Product Data Sheet
00813-0100-5110, Rev CC
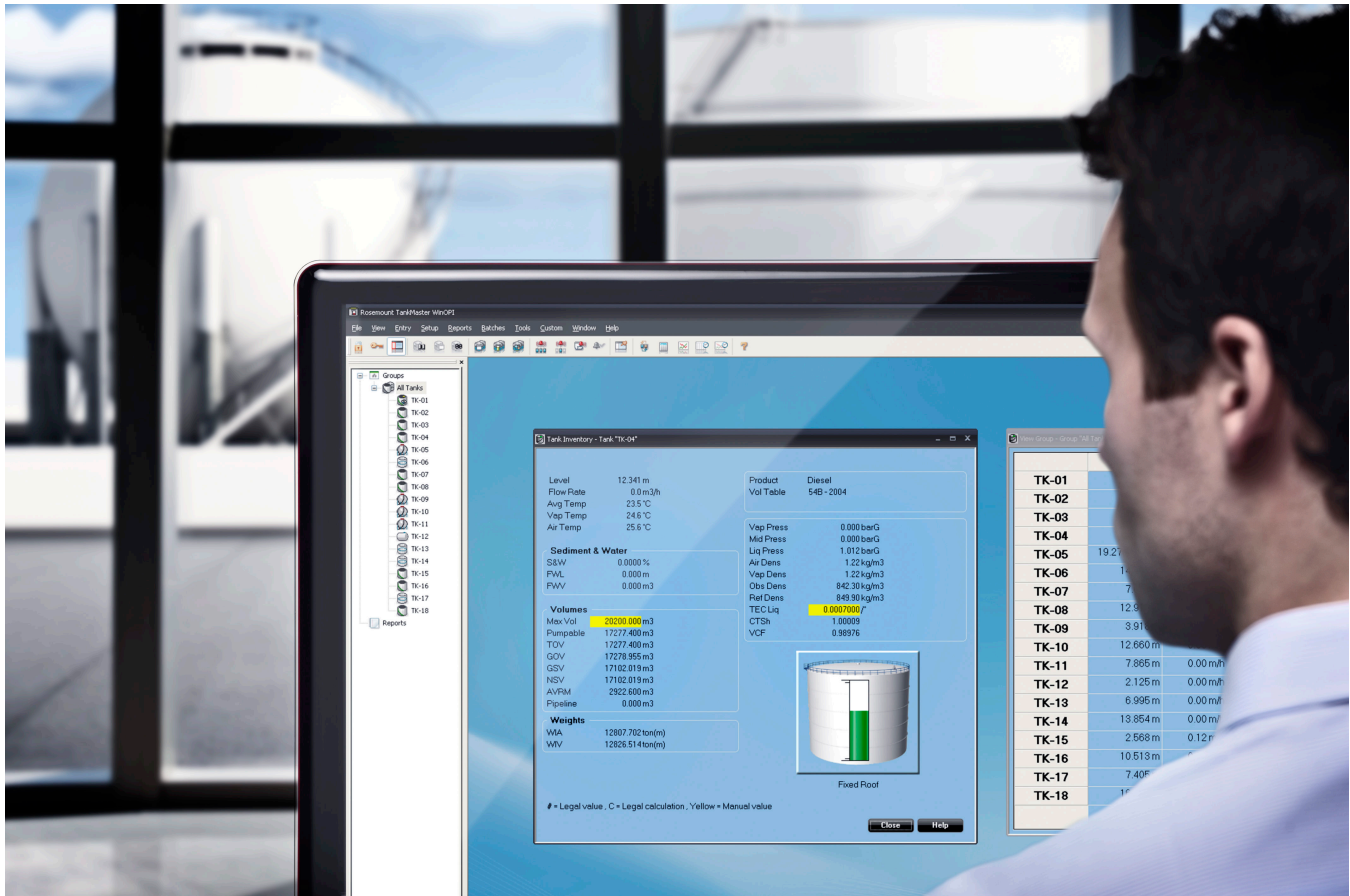September 2023

Rosemount™ TankMaster™ Inventory Management Software

for tank gauging systems

Higher tank farm efficiency by precise tank content monitoring

- Get automatic inventory calculations with API standard net volumes
- Achieve network interoperability with host systems and other vendors' devices
- Detect abnormal roof conditions with proactive monitoring of floating roofs
- Improve safety with easy-to-use alarm management and remote proof tests
- Detect layering and predict roll-over in full containment storage tanks for liquefied natural gas (LNG)

ROSEMOUNT™

EMERSON™

Gain control over your inventory data

TankMaster is a powerful, easy-to-use Windows™-based inventory management software package. It provides operator overview, inventory and custody transfer functions, configuration and service for Rosemount Tank Gauging systems.

This software collects all tank gauging data such as level, temperature, water interface, and pressure from devices in the Rosemount tank gauging system. It automatically calculates volume and mass for inventory and custody transfer tanks. The operator will be able to respond faster to changing tank farm conditions. This will maximize the plant effectiveness, increase productivity, and reduce costs.
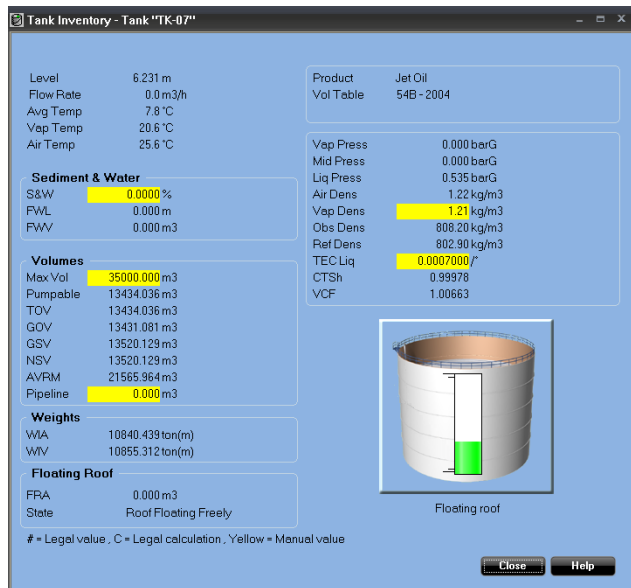
TankMaster gives the most important inventory data for a specific tank in one easy-to-read window.

Inventory and custody

- Real-time tank gauging data such as level, temperature, water interface level, and pressure
- Online gross and net volume inventory calculations based on API and ISO standards
- Hybrid tank gauging with pressure inputs giving data for density and mass calculation
- Batch handling makes it possible to control and follow transferred volumes from the control room

Contents

Improve Operator Overview

The "tank farm explorer" makes it easy to navigate in TankMaster. TankMaster provides several efficient features:

- Customized views with graphic plant layouts
- Advanced group configuration in geographical or product groups etc.
- A user manager with different access levels for personnel
- A setup wizard for guided configuration of all devices in a Rosemount tank gauging system
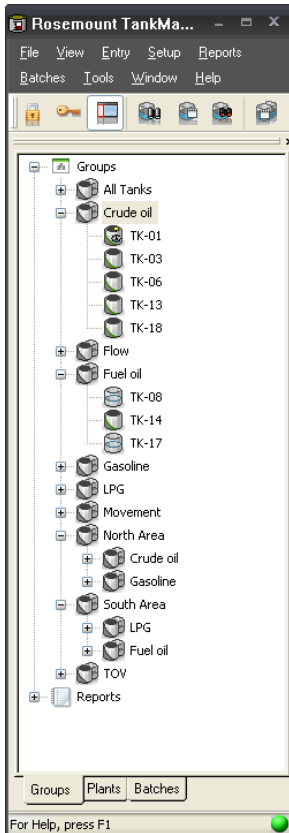
You can easily organize tanks in geographical or product groups, with associated sub-groups.

As in Windows Explorer, it is possible to expand and minimize fields and get direct group and tank access by double-clicking the specific group or tank icon.

Constant 24/7 floating roof monitoring

TankMaster provides real-time verification that the floating roof is operating as normal. When including floating roof functionality and devices, TankMaster monitors for deviations such as roof tilt and drain sump clogging.

Automatic monitoring provides the ability to take preventive measures before a critical incident. A warning given before you have liquid on top of the roof allows for less manual inspection work on the tank roof.

Optimize tank usage and increase safety in full containment storage tanks

TankMaster provides a complete overview of your full containment storage tanks for liquefied natural gas (LNG) and other refrigerated gases.

- Up to four level devices including support for LTD devices

- Support for cool-down and leak detection temperature measurements
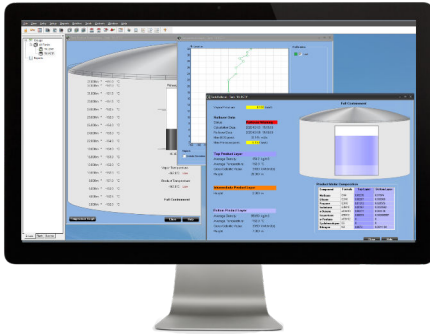
Full support for non-homogeneous gases e.g LNG

Data from level, temperature, and density measurement devices in the tank gauging system are used to detect layering and calculate when a roll-over might occur, enabling operators to take preventative action.

By providing both inventory management and roll-over prediction in a single software solution, TankMaster reduces costs, increases ease-of-use, and reduces the risk of a potential accident.

- Support for configuration and operation of LTD devices

- Product temperature and density profile including product stratification monitoring and alarming

- On-line 24/7 product temperature profile as back-up to LTD-provided profile

- Roll-over prediction

Make essential tank gauging data available

By sharing data with users on all levels of the enterprise through modern network connectivity, operators and plant management are better equipped to make timely decisions.

TankMaster comes in two versions:

- TankMaster WinOpi is a complete custody transfer and inventory software package. All calculations are based on current API and ISO standards.

- TankMaster WinView is a software package with basic inventory capabilities. It is a cost-efficient alternative for operational control at smaller tank terminals, marketing terminals, biofuels, chemical plants, etc.

Full network capabilities

- It is possible to build a network of several server and client PCs with TankMaster software

- The networking function makes it possible to work with TankMaster from any PC in the network

- The operator can configure tanks, handle tank gauging and inventory data, and accept alarms

Figure 1: System Overview
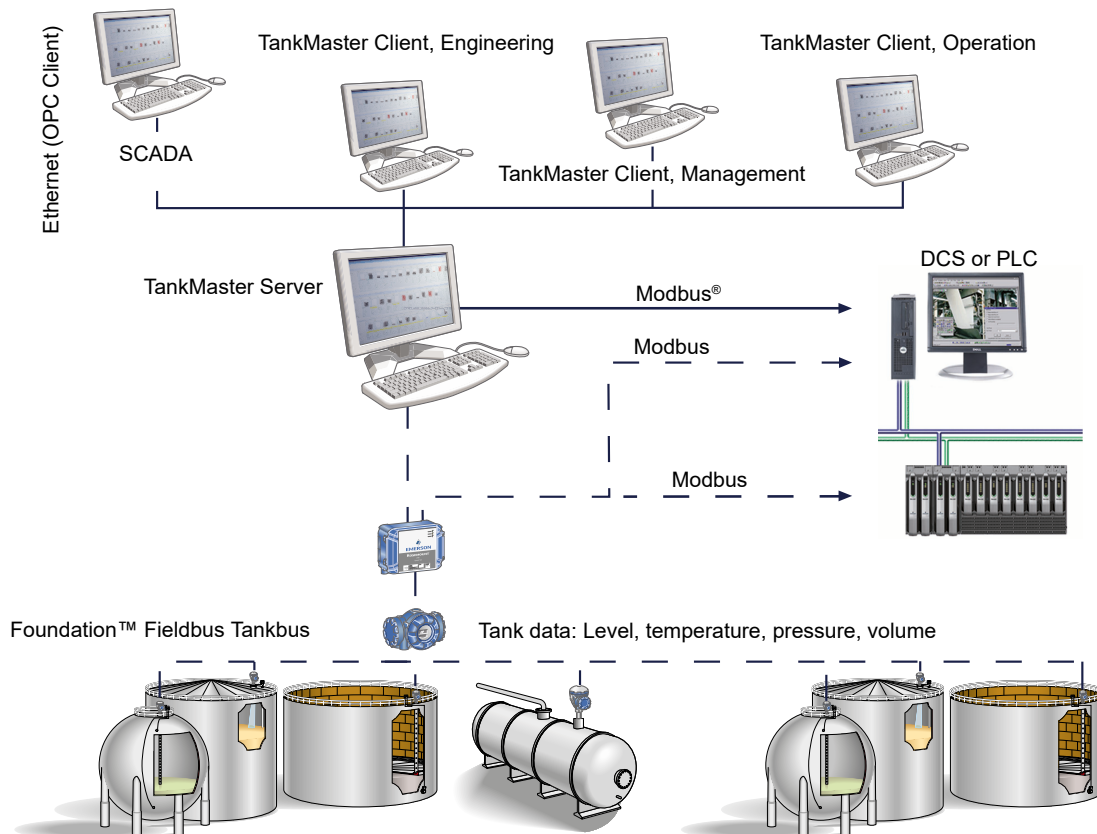
TankMaster distributes essential inventory tank gauging data.

Ordering information

Model codes

Model codes contain the details related to each product. Exact model codes will vary; an example of a typical model code is shown in Figure 2.

Figure 2: Model Code Example

TM 20 S N C C P C RT   R2
_____   _____
          1   2

1. Required model components (choices available on most)

2. Additional options (variety of features and functions that may be added to products)

Rosemount TankMaster Inventory Management
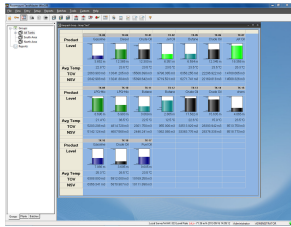
Rosemount TankMaster collects real-time tank gauging data such as level, temperature, water interface level and pressure. It automatically calculates volume and mass for inventory and custody transfer for bulk liquid storage tanks. It also provides operator overview, configuration, setup and service for Rosemount tank gauging systems.

> **VIEW PRODUCT >**

Required model components

Model

Code	Description
TM	Rosemount TankMaster Inventory Management

License

Note that each Rosemount 5900S Radar Level Gauge with 2-in-1 functionality corresponds to two tanks.

Code	Description
DM	TankMaster Demo (no dongle included)
05[1]	TankMaster WinOpi, with TankServer for up to 5 tanks, including WinSetup
20[1]	TankMaster WinOpi, with TankServer for up to 20 tanks, including WinSetup
50[1]	TankMaster WinOpi, with TankServer for up to 50 tanks, including WinSetup
MX[1]	TankMaster WinOpi Max (unlimited number of tanks[2]), including WinSetup
V2[3]	TankMaster WinView, with TankServer for up to 20 tanks, including WinSetup
V5[3]	TankMaster WinView, with TankServer for up to 50 tanks, including WinSetup
VX[3]	TankMaster WinView Max (unlimited number of tanks[2]), including WinSetup
WS[4]	TankMaster WinSetup

[1]　*Configuration, view, and alarm handling. Volume calculations according to API. Includes WinSetup.*
[2]　*If more than 150 tanks, additional TankMaster server(s) are needed. Maximum 150 tanks per server.*
[3]　*Configuration, view, alarm handling, and limited inventory calculations. Includes WinSetup. Requires option code "0" or "00" for Custody Transfer, Batch Handling, HTG and Redundancy. No additional options available.*
[4]　*Configuration and installation of devices and tanks. WinSetup only.*

Host communication

Code	Description
0	None
C[1]	TankMaster communication module
S[1][2]	TankMaster communication module with office link

[1]　*For connection between TankMaster and SCADA/DCS/PLC via Modbus (RS232) and/or OPC DA. Requires WinOpi or WinView.*
[2]　*For connection between TankMaster and Microsoft® Office via OPC server. Includes OPC Office Client/Site Server License.*

Network clients

Code	Description
0	None
1[1]	One TankMaster WinOpi client can connect and read data
2[1]	Two TankMaster WinOpi clients can connect and read data
3[1]	Three TankMaster WinOpi clients can connect and read data
4[1]	Four TankMaster WinOpi clients can connect and read data
5[1]	Five TankMaster WinOpi clients can connect and read data
6[1]	Six TankMaster WinOpi clients can connect and read data
7[1]	Seven TankMaster WinOpi clients can connect and read data
V[1]	Three TankMaster WinView clients can connect and read data
X[1][2]	Specify number of clients

[1] *Number of other TankMaster PCs that can connect and read data simultaneous. This other TankMaster PC can be a TankMaster client or another TankMaster server.*
[2] *Maximum 10 concurrent TankMaster clients.*

Custody transfer

Code	Description
0	None
C[1]	TankMaster custody transfer functions
P[1][2]	TankMaster custody transfer functions PTB Eich

[1] *Custody transfer windows. Includes hardware key, custody transfer seal and metrological seal for custody transfer approvals.*
[2] *Includes PTB sticker.*

Batch handling

Code	Description
0	Default batch functions
B[1]	Extended batch functions

[1] *Stores closed batches up to 365 days, re-calculation of delivery ticket, Microsoft Access database files, and "Tank Transfer Calculator".*

HTG

Code	Description
0	None
P	TankMaster hydrostatic tank gauging functions and calculations

Customization

Code	Description
0	None
C	Customized views

Redundancy

Code	Description
00	None
RT[1] [2]	TankMaster redundancy

(1)   *Requires two identical dongles (can be ordered separately), meaning duplicate redundancy licenses as well as other options (one per dongle).*

(2)   *Batch handling redundancy excluded.*

Additional options

Floating roof monitoring

Code	Description
TF	Floating roof monitoring

LNG/Full containment tanks

Select maximum one of the LNG/Full containment tanks option codes.

Code	Description
LN	LNG/Full containment tank management
R1[1]	LNG/Full containment tank management and rollover prediction for 1 tank
R2[1]	LNG/Full containment tank management and rollover prediction for 2 tanks
R3[1]	LNG/Full containment tank management and rollover prediction for 3 tanks
RX[1]	LNG/Full containment tank management and rollover prediction for X number of tanks (Consult factory)

(1)   *The License option code specifies the total number of tanks in the HMI. This option code specifies the number of tanks with roll-over prediction in the HMI.*

Specifications

Functional specifications

For information on what features are included in which TankMaster version, see Software packages.

User-friendly navigation

The "tank farm explorer" makes it easy to navigate in TankMaster. It is possible to expand and minimize fields. The operator gets direct group and tank access by double-clicking the specific group or tank icon.

Customized views

There are a number of options for customized views; it is possible to either modify the existing window, or build completely new ones to show only the currently most interesting tank parameters. For example:

- A photo of the plant gives a realistic view and by clicking a specific tank, the corresponding tank data will be presented
- A window showing only the currently most interesting tank parameters

Interactive configuration and installation

A step-by-step wizard provides guided configuration and installation of all devices in a Rosemount tank gauging system.

Translation

TankMaster can be translated to any language. Users can change text in the dialogs and menus and verify translated text on site.

Tank gauging data

TankMaster collects real-time tank gauging data such as level, temperature, water interface level, and pressure.

Hybrid tank gauging

With a high accuracy hybrid tank gauging system, the need for manual density sampling is eliminated. With tank gauging data such as level, pressure, and temperature, the operator gets automatic density measurements and mass calculations from the TankMaster system.

Liquefied Petroleum Gas (LPG)/Liquid Natural Gas (LNG)

For tanks containing liquid gas, a number of parameters are relevant. The mass of gas in the Available Room is calculated and the corresponding liquid equivalent volume is presented as Liq Equ in the Tank Inventory window.

The Molecular Mass and the Vapour-Liquid_Volume Ratios are entered into the TankMaster product table.

Density measurement with pressure transmitters

By complementing the level measurement with temperature and pressure measurement, the density of the product in the tank can be continuously calculated.

One or more pressure transmitters with different scalings can be used on the same tank to measure liquid and vapor pressure.

The accuracy of the density calculation largely depends on the accuracy of the pressure transmitter.

Data is calculated according to updated API and ISO standards. Temperature calculations include API algorithms to handle elements close to the bottom. The level value is software corrected for changes in tank reference height.

Data is presented using units from a wide selection; both metric and USA/UK units are supported. Secondary units are available.

TankMaster features very high accuracy net volume calculations (up to 5000 strapping points). Normally less than 100 points per tank are necessary for one-liter accuracy. Quadratic interpolation for spheres and horizontal cylinders is used, which increases volume accuracy and reduces number of strapping points required.

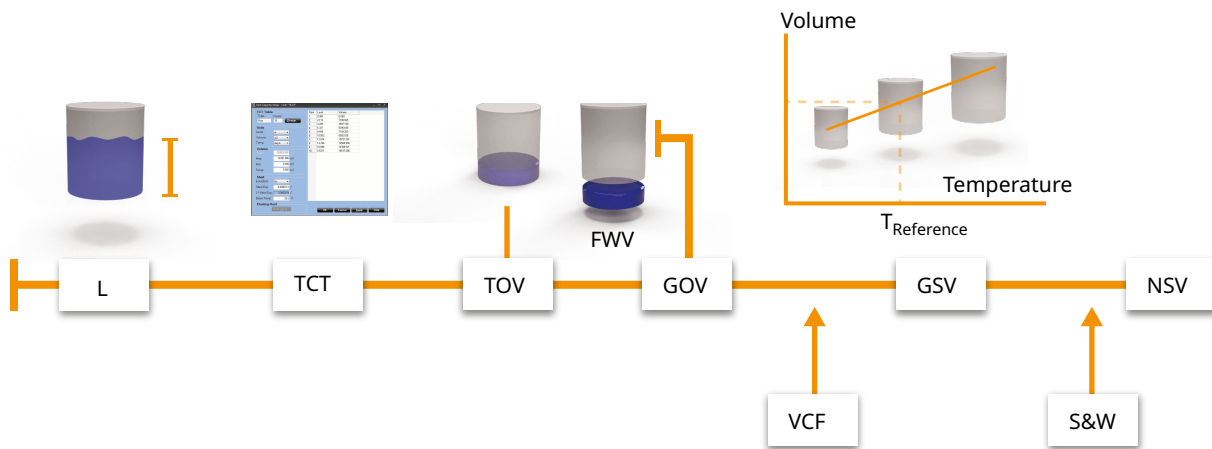## Inventory calculations

Real time inventory calculations include:

■ Gross and net volumes as well as mass calculations, according to current API tables (6, 54, 24, A-D), ISO, and other major standards

■ Tank capacity tables (5000 strapping points) for cylindrical and spherical tanks are supported

■ Liquid and mass calculations of vapor in LPG according to ISO 4267

■ Net Standard volume calculated at a user specified reference temperature

■ Measured and calculated values displayed in secondary units; for example, the results can be shown in both bbl and °F, and m^3 and °C at the same time

TankMaster calculations

The inventory calculations are normally based on volumes. The main calculation is to find a volume correction factor (VCF). The VCF is then used to calculate volume based on a reference temperature.

Inventory parameters are calculated based on input data available for the current tank. Figure 3 shows an example of how the measured product level is converted to a standardized volume.

Figure 3: Inventory Calculations and Custody Transfer

L	Level	VCF	Volume Correction Factor
TCT	Tank Capacity Table	GSV	Gross Standard Volume
TOV	Total Observed Volume	S&W	Sediment & Water
FWV	Free Water Volume	NSV	Net Standard Volume
GOV	Gross Observed Volume		

The inventory calculation is divided into four parts:

1. Calculation of observed volumes

2. Calculation of observed density

3. Calculation of reference density and Volume Correction Factor according to the selected volume correction table

4. Net volumes using the VCF

Total Observed Volume (TOV) is calculated from strapping tables. It is the total volume at the observed temperature of the product.

Gross Observed Volume (GOV) is obtained by subtracting the **Free Water Volume (FWV)** from the TOV. The FWV is calculated from the Free Water Level entered by the operator or measured automatically by using a water level sensor, such as Rosemount 765.

Gross Standard Volume (GSV) is the GOV corrected to the reference temperature 15 °C (60 °F). The correction is made using the Volume Correction Factor according to API Standard 2540.

Net Standard Volume (NSV) is calculated as the Gross Standard Volume minus the dissolved sediment and water. For liquid gas tanks, the liquid equivalent volume of the gas above the product surface is added. The WinOpi also includes a Leak Alarm based on changes of the NSV.

If a pressure transducer is installed in the tank and properly connected and configured, the density of the product can be calculated. This value is presented as the **Observed Density**.

The **Reference Density** is the density of the product at the standard reference temperature 15 °C (60 °F). It can either be manually entered, or automatically calculated from the Average Temperature and the Observed Density if it is available. The Reference Density is calculated using a VCF according to API Tables 5A, 5B, 53A, or 53B. The Observed Density can also be calculated based on the manually entered Reference Density.

Weight calculations are performed using the calculated volumes and either the manually entered density or the observed density. The **Weight In Air (WIA)** is calculated as the Net Standard Volume multiplied by the Weight Conversion Factor.

Supported volume calculation tables

A selection of supported calculation tables:

API Standard 2004	54A, B, C, D
	6A, B, C, D
	60A, B, C, D
	24A, B, C, D
API Standard 2007	54E
	6E
	60E
	24E
ASTM D4311 2015 Standard Practice for Determining Asphalt Volume Correction to a Base Temperature	D4311
Chemical Volume Correction	Chem Linear
API Standard 2004 with operator entered reference temperature	RT_54A, B, C, D
	RT_6A, B, C, D
API Standard 2007 with operator entered reference temperature	RT_54E
	RT_6E
Practical Alcohol Table (VOLUME 2, Table 1)	Alcohol
Density vs Temp table	DVT

DCF Linear/Chem table	DCF Linear/Chem
Aromatic Products	ASTM 1550
	ASTM 1555M
Table for LNG	ISO6976 – 2016
	GPA2172-2014

Batch reports

The batch report provides transfer supervision, when making internal and external transfers in inventory and custody transfer tanks.
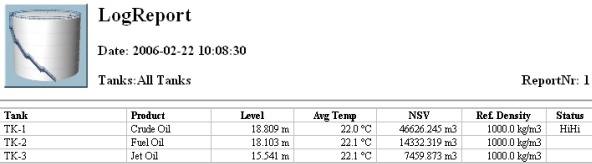
For example, when a ship calls at a plant, a batch report can be started, which presents information about when the transfer was started, elapsed time, remaining time, and estimated stop. An alarm is activated five minutes before, as well as after the transfer is ready. When the transfer is ready, the batch report can be printed for record keeping.

Automatic reports

Standard reports are automatically generated via PDF, text file, printer, or e-mail. The reports are arranged by tanks or groups. The time interval, report layout, and which parameters to include can be specified by the operator. All activities have a time stamp for reliable follow up.

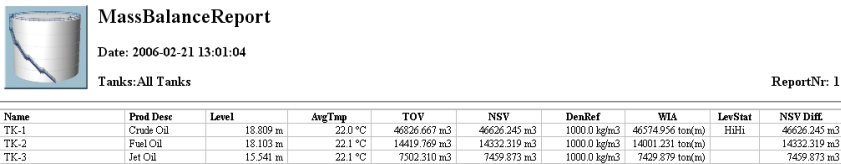Two standard report types are available: Log Report and Mass Balance Report.

Figure 4: The Log Report

LogReport

Date: 2006-02-22 10:08:30

Tanks:All Tanks   ReportNr: 1

Tank	Product	Level	Avg Temp	NSV	Ref. Density	Status
TK-1	Crude Oil	18.809 m	22.0 °C	46626.245 m3	1000.0 kg/m3	HiHi
TK-2	Fuel Oil	18.103 m	22.1 °C	14332.319 m3	1000.0 kg/m3	
TK-3	Jet Oil	15.541 m	22.1 °C	7459.873 m3	1000.0 kg/m3	

The Log Report shows:

- Product
- Level
- Average temperature
- Net Standard Volume (NSV)
- Density
- Level status

Figure 5: The Mass Balance Report

MassBalanceReport

Date: 2006-02-21 13:01:04

Tanks:All Tanks   ReportNr: 1

Name	Prod Desc	Level	AvgTmp	TOV	NSV	DenRef	WIA	LevStat	NSV Diff.
TK-1	Crude Oil	18.809 m	22.0 °C	46826.667 m3	46626.245 m3	1000.0 kg/m3	46574.956 ton(m)	HiHi	46626.245 m3
TK-2	Fuel Oil	18.103 m	22.1 °C	14419.769 m3	14332.319 m3	1000.0 kg/m3	14001.231 ton(m)		14332.319 m3
TK-3	Jet Oil	15.541 m	22.1 °C	7502.310 m3	7459.873 m3	1000.0 kg/m3	7429.879 ton(m)		7459.873 m3

The Mass Balance Report shows:

- Product
- Level
- Average temperature
- Total Observed Volume (TOV)
- Net Standard Volume (NSV)
- Weight In Air (WIA)
- Density
- Level status
- Difference in NSV since last report

Alarm handling

TankMaster features alarm summary, alarm log, and alarm event log for safe and reliable alarm handling.

When an alarm occurs, a bell rings and the alarm icon starts to blink. The operator can set different sounds for each alarm type. Alarms can also be sent via e-mail, or to mobile phones via an SMS Gateway. Alarms are customized at any station in the network and a client signature is saved at every acknowledgment. It is possible to view all alarms in the system or divide the alarms per group or per tank.

The operator can set alarm levels as well as hysteresis and delay times for level, average temperature, vapor temperature, analog input signals, flow rate, flow direction, and others.

Figure 6: Alarm Level Handling
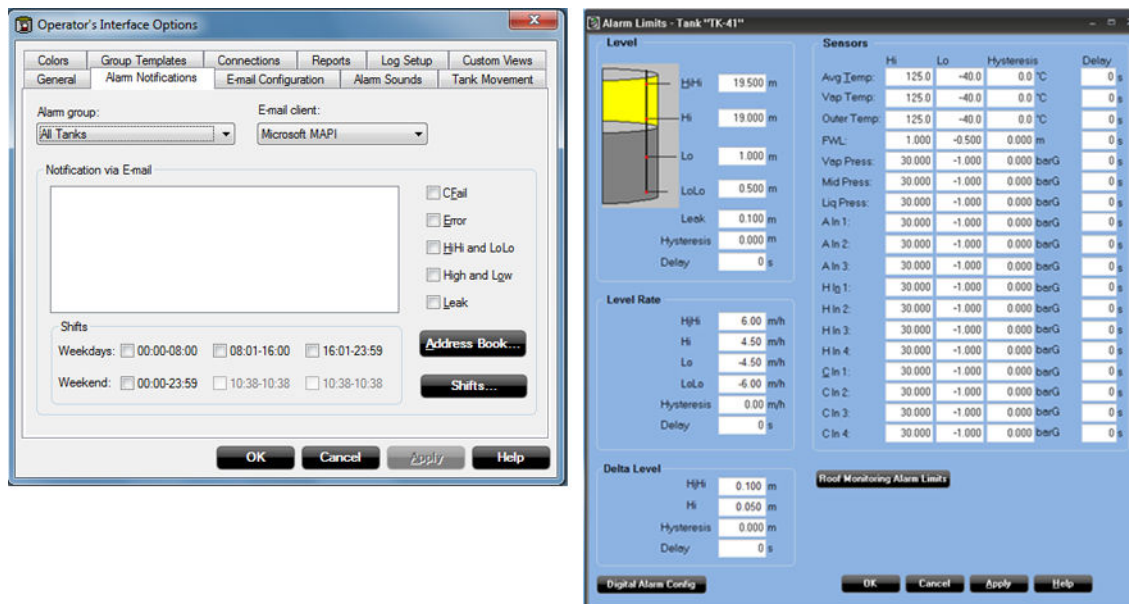
The status of the alarms can be either HiHi, High, Low, LoLo, Error, Leak Hi, Leak Lo, CFail (communication failure), or Normal.

Historical data sampling

The operator can collect historical data for reliable follow up. The generated reports are saved to file. A graph presents the historical trends.

Network capabilities

A network of several server and client PCs can be built. Access TankMaster from any PC in the network.

The networking functions enables working with TankMaster from any PC in the network. Updated real-time data are available on all TankMaster client PCs. The operator can install tanks, handle tank gauging and inventory data, and accept alarms on any PC.

Authority for alarm handling can be distributed in the network. If there are many control rooms, the operator can decide who will be responsible for which tanks in the tank farm, providing high security.

Figure 7: Access TankMaster from Any PC in the Network
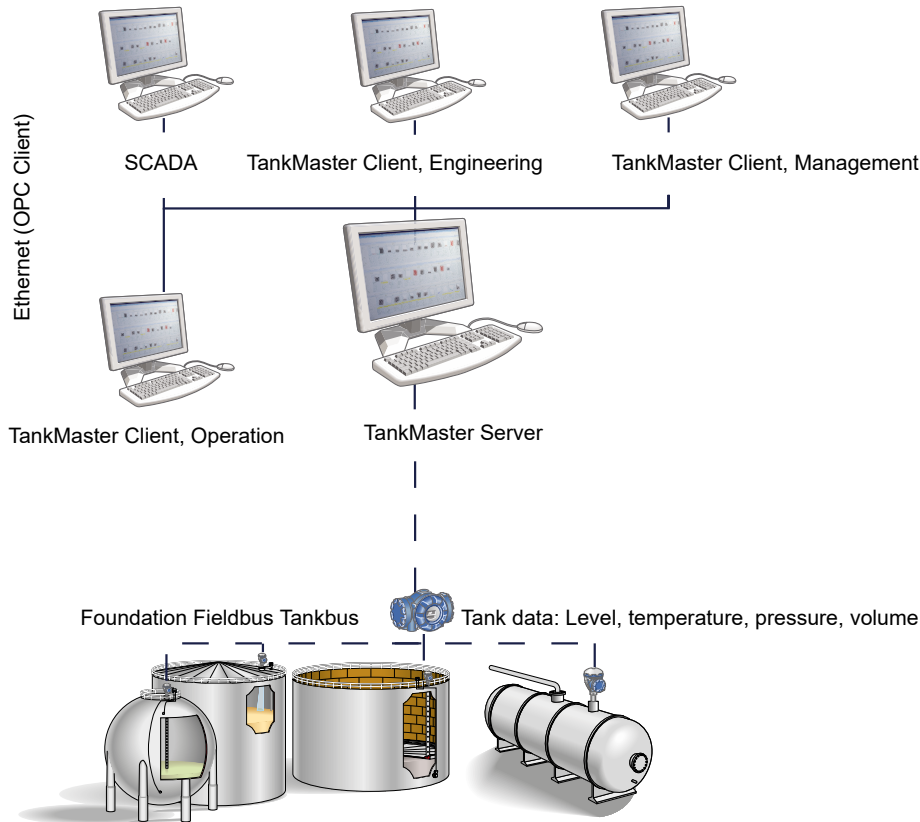
Security

User manager

Several protection levels are implemented to avoid unauthorized changes. These protection levels are categorized as User Access Levels and User Sub Access Levels.

The User Access Levels are:

- Administrator
- Supervisor
- Operator
- View only

Each User Access Level has five User Sub Access Levels. This gives a total of 20 unique access levels.

Figure 8: User Manager
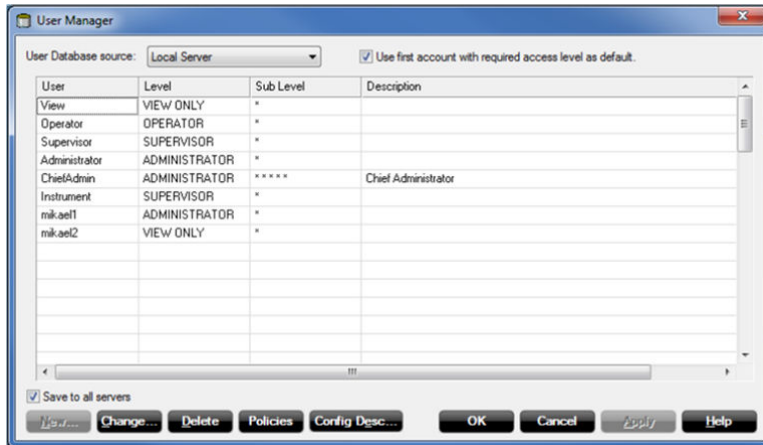
The users can log on and off without restarting the program. In the alarm log it is possible to track who acknowledged a certain alarm. When the shift is over, the operator logs out and the new operator takes over and logs in.

In order to change tank and device configuration, to install new tanks and devices, to calibrate a transmitter, to change holding register values, etc., the user has to be logged on to TankMaster. To perform any such action, the user has to be logged on at the required access level for that action. Different access levels can be set for each window.

Backup

The backup function can be used to save configuration data for devices and tanks, as well as workspace settings.

This function preserves all settings in a format that facilitates a full system restore. Using the backup functionality, the following data can be stored:

- Tank and device configurations
- Any previously created historical data
- Workspace configuration such as tank groups, colors, network settings, etc.

Supported devices

The WinSetup program supports installation and configuration of the following devices:

Tank Gauging key devices

Rosemount 5900S Radar Level Gauge

Rosemount 5900C Radar Level Gauge

Rosemount 5300 Level Transmitter, 5408 Level Transmitters

Rosemount 2460 System Hub, Rosemount 2410 Tank Hub

Rosemount 2240S Temperature Transmitter

Rosemount 2230 Graphical Field Display

Wireless devices

Emerson Wireless 775 THUM™ Adapter

Rosemount 3308 Wireless Level Transmitter

Emerson 1410 Wireless Gateway

Emerson 1420 Wireless Gateway

Generic Wireless devices

Devices from other Vendors

Endress+Hauser MDPII, Endress+Hauser NRF590, Endress+Hauser 8x (NMR, NMS, NRF)

Enraf® servo, Enraf CIU

GPE 31422, GPE 31423

L&J Technologies servo, L&J Technologies MCG3221

Sakura servo

Scientific Instruments 6290 LTD, Scientific Instruments SI-7000 LTD

Varec® servo, Varec 4590

Tokyo Keiso servo

Whessoe servo

Wärtsilä® LTD 1146

Generic drivers

Generic ModbusMaster, Generic OPC Server Device

Tank Gauging legacy devices

Rosemount TankRadar Pro, Rosemount TankRadar 2900, Rosemount TankRadar 3900, FCU 2160, FCU 2165, IDAU, SDAU, Rosemount 5400 Level Transmitter

Open system solution enables integration of other vendor's systems

OPC server with browser

TankMaster uses OPC Data Access 2.0 (OLE for Process Control), an open industry standard, which eliminates the need for costly customized software integration.

With the OPC server and the browser it is possible to import all custody transfer and inventory data to other OPC clients such as different DCSs, PLCs, SCADA systems, or Microsoft Office programs. (Website OPC Foundation: OPCfoundation.org)

Connection to other systems

The Rosemount tank gauging system can be connected to all major suppliers of DCS, SCADA systems, plant host computers or terminal automation systems. The connection can be made in two ways:

- To a TankMaster PC workstation
- Directly to a Rosemount 2460 System Hub

The advantage of connecting to a TankMaster workstation is that not only the measured values, but also the values calculated by the TankMaster can be communicated.

Figure 9: TankMaster Connections to Other Systems

Measured data: Level, Temperature, Pressure etc.

Calculated data: Volume, Mass, Density etc.

Rosemount TankMaster

Rosemount 2460

Measured data: Level, Temperature, Pressure etc.
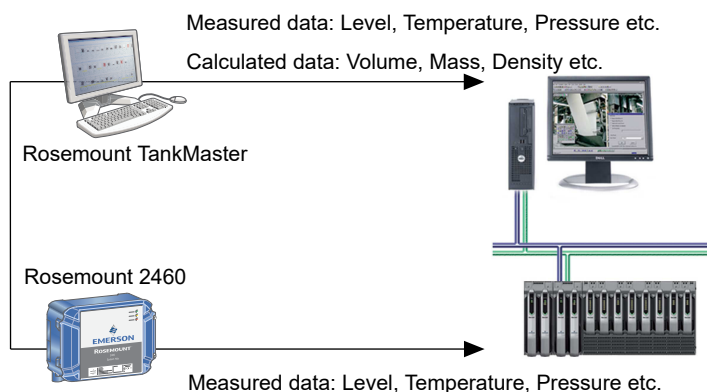
Emulation

It is possible to seamlessly replace other tank management systems with Rosemount TankMaster. Data from different types of units is collected and displayed.
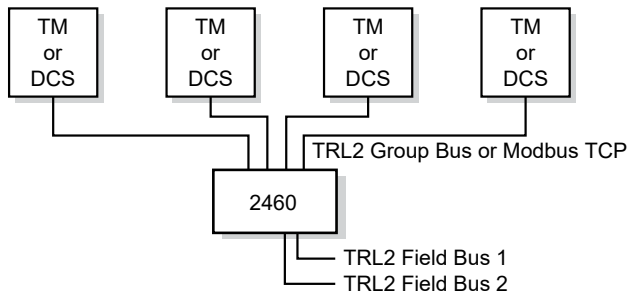
Redundancy

In order to reduce the risk of communication failure between the TankMaster/DCS system and the units connected to the Tankbus, redundancy can be made in several ways.

Redundant TankMaster PC:s

A system can have two redundant TankMaster PCs connected via Modbus TCP or two different group buses to one or several Rosemount 2460 System Hubs.

There are two possible TankMaster configurations:

- Both PC:s active, and separately asking for data

- One primary active PC, and the other silent in backup mode (hot standby)

There can be up to four connections to TankMaster (TM) or DCS units on the group bus ports of the Rosemount 2460.

Redundant Rosemount 2460 System Hubs

The system hub can provide redundancy for critical operations, by using two identical devices.

The primary system hub is active and the other one is in passive mode. If the primary unit stops working properly the secondary unit is activated and a failure message is sent to TankMaster (or a DCS system).

Complete control room redundancy

Complete field to control room redundancy is achieved by using redundant Rosemount 2460 System Hubs, Rosemount 2180 Fieldbus Modems, and TankMaster PCs.

Tankbus and field network redundancy

It is possible to have two Rosemount 2410 Tank Hubs with two separate Tankbuses on the same tank.

All field devices can also be configured in pair:

- Double level measurement devices (two separate gauges or a 2-in-1 gauge)

- Double temperature transmitters with associated sensors

- Double liquid pressure transmitters

Figure 10: Fully Redundant System
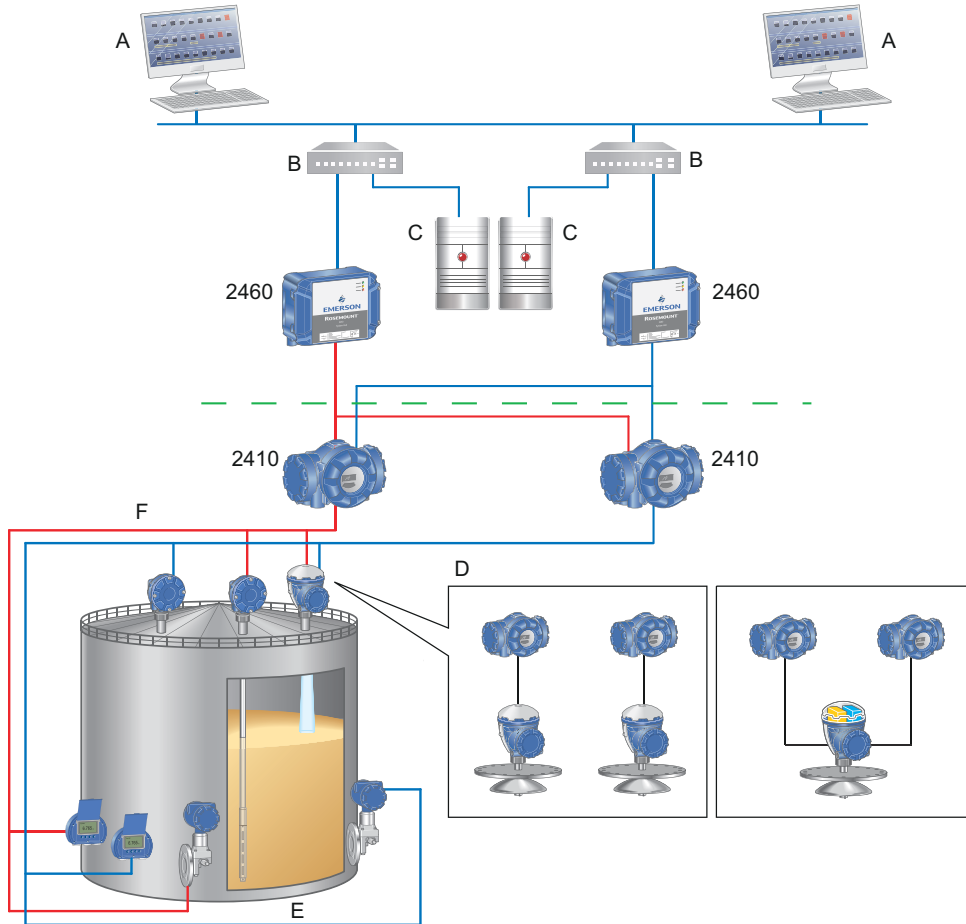
A.   *TankMaster client PCs*
B.   *Network switches*
C.   *TankMaster servers*
D.   *Alternatives for level redundancy:*
     Two tank hubs and two Rosemount 5900S/5300/5408 Level Gauges
     Two tank hubs and one Rosemount 5900S, 2-in-1 Level Gauges
E.   *Pressure x 2*
F.   *Temperature x 2*

Modbus TCP communication

TankMaster supports Modbus TCP communication to the Rosemount 2460 System Hub. Existing plant network can be used for connections between TankMaster and one or several system hubs.

Using Ethernet communication greatly increases communication speed and reduces wiring complexity especially in large redundant tank gauging systems.

Figure 11: Reduntant Tank Gauging System Using Modbus TCP
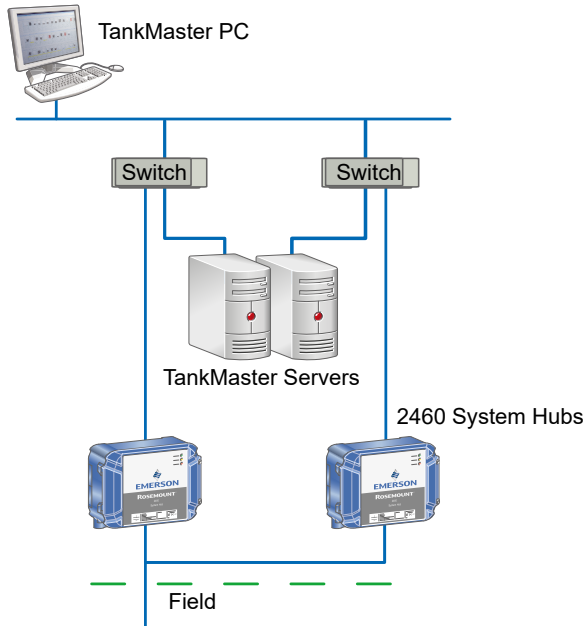
Note
TankMaster redundancy requires two Modbus TCP client connections in each Rosemount 2460 System Hub.

Tank inventory calculator

The tank inventory calculator is a tool that calculates inventory values based on operator entered input values and the selected tank configuration. Input value fields are initiated with the current tank configuration and input values from devices. The operator can then change some or all input values and select **Calculate** to calculate inventory values.
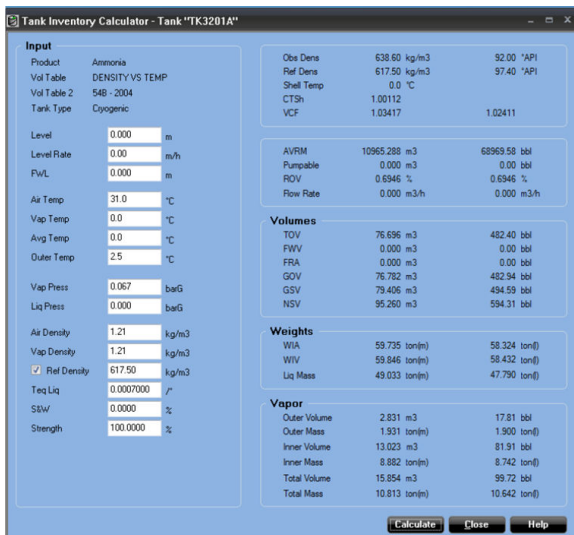
Tank transfer calculator

A tool for the operator to calculate transferred product values or closing values using inventory parameters.
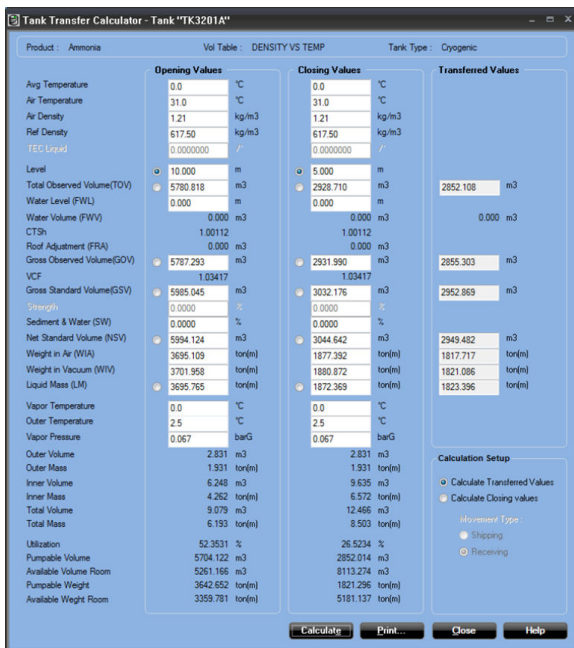
Software packages

- **WinOpi** is a complete custody transfer and inventory software package. All calculations are based on current API and ISO standards. Configuration of the Rosemount Tank Gauging system is made with **WinSetup**, which is included in the delivery.

- **WinView** is a software package with basic inventory capabilities. It is a cost-efficient alternative for operational control at smaller tank terminals, marketing terminals, biofuels and chemical plants, etc. Configuration is made with **WinSetup**, which is included in the delivery.

See Table 1 and Table 2, for further information.

Table 1: Available Features, WinOpi and WinView

Feature	WinOpi	WinView
Alarms	Yes	Yes
Host communication, Modbus, and OPC	Yes	Yes
Custody transfer	Yes	No
API tables	Yes	No
Batch handling	Yes	No
Reports	Yes	Yes, limited[1]
Translation	Yes	Yes
TankMaster network support	Yes	Yes
Customization	Yes	Yes
Create new group of tanks	Yes	Yes
Proof tests	Yes	Yes
Roof monitoring	Yes	No
Full containment/Roll-over	Yes	No

Table 1: Available Features, WinOpi and WinView *(continued)*

Feature	WinOpi	WinView
Redundancy	Yes	No
HTG (hydrostatic tank gauging)	Yes	No
Hybrid tank gauging	Yes	No
Historical function	Yes	No

(1)   *Available Reports features for WinView:*

- *Report types: LogReport in text and/or pdf format.*
- *Outputs: Printed, text file, and e-mail.*

Table 2: Supported Data Parameters, WinOpi and WinView

| Supported (measured or calculated) data parameters	WinOpi	WinView
Level	Yes	Yes
Ullage	Yes	No
Level rate	Yes	Yes
Flow rate	Yes	Yes
Average temperature	Yes	Yes
Spot temperature	Yes	Yes
Vapor temperature	Yes	Yes
Air temperature	Yes	No
Cool-down and leak detection temperature	Yes	No
Free water level	Yes	Yes
Free water volume	Yes	Yes
Total observed volume (TOV)	Yes	Yes
Gross observed volume (GOV)	Yes	No
Gross standard volume (GSV)	Yes	No
Net standard volume (NSV)	Yes	No
Vapor, liquid, and air pressure	Yes	No
Observed density	Yes	Yes, manually entered
Reference density	Yes	No
Mass calculations	Yes	Yes, limited

Proof test manager

TankMaster includes a proof test manager which allows operators to perform proof test of Rosemount Tank Gauging overfill prevention systems safely, and remotely from the control room. The continuous product level monitoring can be combined with proof testing at regular intervals.

The proof test manager provides a number of different tests:

- High level alarm verification using a reference reflector

- High level alarm verification with simulated reference reflector

- One-point level verification by hand-dipping to verify automatic level measurements

- Analog output verification

- Relay output verification

A step-by-step proof test wizard guides the user through selected tests.

Figure 12: Proof Test Windows
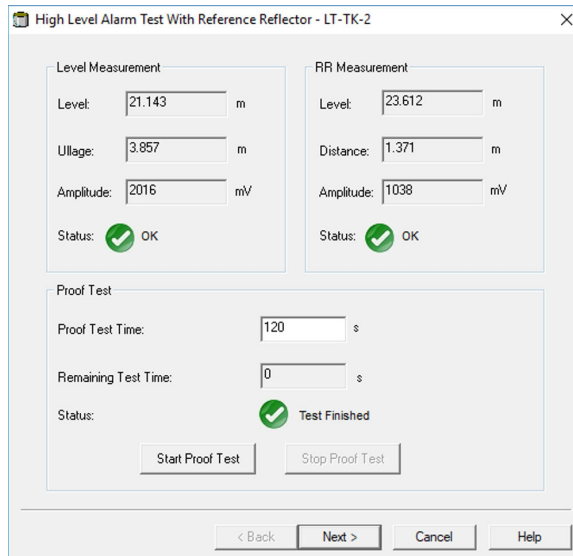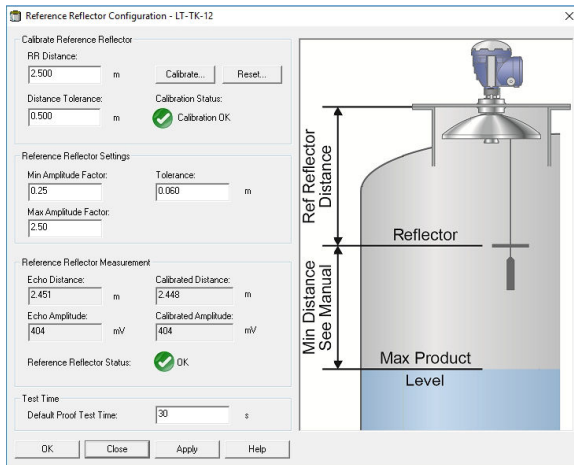
Once the selected proof tests are done, a summary will show a list of tests which have been performed and the results.

Figure 13: Proof Test Summary Window
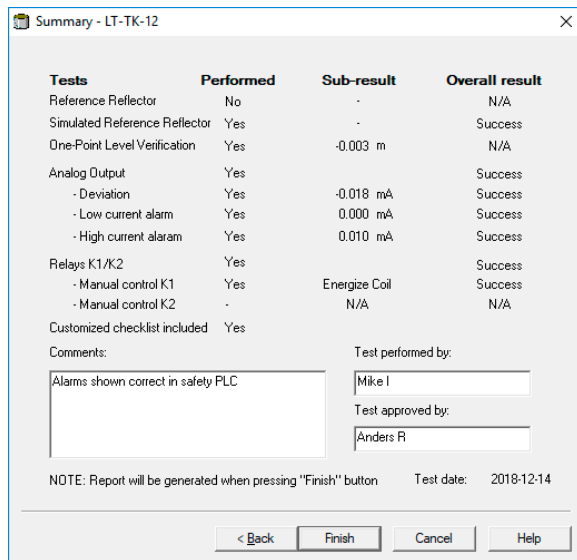
Proof test report

When the proof test is finished and approved, a test report is automatically created.

The test report includes field device specific information for identification, detailed test results, when the test was performed, who performed the test, and who approved it.

Proof test history

All proof test reports can easily be displayed on a later occasion using the proof test history option.

Proof test scheduling

The proof test scheduling option lets the user specify when the next proof test should be performed. You may also set the test frequency and the desired type of reminder: Pop-up message and/or Email.

Floating roof monitoring

The status of a storage tank's floating roof is monitored by this function. It can detect if the roof is tilting, sinking, or if the roof is floating higher/lower than normal.

Level radars are installed at multiple points, spaced evenly around the perimeter of the roof. The following installation alternatives are available:

- Shell mounted with/without level reference
- Roof mounted

See Table 3 for detailed information about the installations.

Drain sump monitoring and hydrocarbon detection

A drain gauge and/or a hydrocarbon gauge can be added to the floating roof monitoring system.

The drain gauge is installed in the drain sump and detects if the drain clogs and water does not run off. Rosemount 3308 Wireless Guided Wave Radar or Rosemount 2160 Wireless Vibrating Fork can be used for drain sump monitoring.

Installed at the floating roof, the hydrocarbon gauge detects potential hydrocarbons on the roof. Typically, the Rosemount 702 Wireless Discrete Transmitter with Liquid Hydrocarbon Detection is used.

Figure 14: Floating Roof System with Shell Mounted and Roof Mounted Radar Devices
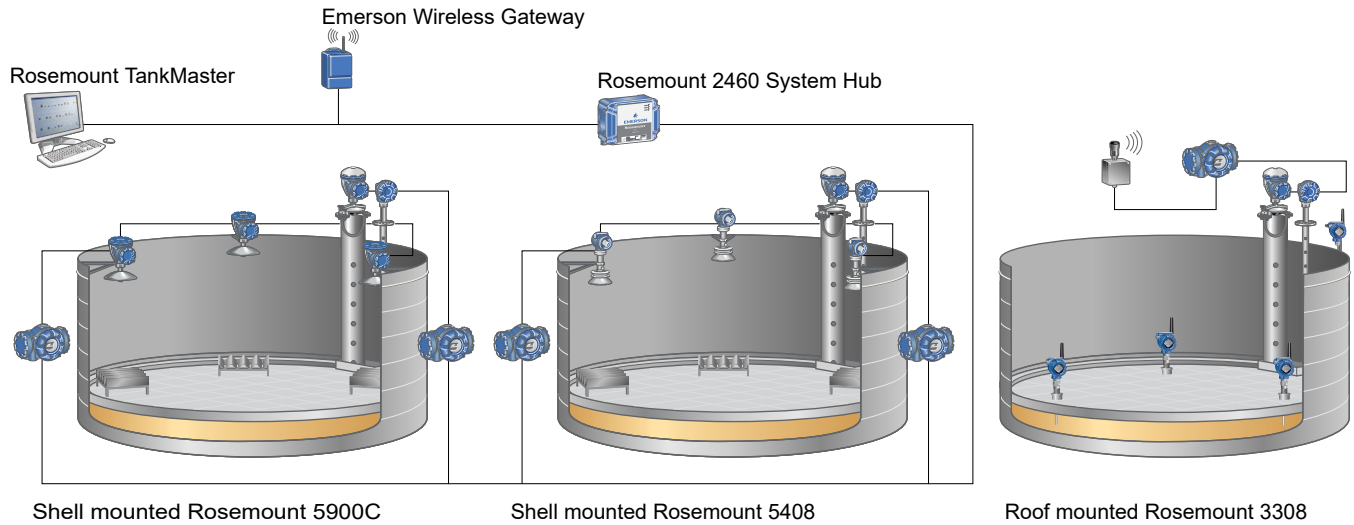

Shell mounted Rosemount 5900C   Shell mounted Rosemount 5408   Roof mounted Rosemount 3308

Table 3: Floating Roof Tank Installation Characteristics

	Shell mounted with/without level reference	Roof mounted
Radar device	Rosemount 5408 or 5900C Non-Contacting Radars	Rosemount 3308 Wireless Guided Wave Radars
Number of radar devices	Minimum three, maximum six	Minimum three, maximum six
Installation	Installed at top of tank shell[1] Also suitable for fixed roof tanks with inner floating roof	Directly on floating roof
Level	Measures distance to the floating roof	Measures distance to the liquid
Tilt	Tracks tilt by comparing measured distance from radars to the floating roof	Tracks tilt by comparing measured distance to the liquid
Roof floating	Tracks roof floating high/low by referencing liquid surface[2]	Tracks roof floating high/low by measuring distance to the liquid
Possible alerts/alarms	▪ Roof tilt ▪ Roof floating high/low[2] ▪ Drain sump full with water[3] ▪ Hydrocarbons detected[4]	▪ Roof tilt ▪ Roof floating high/low ▪ Drain sump full with water[3] ▪ Hydrocarbons detected[4]
Data transmission to control room	Wired connection from level gauge to tank hub Wired or wireless communication from tank hub to control room	Wireless communication

[1] *Local site license may be required for compliance to frequency spectrum approval.*
[2] *Requires level reference (inventory level gauge in still-pipe).*
[3] *Requires drain sump gauge.*
[4] *Requires hydrocarbon detection gauge.*

Graphical overview of floating roof status

TankMaster provides a visual status overview of the floating roof tank together with detailed values for roof floating, roof tilt, and roof drain sump. If an alarm is generated, it is also visible here.

A detailed view provides the user with additional information for each tilt gauge, see Figure 15. History of maximum tilt and maximum/minimum roof floating deviation values are also displayed with corresponding time and tank level.

Figure 15: Detailed View – Roof Floating Higher Than Normal
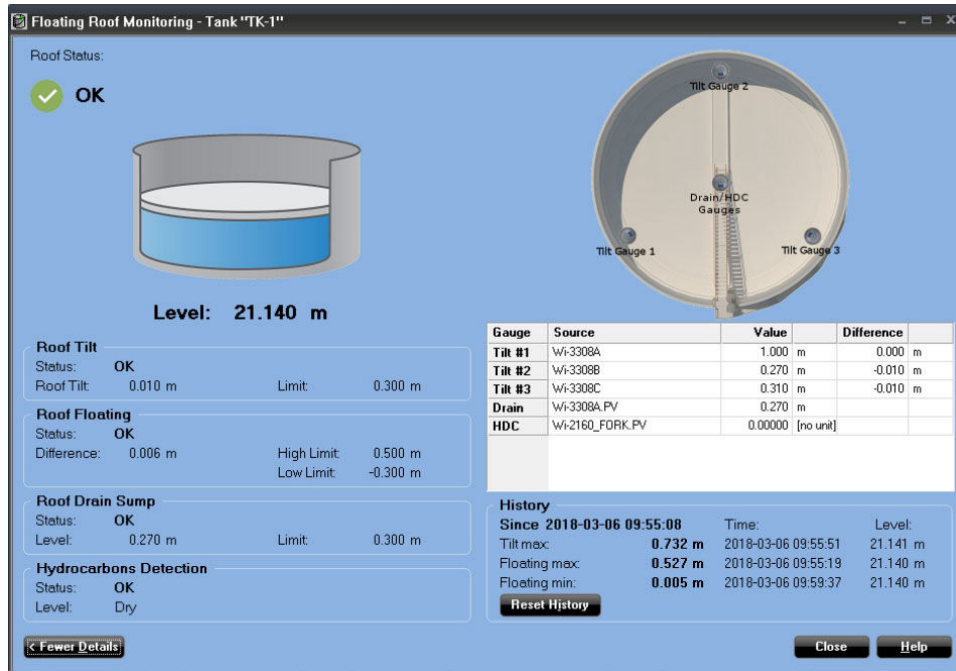
A group summary view displays an overview showing the current mode of all floating roofs, as shown in Figure 16.

The user customizes the view with desired parameters such as: Roof status, level, roof tilt, roof floating, roof drain, and hydrocarbons.
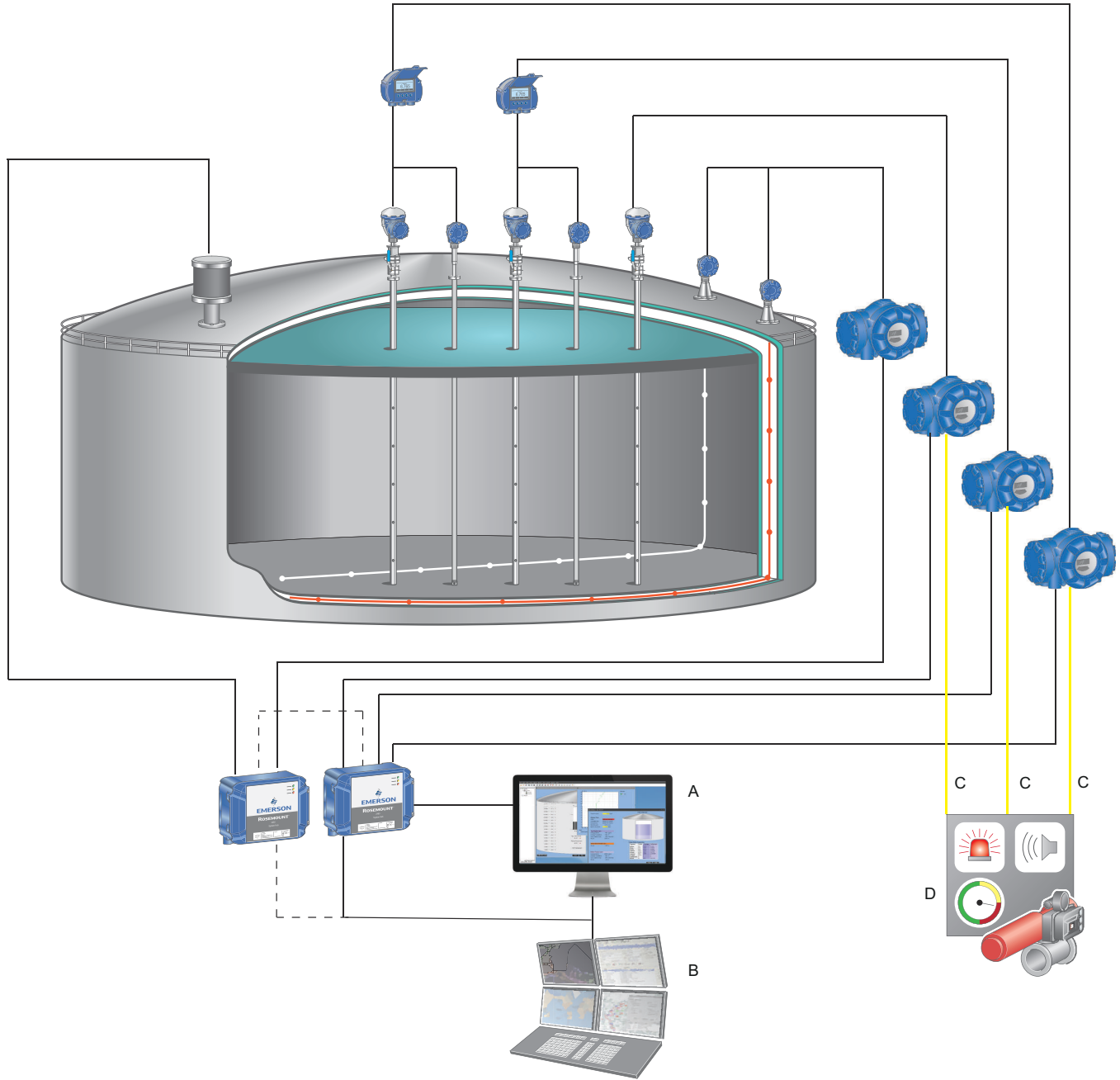
Figure 16: Group Summary View of Floating Roof Tanks
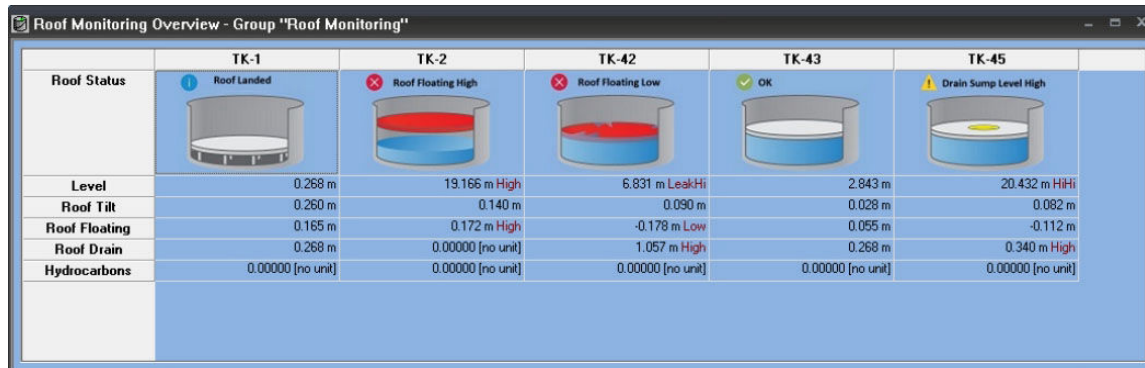
Full containment storage tanks

The TankMaster software provides support for full containment storage tanks, including features for roll-over prediction and stratification.

Figure 17: Typical System Overview for Storage of LNG

A. Rosemount TankMaster
B. DCS/Host
C. SIL 2 Relay or 4-20 mA analog signal
D. Safety Instrumented System (SIS)

A full overview of all tank parameters is available in TankMaster. Temperature and density profile views for both current and historical profile values allows operators to detect signs of product stratification.

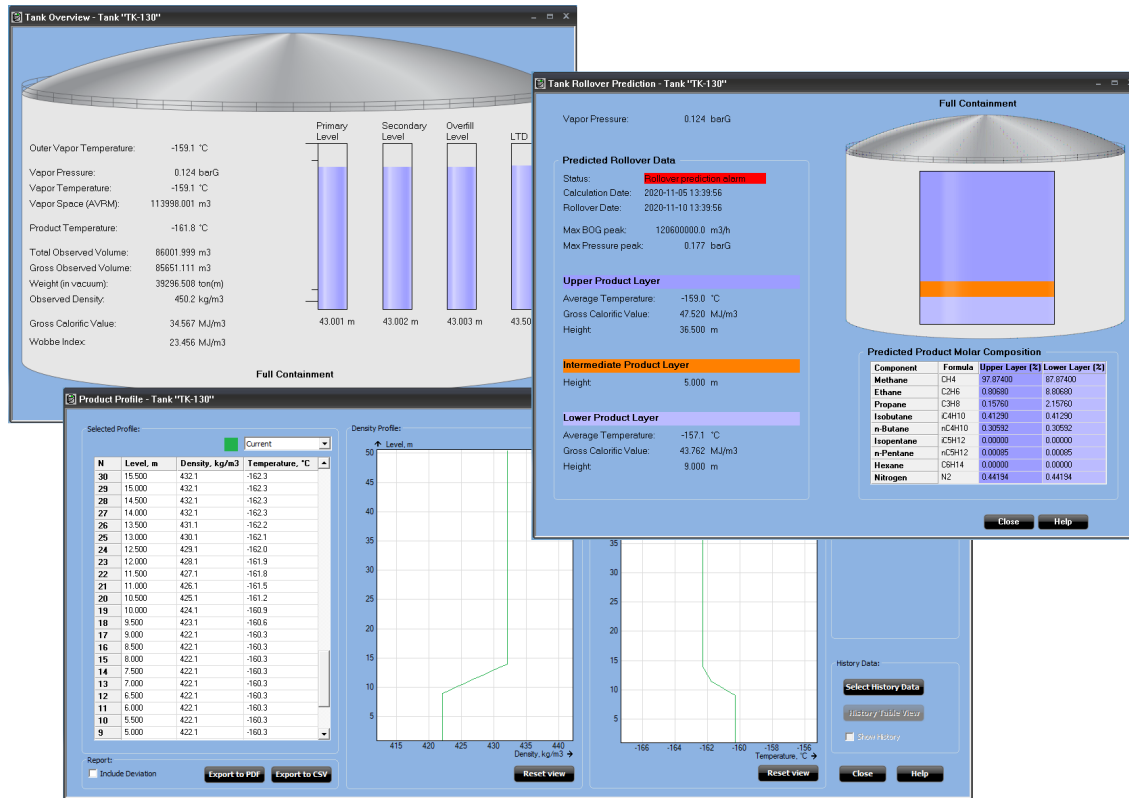**Figure 18: Examples of TankMaster Windows for Full Containment Storage Tanks**

Table 4: Full Containment Storge Tank Support for Refrigerated Gases and LNG

Feature	Description
Multiple level device supported	Supports 3x Level + Stratification instrument (LTD)
Dual inventory temperature devices	Supports 2x Multi spot temperature sensors for average inventory temperature and back up temperature profile
Cool down and leak detection	Supports up to 64 individually positioned temperature measurement positions for inner tank shell and annular space
Full containment inventory calculations	Including vapor equivalent product for dual vapor compartments
Stratification view (for LNG)	Stratification and composition information based on LTD and/or Tank Gauging System data
Roll-over prediction (for LNG)	Including predicted max boil over gas evolution and pressure peak
Deviation alarms	Available for level, temperature (product/leak detection), and product profile deviations (temperature/density)

Roll-over prediction

TankMaster conducts calculations of different LNG layers stored to provide roll-over risk prediction and main consequences e.g. BOG peak and pressure release. The roll-over prediction calculations require site characteristics data, tank characteristics data (e.g. tank size), LNG characteristics, and site and tank operational parameters.

Figure 19: Tank Rollover Prediction Window
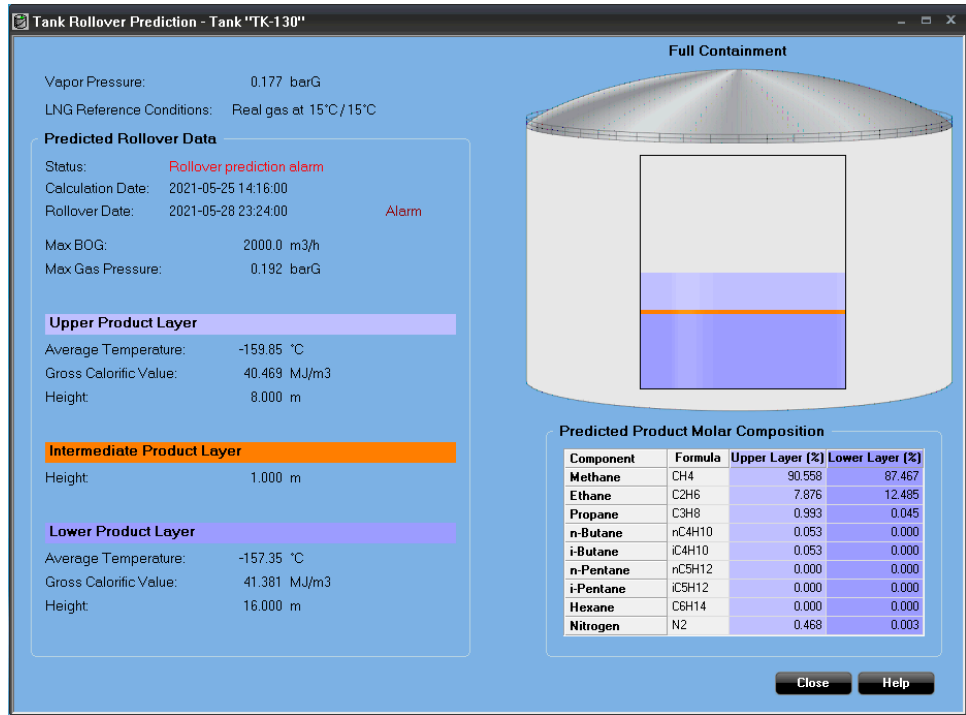
Hardware requirements

The following minimum system specification is required for TankMaster version 6.G1[1]:

Table 5: Hardware requirements

General	
Product	Rosemount TankMaster; WinOpi, WinSetup, WinView
TankMaster PC Hardware	
Processor	Intel® Core™ i5, 2.40 GHz
System type	64-bit Operating System, x64-based processor
Internal Memory (RAM)	16 GB
Hard Disk Drive (HDD) or Solid State Drive (SSD)	128 GB ■ TankMaster and SQL Server 2017 Express need approximately 800 MB. ■ Supported operating systems, up to Microsoft® Windows Server 2022, need approximately 25 GB.
Monitor	Any 22-inch Full HD 1920x1080 monitor
USB ports	One or more dedicated ports, depending on the number of hardware license keys and communication channels, for example: ■ One port for TankMaster hardware key. ■ One port for each protocol channel if Rosemount 2180 Field Bus Modem serial converter is used. ■ One port for LNG Rollover hardware key in case this function is used.
Hardware license key	For hardware license key consider the following: ■ One hardware license key is used for each PC hosting TankMaster TankServer. ■ An extra hardware license key is required for LNG Rollover function for each PC hosting TankMaster TankServer. ■ Hardware key is not required for TankMaster clients that are supposed to connect to the remote TankMaster server. ■ A hardware key is not required to run WinSetup but is required for tanks installation.
FBM	Rosemount 2180 Field Bus Modem Part no: 9240002-635[1]
Network Interface Card (NIC)	Network Interface Card required for Modbus TCP protocol channel and/or for TankMaster Client/Server communication.

(1) *Rosemount 2180 is used for connecting the TRL2 field bus from Rosemount Tank Gauging field devices or the Rosemount 2460 System Hub, to the TankMaster PC in the control room. It can be connected to the PC using either the RS232 or the USB interface.*

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(1) For previous TankMaster versions other system requirements apply. Please contact Emerson Rosemount Tank Gauging for more information.

Software requirements

Operating system

For 6.G1 and higher, 64-bit Operating System with English (US) in the list of preferred languages. Supported families with latest security updates:

- Microsoft® Windows™ 11
- Microsoft Windows 10
- Microsoft Windows Server 2022

All TankMaster nodes must have operating systems with the same regional settings. The decimal point (".") as a decimal symbol must be set on all nodes.

Networking

- TankMaster network clients require a minimum bandwidth of 10 Mbit/s.

For more information: **Emerson.com/global**

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