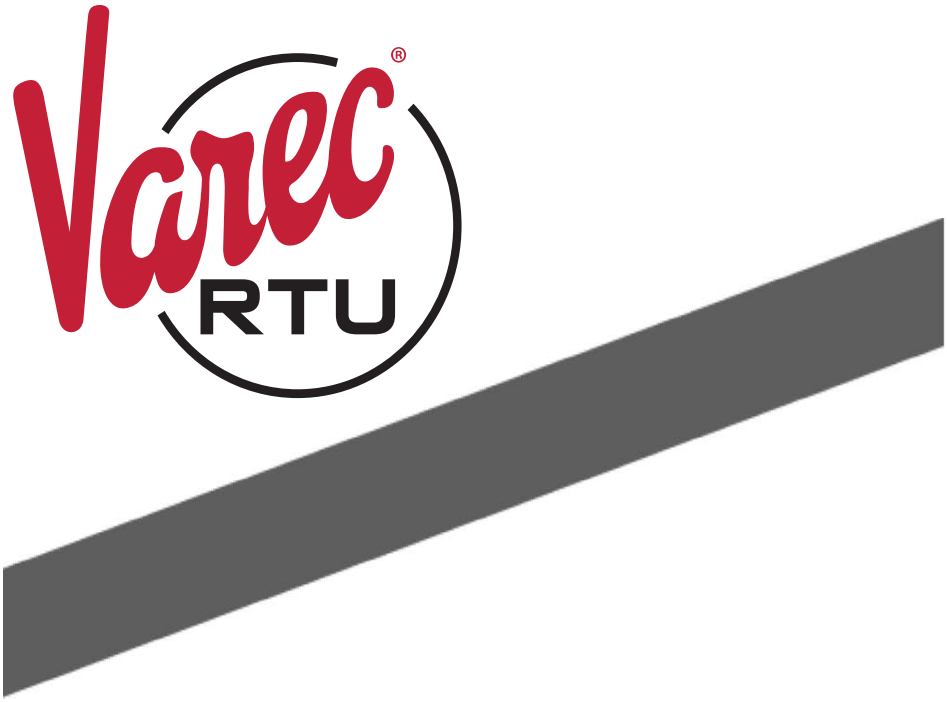

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Software Version 2

8810 VeRTUe Programmers Guide

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Using This Publication

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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

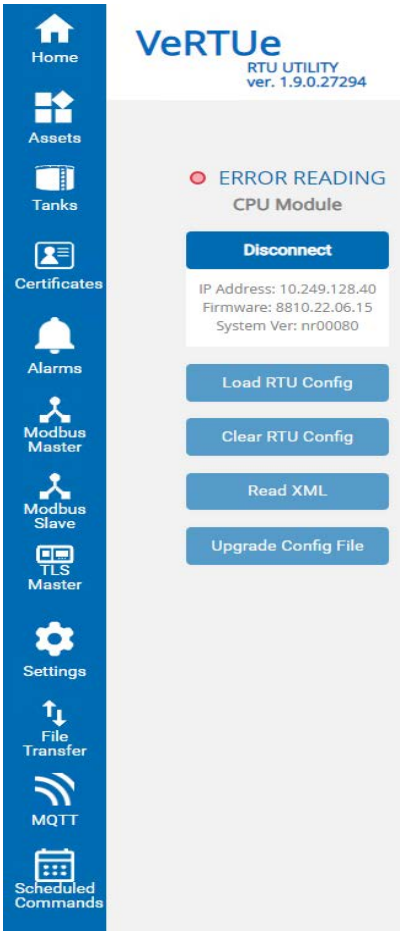


Figure 1-1: VeRTUe Navigation Menu

VeRTUe has ten sections on the navigation bar to help the user configure, analyze, and fix issues for the 8810 RTU: Home, Assets, Tanks, Certificates, Alarms, Modbus Master, Modbus Slave, TLS Master, Settings, and File Transfer. Each choice on the navigation bar will have its own section below.

Connecting to the 8810 RTU

Note If launching VeRTUe from the Start menu or desktop causes an "InternetShortcut" error to occur, perform the following steps:

1. From the Windows desktop, open **Settings**.
2. Select **Apps**.
3. In the right-side pane, select **Default apps**.
4. Scroll to the bottom, and select **Choose default apps by file type**.
5. Scroll down to **.URL**, and click on the default app.

6. Click on **Internet Browser**. The icon should open up your browser when next used.

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.

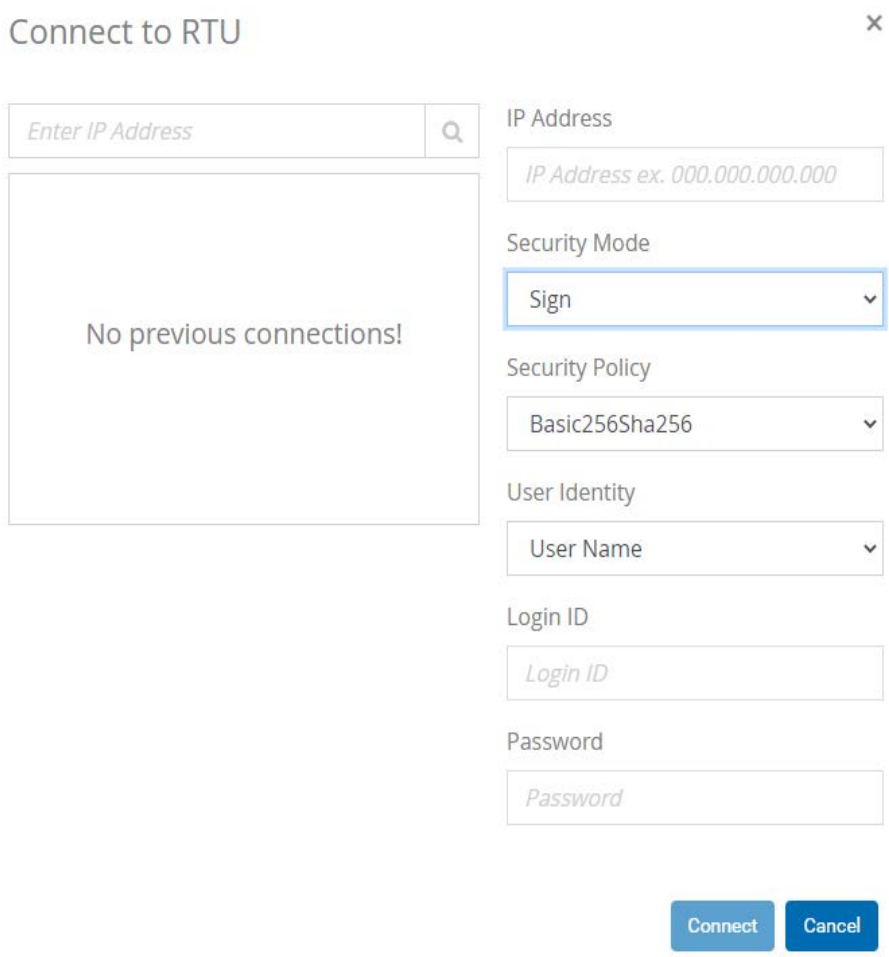


Figure 1-2: VeRTUe Connect to RTU Window

The Home Menu

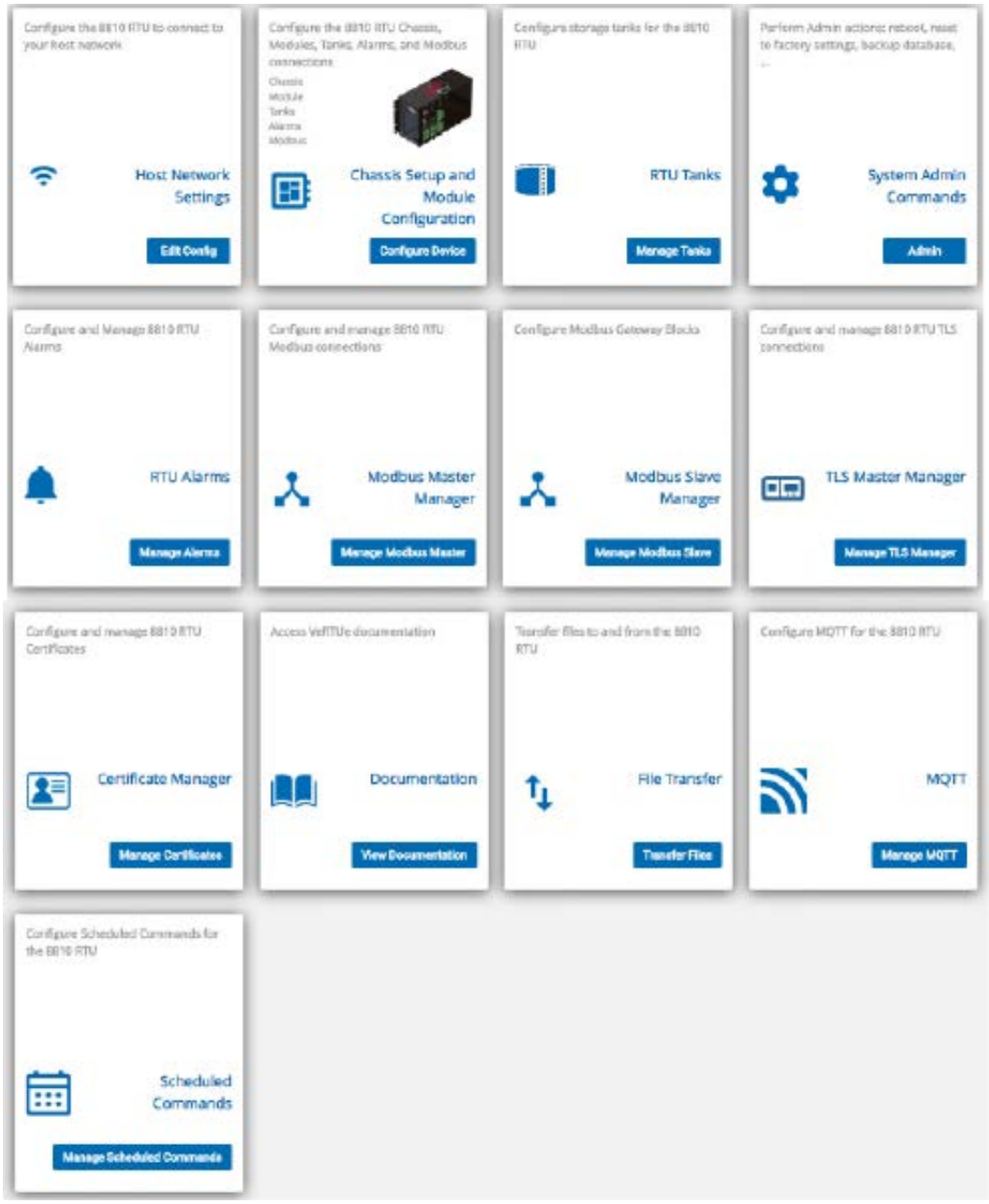


Figure 1-3: VeRTUe Home Menu

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, as well as reset the user's password, and upgrade the firmware remotely as needed.

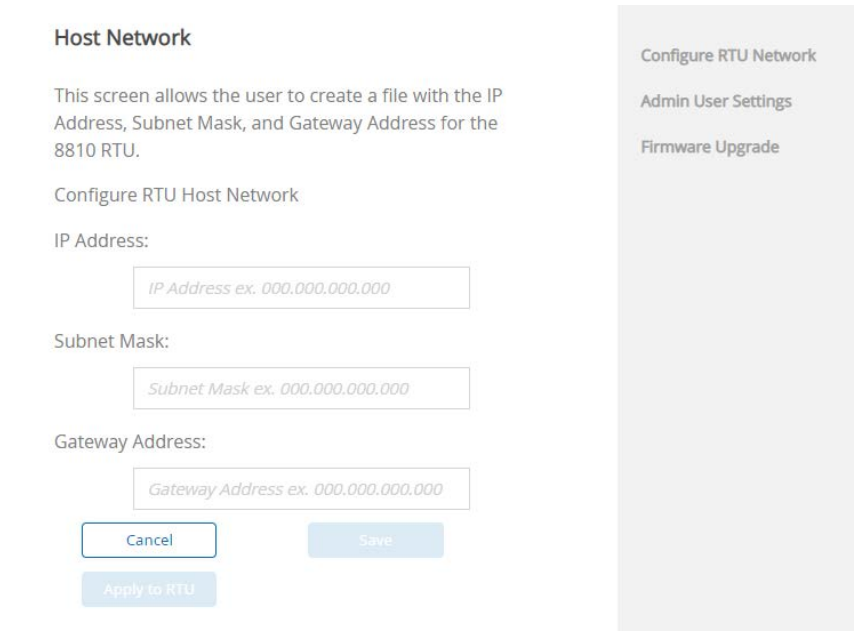


Figure 1-4: VeRTUe Host Network Settings

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 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.

Note Alarms can be set on virtual channels, as well as both digital input and digital output channels.

Modbus Master Manager

The **Modbus Master 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.

Modbus Slave Manager

The **Modbus Slave Manager** protocol handler is used to expose internal data from the 8810 RTU to a Modbus Master. Modbus Slave registers are user definable and may be sequential or not. This is accomplished by the use of "Gateway Blocks" on the Modbus Slave Master page in VeRTUe.

The user configures the data addresses and block sizes for the data to be requested by an external Modbus Master.

TLS Master Manager

The **TLS Master Manager** protocol handler is used to interact with Veeder-Root gauges and understand their TLS Master communications protocol to populate a tank's Level, Temp, WaterLevel, and 25 new dynamic parameters.

> **Note** Each channel only supports no more than one TLS device which is due to the data protocol limitations as described in the Veeder-Root protocol manual.

Certificate Manager

The **Certificate Manager** screen 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** screen opens up the latest version of the VeRTUe manual that matches the version being used.

File Transfer

The **File Transfer** screen allows file transfers between VeRTUe and the OPC UA server embedded within the 8810 RTU. This allows users to open, close, read, and write files stored on the 8810 RTU through a remote connection rather than the need to use a USB flash drive to update the RTU.

MQTT

The **MQTT** screen allows the user to configure the 8810 protocol to set up a remote device to communicate over the internet using MQTT to communicate with internet-connected devices.

Scheduled Commands

The **Scheduled Commands** screen allows the user to configure the 8810 to run a specific command (such as checking levels or temperature of the product) at a specified time, whether once a day, once a week, once a month, and what day of the week and time as well.

The Assets Menu

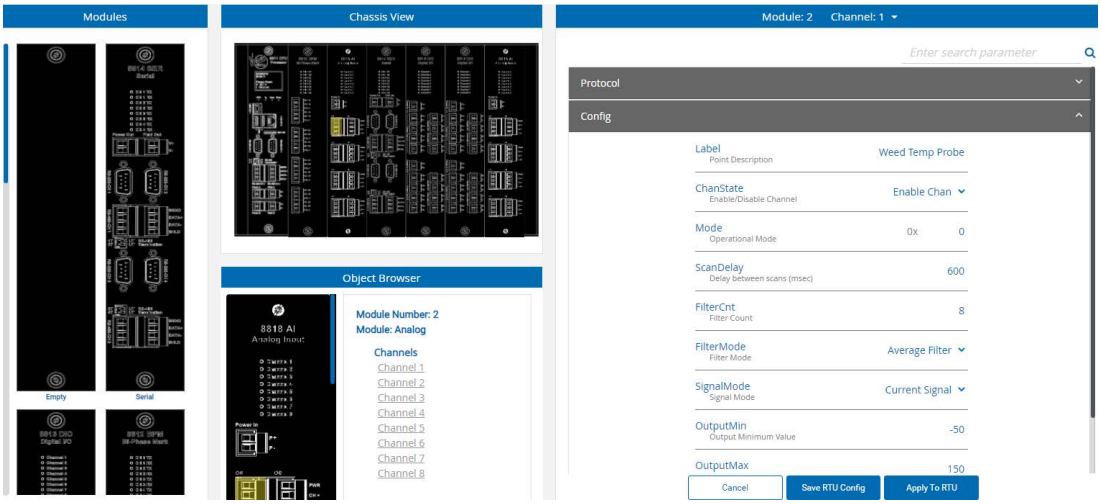


Figure 1-5: VeRTUe Assets Menu

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 Analog Input Module (8818), 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

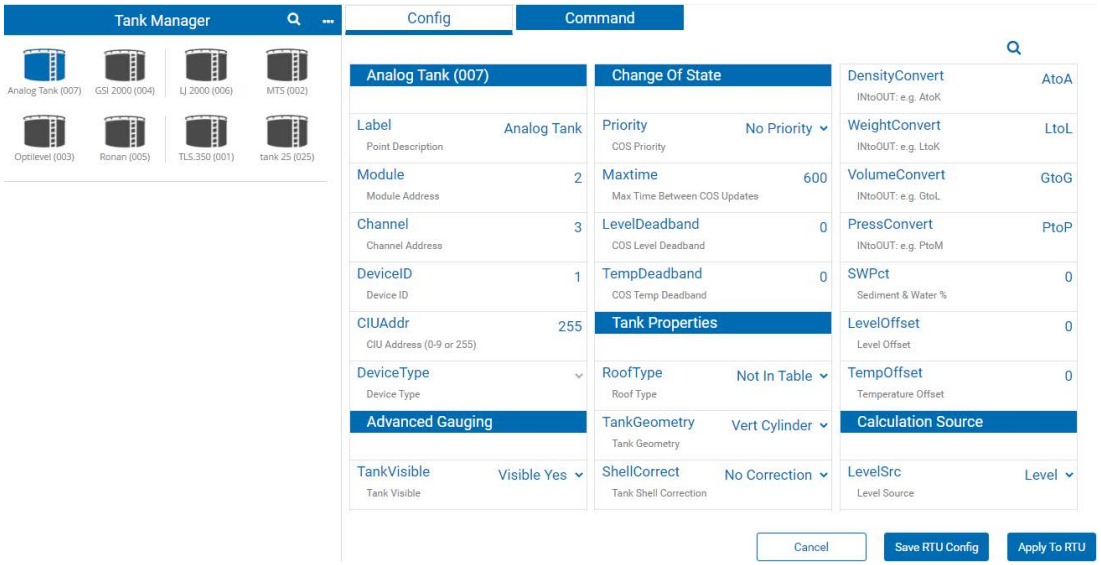


Figure 1-6: Tank Manager Menu

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. Configure the information under the **Tank Roof** section as needed to match the individual tank and strapping table characteristics.
11. 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.
12. Configure any of the tank calculations methods that need to be changed under the **Config** tab listed above.
13. 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 in 8810/API Term	Default Value	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 in 8810/API Term	Default Value	Definition
Channel	0	Channel address (1–8)
DeviceID	0	Device ID
AuxID	255	CIU Address (0–9 or 255) FCU Tank ID (1–32 or 255) DAU ID (1–247 or 255)
DeviceType	0	Device type depends upon the protocol of the associated channel. Options include: • 1 = Enraf 811 • 2 = Enraf 854 • 3 = Enraf 873 • 4 = Enraf 990 • 5 = ATT 4000 • 6= FTT 29xx • 7 = GSI 2000 • 8 = Varec 1800 • 9 = Varec 1900 • 10 = Varec 6500 • 11 = NMS5x • 12 = NMS8x • 13 = NRF590 • 14 = NRF81 • 15 = NMR8x • 16 = LJ1000 • 17 = LJ1500 • 18 = LJ2000 • 19 = MTS • 20 = TLS3xx • 21 = TLS4xx • 22 = X76CTM • 23 = OptiLevel • 24 = RAPTOR • 25 = REX • 26 = RTG • 27 = RTG/DAU • 28 = Enraf 954
Advanced Gauging		
TankVisible	No	Tank visible is set during the Activate and Deactivate tank functions: • 1 = No • 2 = Yes
TOI	B	Type of instrument For the EN811, EN854, EN954, EN990, FTT 29XX
Mode	Run Mode	Mode of operation: • 1 = Run Mode • 2 = Test Mode

Name in 8810/API Term	Default Value	Definition
DataMode	0	Data mode: • 0x0001 = Byte Swap • 0x0002 = Word Swap • 0x0003 = Swap Both • 0x0004 = Reverse (LJ2000) • 0x0004 = Read All Temps (RAPTOR, REX, RTG/DAU) • 0x0008 = Old Firmware (LJ1000, LJ1500) • 0x0008 = 16-bit Level (RAPTOR, REX) • 0x0008 = Modbus Over TCP (GSI 2000) • 0x0010 = 2160 FCU (RAPTOR, REX, RTG, RTG/DAU) • 0x0020 = Flow Rate Method
ScanCmd	BC	Scan commands for the instrument For the EN811, EN854, EN873, EN954, EN990, FTT 29xx, OptiLevel • Enraf: A, B, C, D, E, F, G, J, L, M • OptiLevel: A=Level, B=Volume, C=Ullage
PerInterleave	0	Periodic interleave factor For the EN811, EN854, EN954, EN990, FTT 29XX
PerItemCmd	(null)	Periodic item command For the EN811, EN854, EN954, EN990, FTT 29XX
PerFilter		Periodic reply data filter For the EN811, EN854, EN954, EN990, FTT 29XX
MSSpeed	High	Mark/Space speed: • 1 = High • 2 = Low
ScanMode	Normal Scan	Scan mode: • 1 = Normal Scan • 2 = Auto Scan
FastScanDelta	0.00	Fast scan delta
FastScanTime	60	Fast scan time in minutes
LvlStatFilter		Level status filter C, B, L, R, T, W, D
LvlStatTimer		Level status timer in seconds
FlexConnAddr		FlexConn address (0-1899)
IpAddress		IP Address For the GSI 2000
Change of State		
Priority	High Priority	Change of state priority: • 1 = No Priority • 2 = High Priority • 3 = Low Priority

Name in 8810/API Term	Default Value	Definition
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 Calculations		
StandardsOrg	API	Standards organization: • 1 = API (American Petroleum Institute)
StandardsRev	Commodity 2004	Standards revision: • 1 = Commodity 2004 (API standard)
CommodityType		Commodity type: • 1 = Alpha 60 • 2 = Crude oil • 3 = Refined products • 4 = 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., FtoM • C = Centimeters • F = Feet • I = Inches • M = Meters • m = millimeters • P = Feet-Inches-Sixteenths (or Ft-In-16th) • S = Sixteenths • T = Thirtyseconds

Name in 8810/API Term	Default Value	Definition
TempConvert	FtoF	INtoOUT: e.g. FtoC • C = Celsius • F = Fahrenheit • 1 = Add 100 to Fahrenheit Temp (Mark/ Space only)
DensityConvert	AtoA	INtoOUT: e.g., AtoK • A = API • G = GMML • K = KG/M3 • L = LB/F3
WeightConvert	LtoL	INtoOUT: e.g., LtoK • K = Kilograms • L = Pounds • M = Metric Tons • T = Tons
VolumeConvert	GtoG	INtoOUT: e.g., GtoL • B = Barrels • G = Gallons • L = Liters • M = Cubic Meters
PressConvert	PtoP	INtoOUT: e.g., PtoM • C = KG/CM2 • I = inH2O • K = Kilopascals • M = Megapascals • m = Millibars • P = PSI • S = Pascals
SWPct	0	Sediment & water %
LevelOffset	0.00	Numeric offset applied to level
TempOffset	0.00	Numeric offset applied to temperature
FlowSamples		Number of StrapVol samples used to calculate flow rate Value ranges from 2-16 Default = 8
FlowInterval		Minimum time interval in seconds between flow rate Default = 0
FlowDeadband		Flow rate deadband Used if FlowDeadband or less away than 0 which forces the flow rate to have a value of 0 Default = 0.0
Tank Properties		

Name in 8810/API Term	Default Value	Definition
RoofType	Not In Table	Roof Type: • 1 = In Table (floating roof) • 2 = Not In Table (floating roof) • 3 = Fixed Roof • 4 = 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: • 1 = Vertical Cylinder • 2 = Horizontal Rounded • 3 = Horizontal Flat
ShellCorrect	No Correction	Tank Shell Correction: • 1 = No Correction • 2 = Uninsulated Tank • 3 = Insulated Tank
TankMaterial		Tank Shell Material. Only used if ShellCorrect is "Uninsulated" or "Insulated": • 1 = Mild Steel • 2 = Stainless Steel • 3 = Aluminum • 4 = 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.
Calculation Source		
LevelSrc	Level	Product level source: • 1 = Level • 2 = ManLevel
ManLevel	0	Manual level value
TempSrc	Temp	Product temperature source: • 1 = Temp • 2 = ManTemp
ManTemp	0	Manual temperature value
SolidsLevelSrc	ManSolidsLevel	Solids level source: • 1 = SolidsLevel • 2 = ManSolidsLevel
ManSolidsLevel	0	Manual solids level value. SolidsVol is forced to 0 if ManSolidsLevel is a negative number.
WaterLevelSrc	ManWaterLevel	Water level source: • 1= WaterLevel • 2 = ManWaterLevel

Name in 8810/API Term	Default Value	Definition
ManWaterLevel	-1	Manual water level. WaterVol is forced to 0 if ManWaterLevel is a negative number
DensityMethod	No Method	Density method: • 1 = No Method • 2 = Gauged • 3 = 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
Analog		
AIMinValue	4.0	Minimum nominal mAmp input value as a 16-bit integer
AIMaxValue	20.0	Maximum nominal mAmp input value as a 16-bit integer
AI1LowRange		Nominal low setting for the 32-bit floating point value reported in Analog1
AI1HighRange		Nominal high setting for the 32-bit floating point value reported in Analog1
AI2LowRange		Nominal low setting for the 32-bit floating point value reported in Analog2
AI2HighRange		Nominal high setting for the 32-bit floating point value reported in Analog1
AI3LowRange		Nominal low setting for the 32-bit floating point value reported in Analog3
AI3HighRange		Nominal high setting for the 32-bit floating point value reported in Analog1

The Command Tab

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

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
Tank Name		
GaugeStatus	0 (Undefined)	The value that indicates the status of the gauge The values are: • 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	0	Displacer Position
Level	(null)	Sourced product level in either millimeters ("m") or inches ("i") LevelConvert should be configured accordingly
Temp	(null)	Sourced product temperature in either Fahrenheit ("F") or Celsius ("C") TempConvert should be configured accordingly
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
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

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
ScanStatus		Scan status • 1 = Scanning • 2 = Invalid Module • 3 = Invalid Channel • 4 = Disabled Channel • 5 = Invalid Device Type • 6 = Invalid ScanCmd • 7 = Invalid AuxID • 8 = Invalid Controller • 9 = Invalid Interface Module • 10 = Invalid Protocol • 11 = RegMap Source
ScanTime		Time of the last good response
Elapse	(Displays current DateTime of unit)	Time of last update/scan
PntStatus	112	Byte value indicating status of point. The values are: • 0x00000080 = Stale Level • 0x00000040 = Invalid Density • 0x00000020 = Invalid Temperature • 0x00000010 = Invalid Level • 0x00000008 = Calculation Error • 0x00000004 = Not Scanning • 0x00000002 = AuxID Device Time • 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: • 1 = Reset Gauge • 2 = Raise Servo • 3 = Freeze Servo • 4 = Find Water Level • 5 = Follow Level • 6 = Run Test • 7 = Run Immersed Profile • 8 = Find Bottom • 9 = Copy ItemCmdFile to RTU • 10 = Read Device Config • 11 = Write Device Config • 12 = Copy .cfg to USB • 13 = Copy .log to USB • 14 = Calibrate • 15 = Set Turn Around Delay

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
CmdStatus		The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
CalLevelCmd	0	Calibrate product level command
CalIntfCmd		Calibrate interface level command
AlarmStatus	0x 0	Tank alarm status
DeviceStatus	131	Device status • 0x4000 0000 = Invalid Density • 0x0000 0080 = Tank Calculations • 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 Device status for RTG/DAU devices • 0x8000 0000 = Invalid Level (register) • 0x4000 0000 = Level Warning • 0x2000 0000 = NMI Legal Level • 0x1000 0000 = NMI Approved RTG • 0x0800 0000 = Presentation Level • 0x0100 0000 = LPG Verify Copy • 0x0080 0000 = RTG Comm Error • 0x0040 0000 = Analog 3 Error • 0x0020 0000 = Analog 2 Error • 0x0010 0000 = Analog 1 Error • 0x0000 0080 = AuxID Device Timeout • 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

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
LevelStatus	0	Tank level status Enraf devices report: • 0 = Uncertain no communication last usable value • F = Level information not valid • C = Motor limit switch • B = Block of freeze active • L = Locktest or calibrate active • R = Density scan active ([TP] or [IP]) • T = The gauge is searching for level or test gauge, balance test, or measure frequency command is active • W = Water level found • D = Searching for water (downward) • – = Valid level
TempStatus	0	Tank temperature status
WaterStatus	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: • 1 = Disable • 2 = Enable
FastScanTimer	0	Fast scan timer in minutes
ScanList	Normal Scan	Scan list: • 1 = Normal Scan • 2 = Fast Scan
Volume	0	Reported volume
Ullage	0	Reported ullage
Offset	0	Reported probe offset
Version	0	Displays the software version
LevelRate		Level rate in units of meters per hour or feet per hour, depending upon whether the unconverted Level is in millimeters or inches
Tank Calculations		

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
CalcCmd		Tank calculation command: • 1 = Copy StrapFile to RTU = copy StrapFile from USB to the RTU (a.k.a., upload the StrapFile) • 2 = Copy StrapFile to USB = copy StrapFile from the RTU to USB (a.k.a., download the StrapFile) • 3 = 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 • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
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.
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 (CTPL)	0	Volume correction factor. Calculated from StdDensity and product temperature and pressure.
TempCorFactor (CTL)	0	Correction due to temperature (CTL)
PressCorFactor (CPL)	0	Correction due to pressure

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
TankShellTemp (TSh)	0	Tank shell temperature If ShellCorrect is "Insulated," then TankShellTemp is the same as Temp. Otherwise, TankShellTemp is: ((7 x Temp) + AmbientTemp) / 8.
TankShellCor (CTSh)	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 (FRC)	0	Floating roof correction Only used if RoofType is "Not In Table." RoofWt / (DensInAir x VolCorFactor)
FloatRoofAdj (FRA)	0	Floating roof adjustment Only used if RoofType equals "In Table." (RoofWt / StrapDensity) – (RoofWt / ObsDensity)
StrapVol (TOV)	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 (FW)	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 (GOV)	0	Gross observed volume ((StrapVol – FreeWaterVol) x TankShellCor) +/– FloatRoofCor or FloatRoofAdj
GrossStdVol (GSV)	0	Gross standard volume GrossObsVol x VolCorFactor
TotalCalcVol (TCV)	0	Total calculated volume GrossStdVol + FreeWaterVol
NetStdVol (NSV)	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 (S&Wvol)	0	Sediment & water volume GrossStdVol – NetStdVol
TOVFlowRate		Calculated flow rate for Strap Volume (StrapVol or TOV) Calculated in the units of StrapVol per minute The value can be a positive or negative floating point number
Weight Calculation		

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
GrossStdWt (GSW)	0	Gross standard weight GrossStdVol x DensInAir
NetStdWt (NSW)	0	Net standard weight NetStdVol x DensInAir
NMS NRF NMR Command Parameters		
NMSDeviceCmd		NMS device command: • 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 • 13 = Tank Profile Density • 14 = Interface Profile Density • 15 = Manual Profile Density • 16 = Level Standby
NMSCmdStatus		Status of the last NMS command • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
NMSStatusCode		Gauge status code
NMSStatusText		Gauge status text
ActualDiag		Actual diagnostics or point status
UpperIntLevel		Upper interface level
LowerIntLevel		Lower interface level
BottomLevel		Tank bottom
UpperDensity		Upper density
UpperDensTemp		Upper density temperature
MiddleDensity		Middle density
LowerDensity		Lower density
NxxObsDensity		Observed density for the NMS, NMR, and NRF devices supported by the 8810 RTU
P1		P1 (bottom)
P2		P2 (middle)
P3		P3 (top)

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
VaporTemp		Vapor temperature
AirTemp		Air temperature
LevelPct		Tank level %
MeasLevel		Measured level without corrections
TankUllage		Tank ullage
Alarm1		Alarm 1
Alarm2		Alarm 2
Alarm3		Alarm3
Alarm4		Alarm 4
FilteredDist		Filtered distance
SignalQuality		Signal quality
TankProfDens		Tank profile density
TankProfTemp		Tank profile temperature
IFProfDens		Interface profile density
IFProfTemp		Interface profile temperature
ManualProfDens		Manual profile density
ManualProfTemp		Manual profile temperature
TLS		
TLSVolume		Volume
TLSTCVolume		TC volume
TLSWaterVolume		Water volume
TLSUllage		Ullage
TLSStatusBits		Tank status bits

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
TLSTankAlarms		Tank Alarms as a bitmap: • 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
TLSSensorStat		Sensor status value

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
TLSStartTime		Starting date/time
TLSDuration		Test duration (in hours)
TLSStartTemp		Starting temp
TLSEndTemp		Ending temp
TLSStartVolume		Starting volume
TLSEndRate		Ending rate
TLSTestType1		Test 1 result type
TLSStartTime1		Test 1 start time
TLSManiStatus1		Test 1 manifold status
TLSTestResult1		Test 1 leak test result
TLSTestType2		Test 2 result type
TLSStartTime2		Test 2 start time
TLSManiStatus2		Test 2 manifold status
TLSTestResult2		Test 2 leak test result
TLSTestType3		Test 3 result type
TLSStartTime3		Test 3 start time
TLSManiStatus3		Test 3 manifold status
TLSTestResult3		Test 3 leak test result
Analog		
Analog1		Analog Input #1
Analog2		Analog Input #2
Analog3		Analog Input #3
Temperature		
Temp1-14		Temperature #1-14
TempInLiquid		Specifies which temperature probes are in the product • 0x8000 = Calibration Error • 0x4000 = System Error • 0x2000 = Temp 14 In Liquid • 0x1000 = Temp 13 In Liquid • 0x0800 = Temp 12 In Liquid • 0x0400 = Temp 11 In Liquid • 0x0200 = Temp 10 In Liquid • 0x0100 = Temp 9 In Liquid • 0x0080 = Temp 8 In Liquid • 0x0040 = Temp 7 In Liquid • 0x0020 = Temp 6 In Liquid • 0x0010 = Temp 5 In Liquid • 0x0008 = Temp 4 In Liquid • 0x0004 = Temp 3 In Liquid • 0x0002 = Temp 2 In Liquid • 0x0001 = Temp 1 In Liquid

Name (& API Abbreviation Where Appropriate)	Default Setting	Definition
TempBlocked		Temperature blocked status • 0x8000 = NMI Approved DAU • 0x4000 = Legal NMI Temp • 0x2000 = Temp 14 Blocked • 0x1000 = Temp 13 Blocked • 0x0800 = Temp 12 Blocked • 0x0400 = Temp 11 Blocked • 0x0200 = Temp 10 Blocked • 0x0100 = Temp 9 Blocked • 0x0080 = Temp 8 Blocked • 0x0040 = Temp 7 Blocked • 0x0020 = Temp 6 Blocked • 0x0010 = Temp 5 Blocked • 0x0008 = Temp 4 Blocked • 0x0004 = Temp 3 Blocked • 0x0002 = Temp 2 Blocked • 0x0001 = Temp 1 Blocked
TempError		Specifies which temperature probes are reporting an error • 0x8000 = Temp Average Error • 0x4000 = Master, FCU • 0x2000 = Temp 14 Error • 0x1000 = Temp 13 Error • 0x0800 = Temp 12 Error • 0x0400 = Temp 11 Error • 0x0200 = Temp 10 Error • 0x0100 = Temp 9 Error • 0x0080 = Temp 8 Error • 0x0040 = Temp 7 Error • 0x0020 = Temp 6 Error • 0x0010 = Temp 5 Error • 0x0008 = Temp 4 Error • 0x0004 = Temp 3 Error • 0x0002 = Temp 2 Error • 0x0001 = Temp 1 Error

The Certificates Manager Screen and Security Settings

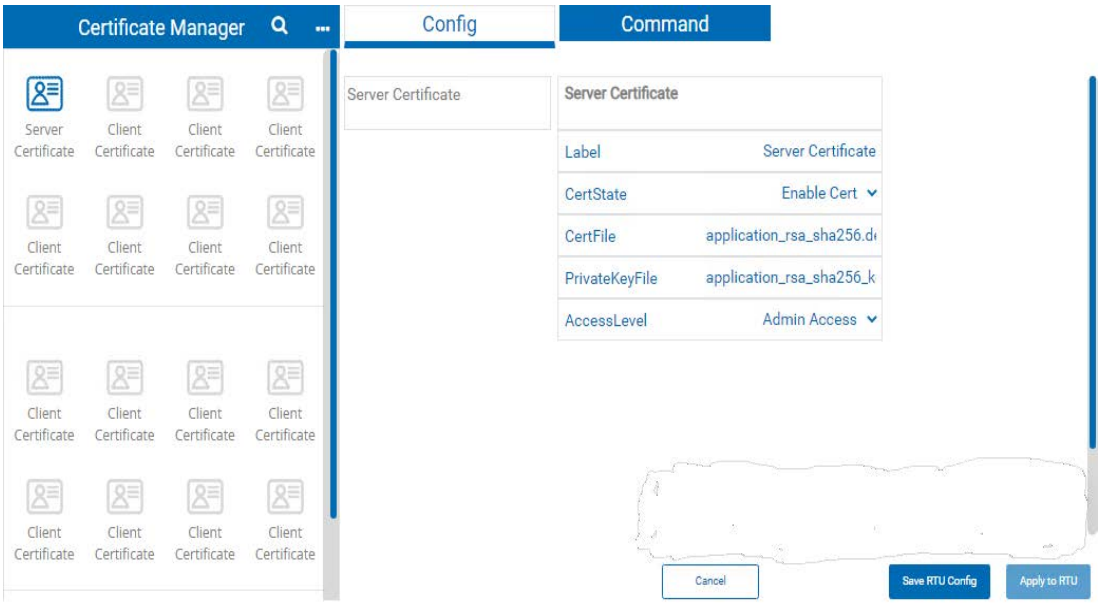


Figure 1-7: VeRTUe Certificates Manager

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 the use of X.509 certificates or, explained further below, a simple username and password (which is the default method to connect).

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 different places based on Microsoft's recommendation in the ProgramData directory depending up on which version of Windows the computer is using.

- 2000/XP/2003 -> C:\Documents and Settings\All Users\Application Data
- Vista/2008/7/8/2012/10 and later -> C:\ProgramData

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

%PROGRAMDATA\Varec\VeRTUe\pki\private where %PROGRAMDATA is dependent upon the operating system. It is also the standard for the Vista operating system and later. For Windows 7 & 8, it is <C:\Documents and Settings\All Users\Application> Data. For 10 and above, it is c:\programdata.

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 Varec VeRTUe service is started for the first time, a new client certificate will be generated, called VeRTUe, and placed in the Microsoft certificates store.

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

1. Open VeRTUe and connect to the 8810 RTU. By default, the following settings are the factory default settings:
   a. IP Address (Shown on RTU display)
   b. Security Mode = None
   c. User Identity = User Name
   d. Login ID = admin
   e. Password = 8810rtu

   If the password has been forgotten, please use **pwreset** login credentials to factory default settings.
2. Select **File Transfer**.
3. Under Configure File Transfer, click **Browse**. The File Explorer window should pop up.
4. In the File Explorer **search field**, open the drive where the certificate is stored (usually the C drive by default).
5. Select the **View** tab in the explorer toolbar.
6. Make sure **Hidden Items** is checked.
7. Navigate to **ProgramData\Varec\VeRTUe\pki\own\Certs**.
8. Select the desired (***.der**) certificate file, and click **Open**.
9. Click **Write to the RTU**.
10. Copy down the certificate name. It's needed for the next step.
11. Select **Certificates** and configure a certificate, for example VeRTUe [108A7228-DA048634A7B7CA80A58226836DE7EBA5].der

    Note Do not configure **Certificate 001**.
12. Make sure **Certificate** is enabled.
13. Click the **Command** tab in VeRTUe.
14. Set the **certcmd** to reset the certificate.

15. Configure the CPU module to use Certificates.
    - Security Mode = Sign and Encrypt
    - Security Policy = Basic256Sha256
    - User Identity = Certificate
16. **Reset** the RTU.
17. Sign in using **Certificate**. Make sure login criteria matches CPU security settings
18. Browse to **ProgramData/Varec/VeRTUe/pki/own/private**.
19. Select the key that matches the certificate installed. For example, VeRTUe [108A7228-DA048634A7B7CA80A58226836DE7EBA5].pfx.

Configuring the 8810 RTU's Authentication Options

Note There are three primary settings to interact with to configure when setting up the 8810's preferred method of authentication: **SecurityMode** (step #3), **SecurityPolicy** (step #4), and **UserIdentity** (step #5).

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 six 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

Note Anonymous and Unsigned & Unencrypted Username Login are the only two options that do not require a certificate.

- **Signed & Unencrypted Username Login**—where a username and password as well as a signed certificate on both sides (the client and the server) are required for verification like the default 8810 RTU login listed in this manual, but the communications are unencrypted
- **Signed & Encrypted Username Login**—where the client can connect with the 8810 via username and password as well as a signed certificate on both sides, but the communications are encrypted
- **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 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 **UserIdentity** 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 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.

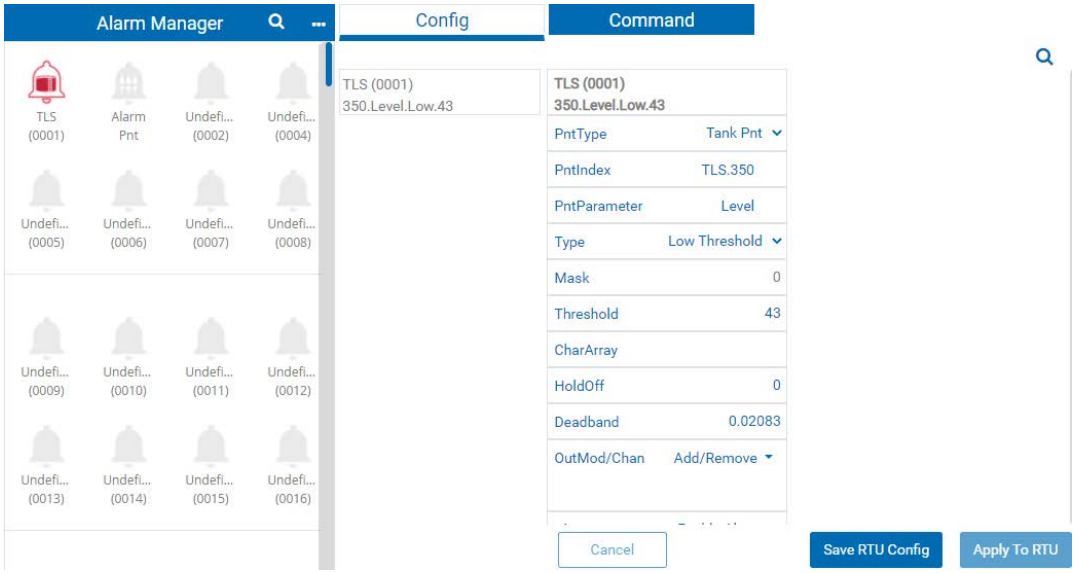


Figure 1-8: Alarm Manager Commands Screen

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.

Note Alarms can be set on virtual channels, as well as both digital input and digital output channels.

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		• 1 = CPU Module • 2 = Interface Module • 3 = Port (Module & Channel) • 4 = FP Register • 5 = Integer Register • 6 = Gateway Block • 7 = Tank • 8 = Alarm • 9 = TLS • 10 = Register Map • 11 = X509 • 12 = Remote File Transfer • 13 = MQTT • 14 = Scheduled Command	None	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

Parameter	Point	Values	Factory Default	Notes
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) TLS (1–4) Register Map (1–800) X509 (1–20) Remote File Transfer (1) MQTT (1) Scheduled Commands (1–400)	None	The point index for the alarm
PntParameter		40 = PntStatus 78 = DIOHwValue 238 = GaugeStatus 239 = Position 240 = Level 241 = Temp 250 = LevelStatus 369 = DeviceStatus	None	The parameter that is being monitored by the alarm The listed numbers are samples The full list of Point Parameters is available through Vertue
Type		• 1 = Bitmap (Mask) • 2 = Match (Mask) • 3 = Mismatch (Mask) • 4 = Low Threshold (Threshold) • 5 = High Threshold (Threshold) • 6 = Character 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	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		The floating point threshold

Parameter	Point	Values	Factory Default	Notes
CharArray				The character array
HoldOff			0	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	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
OutModules		CPU Module (0) Interface Modules (1-6)		OutModules represents the configured output module on the RTU to which the alarm's output will be written
OutChannels		Channels (1-8)		OutChannels represents the configured output 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
OutputBit				The value of the alarm output when the alarm is active

The Command Tab

Parameter	Point	Values	Factory Default	Notes
AlarmCmd		• 1 = 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		0x0000 to 0x8000 = Alarm Reset		This is the current status of the point

The Modbus Master & Slave Managers

VeRTUe currently only uses the below defined Modbus Map to work with both Modbus Master and Modbus Slave devices through 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 Master Manager Parameters

The Modbus Master Manager allows the user to configure the following parameters on the 8810. Each parameter allows the user to select whether the parameter should be considered either a floating point register parameter or an integer register parameter.

There are three choices in the drop-down ellipses: Register Maps, FP Registers, INT Registers, as well as Show or Hide Point Indexes.

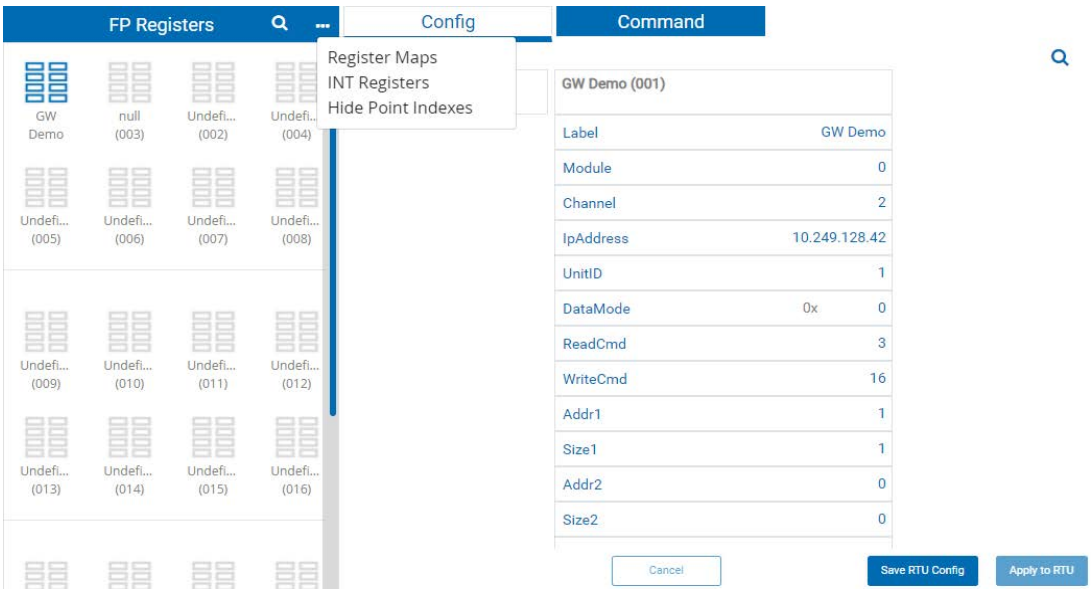


Figure 1-9: Modbus Master Manager Config Screen

Modbus Master FP Registers and INT Registers

The Modbus Master Manager allows the user to configure the following parameters as either a floating point register or as a integer register on the 8810.

Parameter	Type	Values	Factory Default	Description
Config				
Label	Config	ASCII string	Gateway Block XXX	32-character ASCII string where 'XXX' is the GWBLK number (001 to 108)
Module	Config	• 0 = CPU Module • 1-6 = Interface Module	0	Module number
Channel	Config	1-8 = Channel Number		Channel number for the parameter to use on the module
IpAddress	Config			IP address for the device the module is communicating with
UnitID	Config			The ID for the Modbus device on the tank

Parameter	Type	Values	Factory Default	Description
DataMode	Config	Bitmap field used to configure the data mode. • 0x0001 = Byte Swap (A/B -> B/A) • 0x0002 = Word Swap (A/B/C/D -> C/D/A/B) • 0x0003 = Swap Both (A/B/C/D -> D/C/B/A) • 0x0004 = 32-bit Parameter Mode (place 2 16-bit registers in 1 32-bit ValueXX—**Integer Register only**) • 0x0008 = Modbus Over TCP (vs. Modbus TCP) • 0x0010 = Force OPC UA Status Code Good	0	
ReadCmd	Config			Read command
WriteCmd	Config			Write command
StartReg1	Config			Register block #1 Modbus starting address
Size1	Config			Register block #1 size (# of 16-bit registers or # of 32-bit registers if 32-bit Parameter Mode)
StartReg2	Config			Register block #2 Modbus starting address
Size2	Config			Register block #2 size (# of 16-bit registers or # of 32-bit registers if 32-bit Parameter Mode)
StartReg3	Config			Register block #3 Modbus starting address
Size3	Config			Register block #3 size (# of 16-bit registers or # of 32-bit registers if 32-bit Parameter Mode)
StartReg4	Config			Register block #4 Modbus starting address
Size4	Config			Register block #4 size (# of 16-bit registers or # of 32-bit registers if 32-bit Parameter Mode)
Priority	Config	• 1 = No Priority • 2 = High Priority • 3 = Low Priority		Change-of-state priority
Maxtime	Config		600	Max time between change-of-state updates (in seconds)
Command				
Value00-63				
Elapse	Dynamic	(Displays current DateTime of unit)		Time of the last scan of the unit

Parameter	Type	Values	Factory Default	Description
PntStatus	Dynamic	• 0x0000 0001 = Device Timeout • 0x0000 0010 = Transmit Error (**Integer Register only**) • 0x0000 0100 = Unsupported WriteCmd • 0x0000 02000 = Unsupported ReadCmd	0	Bitmap field indicating status of point
PntCheckSum	Dynamic	>=0	Normal Scan	16-bit CRC for the point's configuration parameters

Modbus Register Maps Settings

The Modbus Register Map Manager allows the user to configure the following parameters as register on the 8810.

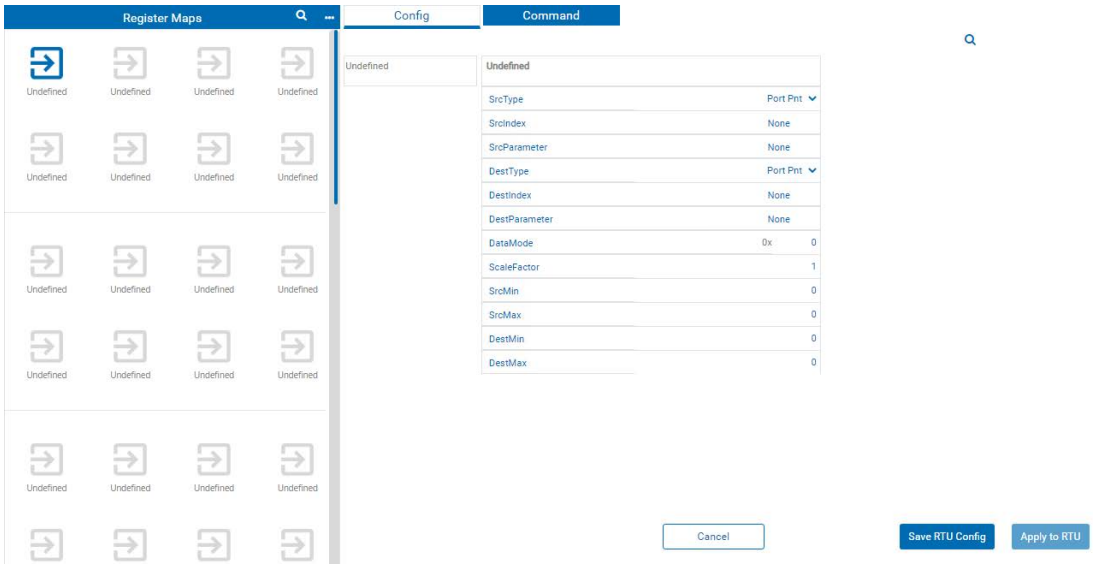


Figure 1-10: Modbus Register Maps Manager Config Screen

Parameter	Type	Values	Factory Default	Description
Config				
SrcType	Config			Source Point Type: • 3 = Port (Module & Channel) (Converted Value) • 4 = Modbus Floating Point Register (Value00 to Value63) • 5 = Modbus Integer Register (Value 00 to Value 63) • 7 = Tank (PerFPValue1 & 2, PerlValue 1 & 2)

Parameter	Type	Values	Factory Default	Description
SrcIndex	Config			Source Point Index: • Port (9–56) • FP Register (1–100) • Integer Register (1–100)
SrcParameter	Config			Source Point Parameter: • 99 = Value00 (Register) • 100 = Value01 (Register) • ... • 162 = Value63 (Register) • 255 = PerFPValue1 (Tank) • 256 = PerFPValue2 (Tank) • 257 = PerlValue1 (Tank) • 258 = PerlValue2 (Tank) • 553 = ConvertedValue (Port)
DestType	Config			Destination Point Type: • 1 = CPU Module • 2 = Interface Module • 3 = Port (Module & Channel) • 4 = FP Register • 5 = Integer Register • 6 = Gateway Block • 7 = Tank • 8 = Alarm
DestIndex	Config			Destination Point Index: • CPU Module (1) • Interface Module (1–6) • Port (1–56) • FP Register (1–100) • Integer Register (1–100) • Gateway Block (1–108) • Tank (1–400) • Alarm (1–1000)
DestParameter	Config			Destination Point Parameter: • 40 = PntStatus • 78 = DIOHwValue • 239 = Position • 240 = Level • 241 = Temp • 250 = LevelStatus • 267 = StdDensity • 369 = DeviceStatus • 405 = ManLevel • 407 = ManTemp • 409 = ManSolidsLevel • 411 = ManWaterLevel • 412 = AmbientTemp • 425 = SWPct

Parameter	Type	Values	Factory Default	Description
DataMode	Config			Data Mode: • If 1, then scale integer to floating point using Min/Max • If 0, then scale integer to floating point using ScaleFactor
ScaleFactor	Config			Scale Factor
SrcMin	Config			Source Minimum Value
SrcMax	Config			Source Maximum Value
DestMin	Config			Destination Minimum Value
DestMax	Config			Destination Maximum Value
Command				
PntStatus	Dynamic	>=0	0	Bitmap field indicating status of point. • 0x0000 0002 = Invalid destination • 0x0000 0001 = Invalid source

Modbus Slave Manager Settings

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

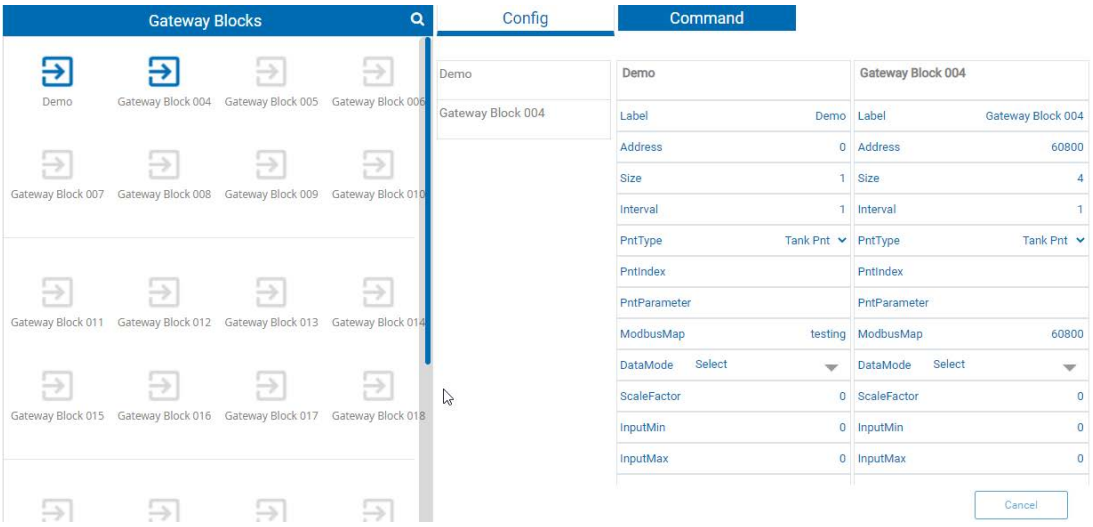


Figure 1-11: Modbus Slave Manager Config Screen

Parameter	Type	Values	Factory Default	Description
Config				
Label	Config	ASCII string	Gateway Block XXX	32-character ASCII string where 'XXX' is the GWBLK number (001 to 108)
StartRegister	Config	0 to 65,535	0	Modbus starting address for the GWBLK
Size	Config	>=0	1	The number of parameters contained in the GWBLK. For example, the 8810 contains up to 400 tanks so this field would be a value from 1 to 400 for a tank.

Parameter	Type	Values	Factory Default	Description
Interval	Config	>=0	1	The number of Modbus 16-bit registers between the start of each parameter in the GWBLK. **Address**, **Size**, and **Interval** are used together to define the map. For example, **Address** = 1000, **Size** = 5, and **Interval** = 10 results in 5 parameters at addresses 1000, 1010, 1020, 1030, and 1040. Set **Interval** to 0 or 1 if the parameter uses consecutive addresses.
PntType	Config	1 to 8	0	The point type. Values are: • 1 =CPU Module • 2 = Interface Module • 3 = Port (i.e. Module & Channel) • 4 = Modbus Floating Point Register • 5 = Modbus Integer Register • 6 = Modbus Gateway Block • 7 = Tank • 8 = Alarm • 9 = TLS • 10 = Register Map • 11 = X509 • 12 = Remote File Transfer • 13 = MQTT • 14 = Scheduled Command **PntType**, **PntIndex**, and **PntParameter** are used together to specify the parameter being assigned to the Modbus **Address**.
PntIndex	Config	>=0	0	The index into the point The valid range depends on the point type: • 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) • TLS (1-4) • Register Map (1-800) • X509 (1-20) • Remote File Transfer (1) • MQTT (1) • Scheduled Commands (1-400) **PntType**, **PntIndex**, and **PntParameter** are used together to specify the parameter being assigned to the Modbus **Address**.

Parameter	Type	Values	Factory Default	Description
PntParameter	Config	>=0	0	Numeric value corresponding to a specific parameter within the point Commonly used values are: • 40 = **PntStatus** • 238 = **GaugeStatus** • 239 = **Position** • 240 = **Level** • 241 = **Temp** • 369 = **DeviceStatus** **PntType**, **PntIndex**, and **PntParameter** are used together to specify the parameter being assigned to the Modbus **Address**.
ModbusMap	Config	ASCII string	Default Map	ModbusMap is a 32-character (max) ASCII string and is case-sensitive. ModbusMap is used to associate a Gateway Block with one or more Modbus Slave channels, or with the Modbus TCP port on the Ethernet channel (i.e., CPU Module Channel 2). Each of these channels has its own ModbusMap parameter, which can be set to different values. When a Modbus message is received on one of these Modbus channels, the 8810 RTU searches for Gateway Blocks with identical ModbusMap values and uses matching Gateway Blocks to respond to that Modbus message. This allows the 8810 RTU to support multiple Modbus Maps simultaneously. For example, depending on the configuration of the Gateway Blocks, one Modbus Slave channel might interpret Modbus register 100 as a “Level”, while a different Modbus Slave channel might interpret that same register as “Temp”.

Parameter	Type	Values	Factory Default	Description
DataMode	Config	>=0	0	Bitmap field used to configure the data mode. • 0x00000001: Scale floating point parameter using Min/Max • 0x00000002: Scale floating point parameter using ScaleFactor • 0x00000004: 32-bit parameter mode. When reading more than one parameter, setting this bit increments to the next (32-bit) parameter within the same point (aka parameter mode), rather than the same parameter in the next point (aka indexing mode). Typically used with Modbus Floating Point and Integer Registers. • 0x00000008: 16-bit parameter mode. Similar to 32-bit parameter mode, but this uses only the least significant 16 bits in each 32-bit parameter. Typically used with Modbus Integer Register when the register has only 16 bits of meaningful data. This mode produces garbage if used with a floating point parameter. • 0x00000010: Return if 0xFF if data is invalid, instead of the value specified in the FailValue parameter. (FailFilter determines if data is bad.) Only used when a 32-bit floating point parameter is scaled to a 16-bit integer.
ScaleFactor	Config	>=0	0	Multiply the floating point number by **ScaleFactor** in order to convert a 32-bit floating point number to a 16-bit integer. **DataMode** bit 0x00000002 must be set. Not used with integers.
InputMin	Config	>=0	0	Use **InputMin**, **InputMax**, **OutputMin**, and **OutputMax** together to scale a 32-bit floating point number to a 16-bit integer, with the 32-bit input value being scaled to the 16-bit output value. **DataMode** bit 0x00000001 must be set. Not used with integers.
InputMax	Config	>=0	0	See **InputMin**.
OutputMin	Config	>=0	0	See **InputMin**.
OutputMax	Config	>=0	0	See **InputMin**.
FailFilter	Config	>=0	0	Bitmap field applied to the **PntType**/ **PntIndex** point's **PntStatus** to determine if a value indicating failure should be reported. If a matching **PntStatus** bit is found and **DataMode** 0x00000010 bit is set, then 0xFFFF is returned. If a matching **PntStatus** bit is found and **DataMode** 0x00000010 bit is not set, then **FailValue** is returned.
FailValue	Config	>=0	0	See **FailFilter**.
Command				
PntStatus	Dynamic	>=0	0	Bitmap field indicating status of point. • 0x00000000: No error.

Parameter	Type	Values	Factory Default	Description
PntCheckSum	Dynamic	>=0	Normal Scan	16-bit CRC for the point's configuration parameters

Modbus Register Maps

The TLS Master Manager

VeRTUe allows users to configure the 8810 RTU to communicate and understand Veeder-Root TLS gauges over an RS-232 Serial channel. The TLS Master protocol is similar parameter-wise to a Modbus Master channel except TLS Master does not have the DetectTime configuration parameter and it uses the third byte of the ComParams parameter to configure the number of stop bits (1 or 2).

TLS Master Manager Settings

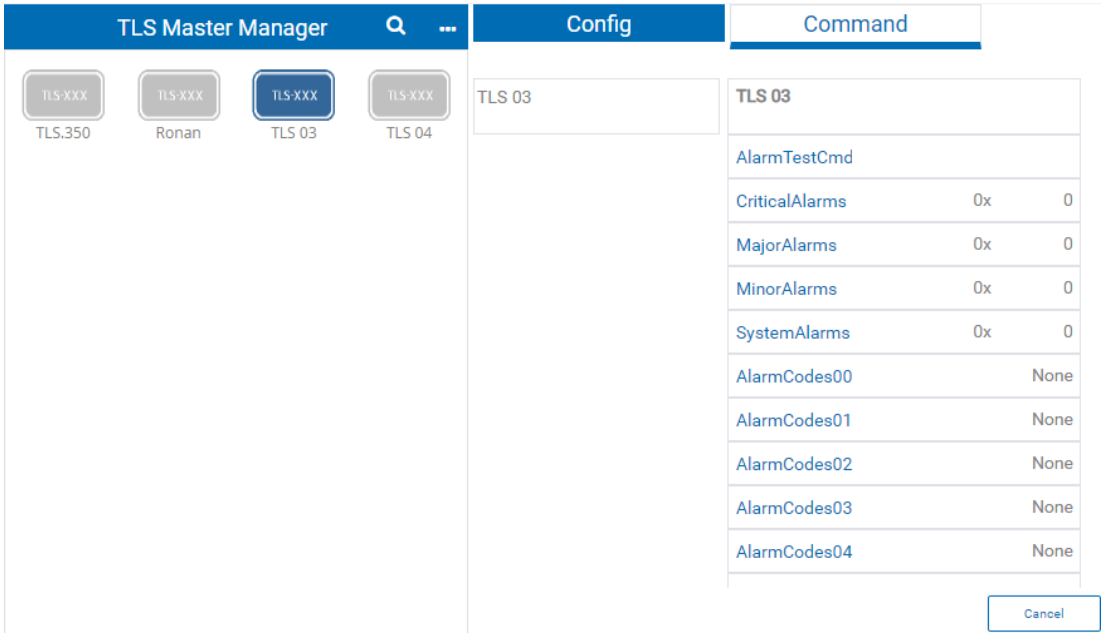


Figure 1-12: TLS Master Manager Config Screen

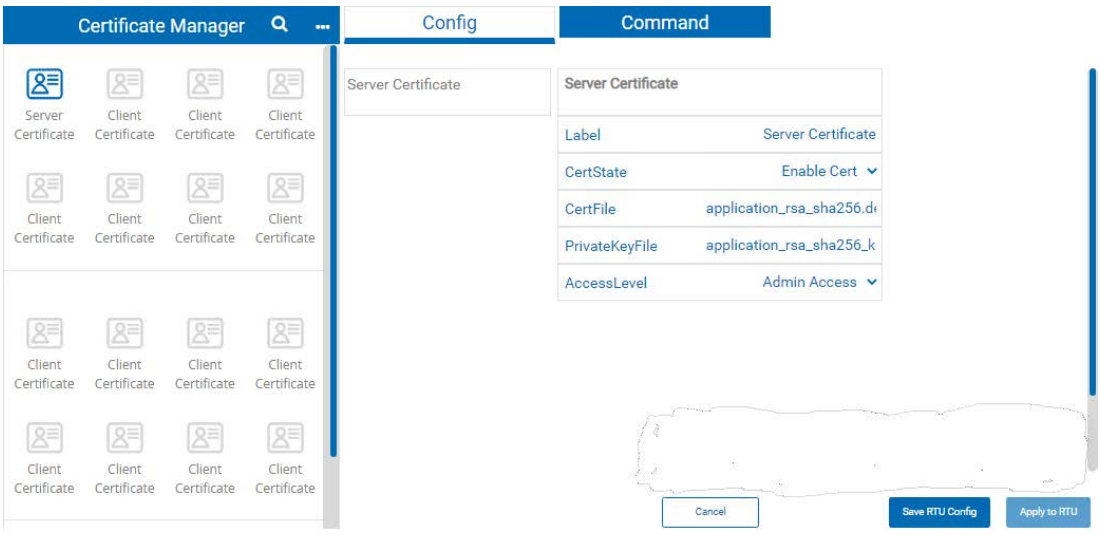
Parameter	Type	Values	Factory Default	Description
Config				
Label	Config	ASCII string		32-character ASCII string point description
Module	Config	• 0 = CPU Module • 1-6 = Interface Module	0	Module number
Channel	Config	1-4	0	Channel number for the TLS connection on the 8814 module
Command				

Parameter	Type	Values	Factory Default	Description
AlarmTestCmd	Dynamic	AANNTT: • AA = Alarm/Warning Category • NN = Alarm Type Number • TT = Tank/Sensor Number	(null)	Alarm test command which is a 6-digit AANNTT string for each alarm
CriticalAlarms	Dynamic	• 0x0001 0000 = Device 16 • 0x0000 8000 = Device 15 • 0x0000 4000 = Device 14 • 0x0000 2000 = Device 13 • 0x0000 1000 = Device 12 • 0x0000 0800 = Device 11 • 0x0000 0400 = Device 10 • 0x0000 0200 = Device 09 • 0x0000 0100 = Device 08 • 0x0000 0080 = Device 07 • 0x0000 0040 = Device 06 • 0x0000 0020 = Device 05 • 0x0000 0010 = Device 04 • 0x0000 0008 = Device 03 • 0x0000 0004 = Device 02 • 0x0000 0002 = Device 01 • 0x0000 0001 = Device 00	0	Grouping of alarms that are considered to be a critical priority to the operation of the system
MajorAlarms	Dynamic	• 0x0001 0000 = Device 16 • 0x0000 8000 = Device 15 • 0x0000 4000 = Device 14 • 0x0000 2000 = Device 13 • 0x0000 1000 = Device 12 • 0x0000 0800 = Device 11 • 0x0000 0400 = Device 10 • 0x0000 0200 = Device 09 • 0x0000 0100 = Device 08 • 0x0000 0080 = Device 07 • 0x0000 0040 = Device 06 • 0x0000 0020 = Device 05 • 0x0000 0010 = Device 04 • 0x0000 0008 = Device 03 • 0x0000 0004 = Device 02 • 0x0000 0002 = Device 01 • 0x0000 0001 = Device 00	0	Grouping of alarms that are considered to be a high priority to the operation of the system

Parameter	Type	Values	Factory Default	Description
MinorAlarms	Dynamic	• 0x0001 0000 = Device 16 • 0x0000 8000 = Device 15 • 0x0000 4000 = Device 14 • 0x0000 2000 = Device 13 • 0x0000 1000 = Device 12 • 0x0000 0800 = Device 11 • 0x0000 0400 = Device 10 • 0x0000 0200 = Device 09 • 0x0000 0100 = Device 08 • 0x0000 0080 = Device 07 • 0x0000 0040 = Device 06 • 0x0000 0020 = Device 05 • 0x0000 0010 = Device 04 • 0x0000 0008 = Device 03 • 0x0000 0004 = Device 02 • 0x0000 0002 = Device 01 • 0x0000 0001 = Device 00	0	Grouping of alarms that are considered to be a medium priority to the operation of the system
SystemAlarms	Dynamic	• 0x0001 0000 = Device 16 • 0x0000 8000 = Device 15 • 0x0000 4000 = Device 14 • 0x0000 2000 = Device 13 • 0x0000 1000 = Device 12 • 0x0000 0800 = Device 11 • 0x0000 0400 = Device 10 • 0x0000 0200 = Device 09 • 0x0000 0100 = Device 08 • 0x0000 0080 = Device 07 • 0x0000 0040 = Device 06 • 0x0000 0020 = Device 05 • 0x0000 0010 = Device 04 • 0x0000 0008 = Device 03 • 0x0000 0004 = Device 02 • 0x0000 0002 = Device 01 • 0x0000 0001 = Device 00	0	Grouping of alarms that are considered to be a low priority to the operation of the system
AlarmCodes00-16	Dynamic	Alarm Category & Type: • AA = Alarm/Warning Category • NN = Alarm Type Number	None	The critical, major, minor, or system alarm codes set up per device
AlarmText00-16	Dynamic	AANN : Alarm/Warning Category : Alarm/Warning Text : CRITICAL/MAJOR/ MINOR/SYSTEM	None	High priority active alarm per device For example: **0203 : MAJOR : Tank Alarm : Tank High Water Alarm**

Parameter	Type	Values	Factory Default	Description
ScanStatus	Dynamic	• 1 = Scanning • 2 = Invalid Module • 3 = Invalid Channel • 4 = Disabled Channel • 5 = Invalid DeviceType • 6 = Invalid ScanCmd • 7 = Invalid AuxID • 8 = Invalid Controller • 9 = Invalid Interface Module • 10 = Invalid Protocol • 11 = RegMap Source		Status of scanning the tank as well as why the tank isn't being scanned
Elapse	Dynamic			Time of the last update
PntStatus	Dynamic	• 0x0000 0004 = Not Scanning • 0x0000 0001 = Device Timeout	0	Bitmap field indicating status of point

Certificates Manager



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 different places based on Microsoft's recommendation in the ProgramData directory depending up on which version of Windows the computer is using.

- 2000/XP/2003 -> C:\Documents and Settings\All Users\Application Data
- Vista/2008/7/8/2012/10 and later -> C:\ProgramData

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 %PROGRAMDATA\Varec\VeRTUe\pki\private where %PROGRAMDATA is dependent upon the operating system. It is also the standard for the Vista operating system and later. For Windows 7 & 8, it is <C:\Documents and Settings\All Users\Application> Data. For 10 and above, it is c:\programdata.

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 Varec VeRTUe service is started for the first time, a new client certificate will be generated, called VeRTUe, and placed in the Microsoft certificates store.

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

1. Open VeRTUe and connect to the 8810 RTU. By default, the following settings are the factory default settings:
   a. IP Address (Shown on RTU display)
   b. Security Mode = None
   c. User Identity = User Name
   d. Login ID = admin
   e. Password = 8810rtu

   If the password has been forgotten, please use **pwreset** login credentials to factory default settings.
2. Select **File Transfer**.
3. Under Configure File Transfer, click **Browse**. The File Explorer window should pop up.
4. In the File Explorer **search field**, open the drive where the certificate is stored (usually the C drive by default).
5. Select the **View** tab in the explorer toolbar.
6. Make sure **Hidden Items** is checked.
7. Navigate to **ProgramData\Varec\VeRTUe\pki\own\Certs**.
8. Select the desired (***.der**) certificate file, and click **Open**.
9. b.Click **Write to the RTU**.
10. Copy down the certificate name. It's needed for the next step.
11. Select **Certificates** and configure a certificate, for example VeRTUe [108A7228-DA048634A7B7CA80A58226836DE7EBA5].der

    Note Do not configure **Certificate 001**.
12. Make sure **Certificate** is enabled.

13. Click the **Command** tab in VeRTUe.
14. Set the **certcmd** to reset the certificate.
15. Configure the CPU module to use Certificates.
    - Security Mode = Sign and Encrypt
    - Security Policy = Basic256Sha256
    - User Identity = Certificate
16. **Reset** the RTU.
17. Sign in using **Certificate**. Make sure login criteria matches CPU security settings
18. Browse to **ProgramData/Varec/VeRTUe/pki/own/private**.
19. Select the key that matches the certificate installed. For example, VeRTUe [108A7228-DA048634A7B7CA80A58226836DE7EBA5].pfx.

Remote File Transfer

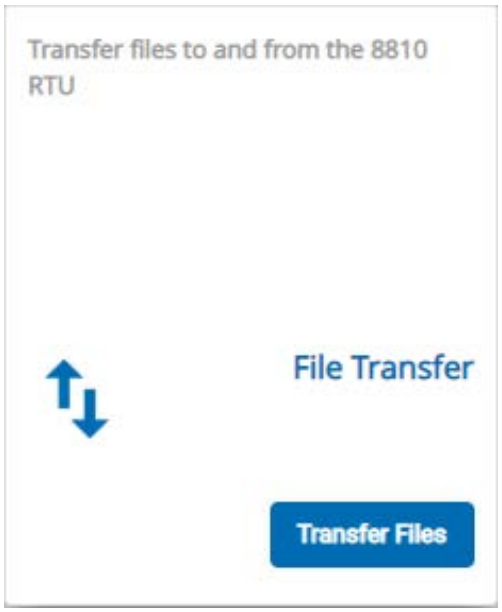


Figure 1-13: The File Transfer Card

File Transfer allows users to upload files similar to how the 8810 RTU can use USB flash drives to upload firmware and files to the device, except with a wider range of options other than just the firmware. The maximum file size is just under 20 MB which is 4 MB larger than the largest 8810 RTU file (the boot.uimage).

> **Note** Very large files can take over 30 seconds to read or write depending upon the connection. To prevent the client from timing out, change the client's "Browse Timeout" and "Call Timeout" to 60 seconds.

Remote File Transfer allows the users to upload and update the following types of files:

File Transfer File Types

File Transfer Type	Upload and/or Download	File Suffix or Name
Boot Firmware	Upload Only	boot.uimage
Application Firmware	Upload Only	ngrtu
RTU Database	Upload & Download	RTUdb
Debug Log	Download Only	DebugLog.txt
X.509 Certificates	Upload & Download	.der
X.509 Server Private Keys	Upload Only	.pem
Tank Calculation Strap Files	Upload & Download	(any value)
Tank Enraf Item Command Files	Upload & Download	(any value)
Tank NNN Enraf Configuration Files	Upload & Download	<NNN>_<Label>.cfg **NOTE:** NNN is the 3-digit tank #
Tank NNN Enraf Log Files	Upload & Download	<NNN>_<Label>.log **NOTE:** NNN is the 3-digit tank #
MQTT Files	Upload & Download	• RootCAFile • CertFile (___.cert.pem) • PrivateKeyFile (___.private.key) • PubFile

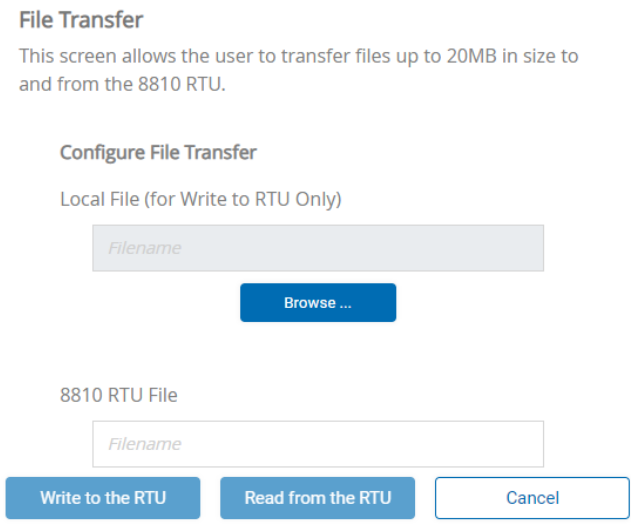


Figure 1-14: File Transfer Screen

File Descriptions

Firmware

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

The firmware is only write-only and cannot be read from the RTU.

Note After uploading new firmware, the 8810 RTU will need to be restarted for the update to take effect.

RTU Database

The 8810 RTU's configuration database is contained in a single file called **RTUdb**. By having the database as a single file, reading the RTUdb speeds up the loading of the database, takes 10 seconds to back up or to restore via an external USB flash drive, and only takes 1-2 minutes to update through VeRTUe's remote file transfer capabilities.

Debug Logs

Using the remote file transfer function or using a USB flash drive, debug logs (**DebugLog.txt**) can be exported and analysed to see what issues could have impacted the proper functionality of the 8810 RTU to help Varec understand and fix any problems.

X.509 Certificates and Keys

X.509 certificates and private keys can be uploaded to the 8810 RTU.

For X.509 certificates, the.der file extension must be used to download an X.509 certificate. If the filename matches the name in the first X.509 certificate **CertFile** parameter, then the file will be treated as the 8810 RTU server certificate. Otherwise, it will be treated as a client certificate.

For X.509 private keys, **.pem** file extension must be used to download an X.509 Private Key. If the filename matches the name in the first X.509 certificate **PrivateKeyFile** parameter, then the file will be treated as the 8810 RTU server private key. Otherwise, it will be rejected. This file is write-only.

Note Client private keys should not be installed on the 8810 RTU.

Note After uploading a third-party X.509 certificate, the 8810 RTU will need to be restarted for the certificate to take effect.

Tank Files (Strap Files as well as Enraf Command, Configuration, and Log Files)

The 8810's Strap File (also known as the tank strapping file or chart) can be read or written over by making sure the **FileName** is set to the same value as the TANK's **StrapFile** parameter.

To read or write a TANK's Item Command File, the TANK's **ItemCmdFile** parameter should be set to the same value as of the file name of the command file being uploaded.

Enraf Command Files have associated configuration and log files. These filenames are named in the form <NNN>_<Label>.cfg or <NNN>_<Label>.log, where <NNN> corresponds to the 3-digit tank number (i.e., 001 to 400) and <Label> refers to the ASCII string defined in the Label parameter.

Note The underscore ("_") and ".cfg" or ".log" are part of the filename.

Each activated tank has an assigned three digit number in parentheses on the Tank Manager page. For example, a tank named EastField3 (014) on the Tank Manager screen would require the .cfg file to be named 014_EastField3.cfg. The same for the .log file, but with the .log suffix instead.

MQTT Files

MQTT is a standard messaging protocol for the Internet of Things (IoT). The purpose is to serve as an extremely lightweight publication and subscription messaging transport system for remote devices.

To use MQTT with the 8810 RTU with the following files are required and their naming conventions:

- RootCAFile
- CertFile (_____.cert.pem)
- PrivateKeyFile (_____.private.key)
- PubFile

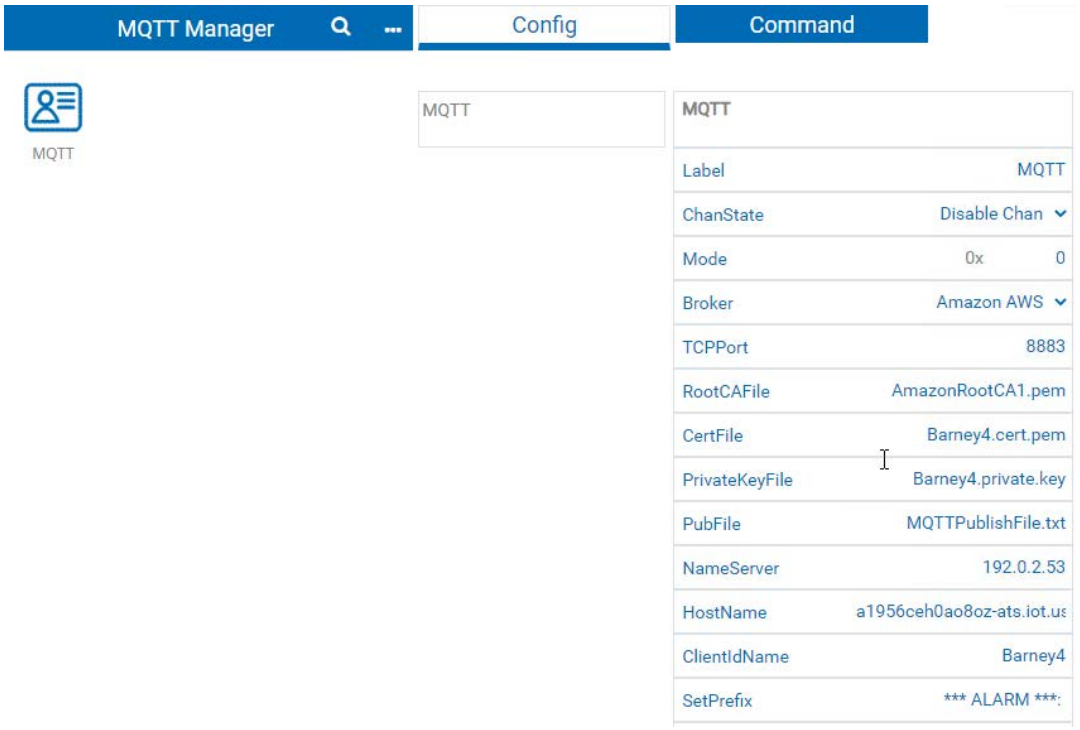
Uploading Files

1. From the menu, select **File Transfer** or click **Transfer Files** on the Home Menu under File Transfer card.
2. To upload files, click **Browse** and navigate to the file you want to upload:
   - **Boot firmware:** boot.uimage
   - **Application firmware:** .ngrtu
   - **RTU database:** RTUdb
   - **X.509 certificates:** *.der
   - **X.509 server private keys:** *.pem
   - **Tank Enraf Item command files**
   - **Tank NNN Enraf configuration files:** <NNN>_<Label>.cfg
   - **Tank NNN Enraf log files:** <NNN>_<Label>.log
   - **MQTT files:** RootCAFile, CertFile (___.cert.pem), PrivateKeyFile (___.private.key), PubFile
3. Click **Write to the RTU** to upload the selected file.

Downloading Files

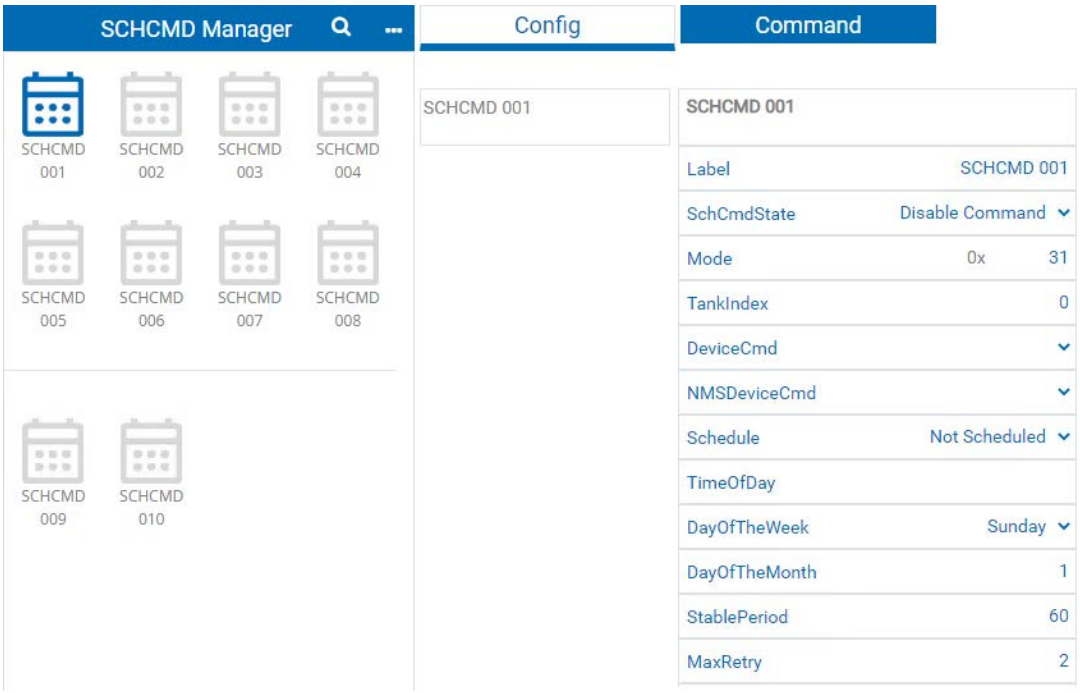
1. From the menu, select **File Transfer** or click **Transfer Files** on the Home Menu under File Transfer card.
2. To download files, enter the specific name of the file you want to download:
   - **RTU database:** RTUdb
   - **Debug log:** DebugLog.txt
   - **X.509 certificates:** *.der
   - **Tank calculation strap files**
   - **Tank Enraf Item command files**
   - **Tank NNN Enraf configuration files:** <NNN>_<Label>.cfg
   - **Tank NNN Enraf log files:** <NNN>_<Label>.log
   - **MQTT files:** RootCAFile, CertFile (___.cert.pem), PrivateKeyFile (___.private.key), PubFile
3. Click **Read to the RTU** to upload the selected file.

MQTT



MQTT is a simple but secure (i.e., encrypted) TCP/IP protocol used to transfer messages over the internet. These messages can be in the form of human-readable ASCII text strings. See *SRM017 8810 MQTT* manual for more information on how to create and configure MQTT to work between the 8810 RTU and remote devices that can use MQTT.

Scheduled Commands



Scheduled Commands are a method for users to schedule a TANK DeviceCmd or NMSDeviceCmd to run in the future, without requiring additional manual intervention. The user can schedule the TANK command (for example, a density measurement) to automatically run periodically once per day, per week, or per month. Alternatively, the user can schedule a command to run only once during the next seven days.

Command	
Parameter	**Definition**
Label	A 32-byte ASCII string that can be used to give the Scheduled Command a human-readable name
SchCmdState	Determines if the Scheduled Command is enabled or disabled • 1 = Disable Command • 2 = Enable Command

Mode	A bitmap (i.e., hexadecimal) field used to alter how the Scheduled Command behaves • 0x0001 = "Use Local Time" — If this bit is set, then the 8810 RTU's local time is used to determine when to run the command. If this bit is not set, then the 8810 RTU's Universal Time (UTC) is used. • 0x0002 = "Verify StablePeriod" — If this bit is set, then the TANK's Level is checked against the StablePeriod to determine if the command can be run. If this bit is not set, then the StablePeriod is ignored. • 0x0004 = "Verify PntStatus Invalid Level Bit" — If this bit is set, then the TANK's "Invalid Level" bit in PntStatus is checked to determine of this command can be run. If this bit is not set, then the "Invalid Level' bit is ignored. • 0x0008 = "Verify PntStatus Invalid Temp Bit" — If this bit is set, then the TANK's "Invalid Temp" bit in PntStatus is checked to determine of this command can be run. If this bit is not set, then the "Invalid Temp' bit is ignored. • 0x0010 = "Verify DeviceStatus Invalid Not Balanced Bit" — If this bit is set, then the TANK's "Not Balanced" bit in DeviceStatus is checked to determine of this command can be run. If this bit is not set, then the "Not Balanced" bit is ignored. This bit only applies to NMS5x and NMS8x devices.
TankIndex	The index of the tank with the value range is 1 to 400
DeviceCmd	The command to be run for EN811, EN854, EN873, EN954, EN990, ATT 4000, FTT 29xx, and Varec 6500 device types Note that the 8810 RTU automatically sets this to 0 if NMSDeviceCmd is configured • 1 = Reset Gauge (EN811, EN854, EN873, EN954, EN990, FTT 29xx, Varec 6500 only) • 2 = Raise Servo (EN811, EN854, EN954, FTT 29xx, Varec 6500 only) • 3 = Freeze Servo (EN811, EN854, EN954 only) • 4 = Find Water Level (EN811, EN854, EN954 only) • 5 = Follow Level (EN811, EN854, EN954 only) • 6 = Run Test (EN811, EN854, EN954 only) • 7 = Run Immersed Profile (EN854, EN954 only) • 8 = Find Bottom (EN854, EN954 only) • 9 = Copy ItemCmdFile to RTU (EN811, EN854, EN873, EN954, EN990 only) • 10 = Read Device Config (EN811, EN854, EN873, EN954, EN990 only) • 11 = Write Device Config (EN811, EN854, EN873, EN954, EN990 only) • 12 = Copy .cfg to USB (EN811, EN854, EN873, EN954, EN990 only) • 13 = Copy .log to USB (EN811, EN854, EN873, EN954, EN990 only) • 14 = Calibrate (ATT 4000, FTT 29xx only)

NMSDeviceCmd	The command to be run for NMS5x and NMS8x device types Note that the 8810 RTU automatically sets this to 0 if DeviceCmd is configured • 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)
Schedule	The frequency of the command to be run • 1 = Not scheduled • 2 = Daily • 3 = Weekly • 4 = Monthly • 5 = One time **NOTE:** When configured as "One Time," the 8810 RTU automatically changes this to "Not Scheduled" immediately after the command runs once, whether that command was successful or not
TimeOfDay	The hours and minutes (in 24-hour HH:MM format) that the command is scheduled to run with the valid range is 00:00 to 23:59
DayOfTheWeek	The day of the week to run the command This is only used when **Schedule** is set to "Weekly" • 1 = Sunday • 2 = Monday • 3 = Tuesday • 4 = Wednesday • 5 = Thursday • 6 = Friday • 7 = Saturday
DayOfTheMonth	The day of the month to run the command This is only used when **Schedule** is set to "Monthly" with the valid range from 1 to 31 **NOTE:** If this is set to 31, then the command is only run during months with 31 days and the same is true with 30 days

StablePeriod	The number of seconds the TANK's Level must not move in order to run the command with the valid range is 0 to 3600 seconds (i.e., one hour) **NOTE:** Setting StablePeriod to a value of 0 is effectively the same as setting the Mode "Verify StablePeriod" bit to 0 Also note that a TANK's LevelDeadband can be used to ignore small changes to Level
MaxRetry	If the command fails during its initial try, this is the number of times the command is retried until the 8810 RTU gives up and waits until the next scheduled time as determined by Schedule with the valid range being 0 (i.e., no retries) to 10
RetryDelay	The number of seconds the 8810 RTU waits between retries with the valid range is 0 to 3600 seconds (i.e., one hour)

Dynamic	
Parameter	**Definition**
SchCmdCmd	A command issued to the Scheduled Command point type itself • 1 = "Reset Scheduled Command" – Reset the Scheduled Command's dynamic parameters to their power-up values • 2 = "Run Scheduled Command" – Immediately run the Scheduled Command, no matter what the schedule is
CmdStatus	The results of the most recent SchCmdCmd • 1 = "Start" • 2 = "Complete" • 3 = "Error" • 4 = "Executing" • 5 = "Invalid" • 6 = "Timeout"
SchCmdStatus	The results of the most recent Scheduled Command • 1 = "Ready" – The Scheduled command is ready to be run but has not yet been run. • 2 = "Complete" – The Scheduled command successfully ran. • 3 = "Error" – The Scheduled Command failed. • 4 = "Executing" – The Scheduled Command currently is running. • 5 = "Retry" – The Scheduled Command failed and will be retried. • 6 = "Not Scheduled" – The Scheduled Command is not scheduled to run.
StatusText	Human readable ASCII text providing additional detail for the SchCmdStatus
LastAttempt	The last time the command was attempted to be run If the Mode "Local Time" bit is set, then this represents the 8810 RTU's local time If this bit is not set, then this represents Universal Time

Elapse	The last time the command successfully ran If the Mode "Local Time" bit is set, then this represents the 8810 RTU's local time If this bit is not set, then this represents Universal Time
PntStatus	A bitmap (i.e., hexadecimal) field reporting the status of the Scheduled Command point. Bits are: • 0x0000 0001 = "Scheduled Command Failed" • 0x0000 0002 = "Tank Command Already In Progress" • 0x0000 0004 = "Disabled (check SchCmdState and Schedule)" • 0x0000 0008 = "Not Stable" • 0x0000 0010 = "Invalid Level" • 0x0000 0020 = "Invalid Temp" • 0x0000 0040 = "Not Balanced" • 0x0000 0080 = "Invalid TankIndex" • 0x0000 0100 = "Scheduled Command Not Support By DeviceType (check DeviceCmd and NMSDeviceCmd)" • 0x0000 0200 = "Invalid Schedule" • 0x0000 0400 = "Invalid TimeOfDay" • 0x0000 0800 = "Invalid Day (check DayOfTheWeek and DayOfTheMonth)"

The System Administration Commands Screen

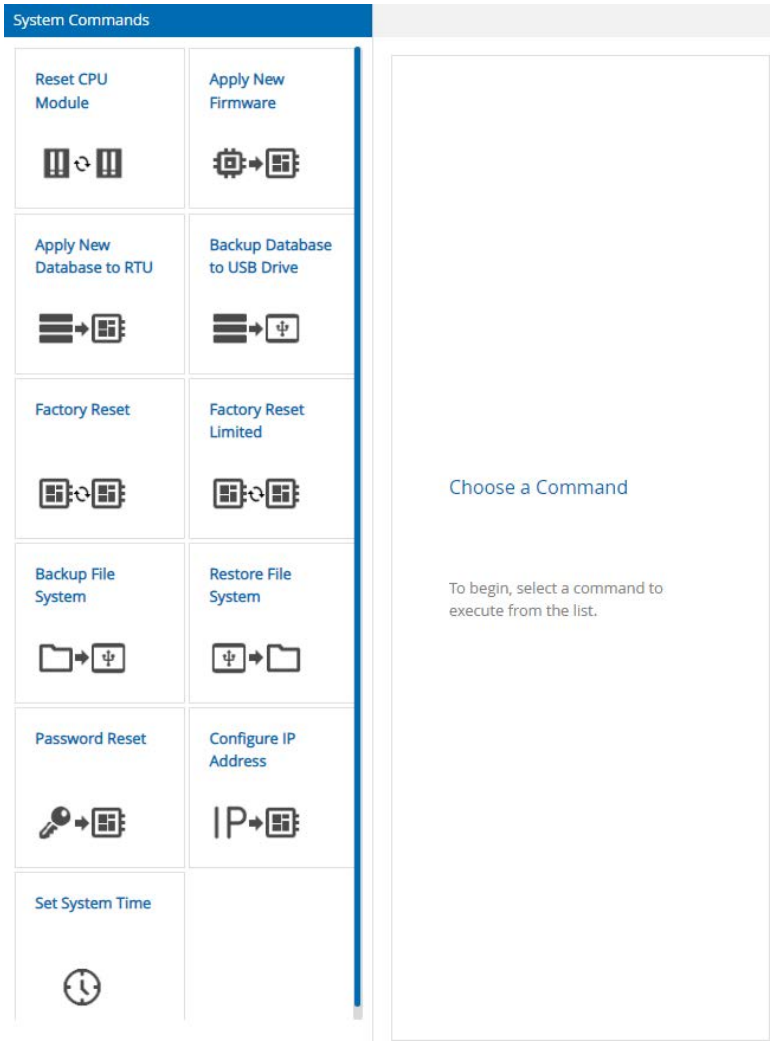


Figure 1-15: System Admin Commands Screen

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 Limited

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.

Backup and Restore Functionality

Backup Functionality

The 8810 RTU allows users to backup files located on the CPU module's internal USB flash drive. This includes the configuration database (RTUdb), X.509 certificates and private keys, Enraf Item Command Files, Tank Calculation Strap Files, and MQTT-related files.

> **Note** The backup functionality does not include firmware files (ngrtu, and boot.uimage) which are stored on the CPU module's internal micro SD card.

The steps to use the Backup functionality are as follows:

1. Insert a USB flash drive into the CPU module's USB port.
2. Open VeRTUe and navigate to **System Admin Commands**.
3. Select **Backup to USB** option in the CPU module's **ModCmd** in VeRTUe..
4. **CmdStatus** reports "Complete" when the backup finishes.

> **Note** A typical backup takes approximately 15 seconds.

Restore Functionality

The 8810 RTU allows users to upload a backup of all files that were created using the **Backup to USB** option.

The steps to use the Restore functionality are as follows:

1. Insert the USB flash drive that contains the backup to restore into the CPU module's USB port.
2. Open VeRTUe and navigate to **System Admin Commands**.
3. Select **Restore to USB** option in the CPU module's **ModCmd** in VeRTUe.

CmdStatus reports "Remove USB" when the restore finishes. When the USB flash drive is removed, the RTU will reboot so the restored files can take effect.

Password Reset

The **Password Reset** command allows the user through an external USB flash drive the admin and user1 usernames and passwords to their default values. This process also restores all of the security settings on the 8810 RTU to their default values where Security Mode is set to None, Security Policy is set to None, and the User Identity is set to Username.

Configure IP Address

The **Configure IP Address** command allows users to configure the 8810 RTU's IP Address. After the IP address is updated, the 8810 RTU will need to be reset by either using the Reset CPU Module function in System Commands or by manually resetting the RTU.

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.
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.

Parameter	Point	Type	Values	Factory Default	Notes
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.
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:

- Virtual Channel
- RTU Slave
- Enraf Master
- Modbus Master
- Modbus Slave
- Digital Input
- Digital Output
- Ethernet
- Mark/Space
- L&J Tankway
- TLS Master
- HLS Master
- Analog Input
- Engauge

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.

> **Note** See Chapter 3 on page 85 (Channel Variables) for information on configuring modules for specific communication channel options.

USB to Ethernet

The 8810 RTU allows users to connect a USB-to-Ethernet adaptor to allow for a second Ethernet connection. The 8810 currently supports four USB-to-Ethernet dongles:

- TRENDnet TU ET100C
- Belkin 55D5050
- TRENDnet TU2 ET100
- D-Link DUBE100B

The connected dongle is automatically assigned an IP address of 169.254.0.1. This will allow a laptop or similar mobile device to connect and configure the RTU while it is on the network via the Ethernet port.

Hardware Devices and Supported Communication Protocols

Hardware Device	Communication Protocols
EN811	Enraf Master
EN854	Enraf Master

Hardware Device	Communication Protocols
EN873	Enraf Master
EN954	Engauge Enraf Master
EN990	Enraf Master
FTT 29XX	Enraf Master Mark/Space Modbus Master
ATT 4000	Modbus Master Mark/Space
MTS	Modbus Master
NMR8X	Modbus Master
NMS5X	Modbus Master
NRF590	Modbus Master
NRF81	Modbus Master
RAPTOR	Modbus Master
REX	Modbus Master
RTG	Modbus Master
GSI 2000	Ethernet Mark/Space Modbus Master
Varec 1800	Mark/Space
Varec 1900	Mark/Space
Varec 6500	Mark/Space
LJ1000	Tankway
LJ1500	Tankway
LJ2000	Tankway
TLS	TLS Master
TLS3xx	TLS Master
TLS4xx	TLS Master
X76CTM	TLS Master
Optilevel	HLS Master

Communication Protocols and Supported Hardware Devices

Communication Protocols	Supported Hardware Devices
Engauge	EN954
Enraf Master	EN811 EN854 EN873 EN954 EN990 FTT 29XX
Ethernet	GSI 2000

Communication Protocols	Supported Hardware Devices
Modbus Master	ATT 4000 FTT 29XX GSI 2000 MTS NMS5X NMS8X NRF590 NRF81 NMR8X RAPTOR REX RTG
Mark/Space	ATT 4000 FTT 29XX GSI 2000 Varec 1800 Varec 1900 Varec 6500
Tankway	LJ1000 LJ1500 LJ2000
TLS Master	TLS3xx TLS4xx X76CTM
HLS Master	Optilevel

CPU Configuration Parameters

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ModConfigured	1	The module installed in the interface module slot: • 1 = CPU Module
IpAddress		The RTU's IP address
SubnetMask		The RTU's subnet mask
Gateway		The RTU's default gateway setting
UnitAddress		The RTU's unit address
AdminName		The administration username
AdminPassword		The password for the administration login
User1Name		The user name of User 1
User1Password		The password for User 1
IpDisplay		The display IP address: • 1 = Display off • 2 = Display on
SystemTime		The system time for the RTU
UTCOffset	-300	UTC offset in minutes

Configuration		
Name	**Default**	**Definition**
DSTState	2	Daylight savings time • 1 = DST off • 2 = DST on
TempUnits	1	The temperature units for the RTU to display measurements • 1 = Fahrenheit • 2 = Celsius
DBFile	RTUdb	The name of the RTU's database
DBDirectory	8810 RTU	The RTU's database directory name
NumberOfTanks		The number of tanks (1–400)
NumberOfAlarms		The number of alarms (1–1000)
NumberOfRegMap	100	The number of register maps (1–800)
NumberOfMfpreg	25	The number of Modbus floating point registers (1–100)
NumberOfMireg	25	The number of Modbus integer registers (1–100)
NumberOfGwblk	10	The number of gateway blocks (1–108)
NumberOfSchCmd	400	The number of scheduled commands (1–400)
AmbientTempSrc	1	The ambient temperature source for tank calculations: • 1 = AmbientTemp • 2 = ManAmbientTemp
ManAmbientTemp	0	The manual ambient temperature in either Celsius and Fahrenheit
AmbTempConvert	FtoF	The conversion for AmbientTemp (as in INtoOUT, as in FtoC)
AmbTempDB	1	The ambient temperature deadband
SecurityMode	1	The security policy — the CPU must be reset for any changes to take effect • 1 = None • 2 = Sign • 3 = SignAndEncrypt
SecurityPolicy	1	The security mode — the CPU must be reset for any changes to take effect • 1 = None • 2 = Basic256Sha256 • 3 = Aes128Sha256RsaOaep • 4 = Aes256Sha256RsaPss
UserIdentity	1	The user identity for login — the CPU must be reset for any changes to take effect • 1 = Anonymous • 2 = UserName • 3 = Certificate

Dynamic/Command	
Name	**Description**
ModCmd	The module command: • 1 = Reset Module • 2 = Copy Firmware to RTU • 3 = Copy Database to RTU • 4 = Copy Database to USB • 5 = Database Factory Reset • 6 = Limited Database Factory Reset • 7 = Copy Debug Log to USB • 8 = Delete Client Certificates • 9 = Delete Server Certificates • 10 = Backup from RTU to USB • 11 = Restore from USB to RTU
CmdStatus	The status of the last command: • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout • 7 = Remove USB (CPU only) • 8 = Database In Use (CPU only)
ModInstalled	The module installed in the slot: • 1 = CPU module • 2 = Unknown module
SysVer	The system version for legacy
FwVer	The firmware version
SysCheckSum	The firmware checksum
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
NumResets	The number of resets
ErrorCode	The error detected by the firmware
CpuTemp	The temperature of the CPU in Celsius or Fahrenheit
InputVolt	The input voltage in volts
InputCurrent	The input current in mA
Zone1Temp	The temperature of Zone 1
Zone2Temp	The temperature of Zone 2
VccVolt	The voltage common collector voltage

Dynamic/Command	
Name	**Description**
FieldVoltStat	The field voltage status • 1 = Voltage Off • 2 = Voltage On
FieldVolt	The field voltage in volts
FieldCurrent	The field current in mA
Zone3Temp	The temperature of Zone 3
Zone4Temp	The temperature of Zone 4
Zone5Temp	The temperature of Zone 5
IsoVccVolt	The isolated voltage common collector voltage
ExternalUSB	The status of the external USB flash drive • 1 = Removed • 2 = Inserted
ExternalSDC	The status of the external SD card • 1 = Removed • 2 = Inserted
ResetTime	The time of the last RTU reset
AmbientTemp	The ambient temperature in Celsius or Fahrenheit
BootVer	The boot version
MacAddress	The MAC address
DBInUse	The number of database writes in progress
PntStatus	The point status as a bitmap: • 0x8000 0000 = Invalid Security Configuration • 0x0800 0000 = Unknown Module Type • 0x0400 0000 = Module Communication Error • 0x0200 0000 = Module Configuration Mismatch • 0x0100 0000 = Module Not Installed
PntCheckSum	The point checksum A 16-bit number representing the CRC of the CPU Module's configuration database

CPU — X.509 Certificate

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
CertState		Current state of the X.509 certificate • 1 = Certificate Enabled • 2 = Certificate Disabled
CertFile		Certificate file in DER format
PrivateKeyFile		Private key file in PEM format (Server certificate only)
AccessLevel		Current access level of the X.509 certificate • 1 = Administrator Access • 2 = User Access

Dynamic/Command	
Name	**Description**
CertCmd	Current command concerning the X.509 certificate • 1 = Copy Certificate and Private Key to RTU • 2 = Copy Certificate and Private Key to USB • 3 = Reset Certificate • 4 = Delete Certificate
CmdStatus	The status of the last command • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
CertType	Type of certificate • 1 = Server Certificate • 2 = Client Certificate
IssuedTo	Issued to as a standard text common name
IssuedBy	Issued by as a standard text common name
ValidFrom	The start date and time the certificate is valid from in a date & time format (displayed as M/D/YYYY X:XX:XX)
ValidTo	The end date and time the certificate is valid to in a date & time format (displayed as M/D/YYYY X:XX:XX)
PntStatus	The point status of the certificate • 0x0000 0004 = Expired • 0x0000 0002 = No Thumbprint • 0x0000 0001 = User Disabled

CPU — Remote File Transfer

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

Dynamic/Command	
Name	**Description**
FileCmd	Current command concerning the X.509 certificate • 1 = Reset File
CmdStatus	The status of the last command • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
FileName	File name with a maximum of 80 characters • boot.uimage = boot firmware (write only) • ngrtu = application firmware (write only) • RTUdb = RTU database • DebugLog.txt = Debug Log • <CertFile> = X.509 certificate (.der) • <PrivateKeyFile> = X.509 server (.pem) • <StrapFile> = Tank calculations strap file • <ItemCmdFile> = Tank Enraf item command file • <NNN> <Label>.cfg = Tank NNN Enraf configuration file • <NNN> <Label>.log = Tank NNN Enraf log file • <RootCAFile> = MQTT root certificate authority file (.pem) • <CertFile> = MQTT certificate (.cert.pem) • <PrivateKeyFile> = MQTT private key (.pem) • <PubFile> = MQTT publish file (.txt)
FileState	State of the file • 1 = File Is Open For Reading • 2 = File Is Open For Writing • 3 = File Is Closed

Dynamic/Command	
Name	**Description**
FileStatus	Status of the file • 1 = No File Error • 2 = Invalid FileName • 3 = File Not Found • 4 = Invalid Argument • 5 = Invalid State • 6 = File Is Write Only • 7 = Private Key Filename Mismatch • 8 = Memory Device Error • 9 = Invalid OPC UA Node ID
PntStatus	Point status of the certificate • 0x0000 0080 = Invalid OPC UA Node ID • 0x0000 0040 = Memory Device Error • 0x0000 0020 = Private Key Filename Mismatch • 0x0000 0010= File Is Write Only • 0x0000 0008 = Invalid State • 0x0000 0004 = Invalid Argument • 0x0000 0002 = File Not Found • 0x0000 0001 = Invalid File Name

CPU — MQTT

Configuration		
Name	**Default**	**Definition**
Label	pntname	An ASCII string (32 byte max) that stands as a name for the point
ChanState	1	Current state of the MQTT channel • 1 = Disable Channel • 2 = Enable Channel
Mode	0	Operational mode 0x0001 = Halt MQTT if an error is detected
Broker	1	MQTT broker being used 1 = Amazon AWS
TCPPort	8883 or 443	TCP Port address
RootCAFile		Name of the root certificate authority file (.pem)
CertFile		File name of the certificate
PrivateKeyFile		File name of the private key (.private.key)
PubFile		Name of the publish file
NameServer		MQTT name server **Note:** A CPU module reset is required if this value is changed
HostName	.amazonaws.com	Host name (a.k.a., Endpoint)
ClientIdName		Name of the client ID
SetPrefix	***ALARM***	Place to configure the prefix for an alarm message
ClearPrefix	Alarm Cleared	Place to configure the prefix for a cleared alarm message
QualOfService	1	Quality of service for the MQTT message • 1 = Message Delivered At Most Once • 2 = Message Delivered At Least Once • 3 = Message Delivered Exactly Once (not supported by Amazon AWS)
Retain		Setting to retain or not retain last message • 1 = Do Not Retain The Last Message Of Each Topic At The Broker • 2 = Retain The Last Message Of Each Topic At The Broker
InitDelay	10	Delay to initialize MQTT (0–300 seconds)
Timeout	5	Amount of time to timeout a message (1–60 seconds)
PubDelay	100	Delay before publishing an MQTT message
MaxRetry	2	Maximum number of retries
KeepAlive	20	Amount of time to keep the message alive (1–1440 minutes (24 hours))
SubTopic1		Subscribe topic #1

Dynamic/Command	
Name	**Description**
ChanCmd	Current command concerning MQTT • 1 = Reset Channel • 2 = Publish All Messages
CmdStatus	The status of the last command • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComStatus	The status of the MQTT communication service • 1 = Offline • 2 = Online
NumPubMessages	Number of messages in publish file
CurPubTopic	Current topic being published
CurPubMessage	Message in the current topic being published
CurSubTopic	Current topic being subscribed
CurSubMessage	Message of the current topic being subscribed to
StatusText	Status text of the MQTT service
NumRequests	Number of requests
NumTrans	Number of successful transactions
NumComErrors	Number of requests with errors
NumTimeouts	Number of request timeouts

Dynamic/Command	
Name	**Description**
PntStatus	The point status of the MQTT service • 0x0200 0000 = Received Unexpected Message Type • 0x0100 0000 = Subscribe Error • 0x0080 0000 = Publish Error • 0x0040 0000 = Socket Error • 0x0020 0000 = Buffer Overflow • 0x0010 0000 = Protocol Error • 0x0008 0000 = TLS Alert • 0x0004 0000 = Policy Topic Or ClientIdName Conflict • 0x0002 0000 = Already Connected • 0x0001 0000 = Broker Refused Connection • 0x0000 8000 = Broker Certificate Not Trusted • 0x0000 4000 = Connect Buffer Overflow • 0x0000 2000 = Client Certificate, Policy, or ClientIdName Error • 0x0000 1000 = Connect Socket Error • 0x0000 0800 = Check HostName And NameServer • 0x0000 0400 = Cannot Connect To HostName • 0x0000 0200 = Unknown Connection Error • 0x0000 0100 = CertFile/PrivateKeyFile Format Error • 0x0000 0080 = PubFile Parse Error • 0x0000 0040 = PubFile Error • 0x0000 0020 = RootCAFile Error • 0x0000 0010 = PrivateKeyFile Error • 0x0000 0008 = CertFile Error • 0x0000 0004 = Disabled • 0x0000 0002 = Ping Timeout • 0x0000 0001 = Communication Timeout

CPU — Configuration for Ethernet Port

Protocol		
Name	**Default**	**Definition**
Protocol		Protocol & Devices Supported • 1 = Virtual Channel • 2 = RTU Slave • 3 = Enraf Master (EN811, EN854, EN954, EN990, FTT 29XX) • 4 = Modbus Master (ATT 4000, FTT 29XX, GSI 2000, NMS5X, NMS8X, NRF590, NRF81, NMR8X, MTS, RAPTOR, REX, RTG, RTG/DAU) • 5 = Modbus Slave • 6 = Digital Input • 7 = Digital Output • 8 = Ethernet (GSI 2000) • 9 = Mark/Space (ATT 4000, FTT 29XX, GSI 2000, Varec 1800, Varec 1900, Varec 6500) • 10 = Tankway (LJ1000, LJ1500, LJ2000) • 11 = TLS Master (TLS, TLS3XX, TLS4XX, X76CTM) • 12 = HLS Master (OptiLevel) • 13 = Analog Input • 14 = Engauge

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		The operational mode of the channel
BaudRate		The baud rate of the channel
ComParams	8N	The communication parameters in data bits and parity • O = Odd • E = Even • N = None
RespDelay	50	The response delay (in milliseconds)
InitDelay	60	The initialization delay from 0 to 300 seconds

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

Dynamic/Command	
Name	**Description**
CmdStatus	Status of the last command • 1 = Start • 2 = Complete • 3 = Error • 4 = Executing • 5 = Invalid • 6 = Timeout
ComBus	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	Communication status of the module • 1 = Offline • 2 = Online
CurCommand	Current command for the module
NumRequests	Current number of requests in the module
NumTrans	Current number of successful transactions the module is processing
NumComErrors	Number of requests with errors
Elapse	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 8000 = Duplicate Engauge (Engauge Only) • 0x0000 4000 = Duplicate FlexConnAddr (Engauge Only) • 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 A 16-bit number representing the CRC of the CPU Module's configuration database

Hardware Module Configuration

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

Dynamic/Command	
Name	**Description**
FpgaVer	The version of the field-programmable gate array
WatchdogTimer	The elapsed time in milliseconds since the WatchdogTimer was last serviced
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 A 16-bit number representing the CRC of the module's configuration database

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, EN954, 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) • 0x02 = Hardware Input 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

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 • 0x0001 0000 = Action Failed (Digital Input only) • 0x0000 4000 = Duplicate Engauge Channel (Engauge only) • 0x0000 4000 = Duplicate FlexAddr (Engauge only) • 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

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)
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

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

Enraf Master Channel Variables

All Options Excluding the 954

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
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

Configuration		
Name	**Default**	**Definition**
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
DeviceList	The devices in the scan list • F = Modbus Floating Point Register • I = Modbus Integer Register • T = Tank • V = Veeder-Root TLS

Dynamic/Command	
Name	**Description**
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

For the 954 via Engauge

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		Not used at this time
BaudRate	2400	The baud rates of 1200, 2400, 4800, 9600, 19200, and 38400
ComParams	8N1	How the 954 communicates: 8 data bits, no parity, and 1 stop bit

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
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
DuplicateAddr	The displaying of any duplicate addresses for a FlexConn address where 0-1899 are what addresses are duplicated and a value of 1900 means there are no duplicated addresses
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 8000 = Duplicate Engauge Channel • 0x0000 4000 = Duplicate FlexConnAddr • 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
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)

Configuration		
Name	**Default**	**Definition**
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)
TempInterleave	10	The temperature interleave factor; for protocols that use this parameter, this is the number of level readings between each temperature reading
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
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 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
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
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	ModbusMap is a 32-character (max) ASCII string and is case-sensitive. ModbusMap is used to associate a Gateway Block with one or more Modbus Slave channels, or with the Modbus TCP port on the Ethernet channel (i.e., CPU Module Channel 2). Each of these channels has its own ModbusMap parameter, which can be set to different values. When a Modbus message is received on one of these Modbus channels, the 8810 RTU searches for Gateway Blocks with identical ModbusMap values and uses matching Gateway Blocks to respond to that Modbus message. This allows the 8810 RTU to support multiple Modbus Maps simultaneously. For example, depending on the configuration of the Gateway Blocks, one Modbus Slave channel might interpret Modbus register 100 as a “Level”, while a different Modbus Slave channel might interpret that same register as “Temp”.

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
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
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

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
Priority	1	Change of state priority • 1 = No Priority • 2 = High Priority • 3 = Low Priority
Maxtime	600	Max time between change of state updates
ContactType		The state of the contact: • 1 = Normally Open • 2 = Normally Closed
FilterCnt		The hardware digital input uses FilterCnt to prevent noise from causing an inadvertent action and is applied to the digital input A FilterCnt value of 0 is treated as the same as 1 and a value above 100 is treated as 100

Configuration		
Name	**Default**	**Definition**
DI0to1Action		The action taken when DIOValue transitions from 0 to non-0. The options are: • “No Action” = No action is taken • “Reset All Alarms” = Resets all active ALARMs — this is the same as setting each ALARM's AlarmCmd parameter to “Reset Alarm” for all active alarms • "Reset Alarm" = Resets an alarm for one port only. • “Reset RTU” = Resets the RTU — this is the is the same as what happens when the user sets the CPU Module's ModCmd parameter to "Reset Module" • "Reset Password” = This sets the CPU Module’s AdminName, AdminPassword, User1Name, User1Password, SecurityMode, SecurityPolicy, and UserIdentity configuration parameters to their factory default settings • “Issue Command” = Issues the TANK command specified in DIXtoYValue to the TANK specified in PntIndex • “Write Modbus” = Writes the value specified in DIXtoYValue to the MIREG specified in PntIndex using the ValueXX parameter specified in PntParameter • "Write Value" = Writes values to any parameter within the 8810 RTU
DI1to0Action		Similar to DI0to1Action but this action is taken when DIOValue transitions from non-0 to 0

Configuration		
Name	**Default**	**Definition**
DI0to1Value		Only used if DI0to1Action is either Issue Command or Write Modbus For DeviceTypes NMS5x or NMS8x: • 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) For any other DeviceType: • 1 = Reset Gauge • 2 = Raise Servo • 3 = Freeze Servo • 4 = Find Water Level • 5 = Follow Level • 6 = Run Test • 7 = Run Immersed Profile • 8 = Find Bottom • 9 = Copy ItemCmdFile to RTU • 10 = Read Device Config • 11 = Write Device Config • 12 = Copy .cfg to USB • 13 = Copy .log to USB • 14 = Calibrate If DI0to1Action is "Write Modbus", then this is the value of the 16- or 32-bit integer parameter to be written to the MIREG specified in PntIndex using the Value XX parameter specified in PntParameter
DI1to0Value		The value changed to when DI1to0Action transitions from a non-0 value back to 0
PntIndex		If DIXtoYAction is "Issue Command", then this is the point index of the TANK (1 to 400) If DIXtoYAction is "Write Modbus", then this is the point index of the MIREG (1 to 100) Note that you cannot set DI0to1Action to "Issue Command" and also set DI1to0Action to "Write Modbus" at the same time

Configuration		
Name	**Default**	**Definition**
PntParameter		If DIXtoYAction is "Write Modbus", then this represents the point parameter of the 64 different MIREG ValueXX parameters: • 99 = Value00 • 100 = Value01 ... • 162 = Value63
DI0to1FPValue		Digital input 0-to-1 floating point value (used if Action is 7): If Action is 7, this is the value to be written to Modbus floating point register
DI1to0FPValue		Digital input 1-to-0 floating point value (used if Action is 7): If Action is 7, this is value to be written to Modbus floating point register

Dynamic/Command	
Name	**Description**
ChanCmd	The channel command • 1 = Reset Channel (resets the DIoHwValue filter and StatusText) • 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
ContactType	The values that represent if the channel is open or not • 1 = Normally open (Default value) • 2 = Normally closed

Dynamic/Command	
Name	**Description**
DIOValue	The most recent Digital I/O value that represents both the physical hardware input as well as the ALARM output • 0x01 = Manual Input/Output Value • 0x02 = Hardware Input Value • 0x04 = Alarm Output Value
DIOHwValue	The Digital I/O hardware value • 0 = Off • 1 = On
FilterCnt	The filter count for the number of times before the filter value is updated (ranges from 1–100)
FilteredValue	The filtered value of DIOHwValue with FilteredCrit being used as the filter Note that DIOHwValue is updated approximately 10 times a second, so a FilterCrit of 100 is effectively a 10 second filter
StatusText	The human readable text string that reports the status of the action
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 • 0x0001 0000 = Action failed (Digital Input only) — see StatusText for explanation of the failure • 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
ContactType		The values that represent if the channel is open or not • 1 = Normally open (Default value) • 2 = Normally closed

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

Dynamic/Command	
Name	**Description**
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

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

Configuration		
Name	**Default**	**Definition**
ModbusID	1	The device address to respond to (Server only)
ModbusMap	Default Map	ModbusMap is a 32-character (max) ASCII string and is case-sensitive. ModbusMap is used to associate a Gateway Block with one or more Modbus Slave channels, or with the Modbus TCP port on the Ethernet channel (i.e., CPU Module Channel 2). Each of these channels has its own ModbusMap parameter, which can be set to different values. When a Modbus message is received on one of these Modbus channels, the 8810 RTU searches for Gateway Blocks with identical ModbusMap values and uses matching Gateway Blocks to respond to that Modbus message. This allows the 8810 RTU to support multiple Modbus Maps simultaneously. For example, depending on the configuration of the Gateway Blocks, one Modbus Slave channel might interpret Modbus register 100 as a “Level”, while a different Modbus Slave channel might interpret that same register as “Temp”.

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
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)

Configuration		
Name	**Default**	**Definition**
ModbusMap	Default Map	ModbusMap is a 32-character (max) ASCII string and is case-sensitive. ModbusMap is used to associate a Gateway Block with one or more Modbus Slave channels, or with the Modbus TCP port on the Ethernet channel (i.e., CPU Module Channel 2). Each of these channels has its own ModbusMap parameter, which can be set to different values. When a Modbus message is received on one of these Modbus channels, the 8810 RTU searches for Gateway Blocks with identical ModbusMap values and uses matching Gateway Blocks to respond to that Modbus message. This allows the 8810 RTU to support multiple Modbus Maps simultaneously. For example, depending on the configuration of the Gateway Blocks, one Modbus Slave channel might interpret Modbus register 100 as a “Level”, while a different Modbus Slave channel might interpret that same register as “Temp”.

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
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
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

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.

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

CPU Config & CPU Dynamic					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
CPU Config	AmbientTempSrc			CONFIG	Ambient temperature source. Enumerated type: • 1 = AmbientTemp • 2 = ManAmbientTemp
	ManAmbientTemp			CONFIG	Manual Ambient Temperature This is a user-configurable ambient temperature to be used if AmbientTemp is not periodically updated via Modbus (see AmbientTemp).
	AmbTempConvert			CONFIG	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			CONFIG	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		REGMAP	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**		CONFIG	Standards organization Enumerated type: 1 = American Petroleum Institute (API)
	StandardsRev	Standard - Revision**		CONFIG	Standards revision Enumerated type: 1 = Commodity 2004 (API)
	CommodityType	Commodity - Table**		CONFIG	Commodity type Enumerated type: • 1 = Alpha 60 • 2 = Crude Oil • 3 = Refined Product • 4 = Lubricating Oil
	Alpha60	Alpha**		CONFIG	Product Alpha 60 This coefficient is used only if CommodityType is "None". Range is 0.00023 to 0.00096 for Fahrenheit, 0.000414 to 0.001674 for Celsius
	StdTemp	Temperature Standard**		CONFIG	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 60F is used regardless of the StdTemp value.
	StrapFile			CONFIG	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			CONFIG	4 character ASCII string (For example, "FtoM" for feet to meters) • C = Centimeters • F = Feet • M = Meters • m = Millimeters • P = Feet-Inches-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			CONFIG	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			CONFIG	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			CONFIG	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			CONFIG	4 character ASCII string for volume conversions (For example, "GtoL" for Gallons to Liters) • B = Barrels • G = Gallons • L = Liters • M = Cubic Meters
	PressConvert			CONFIG	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
	FlowConvert				Used to convert the TANK TOVFlowRate parameter
	SWPct	Percent SW	S&W%	CONFIG or REGMAP	Sediment & water percent Also referred to as Sediment & Water
	LevelOffset			CONFIG	Numeric offset applied to Level
	TempOffset			CONFIG	Numeric offset applied to Temp
	FlowSamples				Number of StrapVol samples used to calculate flow rate Value ranges from 2–16 Default = 8
	FlowInterval				Minimum time interval in seconds between flow rate Default = 0
	FlowDeadband				Flow rate deadband Used if FlowDeadband or less away than 0 which forces the flow rate to have a value of 0 Default = 0.0

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
Tank Properties	RoofType	Roof Type		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	Tank Geometry		CONFIG	Tank geometry Enumerated type: • 1 = Vertical Cylinder • 2 = Horizontal Rounded • 3 = Horizontal Flat
	ShellCorrect	Tank Shell Correction		CONFIG	Tank shell correction Enumerated type: • 1 = No Correction • 2 = Uninsulated Tank • 3 = Insulated Tank
	TankMaterial	Tank Material		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	Tank Expansion Coefficient	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

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
Analog	ManLevel			CONFIG or REGMAP	Manual Level value
	TempSrc			CONFIG	Product temperature source Enumerated type: • 1 = Temp • 2 = ManTemp
	ManTemp			CONFIG or REGMAP	Manual temperature value
	SolidsLevelSrc			CONFIG	Solids level source Enumerated type: • 1 = SolidsLevel • 2 = ManSolidsLevel
	ManSolidsLevel			CONFIG or REGMAP	Manual solids level value SolidsVol is forced to 0 if ManSolidsLevel is a negative number.
	WaterLevelSrc			CONFIG	Water level source Enumerated type: • 1 = WaterLevel • 2 = ManWaterLevel
	ManWaterLevel			CONFIG or REGMAP	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	Density Product Standard		CONFIG or CALC or REGMAP	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
	AIMinValue				Minimum nominal mAmp input value as a 16-bit integer
	AIMaxValue				Maximum nominal mAmp input value as a 16-bit integer

Tank Config					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	AI1LowRange				Nominal low setting for the 32-bit floating point value reported in Analog1
	AI1HighRange				Nominal high setting for the 32-bit floating point value reported in Analog1
	AI2LowRange				Nominal low setting for the 32-bit floating point value reported in Analog2
	AI2HighRange				Nominal high setting for the 32-bit floating point value reported in Analog2
	AI3LowRange				Nominal low setting for the 32-bit floating point value reported in Analog3
	AI3HighRange				Nominal high setting for the 32-bit floating point value reported in Analog3

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**
	GaugeStatus	Gauge Status		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 Product Observed***		SOURCE	Source product density Note that only EN811, EN854, NMS5x, and NMS8x devices support product density
	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

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	Pressure	Pressure Vapor		SOURCE	The pressure applied to the fluid in the storage container or tank Pressure will change the density of the product thus impacting the VCF calculation 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
	ScanTime				
	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 • 0x0000 0080 = Stale Level • 0x0000 0040 = Invalid Density • 0x0000 0020 = Invalid Temperature • 0x0000 0010 = Invalid Level • 0x0000 0008 = Calculation Error • 0x0000 0004 = Not Scanning • 0x0000 0002 = CIU Timeout • 0x0000 0001 = Device Timeout
	PntCheckSum				Point check sum

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
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.
	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 = CIU Timeout • 0x8000 0000 = Not Balanced • 0x4000 0000 = Invalid Density • 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

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	LevelStatus				Tank level status as reported by the gauge VeRTUe and ViewRTU display the value in hexadecimal. Other tools display the value in decimal. Refer to Enraf documentation for the values reported by the gauge. (Only for EN811, EN854, EN873, EN990, ATT 4000, FTT 29xx, GSI 2000, Varec 1800, Varec 1900, and Varec 6500)
	TempStatus				Tank temperature status as reported by the gauge VeRTUe and ViewRTU display the value in hexadecimal. Other tools display the value in decimal. Refer to Enraf documentation for the values reported by the gauge. (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)
	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)

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	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 Uses the same units as configured in LevelConvert. (Only for Optilevel)
	Offset				Offset (Only for Optilevel)
	Version				Version (Only for MTS and Optilevel)

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
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

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
Density Calculations	ObsDensity	Density Observed		CALC	Observed density ObsDensity is calculated from StdDensity and product temperature.
	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. VolCorFactor value is rounded. (For this release, pressure is always 0.)
	TempCorFactor	Volume Correction For Temperature	CTL	CALC	Correction due to temperature Since pressure is always 0 for this release, this is the same value as VolCorFactor
	PressCorFactor	Volume Correction For Pressure	CPL	CALC	Correction due to pressure Since pressure is always 0 for this release, this is reported as 1.0.
	TankShellTemp	Tank Installation Temperature	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	Volume Roof Correction	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)

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	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
	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
	TOVFlowRate			CALC	Calculated flow rate for Strap Volume (StrapVol or TOV) Calculated in the units of StrapVol per minute The value can be a positive or negative floating point number
	MinOpVol			CALC	Minimum operating volume Strap table lookup from MinOpLevel
	MaxOpVol			CALC	Maximum operating volume Strap table lookup from MaxOpLevel

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	AvailVol			CALC	Available volume StrapVol – MinOpValue Reports 0 if values are calculated to be less than 0.
	RemCapVol			CALC	Remaining capacity volume MaxOpVol – StrapVol Reports 0 if values are calculated to be less than 0.
	NetAvailVol	Net Available Volume			Calculation: NetStdVol – ((MinOpVol + RoofVol) * VolCorFactor) Reports 0 if values are calculated to be less than 0.
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

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	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
	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

Tank Dynamic/Command					
OPC UA Folder	**Display Name**	**FM Settings**	**API Abbr.**	**Input From**	**Notes**
	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
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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