8810 RTU VeRTUe Guide

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Software Version 1.1

Vertue Programmers Guide

Automation Solutions for Oil & Gas, Defense, and Aviation

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Read this manual carefully and make sure you understand its contents before using this product. Follow all instructions and safety guidelines presented in this manual when using this product. If the user does not follow these instructions properly, Varec cannot guarantee the safety of the system.

Contents

1 Using Vertue

This chapter describes how to use Varec's new OPC client, known as Vertue, for the 8810.

Vertue is a configuration application that allows users or technicians to configure, diagnose, and troubleshoot the 8810. Vertue provides options to configure which modules are installed within the RTU chassis, communication settings for individual modules and channels, specific parameters for individual points, bulk changes to parameters across multiple points, alarm tests, and mapping of Modbus registers to RTU tags.

Vertue will also support efficiency tools and diagnostic views to allow the user to quickly find points/tags, to visualize mismatches in configuration, and to quickly recognize abnormal conditions.

Vertue is designed to support users in accurate configuration of the 8810 by restricting selections to those that are valid for selected protocol and devices.

Vertue uses the OPC UA standard and supports both online and offline configurations.

> **Note** Varec recommends using Vertue over the older ViewRTU due to issues ViewRTU has with the following items: setting up alarms, only allowing 150 points to be created, does not allow points to be added or deleted, lack of firmware download capabilities, and the ability to download tank gauge configurations.

> **Note** The latest PDF manual for the version of Vertue being used can be accessed from the Vertue Home screen by clicking on Documentation.

System Requirements

This section describes the general system requirements for Vertue.

Vertue is available in both a standalone application and will be in the future an integrated part of the FuelsManager application suite. As a standalone application, Vertue will be installed independently of any FuelsManager functionality and can be installed on a lower-end laptop configuration.

In an integrated deployment in the future, Vertue is expected to run on a higher-end server class platform. Furthermore, Vertue will allow the sharing of common configuration parameters so that the user only has to configure parameters in one place.

Standalone Minimum Requirements:

- Windows 10
- 8 GB of RAM
- 500 GB HDD
- 100/1000 GB network card
- Available USB port

Vertue Default Settings

This section describes default settings for the 8810 RTU before configuring it through Vertue. If a Factory Reset command is sent to the 8810 RTU, all settings will be cleared and these four settings will be set to the below listed settings.

- **IP Address:** 192.168.1.1

- **Subnet Mask:** 255.255.255.255
- **Username:** admin
- **Password:** 8810rtu

The Vertue Menu Bar

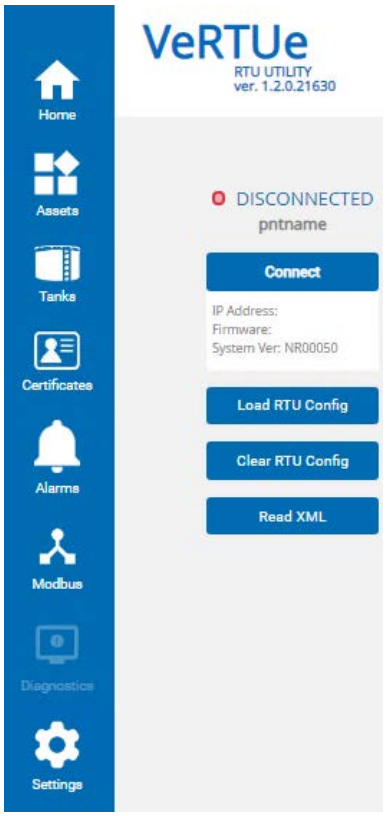

Figure 1-1: Vertue Navigation Menu

Vertue has five sections on the navigation bar to help the user configure, analyze, and fix issues for the 8810 RTU: Home, Assets, Tanks, Certificates, Alarms, Modbus, and Settings. Each choice on the navigation bar will have its own section below.

Connecting to the 8810 RTU

First thing to do is to connect with the 8810 RTU device you want to work with. Click **Connect** to open up the Connect to RTU window. Enter the **IP Address**, the **Login Id**, and the **Password** for the 8810 RTU device you want to connect to.

Security settings are selected on the screen where the user selects the appropriate **Security Mode**. Depending upon the 8810 RTU's security configuration, **Security Policy**, **User Identity**, as well as **Certificate** are other available options as shown in the figure below.

Once Vertue has connected with the 8810 RTU, either select **Read from RTU** to download the current configuration from the RTU to Vertue including the modules and how they are configured, the tank farm configurations, and also the Diagnostic Views set up for the RTU, or **Write to RTU** if you have a pre-configured file you want the RTU to use.

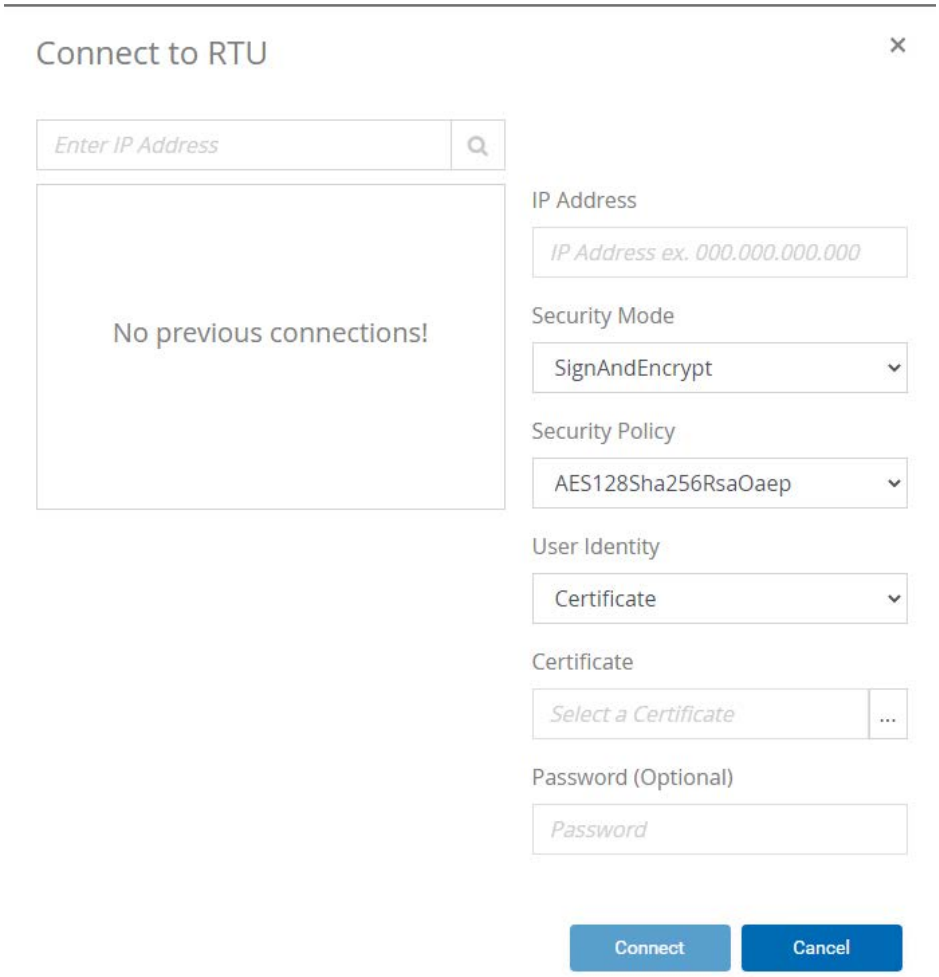

Figure 1-2: Vertue Connect to RTU Window

The Home Menu

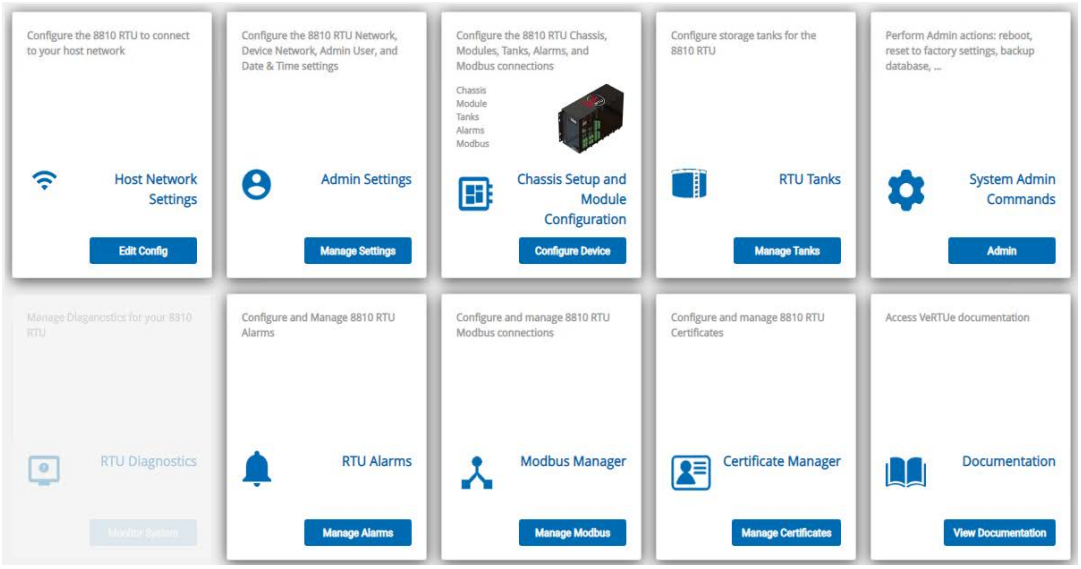

Figure 1-3: Vertue Home Menu

The Home menu allows the user to set up the host network, setup and configure the RTU 8810 chassis and modules, configure any connected tank farms, and configure how Vertue displays diagnostic information.

Host Network Settings

The Host Network screen is where the user can create a file which enables connection to an RTU through configuration of the IP address, subnet mask, and gateway address for each RTU the user wants to communicate with.

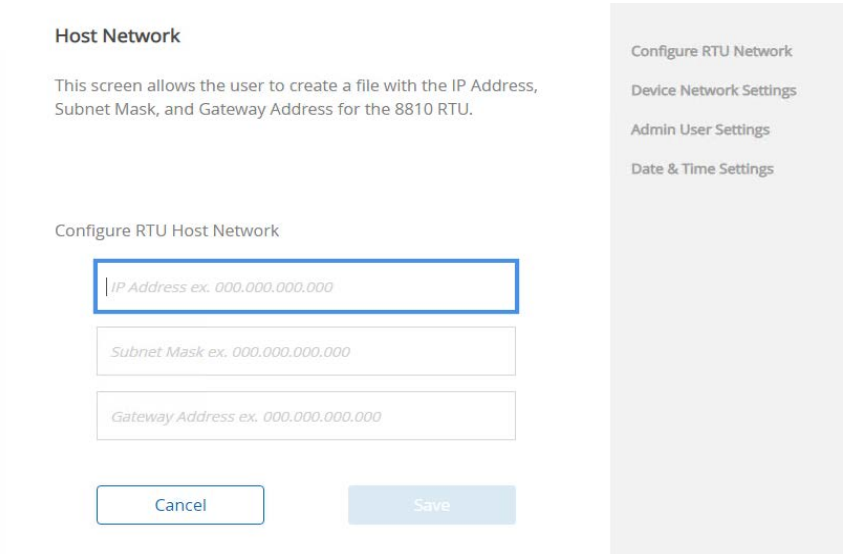

Figure 1-4: Vertue Host Network Settings

Admin Settings

The **Admin Settings** is where users can configure the RTU's host network, configure the device's network settings, reset the user's password, and configure the Date & Time Settings as needed.

Chassis Setup and Module Configuration

The **Chassis Setup and Module Configuration** screen allows the user to configure the 8810's CPU and any modules plugged into the RTU. Either the Chassis Setup and Module Configuration link's Configure Device link or the Assets link on the left-side navigation menu takes the user to the same configuration screen. For more details, see the Assets Menu section below.

RTU Tanks

The **Tank Manager** screen allows the user to configure the tanks and command each tank. Either link takes the user to the same configuration screen. For more details, see the Tank Manager Screen section below.

System Admin Commands

The **System Commands** screen is where the user can interact with the 8810 RTU to reset the RTU, apply firmware, apply or backup a database, as well as perform a factory reset or a limited factory reset. For more details, see the System Admin Commands Screen section below.

RTU Diagnostics

RTU Diagnostics is a feature Varec is currently working on implementing in the future.

RTU Alarms

The **Alarm Manager** screen is where the user can configure each point (whether it is a tank, a module, the CPU, a port, or an alarm) to alert Vertue users when any certain parameters are triggered according to how they are set up. Either the RTU Alarms link or Alarms link on the left-side navigation menu take the user to the same configuration screen. For more details, see the Alarm Manager Screen section below.

Modbus Manager

The **Modbus Manager** protocol handler uses Modbus Maps to scan data from Modbus slave devices. Each point of a Modbus Map is responsible for setting up the parameters to communicate to a slave device. For each slave device being scanned, there must be a corresponding point. Multiple points may be used to scan a single device.

The user specifies data addresses and block sizes for requesting data from slave devices. Points are processed sequentially and data is requested from the slave device.

The Modbus settings in Vertue are used to monitor the tanks needs to match the settings in the Modbus Master device. Look for what Modbus settings are required in the documentation for the gauge that is attached to the tank.

Certificates

The **Certificates** link allows the user to view, select, associate, and configure what certificates Vertue will use to communicate with the 8810 RTU. While what security methods to connect to the 8810 RTU are selected on the Connect to RTU screen upon logging in, the recognized

certificates will be listed on the Certificates screen and what form of security required to connect will be configured on the 8810 RTU's CPU module screen.

Documentation

The **Documentation** link opens up the latest version of the Vertue manual that matches the version being used.

The Assets Menu

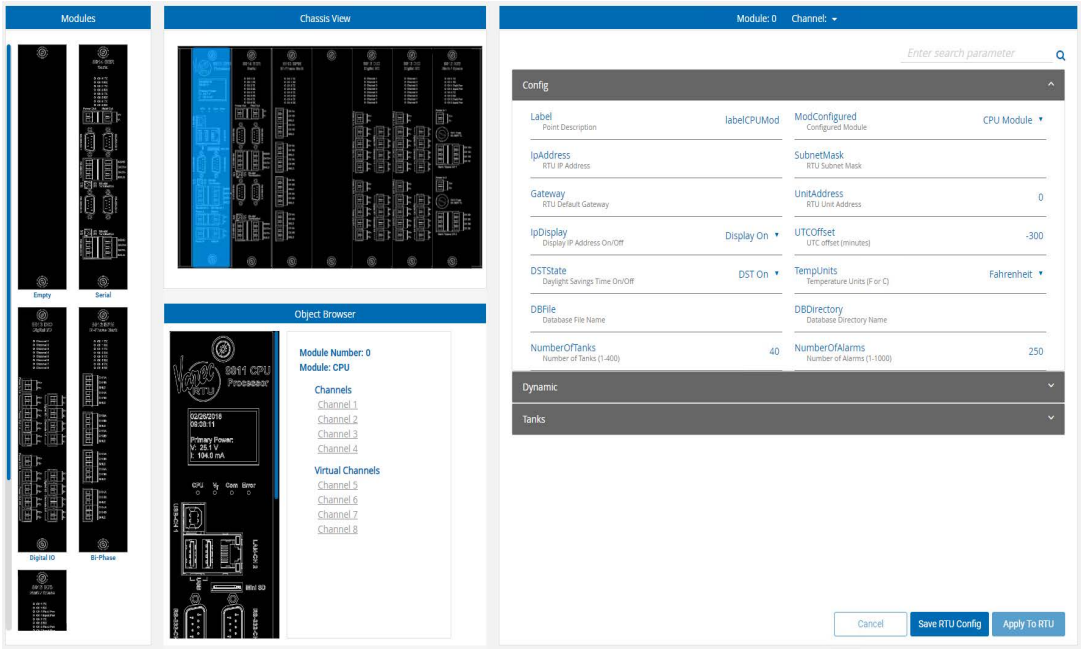

Figure 1-5: Vertue Assets Menu

Configuring Modules and Viewing Settings

The user is able to view and configure the settings for each module.

Under **Modules**, the user can drag the different types of modules the 8810 can use (currently the Tankway Module (8816), Mark/Space Module (8815), the Serial Module (8814), the Digital IO Module (8813), and the Bi-Phase Mark Module (8812).

To set up a specific module, drag the image on the left side of the window under **Modules** into the appropriate slot. If you want to reset what is listed in a slot, drag the **Empty** slot on top of the module to clear the settings.

The ways to configure a module under the Config section are to either select the module at the top of the window which will give you the ability to configure the settings for the entire card or by clicking either on the closeup image of the card's connection points below or click on the specific channel to the right of the module's closeup image.

Figure 1-5 shows the CPU selected at the top of the Chassis section. To the right under Config, the settings for the CPU module can be configured as needed. The Dynamic and Tanks sections show the relevant data for the selected module.

The Config, Dynamic, and Tanks menus dynamically change depending upon what is selected to the left (the specific module as a whole or the specific channel).

Config allows the user to configure values for a module's or channel's writable parameters. The 8811 CPU Module has the most settings and information of the various settings due to it being the brains behind the entire 8810 RTU.

Dynamic allows the to send commands and view the read-only parameters for a module or channel.

Tanks allows the user the ability to configure and monitor tanks connected to the module's channels. Clicking **Tank Assignment** takes the user to the Tanks menu.

The **Enter search parameter** field above the Config, Dynamic, and Tanks section allows the user to narrow down the visible parameters based upon what is typed into the field. If nothing is available under the section, it won't display anything. The search functionality is based around a search functionality which is helpful when unsure what the parameter is named.

For example, while the CPU module is selected under Chassis, a user could type in the word **check** and it would display the information for SysCheckSum and PntCheckSum. The search field only searches through the command and parameter names, not any value or descriptive text.

The Tanks Manager Screen

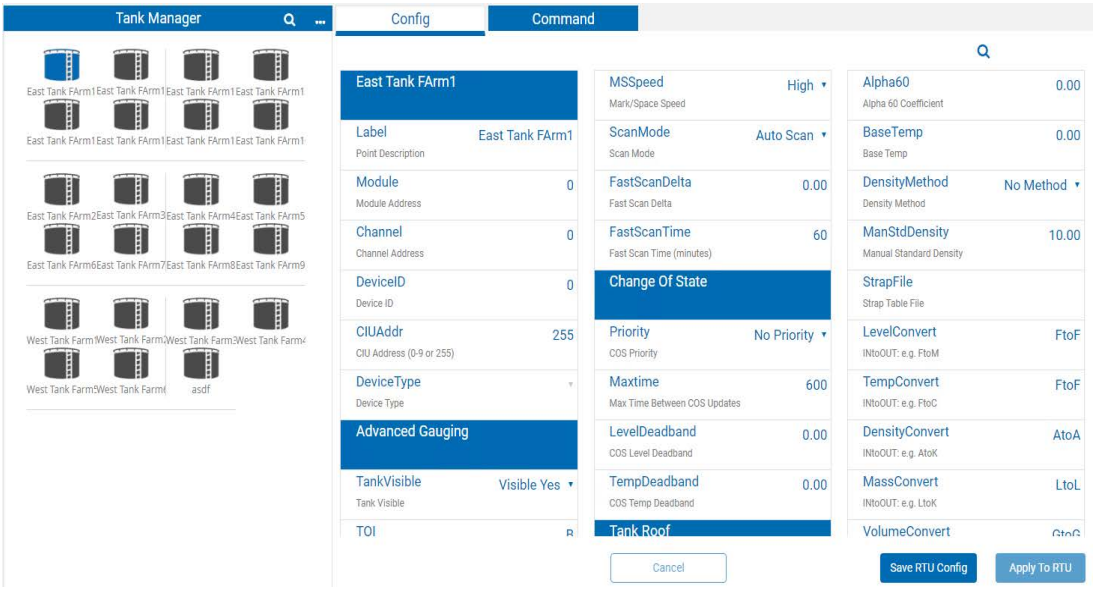

Figure 1-6: Tanks Menu

The Tanks menu window has three areas: **Tank Manager** where active tanks are displayed, the **Config** tab where the user can configure or change the settings for the specific tank, and the **Command** tab where information concerning the tank such as temperature, levels and pressures, as well as calculations of the material being stored are displayed.

In the Tank Manager area, the search function allows the user to find a specific tank if the number of tanks is large. The three dots is where a user can Activate a tank or Deactivate one as needed. The number of tanks available for activation is controlled by the CPU Module parameter, NumberOfTanks.

In both the Config and Command tab areas, the search functionality allows the user to display the desired setting using a incremental search method. Any part of the label for the setting will work; for example, typing in "Vol" in the search field returns the settings for StrapVolume, WaterVolume, GrossVolume, VolCorFactor, and NetVolume.

Users can update multiple tanks at once using multi-select. When multiple tanks are selected, any common parameter values are displayed. If a parameter value is shown blank, its value varies among the selected tanks. A user can set the value for any parameter for all selected tanks at once. Tank Label and Device ID offer Auto Number functionality. For label, the user can specify a Label with starting and increment by numbers. For Device ID, a user will specify the starting and increment by numbers.

When configuring a tank, note that the Device Type list is populated based on the protocol of the associated module and channel. Subsequently, Device Commands are restricted based on the device type configured

First Time Setup Steps (Connecting, Configuring a Module, and Tank Setup)

Once the 8810 RTU and modules are physically connected to the tank feed, the following steps help with first time software setup of connecting, setting up a card, and then connecting a tank to a card.

Note The Apply To RTU button is only functional when you are connected to an RTU. This button will be grayed out if there are no changes to apply.

Note The Cancel button will be grayed out if there have been no changes made since the last Apply To RTU, Cancel, Load RTU Config or Clear RTU Config.

Connecting

1. Launch a web browser and enter the following address: **localhost:60000**.
2. Click **Connect** on the left side of the screen.
3. Enter the **IP Address** of the 8810, **Login Id**, **Password**, and click **Connect**. Previous RTU connections are remembered in the left pane.
4. On the **Connecting to RTU** screen, click **Read from RTU**. Click **OK** to read the active RTU configuration.

Configuring a Module

1. On the Chassis Setup and Module Configuration card, click **Configure Device**.
2. Drag the card you want to add under the **Modules** section on the left side of the screen over to the appropriate slot for on the Chassis. If you make a mistake, you can drag the Empty module over the slot you want to reset.

   Note If you select the slot before dragging the image of the module over, check the ModInstalled parameter to see what module should be configured for the slot.

   Note The CPU is hardcoded in the first slot, slot 0. Other modules can be swapped out as needed.
3. Confirm that the card you dragged over is the correct module by verifying that the **HwID** or **ModInstalled** under the Dynamic section of the module is the same. If so, continue. If not, drag the correct module into the slot.
4. Click the **Config** section of Module & Channel setup, and then click the blue text for **Label**. Enter the desired label for the installed module.
5. Click either the channel you want to configure on the physical image of the module or click the channel listing under the textual listing of the card's channels.
6. Select the correct **Protocol** under the Protocol section.
7. Click **Config** and configure the following:
   a. Enter the **Label** (an optional setting) for the channel
   b. Set **ChanState** to **Enable Chan**

c. (For Enraf Master) Set the baud rate to the desired rate (1200 or 2400)

8. Click **Apply to RTU**. The Apply to RTU button is only functional when you are connected to an RTU. This button will be grayed out if there are no changes to apply.

Configuring a Tank

1. Click the **Tanks** menu to start configuring a tank, or click **Tanks** on the configuration window for the relevant module's channel, and then click **Tank Assignment** to associate a tank with this specific channel.
2. On the **Tank Manager** section, click the three dots in the top right corner, and then click **Activate** on the dropdown list to display what inactive tanks are able to be selected.
3. Select the specific tank, and then click **Activate** to activate the tank. You can also multi-select tanks using window select, Shift-select, or Ctrl-select.
4. Select the tank under **Tank Manager**.
5. Set the **Module** to what slot the module is in that the tank is connected to.
6. Set the **Channel** to what channel the tank is connected to.
7. Set the **DeviceID** for the Device ID.
8. If not using CIU, CIUAddr can stay as the default setting of 255.
9. Set **DeviceType** to what type of device the tank is communicating through to the 8810 RTU. Note the list of available Device Types is based upon the protocol of the assigned channel.
10. Set **ScanMode** to either **Normal Scan** or **Auto Scan** as desired.
11. Set **Priority** to as desired.
12. Configure the information under the **Tank Roof** section as needed.
13. Configure the **DensityMethod** to the method to be used. **NOTE:** If Manual Standard is selected, set the next field, **ManStdDensity** to the density to use.
14. Configure any other settings as is needed.
15. Click **Apply to RTU** when finished. The Apply to RTU button is only functional when you are connected to an RTU. This button will be grayed out if there are no changes to apply.

Verification of Channel and Tank Setup

To make sure a channel is properly configured as well as whether a tank is connected and reading, follow the below mentioned steps.

1. Click on **Tanks** on the left navigation menu unless already on that window.
2. Select the tank under **Tank Manager**.
3. Check the values for **Position**, **Level**, or **Temp** to verify values are displaying for the current status of the material stored in the tank. If the values are 0, walk back through the above settings to make sure the configuration of the channel and tank are correct.

The Tank Config Tab

In the below listed table of tank Configuration parameters, each parameter is defined to explain the concept behind it and how it fits together in the 8810 RTU/FuelsManager ecosystem.

Name	Default Setting	Definition
Tank Name		
Label	Tank xxx	The point description or label for the tank.
Module	0	Module address (CPU Module = 0, Interface Modules = 1-6)

Name	Default Setting	Definition
Channel	0	Channel address (1–8)
DeviceID	0	Device ID
CIUAddr	255	CIU address (0–9 or 255)
DeviceType	0	Device type depends upon the protocol of the associated channel. Options include: Enraf 811 Enraf 854 Enraf 873 Enraf 990 ATT 4000 FTT 29xx GSI 2000 Varec 1800 Varec 1900 Varec 6500 NMS5x NMS8x NRF590 NRF81 NMR8x LJ1000 LJ1500 LJ2000 MTS
Advanced Gauging		
TankVisible	No	Tank visible is set during the Activate and Deactivate tank functions: No Yes
TOI	B	Type of instrument
Mode	Run Mode	Mode of operation: Run Mode Test Mode
DataMode	0	Data mode: 0x0001 = Byte Swap 0x0002 = Word Swap 0x0003 = Swap Both
ScanCmd	BC	Scan command for instrument
PerInterleave	0	Periodic interleave factor
PerItemCmd	(null)	Periodic item command
PerFilter		Periodic reply data filter
MSSpeed	High	Mark/Space speed: High Low
ScanMode	Normal Scan	Scan mode: Normal Scan Auto Scan
FastScanDelta	0.00	Fast scan delta
FastScanTime	60	Fast scan time in minutes
Change of State		

Name	Default Setting	Definition
Priority	High Priority	Change of state priority: No Priority High Priority Low Priority
Maxtime	600	Specifies the maximum time (in seconds) between automatic Change of State data being sent to the Host in response to a Change of State request. When the Maxtime period expires, the Value to is forced to appear as if it has changed even if has not, ensuring that the data is sent to the host periodically. Setting Maxtime to 0 disables this option. The maximum is 255 seconds.
LevelDeadband	0.1	Affects the Change of State processing of the level deadband. It allows the user to filter out insignificant changes, freeing the communication link to send other data.
TempDeadband	0.25	Affects the Change of State processing of the temperature deadband. It allows the user to filter out insignificant changes, freeing the communication link to send other data.
Tank Properties		
RoofType	Not In Table	Roof Type: In Table Not In Table Fixed Roof No Roof Note: Similar to FuelsManager, this combines the concepts of "Roof Type" and "Weight in Strapping Table" into one parameter.
TankGeometry	Vert Cylinder	Tank Geometry: Vert Cylinder Horz Rounded Horz Flat
ShellCorrect	No Correction	Tank Shell Correction: No Correction Uninsulated Insulated
TankMaterial	Mild Steel	Tank Shell Material. Only used if ShellCorrect is "Uninsulated" or "Insulated": Mild Steel Stainless Steel Aluminum Other Material
ExpCoef	0	Tank shell expansion coefficient. Only used if ShellCorrect is "Uninsulated" or "Insulated." User configurable if TankMaterial is "Other Material" or unspecified. Otherwise, this field is automatically filed out.
Tank Calculations		
StandardsOrg	API	Standards organization: API (American Petroleum Institute)

Name	Default Setting	Definition
StandardsRev	Commodity 2004	Standards revision: Commodity 2004 (API standard)
CommodityType		Commodity type: Alpha 60 Crude oil Refined product Lubricating oil
Alpha60	0.00	Alpha 60 coefficient. Range is 0.00023 to 0.00096 for Fahrenheit and 0.000414 to 0.001674 for Celsius
StdTemp	15	Standard temperature. Only used if Temp is in Celsius. Set to either 15C or 20C, although any floating point value is allowed. If Temp is in Fahrenheit, then 60C is used regardless of the StdTemp value.
StrapFile	(null)	Strap file table (a.k.a., tank strapping chart). ASCII name of the Strap File (up to 32 characters).
LevelConvert	FtoF	INtoOUT: e.g. F = Feet M = Meters m = millimeters
TempConvert	FtoF	INtoOUT: e.g. FtoC
DensityConvert	AtoA	INtoOUT: e.g. AtoK
WeightConvert	LtoL	INtoOUT: e.g. LtoK
VolumeConvert	GtoG	INtoOUT: e.g. GtoL
PressConvert	PtoP	INtoOUT: e.g. PtoM
SWPct	0	Sediment & water %
LevelOffset	0.00	Numeric offset applied to level
TempOffset	0.00	Numeric offset applied to temperature
Calculation Source		
LevelSrc	Level	Product level source: Level ManLevel
ManLevel	0	Manual level value
TempSrc	Temp	Product temperature source: Temp ManTemp
ManTemp	0	Manual temperature value
SolidsLevelSrc	ManSolidsLevel	Solids level source: SolidsLevel ManSolidsLevel
ManSolidsLevel	0	Manual solids level value. SolidsVol is forced to 0 if ManSolidsLevel is a negative number.
WaterLevelSrc	ManWaterLevel	Water level source: WaterLevel ManWaterLevel

Name	Default Setting	Definition
ManWaterLevel	-1	Manual water level. WaterVol is forced to 0 if ManWaterLevel is a negative number.
DensityMethod	No Method	Density method: No Method Gauged Manual Standard
StdDensity	0	Standard density. If DensityMethod is "Manual Standard," then this is manually configured by the user. If "Gauged," then StdDensity is calculated when the value of GaugedDensity or DensityTemp change. Whether "Manual Standard" or "Gauged," the value of StdDensity is saved in non-volatile memory.

The Command Tab

In the below listed table of tank Command parameters, each parameter is defined to explain the concept behind it and how it fits together in the 8810 RTU/FuelsManager ecosystem.

Name	Default Setting	Definition
Tank Name		
GaugeStatus	0 (Undefined)	The value that indicates the status of the gauge The values are: Block Bottom Doing Profile Failure Finding Water Following Level Following Water Invalid Lock Test Service Mode Transitional UnderRange Valid
Position	0	Displacer Position
Level	(null)	Sourced product level
Temp	(null)	Sourced product temperature
SolidsLevel	(null)	Sourced solids level (a.k.a., sediment level) The solids level can be manually configured (see SolidsLevelSrc) or based on SolidsLevel, with SolidsLevel being the same as the bottom level. Note that only some Enraf and E+H devices support bottom level.
WaterLevel	0	Sourced water level Note that only some Enraf and E+H devices support water level.
GaugedDensity	(null)	Gauged density

Name	Default Setting	Definition
DensityTemp	0	Sourced product temperature at the time that GaugedDensity was calculated. Note that only some Enraf and E+H devices support gauged density.
Pressure	0	To be used with flowing products, which is not supported at this time. Currently always reported as 0.
RTD1	0	Resistance temperature detector
ScanStatus		Scan status
Elapse	(Displays current DateTime of unit)	Time of last update/scan
PntStatus	112	Byte value indicating status of point. The values are: 0x0000: No error 0x00000080 = Stale Level 0x00000040 = Invalid Density 0x00000020 = Invalid Temperature 0x00000010 = Invalid Level 0x00000008 = Calculation Error 0x00000004 = Not Scanning 0x00000002 = CIU Timeout 0x00000001 = Device Timeout
PntCheckSum		CRC-16 Checksum for point's static Configuration Parameters
Advanced Gauging		
DeviceCmd		Device commands are available based on the selected device type and protocol: Reset Gauge Raise Servo Freeze Servo Find Water Level Follow Level Run Test Run Immersed Profile Find Bottom Copy ItemCmdFile to RTU Read Device Config Write Device Config Copy .cfg to USB Copy .log to USB Calibrate
CmdStatus		The status of the last command: Start Complete Error Executing Invalid Timeout
CalLevelCmd	0	Calibration level command
AlarmStatus	0x 0	Tank alarm status
LevelStatus	0x 0	Tank level status
DeviceStatus	0x 1	Device status
TempStatus	0x 0	Tank temperature status

Name	Default Setting	Definition
WaterStatus	0x 0	Water level status
ItemCmd		Item command
TestCmd		Operational test command
CmdReply		Command reply
PerCmdReply		Periodic command reply
PerFPValue1	0	Periodic floating point value #1
PerFPValue2	0	Periodic floating point value #2
PerIValue1	0	Periodic integer value #1
PerIValue2	0	Periodic integer value #2
ItemCmdFile		ItemCmd file name
FastScanCmd	Disable	Fast scan command: Disable Enable
FastScanTimer	0	Fast scan timer in minutes
ScanList	Normal Scan	Scan list: Normal scan Fast scan
Tank Calculations		
CalcCmd		Tank calculation command: Copy SF to RTU = copy StrapFile from USB to the RTU (a.k.a., upload the StrapFile) Copy SF to USB = copy StrapFile from the RTU to USB (a.k.a., download the StrapFile) Run Calculation Note: Typically, calculations are only run when an input changes. The Run Calculation option allows the user to manually force a one-time recalculation.
CalCmdStatus		Calculation command status
CalcCode		Tank calculation status code, with a value of "0" meaning there is no error with the most recent tank calculations.
CalcText	StrapFile Not Configured	ASCII text explanation of CalcCode
StrapTemp	0	Product temperature read from the StrapFile
StrapDensity	0	Product density read from the StrapFile
RoofFloatingHt	0	Roof floating height read from the StrapFile. Used with RoofLandedHt to determine Critical Zone and Landed floating roofs. (The Critical zone is the level between the roof fully floating and fully landed.)
RoofLandedHt	0	Roof landed height read from the StrapFile.
RoofWt	0	Roof weight read from the StrapFile.
Density Calculations		
ObsDensity	0	Observed product density. ObsDensity is calculated from StdDensity and the product temperature.

Name	Default Setting	Definition
DensinAir	0	Product density in air. Converted from ObsDensity based on API 12.3, table 5.
StdDensinAir	0	Product standard density in air. Converted from StdDensity based upon API 12.3, table 5.
Volume Calculations		
VolCorFactor	0	Volume correction factor. Calculated from StdDensity and product temperature and pressure.
TempCorFactor	0	Correction due to temperature
PressCorFactor	0	Correction due to pressure
TankShellTemp	0	Tank shell temperature If ShellCorrect is "Insulated," then TankShellTemp is the same as Temp. Otherwise, TankShellTemp is: ((7 x Temp) + AmbientTemp) / 8.
TankShellCor	0	Tank shell correction factor. Only used if ShellCorrect is set to "Correction." 1 + (2 x ExpCoef x (TankShellTemp – StrapTemp)) + ($ExpCoef^2$ x (TankShellTemp *StrapTemp)^2)
FloatRoofCor	0	Floating roof correction Only used if RoofType is "Not In Table." RoofWt / (DensInAir x VolCorFactor)
FloatRoofAdj	0	Floating roof adjustment Only used if RoofType equals "In Table." (RoofWt / StrapDensity) – (RoofWt / ObsDensity)
StrapVol	0	Total observed volume. Strap look up from product level.
SolidsVol	0	Strap lookup for SolidsLevel
WaterVol	0	Strap lookup for WaterLevel, with SolidsVol subtracted.
FreeWaterVol	0	Free water volume SolidsVol + WaterVol
RoofVol	0	Roof volume If RoofType equals "Not In Table," then RoofVol = FloatRoofCor. If RoofType equals "In Table," then RoofVol = FloatRoofAdj.
GrossObsVol	0	Gross observed volume ((StrapVol – FreeWaterVol) x TankShellCor) +/– FloatRoofCor or FloatRoofAdj
GrossStdVol	0	Gross standard volume GrossObsVol x VolCorFactor
TotalCalcVol	0	Total calculated volume GrossStdVol + FreeWaterVol

Name	Default Setting	Definition
NetStdVol	0	Net standard volume Note that the x (100 – SW%) / 100" portion of the equation is called "Correction for Solids & Water (CSW)." ((100 – SWPct) / 100) x GrossStdVol
SWVol	0	Sediment & water volume GrossStdVol – NetStdVol
Weight Calculation		
GrossStdWt	0	Gross standard weight GrossStdVol x DensInAir
NetStdWt	0	Net standard weight NetStdVol x DensInAir
NMS NRF NMR		
NMSDeviceCmd		NMS device command: Follow Level Raise Displacer Stop Displacer Find Bottom Lvl Follow Upper IF Follow Lower IF Upper Density Middle Density Lower Density Repeatability Find Wtr Level Release Tension Run Tk Profile Run IF Profile Run Man Prof Level Standby
NMSCmdStatus		Status of the last NMS command
NMSStatusCode		Gauge status code
NMSStatusText		Gauge status text
UpperIntLevel		Upper interface level
LowerIntLevel		Lower interface level
BottomLevel		Tank bottom
UpperDensity		Upper density
MiddleDensity		Middle density
LowerDensity		Lower density
NxxObsDensity		Nxx observed density
P1		P1 (bottom)
P2		P2 (middle)
P3		P3 (top)
VaporTemp		Vapor temperature
AirTemp		Air temperature
LevelPct		Tank level %
MeasLevel		Level without corrections
TankUllage		Tank ullage

Name	Default Setting	Definition
ActualDiag		Actual diagnostics
Alarm1		Alarm 1
Alarm2		Alarm 2
Alarm3		Alarm3
Alarm4		Alarm 4
FilteredDist		Filtered distance
SignalQuality		Signal quality

The Certificates Manager Screen and Security Settings

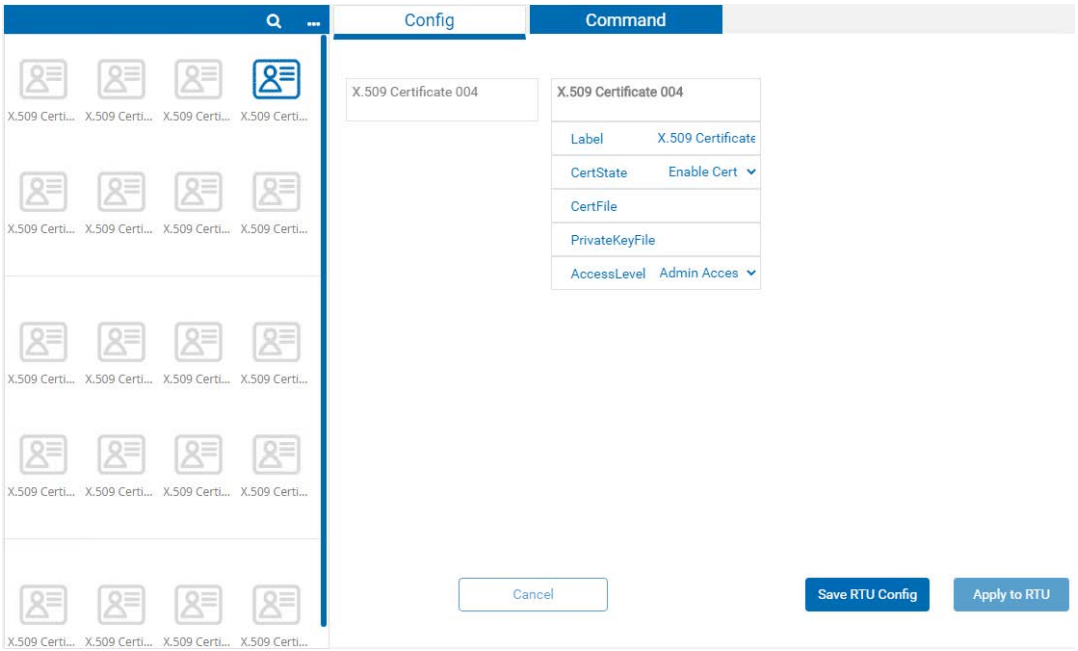

Figure 1-7: Vertue Certificates Manager

There are different ways to configure the 8810 and Vertue to connect with each other—no authentication (Anonymous), simple username and password, and certificates. The 8810 RTU also allows for encryption of communications between Itself and any OPC UA Clients.

Below are the different ways to configure the 8810's security modes to connect to the 8810 RTU: via use of X.509 certificates or simple username and password (which is the default method to connect).

Anonymous

Select Security Mode of None, then User Identify of Anonymous in order to connect without any authentication.

User Name

Select Security Mode of None, then User Identify of User Name in order to connect with a username and password.

Certificates

Upon connecting to the 8810 RTU with Vertue, a popup window opens that asks the user "Add to trusted store?" This starting up of the Vertue service creates the Vertue client certificate. The user would then copy the generated certificate to the 8810 RTU. More details for how to setup and enable certificates are listed below.

8810 Server Certificate

When a client, such as Vertue, first connects to the 8810, the Server Certificate will be presented. The user will be prompted as to whether to add the certificate to the Trusted Store. The user must click Yes in order for this client to be able to communicate with the 8810. This Vertue self-signed certificate is automatically placed in C:\ProgramData\Softing\OpcClient\pki\own\certs.

This self-signed certificate is used for any connection that requires Sign or Sign & Encrypt, even if the User Identity is set to Username. Make sure to copy this self-signed certificate into one of the 8810's certificate slots.

Client certificates other than the Vertue self-signed certificate (RTU 8810 OpcUaInterface [xxx].der (where [xxx] is the number generated) must have a .pfx file present and located in C:\ProgramData\Softing\OpcClient\pki\own\private. Client certificates are only used when Mode is set to Sign or Sign & Encrypt **and** User Identity is set to Certificate. This certificate must also be copied into one of the 8810's certificate slots.

Note The Security Mode, Security Policy, and User Identity parameters are stored in the .rtuconfig file. When working with saved files, be sure to confirm the parameters are set properly for your RTU prior to doing a Write To RTU.

Note Use the pwreset file to restore default security on the RTU if you are unable to connect to it. The pwreset file will set Security Mode back to None, Security Policy to None, and User Identity to Username. It will restore the default admin and user1 passwords so those accounts can be used to connect.

Vertue Client Certificate

When the VarecVertue service is started for the first time, a new client certificate will be generated, called RTU 8810 OpcUaInterface, and placed in the Microsoft certificates store.

Use the following steps to export the generated certificate and copy it to the 8810 RTU.

1. In the Windows search field, type **certificates** and press **Enter**. Windows Certmgr or Certlm (Certificates Manager) opens.
2. Click on the arrow next to **Personal**, and then open **Certificates**.
3. Right click on **RTU 8810 OpcUaInterface**, select **All Tasks**, and then select **Export**.
4. In the Certificate Export Wizard, click **Next**.
5. Select **Yes**, export the private key, and then click **Next**.
6. Select DER encoded binary X.509 (.CER), and then click **Next**.
7. Browse to a location to save the exported certificate, and save it as R**TU 8810 OpcUaInterface**. Click **Next**, and then **Finish**.
8. Browse to the folder location of the exported certificate, and rename the file extension to **.der**
9. Copy the exported certificate to a USB flash drive, and insert the USB flash drive into the 8810 once the copying is done.
10. In Vertue, go to **Certificates** and select a certificate not previously used
11. Enter **CertFile** of **RTU 8810 OpcUaInterface.der**.
12. Apply to RTU.
13. Click on the **Command** tab.
14. Under Command, click **CertCmd** and choose **Copy to RTU**. Click Yes.
15. By default, the certificate will be enabled.

Configuring the 8810 RTU's Authentication Options

1. From the Vertue Home menu, select either **Assets** on the left menu or **Configure Device** from the home page.
2. Select the **CPU** from the Chassis View selection.

3. Under the Config section, select the **SecurityMode** to use for authentication between Vertue users and the 8810 RTU.

   Note With the use of X.509 certificates, the 8810 RTU can ensure three different levels of security: None, Signed, and SignedAndEncrypted through the use of Vertue.

   Vertue allows administrators to configure the RTU to use the three above-listed methods:

   - **None** which means no security: no certificates and the data is transmitted unencrypted
   - **Sign** where the client and the 8810 have confirmed their identities using X.509 certificates allowing for unencrypted data transfer
   - **SignAndEncrypt** where the client and the 8810 have confirmed their identities using X.509 certificates and are exchanging encrypted data so only the 8810 and the confirmed client can understand the encrypted data being transferred

   Note There are five communication options that the 8810 RTU use with or without the use of X.509 certificates through the following settings:

   - **Anonymous**—where the client connects to the 8810 with no form of verification
   - (Default) **Unsigned & Unencrypted Username Login**—where only a username and password are required for verification like the default 8810 RTU login listed in this manual.
   - **Signed & Unencrypted Certificate Login**—where both the 8810 and the client have connected server and client X.509 certificates to allow secure, but unencrypted data communication
   - **Signed & Encrypted Username Login**—where the client can connect with the 8810 via username and password, but the communications are encrypted
   - **Signed & Encrypted Certificate Login**—where both the 8810 and client have connected server and client X.509 certificates, allowing for secure and encrypted data communication

4. Set the SecurityPolicy which is what form of encryption the 8810 RTU will use which gives the options of Basic256Sha256, Aes128Sha256Oae, and Aes256Sha256Pss.

   Note The following list explains the basic concepts of the three SecurityPolicy choices:

   - **Basic256Sha256** is the standard OPC UA security policy designed for high security needs
   - **Aes128Sha256Oae** is one of the two choices for the gold standard of encryption using 128 bit variable encryption method
   - **Aes256Sha256Pss** is the second choice for the gold standard of encryption, but uses a more robust 256-bit variable encryption method

5. Set the User Identity by selecting one of the following choices:

   - **Anonymous** for allowing people to log in with no username and password or certificate
   - **UserName** for requiring a username and password combination to log in
   - **Certificate** for requiring a valid certificate to be on the client to allow a connection

The System Administration Commands Screen

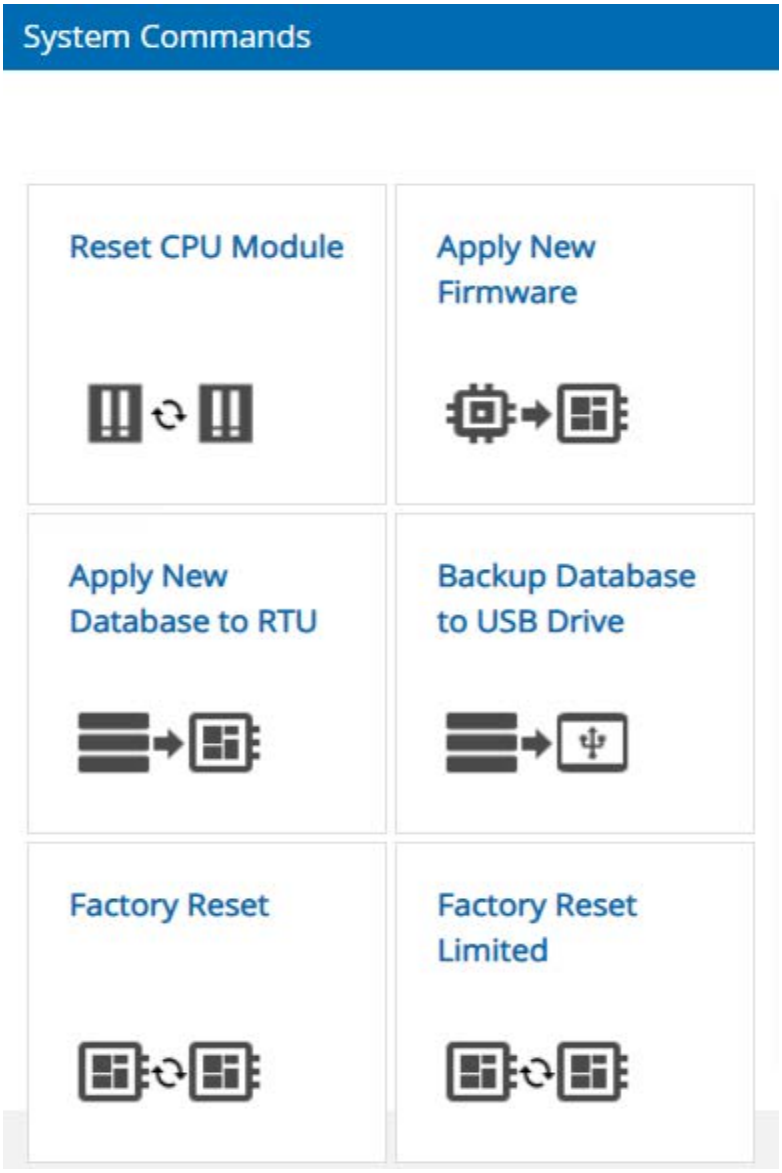

Figure 1-8: System Admin Commands Screen

Reset CPU Module

The **Reset CPU Module** command is the equivalent to power cycling the CPU module which provides power to the entire RTU.

When this option is selected, all devices connected to the 8810 RTU lose communication, including the device that initiated the reset. Communication is restored once the firmware reinitializes the RTU which should take approximately one minute.

> **Note** An external USB flash drive cannot be connected to the 8810 RTU if the user wants the RTU to power cycle. Once there are no USB drives connected to the device, the 8810 will be able to reboot.

Apply New Firmware

The **Apply New Firmware** command allows the user to upgrade the CPU Module's firmware through a connected external USB flash drive.

The firmware consists of two executable files. The larger of the two files, the **boot.uimage** contains the operating system, libraries, and Board Support Package (BSP). The smaller of the two files, the **ngrtu** contains the application. It is possible to upgrade either one or both at the same time.

To upgrade the firmware, the user must copy one or both files (depending upon the need) onto a USB flash drive and then plug it into one of the CPU Module's USB slots. The LCD will display a message for approximately three seconds indicating that an external USB flash drive has been plugged in.

After an external USB flash drive has been connected and the Apply New Firmware command has been selected, the RTU will begin to copy the firmware from the USB flash drive to a backup memory location on the internal Micro SD card. This process takes up to 60 seconds to complete.

If the copying is successful, the files are moved to the primary memory location on the internal Micro SD card, and CmdStatus will display "Complete" for five seconds before displaying "Remove USB." As soon as the USB flash drive is removed, the RTU will power cycle and boot up with the newly added firmware.

If the copying of the new firmware fails, the files are not moved to the primary memory location and CmdStatus will report an error.

Apply New Database to RTU

The **Apply New Database to RTU** command allows the user to copy a new database to the RTU.

> **Note** Applying a new database to the RTU is the recommended second step of the process. Varec recommends first backing up the database to a USB drive before applying a new database.

This option is used with the CPU Module's DBFile 32-character ASCII string parameter. DBFile specifies the name of the directory on the USB flash drive the 8811 should use to find the database. By assigning unique DBFile values to each RTU, it is possible to store multiple RTU databases to a single USB flash drive.

To copy the database, the user must plug in an external USB flash drive and then plug it into either of the CPU Module's two USB slots. The LCD will display a message for approximately three seconds indicating that an external USB flash drive has been plugged in.

After an external USB flash drive is detected by the RTU and the Apply New Database to RTU command is selected, the RTU will begin to copy the database from the USB flash drive to a backup memory location on the internal non-volatile memory. This process takes up to 60 seconds to complete.

If the copying is successful, the files are moved to the primary memory location on the internal non-volatile memory, and CmdStatus will display "Complete" for five seconds before displaying "Remove USB." As soon as the USB flash drive is removed, the RTU will power cycle and boot up with the newly added firmware.

If the copying of the new database fails, the files are not moved to the primary memory location and CmdStatus will report an error.

Backup Database to USB Drive

The **Backup Database to USB Drive** command allows the user to make a backup copy of the 8810's database to an external USB flash drive.

Note Backing up the existing database is the recommended first step with applying a new database to the RTU as the second step of the process.

This option is used with the CPU Module's DBFile 32-character ASCII string parameter. DBFile specifies the name of the directory on the USB flash drive the 8811 should use to backup the database to. By assigning unique DBFile values to each RTU, it is possible to store multiple RTU databases to a single USB flash drive.

To backup the database, the user must plug in an external USB flash drive into either of the CPU Module's two USB slots. The LCD will display a message for approximately three seconds indicating that an external USB flash drive has been plugged in.

After an external USB flash drive is detected by the RTU and the Backup Database to USB Drive command is selected, the RTU will begin to copy the database from the internal non-volatile memory to the external USB flash drive. This process takes up to 60 seconds to complete.

If the copying is successful, the files are moved to the primary memory location on the internal non-volatile memory and CmdStatus will display "Complete" for five seconds before displaying "Remove USB."

If the copying of the new database fails, the files are not moved to the primary memory location and CmdStatus will report an error.

Factory Reset

The **Factory Reset** command allows the user to restore RTU's entire configuration database to its factory default settings. The only configuration parameter that will not be reset is the SystemTime which is stored on the CPU Module's battery backed-up Real-Time clock.

Note Extreme caution should be used with this command since all configuration settings will be restored to the factory default. This includes **IpAddress** which will cause the TCP/IP device to be unable to communicate with the 8810 until **IpAddress**, **SubnetMask**, **Gateway**, and **SystemTime** are reconfigured.

An external USB flash drive cannot be plugged into the device for the device to complete a factory reset.

Factory Reset Limted

The **Factory Reset Limited** command allows the user to restore RTU's entire configuration database to its factory default settings except for **IpAddress**, **SubnetMask**, **Gateway**, and **SystemTime**. Selecting Factory Reset Limited will make sure the 8810 RTU can communicate with Vertue upon rebooting.

The Alarm Manager Screen

The **Alarm Manager** screen is where the user can configure each point (whether it is a tank, a module, the CPU, a port, an interface, or an alarm) to alert Vertue users when any certain parameters are triggered as well as see the status of the configured alarms.

Alarm Point Indexes and alarm names will automatically update to reflect data modified on the chassis and tank pages within Vertue.

For tank and chassis label changes made outside of Vertue, Vertue alarms will not update until a user browses to the Tanks or Chassis page to allow those parameters to be read and processed. At that time, the new labels will be available to the alarms in Vertue and will update automatically.

Note The order of the alarms under Alarm Manager is in alphabetical order based first upon enabled alarms, disabled alarms, and then undefined alarms.

Note A gray alarm is disabled or undefined, a black alarm is enabled, a blue alarm is the current selected alarm, and a red alarm is an active alarm.

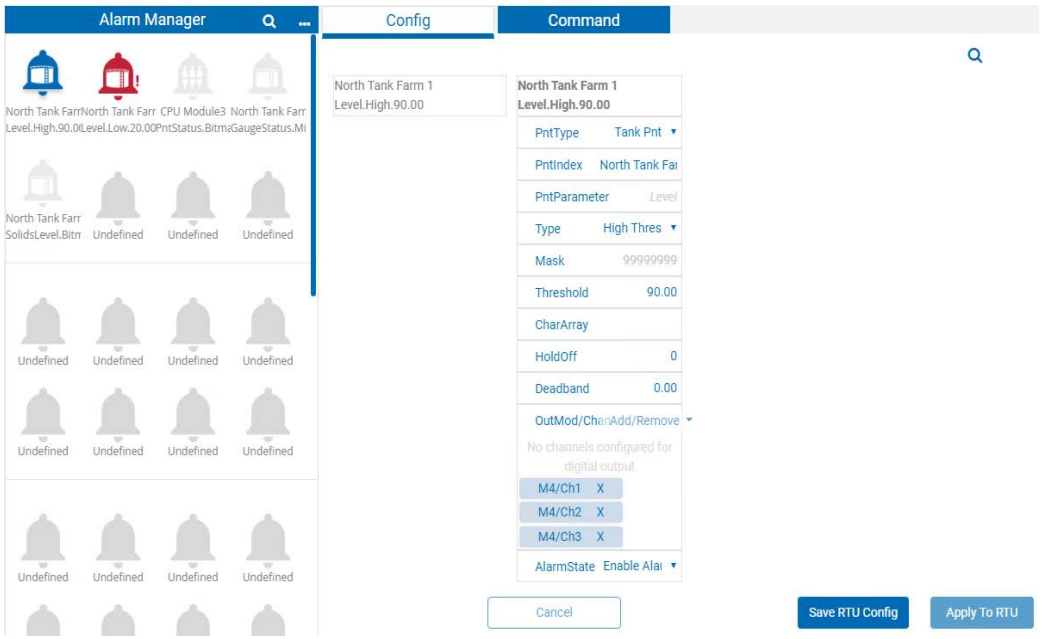

Figure 1-9: Alarm Manager Commands Screen

First Time Alarm Setup Steps

To add and configure an alarm for a tank, first follow the steps to configure a channel and a tank for the configured channel, and then follow the steps below. To add and configure any other alarms, make sure you've set up the associated device and follow the steps below:

Note The Apply To RTU button is only functional when you are connected to an RTU. This button will be grayed out if there are no changes to apply.

Note The Cancel button will be grayed out if there have been no changes made since the last Apply To RTU.

1. Click the **Alarms** icon on the left-side navigation bar or click **Manage Alarms** on the RTU Alarms card from the home page.
2. Select an **Undefined** alarm icon under the Alarm Manager column.
3. Set the **PntType** to the desired type.
4. Set the **PntIndex** to the setting based upon the PntType selected above.

   Note Both the PntIndex and PntParameter fields are "type ahead" fields that are filtered based on any text present. You may have to clear an existing value in order to see other values available for selection.

5. Select the **PntParameter** from the list. Anything you start typing will help narrow down your potential parameters.

   Note Both the PntIndex and PntParameter fields are "type ahead" fields that are filtered based on any text present. You may have to clear an existing value in order to see other values available for selection.

6. Select the alarm **Type**. Note that only the Types that are compatible with the selected PntParameter's data type will be provided for selection. What type you select will determine

whether the Mask (hexadecimal or decimal), Threshold (floating point number), or CharArray (ASCII string) field is enabled.

Bitmap, Match, and Mismatch only use the Mask field below. Low Threshold and High Threshold only use Threshold below. CharArray only uses the CharArray field below.

The other two fields will be grayed out.

7. Enter the **Mask**, **Threshold**, or **CharArray** depending upon what Type was selected above.
8. Set the **HoldOff** field to the timed delay setting as desired.
9. Set the **Deadband**, if needed, to what extra amount the threshold should reach before deactivating the alarm.
10. Click the **Add/Remove** dropdown link to open the **Outmod/Chan** selection dialog. Select a single or multiple OutMod/Chan settings or click again to deselect what module and channel is needed for the alarm configuration.
11. Set the **AlarmState** to Enable Alarm if the alarm should be enabled at this time.

Note The naming convention for each alarm is based upon what settings are selected in the creation of the alarm. If the settings are changed, the name of the alarm will also be altered to reflect the current settings configured. For example, **East Tanks1.Level.High.40.00**.

Note Setting up an alarm point in PntType will give the name of the alarm based upon the selection. For example, **Alarm Pnt 1.AlarmCmd.Low.20**.

Alarm Configurations and Command Fields

The Config Tab

Parameter	Point	Values	Factory Default	Notes
PntType		None CPU Pnt Interface Pnt Port Pnt FP Reg Pnt INT Reg Pnt Tank Pnt Alarm Pnt	None	This is the point type for the point index for which the point parameter is associated. PntType serves as a filter to restrict the list of PntIndexes that are returned in the next field.
PntIndex		CPU Module (1) Interface Module (1-6) Port (1-56) FP Register (1-1000) Integer Register (1-100) Gateway Block (1-108) Tank (1-400) Alarm (1-1000)	None	This is the point index for the alarm.
PntParameter		40 = PntStatus 78 = DIOHwValue 238 = GaugeStatus 239 = Position 240 = Level 241 = Temp 250 = LevelStatus	None	This is what parameter is being monitored by the alarm. The listed numbers are samples. The full list of Point Parameters is available through Vertue.

Parameter	Point	Values	Factory Default	Notes
Type		Bitmap (Mask) Match (Mask) Mismatch (Mask) Low Threshold (Threshold) High Threshold (Threshold) Char Array (CharArray)		The **Bitmap** alarm type reports an alarm by performing a bitwise AND of the Mask with the value of the parameter being monitored. The **Match** alarm type reports an alarm if the Mask matches the value of the parameter being monitored. The **Mismatch** alarm type reports an alarm if the Mask does not match the value of the parameter being monitored. The **Low Threshold** alarm type reports an alarm if the value of the parameter being monitored is less than or equal to Threshold. The **High Threshold** alarm type reports an alarm if the value of the parameter being monitored is greater than or equal to Threshold. The **Char Array** alarm type reports an alarm if the value of the parameter matches any of the ASCII characters in CharArray.
Mask			0	This is the integer mask. Mask is displayed in Hex format in Vertue if the alarm Type is set to Bitmap. Mask is displayed in decimal format if the alarm Type is configured as Match or Mismatch.
Threshold		100.00		This is the floating point threshold.
CharArray				This is the character array.
HoldOff			0	This is the alarm hold off in seconds. A value of 0 means that the alarm is immediately activated if detected. Otherwise, the alarm condition must be true for the specified number of seconds before the alarm will be activated.
Deadband			0.02	This is the alarm deadband for threshold. This is the amount the value of the parameter being monitored has to drop below the "High Threshold" or raise above the "Low Threshold" for the alarm to be considered cleared.

Parameter	Point	Values	Factory Default	Notes
OutMod/Chan		**Output Modules:** CPU Module (0) Interface Modules (1-6) **Output Channels:** Channel (1-8)		OutMod/Chan represents the configured output module and channel on the RTU to which the alarm's output will be written.
AlarmState		Disable Alarm Enable Alarm		This is the operational state of the alarm.

The Command Tab

Parameter	Point	Values	Factory Default	Notes
AlarmCmd		Reset Alarm		This is where users will come to reset an alarm that has been triggered.
Output				This is the alarm output. 0 means the alarm is inactive (a.k.a., clear), 1 means the alarm is active (a.k.a., triggered).
PntStatus				This is the current status of the point.

Modbus Manager

Vertue currently only uses the below defined Modbus Map to work with the Modbus Slave devices and the Modbus protocol. Custom configuration of the Modbus Map via gateway blocks is not supported yet in Vertue.

> **Note** Select the Default Map and configure the Modbus ID for Modbus Slave channels via the Chassis.

The 8810 RTU and Vertue use Modbus Register Maps (REGMAP). A REGMAP is used to copy or "map" the value (Value00 to Value63) of a Modbus Floating Point Register (MFPREG) or a Modbus Integer Register (MIREG) to a variety of available parameter within the 8810. For example, MFPREG Value00 can be mapped to a Tank's Level parameter, meaning that Level is updated any time Value00 is updated. Modbus Manager allows the user to access and configure the REGMAP settings.

The below table lists the default Modbus map which is a list for any Modbus slave device that defines what the data is (such as Level, Temp, GaugeStatus), how the data is stored, and where the data is stored. Each parameter is an integral part of a Modbus Map.

In the table below, Scale Factor is a factor that can be applied to convert an integer slave value to a floating point value. Scale Factor is only used on integer values. It does not apply to Floating Point registers.

The FailFilter column are the settings used to monitor PntStatus bits. When the FailFilter is not 0, bits set in FailFilter are compared with the bits in PntStatus and the FailValue is reported if any bits match.

Parameter	Start Address	End Address	Type	Scale Factor	FailFilter	Fail Value
Position	60000	60799	32-bit float	None	Device Timeout CIU Timeout Not Scanning	-1000
Level	60800	61599	32-bit float	None	Device Timeout CIU Timeout Not Scanning Invalid Level	-1000
Temp	61600	62399	32-bit float	None	Device Timeout CIU Timeout Not Scanning Invalid Temp	-1000
GaugeStatus	62400	63199	32-bit uint	None	None	N/A
PntStatus	63200	63999	32-bit uint	None	None	N/A
Position	64000	64399	16-bit uint	1000	Device Timeout CIU Timeout Not Scanning	0
Level	64400	64799	16-bit uint	1000	Device Timeout CIU Timeout Not Scanning Invalid Level	0
Temp	64800	65199	16-bit uint	100	Device Timeout CIU Timeout Not Scanning Invalid Temp	0

Note See the Varec 8810 RTU Modbus Service Manual (SRM016) for a more detailed explanation for how Modbus works.

Modbus Manager Settings

The Modbus Manager allows the user to configure the following parameters on the 8810.

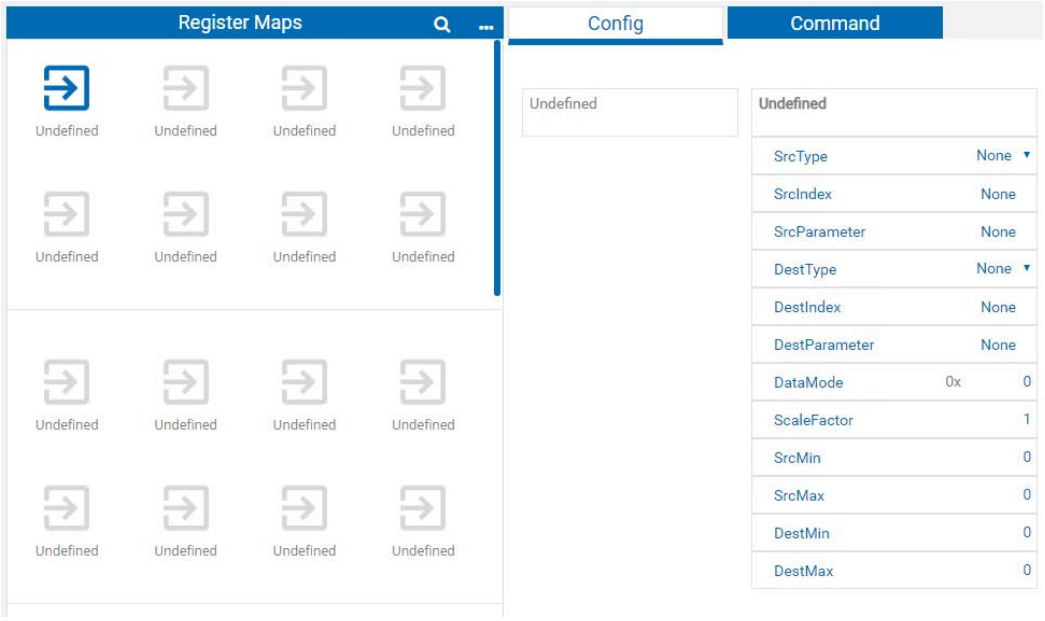

Figure 1-10: Modbus Manager Config Screen

Setting Name	Definition	Type	Variables Choices/Defaults
		Config	
SrcType	Source Point Type	32-bit unsigned int	None FP Reg Pnt INT Reg Pnt
SrcIndex	Source Point Index.	32-bit unsigned int	Valid values are 1 to 100 which corresponds to the index of the Modbus Floating Point and Integer Registers
SrcParameter	Source Point Parameter	32-bit unsigned int	99 corresponds to Value00, 100 to Value01, etc.
DestType	Destination Point Type	32-bit unsigned int	CPU Pnt Port Pnt Tank Pnt
DestIndex	Destination Point Index	32-bit unsigned int	Valid values depend upon the DestType: CPU Module (1) Port (1-56) Tank (1-400)
DestParameter	Destination Parameter	32-bit unsigned int	The parameter to which the register value will be mapped.
DataMode	A bitmap field defining how the Modbus Integer Register source is converted to a 32-bit floating point destination.	32-bit unsigned int	Bitmap field defining how the Modbus Integer Register source is converted to a 32-bit floating point destination. Scale using SrcMin, SrcMax, DestMin, DestMax parameter. Otherwise, ScaleFactor is used.

Setting Name	Definition	Type	Variables Choices/Defaults
ScaleFactor	Scale Factor is how Modbus within the Modbus Map is configured to work with a Modbus register since the registers only store whole numbers.	Floating point	Multiply the source integer value by ScaleFactor to produce a 32-bit floating point value to be copied to the destination parameter. Defaults to 1.
SrcMin	Minimum source value	Floating point	
SrcMax	Maximum source value	Floating point	
DestMin	Minimum destination value	Floating point	
DestMax	Maximum destination value	Floating point	
Command			
PntStatus	Point Status	32-bit unsigned int	0x01 = Invalid source 0x02 = Invalid destination

Auto Scan and Fast Scan

Auto Scan is a functionality built into the 8810 RTU for the Enraf Master, Modbus Master, Mark/Space, and L&J Tankways channels. The purpose of Auto Scan is to enable the tanks to shift to a Fast Scan mode if the level starts to change in anything other than normal fluctuations, and then after the tank level stops changing, to shift back automatically to a normal mode.

Fast Scan is checking every few seconds to see what the level status is. An issue that arose in the past was that someone would manually put a tank on Fast Scan and it would slow down the level checking response from other tanks. By default, Fast Scan is set to revert to its original setting (Auto Scan or Normal Scan) after 60 minutes. This setting can be changed within Vertue.

Fast Scan works by giving any tanks set to Fast Scan priority over any tanks set to Normal Scan. For example, if first five tanks are set to Fast Scan and second five are set to Normal Scan, the order of scanning tanks would be: Tank 1, Tank 2, Tank 3, Tank 4, Tank 5, Tank 6, and then back to Tank 1, Tank 2, Tank 3, Tank 4, Tank 5, Tank 7, and then start again with the first five before moving on to Tank 8.

When the tanks are set to Auto Scan, Fast Scanning will start when the level changes by a set measurement amount and then go back to Normal Scanning when the level change stops.

The 8810 RTU is designed to only allow 40% of the tanks to be set to Fast Scan. Anything over 40% of the tanks being set to Fast Scan causes the system to shift all the tanks back down to its default settings (either Auto Scan or Normal Scan). AutoScanStatus is the dynamic setting that is set to Inactive if no tanks are on Fast Scan and will shift back to Inactive if the 40% threshold is passed.

Parameter	Point	Type	Values	Factory Default	Notes
Protocol	Channel	Config	Enraf Master Mark/Space Modbus Master L&J Tankway	Virtual Channel	This can be configured for other values but only 'Enraf Master', 'Mark/Space', 'Modbus Master', and 'L&J Tankway' channels support Auto Scan.

Parameter	Point	Type	Values	Factory Default	Notes
FastScanPct	Channel	Config	1 to 40	40	This is the maximum percentage of tanks that are allowed to be on this Channel's Fast Scan List at the same time. When more than FastScanPct of all tanks associated with a channel change by FastScanDelta at the same time, then these are treated as if all tanks are on the Normal Scan List, although ScanList continues to report "Fast Scan" for these tanks.
NormalScanCmd	Channel	Command	Disable Enable	Auto Scan	When set to "Enable", this forces all tanks associated with this channel onto the Normal Scan List. Note that this command has precedent over ScanMode and FastScanCmd.
NumScanList	Channel	Dynamic	0 to 400	0	This is the total number of tanks being scanned by this channel.
NumFastScan	Channel	Dynamic	0 to 400	0	This is the total number of tanks on the Fast Scan List for this channel.
DeviceList	Channel	Dynamic	ASCII string		This is an ASCII string containing the first 20 devices assigned to this channel. A single character prefix is used to indicate if this device is a MFPREG ("F"), MIREG ("I"), or Tank ("T").
AutoScanStatus	Channel	Dynamic	Inactive Active	Active	This reports "Inactive" if Auto Scan is disabled as a result of NormalScanCmd being set to 'Enable' or if the FastScanPct threshold is exceeded.
ScanMode	Tank	Config	Auto Scan Normal Scan	Auto Scan	If set to "Auto Scan", then the RTU firmware uses Level and FastScanDelta to determine if the tank is on the Normal or Fast Scan List. If set to 'Normal Scan', then the tank is forced onto the Normal Scan List unless overwritten by FastScanCmd.

Parameter	Point	Type	Values	Factory Default	Notes
FastScanDelta	Tank	Config	>=0.0001	0.001	The amount Level has to change between readings in order for the tank to be on the Fast Scan List.
FastScanTime	Tank	Config	>=1	60	This is in minutes. Used in conjunction with FastScanCmd and FastScanTimer to force a tank onto the Fast Scan List.
FastScanCmd	Tank	Command	Disable Enable	Disable	When set to "Enable", this forces a tank onto the Fast Scan List until Level has moved by less than FastScanDelta for FastScanTime minutes. FastScanCmd automatically reverts to 'Disable' when this happens.
Level	Tank	Dynamic	>=0	0	This is the fuel level reported by the tank.
FastScanTimer	Tank	Dynamic	>=0	0	This is in minutes. Indicates how many minutes remain until a tank that was forced on the Fast Scan List by FastScanCmd reverts to the Scan List determined by ScanMode.
ScanList	Tank	Dynamic	Fast Scan Normal Scan	Normal Scan	This indicates whether the tank is on the Fast or Normal Scan List.

The 8810 RTU's Watchdog Feature and Vertue

A watchdog timer is an electronic timer designed to check for any hardware issues or malfunctions and then notify users of a potential hardware issue. The 8810's CPU watchdog mechanism monitors the 8810's CPU to determine that it is working as expected and will create an alert to notify the users and the monitoring system.

The 8810 firmware periodically resets the hardware watchdog, unless the firmware detects an error, at which point it stops resetting the watchdog. The hardware watchdog will trip if it is not reset for 10 seconds.

When the watchdog feature scans the 8811 CPU and doesn't receive the expected response, it sends a signal to alert the user by activating or deactivating the circuit to which it is connected. When the watchdog trips, it could be any of the 60 various tasks that the CPU performs, which causes the watchdog to alert the user. The watchdog will trip (or timeout) between 10 seconds (at the minimum) and 20 seconds (at the maximum).

For the 8813 Digital I/O module, the software component of the watchdog can be set up on Channel 8. It can be configured to either be an alarm watchdog or a CPU watchdog. Channel 8

must be enabled for the watchdog feature to work. Also, Channel 8's Protocol must be set to Digital Out to use it.

> **Note** Vertue will display a red exclamation mark next to Watchdog under the 8813 Digital I/O if Channel 8's Protocol is set to Digital Input rather than either Virtual Chan or Digital Output since Watchdog will not work if the protocol is set to Digital Input.

Any of the 8810 modules can be set up to work as a CPU watchdog by setting a channel on the module to Virtual Channel and enabling the watchdog feature. Although designed to work with the watchdog circuitry on the DIO Module, this can also be a "firmware only" feature when Channel 8 is configured as a Virtual Channel. This will allow the 8810 to monitor for any potential software task failures.

The following are the three configurations for the watchdog feature in Vertue under the Config setting for the channel:

1. Disable
2. Alarm Watchdog
3. CPU Watchdog

Under the Dynamic settings for the channel, the WatchdogTimer settings displays in milliseconds the amount of time since the watchdog was last serviced. If the watchdog parameter is set to Disable, this WatchdogTimer parameter will continually increase.

How to Reset (Clear) a Watchdog Timeout

Any of these methods can be used to reset the watchdog timer:

- Power cycle the RTU
- Set the Watchdog parameter under Config on the channel to Disable
- Remove and reinstall the interface module

2 Hardware Devices and Communications Protocols

The 8810 RTU allows users to work with a number of hardware devices (Varec hardware and other devices) to work with tanks and other storage devices. The following protocols are currently supported by the 8810 RTU with the various hardware devices that can be configured through Vertue:

- Enraf Master
- Modbus Master
- Mark/Space
- L&J Tankway
- Analog Input

The following tables display the hardware the 8810 RTU supports and the protocols available to each piece of supported hardware and the four protocols that support the hardware the 8810 works with.

Hardware Devices and Supported Communication Protocols

Hardware Device	Communication Protocols
EN811	Enraf Master
EN854	Enraf Master
EN873	Enraf Master
EN990	Enraf Master
FTT29XX	Enraf Master Mark/Space Modbus Master
MTS	Modbus Master
NMR8X	Modbus Master
NMS5X	Modbus Master
NRF590	Modbus Master
NRF81	Modbus Master
V1800	Mark/Space
V1900	Mark/Space
V6500	Mark/Space
GSI2000	Mark/Space
Varec 1800	Mark/Space
Varec 1900	Mark/Space
Varec 6500	Mark/Space
LJ1000	Tankway
LJ1500	Tankway
LJ2000	Tankway
TLS	TLS Master
TLS3xx	TLS Master

Hardware Device	Communication Protocols
TLS4xx	TLS Master
X76CTM	TLS Master
Optilevel	HLS Master

Communication Protocols and Supported Hardware Devices

Communication Protocols	Supported Hardware Devices
Enraf Master	EN811 EN854 EN873 EN990 FTT29XX
Modbus Master	ATT4000 FTT29XX MTS NMS5X NMS8X NRF590 NRF81 NMR8X
Mark/Space	ATT4000 FTT29XX GSI2000 V1800 V1900 V6500
Tankway	LJ1000 LJ1500 LJ2000
TLS Master	TLS TLS3xx TLS4xx X76CTM
HLS Master	Optilevel

Hardware Configuration Parameters

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point

Configuration		
Name	**Default**	**Definition**
ModConfigured	1	The module installed in the interface module slot: • 1 = Bi-Phase Mark • 2 = Serial Module • 3 = Digital IO • 4 = Mark/Space • 5 = Tankway • 6 = Analog Input
Watchdog	1	The state of the watchdog functionality of the module (DIO Channel 8): • 1 = Disable • 2 = Alarm Watchdog • 3 = CPU Watchdog

Dynamic/Command	
Name	**Description**
ModCmd	The module command: • 1 = Reset Module
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ModInstalled	The module installed in the slot: • 1 = Bi-Phase Mark • 2 = Serial Module • 3 = Digital IO • 4 = Mark/Space • 5 = Unknown Module • 6 = Tankway • 7 = Analog Input
ModTemp	The module's temperature in Celsius or Fahrenheit (as configured on the CPU's TempUnits)
HwID	The module board ID
HwDate	The module's manufacture date
HwSerialNo	The module's serial number
HwPartNo	The module's part number
HwVer	The printed circuit board's hardware version
FpgaVer	The version of the field-programmable gate array
WatchdogTimer	The elapsed time in milliseconds since the WatchdogTimer was last serviced

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed
PntCheckSum	The point checksum

3 Channel Variables

The 8810 RTU allows users to work with a number of protocols to keep track of the tanks and other storage devices. The following protocols are currently supported by the 8810 RTU and can be configured through Vertue:

- Virtual Channel
- RTU Slave
- Enraf Master (EN811, EN854, EN873, EN990, FTT 29xx)
- Modbus Master (MFPREG, MIREG, ATT 4000, FTT 29xx, GSI 2000, NMS5x, NRF590, NRF81, NMR8x, MTS)
- Modbus Slave (GWBLK)
- Digital Input
- Digital Output
- Ethernet (OPC UA, MFPREG, MIREG)
- Mark/Space (ATT 4000, FTT 29xx, GSI 2000, Varec 1800, Varec 1900, Varec 6500)
- L&J Tankway (LJ1000, LJ1500, LJ2000)
- TLS Master (TLS, TLS3xx, TLS4xx, X76CTM)
- HLS Master (Optilevel)
- Analog Input

The following tables display the protocols available to channels and the Configuration as well as the Dynamic information displayed on each channel.

Virtual Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 characters max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Priority	1	Change of state priority • 1 = No Priority • 2 = High Priority • 3 = Low Priority
Maxtime	600	Max time between change of state updates

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm

Dynamic/Command	
Name	**Description**
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
DIOValue	The Digital I/O value (firmware bitmap value) • 0x01 = Manual Input/Output Value • 0x02 = Hardware Input Value • 0x04 = Alarm Output Value
DIOHwValue	The Digital I/O hardware value (input or output value in the hardware) • 0 = Off • 1 = On
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout

Dynamic/Command	
Name	**Description**
PntCheckSum	The point checksum

RTU Slave Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
BaudRate	19200	The baud rate
ComParams	8N	The number of data bits and parity • O = Odd • E = Even • N = None
RespDelay	50	The response delay (in milliseconds)

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
ComStatus	The communication status of the module (online or offline)

Dynamic/Command	
Name	**Description**
CurCommand	The current command for the module
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module is processing
NumComErrors	The number of requests with errors
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Enraf Master Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
BaudRate	2400	The baud rate
Timeout	2000	The communication timeout (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds

Configuration		
Name	**Default**	**Definition**
MaxRetry	2	The number of retries (Client only)
TempInterleave	10	The temperature interleave factor; for protocols that use this parameter, this is the number of level readings between each temperature reading
HoldOff	10	The gauge down HoldOff count
FastScanPct	40	The fast scan percent (between 1% to 40%)

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
CurDeviceID	The address of the current device
CurCommand	The current command for the module
CurLabel	The current point descriptor
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts
NumScanList	The number of points in a scan list
NumFastScan	The number of points in a fast scan

Dynamic/Command	
Name	**Description**
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Modbus Master Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Mode	0	The operational mode state
BaudRate	19200	The baud rate

Configuration		
Name	**Default**	**Definition**
ComParams	8N	The number of data bits, parity, and stop bits (1 stop bit is assumed if not specified) • O = Odd • E = Even • N = None
Timeout	2000	The communication timeout (in milliseconds)
DetectTime	20	The Modbus detect time (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
MaxRetry	2	The number of retries (Client only)
FastScanPct	40	The fast scan percent (between 1% to 40%)

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
CurLabel	The current point descriptor
CurMessage	The current message
NumRequests	The current number of requests in the module
NumTrans	The current number of successful transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts

Dynamic/Command	
Name	**Description**
NumScanList	The number of points in a scan list
NumFastScan	The number of points in a fast scan
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Modbus Slave Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel

Configuration		
Name	**Default**	**Definition**
Mode	0	The operational mode state
BaudRate	19200	The baud rate
ComParams	8N	The number of data bits, parity, and stop bits (1 stop bit is assumed if not specified) • O = Odd • E = Even • N = None
RespDelay	50	The response delay (in milliseconds)
DetectTime	20	The Modbus detect time (in milliseconds)
ModbusID	1	The device address to respond to (Server only)
ModbusMap	Default Map	An ASCII string (32 byte max) to define the name of the Modbus Map associated with this channel

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
ComStatus	The communication status of the module
CurMessage	The current message
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module is processing
NumComErrors	The number of requests with errors
GwblkList	The Modbus Gateway Blocks list
Elapse	The time of the last transaction

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Digital Input Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Maxtime	600	Max time between change of state updates
Priority	1	Change of state priority • 1 = No Priority • 2 = High Priority • 3 = Low Priority

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
DIOValue	The Digital I/O value • 0x01 = Manual Input/Output Value • 0x02 = Hardware Input Value • 0x04 = Alarm Output Value
DIOHwValue	The Digital I/O hardware value • 0 = Off • 1 = On
Elapse	The time of the last transaction

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Digital Output Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Priority	1	Change of state priority • 1 = No Priority • 2 = High Priority • 3 = Low Priority
Maxtime	600	Max time between change of state updates

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
DIOValue	The Digital I/O value • 0x01 = Manual Input/Output Value • 0x02 = Hardware Input Value • 0x04 = Alarm Output Value
DIOHwValue	The Digital I/O hardware value • 0 = Off • 1 = On
Elapse	The time of the last transaction

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Ethernet Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Mode	0	The operational mode state
Timeout	2000	The communication timeout (in milliseconds)
RespDelay	50	The response delay (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
Maxtime	600	Max time between updates
ModbusID	1	The device address to respond to (Server only)
ModbusMap	Default Map	An ASCII string (32 byte max) to define the name of the Modbus Map associated with this channel

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
ComStatus	The communication status of the module
CurLabel	The current point descriptor
CurMessage	The current message
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts
NumScanList	The number of points in a scan list
NumClientList	The number of Modbus TCP clients
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
GwblkList	The ASCII string containing a list of gateway blocks assigned to this channel
Elapse	The time of the last transaction

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Mark/Space Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Timeout	2000	The communication timeout (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
MaxRetry	2	The number of retries (Client only)
HoldOff	10	The gauge down HoldOff count
FastScanPct	40	The fast scan percent (between 1% to 40%)

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
CurDeviceID	The address of the current device
CurLabel	The current point descriptor
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts
NumScanList	The number of points in a scan list
NumFastScan	The number of points in a fast scan
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active
Elapse	The time of the last transaction

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Tankway Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Timeout	2000	The communication timeout (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
MaxRetry	2	The number of retries (Client only)
HoldOff	10	The gauge down HoldOff count
FastScanPct	40	The fast scan percent (between 1% to 40%)

Configuration		
Name	**Default**	**Definition**
LevelFilter	0.5	The value used by LJ1000, LJ1500, and L2000 points for filtering level changes when the level changes to filter inaccurate readings coming from the Tankway devices
TempFilter	10	The value used by LJ1000, LJ1500, and L2000 points for filtering temperature changes when the level changes to filter inaccurate readings coming from the Tankway devices.
FilterCnt	5	The number of bad values of LevelFilter and TempFilter that are ignored until the number of good values are received to

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
CurDeviceID	The address of the current device
CurCommand	The current command
CurLabel	The current point descriptor
CurMessage	The current message
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts

Dynamic/Command	
Name	**Description**
NumScanList	The number of points in a scan list
NumFastScan	The number of points in a fast scan
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

TLS Master Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point

Configuration		
Name	**Default**	**Definition**
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Mode	0	The operational mode state
BaudRate	19200	The baud rate
ComParams	8N	The number of data bits, parity, and stop bits (1 stop bit is assumed if not specified) • O = Odd • E = Even • N = None
Timeout	2000	The communication timeout (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
MaxRetry	2	The number of retries (Client only)
FastScanPct	40	The fast scan percent (between 1% to 40%)

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
CurLabel	The current point descriptor
CurMessage	The current message
NumRequests	The current number of requests in the module

Dynamic/Command	
Name	**Description**
NumTrans	The current number of successful transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts
NumScanList	The number of points in a scan list
NumFastScan	The number of points in a fast scan
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

HLS Master Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Mode	0	The operational mode state
BaudRate	19200	The baud rate
ComParams	8N	The number of data bits, parity, and stop bits (1 stop bit is assumed if not specified) • O = Odd • E = Even • N = None
Timeout	2000	The communication timeout (in milliseconds)
DetectTime	20	The Modbus detect time (in milliseconds)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
MaxRetry	2	The number of retries (Client only)
FastScanPct	40	The fast scan percent (between 1% to 40%)

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout

Dynamic/Command	
Name	**Description**
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
CurLabel	The current point descriptor
CurMessage	The current message
NumRequests	The current number of requests in the module
NumTrans	The current number of successful transactions the module is processing
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts
NumScanList	The number of points in a scan list
NumFastScan	The number of points in a fast scan
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active
Elapse	The time of the last transaction

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

Analog Input Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
ScanDelay	100	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
FilterCnt		The number of AI channel scan samples to be collected for the filter. Range is 1 to 8 samples for the analog input channel.

Configuration		
Name	**Default**	**Definition**
FilterMode		The filter to be applied to the FilterCnt number of samples. Values are: • "Middle Filter" – Use the median value of the samples. In the case of an even number of samples being collected, use the average of the 2 middle samples. • "Average Filter" – Calculate the average of the samples. • "Lag Filter" – Use all FilterCnt samples, but give more weight to the most recent samples.
SignalMode		The input signal in volts or amps. Values are: • "Voltage Signal" – The input signal is in volts • "Current Signal" – The input signal is in milliamps
OutputMin		Used in conjunction with OutputMax, these determine how the analog input signal is scaled. For example, for a 40-foot tank, OutputMin might be set to 0, while OutputMax might be set to 40. For an amp input signal, the normal range is 4-20 mAmp, and the OutputMin/OutputMax should be set to reflect to this normal range. It's possible for the amp input signal to exceed this range. If it does, then this will result in a ConvertedValue that is outside of the range defined by OutputMin/OutputMax.
OutputMax		Used in conjunction with OutputMin, these determine how the analog input signal is scaled. For example, for a 40-foot tank, OutputMin might be set to 0, while OutputMax might be set to 40. For an amp input signal, the normal range is 4-20 mAmp, and the OutputMin/OutputMax should be set to reflect to this normal range. It's possible for the amp input signal to exceed this range. If it does, then this will result in a ConvertedValue that is outside of the range defined by OutputMin/OutputMax.

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout

Dynamic/Command	
Name	**Description**
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
NumRequests	Keeps track of the number of times the firmware attempted to read the analog input signal
NumTrans	Keeps track of the number of successful analog input signal reads
NumComErrors	Keeps track of the number of times a call to low-level hardware drivers have failed
NumIoErrors	Keeps track of the number of times RawValue is outside its fault range (3.6-21.0 mAmp) (i.e., the number of requests with input or output errors)
RawValue	This is the raw 24-bit value read from the analog input signal. • OPCUA Status Code “Bad Sensor Failure” is reported if an interface module is not installed • OPCUA Status Code “Bad Out Of Service” is reported if ChanState is disabled
FilteredValue	This is the 24-bit value with the filter applied • OPCUA Status Code “Bad Sensor Failure” is reported if an interface module is not installed. • OPCUA Status Code “Bad Out Of Service” is reported if ChanState is disabled. • OPCUA Status Code “Bad Out Of Range” is reported if FilteredValue is under or over range.
ConvertedValue	This is the FilteredValue scaled according to OutputMin and OutputMax • OPCUA Status Code “Bad Sensor Failure” is reported if an interface module is not installed • OPCUA Status Code “Bad Out Of Service” is reported if ChanState is disabled • OPCUA Status Code “Bad Out Of Range” is reported if FilteredValue is under or over range • OPCUA Status Code “Bad Out Of Range” is reported there is an error with the calibration data
Elapse	The last time the analog input module was scanned

Dynamic/Command	
Name	**Description**
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout NOTE: • 0x0000 0800 = Under Range – FilteredValue has been less than the NAMUR NE43 standard fault value (3.6 mAmp) for 4 seconds. • 0x0000 1000 = Over Range – FilteredValue has been greater than the NAMUR NE43 standard fault value (21.0 mAmp) for 4 seconds. • 0x0000 2000 = Calibration Error – The AI Module's calibration data is wrong. As a result, the AI channel might report inaccurate values.
PntCheckSum	The point checksum

The Complete List of Channel Variables

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	The current state of the channel • 1 = Disable Channel • 2 = Enable Channel
Mode	0	The operational mode state
BaudRate	19200	The baud rate
ComParams	8N	The number of data bits and parity • O = Odd • E = Even • N = None
RespDelay	50	The response delay (in milliseconds)
Timeout	2000	The communication timeout (in milliseconds)
DetectTime	20	The Modbus detect time (in milliseconds)
MaxRetry	2	The number of retries (Client only)
ScanDelay	50	Delay between scans (in milliseconds) (Client only) with the minimum scan delay is 100 msec and maximum scan delay is 60 seconds
TempInterleave	10	The temperature interleave factor; for protocols that use this parameter, this is the number of level readings between each temperature reading
HoldOff	10	The gauge down HoldOff count
FastScanPct	40	The fast scan percent (between 1% to 40%)
Maxtime	600	Max time between change of state updates
Priority	1	Change of state priority • 1 = No Priority • 2 = High Priority • 3 = Low Priority
ModbusID	1	The device address to respond to (Server only)
ModbusMap	Default Map	An ASCII string (32 byte max) to define the name of the Modbus Map associated with this channel

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel • 2 = Reset Alarm

Dynamic/Command	
Name	**Description**
NormalScanCmd	The normal scan command • 1 = Disable • 2 = Enable
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	The communication bus for the slot: • 1 = Bi-Phase Mark • 2 = RS-232 • 3 = RS-485 • 4 = USB • 5 = Digital IO • 6 = Ethernet • 7 = Mark/Space • 8 = Tankway • 9 = Analog Input
ComStatus	The communication status of the module (1 = Offline, 2 = Online)
CurCommand	The current command for the module
CurDeviceID	The address of the current device
CurLabel	The current point descriptor
CurMessage	The current message
NumRequests	The current number of requests in the module
NumTrans	The current number of transactions the module has successfully transmitted
NumComErrors	The number of requests with errors
NumTimeouts	The number of request timeouts
NumScanList	The number of points in a scan list
NumClientList	The number of Modbus TCP clients
NumFastScan	The number of points in a fast scan
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS
GwblkList	The ASCII string containing a list of gateway blocks assigned to this channel
AutoScanStatus	The auto scan status • 1 = Inactive • 2 = Active

Dynamic/Command	
Name	**Description**
DIOValue	The Digital I/O value • 0x01 = Manual Input/Output Value • 0x02 = Hardware Input Value • 0x04 = Alarm Output Value
DIOHwValue	The Digital I/O hardware value • 0 = Off • 1 = On
Elapse	The time of the last transaction
PntStatus	The point status as a bitmap: • 0x0800 0000 = Unknown Module • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed • 0x0000 2000 = Calibration Error • 0x0000 1000 = Over Range • 0x0000 0800 = Under Range • 0x0000 0400 = Power Failure • 0x0000 0200 = Line Shorted • 0x0000 0100 = Digital Output Loopback Mismatch • 0x0000 0080 = Digital Input Value Mismatch • 0x0000 0040 = Protocol Mismatch • 0x0000 0020 = Disabled • 0x0000 0010 = Transmit Error • 0x0000 0008 = USB Controller Error • 0x0000 0004 = HW Communication Error • 0x0000 0002 = Initialization Failure • 0x0000 0001 = Communication Timeout
PntCheckSum	The point checksum

4 Volume Calculations

Volume Calculation Correction Methods

This section describes the correction methods and tank calculations used by Vertue. Since the volume of the product in a tank varies with the temperature and density, you must use a correction method to correct for variations in temperature and density of the product.

Volume Correction Basics

In 2004, American Petroleum Institute (API) updated the standards for volume correction in their Manual of Petroleum Measurement Standards (MPMS) in a chapter known as Chapter 11.1, "Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils."

The 8810 RTU uses the latest calculations from API's 2004 standards and Vertue displays the corrected volumes based on different variables. To understand the concepts behind the calculations, here are the following definitions and a graphic to help explain how volume correction values work together to give the volume correction factor (VCF). Once the VCF has been calculated, the value can be used to help calculate volume based upon the temperature of the stored liquid.

Volume Correction Definitions

Observed, Standard/Base, and Alternate

According to the API, there are three concepts behind the values that make up volume correction calculations: Observed values, Standard (or Base) values, and Alternate values. They define the three types of values as the following:

Observed conditions are the temperature and pressure at which the density of a liquid is actually or assumed to have been measured.

Standard or **base** conditions are defined combinations of temperature and pressure at which liquid volumes are expressed for purposes of custody transfer, stock accounting, etc. The terms standard and base are used interchangeably. Accepted standard temperatures are 60°F, 15°C, and 20°C. Accepted standard pressures are zero gauge pressure or the liquid's vapor pressure at the standard temperature.

Alternate conditions are any other temperature and pressure conditions to which the observed or standard density can be corrected.

An example of the terms to help with understanding how it fits together:

> *A storage tank contains a liquid that has an average temperature of 122°F. A sample is withdrawn and the **observed** density of the liquid is measured at 85°F. Since the accepted **standard** temperature for liquids is 60°F, the user would like to correct the temperature to 60°F from the current 85°F. While the temperature in the tank in this situation is the 122°F, the temperature is different from what the observed result was (85°F), it cannot be applied to the tank volume. Because of the variation, the 122°F temperature is considered the **alternate** condition.*

The volume correction techniques listed below explain the values associated with the calculations to perform the calculations by hand that the 8810 RTU has built in to calculate for the users.

The 8810 RTU and Volume Calculations

The 8810 RTU is capable of performing the complex calculations necessary for the up-to-date and modern American Petroleum Institute (API) standards of volume correction according to the API 2004 standards with Vertue simplifying the displaying of the important figures based upon the storage variables.

While the 8810 will perform the calculations, the following tables will explain how to configure Vertue to allow it to deliver the necessary computations depending upon the company's need.

CPU Config & CPU Dynamic Parameters

CPU Config & CPU Dynamic					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
CPU Config	AmbientTempSrc			MAN	Ambient temperature source. Enumerated type: • 1 = AmbientTemp • 2 = ManAmbientTemp
	ManAmbientTemp			MAN	Manual Ambient Temperature. This is a user-configurable ambient temperature to be used if AmbientTemp is not periodically updated via Modbus (see AmbientTemp).
	AmbTempConvert			MAN	Ambient Temperature Conversion. 4 character ASCII string (e.g. 'CtoF' for Celsius-to-Fahrenheit). Units conversion for AmbientTemp. Needed if AmbientTemp has a different units than Temp.
	AmbTempDB			MAN	Ambient Temperature Deadband. Used to prevent small AmbientTemp variations from causing extraneous tank calculations. The default is 1.0 degree F or C.
CPU Dynamic	AmbientTemp	Temperature Ambient		SRC	Sourced Ambient Temperature. Only used if ShellCorrect is 'Correction'. To get a value, first configure a Modbus Integer or Floating Point Register to periodically read a temperature from a remote device. Then configure a Modbus Register Map to map the Register value to AmbientTemp.

Table 4-1: Volume Correction Settings for the CPU (CPU Config and CPU Dynamic) Settings

Tank Configuration Parameters

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
Tank Calculations	StandardsOrg	Standards Organization**		MAN	Standards organization Enumerated type: 1 = American Petroleum Institute (API)
	StandardsRev	Standard - Revision**		MAN	Standards revision Enumerated type: 1 = Commodity 2004 (API)
	CommodityType	Commodity - Table**		MAN	Commodity type Enumerated type: • 1 = Alpha 60 • 2 = Crude Oil • 3 = Refined Product • 4 = Lubricating Oil
	Alpha60	Alpha**		MAN	Product Alpha 60 This coefficient is used only if CommodityType is "Alpha 60" Range is 0.00023 to 0.00096 for Fahrenheit, 0.000414 to 0.001674 for Celsius
	StdTemp	Temperature Standard**		MAN	Standard Temperature. Only used if Temp is in Celsius. Set to either 15C or 20C, although any floating point value is allowed. If Temp is in Fahrenheit, then 60C is used regardless of the StdTemp value.
	StrapFile			MAN	Tank strap file (a.k.a., tank strapping chart) ASCII name of the Strap File (up to 32 characters).

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	LevelConvert			MAN	4 character ASCII string (For example, "FtoM" for feet to meters) • C = Centimeters • F = Feet • M = Meters • m = Millimeters • P = Feet-Iniches-Sixteenth • S = Sixteenths • T = Thirtyseconds • 0 = Feet-Inches-Sixteenths (Mark/Space only) • 1 = Feet (Mark/Space only) • 2 = 0-20 Meters (Mark/Space only) • 3 = 0-30 Meters (Mark/Space only)
	TempConvert			MAN	4 character ASCII string for temperature conversions (For example, "FtoC" for Fahrenheit to Celsius) • C = Celsius • F = Fahrenheit • 1 = Add 100 to Fahrenheit (Mark/Space only)
	DensityConvert			MAN	4 character ASCII string for density conversions (For example, "AtoK" for API to KG/M3) • A = API • G = GMML • K = KG/M3 • L = LB/F3
	WeightConvert			MAN	4 character ASCII string for weight/mass conversions (For example, "LtoK" for Pounds to Kilograms) • K = Kilograms • L = Pounds • M = Metric Tons • T = Tons

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
Tank Calculations	VolumeConvert			MAN	4 character ASCII string for volume conversions (For example, "GtoL" for Gallons to Liters) • B = Barrels • G = Gallons • L = Liters • M = Cubic Meters
	PressConvert			MAN	4 character ASCII string for pressure conversions (For example, "PtoM" for PSI to Megapascals) • C = KG/CM2 • I = inH2O • K = Kilopascals • M = Megapascals • m = Millibars • P = PSI • S = Pascals
	SWPct	Percent SW	S&W%	MAN	Sediment & water percent Also referred to as Sediment & Water
	LevelOffset			MAN	Numeric offset applied to Level
	TempOffset			MAN	Numeric offset applied to Temp
Tank Properties	RoofType			CONFIG	Roof type Enumerated type: • 1 = In Table (Floating Roof) • 2 = Not In Table (Floating Roof) • 3 = Fixed Roof • 4 = No Roof Similar to FuelsManager, this combines the concepts of "Roof Type" and "Weight In Strapping Table" into one parameter.
	TankGeometry			CONFIG	Tank geometry Enumerated type: • 1 = Vertical Cylinder • 2 = Horizontal Rounded • 3 = Horizontal Flat

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	ShellCorrect			CONFIG	Tank shell correction Enumerated type: • 1 = No Correction • 2 = Uninsulated Tank • 3 = Insulated Tank
	TankMaterial			CONFIG	Tank shell material Only used if ShellCorrect is "Uninsulated" or "Insulated" Enumerated type: • 1 = Mild Steel • 2 = Stainless Steel • 3 = Aluminum • 4 = Other Material
	ExpCoef		ExpCoef	CONFIG	Tank shell expansion coefficient Only used if ShellCorrect is "Uninsulated" or "Insulated". User configurable if TankMaterial is "Other Material" or unspecified. Otherwise, this field is automatically filled out.
Calculation Source	LevelSrc			CONFIG	Product level source Enumerated type: • 1 = Level • 2 = ManLevel
	ManLevel			CONFIG	Manual Level value
	TempSrc			CONFIG	Product temperature source Enumerated type: • 1 = Temp • 2 = ManTemp
	ManTemp			CONFIG	Manual temperature value
	SolidsLevelSrc			CONFIG	Solids level source Enumerated type: • 1 = SolidsLevel • 2 = ManSolidsLevel
	ManSolidsLevel			CONFIG	Manual solids level value Set to -1 for 0 SolidsVol
	WaterLevelSrc			CONFIG	Water level source Enumerated type: • 1 = WaterLevel • 2 = ManWaterLevel

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	ManWaterLevel			CONFIG	Manual water level value Set to -1 for 0 WaterVol
	DensityMethod			CONFIG	Density method Enumerated type: • 1 = No Method • 2 = Gauged • 3 = Manual Standard
	StdDensity			CONFIG or CALC	Standard density If DensityMethod is 'Manual Standard', then this is manually configured by the user If 'Gauged', then StdDensity is calculated when the value of GaugedDensity or DensityTemp change Whether 'Manual Standard' or 'Gauged', the value of StdDensity is saved in non-volatile memory

Table 4-2: Volume Correction Settings for Tank Config Settings

Tank Dynamic/Command Parameters

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
Calculation Source	Level	Level Product		SOURCE	Sourced product level
	GaugeStatus			SOURCE	Gauge status: • 1 = Block • 2 = Bottom • 3 = Doing Profile • 4 = Failure • 5 = Finding Water • 6 = Following Level • 7 = Following Water • 8 = Invalid • 9 = Lock Test • 10 = Service Mode • 11 = Transitional • 12 = UnderRange • 13 = Valid • 14 = NMS Status
	Position			SOURCE	Displacer position (For EN811, EN854, NMS5x, and NMX8x gauges only)
	Level			SOURCE	Tank level
	Temp	Temperature Product		SOURCE	Sourced product temperature
	SolidsLevel	Level Solids		SOURCE	Sourced solids (a.k.a., sediment) level The solids level can be manually configured (see SolidsLevelSrc) or based on SolidsLevel, with SolidsLevel being the same as the bottom level Note that only EN811, EN854, NMS5x, and NMS8x devices support solids level
	WaterLevel	Level Water		SOURCE	Sourced water level Note that only EN811, EN854, NMS5x, and NMS8x devices support water level
	Gauged Density	Density Gauged***		SOURCE	Source product density Note that only EN811, EN854, NMS5x, and NMS8x devices support product density

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	DensityTemp	Temperature Density		SOURCE	Sourced product temperature at the time that GaugedDensity was calculated Note that only EN811, EN854, NMS5x, and NMS8x devices support gauged density
	Pressure			SOURCE	To be used with flowing products, which is not supported at this time Currently always reported as 0
	RTD1				RTD1 (Only for ATT 4000 and FTT 29xx)
	ScanStatus				Status of the scan: • 1 = Scanning • 2 = Invalid Module • 3 = Invalid Channel • 4 = Disabled Channel • 5 = Invalid DeviceType • 6 = Invalid ScanCmd • 7 = Invalid CIUAddr • 8 = Invalid Controller • 9 = Invalid Interface Module • 10 = Invalid Protocol • 11 = RegMap Source
	Elapse				Time of the last update by a REGMAP
	PntStatus			CALC	Bit 0x0008 is added for "Tank Calculation Error" CalcCode and CalcText contain the details of why the "Tank Calculation Error" bit was set
	PntCheckSum				Point check sum
Advanced Gauging	DeviceStatus			CALC	Bit 0x0x0010 is added for 'Tank Calculation Error' and bit 0x0020 is added for 'Floating Roof Landed'. A landed floating roof is not treated like an error condition but a floating roof in the critical zone is. Therefore, a critical zone error is reported by setting the 'Tank Calculation Error' bit and reporting this specific error condition in CalcCode and CalcText.

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	CmdStatus				Status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
	CallLevelCmd				Calibrate product level command ((Only for ATT 4000, FTT 29xx, and MTS)
	CallIntfCmd				Calibrate interface level command (Only for MTS)
	AlarmStatus				Tank alarm status
	DeviceStatus				Device status of the bitmap: • 0x8000 0000 = Not Balanced • 0x4000 0000 = Invalid Density • 0x0000 0080 = Tank Calculations Disabled • 0x0000 0040 = RegMap Source • 0x0000 0020 = Floating Roof Landed • 0x0000 0010 = Calculation Error • 0x0000 0008 = Invalid Temp • 0x0000 0004 = Invalid Level • 0x0000 0002 = Device Timeout • 0x0000 0001 = Not Scanning
	LevelStatus				Tank level status (Only for EN811, EN854, EN873, EN990, ATT 4000, FTT 29xx, GSI 2000, Varec 1800, Varec 1900, and Varec 6500)
	TempStatus				Tank temperature status (Only for EN811, EN854, EN873, EN990, ATT 4000, FTT 29xx, GSI 2000, Varec 1800, Varec 1900, and Varec 6500)
	WaterStatus				Water level status (Only for EN811, EN854, EN873, EN990, and FTT 29xx)

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	ItemCmd				Item command (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	TestCmd				Operational test command (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	CmdReply				Command reply (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	PerCmdReply				Periodic command reply (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	PerFPValue1				Periodic floating point value (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	PerFPValue2				Periodic floating point value (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	PerlValue1				Periodic integer value (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	PerlValue2				Periodic integer value (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	ItemCmdFile				Item command file name (Only for EN811, EN854, EN873, EN990, and FTT 29xx)
	FastScanCmd				Fast scan command • 1 = Disable • 2 = Enable
	FastScanTimer				Fast scan timer in minutes
	ScanList				Scan list • 1 = Normal Scan • 2 = Fast Scan
	Volume				Volume (Only for Optilevel)
	Ullage				Ullage (Only for Optilevel)
	Offset				Offset (Only for Optilevel)

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	Version				Version (Only for MTS and Optilevel)
Tank Calculation	CalcCmd			COMMAND	Tank Calculation Command. Enumerated type: • 1 = Copy StrapFile from USB to RTU (a.k.a. "download") • 2 = Copy StrapFile from RTU to USB (a.k.a. "upload") • 3 = Run Calculation Typically, calculations are run only when an input changes This option allows the user to manually force a one-time recalculation
	CalcCmdStatus			CALC	Tank Calculation Command Status. Enumerated type: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
	CalcCode			CALC	Tank Calculations status code with a value of "0" meaning there is no error with the most recent tank calculations
	CalcText			CALC	ASCII text explanation of CalcCode
	StrapTemp	Strap Temperature	TSh_{REF}	STRAPFILE	Product temperature read from the strap file
	StrapDensity	Strap Density		STRAPFILE	Product density read from the strap file
	RoofFloatingHt	Roof Floating Height*		STRAPFILE	Roof floating height read from the strap file Used with RoofLandedHt to determine critical zone and landed floating roofs (The critical zone is the level between the roof fully floating and fully landed)
	RoofLandedHt	Roof Landed Height*		STRAPFILE	Roof landed height read from the strap file
	RoofWt	Roof Weight**		STRAPFILE	Roof weight read from the strap file
Density Calculations	ObsDensity	Density Observed		CALC	Observed density ObsDensity is calculated from StdDensity and product temperature

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	DensInAir	Density Product in Air		CALC	Product density In air Converted from ObsDensity based on API 12.3, Table 5
	StdDensInAir	Density Product Standard in Air		CALC	Product standard density in air Converted from StdDensity based on API 12.3, Table 5
Volume Calculations	VolCorFactor	Volume Correction for Temperature and Pressure	CTPL	CALC	Volume correction factor Calculated from StdDensity and product temperature and pressure (For this release, pressure is always 0)
	TempCorFactor		CTL	CALC	Correction due to temperature Since pressure is always 0 for this release, this is the same value as VolCorFactor
	PressCorFactor		CPL	CALC	Correction due to pressure Since pressure is always 0 for this release, this is reported as 1.0
	TankShellTemp		TSh	CALC	Tank shell temperature If ShellCorrect is "Insulated", then TankShellTemp is the same as Temp Else, TankShellTemp is ((7 x Temp) + AmbientTemp) / 8
	TankShellCor	Tank Shell Correction	CTSh	CALC	Tank shell correction factor Only used if ShellCorrect is "Correction" 1 + (2 * ExpCoef * (TankShellTemp – StrapTemp)) + (ExpCoef2 * (TankShellTemp * StrapTemp)2)
	FloatRoofCor		FRC	CALC	Floating roof correction Only used if RoofType equals "Not In Table." RoofWt / (DensInAir * VolCorFactor)
	FloatRoofAdj		FRA	CALC	Floating roof adjustment Only used if RoofType equals 'In Table' (RoofWt / StrapDensity) – (RoofWt / ObsDensity)
	StrapVol	Volume Total Observed	TOV	CALC	Total observed volume Strap lookup from product level
	SolidsVol	Volume Solids		CALC	Strap lookup for SolidsLevel
	WaterVol	Volume Water		CALC	Strap lookup for WaterLevel with SolidsVol subtracted

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	FreeWaterVol	Volume Bottoms	FW	CALC	Free water volume SolidsVol + WaterVol
	RoofVol			CALC	Roof volume If RoofType equals "Not In Table", then RoofVol = FloatRoofCor If RoofType equals "In Table," then RoofVol = FloatRoofAdj
	GrossObsVol	Volume Gross Observed	GOV	CALC	Gross observed volume ((StrapVol – FreeWaterVol) x TankShellCor) +/– FloatRoofCor or FloatRoofAdj
	GrossStdVol	Volume Gross Standard	GSV	CALC	Gross standard volume GrossObsVol x VolCorFactor
	TotalCalcVol	Volume Total Calculated	TCV	CALC	Total calculated volume GrossStdVol + FreeWaterVol
	NetStdVol	Volume Net Standard	NSV	CALC	Net standard volume Note that the "(100 – SW%) / 100" portion of the equation is called Correction for Solids & Water (CSW) ((100 – SWPct) / 100) * GrossStdVol
	SWVol	Volume SW	$S\&W_{VOL}$	CALC	Solids & water volume (Solids is also known as Sediment) GrossStdVol – NetStdVol
Weight Calculations	GrossStdWt	Weight Gross Standard	GWS	CALC	Gross standard weight GrossStdVol * DensInAir
	NetStdWt	Weight Net Standard	NSW	CALC	Net standard weight NetStdVol * DensInAir

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
NMS/NRF/NMR	NMSDeviceCmd				NMS device commands for both the NMS5x and NMS8x lines: • 1 = Follow Level • 2 = Raise Servo • 3 = Freeze Servo • 4 = Find Bottom • 5 = Follow Upper Interface Level • 6 = Follow Lower Interface Level • 7 = Upper Density • 8 = Middle Density • 9 = Lower Density • 10 = Repeatability • 11 = Find Water Level • 12 = Release Overtension (NMS8x only) • 13 = Run Tank Profile • 14 = Run Interface Profile • 15 = Run Manual Profile • 16 = Level Standby (NMS8x only)
	NMSCmdStatus				Status of the last NMS command for both the NMS5x and NMS8x lines: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
	NMSStatusCode				Gauge status code for both the NMS5x and NMS8x lines
	NMSStatusText				Gauge status texts for both the NMS5x and NMS8x lines
	ActualDiag				Actual diagnostics for the NMS5x line, NMS8x line, NRF81, and NMR8x line Point status for the NRF590
	UpperIntLevel				Upper interface level for the NMS5x line, NMS8x line, NRF81, and NMR8x line
	LowerIntLevel				Lower interface level for the NMS5x line, NMS8x line, NRF81, and NMR8x line
	BottomLevel				Tank bottom for both the NMS5x and NMS8x lines

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	UpperDensity				Upper density for the NMS5x line, NMS8x line, NRF81, and NMR8x line
	MiddleDensity				Middle density for the NMS5x line, NMS8x line, NRF81, and NMR8x line
	LowerDensity				Lower density for the NMS5x line, NMS8x line, NRF81, and NMR8x line
	NxxObsDensity				Nxx observed density for the NMS8x line, NRF590, NRF81, and NMR8x line
	P1				P1 (bottom) for the NMS8x line, NRF590, NRF81, and NMR8x line
	P2				P2 (middle) for the NMS8x line, NRF590, NRF81, and NMR8x line
	P3				P3 (top) for the NMS8x line, NRF590, NRF81, and NMR8x line
	VaporTemp				Vapor temperature for the NMS8x line, NRF590, NRF81, and NMR8x line
	AirTemp				Air temperature for the NMS8x line, NRF81, and NMR8x line
	LevelPct				Tank level percentage for the NMS8x line, NRF590, NRF81, and NMR8x line
	MeasLevel				Measured level without corrections for the NMS8x line, NRF590, NRF81, and NMR8x line
	TankUllage				Tank ullage for the NMS8x line, NRF81, and NMR8x line
	Alarm1				Alarm 1 for the NMS8x line, NRF81, and NMR8x line
	Alarm2				Alarm 2 for the NMS8x line, NRF81, and NMR8x line
	Alarm3				Alarm 3 for the NMS8x line, NRF81, and NMR8x line
	Alarm4				Alarm 4 for the NMS8x line, NRF81, and NMR8x line
	FilteredDist				Filtered distance for the NMR8x line
	SignalQuality				Signal quality for the NMR8x line: • 0 = No Signal • 1 = Weak Signal • 2 = Medium Signal • 3 = Strong Signal

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
TLS (Only for TLS-3xx and TLS-4xx)	TLSVolume				Volume
	TLSTCVolume				Temperature corrected volume
	TLSWaterVolume				Water volume
	TLSUllage				Ullage
	TLSStatusBits				Bitmap of the tank status bits: • 0x0004 = Invalid Fuel Height Alarm • 0x0002 = Leak Detection In Progress • 0x0001 = Delivery In Progress

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	TLSTankAlarms				Bitmap of the tank alarms: • 0x8000 0000 = Fuel Quality Alarm • 0x4000 0000 = Density Warning • 0x2000 0000 = Delivery Density Warning • 0x1000 0000 = Tank/Line Gross Leak Alarm • 0x0800 0000 = Tank Missing Delivery Ticket Warning • 0x0400 0000 = Tank Cold Temperature Warning • 0x0200 0000 = Tank HRM Reconcilliation Alarm • 0x0100 0000 = Tank HRM Reconcilliation Warning • 0x0080 0000 = Tank Accu Chart Calibration Warning • 0x0040 0000 = Tank CSLD Rate Increase Warning • 0x0020 0000 = Tank Siphon Break Active Warning • 0x0010 0000 = Tank No CSLD Idle Time Warning • 0x0008 0000 = Tank Leak Test Active • 0x0004 0000 = Tank Annual Test Needed Alarm • 0x0002 0000 = Tank Periodic Test Needed Alarm • 0x0001 0000 = Tank Annual Test Needed Warning • 0x0000 8000 = Tank Periodic Test Needed Warning • 0x0000 4000 = Tank Annual Leak Test Fail Alarm • 0x0000 2000 = Tank Periodic Leak Test Fail Alarm • 0x0000 1000 = Tank Gross Leak Test Fail Alarm • 0x0000 0800 = Tank Maximum Product Alarm • 0x0000 0400 = Tank Delivery Needed Warning • 0x0000 0200 = Tank High Water Warning • 0x0000 0100 = Tank Probe Out Alarm • 0x0000 0080 = Tank Invalid Fuel Level Alarm • 0x0000 0040 = Tank High Product Alarm • 0x0000 0020 = Tank Sudden Loss Alarm • 0x0000 0010 = Tank Low Product Alarm • 0x0000 0008 = Tank Overfill Alarm • 0x0000 0004 = Tank High Water Alarm • 0x0000 0002 = Tank Leak Alarm • 0x0000 0001 = Tank Setup Data Warning

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	TLSSensorStat				Liquid sensor status: • 0 = Normal • 1 = Setup Data Warning • 2 = Fuel Alarm • 3 = Out Alarm • 4 = Short Alarm • 5 = Water Alarm • 6 = Water Out Alarm • 7 = High Liquid Alarm • 8 = Low Liquid Alarm • 9 = Liquid Warning
	TLSStartTime				Leak detect starting date and time
	TLSDuration				Leak detect test duration in hours
	TLSStartTemp				Leak detect starting temperature
	TLSEndTemp				Leak detect ending temperature
	TLSStartVolume				Leak detect starting volume
	TLSEndRate				Leak detect ending rate
	TLSTestType1				Previous in-tank leak test result: • 0 = 0.20 gal/hr Test • 1 = 0.10 gal/hr Test • 2 = Gross (3 gal/hr) Test
	TLSStartTime1				Previous in-tank leak test start time
	TLSManiStatus1				Previous in-tank leak manifold: • 1 = Tank Not Manifolded During Leak Test • 2 = Tank Manifolded During Leak Test
	TLSTestResult1				Previous in-tank leak test result: • 1 = Test Invalid • 2 = Test Passed • 3 = Test Failed
	TLSTestType2				Previous in-tank leak test result: • 0 = 0.20 gal/hr Test • 1 = 0.10 gal/hr Test • 2 = Gross (3 gal/hr) Test
	TLSStartTime2				Previous in-tank leak test start time

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	TLSManiStatus2				Previous in-tank leak manifold: • 1 = Tank Not Manifolded During Leak Test • 2 = Tank Manifolded During Leak Test
	TLSTestResult2				Previous in-tank leak test result: • 1 = Test Invalid • 2 = Test Passed • 3 = Test Failed
	TLSTestType3				Previous in-tank leak test result: • 0 = 0.20 gal/hr Test • 1 = 0.10 gal/hr Test • 2 = Gross (3 gal/hr) Test
	TLSStartTime3				Previous in-tank leak test start time
	TLSManiStatus3				Previous in-tank leak manifold: • 1 = Tank Not Manifolded During Leak Test • 2 = Tank Manifolded During Leak Test
	TLSTestResult3				Previous in-tank leak test result: • 1 = Test Invalid • 2 = Test Passed • 3 = Test Failed

Table 4-3: Volume Correction Settings for Tank Dynamic Settings

Notes

*	Setting in FM available to operations like a Tag
**	Label in config settings, not a Tag
***	*Does not yet exist but needs to*

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