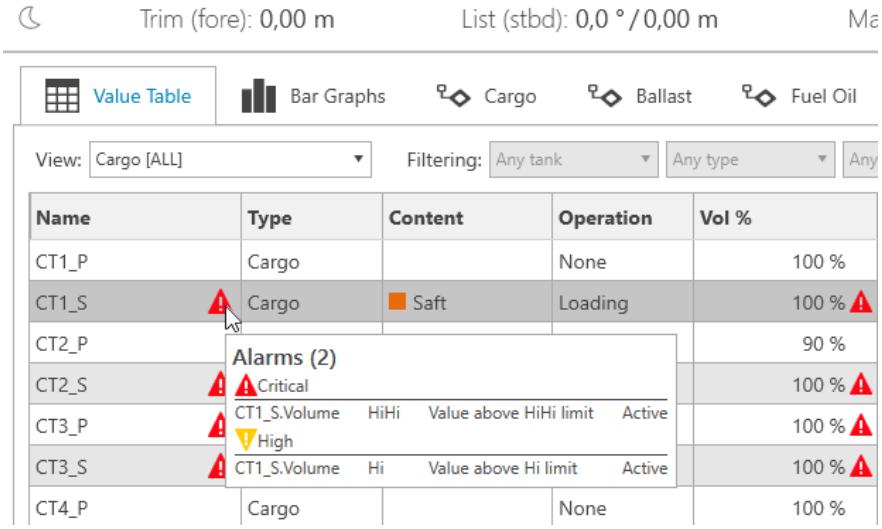


Figure 2-2: Alarm icon tooltip

2.4 Main Views

This chapter gives a brief overview of the available main views.

2.4.1 Value Table

The value table view is shown by pressing **Alt-F3**, **View->Value Table** menu or by clicking the **Value Table** tab. It shows the tank data in a spreadsheet like format (Figure 2-3). Different tanks can be viewed by using the various filtering functions. See chapter 4.1 for detailed description of this view.

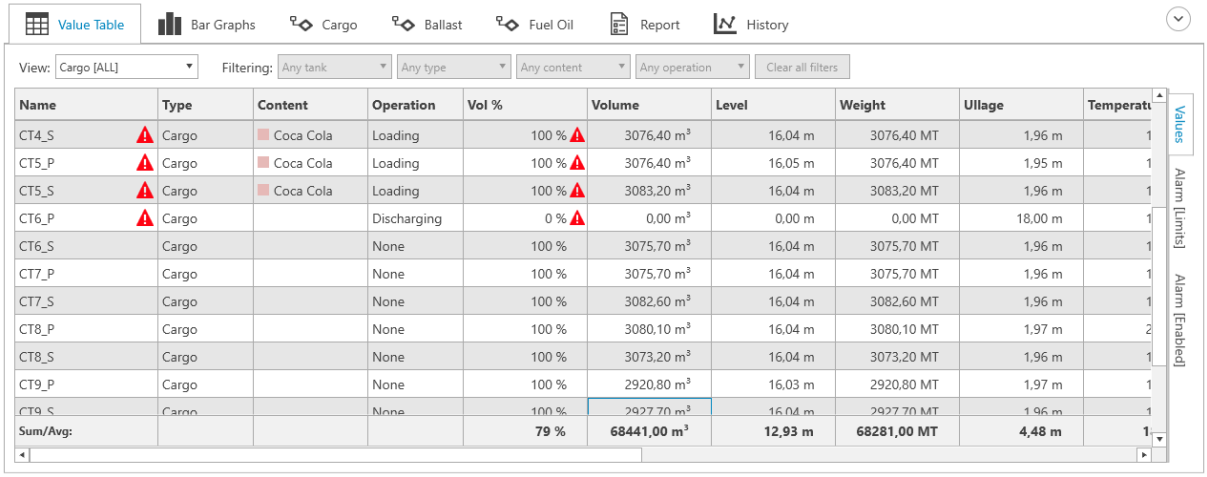


Figure 2-3: Tank Value table view

2.4.2 Bar Graph

The bar graph view is shown by pressing **Ctrl-F3**, **View->Bar Graphs** menu or by clicking the **Bar Graphs** tab. It shows the tank data as graphical bars (Figure 2-4). Different tanks can be viewed by using the various filtering functions. See chapter 0 for detailed description of this view.

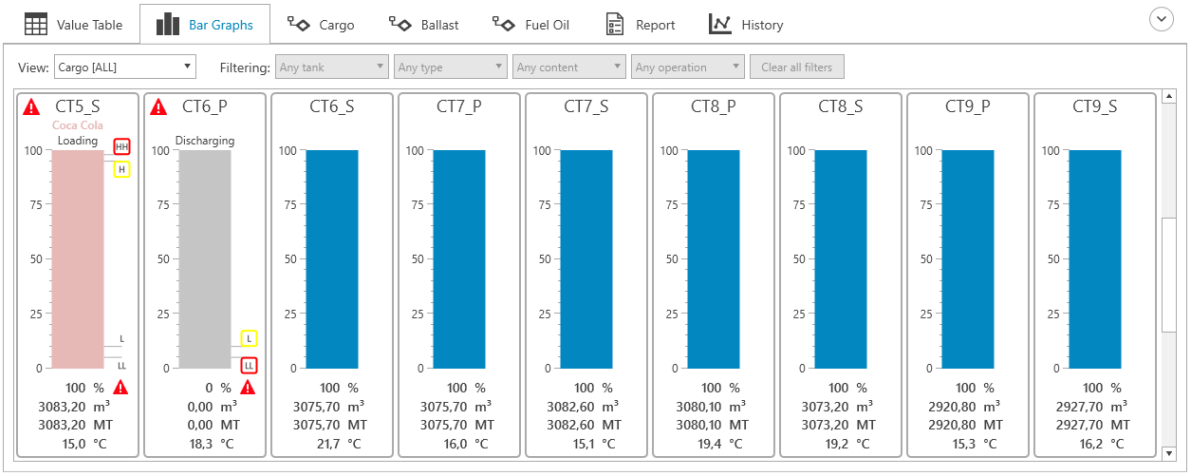


Figure 2-4: Tank Bar graph view

2.4.3 Layout Views

Layout view(s) are shown by pressing **Shift-F3**, **View->[Actual View]** or by clicking the actual view tab (Named Cargo, Ballast and Fuel Oil in Figure 2-5).
Layout views are custom views created specifically for each vessel, and depending on the installed equipment, type of vessel, etc. can vary greatly. An example of a layout view is shown below in Figure 2-5. See chapter 4.3 for detailed description of the layout view.

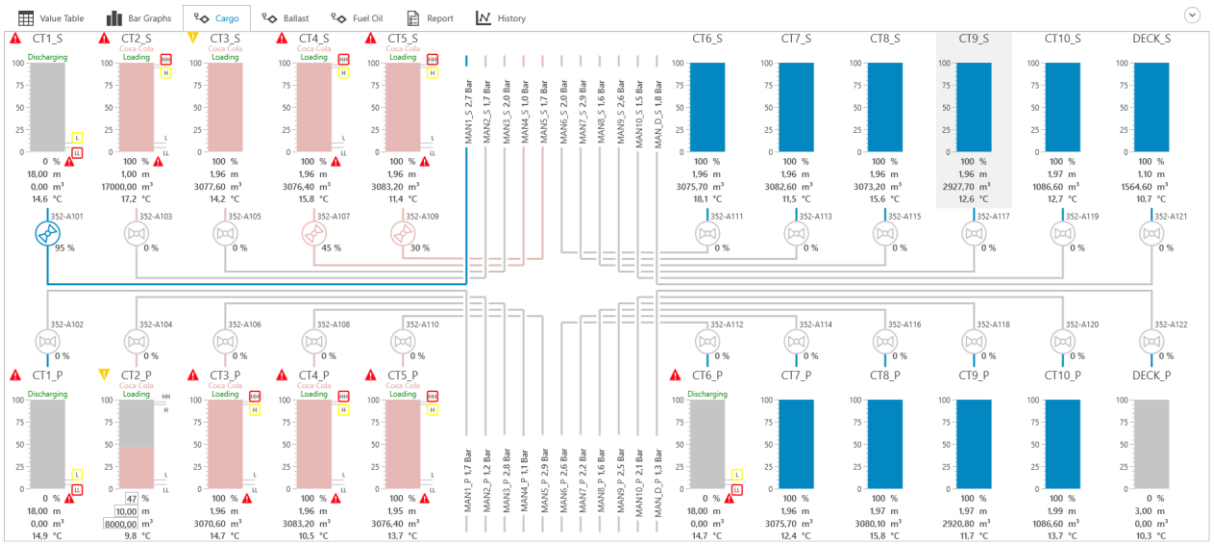


Figure 2-5: Cargo tanks layout view

2.5 Unit Settings

Open the **System->Unit Settings** menu (Figure 2-6) to configure the desired units used for displaying volume, mass, etc. The selected units will be reflected in all the user interface views and reports.

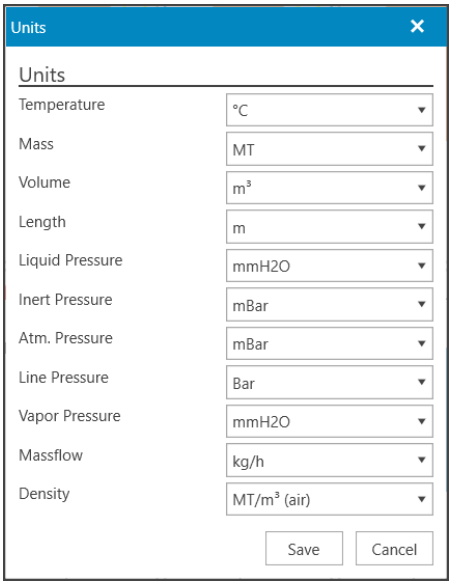


Figure 2-6: Unit settings

2.6 Quality & Alarm indications

Values in the system can have an alarm, e.g. when the value is above a given limit. This is indicated by an alarm icon next to the number, like this (See Chapter 5 for alarm system details):

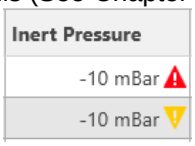


Figure 2-7: Alarm indication

In addition, values have an associated quality. When the quality of a value is bad this is indicated by another icon next to the value:

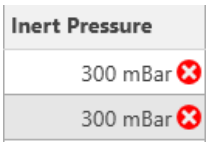


Figure 2-8: Bad value indication

Note: The bad value indication means that this value cannot be trusted. The reason is due to IO error, sensor failure, etc indicated by an associated alarm

3 TANK OPERATIONS

This chapter describes the functions related to setting up tanks prior to loading, discharge, etc. Tanks has a property called ‘Operation’ which is used to denote the current operation for this tank. The various operations are:

- Loading: Indicates that this tank is being loaded
- Discharging: Indicates that this tank is being discharged
- None: Indicates that there is currently no operation performed on this tank

In addition to this, each tank has a ‘Content’ property used to indicate the current content of the tank. The contents are user defined and the operator can add any number of contents.

3.1 Tank Contents

The edit and/or view the list of tank contents, go to menu: **Operation->Edit Content settings**. This opens a popup window showing the defined contents in the system (Figure 3-1). The density settings for the contents are shown in the units set in the *Unit Settings* window (Section 2.5).

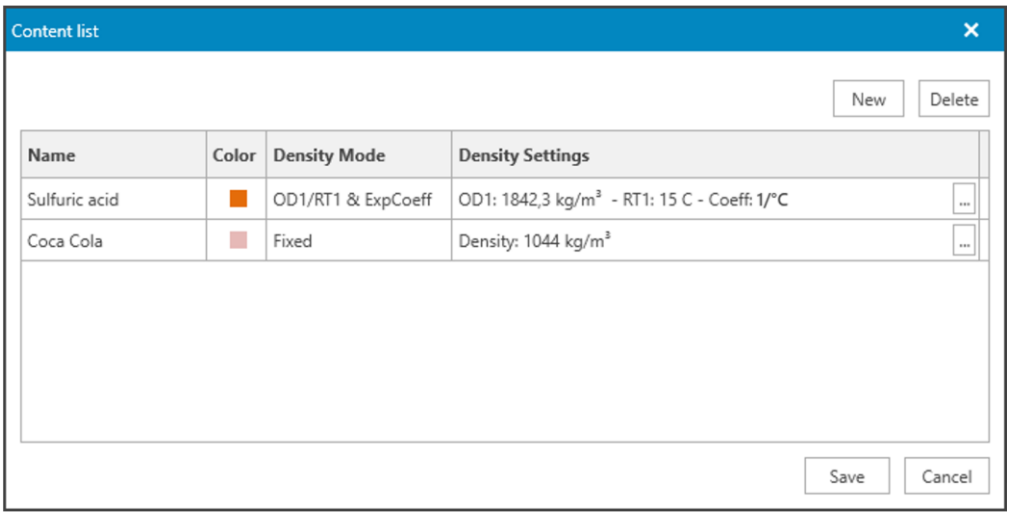


Figure 3-1: Tank contents list

Use the **New** and **Delete** button to add new or delete contents, to edit name or color for a content click in the desired cell. Each content can have density setting defined, which is set on the tanks when loading that content. Once done, click **Save** to save any changes and close the window or **Cancel** to close and ignore any changes entered.
To edit the density settings, click the **…** button in the **Density Settings** column, which opens a popup to edit the settings (Figure 3-2):

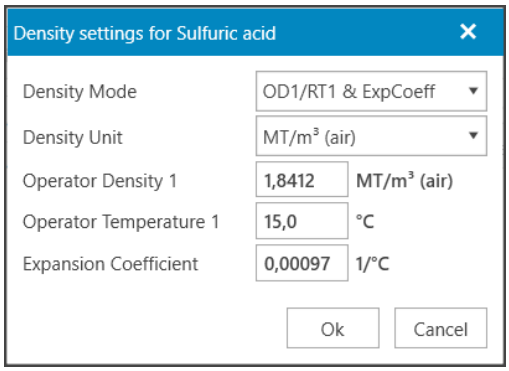


Figure 3-2: Content density settings

> **Tip: To enter density in another unit than the configured unit, use the 'Density Unit' setting (See Figure 3-2).**

The following density settings are available:

Density Mode	Description
OD1/RT1 & ExpCoeff	Density is entered for a specific temperature, with an expansion coefficient describing the volumetric change with temperature.
OD1/RT1 & OD2/RT2	Densities at two different temperatures are entered.
ASTM54B	Uses ASTM54B table to calculate actual density based on the entered reference density.
API	Enter API type (Crude, Product, Lubrication or Ballast) and the API
Fixed	Enter a fixed density.

All modes, except **Fixed**, calculates actual density based on the temperature of the liquid in the tanks.

3.2 Prepare Tanks for Loading

To open the prepare tanks for loading dialog (Figure 3-3), press **F2** or **Operation->Prepare tanks for loading** menu:

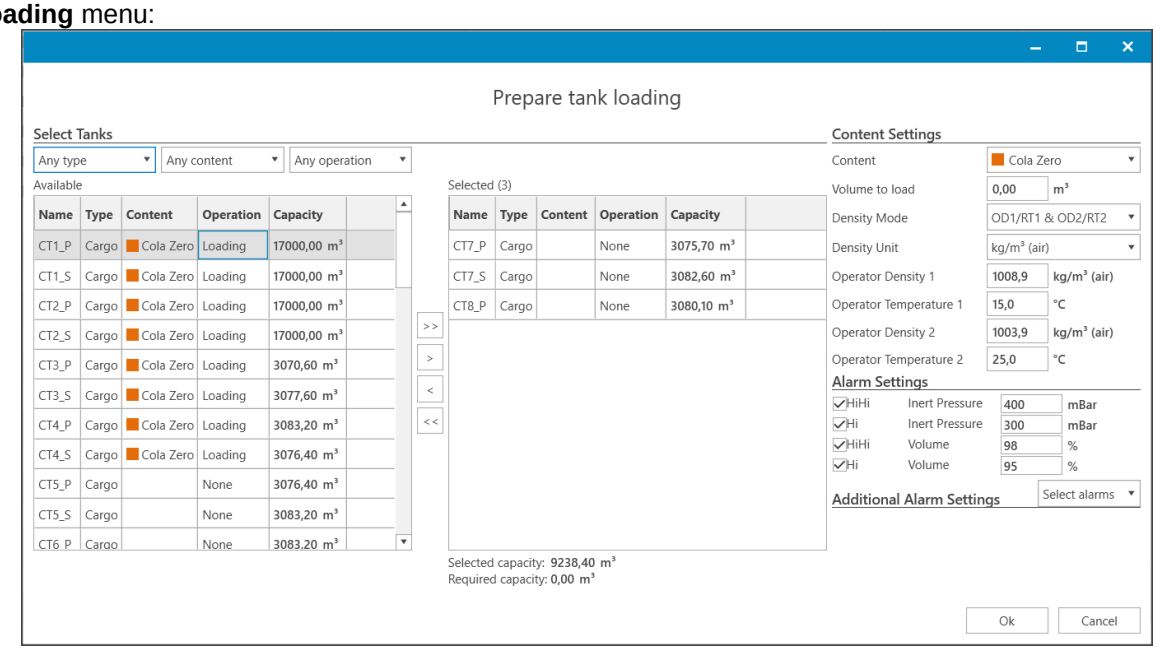


Figure 3-3: Prepare tanks for loading

To prepare tanks for loading follow these steps:

1. **Select the desired tanks**
   This is done by moving the tanks from the list of available tanks to the list of selected tanks using the arrow buttons. The list of available tanks can be filtered by type, content and/or operation.

2. **Select content & density settings**
   Select the desired content from the **Content** drop down list, which will update the density mode/settings to that of the selected content. Optionally the density mode and settings can be overridden/set directly. If desired, the **Volume to load** can be set which is shown below the selected tanks together with the total volume of the selected tanks to ensure enough tank capacity is selected.

3. **Set alarm settings**
   Here the desired alarm limits can be adjusted. By default, Hi & HiHi limit alarms for Volume & Inert Pressure is enabled. In addition, more alarm settings can be set under **Additional Alarm Settings** using the **Select alarms** drop down menu. The set limits and alarms are remembered and used as a default for the next time.

4. **Review settings & Complete**
   When the desired settings are correct, click the **Ok** button, which will set the operation, content, density and alarm settings on all selected tanks. Clicking **Cancel** will close the window without applying any changes.

3.3 Prepare Tanks for Discharge

To open the prepare tanks for discharge dialog (Figure 3-4), press **Shift-F2** or **Operation->Prepare tanks for discharging** menu:

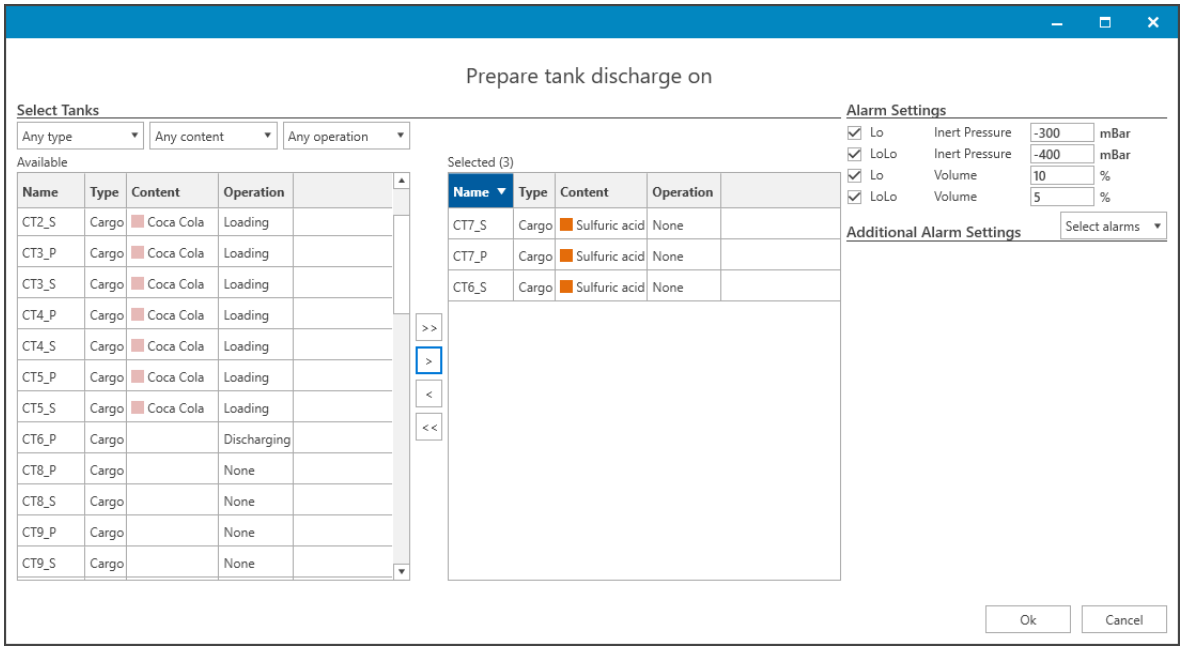


Figure 3-4: Prepare tanks for discharge

To prepare tanks for discharging follow these steps:

1. **Select the desired tanks**
   This is done by moving the tanks from the list of available tanks to the list of selected tanks using the arrow buttons. The list of available tanks can be filtered by type, content and/or operation.

2. **Set alarm settings**
   Here the desired alarm limits can be adjusted. By default, Lo & LoLo limit alarms for Volume & Inert Pressure is enabled. In addition, more alarm settings can be set under **Additional Alarm Settings** using the **Select alarms** drop down menu. The set limits and alarms are remembered and used as a default for the next time.

3. **Review settings & Complete**
   When the desired settings are correct, click the **Ok** button, which will set the operation and alarm settings on all selected tanks. Clicking **Cancel** will close the window without applying any changes.

3.4 End operation on Tanks

To open the end operation dialog (Figure 3-5), press **Alt-F2** or **Operation->End operation on tanks** menu:

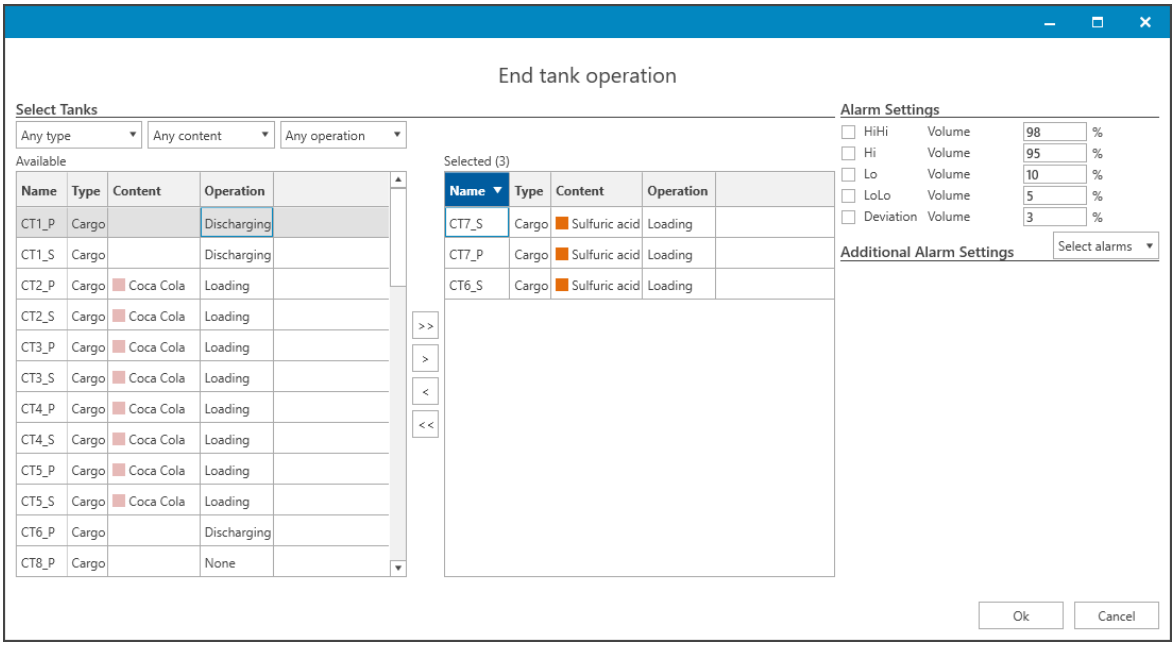


Figure 3-5: End operation on tanks

To end loading or discharging operation on tanks follow these steps:

1. **Select the desired tanks**
   This is done by moving the tanks from the list of available tanks to the list of selected tanks using the arrow buttons. The list of available tanks can be filtered by type, content and/or operation.

2. **Set alarm settings**
   Here the desired alarm limits can be adjusted. By default, all alarms for Volume is disabled. In addition, more alarm settings can be set under **Additional Alarm Settings** using the **Select alarms** drop down menu. The set limits and alarms are remembered and used as a default for the next time.

3. **Review settings & Complete**
   When the desired settings are correct, click the **Ok** button, which will set the operation and alarm settings on all selected tanks. Clicking **Cancel** will close the window without applying any changes.

3.5 Reset Tanks

Reset tanks is used for removing their content. For instance, after a tank has been discharged and cleaned, this function can be used.
To open the reset tanks dialog (Figure 3-6), open **Operation->End operation on tanks** menu:

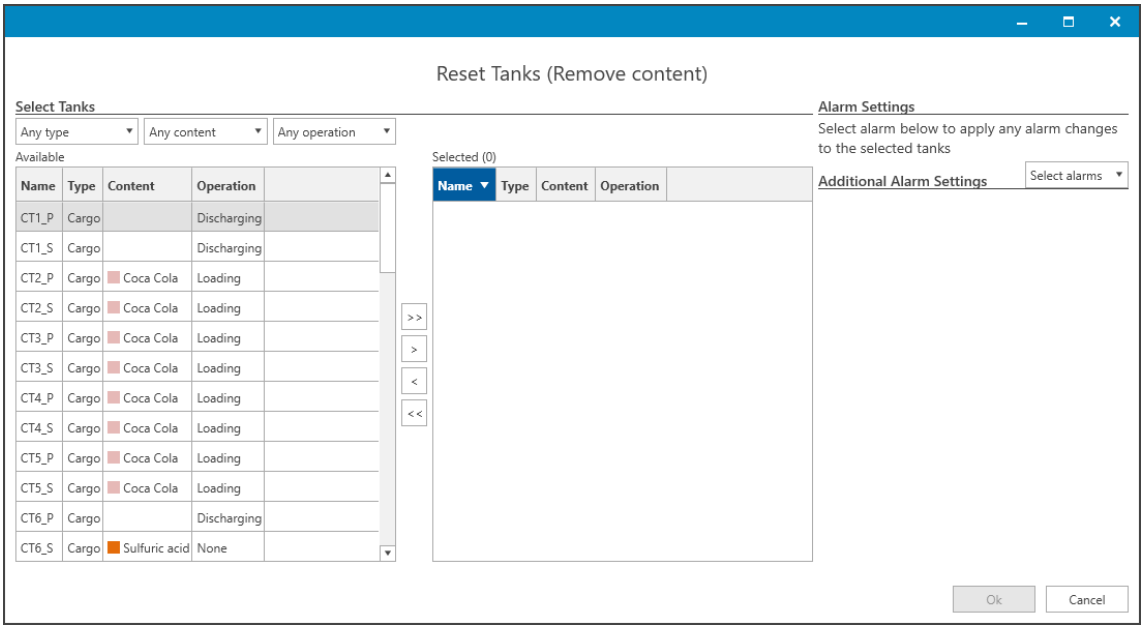


Figure 3-6: Reset tanks

To reset tanks, follow these steps:

1. **Select the desired tanks**
   This is done by moving the tanks from the list of available tanks to the list of selected tanks using the arrow buttons. The list of available tanks can be filtered by type, content and/or operation.

2. **Set alarm settings**
   Here the desired alarm settings can be adjusted. The default is that no alarm settings are changed. However, if desired, alarm settings can be set under **Additional Alarm Settings** using the **Select alarms** drop down menu.

3. **Review settings & Complete**
   When the desired settings are correct, click the **Ok** button, which will remove the content and set the configured alarm settings on all selected tanks. Clicking **Cancel** will close the window without applying any changes.

3.6 Zero-set/Optimize tanks

This function is used to zero adjust pressure sensors on tanks. However, some restrictions for zero adjustment apply:

- To zero adjust any Inert Gas Pressure (IGP) sensors, the tank must be open to atmosphere.
- To zero adjust any bottom or upper sensors, the sensors cannot be submerged in fluid.
- We recommend zero adjustment to be performed immediately before loading.

To perform this operation, open **Operation->Zero Set/Optimize Tanks** menu. This opens the popup window shown in Figure 3-7 below:

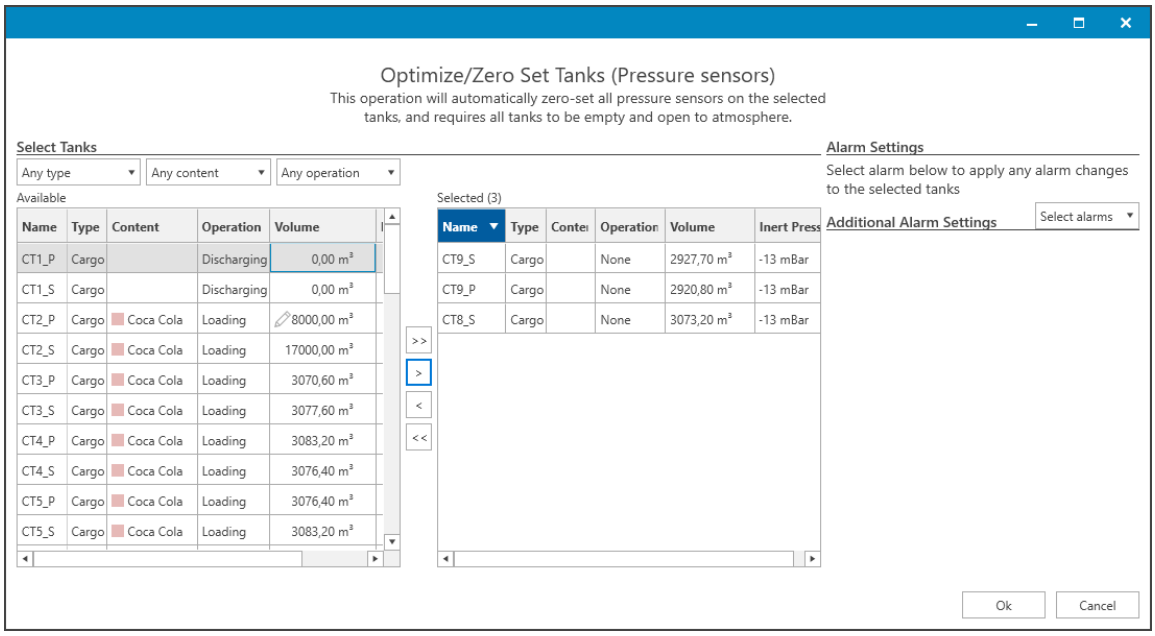


Figure 3-7: Zero set tanks

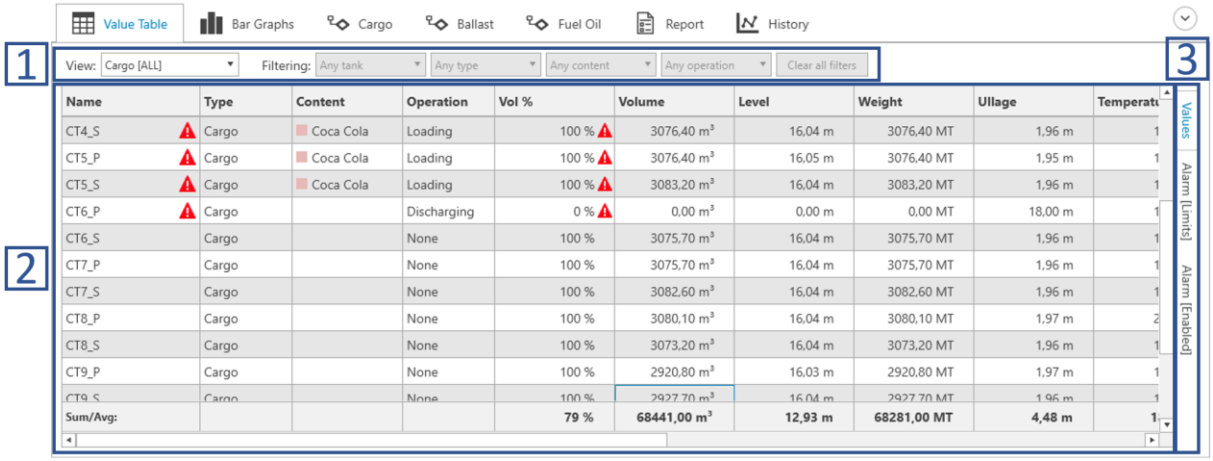
4 VIEWS

This chapter describes in detail the functionality of the main views introduced in chapter 2.4.

4.1 Value Table

This view shows the tank data in a spreadsheet like format, and consists of three areas (Figure 2-3):

1. Filtering: Used to select which tanks to display. Can select views based on tank type, tank content, etc.
2. Displayed tanks: Shows the selected tanks, and their key values.
3. Selection of columns: Used to select what information are shown.



Name	Type	Content	Operation	Vol %	Volume	Level	Weight	Ullage	Temperatu
CT4_S	Cargo	Coca Cola	Loading	100 %	3076,40 m³	16,04 m	3076,40 MT	1,96 m	1
CT5_P	Cargo	Coca Cola	Loading	100 %	3076,40 m³	16,05 m	3076,40 MT	1,95 m	1
CT5_S	Cargo	Coca Cola	Loading	100 %	3083,20 m³	16,04 m	3083,20 MT	1,96 m	1
CT6_P	Cargo		Discharging	0 %	0,00 m³	0,00 m	0,00 MT	18,00 m	1
CT6_S	Cargo		None	100 %	3075,70 m³	16,04 m	3075,70 MT	1,96 m	1
CT7_P	Cargo		None	100 %	3075,70 m³	16,04 m	3075,70 MT	1,96 m	1
CT7_S	Cargo		None	100 %	3082,60 m³	16,04 m	3082,60 MT	1,96 m	1
CT8_P	Cargo		None	100 %	3080,10 m³	16,04 m	3080,10 MT	1,97 m	2
CT8_S	Cargo		None	100 %	3073,20 m³	16,04 m	3073,20 MT	1,96 m	1
CT9_P	Cargo		None	100 %	2920,80 m³	16,03 m	2920,80 MT	1,97 m	1
CT9_S	Cargo		None	100 %	2927,70 m³	16,04 m	2927,70 MT	1,96 m	1
Sum/Avg:				**79 %**	**68441,00 m³**	**12,93 m**	**68281,00 MT**	**4,48 m**	1

Figure 4-1: Tank Value table view

Tip: The columns (types, size, etc) in the value table view can configured (0)

4.1.1 Tank filtering

To control which tanks to view, open the **View** dropdown shown in Figure 4-2.

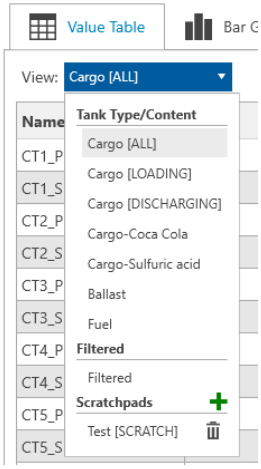


Figure 4-2: Value table view selection

The various views are categorized into three:

Tank Type/Content	These views are used to filter tanks either by tank type or content. *Cargo [ALL]*: Shows all cargo tanks *Cargo [LOADING]*: Shows all cargo tanks in loading operation *Cargo [DISCHARGING]*: Shows all cargo tanks in discharging operation In addition, one view pr. content type currently set on the tanks is available.
Filtered	When selecting this option, the filter row (#1 in Figure 4-1) is used to filter the tanks as desired. Filtering can be done by: Tanks: Select one or more tanks Type: Cargo, Ballast, Fuel, etc. Content: Filter by currently used content Operation: Filter by tank operation
Scratchpads	Scratchpads are views that the user can create and save. Multiple views can be created with the desired tanks. Blank rows and rows with partial sum values can be added. See 4.1.2 for detailed description.

4.1.2 Scratchpads

Create new scratchpad view

To create a new scratchpad view, open the View dropdown (Figure 4-2) and click the + icon. This opens the dialog shown below (Figure 4-3).

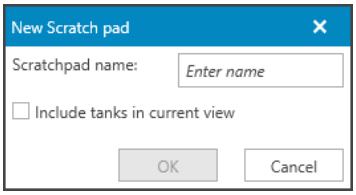


Figure 4-3: Create new scratchpad

1. Enter a name for the scratchpad view
2. 'Include tanks in current view': If checked will include all the tanks in the current view, otherwise the created scratchpad will be initially empty.
3. Click the **Ok** button to create the scratchpad or **Cancel** to cancel.

Working with scratchpads

Once a scratchpad is selected it is possible to edit which tanks are viewed. The following rows can be added to a scratch pad:

1. Tank: Displays tank values for this tank.
2. Blank: A blank row, can be used add spacing between rows for easier readability.
3. Part. Sum: A row which shows the sum/average values for tanks above (up to previous part. sum, or top if no part. sum is defined above).
    a. Tank volume & weight are shown as sum
    b. All other values are shown as average

An example is shown in Figure 4-4 showing tank, blank and part. sum rows. The first part. sum row shows the sum/average values for tanks CT1_P and CT1_S. The second part. sum row shows the sum/average for tanks CT8_P and CT8_S.

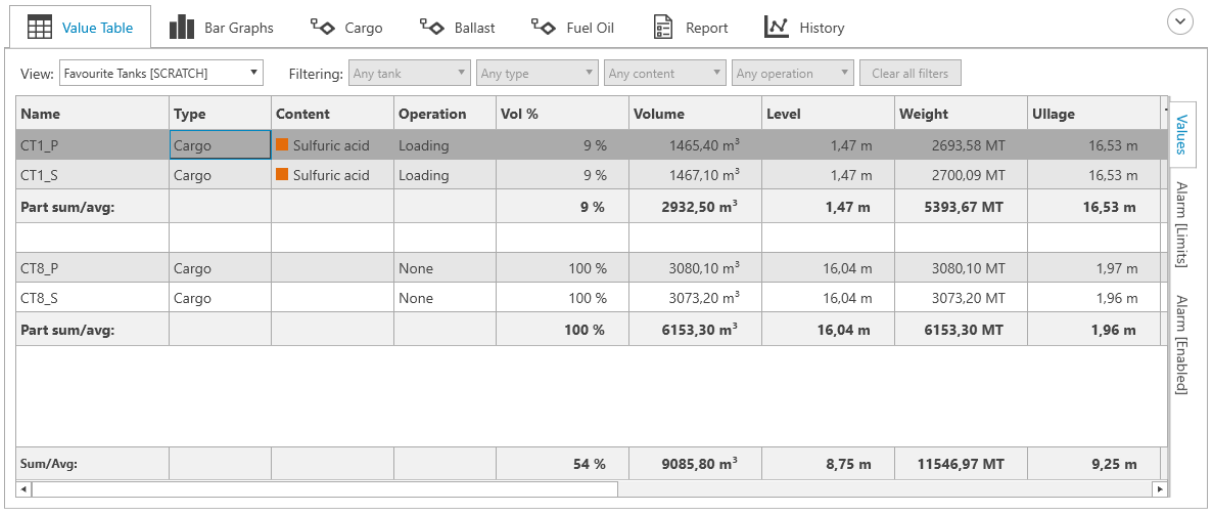


Figure 4-4: Example scratchpad

To add/delete rows from scratchpad right-click the desired row which shows a context menu (Figure 4-5).

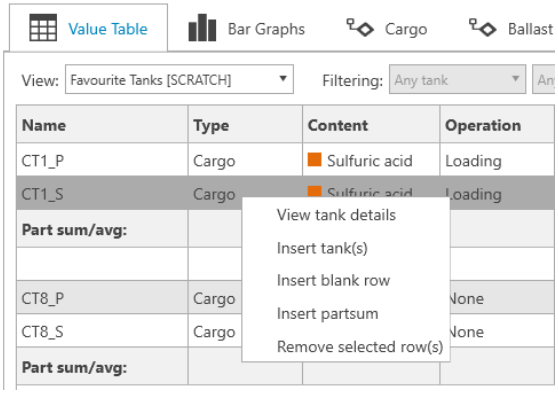


Figure 4-5: Insert/delete rows

The following options are available:

- **View tank details**: Opens the faceplate for this tank (See chapter 0).
- **Insert tank(s)**: Shows a dialog where desired tank(s) can be added.
- **Inert blank row**: Inserts a blank row at this location.
- **Insert part sum**: Insert a part sum row at this location.
- **Remove selected row(s)**: Deletes the selected row from the scratchpad.

Deleting scratchpads

A scratchpad group can be deleted by clicking the 🗑 icon to the right of the scratchpad in the view list (See Figure 4-2).

4.1.3 Views

When the ‘Values’ (#3 in Figure 4-1) view are selected, the following settings can be changed:

- Adding/removing columns: By right-clicking a column header (See Figure 4-6).
- Column width: By clicking and dragging the separator line on the right side of the column.
- Column order: By clicking and dragging the column header to the desired location.

The column settings (column types, order and widths) are saved automatically, and are individual to each client computer of the system.

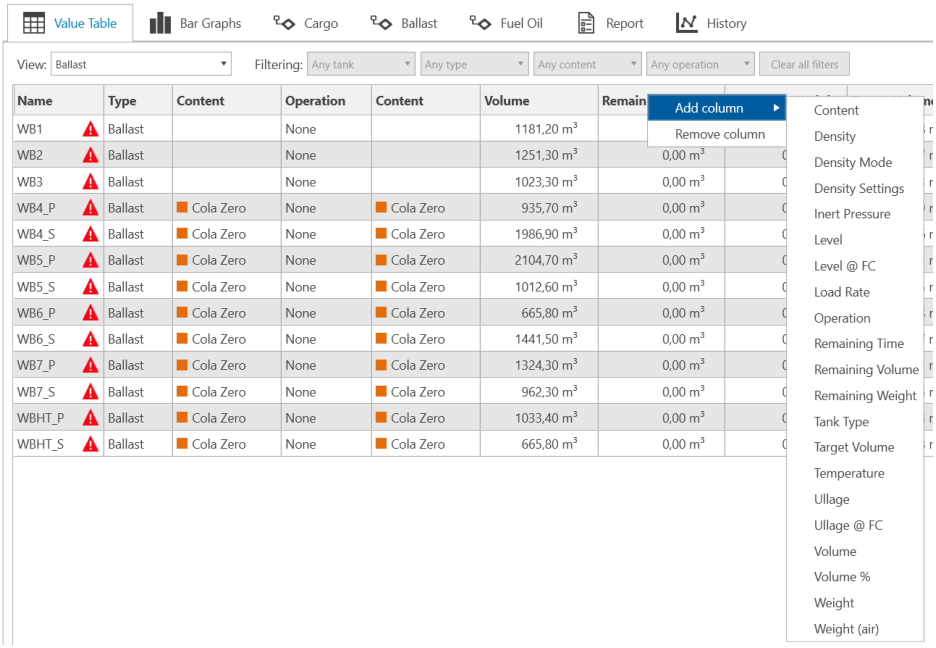


Figure 4-6: Adding/removing columns

Using the *Alarm [Limits]* and the *Alarm [Enabled]* views, alarm for the tanks can easily be viewed and configured. Figure 4-7 shows the *Alarm [Limits]* view.

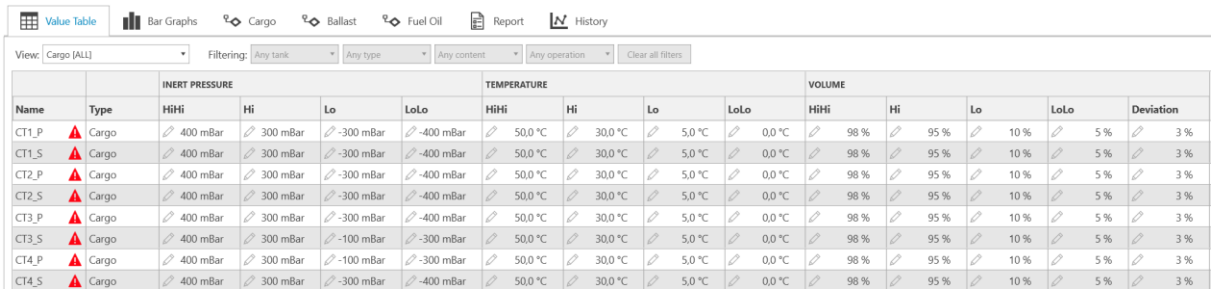


Figure 4-7: Alarm [Limits] view

4.2 Bar Graphs

This view shows the tank data in graphical bar format, and consists of two areas (Figure 2-4):

1. Filtering: Used to select which tanks to display. Can select views based on tank type, tank content, etc.
2. Displayed tanks: Shows the selected tanks, and their key values.

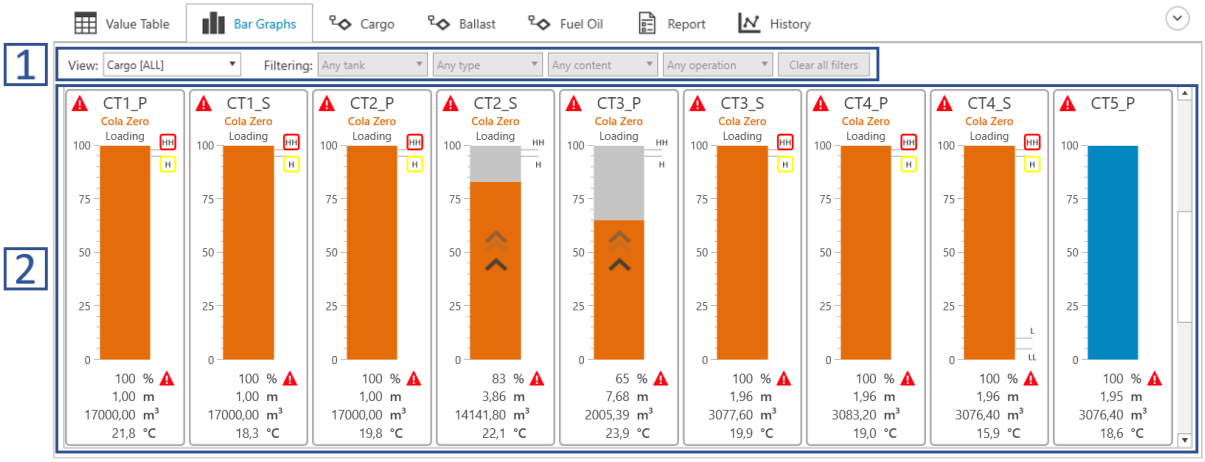


Figure 4-8: Tank Bar graph view

The type of values shown for each tank is fixed, to see more/other values open the tank faceplate by double-clicking the desired tank (Section 0).

4.3 Layout Views

The layout views are created specifically for each installation, and will vary depending on the type of vessel, whether the system includes valve & pump control, etc. An example is shown in Figure 4-9:

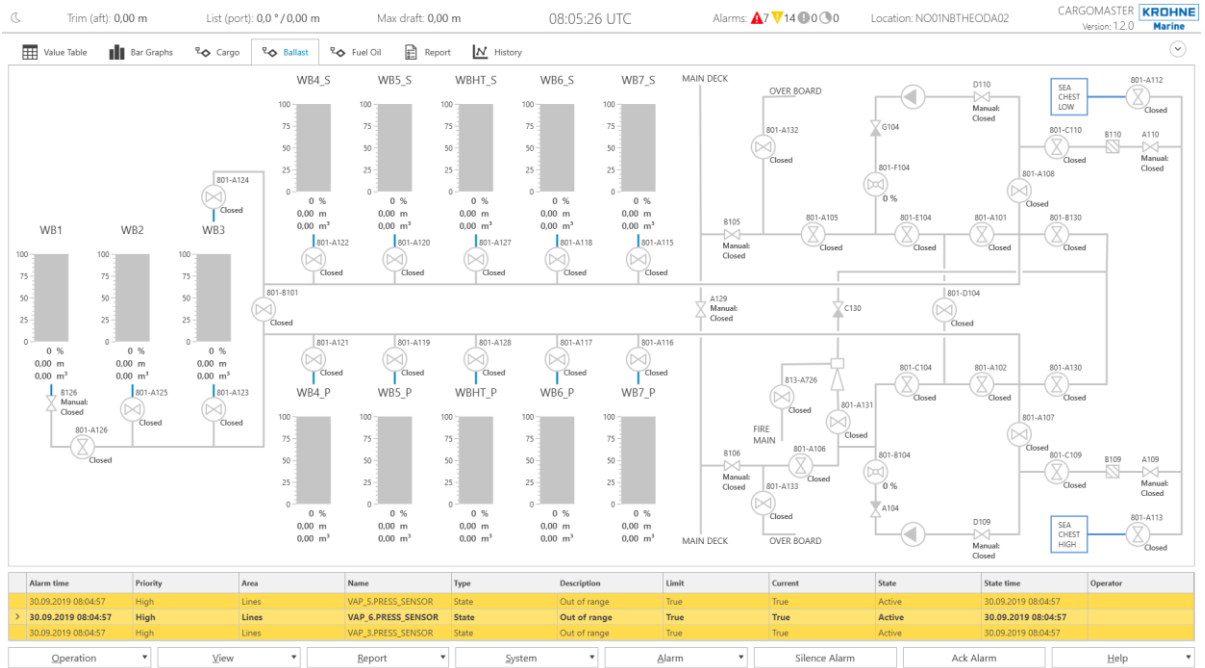


Figure 4-9: Ballast layout view

While the exact layout of the view will vary, each tank is displayed according to Figure 4-10 below:

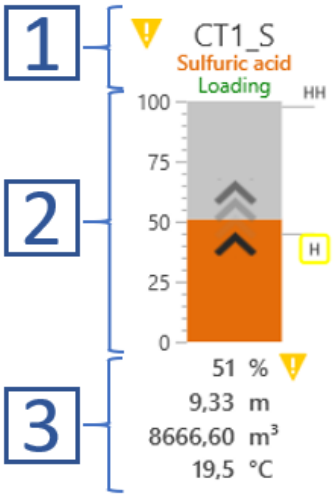


Figure 4-10: Tank view

The following information is presented:

1. The name, content and operation of the tank, and an alarm indicator in case the tank has any alarms. In this case
    a. Name: CT1_S
    b. Content: Sulfuric acid
    c. Operation: Loading
    d. Alarms: The tank has one (or more) high priority alarms indicated by the yellow triangle (See Chapter 5 for details on alarm system).
2. Bar graph showing the current volume % of the tank.
    a. The bar has the same color as the content for easy identification
    b. If load rate is detected on the tank, an animated arrow is shown (as is the case here). Pointing upwards is positive load rate and pointing downwards is negative.
    c. Volume alarms are shown as icons (HH, H, L and LL) to the right of the bar. In this case the tank has Hi and HiHi alarms enabled and the Hi alarm is active.
3. Key measurement data for tank.
    a. Showing: Volume %, Ullage (Level for Ballast and Misc tanks), Volume and Temperature.
    b. If any of the shown values has an alarm, this is indicated by the alarm icon to the right of the value. In this example the Volume % has an alarm.

Clicking the tank symbol will open the faceplate.

4.4 Tank Faceplate

The tank faceplate (Figure 4-11) shows key data for the tank, and can be used to keep a closer look at specific tanks (Multiple faceplates can be opened simultaneously).

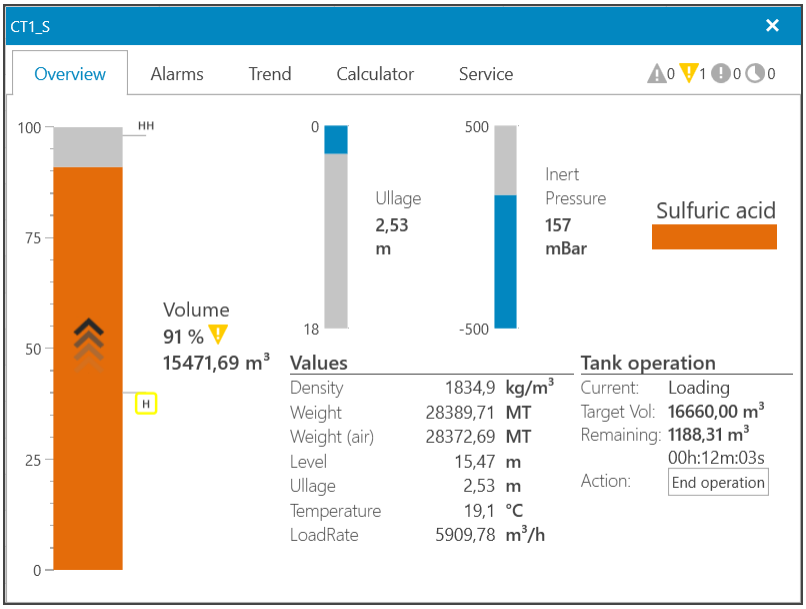


Figure 4-11: Tank faceplate

The faceplate contains five tabs:

- **Overview**: Shows key values for the tank.
- **Alarms**: Show and adjust alarm settings.
- **Trend**: Use to trend tank parameters over time.
- **Calculator**: Use to calculate tank volume based on ullage or vice-versa.
- **Service**: Service information

In addition, an alarm indicator for the tank is shown at the top right corner to give a quick overview of whether this tank has any alarms (Place mouse over icon for additional information). The example above has 1 high priority alarm.

4.4.1 Overview

The overview tab (Figure 4-12), shows the following data:

1. Bars showing the volume, ullage and inert pressure of the tank. Alarm limits are visualized on the bar.
2. Content of the tank
3. Measurement values
4. Operation settings & values

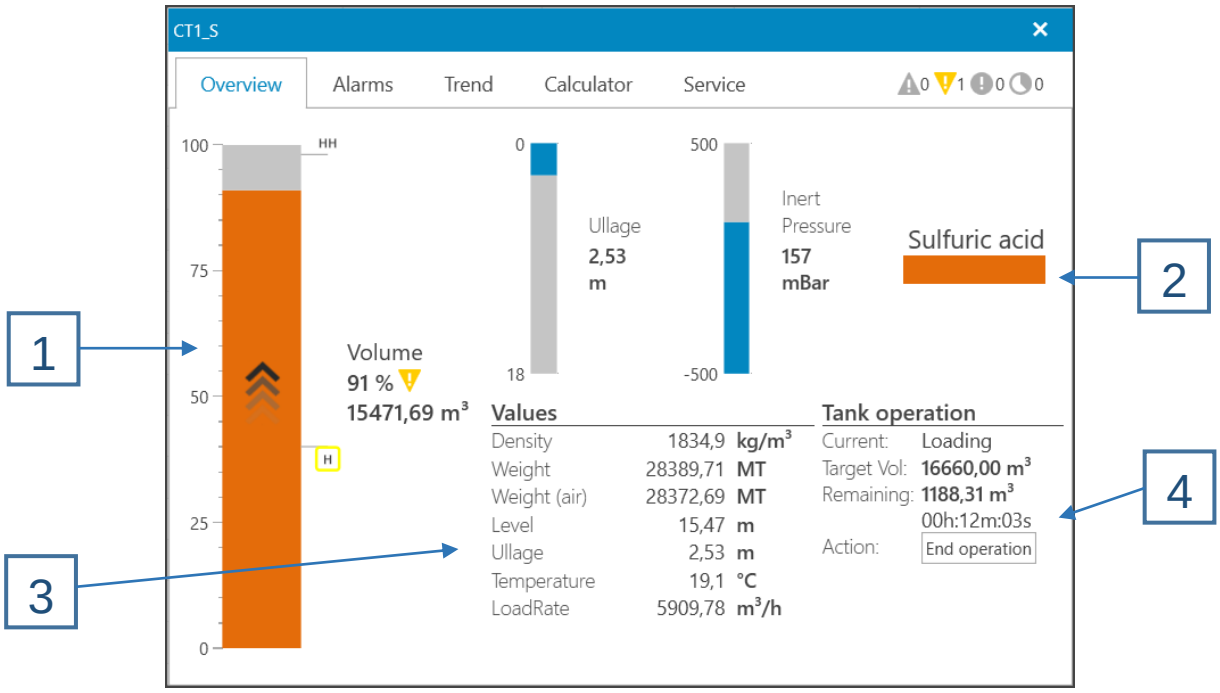


Figure 4-12: Tank faceplate - Overview tab

4.4.2 Alarms

This tab shows all alarms for the tank (Figure 4-13), the possible adjustments to each alarm is:

- **Enabled**: Whether this alarm is enabled or not.
- **Limit**: The limit for this alarm.

Only certain settings can be changed, which is indicated by the (pencil) symbol.

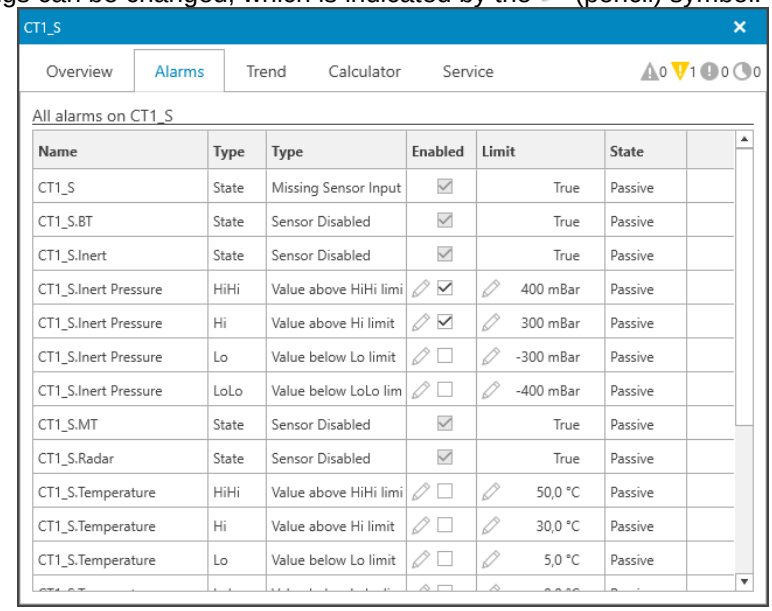


Figure 4-13: Tank faceplate - Alarms tab

Clicking the column header will sort the list according to that column.

4.4.3 Trend

This tab enabled trending tank values over time (Figure 4-14).

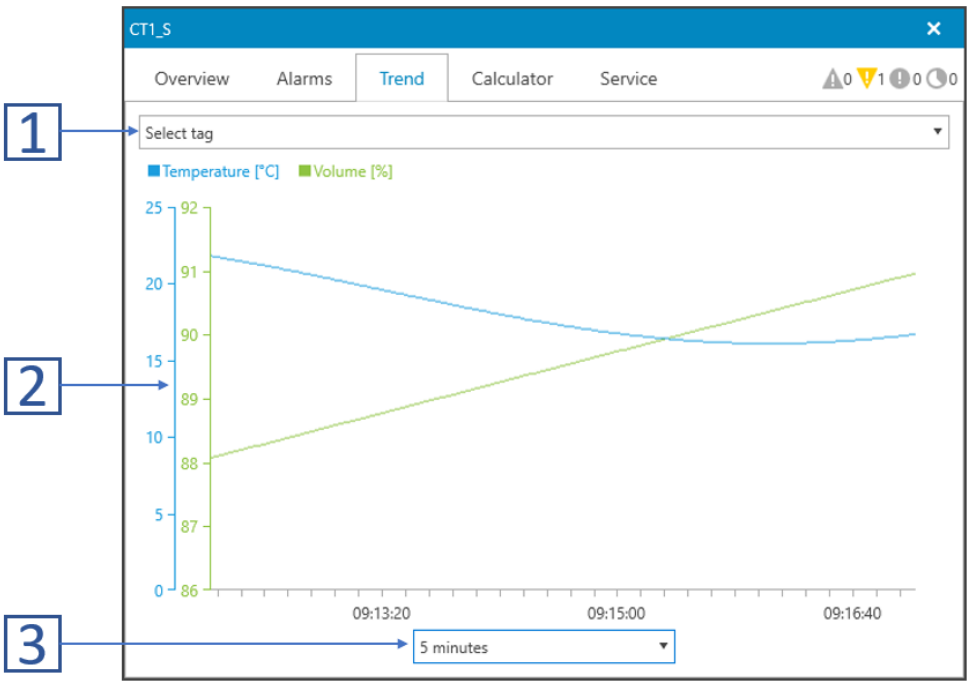


Figure 4-14: Tank faceplate - Trend tab

1. Use this drop-down menu to select the desired tags to trend
2. Shows the trends for the selected tags
3. Select the desired time range for the trend.

For more detailed analysis, including zooming and custom time range selection, use the history view (see Chapter 7).

4.4.4 Calculator

This is a calculator based on the current tank measurement and volume table (Figure 4-15). Given a trim and list, volume or weight can be entered, and the ullage calculated, or vice-versa.

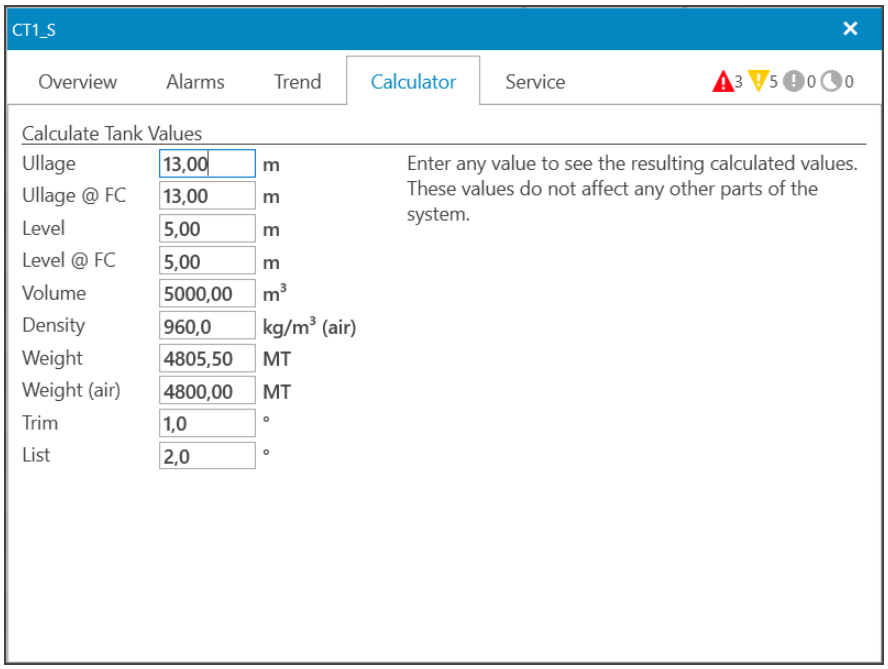


Figure 4-15: Tank faceplate - Calculator tab

4.4.5 Service

The service tab (Figure 4-16) consists of 6 sub-tabs:

- **Sensor Inputs**: Shows the sensors configured for this tank
- **Density**: Shows the tank density settings
- **Sizes**: Shows the tank measurements and sensor positions.
- **Tags**: Lists all tags for the tank
- **Alarms**: Lists all alarms for the tank
- **Attributes**: Lists all attributes for the tank

Sensor Inputs

This tab lists all the sensors connected to this tank and their corresponding values and parameters such as: raw value, sensor value, filter settings, position in tank (Figure 4-16).

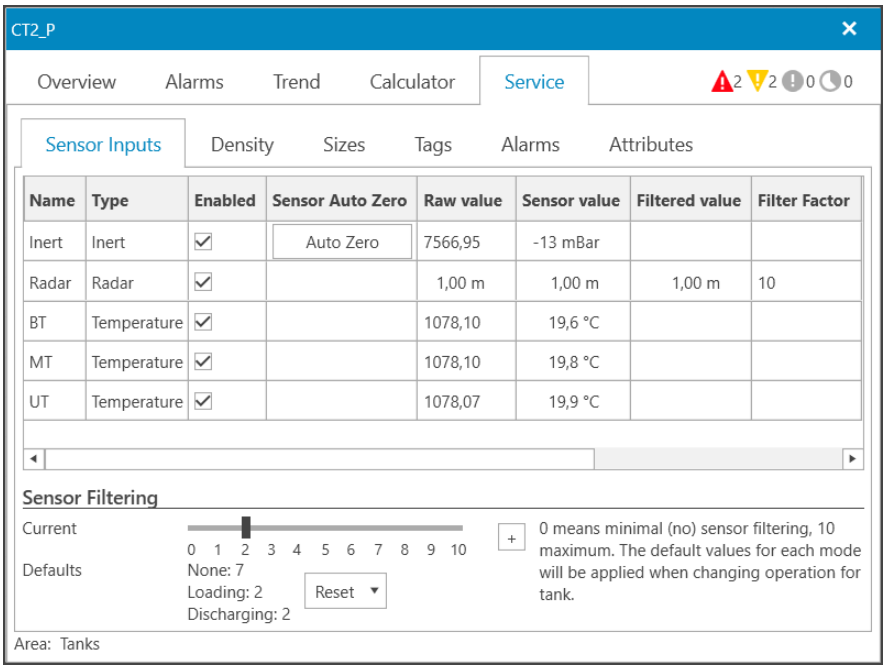


Figure 4-16: Tank faceplate - Service tab

Sensor inputs on the tank are low pass filtered to reduce noise and provide a more stable reading. Filtering is applied on a scale from 0 to 10, where 0 means no filter and 10 is the maximum. When the tank is not in loading or discharging operation, it is expected that the volume in the tank is constant and a higher filter value is applied (7 is the default) to reduce the effect of liquid sloshing in the tank due to movement.
However, during loading/discharging the volume is changing and a lower filter (2 is the default) is used.
The slider in Figure 4-16 can be used to adjust filter if experience dictates it should be higher or lower. When the value has been adjusted, it can be set as the new default using the **+** button. To reset the back to factory defaults us the **Reset** button.

Density view

Shows the density settings for the tank and the actual density calculated (Figure 4-17).

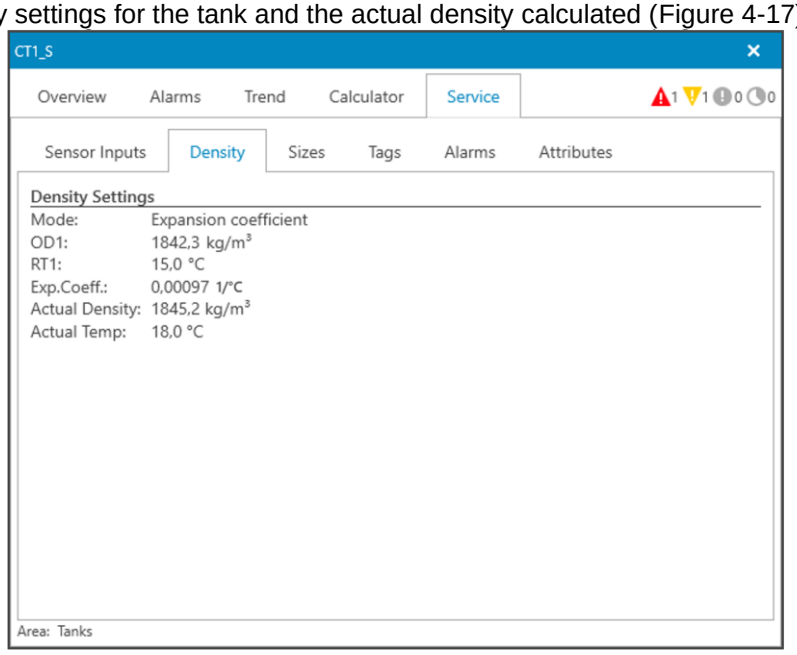


Figure 4-17: Tank faceplate - Density settings

Sizes view

Shows the tank measurements and sensor positions in the tank (Figure 4-18). The sensor positions are shown graphically, and the view can be selected using the **Graph View** drop-down menu.

Figure 4-18: Tank faceplate - Sizes

The tags, alarms and attributes view show detailed service information for the tank. These views are not needed for normal operation and not described in this manual.

4.5 Draft & Trim/List

To view the draft and trim/list of the vessel press **F4** or **System->View draft & trim/list** menu, which opens the view as a popup (Figure 4-19). The view contains the following information:

- **Ambient Conditions**
  The atmospheric pressure and temperature. Depending on the configuration they can be either measured from a sensor or set manually.
  Atmospheric pressure is an important measurement used as a reference to other pressure sensors. In the case of failure of this sensor, it can be switched to **Manual** using the drop-down menu and a pressure can be entered manually.
- **Trim/List**
  Shows the trim and list of the vessel in degrees and meter. The method for calculating trim and list can be selected between:
  - Inclinometer: Measured by an inclinometer sensor
  - Draft: Measured from the draft sensors
  - Manual: Entered manually
- **Drafts**
  Shows the measured drafts of the vessel. To get an accurate reading the density of the sea water must be entered in the **Seawater density** field.

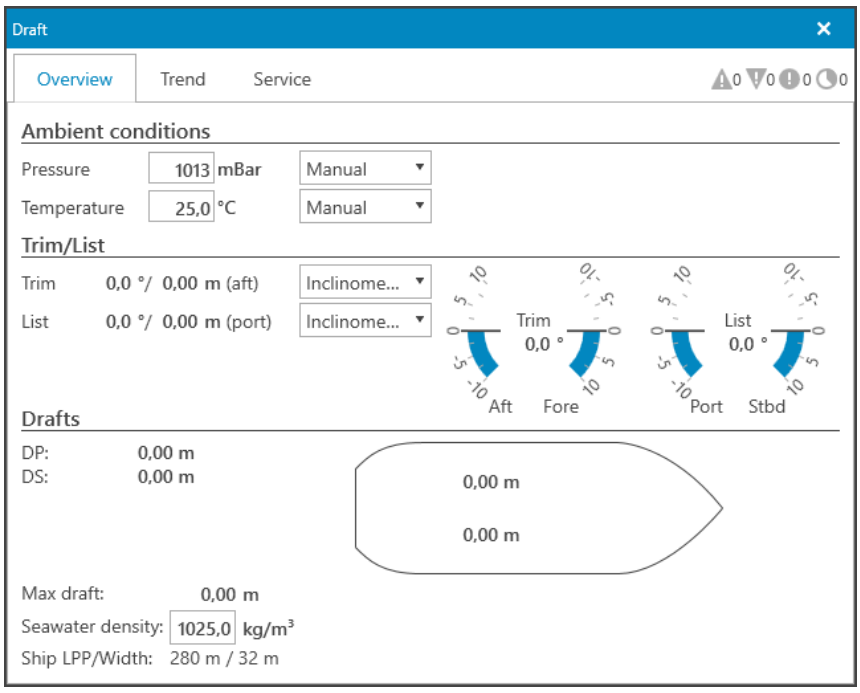


Figure 4-19: Draft & Trim/List view

4.6 Line/Vapor pressure

If the system has line and/or vapor pressures configured, these can be viewed by opening menu **System->View line pressures** & **System->View vapor pressures**. Figure 4-20 below shows the line pressures.

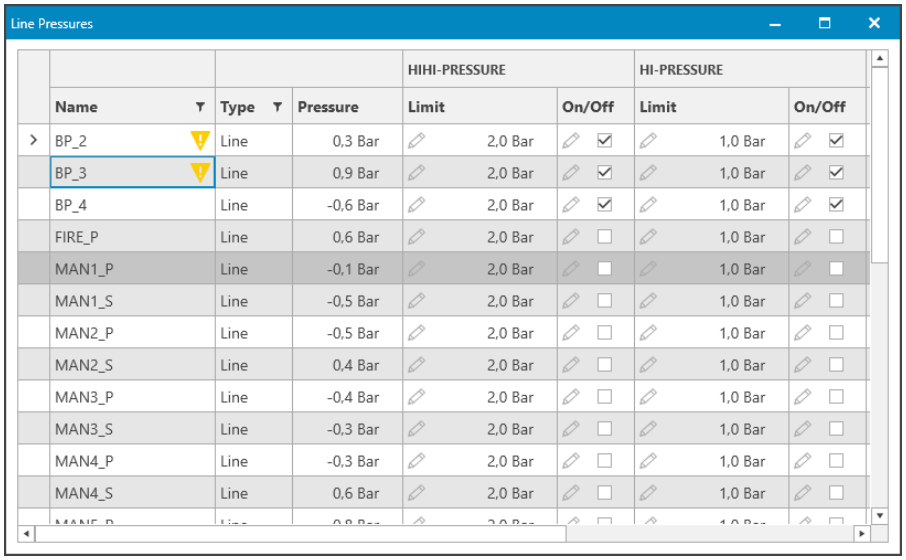


Figure 4-20: Line pressures

This view shows all line pressures of the system. Alarm limits are also displayed, and adjustable if the cell has the pencil symbol. If a line has an alarm it is indicated by an alarm icon next to the name (As is the case for BP_2 and BP_3 in the example above).

To monitor specific line(s) right click the line to show a context menu and click **View details** (Figure 4-21):

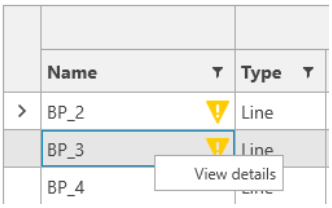


Figure 4-21: Line pressure context menu

This opens the faceplate for the line (Figure 4-22):

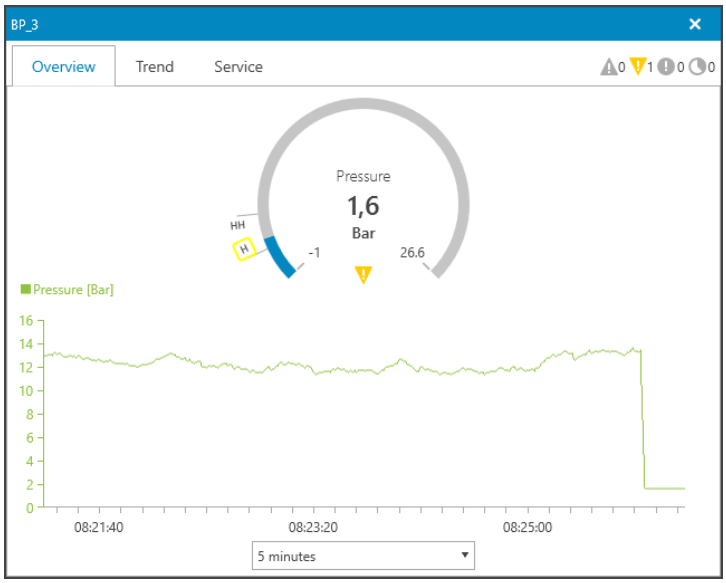


Figure 4-22: Line pressure faceplate

The current pressure is displayed on the gauge, together with the set alarm limits (Indicated by the H and HH icons in the above example). Additionally, the line pressure is graphed over time, with a selectable time range.

5 ALARM SYSTEM

This chapter describes the operation and usage of the alarm system in CARGOMASTER®. The alarm system is used to inform the operator of abnormal situations, system failures, values outside limits, etc. The system includes a buzzer (audible alarm) which is triggered when a new alarm is active. Depending on the configuration, also external lights might be connected and triggered by certain alarms.

5.1 Alarm types

The various types of alarms in the system are:

- **Limit**: Alarms triggered when a measurement value is above or below a set limit (I.e. on tank volume %). Normally these types are configured:
  - HiHi: Critical priority alarm, triggered when value above the limit
  - Hi: High priority alarm, triggered when value above the limit
  - Lo: High priority alarm, triggered when value below the limit
  - LoLo: Critical priority alarm, triggered when value below the limit
- **State**: Alarms triggered by a change in state. Examples:
  - Out of range alarm on sensor: Sensor is outside the specified range
  - Sensor Disabled: Alarm on a tank indicating a sensor has been disabled
  - IO alarm: Alarms indicating failure in communication with IO system.

5.2 Severities & States

An alarm can have one of three different severities: Critical, High and Medium. Additionally, alarms can be shelved which means the alarm is hidden from the main alarm view for a specified time (See Chapter X). To display alarm information in the user interface icons for each severity are used and shown below:

Table 1: Alarm severity icons

Critical	High	Medium	Shelved
			

In addition to having a given severity, an alarm is always in one of five states. Table 2 shows the states and how the alarm is presented depending on the state.

Table 2: Alarm states

State	Description	Display Icon	List color
Passive	The alarm is passive.	None	Not visible in lists
Active	The alarm is active, the initial state after the alarm limit is violated.	Critical, High or Medium depending on alarm severity.	Blinking Red, yellow or turquoise.
Acknowledged	The alarm is still active, but the user has acknowledged the alarm.	Critical, High or Medium depending on alarm severity.	Steady Red, yellow or turquoise.
Returned	The alarm was active and unacknowledged by the user but the value has returned below the alarm limit threshold.	Critical, High or Medium depending on alarm severity.	Black/white.
Shelved	The alarm has been put on the shelve list by the user.	The shelved icon.	Steady Red, yellow or turquoise.[1]

The various states and the triggers for transitions from one state to another is illustrated in the figure below (Figure 5-1).

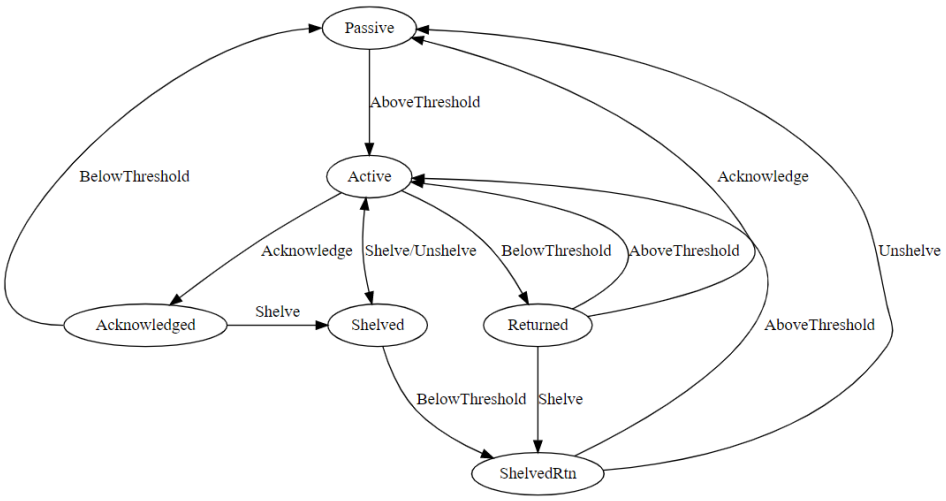


Figure 5-1: Alarm state diagram

[1] Shelved alarms are not visible in the normal alarm lists, only in the shelved list.

5.3 Main view

Figure 5-2 shows the main view of the application with the following alarm information present:

1. This shows an overview of the total number of alarms in the system:
   a. See Table 1 for description of the different icons.
   b. The number next to each icon is the number of alarms for this severity.
   c. In the case of zero alarms, the icon is colored grey.
2. The alarm icon next to the tank name indicates that tank CT1_P has one (or more) alarms, where the highest severity is critical.
3. The alarm icon next to the volume % indicates that the tank CT1_P has one (or more) alarms on the volume %, where the highest severity is critical.
4. Shows the top 3 active alarms, colored according to Table 2.
5. Open the alarm menu with the following options:
   a. Details List: Opens a detailed alarm list as a separate popup
   b. Shelve alarm: Shelves the selected alarm in area #4
6. Silences the alarm buzzer
7. Acknowledges the selected alarm in area #4

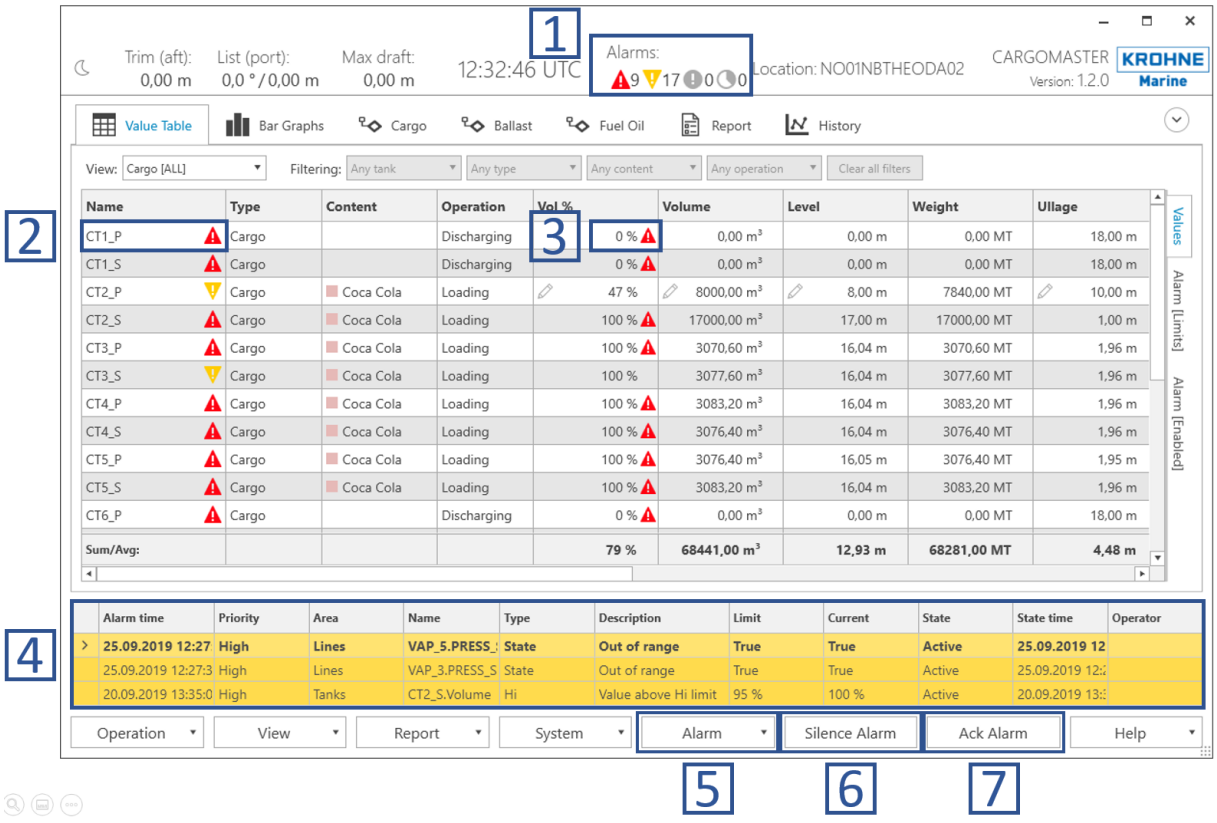


Figure 5-2: Alarm information

5.3.1 Main alarm list

The main alarm list (#4 in Figure 5-2) shows the top three active alarms. Alarms are sorted by the following rules:

- First all the alarms are sorted by state in this order: Active, Acknowledged, Returned
- Then the alarms are sorted by severity in this order: Critical, High, Medium
- Last, the alarms are sorted by time.

5.3.2 Icon context information

When the mouse is placed over an alarm icon, more information is shown. Figure 5-3 shows an example: Volume % of tank CT1_S has two alarms: HiHi and Hi.

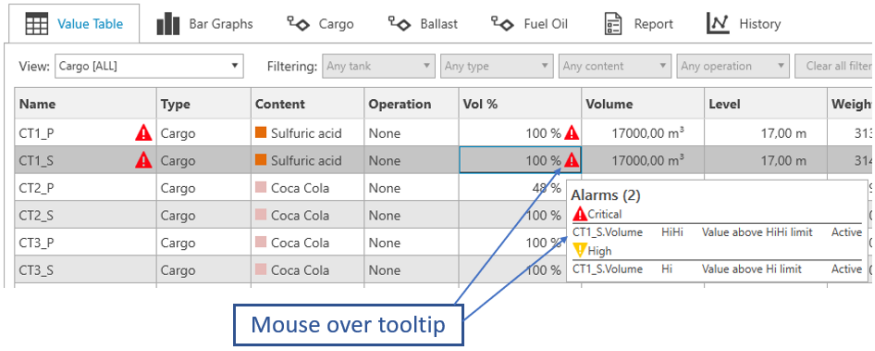
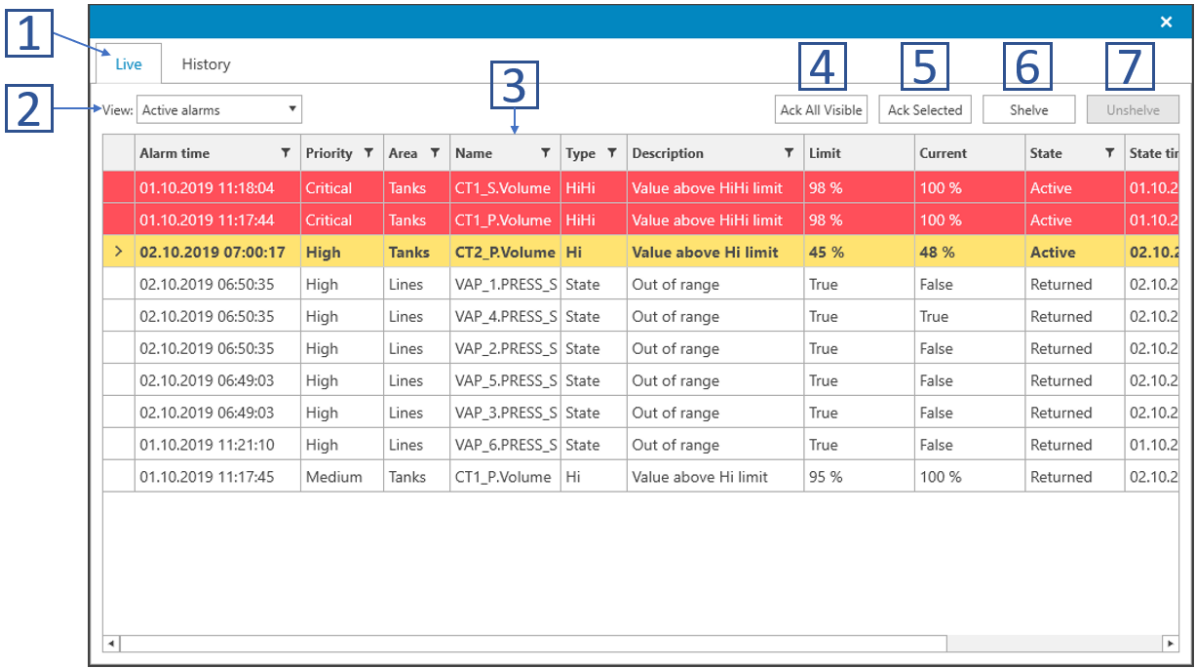


Figure 5-3: Alarm icon tooltip

5.4 Details list

In a situation where many alarms are active, it is possible to open a popup window with more alarm information. To open this list (shown below in Figure 5-4) press **Alt-F11** or **Alarm->Details List** menu.



Alarm time	Priority	Area	Name	Type	Description	Limit	Current	State	State ti
01.10.2019 11:18:04	Critical	Tanks	CT1_S.Volume	HiHi	Value above HiHi limit	98 %	100 %	Active	01.10.2
01.10.2019 11:17:44	Critical	Tanks	CT1_P.Volume	HiHi	Value above HiHi limit	98 %	100 %	Active	01.10.2
02.10.2019 07:00:17	**High**	**Tanks**	**CT2_P.Volume**	**Hi**	**Value above Hi limit**	**45 %**	**48 %**	**Active**	**02.10.2**
02.10.2019 06:50:35	High	Lines	VAP_1.PRESS_S	State	Out of range	True	False	Returned	02.10.2
02.10.2019 06:50:35	High	Lines	VAP_4.PRESS_S	State	Out of range	True	True	Returned	02.10.2
02.10.2019 06:50:35	High	Lines	VAP_2.PRESS_S	State	Out of range	True	False	Returned	02.10.2
02.10.2019 06:49:03	High	Lines	VAP_5.PRESS_S	State	Out of range	True	False	Returned	02.10.2
02.10.2019 06:49:03	High	Lines	VAP_3.PRESS_S	State	Out of range	True	False	Returned	02.10.2
01.10.2019 11:21:10	High	Lines	VAP_6.PRESS_S	State	Out of range	True	False	Returned	01.10.2
01.10.2019 11:17:45	Medium	Tanks	CT1_P.Volume	Hi	Value above Hi limit	95 %	100 %	Returned	02.10.2

Figure 5-4: Alarm details list

The list shows all alarms present in the system, colored according to Table 2. The functions in the details list are (referring to numbers in Figure 5-4):

1. Select between **Live** and **History** tab
    a. Live shows the current alarm situation
    b. History shows the historical alarms (See chapter 0)
2. Select the alarms to display:
    a. Active alarms: The default view. Shows all alarms except shelved/suppressed.
    b. Shelved alarms: Shows only the shelved alarms.
    c. Suppressed alarms: Shows only the suppressed alarms.
    d. All alarms: Shows all alarms, including shelved & suppressed.
3. The column header can be clicked:
    a. Clicking the name will sort by this column
    b. Clicking the icon will open a menu where filters can be applied to this column
4. Acknowledges all visible alarms in the list
5. Acknowledge the selected alarm
6. Shelve the selected alarm
7. Unshelve the selected alarm

The alarm list contains a context menu which is shown when an alarm is right-clicked:

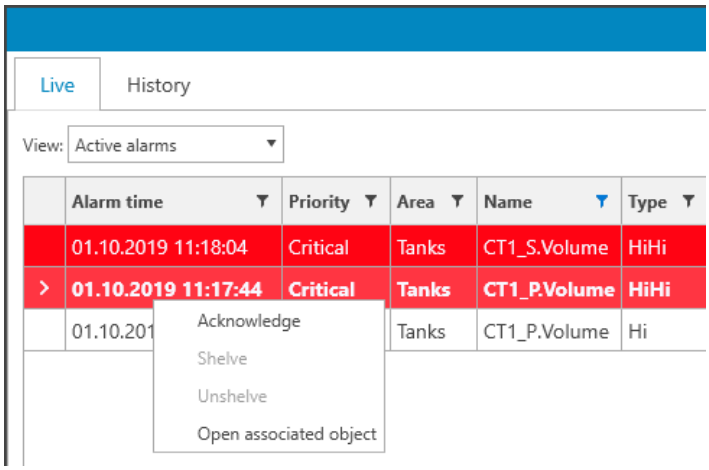


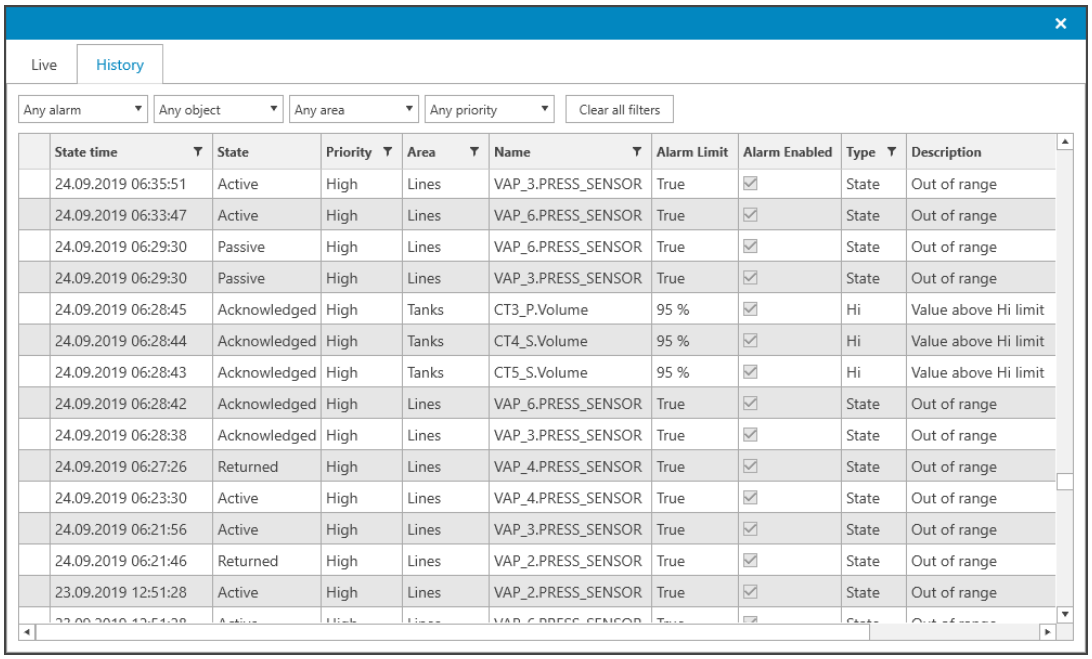
Figure 5-5: Alarm list context menu

It has these options:

- **Acknowledge**: Acknowledges the clicked alarm
- **Shelve**: Shelves the clicked alarm
- **Unshelve**: Unshelves the clicked alarm
- **Open associated object**: Opens the faceplate for the object with the alarm (In the example above would open the faceplate for tan CT1_P).

5.4.1 Historical alarms

By selecting the **History** tab, the view changes to display of historical alarms shown in Figure 5-6 below. The history contains the last 10 000 alarm events and can be used as a diagnostic/troubleshooting tool.



State time	State	Priority	Area	Name	Alarm Limit	Alarm Enabled	Type	Description
24.09.2019 06:35:51	Active	High	Lines	VAP_3.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:33:47	Active	High	Lines	VAP_6.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:29:30	Passive	High	Lines	VAP_6.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:29:30	Passive	High	Lines	VAP_3.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:28:45	Acknowledged	High	Tanks	CT3_P.Volume	95 %	☑	Hi	Value above Hi limit
24.09.2019 06:28:44	Acknowledged	High	Tanks	CT4_S.Volume	95 %	☑	Hi	Value above Hi limit
24.09.2019 06:28:43	Acknowledged	High	Tanks	CT5_S.Volume	95 %	☑	Hi	Value above Hi limit
24.09.2019 06:28:42	Acknowledged	High	Lines	VAP_6.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:28:38	Acknowledged	High	Lines	VAP_3.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:27:26	Returned	High	Lines	VAP_4.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:23:30	Active	High	Lines	VAP_4.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:21:56	Active	High	Lines	VAP_3.PRESS_SENSOR	True	☑	State	Out of range
24.09.2019 06:21:46	Returned	High	Lines	VAP_2.PRESS_SENSOR	True	☑	State	Out of range
23.09.2019 12:51:28	Active	High	Lines	VAP_2.PRESS_SENSOR	True	☑	State	Out of range

Figure 5-6: Historical alarm list

The view can be filtered by a specific alarm, object, area or priority using the drop-down menus. In addition, the view has a context menu shown below (Figure 5-7) which can be used to quickly add filters based on the selected/clicked alarm.

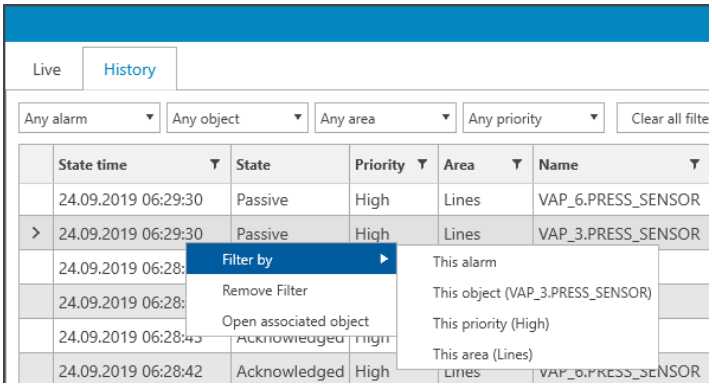


Figure 5-7: Historical alarm context menu

5.5 Alarm shelving

Alarm shelving is the process of removing and alarm from the main display lists and putting it on a “shelf”. As an example, this can be used in the case of a faulty sensor for a tank. In this case a service attendance might be required, which will be done after some weeks. In the meantime, the operator is aware of the alarm (and might have also disabled the sensor on the tank to enable manual input) and can shelve it to remove it from the main lists. Shelving is always done using a specified time duration, such that after the specified time the alarm reappears on the main alarm lists.

Note: Shelving is not possible for critical alarms.

When shelving an alarm, the following prompt is shown:

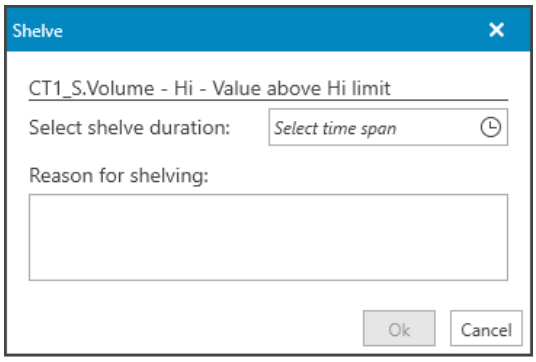


Figure 5-8: Shelve alarm prompt

The operator must enter two things to be allowed to shelve:

1. The shelve duration. This is the time after which the alarm will be automatically removed from the shelve list and re-appear on the main alarm lists.
2. Enter a text describing the reason for shelving this alarm. E.g. “Service scheduled for date X”.

5.6 Testing of alarms

During commissioning of CARGOMASTER® system, replacement of sensors etc, it is normally advised to perform tests of the alarm limits.
Example on how to test 95% high level alarm and 98% high high level alarm by disabling tank radar:

5.6.1 Disable tank level radar.

From “Value Table” view, right-click desired tank name, then click “View tank details”.
In tank detail window appearing, select “Service” and uncheck “Enabled” for Radar:

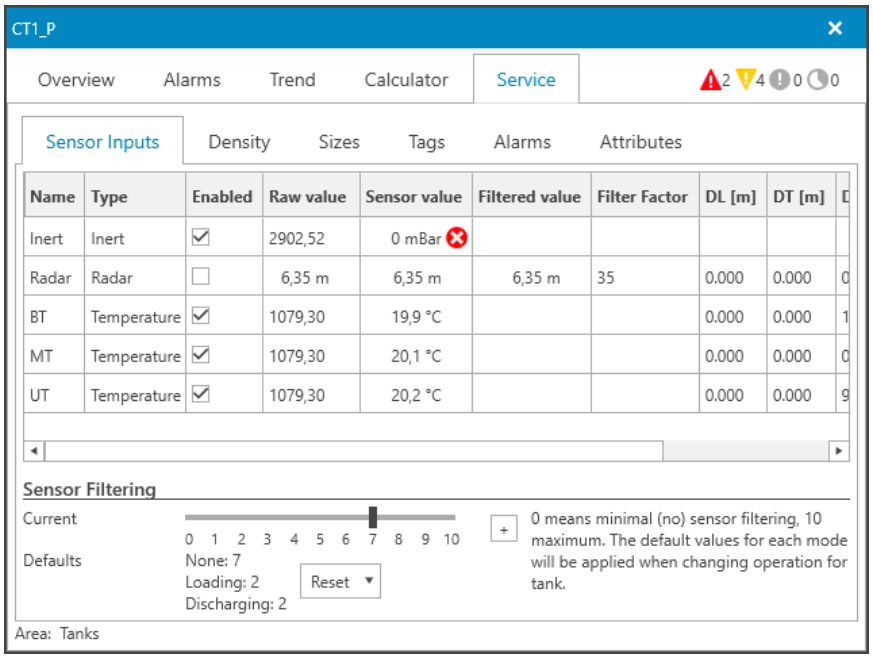


Figure 5-9: Disabling tank level radar

Alarm “Sensor Disabled” will now appear:

Alarm time	Priority	Area	Name	Type	Description	Limit	Current
01.07.2021 12:31:24	High	Tanks	CT1_P.Radar	State	Sensor Disabled	True	True

Figure 5-10: Sensor Disabled alarm

5.6.2 Set tank volume % manually.

From “Value Table” view, write manual Vol% for the same tank as pt 5.6.1, starting with 96% for testing the 95% (Hi) alarm limit.
“Hi” alarm will now appear for this tank:

Alarm time	Priority	Area	Name	Type	Description	Limit	Current
01.07.2021 12:32:32	High	Tanks	CT1_P.Volume	Hi	Value above Hi limit	95 %	96 %

Figure 5-11: Hi alarm

Perform the same for 98% (HiHi) alarm limit by manually entering 99%, “HiHi” alarm will appear:

Alarm time	Priority	Area	Name	Type	Description	Limit	Current
01.07.2021 12:33:19	Critical	Tanks	CT1_P.Volume	HiHi	Value above HiHi limit	98 %	99 %

Figure 5-12: HiHi alarm

5.6.3 Enable tank level radar.

After completion of testing the alarm limits, **tank level radar must be enabled in order to have correct sensor readings**.
Perform reverse operation of pt 5.6.1 and make sure “Enabled” is checked for the radar.
“Sensor disabled” alarm will now disappear.

6 VALVE CONTROL

This chapter describes the operation of the valve control part of the system. Note that, depending on the system this might not be configured. An example of a layout view of the ballast system is shown in Figure 6-1. It shows the ballast tanks, the piping, valves and pumps. The view consists of various components which are color coded to indicate whether valves are open or closed. Pipes connected to tanks shows the same color as content in the tank for easy identification.

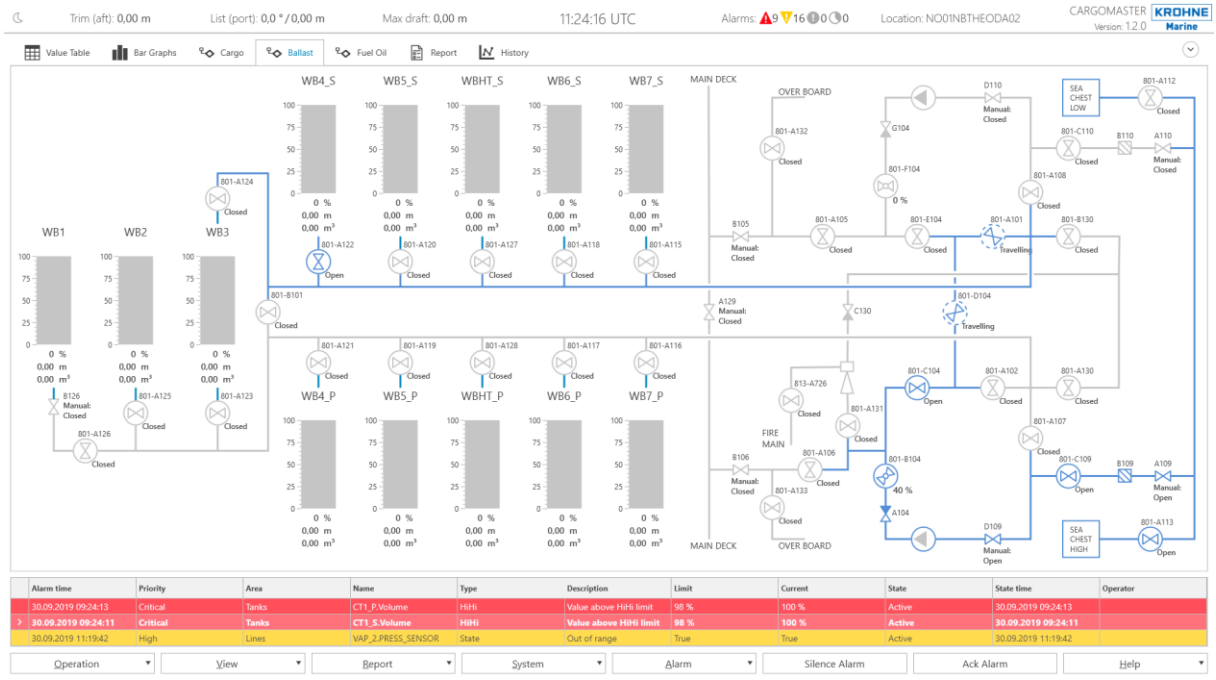


Figure 6-1: Ballast layout view

6.1 Valves

Three different valves are supported:

- **On/off valve**: A remote controlled on/off valve.
- **Throttle valve**: A remote controlled throttle valve.
- **Manual valve**: A manual on/off valve. Note: No remote control but can be set for indication.

To control the valves, click the symbol and a popup menu according to the clicked valve will show.

6.1.1 On/off valve

The on/off valve symbol is shown below (Figure 6-2).

Figure 6-2: On/off valve

It has four states:

1. **Closed**: The valve is closed. The circle around it is grey and the angle of the valve symbol is 90° relative to the input/output pipes. The color of the output pipe is grey.
2. **Travelling**: The valve is travelling (between open and closed position). The circle around is animated with a dashed line to indicate valve movement. The valve symbol is angled 45° relative to the input/output pipes. The circle around it is colored according to the pipe, and the color of the output pipe is set equal to the input.
3. **Open**: The valve is open. The valve symbol is angled 0° relative to the input/output pipes. The circle around it is colored according to the pipe, and the color of the output pipe is set equal to the input.
4. **Unknown**: The position of the valve is unknown. The valve symbol is angled 45° relative to the input/output pipes. The circle around is colored according to the pipe, and the color of the output pipe is set equal to the input.

When the valve is in the unknown position, the cause is likely due to a failure of the valve or the external valve control system. Check for alarms or check external valve control system for details.

Clicking the valve opens the context menu shown below (Figure 6-3):

- Valve Position: Shows the valve current position
- Valve Operation: Press **Open** or **Close** to issue a command to the valve system to open or close the valve.

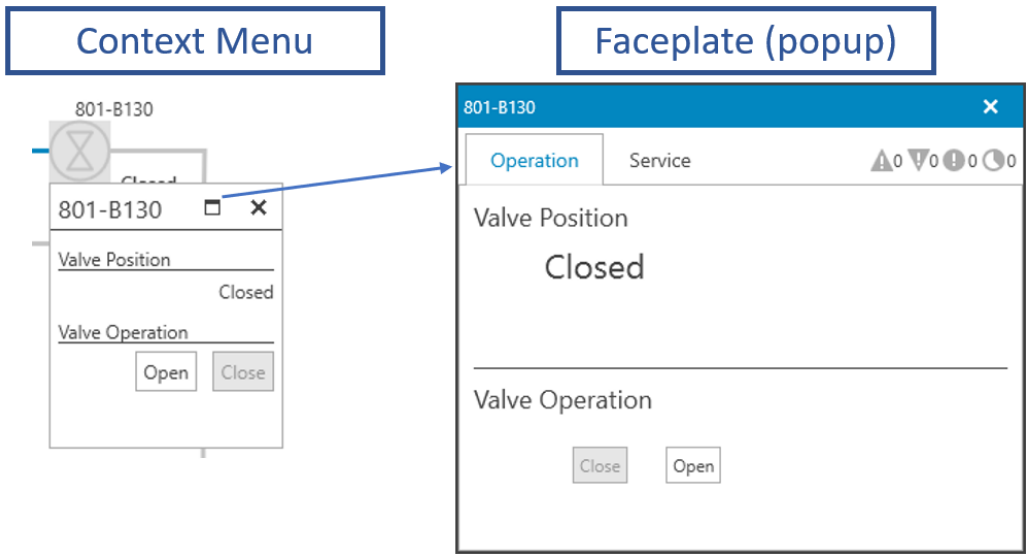


Figure 6-3: On/off valve context menu & faceplate

The context menu opens next to the valve and is closed if another context menu is opened. If desired the faceplate for the valve can be opened as a popup window by clicking the maximize icon on the context menu (See Figure 6-3). This window has the same information as the context menu but can be kept open.

6.1.2 Throttle valve

The throttle valve is shown below (Figure 6-4).

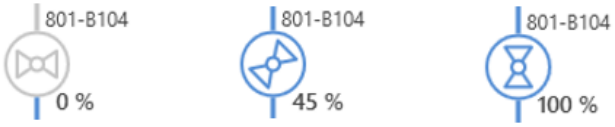


Figure 6-4: Throttle valve

The symbol has these states:

1. **Fully closed**: The valve opening is shown as 0 %. The circle around it is grey and the angle of the valve symbol is 90° relative to the input/output pipes. The color of the output pipe is grey.
2. **Partially open**: The actual valve opening is shown (45 % in this case, and the valve symbol is angled 45° relative to the input/output pipes. The circle around it is colored according to the pipe, and the color of the output pipe is set equal to the input.
3. **Fully open**: The valve is open, shown by 100 % opening. The valve symbol is angled 0° relative to the input/output pipes. The circle around it is colored according to the pipe, and the color of the output pipe is set equal to the input.

Clicking the valve opens the context menu shown below (Figure 6-5):

- Valve Position: Shows the valve current position
- Valve Setpoint: Used to control the set point of the valve. The current setpoint is shown in percentage next to the slider (30 % in this case). Use the ++/-- buttons to adjust setpoints in ± 10 % steps or +/- to adjust in ± 1 % steps. Alternatively drag the slider to the desired set point.

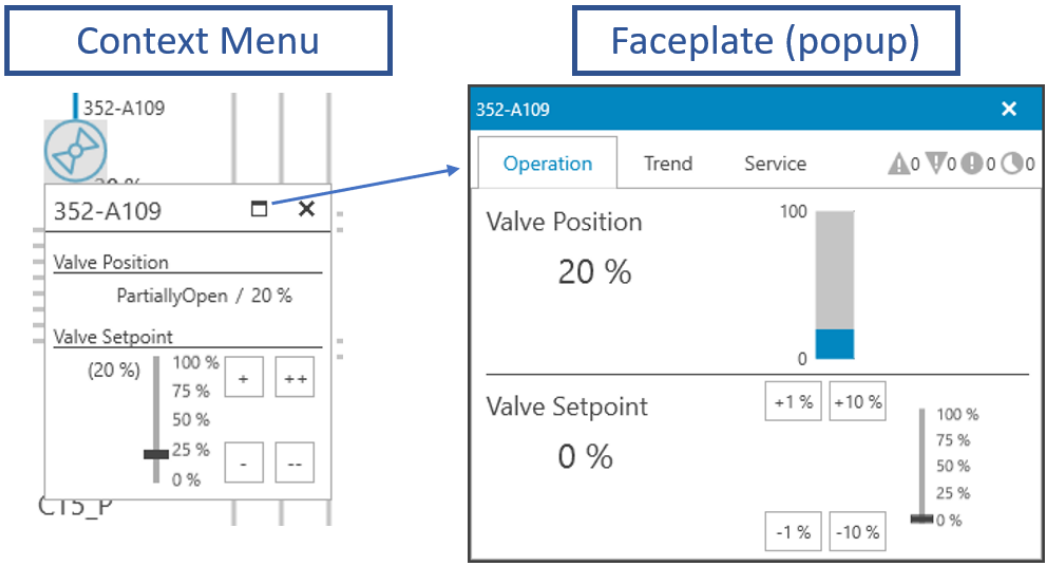


Figure 6-5: Throttle valve context menu & faceplate

The context menu opens next to the valve and is closed if another context menu is opened. If desired the faceplate for the valve can be opened as a popup window by clicking the maximize icon on the context menu (See Figure 6-5). This window has the same information as the context menu but can be kept open.

6.1.3 Manual valve

This valve has no feedback or remote control from the real physical valve and is only used as a manual/tick-off valve in the diagrams. The manual tick of valve symbol is shown below (Figure 6-6). To easily separate it from actual remote-controlled valves it does not have the circle around, and it has the text **Manual** next to the set position (open or closed).

Figure 6-6: Manual valve

It has two states:

1. **Closed**: Valve symbol is colored grey and the color of the output pipe is grey.
2. **Open**: Valve symbol is colored according to the pipe, and the color of the output pipe is set equal to the input.

Clicking the valve opens the context menu shown below (Figure 6-7):

- Valve indication: Shows the manually set position of the valve (Open or Closed). Click the **Open** or **Close** button to change the indicated position.

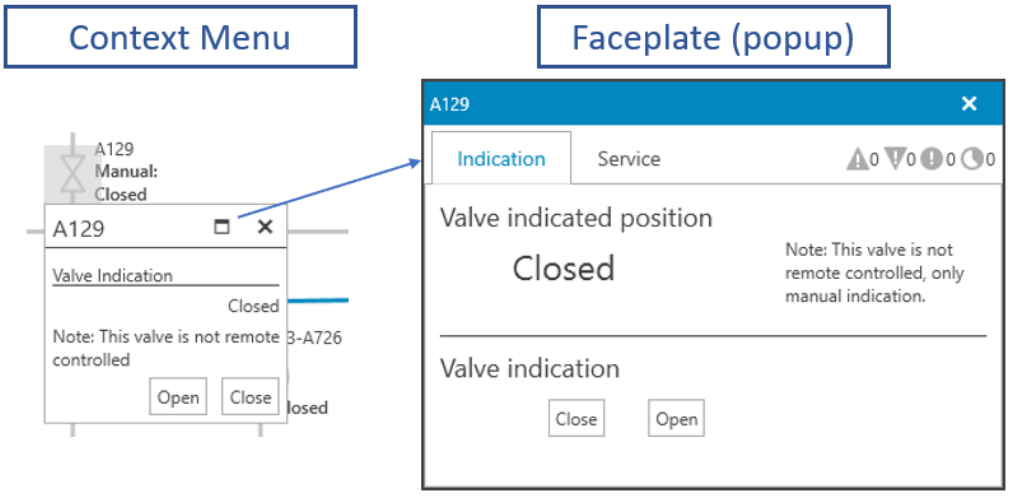


Figure 6-7: Manual valve context menu & faceplate

The context menu opens next to the valve and is closed if another context menu is opened. If desired the faceplate for the valve can be opened as a popup window by clicking the maximize icon on the context menu (See Figure 6-7). This window has the same information as the context menu but can be kept open.

6.2 Other Symbols

Depending on the configuration, the layout might contain other symbols than tanks and valves. Figure 6-8 shows the most common symbols. These symbols do not have any function and are purely used

for visualization. They follow the regular coloring rules of piping, one exception is the sea chest, which is a source of sea water and thus has a blue color (Similar to a tank).

Figure 6-8: Layout symbols

7 HISTORICAL DATA

To access and trend historical data navigate to the **History** tab of the main view. This view lists all available tags for trending, shown under the Available tags heading, the list can be filtered using the search box.

Double-clicking the desired tag to add it to the chart, up to 6 tags can be viewed simultaneously. To remove a tag from the chart, click the X icon on the legend above the chart.

Use the **From**, **Time period** and **To** options below the chart to select the desired time range. The chart can also be dragged using the mouse to adjust the time.

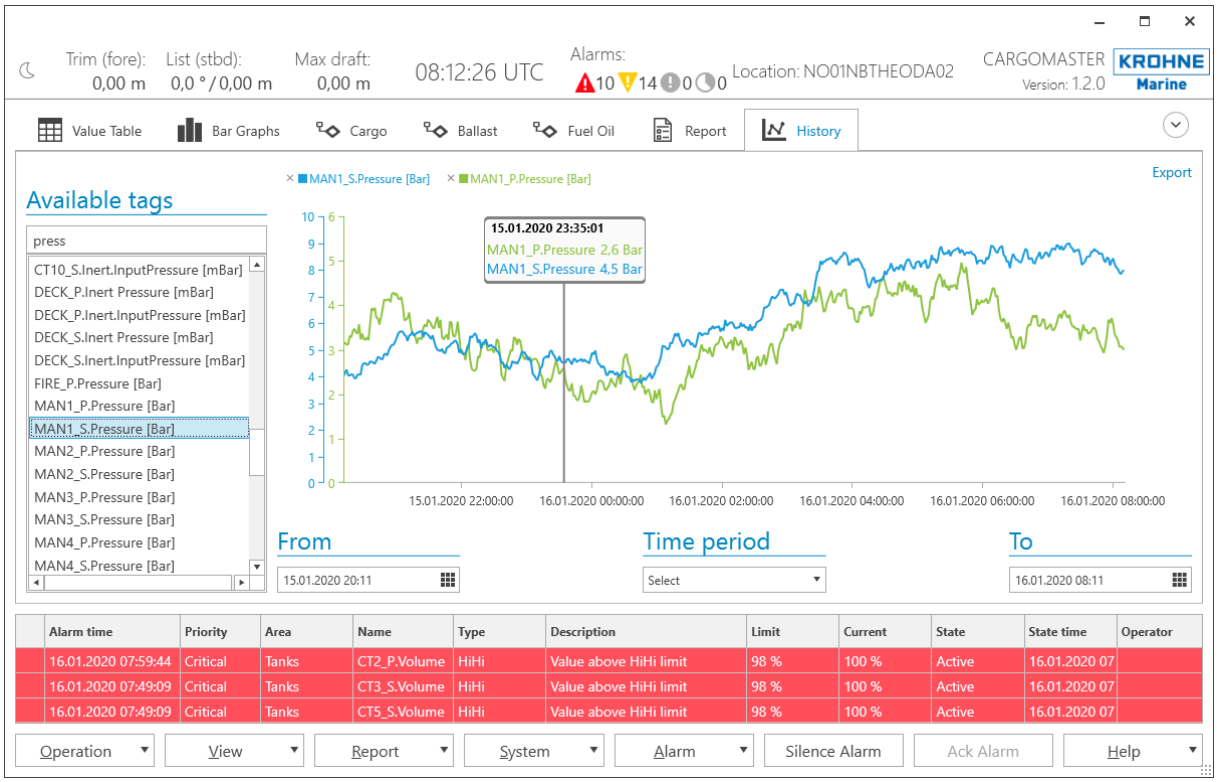


Figure 7-1: Historical data trending

8 REPORTS

The reports of the system are available under the **Reports** tab of the main view. Currently one report is available: Survey Report.

8.1 Survey Report

To generate the survey report, select **Survey Report** and click **Show** button which open this prompt:

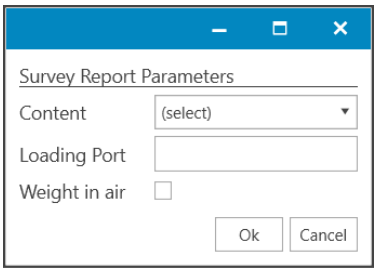


Figure 8-1: Survey report parameters

Select the desired content, enter the loading port and click **Ok** to generate the report. If weight in air is desired, select the checkbox next to it, otherwise weight in vacuum is displayed. An example is shown below (Figure 8-2):

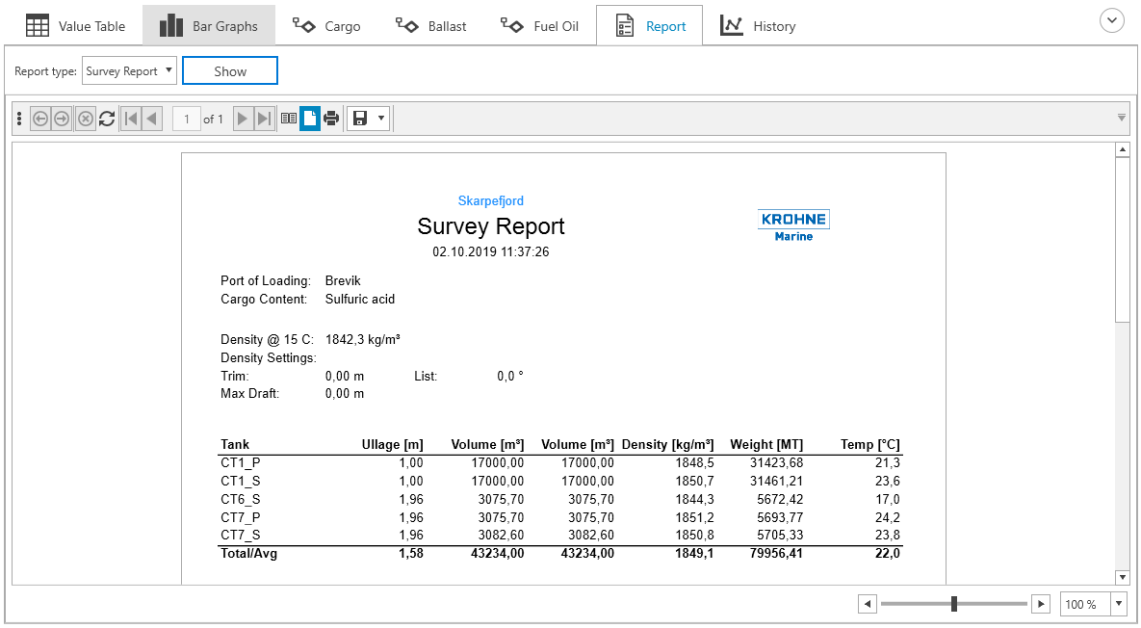


Figure 8-2: Survey Report

8.2 Summary Report

The summary report is used to show the tank parameters (Volume, weight, etc.) at the start/end and the change over a time period, f.ex. before and after a loading operation.

To generate the summary report, select **Summary Report** and click **Show** button which open this prompt:

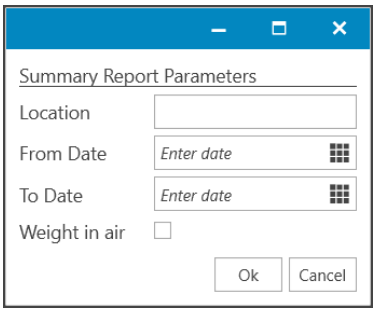


Figure 8-3: Summary Report parameters

Select the (optionally) location, enter the From/To data and click **Ok** to generate the report. If weight in air is desired, select the checkbox next to it, otherwise weight in vacuum is displayed. An example is shown below (Figure 8-4):

> **Note: This report uses historical data, if historical data is not available for the provided time range it will not be present on the report (Default historical data is available for the last 90 days).**

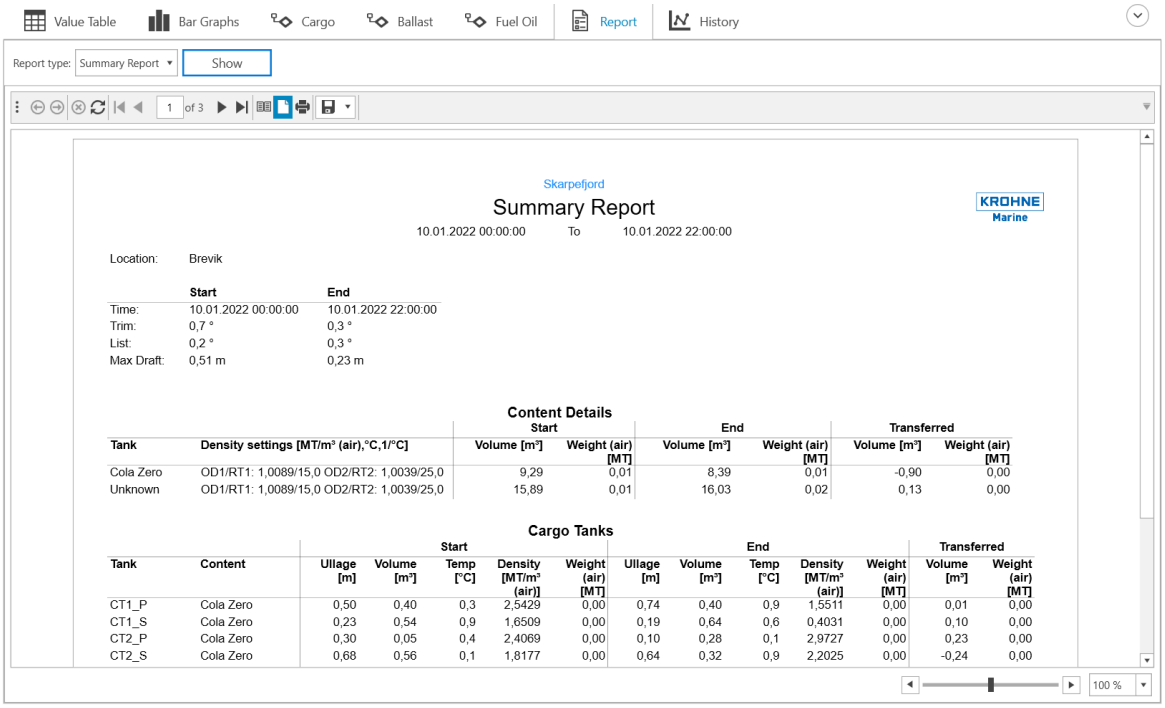


Figure 8-4: Summary Report

8.3 Value Table Report

The value table report shows values in the same format as in the “Values” view of the Value Table (See 4.1).

To generate the value table report, select **Value Table Report** and click **Show** button which open this prompt:

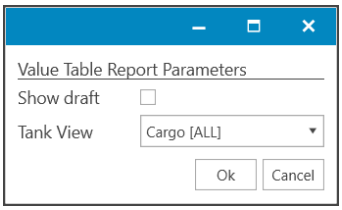
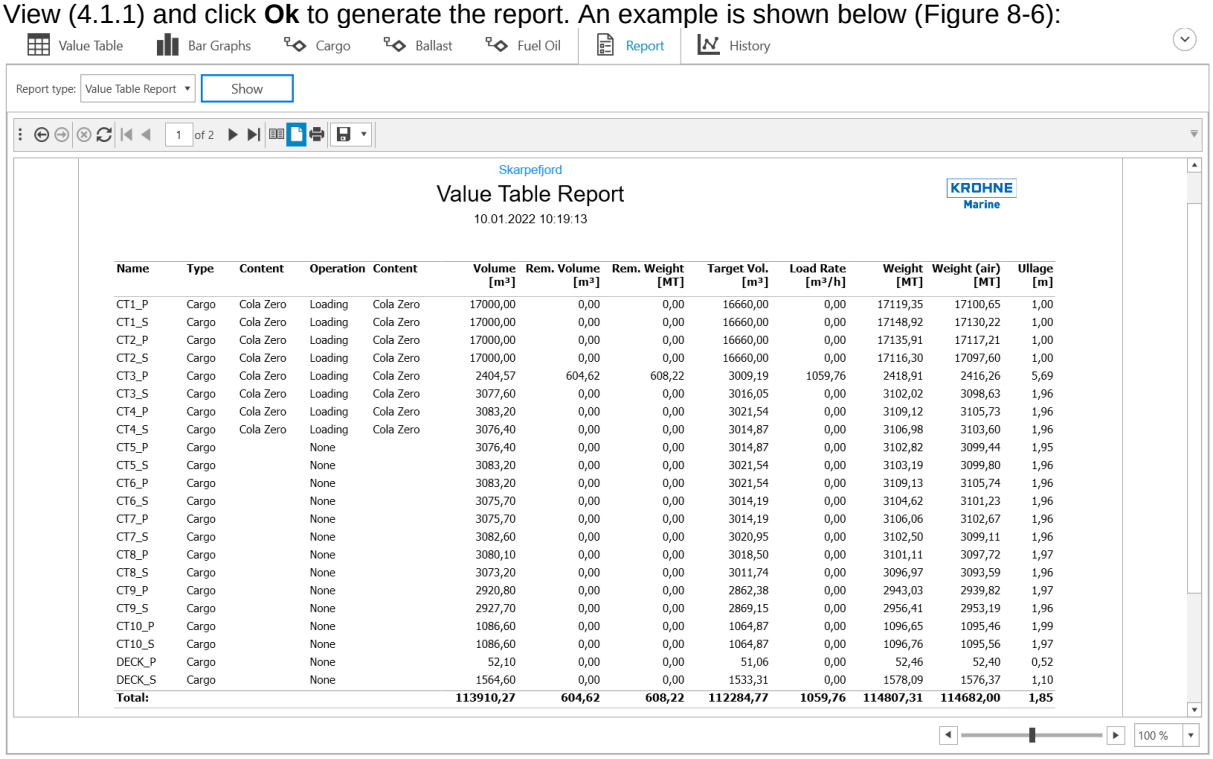


Figure 8-5: Value Table Report parameters

Select the “Show draft” checkbox to include draft information on the report, select the desired Tank View (4.1.1) and click **Ok** to generate the report. An example is shown below (Figure 8-6):



Name	Type	Content	Operation	Content	Volume [m³]	Rem. Volume [m³]	Rem. Weight [MT]	Target Vol. [m³]	Load Rate [m³/h]	Weight [MT]	Weight (air) [MT]	Ullage [m]
CT1_P	Cargo	Cola Zero	Loading	Cola Zero	17000,00	0,00	0,00	16660,00	0,00	17119,35	17100,65	1,00
CT1_S	Cargo	Cola Zero	Loading	Cola Zero	17000,00	0,00	0,00	16660,00	0,00	17148,92	17130,22	1,00
CT2_P	Cargo	Cola Zero	Loading	Cola Zero	17000,00	0,00	0,00	16660,00	0,00	17135,91	17117,21	1,00
CT2_S	Cargo	Cola Zero	Loading	Cola Zero	17000,00	0,00	0,00	16660,00	0,00	17116,30	17097,60	1,00
CT3_P	Cargo	Cola Zero	Loading	Cola Zero	2404,57	604,62	608,22	3009,19	1059,76	2418,91	2416,26	5,69
CT3_S	Cargo	Cola Zero	Loading	Cola Zero	3077,60	0,00	0,00	3016,05	0,00	3102,02	3098,63	1,96
CT4_P	Cargo	Cola Zero	Loading	Cola Zero	3083,20	0,00	0,00	3021,54	0,00	3109,12	3105,73	1,96
CT4_S	Cargo	Cola Zero	Loading	Cola Zero	3076,40	0,00	0,00	3014,87	0,00	3106,98	3103,60	1,96
CT5_P	Cargo		None		3076,40	0,00	0,00	3014,87	0,00	3102,82	3099,44	1,95
CT5_S	Cargo		None		3083,20	0,00	0,00	3021,54	0,00	3103,19	3099,80	1,96
CT6_P	Cargo		None		3083,20	0,00	0,00	3021,54	0,00	3109,13	3105,74	1,96
CT6_S	Cargo		None		3075,70	0,00	0,00	3014,19	0,00	3104,62	3101,23	1,96
CT7_P	Cargo		None		3075,70	0,00	0,00	3014,19	0,00	3106,06	3102,67	1,96
CT7_S	Cargo		None		3082,60	0,00	0,00	3020,95	0,00	3102,50	3099,11	1,96
CT8_P	Cargo		None		3080,10	0,00	0,00	3018,50	0,00	3101,11	3097,72	1,97
CT8_S	Cargo		None		3073,20	0,00	0,00	3011,74	0,00	3096,97	3093,59	1,96
CT9_P	Cargo		None		2920,80	0,00	0,00	2862,38	0,00	2943,03	2939,82	1,97
CT9_S	Cargo		None		2927,70	0,00	0,00	2869,15	0,00	2956,41	2953,19	1,96
CT10_P	Cargo		None		1086,60	0,00	0,00	1064,87	0,00	1096,65	1095,46	1,99
CT10_S	Cargo		None		1086,60	0,00	0,00	1064,87	0,00	1096,76	1095,56	1,97
DECK_P	Cargo		None		52,10	0,00	0,00	51,06	0,00	52,46	52,40	0,52
DECK_S	Cargo		None		1564,60	0,00	0,00	1533,31	0,00	1578,09	1576,37	1,10
Total:					**113910,27**	**604,62**	**608,22**	**112284,77**	**1059,76**	**114807,31**	**114682,00**	**1,85**

Figure 8-6: Value Table Report

9 MAINTENANCE

9.1 Sensor Disable

If a sensor shows significant evidence of being damaged, it may be necessary to disable it, until it can be replaced.

To disable a sensor, follow this procedure:

1. Open the faceplate for the tank where the sensor is located.
    a. In the bar graph or layout view: Click the tank to open faceplate
    b. In the value table view: Right click the tank and click **View tank details**
2. Click the **Service** tab
3. Locate the sensor and click the Enabled checkbox (See Figure 9-1 below).

> **Note:** Disabling a sensor will trigger a **Sensor Disabled** alarm on the affected tank. If desired this alarm can be shelved until service can be performed on the faulty sensor.

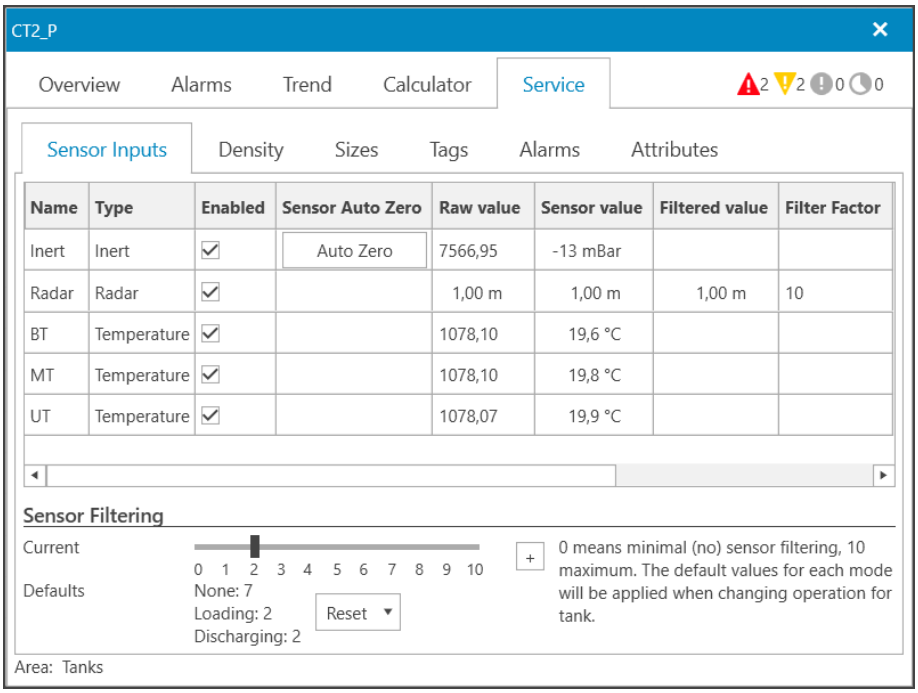


Figure 9-1: Tank sensor disabled

9.2 Sensor Auto-Zero

Sensor auto-zero function are available for tank and line pressure sensors.

> **Note:** Tank pressure sensors can also auto zeroed using the **Zero Set/Optimize Tank** function (0), and is more efficient to use for zero setting multiple tank sensors.

- For Tanks:
  - Open the Tank Faceplate and select the **Service->Sensor Inputs** tab (Figure 9-1)
  - Click the **Auto Zero** button for the pressure sensor
  - Figure 9-2 shows, click **OK** to confirm and auto zero the sensor.
- For Lines:
  - Open the Line Faceplate and select the **Service->Sensors** tab (0)
  - Click the **Auto Zero** button for the pressure sensor
  - Figure 9-2 shows, click **OK** to confirm and auto zero the sensor.

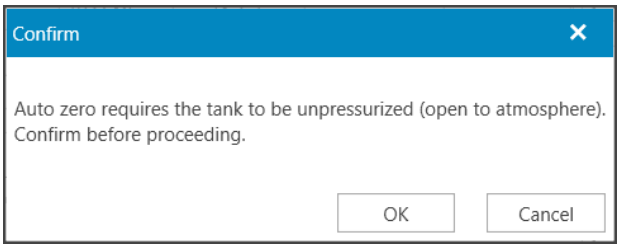


Figure 9-2: Auto Zero confirm

In addition to automatic zero settings, the sensors offset & gain can also be set manually (9.3).

9.3 Sensor offset & gain

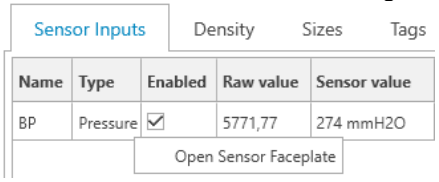
The system has an option to adjust the offset and gain for sensors, this offers the possibility to compensate incorrectly zero-adjusted sensors, e.g. where a tank has been zeroed with cargo still in the tank.

Offset Adds or subtracts a constant value.
Gain Adds a percentage correction to the sensor value. Note this is not considered an everyday routine, please read the examples carefully before attempting to adjust the gain settings.

9.3.1 Offset adjustment

To see and/or adjust the offset values for a sensor, it's faceplate needs to be opened. In the case of a tank sensor the easiest way is:

1. Open the tank faceplate
   a. In the bar graph or layout view: Click the tank to open faceplate
   b. In the value table view: Right click the tank and click **View tank details**
2. Click the **Service** tab
3. Locate the desired sensor and right click it which opens a context menu:



4. Click **Open Sensor Faceplate**

The sensor faceplate shows detailed data for the sensor, including the zero (offset) and gain value as shown below (Figure 9-3):

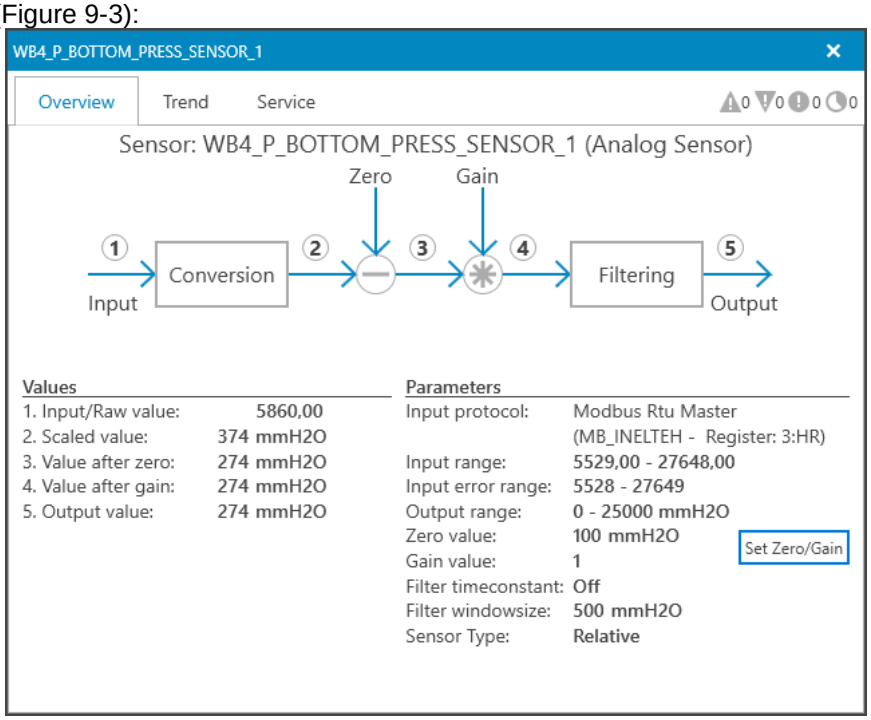


Figure 9-3: Analog sensor faceplate

In this example the offset for bottom pressure sensor for tank WB4_P shows 100 mmH_2O. It has a corresponding Value of 274 mmH_2O. The Value is the pressure on the sensor currently used for level presentation (level = pressure divided on density). Let's assume that this sensor currently has incorrect offset adjustment, and that it is necessary to correct it. To make this example simple, we also assume that the tank contains fresh water with a density of 1.0000. The correct level in the tank is now 350 mm and we need to enter a new offset value. The deviation is 350-274 = 76 mmH_2O, and the correct offset value should then be 100 - 76 = 24 mmH_2O (Old offset minus deviation equals new offset).

To set the new offset value click the **Set Zero/Gain** button, which shows the following:

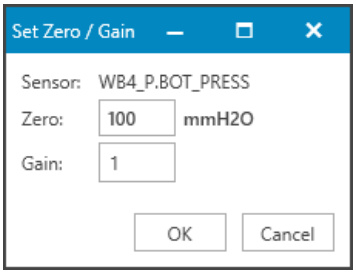


Figure 9-4: Set Zero/Gain dialog

It shows the currently set values for zero (offset) and gain, enter the new desired values, in this case a zero value of 24 mmH_2O, and keep the gain unchanged at 1. Click the **OK** button to store the new values.
After adjustments the value of the sensor value is changed:

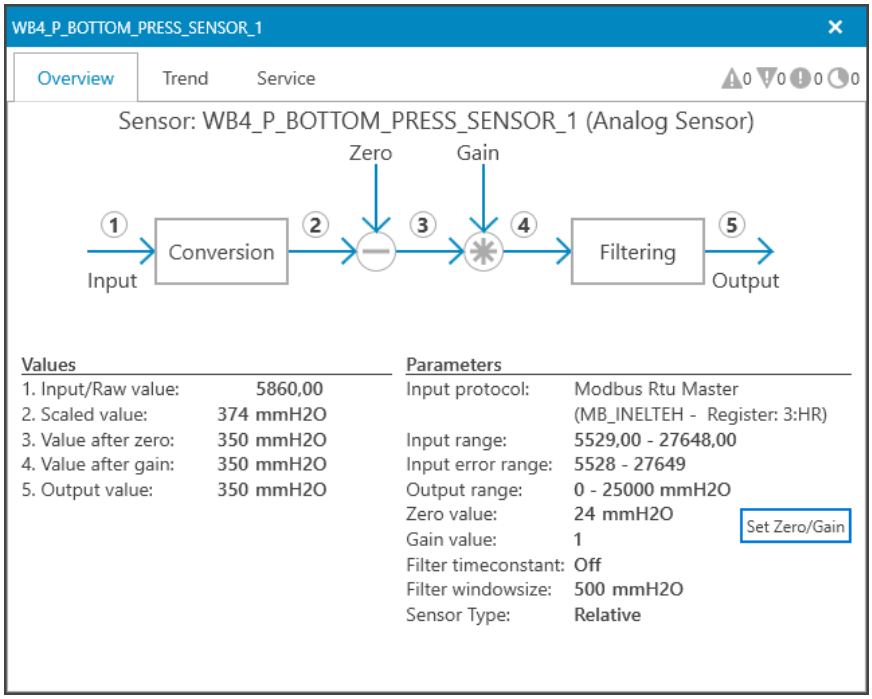


Figure 9-5: Sensor after zero (offset) adjustment

And the tank shows the correct level:

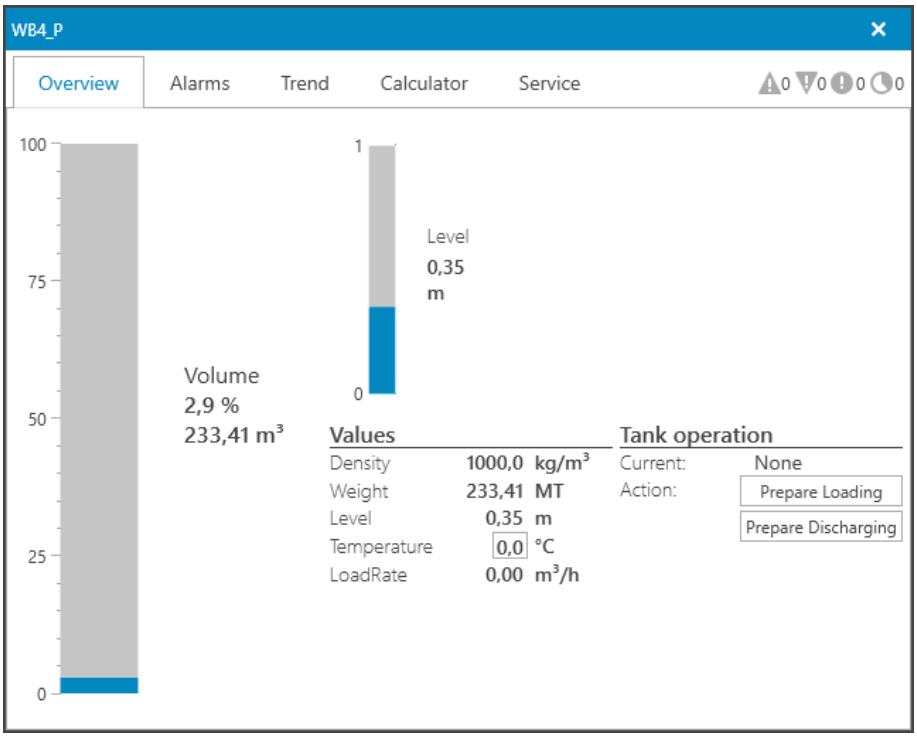


Figure 9-6: Tank after sensor zero (offset) adjustment

Note: The sensor should be zeroed using the normal procedure as soon as the tank is empty. See chapter 0.

9.3.2 Gain adjustment

Gain adjustments may be applied where you have deviations that are not constants, but where the deviation is a certain percentage of the reading, e.g. where the deviation is 5% at both 50% level and 98% level. Applying a gain of 1.05 will add 5% to the reading whereas gain 0.95 will subtract 5% from the reading.

Note: It is necessary to use a pressure calibrator in order to precisely determine the deviation in reading from the sensors. The use of experience data alone may not be sufficient to achieve the highest possible accuracy.

In the following example, the tank shown is displaying a 130 mmH_2O too low value for 98% level. When the level drops to nearly empty tank, the reading displays very close to correct, with only a few mm deviation.

Note: Use the gain setting with care, as this is normally a temporary fix as the sensor is most probably out of spec.

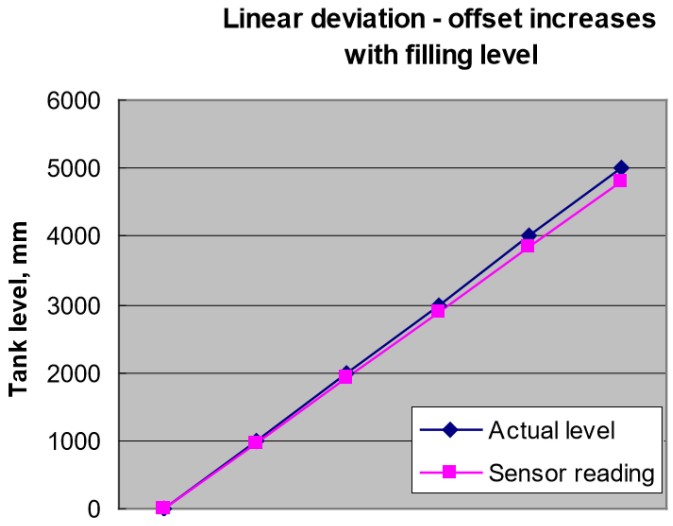


Figure 9-7: Sensor deviation

Our example tank is 18000 mm high. Consider the numbers:

Level %	**70**	**98**
Actual Level [mm]	12600	17640
Sensor Reading [mm]	12510	17510
Needed gain adjustment	12600/12510 = 1.0072	17640/17510 = 1.0074

Note that the deviation at 70 % level is 90 mm and at 98 % it is 130mm. However, the deviation factor is the same, and both readings can be tuned in by applying the same gain correction: 1.007.

Do not forget to include actual density in the arithmetic when you calculate what the correct reading should be. Actual Density = Density compensated for the actual temperature.

10 REFERENCE

10.1 Keyboard Shortcuts

Shortcut key	View
Alt+F3	Value Table – Numerical spreadsheet display
Ctrl+F3	Bar graph – Vertical bars displaying key tank values
Shift+F3	Layout – Custom layout views depending on configuration. If multiple views are configured pressing the shortcut keys will cycle thru the layout views.
F2	Prepare Tanks for Loading
Shift-F2	Prepare Tanks for Discharge
Alt-F2	End operation on Tanks
F4	Show Draft & Trim/List
Alt-F11	Show alarm detail list
F11	Silence alarm
Shift-F11	Acknowledge selected alarm

10.2 Alarm Descriptions

This chapter describes the various alarms in the system. The actual alarms that can be present depends on the configuration and might be less than the ones listed here.

10.2.1 Tag Alarms

These alarms are general and can occur on any tag (value) in the system depending on the configuration[2]. The alarms are:

Alarm Type	Description	Cause
LoLo	Value below LoLo limit	The value is below the configured LoLo alarm limit.
Lo	Value below Lo limit	The value is below the configured Lo alarm limit.
Hi	Value above Hi limit	The value is above the configured Hi alarm limit.
HiHi	Value above HiHi limit	The value is above the configured HiHi alarm limit.
Deviation	Value deviated from setpoint	The value deviated from the configured setpoint (Deviation larger than the set limit).

10.2.2 State Alarms

These alarms indicate the presence of an abnormal or failure situation of the system and devices. Various components of the system such as Tanks, IO protocols, etc. have different alarms, and are listed below.

10.2.2.1 Tank Alarms

Description	Cause	Resolution
Missing Sensor Input	The tank does not have valid input on one or more sensors, due to IO error, faulty sensor, etc. Resulting in values of the tank to be uncertain.	Fix the IO/sensor error. In the meantime, the faulty sensor can be disabled on the tank and a manual input can be given (See chapter 4.4.5).
Sensor Disabled	A sensor input on the tank has been disabled.	Fix the IO/sensor. While waiting on spares/service, this alarm can be shelved.

10.2.2.2 Line Alarms

Description	Cause	Resolution
Missing Sensor Input	The line does not have valid input on one or more sensors, due to IO error, faulty sensor, etc. Resulting in values of the line to be uncertain.	Fix the IO/sensor error.

[2] In a standard configuration 'Deviation' alarm is present on tank volume and LoLo/Lo/Hi/HiHi alarms present on line pressures and tank temperature, inert pressure and volume.

10.2.2.3 Draft Alarms

Description	Cause	Resolution
Missing Sensor Input	The draft does not have valid input on one or more sensors, due to IO error, faulty sensor, etc.	Fix the IO/sensor error. In the meantime, the trim/list can be entered manually or by inclinometer/draft (depending on which is available) in the “View draft & trim/list” window (F4).

10.2.2.4 System Alarms

Description	Cause	Resolution
Primary server down	The primary server is down (faulty, power failure, etc), the backup server has taken over.	Make sure the PC is powered on, otherwise contact KROHNE Marine for support.
Backup server down	The backup server is down (faulty, power failure, etc), this means there is no redundancy if the primary fails.	Make sure the PC is powered on, otherwise contact KROHNE Marine for support.
Primary history storage error	An error occurred when storing historical data on the primary server. Can affect access to historical trending.	Restart system, if alarm persists contact KROHNE Marine for support.
Backup history storage error	An error occurred when storing historical data on the backup server. Can affect access to historical trending.	Restart system, if alarm persists contact KROHNE Marine for support.

10.2.2.5 Valve Alarms

On/Off valve

Description	Cause	Resolution
Maximum travel time exceeded	The valve failed to open or close within the set maximum time.	
Travel time below minimum	The valve open or closing time was below the set minimum time.	

Throttle valve

Description	Cause	Resolution
Position not reached in time	The valve failed to reach the setpoint within the set maximum time.	

10.2.2.6

10.2.2.7 IO Alarms

Note: Most IO alarms will result in sensors connected to that IO device to lose their readings. This will be indicated by "bad value" indication (See chapter 2.6), also "Missing sensor input" alarms on tanks/lines where the sensors are located will be raised.

Modbus

Description	Cause	Resolution
Hardware error	The protocol failed due to a hardware error (Faulty serial port, etc) causing communication to stop.	Restart system, if alarm persists contact KROHNE Marine for support.
Communication error	The device failed to communicate (Failure in external system, cable disconnect, etc), causing communication to stop.	Make sure external system is operational and check for disconnected cables, etc. Finally restart system, if alarm persists contact KROHNE Marine for support.

IS40

Description	Cause	Resolution
Port 1 Error	The protocol failed due to a hardware error (Faulty serial port, etc) causing communication to stop on port 1.	Restart system, if alarm persists contact KROHNE Marine for support.
Port 2 Error	The protocol failed due to a hardware error (Faulty serial port, etc) causing communication to stop on port 2.	Restart system, if alarm persists contact KROHNE Marine for support.
Port 1 Timeout	The device communication timed out on port 1 (Failure in IO cabinet, cable disconnect, etc).	Make sure SCU is powered on and no cables are disconnected, etc. Finally restart system, if alarm persists contact KROHNE Marine for support.
Port 2 Timeout	The device communication timed out on port 2 (Failure in IO cabinet, cable disconnect, etc).	Make sure SCU is powered on and no cables are disconnected, etc. Finally restart system, if alarm persists contact KROHNE Marine for support.

Note: The IS40 IO Protocol will continue to function unless there is a failure on both port 1 and port 2.

10.2.2.8 Sensor Alarms

Note: Most sensor alarms will result in the measurement value from the sensor to be uncertain. This will be indicated by "bad value" indication (See chapter 2.6), also alarms on the tank where the sensor are located will be raised.

Analog Sensor

Description	Cause	Resolution
Out of range	The sensor raw value is outside the allowed range causing the value to be uncertain.	

Radar Sensor

Description	Cause	Resolution
Hart Com Error	Communication between the SCU and the radar failed.	
Hardware Error	The radar reports a hardware error.	
PLC Module Error	Internal failure in the SCU.	
Open/short circuit	Open or short circuit on the line from SCU to radar.	

IS40 Temp Sensor

Description	Cause	Resolution
AD Card error	Internal communication error between TI and AD card.	
Out of range	The sensor raw value is outside allowed range.	
Conversion error	The sensor value could not be converted.	
Calibration error	AD card calibration failed.	