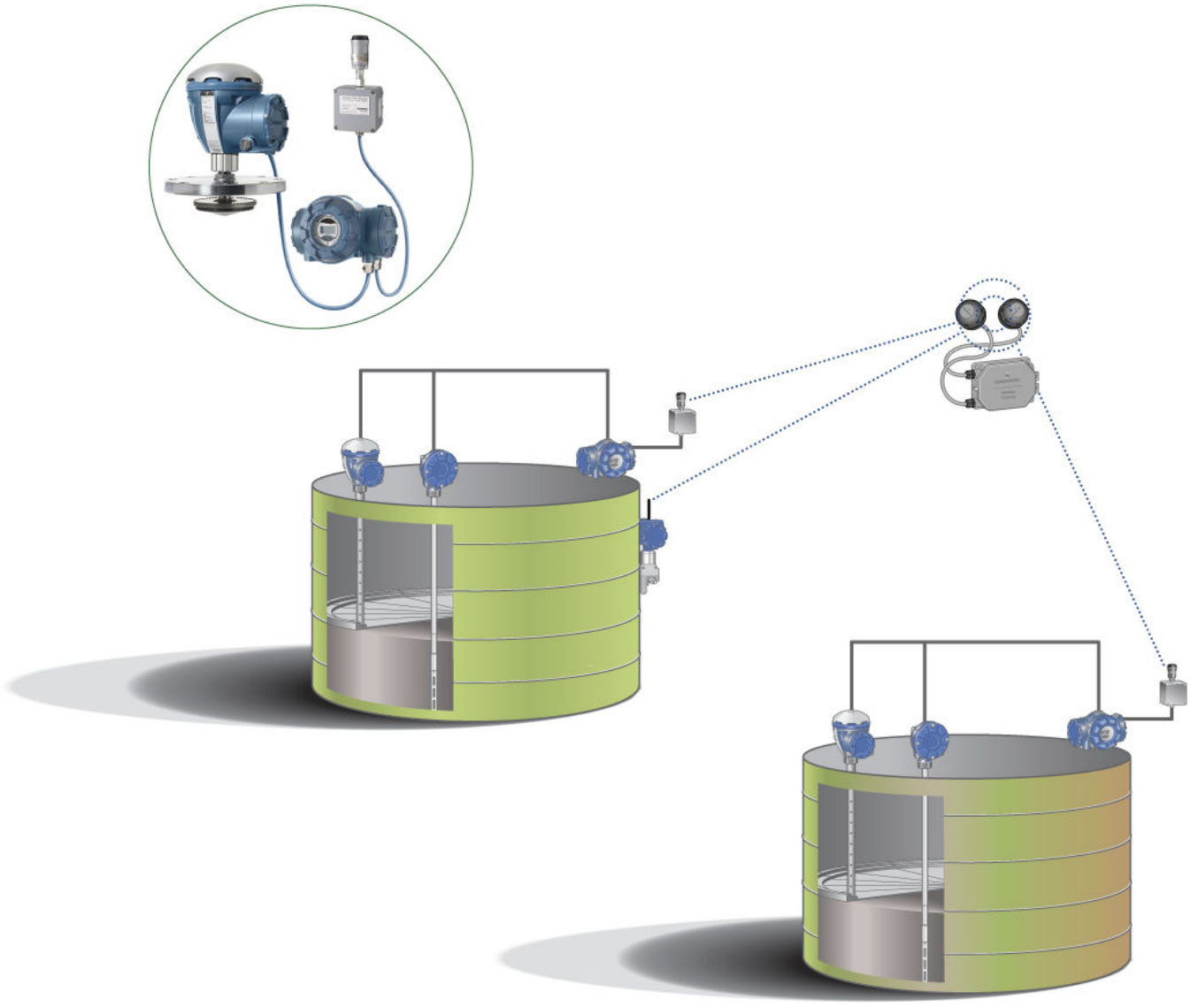
Reference Manual
00809-0100-5200, Rev AD
October 2023

Rosemount™ Tank Gauging Wireless System

Wireless System



ROSEMOUNT™

EMERSON™

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

For equipment service or support needs, contact your local Emerson representative.

Contents

Chapter 1 Introduction 5
1.1 The Wireless Tank Gauging system 5
1.2 *Wireless*HART® – the industry standard 6
1.3 Manual overview 7
1.4 Wireless Tank Gauging System Components 9
1.5 Installation procedure 11
1.6 References 12

Chapter 2 Network Planning 13
2.1 Overview 13
2.2 Scope 14
2.3 Design 15
2.4 Fortify 18

Chapter 3 Configuration 19
3.1 Safety messages 19
3.2 Configuration overview 20
3.3 THUM Adapter configuration 23
3.4 Repeater configuration 33

Chapter 4 Installation 39
4.1 Safety messages 39
4.2 Installation considerations 39
4.3 Preparation checklist 40
4.4 Mechanical installation 41
4.5 Electrical installation 46

Chapter 5 Commissioning 51
5.1 Safety messages 51
5.2 Commissioning introduction 52
5.3 Starting up devices 54
5.4 Verify network device connection 57
5.5 Verify network device status 58
5.6 Verify network design rules 60
5.7 View network live 62

Chapter 6 TankMaster Setup 63
6.1 Introduction 63
6.2 Installing gateway and field devices 63

Appendix A HARTMaster Configuration 75
A.1 HART® modem 75
A.2 Gateway communication 78

Appendix B Device Identification 81
B.1 Device main label 81

B.2 Serial number in TankMaster WinSetup 82

Appendix C HART® Tags 83

C.1 Rosemount 2410 Tank Hub 83

C.2 Connected field devices 85

Appendix D Installing generic FOUNDATION™ Fieldbus devices 87

D.1 Introduction 87

D.2 Installation procedure 88

Appendix E Troubleshooting 101

E.1 Hart master communication 101

E.2 Network design 105

E.3 THUM™ Adapter 106

E.4 Gateway 107

1 Introduction

1.1 The Wireless Tank Gauging system

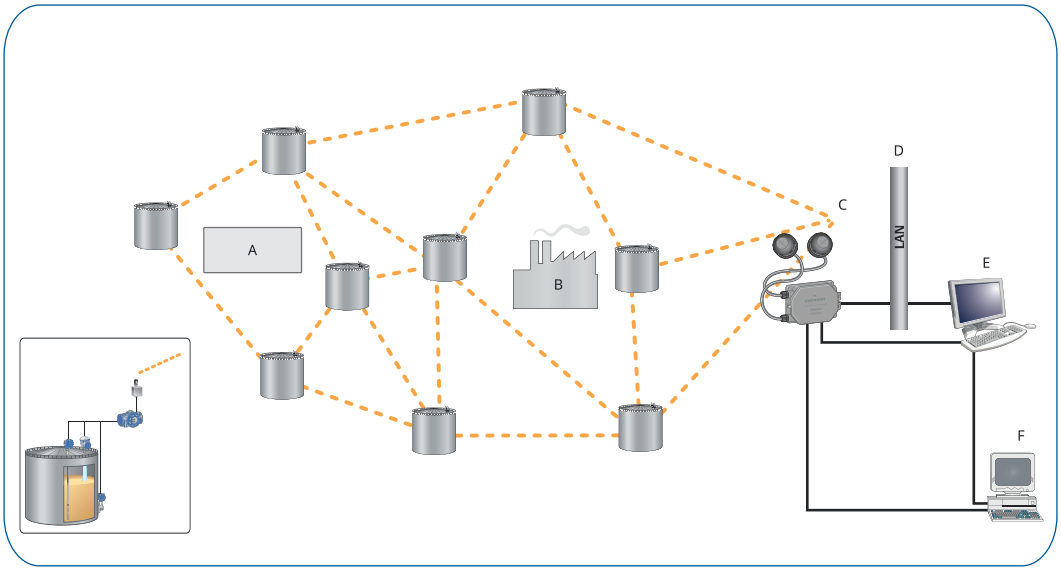
The Wireless Tank Gauging System is based on IEC 62591 (*Wireless*HART®), the industry standard for wireless field networks.

The reduced field wiring leads to large savings in infrastructure, design and labor required for installation and commissioning.

No hot work is required and production downtime is minimized.

In addition, compared to other systems, the time between project start-up and an up-and-running wireless system is drastically reduced.

Figure 1-1: Wireless Tank Gauging Network



A. Temporary obstacle
B. Permanent obstacle
C. Emerson Wireless Gateway
D. LAN
E. Rosemount TankMaster™
F. DCS/Host

1.2 *Wireless*HART® – the industry standard

*Wireless*HART is the first simple, reliable and secure wireless communication standard for process monitoring and control applications (IEC 62591Ed. 1.0).

Self-organizing adaptive mesh routing

- No wireless expertise required, devices automatically find the best communication paths
- Network continuously monitors paths for degradation and repairs itself
- Adaptive behavior provides reliable, hands-off operation and simplifies network deployments, expansion and reconfiguration
- Supports both star and mesh topologies

Industry standard radio with channel hopping

- Standard IEEE 802.15.4 radios
- 2.4 GHz ISM band sliced into 16 radio-channels
- Continuously “hop” across channels to avoid interference and increase reliability
- Direct Sequence Spread Spectrum (DSSS) technology delivers high reliability in challenging radio environment

Self-healing network

- If an obstruction is introduced into the mesh network, devices will automatically find the best alternative communication path. This path will be created and the information will continue to flow

Seamless integration to existing hosts

- Transparent and seamless integration
- Same control system applications
- Gateways connect using industry protocols

1.3 Manual overview

This manual provides specific configuration, installation and commissioning information for the Wireless Tank Gauging System. For complete installation information, see the reference manual for each device.

For configuration guidance see the Rosemount System Configuration Manual (Document No. 00809-0300-5100).

Introduction	• The Wireless Tank Gauging system • *Wireless*HART® – the industry standard • Wireless tank gauging system components • Installation procedure • References
Network Planning	• Scope • Design • Fortify
Configuration	• Configuration overview • Emerson 775 Wireless THUM™ Adapter configuration • Repeater configuration
Installation	• Installation considerations • Mechanical installation • Electrical installation
Commissioning	• Starting up devices • Verify network device connection • Verify network device status • Verify network design rules • View network live (optional)
TankMaster Setup	• Installation of Gateway and field devices
HARTMaster Configuration	• Protocol configuration for wired communication with HART modem • Protocol configuration for Gateway communication
Device Identification	• Identification of serial number
HART® Tags	• Rosemount 2410 Tank Hub • Field devices connected to the Tankbus
Installing generic FOUNDATION™ Fieldbus devices	• Installation procedure
Troubleshooting	• Exception Counter

- Network Design
- Communication
- THUM Adapter
- Gateway

1.4 Wireless Tank Gauging System Components

1.4.1 Emerson Wireless Gateway

The Emerson Wireless Gateway enables communication between wireless devices and host applications, such as Rosemount TankMaster™. Each gateway manages its own unique wireless network.

A single gateway can support up to 200 (100+100) nodes. In a wireless Rosemount Tank Gauging system, it is recommended to use one gateway for maximum 70 (35+35) nodes. Each wireless node in the Rosemount Tank Gauging system consists of a Rosemount 2410 Tank Hub and other devices such as the Rosemount 5900 level gauge, Rosemount 5300/5400 level transmitters, Rosemount 2230 Graphical Field Display, and Rosemount 2240S Multiple-input Temperature Transmitter. For Wireless Tank Gauging systems, the Emerson Wireless 1410S1/S2 Gateways are supported as well as the Emerson Wireless 1410/1420 Gateways.

1.4.2 Rosemount 2410 Tank Hub

The Rosemount 2410 Tank Hub handles communication between the field devices and the control room. It is available in two versions; “single tank” or “multiple tanks”. In a wireless network, the 2410 is connected to an Emerson 775 Wireless THUM™ Adapter.

The tank hub feeds power to the devices on the Tankbus and collects and calculates tank data.

1.4.3 Emerson 775 Wireless THUM™ Adapter

The Emerson 775 Wireless THUM Adapter acts as a wireless data link between Rosemount 2410 Tank Hub and an Emerson Wireless Gateway in an IEC 62591 (*Wireless*HART®) network. It is powered by the tank hub via a 2-wire intrinsically safe fieldbus.

1.4.5 AMS Wireless SNAP-ON

AMS Wireless SNAP-ON is an optional software for designing and monitoring(1) *Wireless*HART® networks. It can be used with plot plans or simple scaled drawings to layout the network.

AMS Wireless SNAP-ON can be used as a stand-alone application for site planning and in a real-time mode to monitor(1) the network. This tool incorporates the best practices of design rules recommended for planning a network.

Features:

- AMS Device Manager plug-in software for wireless mesh network planning and monitoring(1)
- Can be installed “offline” without AMS Device Manager

(1) Online monitoring of WirelessHART networks requires AMS Device Manager or AMS Device Configurator to be installed.

1.5 Installation procedure

Summary of wireless system installation procedure:

Prerequisites

Note
The Network planning must be finished before starting the installation procedure.

Procedure

1. Network planning (see Network Planning)
2. Preparations (see Preparations)
3. Configure THUM Adapter (see THUM Adapter configuration)
    a) Network ID and Join Key
    b) HART Tag
    c) Connected sub-device
    d) Advanced configuration (if applicable)
4. Configure repeater (when required) (see Repeater configuration)
    a) Network ID and Join Key
    b) HART Tag
5. Review installation considerations (see Installation considerations)
6. Install the devices (see Mechanical installation)
7. Connect the devices (see Electrical installation)
8. Start-up the devices (see Starting up devices)
9. Verify network device connection, status, and design rules (see Verify network device connection, Verify network device status, and Verify network design rules).
10. Install and configure devices in TankMaster (see TankMaster Setup)

1.6 References

Document Title	Document No.
Emerson Wireless 1410S Gateway Reference Manual	00809-0600-4410
Emerson Wireless 775 THUM™ Adapter Reference Manual	00809-0100-4075
Emerson Wireless Gateway 4.6 User Guide	00821-0100-6129
Emerson Wireless Gateway User Interface Terminology Guide for Firmware Revision 4.5	00809-1600-4420
Rosemount 2410 Tank Hub Reference Manual	00809-0100-2410
Rosemount 702 Wireless Discrete Transmitter Reference Manual	00809-0200-4702
Emerson Wireless 775 THUM™ Adapter Mechanical Installation Drawing	9150070-981
Rosemount 2410 Tank Hub to Emerson Wireless 775 THUM™ Adapter Electrical Installation Drawing	9150070-991
Single Tank with Emerson Wireless 775 THUM™ Adapter Electrical Installation Drawing	9240041-997
Rosemount Tank Gauging System High performance bulk liquid measurement	00813-0100-5100
Rosemount Tank Gauging System Configuration Manual	00809-0300-5100
IEC 62591 (*Wireless*HART®) System Engineering Guidelines	00809-0100-6129

2 Network Planning

2.1 Overview

This section provides a brief overview of network planning and recommendations to ensure proper network performance. The network planning must be done before the wireless devices are installed.

There are three fundamental design rules for designing a network:

- Scope - Divide the tank farm in logical groups or subsections of a tank area
- Design - Apply design rules to ensure optimum connectivity
- Fortify - Fix any potential weaknesses in the network design

The guidelines support design of small networks, less than 10 wireless devices, as well as multiple networks containing a larger number of devices.

Designing a wireless network requires a scaled drawing for selecting a gateway location, arranging wireless devices and testing the layout against network design recommendations.

The optional software AMS Wireless SNAP-ON, is a design tool that is recommended to be used for network planning.

The wireless devices are located according to their tank connection. Only an approximate location on the scaled drawing is required since the self-organizing mesh technology will adapt to conditions as they exist and change from the point of installation.

For more information see the following documents:

- IEC 62591 (*Wireless*HART®) System Engineering Guide

2.2 Scope

2.2.1 Define the network area

Obtain a scaled drawing of the tank farm. An existing location plan or aerial picture can be used.

The tank farm often has a natural organization that can be used for scoping networks. Wireless points are ideally organized by tank groups. Divide the tank farm in logical units.

Find a suitable location of the gateway, as close to the centre of the mesh network as possible. Look at available wired infrastructure. If no suitable wired infrastructure is available, consider a wireless back-bone e.g. Pervasive Field Network (PFN).

Determine number of wireless devices per gateway. The wireless network gets more robust as more devices are added. Up to 35 tanks per gateway is recommended. Look at the physical location of the critically located tanks.

In a Wireless Tank Gauging system; if an update of 8 seconds is required, all nodes should have direct contact with the Gateway.

2.2.2 Define area density

The area density is defined by the obstruction height and obstruction density and sets the expectations for the wireless network range. A tank farm has typically an area density of “light infrastructure”(2).

A walk through the tank farm is recommended to get a good overview of the topology and high buildings that may block communication paths. Look for a good position to place the gateway antenna and other wireless devices.

(2) For further information see the IEC 62591 (WirelessHART®) System Engineering Guide.

2.3 Design

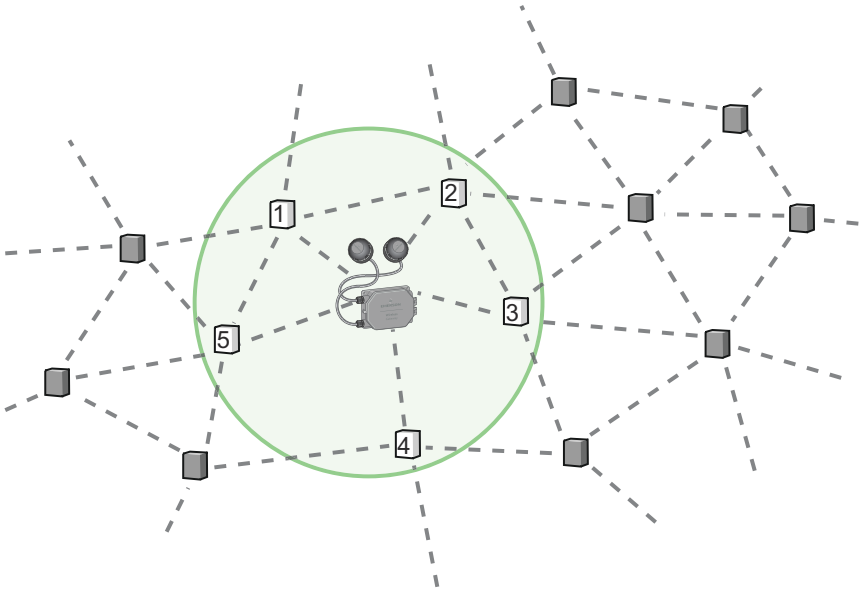
There are three fundamental design rules: Rule of 5, Rule of 3, and Rule of 25%.

The design rules are worked out to ensure a secure margin when implementing a wireless network. During commissioning the implementation of the design rules must be verified. See Verify network design rules.

Rule of 5

Every wireless network should have a minimum of 5 devices within effective range of the gateway.

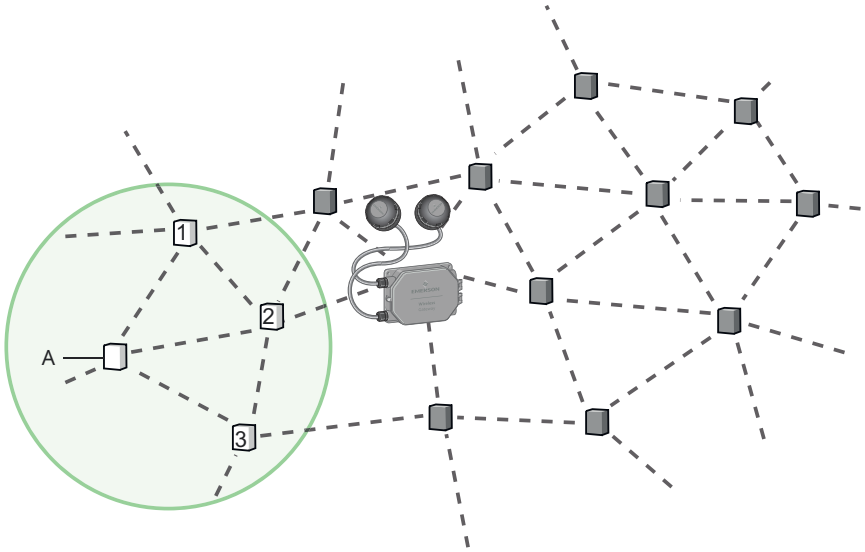
Figure 2-1: Rule of 5



Rule of 3

When designing, every wireless device should have a minimum of 3 neighbors within effective range. This ensures there will be at least 2 possible connections once commissioned.

Figure 2-2: Rule of 3

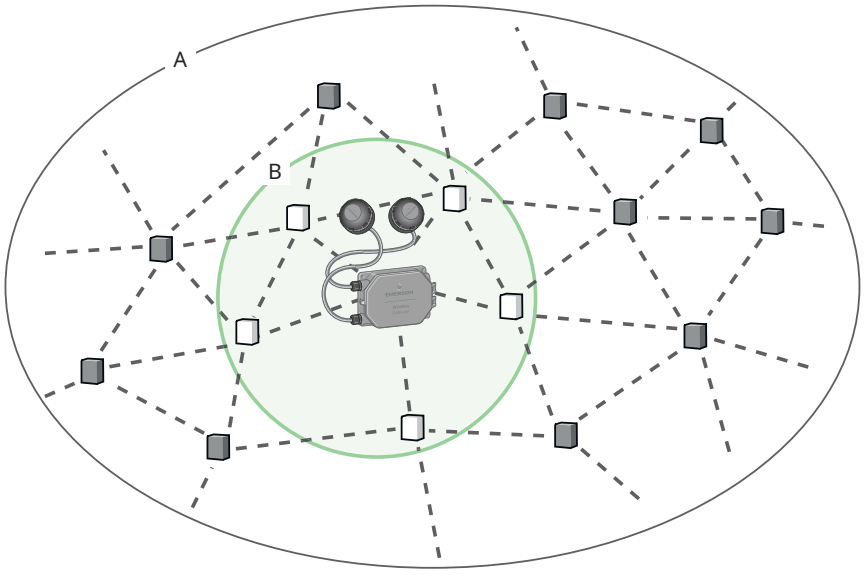


A. Minimum 3 neighbors

Rule of 25%

Every wireless network with more than 5 devices should have a minimum of 25% of the devices within effective range of the gateway.

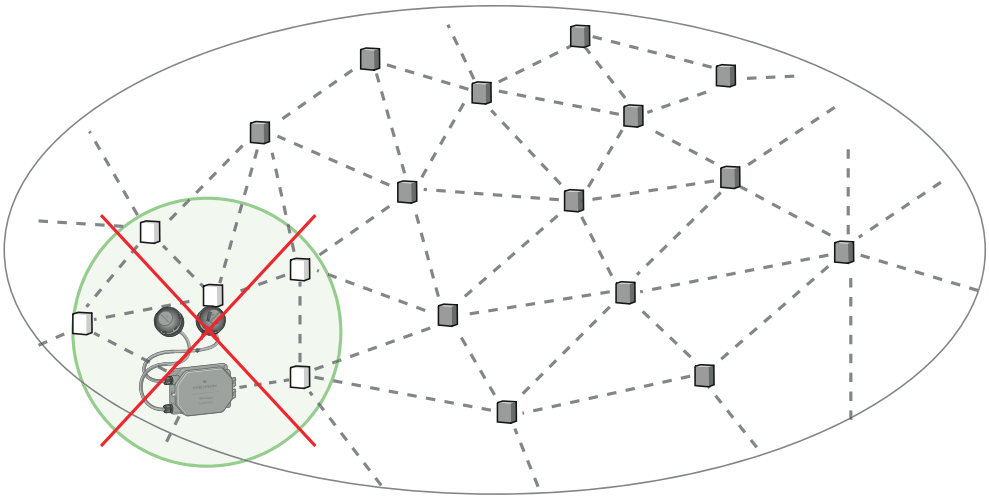
Figure 2-3: Rule of 25%



A. 100%
B. Minimum 25%

Note
The Gateway should be placed at the center of the network for optimum performance.

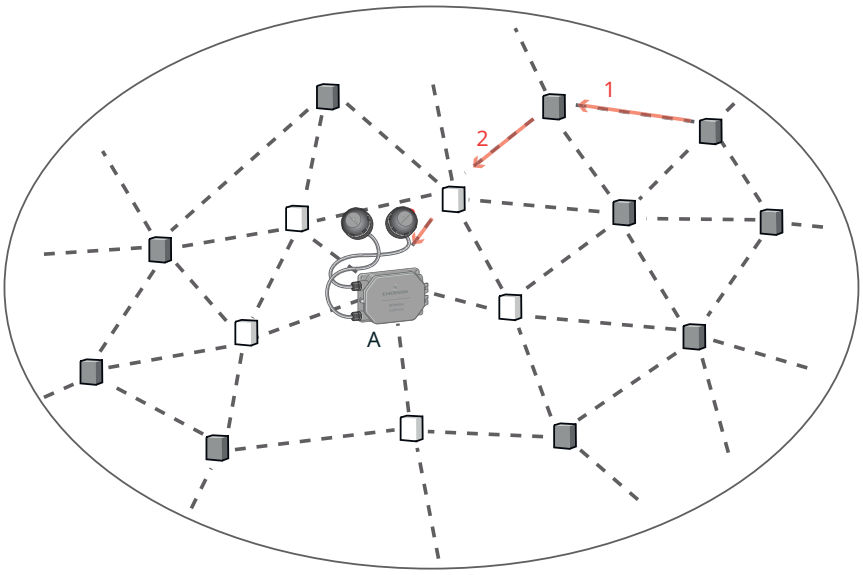
Figure 2-4: Incorrect Position of Gateway



The update rate of the network depends on the depth of the network, i.e. the number of hops. The less hops in the network, the faster the update rate (see Figure 2-5).

For best performance, all devices in the network shall use the same update rate.

Figure 2-5: Number of Hops



A. Three hops

2.4 Fortify

2.4.1 Stress testing

Stress testing the network design by altering the effective range of devices is recommended to identify potential weaknesses in the network. To stress test the network, reduce the effective range of the devices in 10% increments. Then test the design rules against reduced effective ranges.

For example, suppose an effective range of 150 m was used for initial design. Reducing effective range by increments of 15 m (10%) will reveal where the weak spots exist. This process builds confidence in the design.

2.4.2 Fortify the network

When stress testing a network, the weaknesses are identified. Fortify the network by resolving the weaknesses.

Using repeaters is an alternative to support the fortification of a network. Instead of another wireless device with a specific measurement purpose, the repeater is used specifically for the purpose of providing more connection within the network. Repeaters can be used effectively within dense infrastructure if they are placed above the infrastructure to maximize effective range of devices below.

Rule of 5 can be resolved by adding another device within the effective range of the gateway.

When rule of 3 is broken, it can be fortified by moving the THUMs or repeaters to a better position on the tank, or by adding more devices.

Rule of 25% can be resolved in several different ways. Below are three options to fortify the network design, each with its own consideration:

1. Add more devices within the effective range of the gateway. While this is a good solution, there may not be more points of value within effective range of the gateway.
2. Move the gateway into a more central location relative to the distribution of wireless devices. In this case, there may not be a convenient host system integration point at the center of the network.
3. Add another gateway. The increased concentration of field devices within effective range of the added gateway ensures long-term, trouble-free scalability. There may still be the issue with a convenient host system integration point as with option 2.

3 Configuration

3.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions could result in death or serious injury.

Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Before connecting a handheld communicator in an explosive atmosphere, be sure that the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Do not remove the transmitter cover in explosive atmospheres when the circuit is live.

⚠ WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

Ensure the device is installed by qualified personnel and in accordance with applicable code of practice.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any services other than those contained in this manual unless you are qualified.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

⚠ WARNING

High voltage that may be present on leads could cause electrical shock.

Avoid contact with leads and terminals.

Ensure the mains power to the device is off and the lines to any other external power source are disconnected or not powered while wiring the device.

3.2 Configuration overview

In order to communicate with the Emerson Wireless Gateway, and ultimately the Host System (e.g. TankMaster), the Emerson 775 Wireless THUM™ Adapter and other wireless devices must be configured with a proper Network ID and Join Key to communicate with the wireless network. The wireless devices can be ordered with Network ID and Join Key configured at factory.

When the Network ID and Join Key have been configured, the remaining configuration and installation shall be done. Configuration and installation can be performed in desired order.

Emerson 775 Wireless THUM Adapter configuration:

- Network ID and Join Key
- Identification (HART Tag)
- Connected Sub-device
- Advanced Configuration (if applicable)

Repeater configuration:

- Network ID and Join Key
- Identification (HART® Tag)
- Repeater Settings

3.2.1 Configuration Tools

The following configuration tools can be used for the wireless network devices:

- TankMaster WinSetup(3)
- AMS Wireless Configurator
- Field Communicator

3.2.2 TankMaster WinSetup

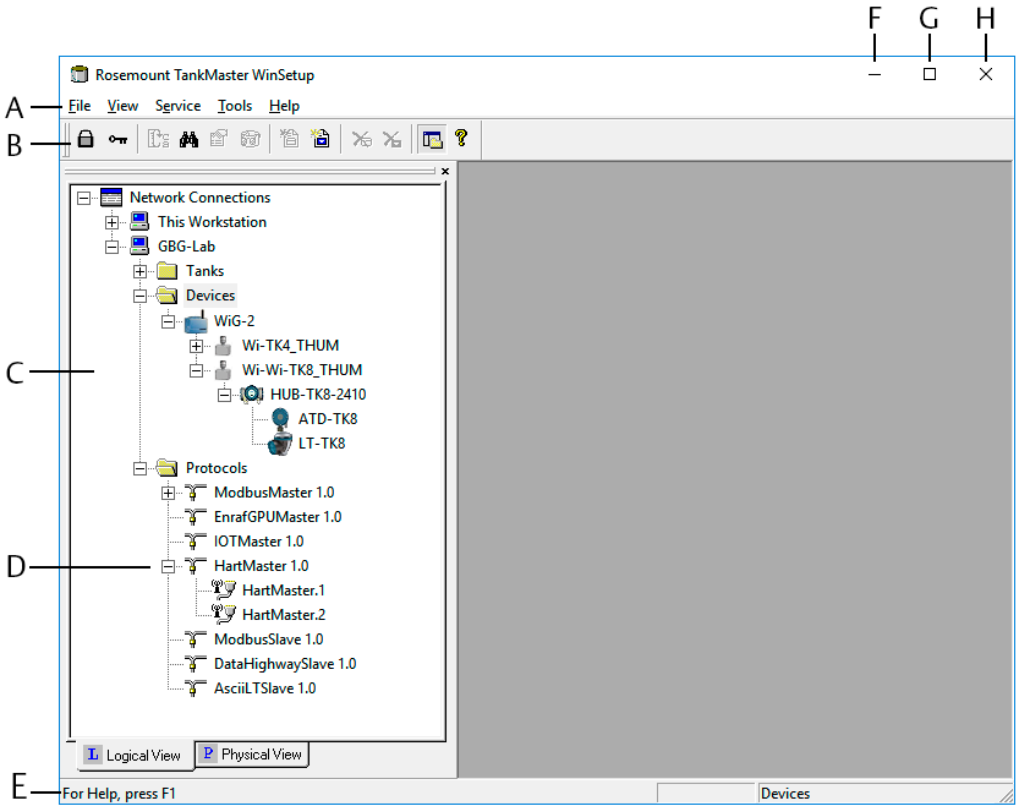
In a standard Rosemount Tank Gauging system, TankMaster communicates with the field devices on the Tankbus by using a wired connection to the 2410 Tank Hub. TankMaster also supports configuration of field devices in a Wireless system via a Emerson Wireless Gateway.

Figure 3-1 shows the main window in TankMaster WinSetup, which includes the workspace to display tanks and devices, a menu bar at the top of the screen, a status bar at the bottom of the screen and a number of shortcut buttons in the toolbar. WinSetup lets you install and configure Tank Gauging systems including wired as well as wireless devices.

For more information on how to use TankMaster WinSetup, see the Rosemount System Configuration Manual (Document No. 00809-0300-5100).

(3) In case TankMaster will be used for tank monitoring, the whole system must be installed and configured with TankMaster WinSetup.

Figure 3-1: TankMaster WinSetup Main Window



A. Menubar
B. Toolbar
C. Workspace
D. HartMaster protocol
E. Status bar
F. Minimize
G. Maximize
H. Close

3.2.3 Preparations

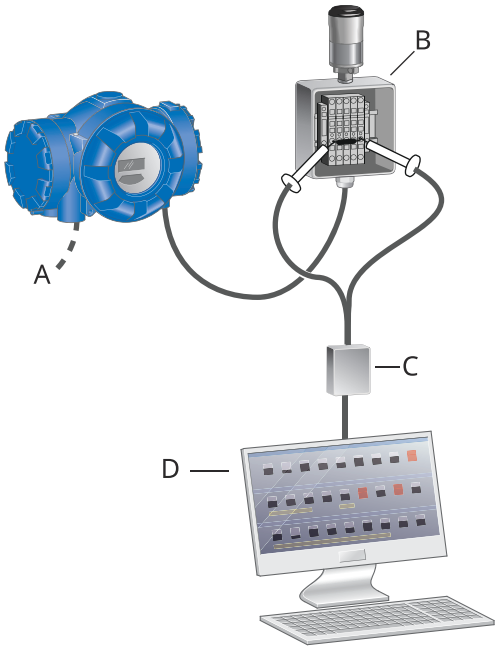
In order to setup a wireless network, the THUM Adapters and repeaters[4] need to be configured for communication with the Emerson Wireless Gateway. The configuration is done by using a wired connection via a HART modem. Once the THUM Adapter is online and connected to the Gateway, some configuration settings, such as update rate (burst rate) and sub-device type, can be changed via the wireless network.

HART® modem

To configure the THUM Adapter, connect a HART modem in parallel with a resistor located in the THUM connection box as illustrated in Figure 3-2. See section HART Modem Connected to THUM Adapter to ensure proper wiring.

(4) A repeater can be any wireless device acting as a network node.

Figure 3-2: Wired Configuration Using a HART Modem



A. Connection to field devices
B. THUM Adapter connection box
C. Connect a HART modem in parallel with the resistor located in the THUM Adapter connection box
D. TankMaster PC

Communication channel

In order to communicate with the TankMaster PC, a HartMaster communication protocol channel needs to be enabled in TankMaster WinSetup (see HARTMaster Configuration for more information).

Related information

HARTMaster Configuration

3.3 THUM Adapter configuration

THUM Adapter configuration includes a few steps in order to setup communication with the wireless network. Ensure that preparations are properly performed prior to starting the configuration procedure (see Preparations).

Network ID and Join Key

Setup the Network ID and Join Key of the Gateway in order to access the network.

Identification (HART Tag)

The HART Tag is used for identification in the wireless network.

Connected Sub-devices

Choose device type in order to setup suitable tank measurement data to send via the THUM to the gateway.

Advanced configuration (if applicable)

Use the **Advanced** option in case you would like to customize tank measurement data (Burst Messages) from the THUM to the gateway.

Note
Note the serial number of each THUM Adapter for future reference. The serial number is found on the label attached to the THUM Adapter. See Device Identification for further information.

Related information

Network ID and Join Key
Identification
Connected Sub-device
Advanced Configuration
Installation procedure

3.3.1 Network ID and Join Key

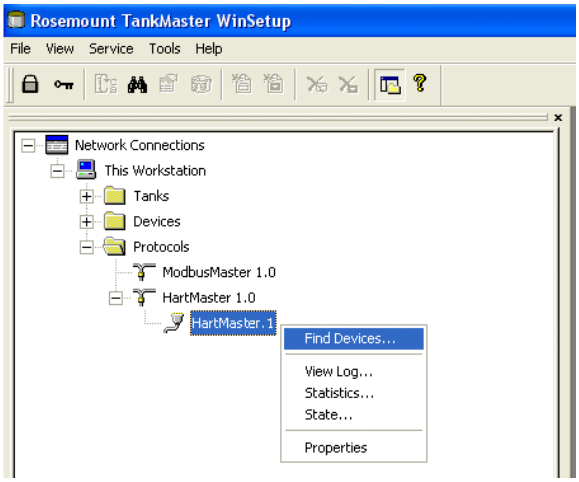
The THUM Adapter has to be configured with the same Network ID and Join Key as the gateway in order to join the network. To access the THUM Adapter on the wired HART bus and configure Network ID and Join Key:

Prerequisites

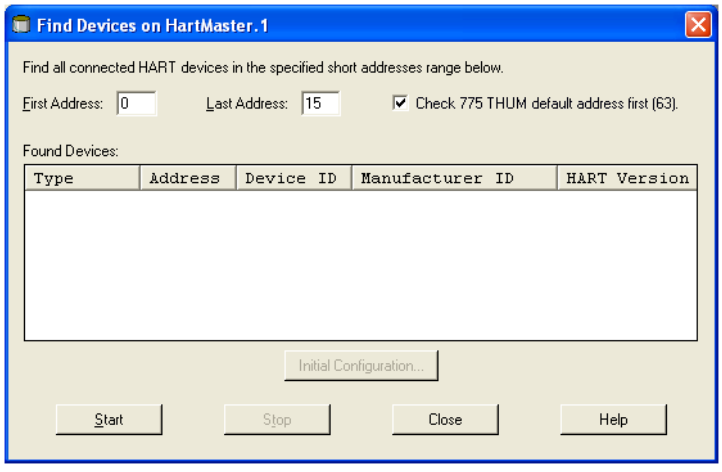
The current Network ID and Join Key can be obtained from the Emerson Wireless Gateway's web server. Follow the instructions in View Network ID and Join Key in Gateway.

Procedure

1. In the ***TankMaster WinSetup*** workspace, select the **HartMaster** channel icon.
2. Right-click and choose the **Find Devices** option.

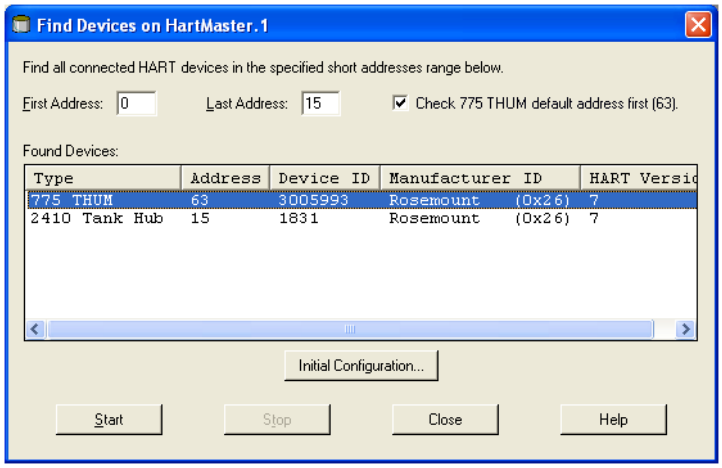


3. Enter First Address 0 and Last Address 16 to specify the address range for searching connected HART devices. Ensure that the **Check 775 THUM default address 63 first** check box is selected. This will ensure that TankMaster searches for the THUM also in case the default address is not within the specified address range.

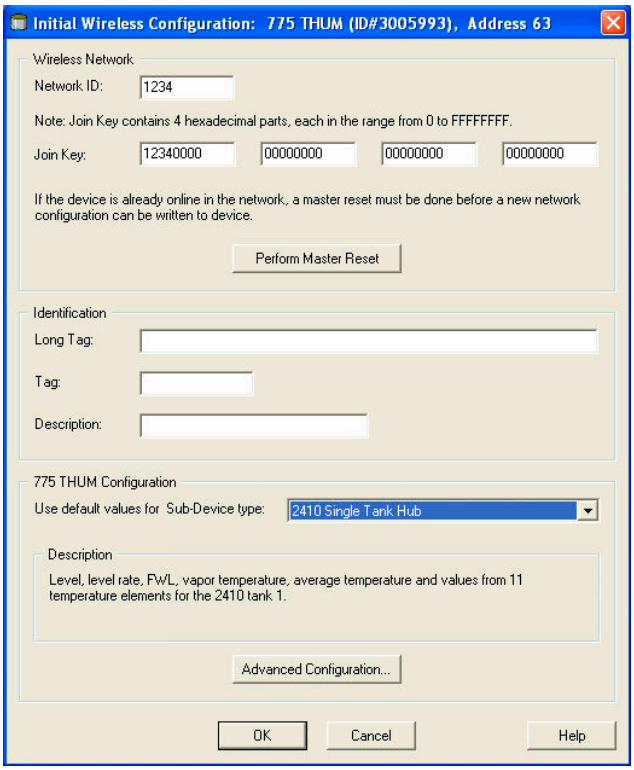


4. Click the **Start** button.
   Devices will appear as they are found on the HART bus.

5. In the ***Find Devices*** window, select the THUM Adapter, and click the **Initial Configuration** button[5].



6. Enter the same Network ID and Join Key as the Gateway for access to the wireless network.



Need help?
In case the Network ID and Join Key are unknown, see View Network ID and Join Key in Gateway.

(5) After power up, it may take up to three minutes until the THUM radio module is up and running and the Initial Wireless Configuration window can be configured.

Postrequisites

Continue the configuration procedure with Identification and Sub-device.

Related information

Identification
Connected Sub-device

View Network ID and Join Key in Gateway

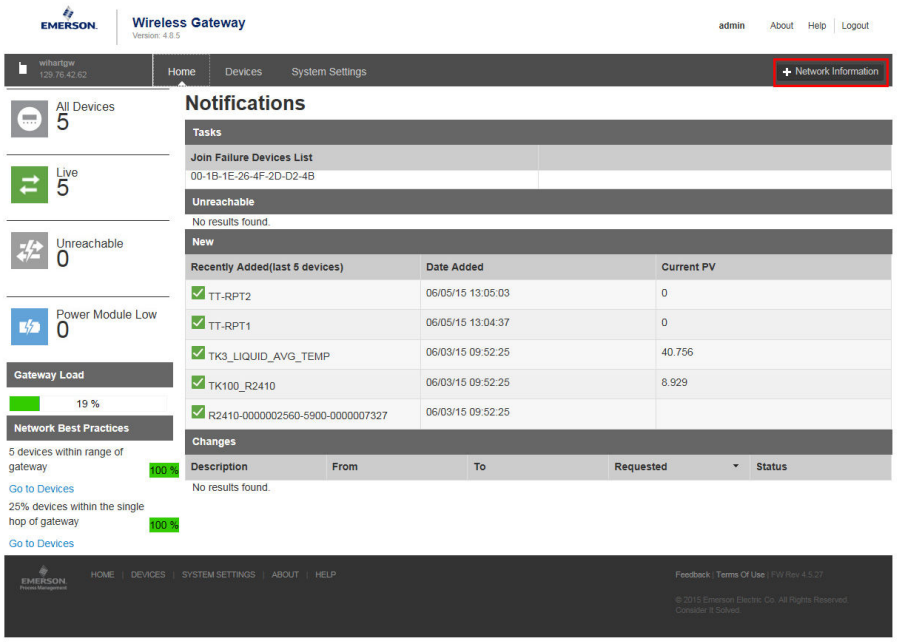
To view the current Network ID and Join Key you will need to log on to the Emerson Wireless Gateway's integrated web server. Do the following:

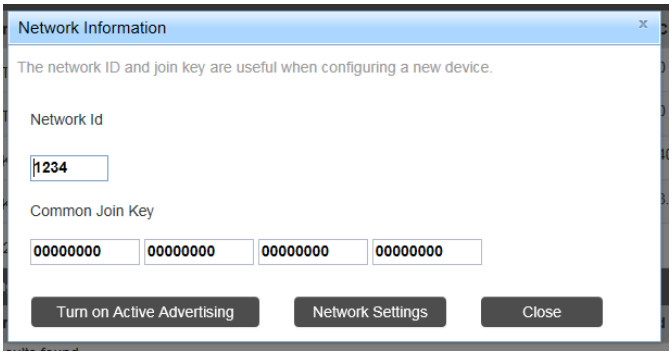
Procedure

1. Open a standard web browser (typically Microsoft® Edge or Google Chrome).
2. Enter the current IP address (default primary port is 192.168.1.10) of the Emerson Wireless Gateway's integrated web server in the address bar.
3. Acknowledge the security to proceed.
4. Enter `admin` for User Name and `default` for the Password.

Need help?
For further instructions on how to log on to the Gateway, see the Emerson 1410S Wireless Gateway Reference Manual.

5. Click on the **Network Information** button.





3.3.2 Identification

Each THUM Adapter is connected to a Rosemount 2410 Tank Hub. It is recommended that the THUM and the 2410 Tank Hub are given the same HART Tag name, with different suffix.

Procedure

1. Set Long Tag.

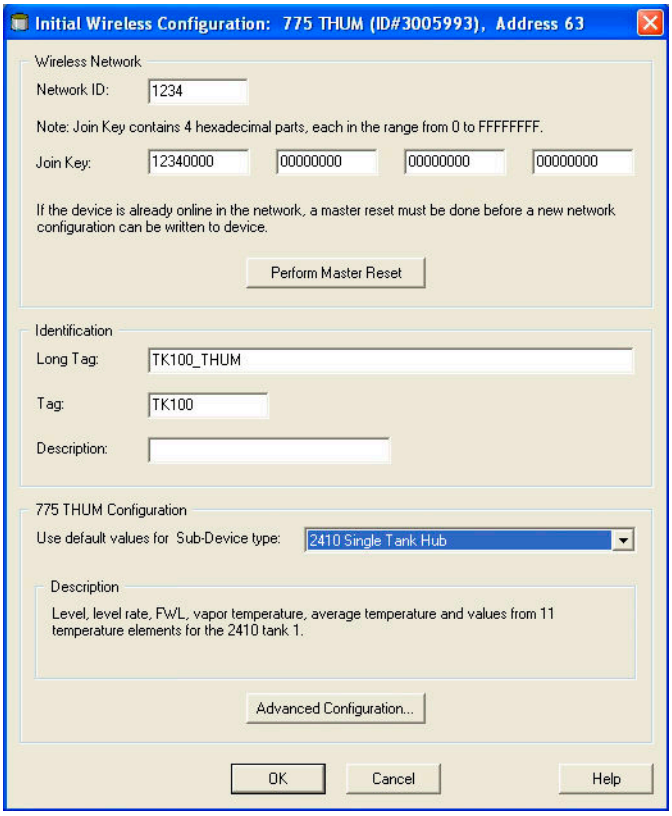
   #### Example

   In this example “TK100_THUM”.

2. Set (HART) Tag.

   #### Example

   In this example “TK100”.



3.3.3 Connected Sub-device

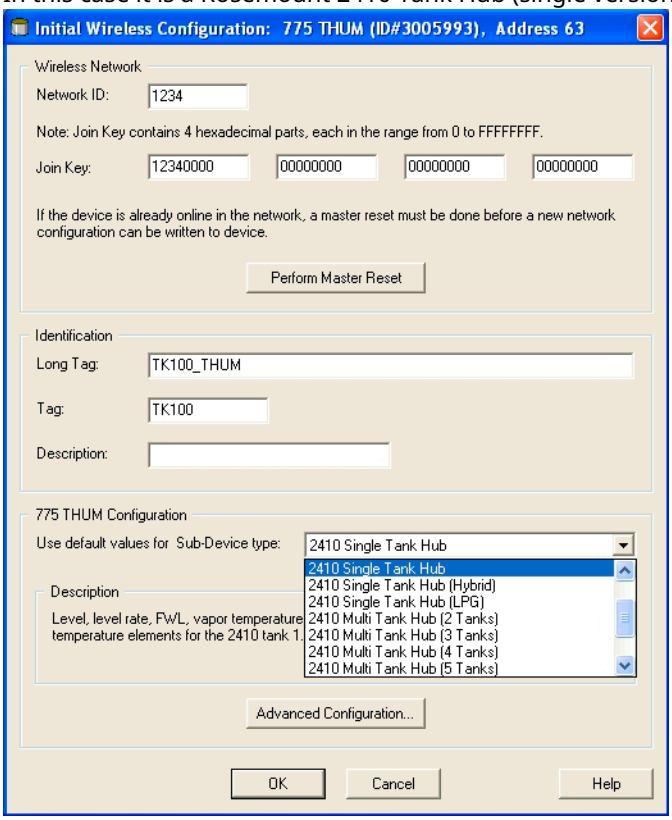
In the ***775 THUM Configuration*** pane in the ***Initial Wireless Configuration*** window, there is a drop-down list of pre-defined devices and settings.

Procedure

1. From the drop-down list, select which device is connected to the THUM and best fits your application.

   #### Example

   In this case it is a Rosemount 2410 Tank Hub (single version).



2. Verify that the desired tank measurement variables appear in the *Description* pane.

   Pre-configured tank measurement data is displayed in the *Description* field. There is a number of pre-defined factory configured burst message options for the different combinations of Tank Hub and number of tanks:

Sub-device Type	Pre-configured Burst Message Variables
2410 Single Tank Hub	Level, Level Rate, FWL (Free Water Level), Vapor Temperature, Average Temperature, and 11 temperature element values
2410 Single Tank Hub (Hybrid)	Level, Level Rate, FWL (Free Water Level), Vapor Pressure, Liquid Pressure, Vapor Temperature,

Sub-device Type	Pre-configured Burst Message Variables
	Average Temperature, and 9 temperature element values
2410 Single Tank Hub (LPG)	Level, Level Rate, Vapor Pressure, Liquid Pressure, Vapor Temperature, Average Temperature, and 10 temperature element values
2410 Multi Tank Hub (2 tanks)	Level, Level Rate, FWL (Free Water Level), Vapor Pressure, Liquid Pressure, Vapor Temperature, Average Temperature for the two tanks. 2 spare variables
2410 Multi Tank Hub (3 tanks)	Level, Level Rate, FWL (Free Water Level), and Average Temperature for the three tanks. 4 spare variables
2410 Multi Tank Hub (4 tanks)	Level, Level Rate, and Average Temperature for the four tanks. 4 spare variables
2410 Multi Tank Hub (5 tanks)	Level, Level Rate, and Average Temperature for the five tanks. 1 spare variable
2410 Multi Tank Hub (8 tanks)	Level, and Average Temperature for the eight tanks.
2410 Multi Tank Hub (10 tanks)	Level for the ten tanks. 6 spare variables

3. Click the **OK** button to finish configuration of the THUM Adapter.

Postrequisites

In case you would like to customize burst message settings, click the **Advanced Configuration** button, see Advanced Configuration for further information.

3.3.4 Advanced Configuration

In the ***Advanced Configuration*** window you can customize burst message settings such as Update Rate and Tank Measurement Data (Variable 1 to 8).

Prerequisites

Note
An update rate of 8 seconds is not recommended during configuration of field devices.

Procedure

1. The THUM is normally pre-configured in factory for Tank Gauging applications. Ensure the Wired Device options are set according to Table 3-1.

   Wired Device settings are optimized for the selected sub-device type and should normally not be changed. For the 2410 Tank Hub the following settings apply:

   Table 3-1: Advanced Configuration Settings

Item	Wired Device settings
Current Control	Fixed High Current
Voltage Drop	Fixed Voltage Drop
Routing Mode	Normal
Discovery Mode	Find at Short Address
Find at Address	15

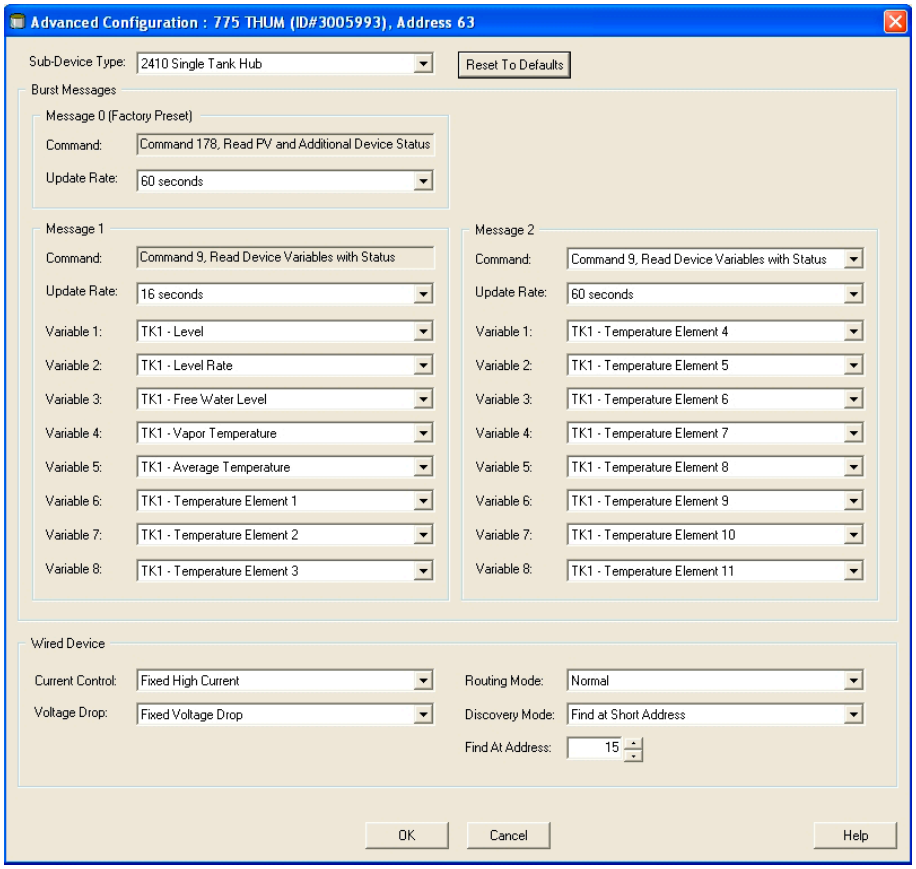
2. Change Tank Measurement Data (Variable 1 to 8), Update Rate and Command settings to fit your application, according to available options.
3. Click the **OK** button to finish configuration of the THUM Adapter.

Burst Message Update Rates and Commands

The THUM transmits three burst messages, one message for the THUM (Message 0) and two messages for the Rosemount 2410 Tank Hub (Message 1 and Message 2, which are used for tank measurement data). These messages are sent at pre-defined Update Rates from the THUM Adapter to the gateway. Different burst Commands are used for the three messages:

Table 3-2: Burst Messages

Message number	Update Rate	Burst Command
Message 0	60 s (optional: 120 s)	Read PV and Additional Device Status
Message 1	16 s (optional: 8, 32, 60 or 120 s)	Read Device Variables with Status
Message 2	60 s (optional: 16, 32, or 120 s)	Read Device Variables with Status (default), Additional Device Status, or None



3.4 Repeater configuration

Any *Wireless*HART® device can work as a repeater. To use a device only as a repeater, it is recommended to choose a device with a long life power module and an antenna suitable for the application (fortifying the network or bridging long distances).

Repeater configuration steps

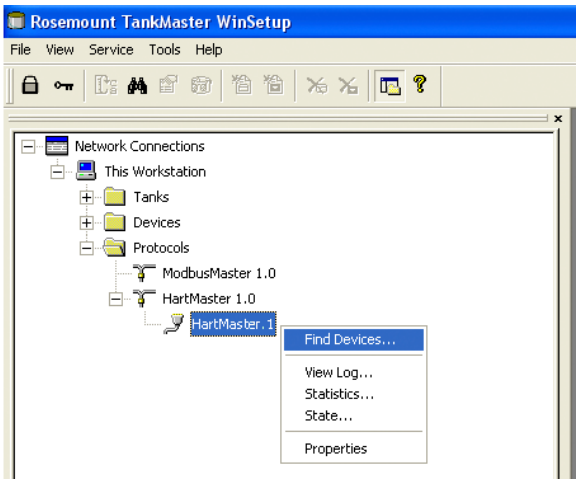
- Network ID and Join Key
- Identification (HART tag)
- Repeater Settings

3.4.1 Network ID and Join Key

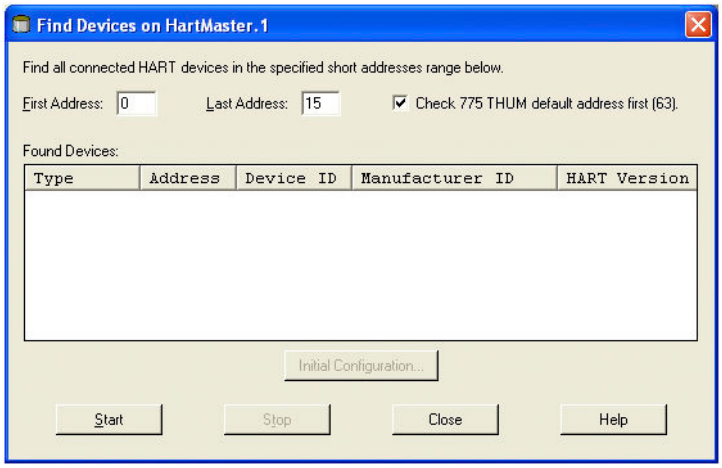
The wireless device used as a repeater has to be configured with the same Network ID and Join Key as the gateway in order to join the wireless network. To access the repeater on the HART bus:

Procedure

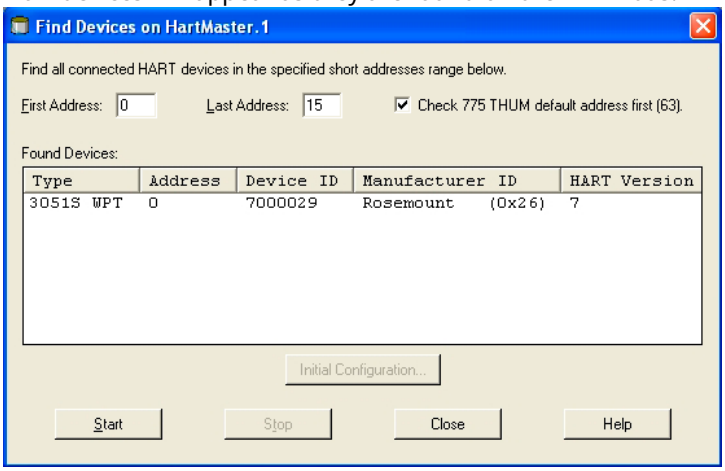
1. In the ***TankMaster WinSetup*** workspace, select the **HartMaster** channel icon.
2. Right-click and choose the **Find Devices** option.



3. Enter First Address and Last Address to specify the address range for searching connected HART devices.

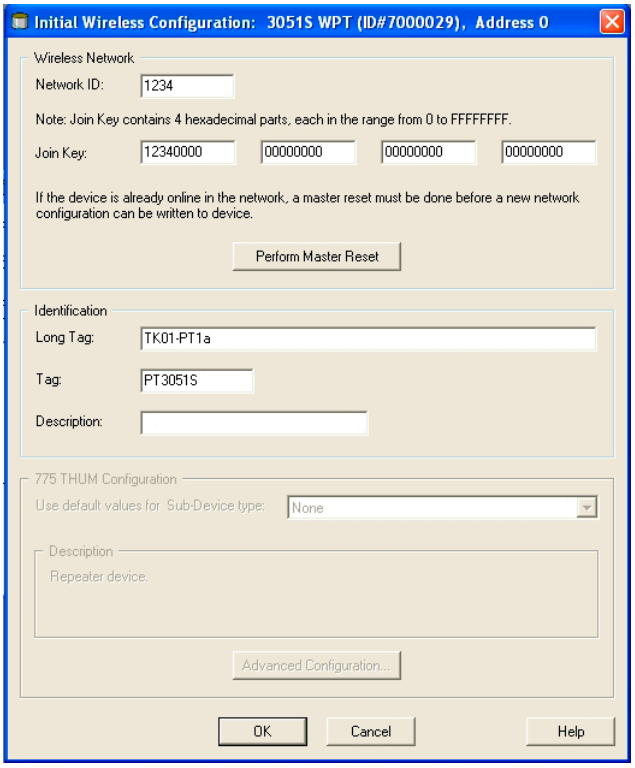


4. Click the **Start** button.
   Now devices will appear as they are found on the HART bus.



5. In the ***Find Devices*** window, select the device to be used as a repeater and click the **Initial Configuration** button.

6. Set Network ID and Join Key.



Need help?
If the Network ID and Join Key are unknown, follow the steps in View Network ID and Join Key in Gateway.

3.4.2 Identification

Set Long Tag and (HART) Tag. See Identification for more information.

3.4.3 Repeater settings

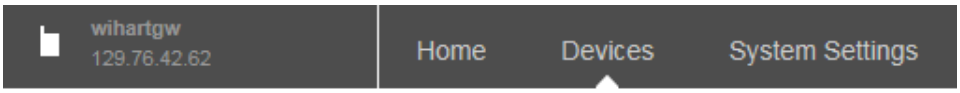
To change the Update Rate you will need to log on to the Emerson Wireless Gateway's integrated web server. Do the following:

Procedure

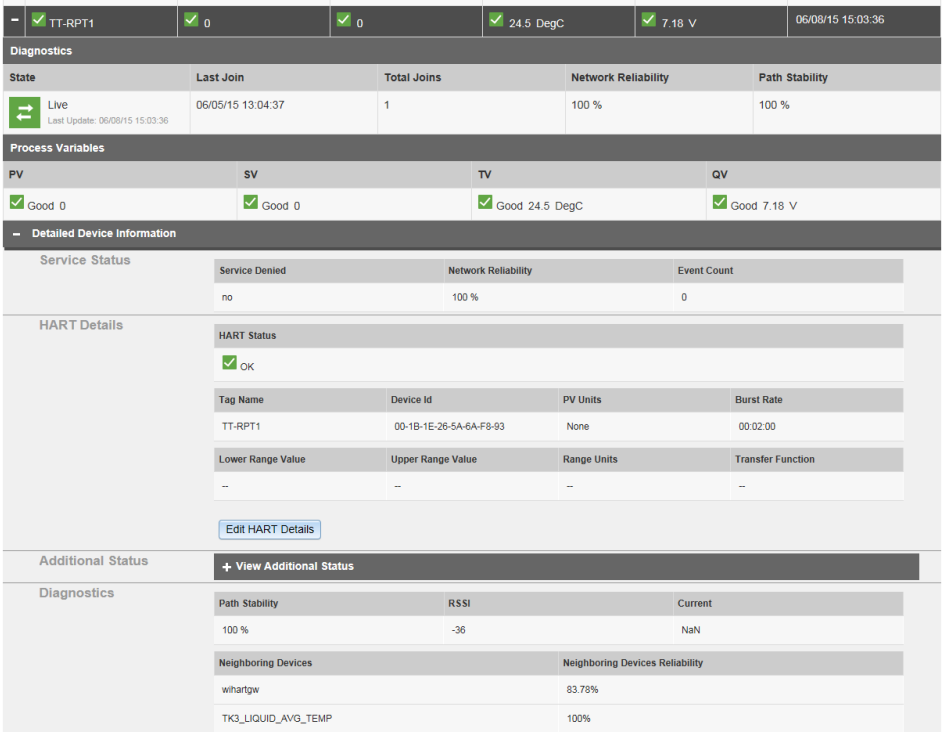
1. Open a standard web browser (typically Microsoft® Internet Explorer).
2. Enter the current IP address of the Emerson Wireless Gateway's integrated web server in the address bar.
3. Acknowledge the security to proceed.
4. Enter `admin` for User Name and `default` for the Password.

Need help?
For further instructions on how to log on to the gateway, see the Emerson Wireless 1420 Gateway Reference Manual (Document No. 00809-0200-4420).

5. Open **Devices** in the menu bar.

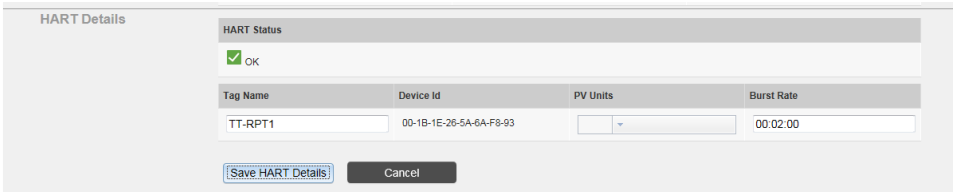


6. Click on the repeater you wish to change update rate on.



7. Open **Detailed Device Information** and click on the **Edit HART Details** button.

8. Change the burst rate and click on **Save HART Details** or **Cancel** to exit the Edit-mode.



4 Installation

4.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions could result in death or serious injury.

Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Before connecting a handheld communicator in an explosive atmosphere, be sure that the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Do not remove the transmitter cover in explosive atmospheres when the circuit is live.

⚠ WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

Ensure the device is installed by qualified personnel and in accordance with applicable code of practice.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any services other than those contained in this manual unless you are qualified.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

⚠ WARNING

High voltage that may be present on leads could cause electrical shock.

Avoid contact with leads and terminals.

Ensure the mains power to the device is off and the lines to any other external power source are disconnected or not powered while wiring the device.

4.2 Installation considerations

For installation considerations consult the Reference Manual of the specific device. See the reference list in References.

4.3 Preparation checklist

Before starting the installation, make sure the tasks in the preparation checklist below have been performed:

- Verify that a network diagram has been designed according to best practice installation guidelines
- Make sure the Emerson 775 Wireless THUM™ Adapter and other wireless devices have been configured with correct Network ID and Join Key

Note

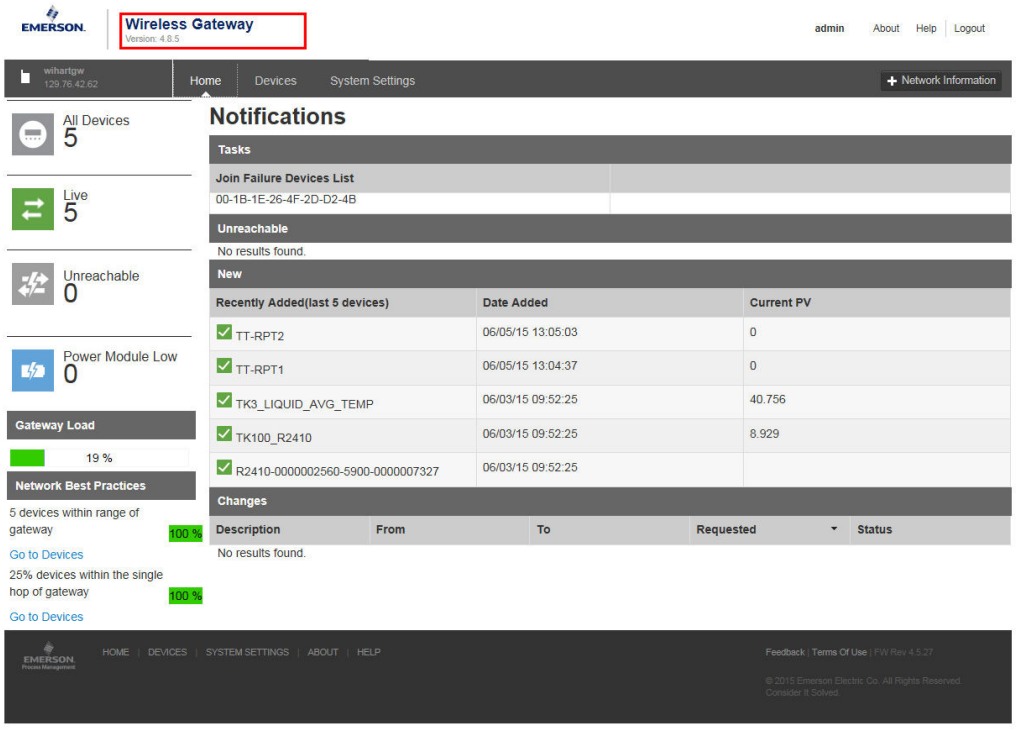
All versions of Emerson Wireless Gateway 1410S are compatible with Rosemount Tank Gauging systems.

In case you are connecting a Rosemount 2410 Tank Hub to THUM adapter and Emerson Wireless 1420 Gateway, ensure that firmware is minimum version 3.9.6 (for 3.x.x gateway) or 4.3.17 (for 4.x.x gateway). In case a firmware update is needed contact Emerson Automation Solutions/Rosemount Tank Gauging service department.

Note

Emerson 775 Wireless THUM™ Adapter Rev 5 or higher is necessary for using AMS Wireless.

Figure 4-1: Firmware Version is Shown in the Gateway Web Server Upper Left Corner



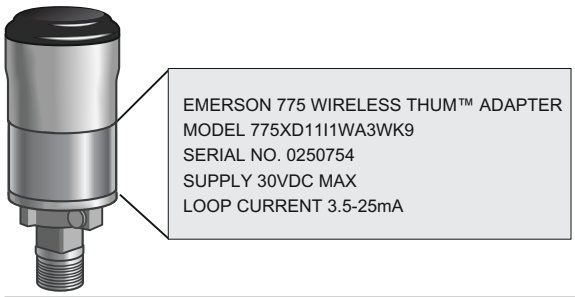
4.4 Mechanical installation

4.4.1 Emerson 775 Wireless THUM Adapter

Note
Note serial number of each THUM Adapter and tank name. The serial number can be used to identify the THUM Adapters in the gateway.

The serial number is found on the label attached to the THUM Adapter. For more information about the THUM Adapter serial number, see Device main label.

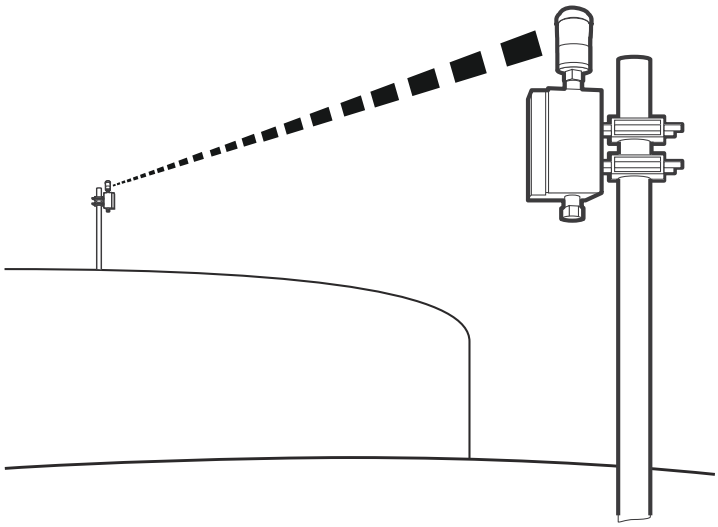
Figure 4-2: Label with Serial Number



THUM Adapter location

The THUM Adapter shall be positioned in such a way that good communication is established between the nearest nodes. If possible, try to find a position where the THUM Adapter has line-of-sight to at least one other node. Otherwise move the THUM Adapter along the tank until a good position is found.

Figure 4-3: Line-of-Sight Between Two THUM Adapters

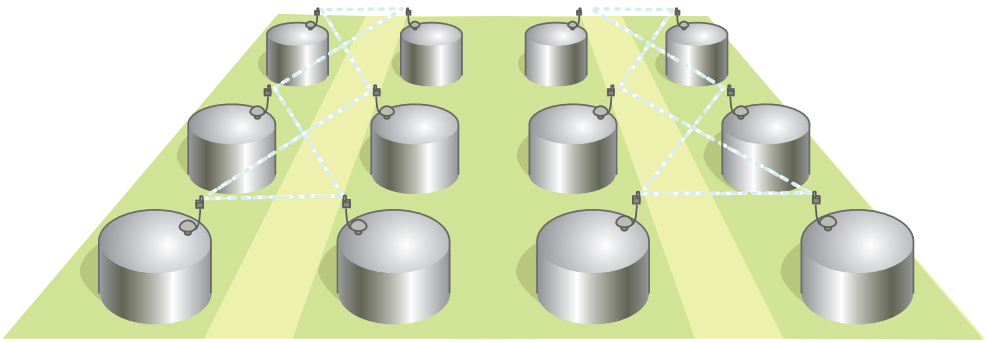


The THUM Adapter shall be positioned vertically as shown in Figure 4-3. The THUM Adapter is recommended to be installed at a minimum of 2 m (6 ft.) above tank roofs, away from any large structure for optimal range performance.

See the THUM Adapter Mechanical Installation Drawing (Document No. 9150070-981) for more details.

In a tank farm, tanks are often located on both sides along a road. In such a case, it is recommended to install the THUM Adapters on the tank side pointing towards the road. This way the THUM Adapters will form communication paths to devices along the road.

Figure 4-4: THUM Adapter Positions in a Tank Farm

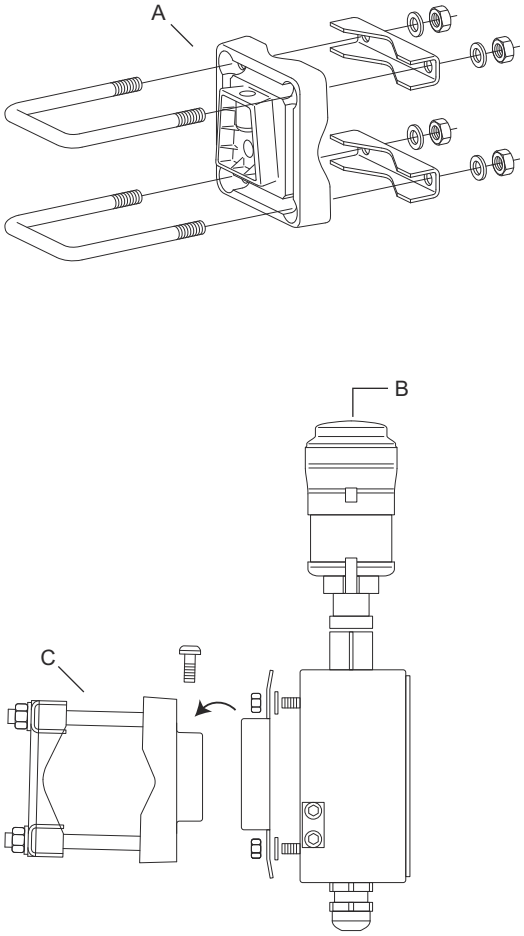


Mounting Kit

The THUM Adapter is supplied with a mounting kit, which allows the THUM to be installed away from the Tank Hub at the best possible position on the tank roof.

The THUM can be installed on a vertical or horizontal pipe or an angle bar, 25-50 mm (1-2 in.) in diameter, as shown in Figure 4-5.

Figure 4-5: Installation of THUM Adapter Using the Mounting Kit

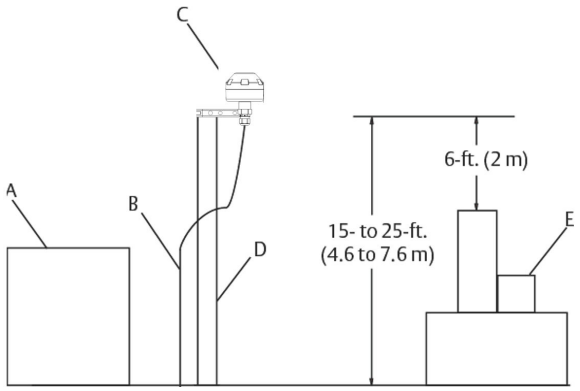


A. Mounting kit
B. Vertical orientation of THUM Adapter
C. Mounting kit for vertical or horizontal pipe installation

4.4.2 Emerson Wireless Gateway

The Emerson Smart Antenna should be mounted in a location that allows convenient access to the host system network (wireless I/O) as well as the wireless field device network. Find a location where the Smart Antenna has optimal wireless performance. Ideally this will be 15 - 25 ft. (4.6 - 7.6 m) above the ground or 6 ft. (2 m) above obstructions or major infrastructure. If the Gateway is using two Emerson 781S Smart Antennas, they do not need to be installed near each other. There should be at least 3 ft. (1 m) of separation between the two.

Figure 4-6: Mounting Location



A. *Control room*
B. *RS-485 cable*
C. *Smart Antenna*
D. *Mast or pipe*
E. *Infrastructure*

Related information

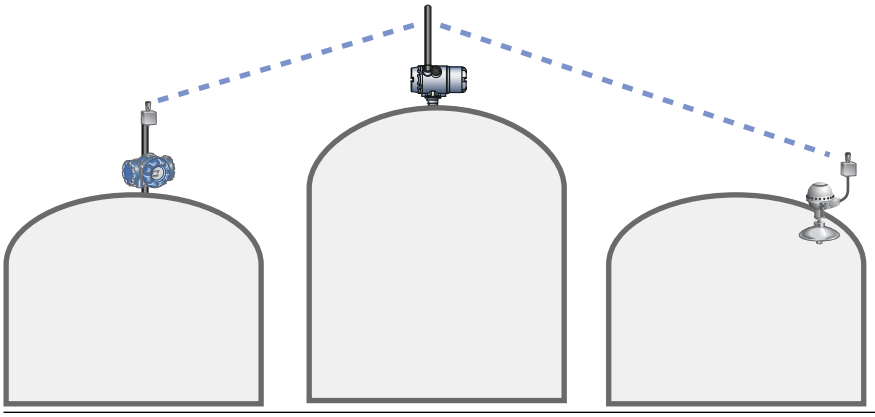
Emerson Wireless 1410S Gateway and 781S Smart Antenna Reference Manual
Emerson Wireless 1410S Gateway Quick Start Guide

4.4.3 Repeater

Verify in the network diagram where the repeater shall be positioned. Install the repeater in a position which provides the best possible conditions for wireless communication according to the network planning.

Repeaters are installed in a location where the maximum number of connections with wireless devices can be achieved, near the location that needs additional wireless connectivity.

Figure 4-7: Installation of Repeaters



When choosing an installation location and position, take into account service space for the repeater.

The repeater shall be positioned vertically (straight up) at a minimum of 2 m (6 ft.) above tank roofs, away from any large structure for optimal range performance.

4.5 Electrical installation

4.5.1 Grounding

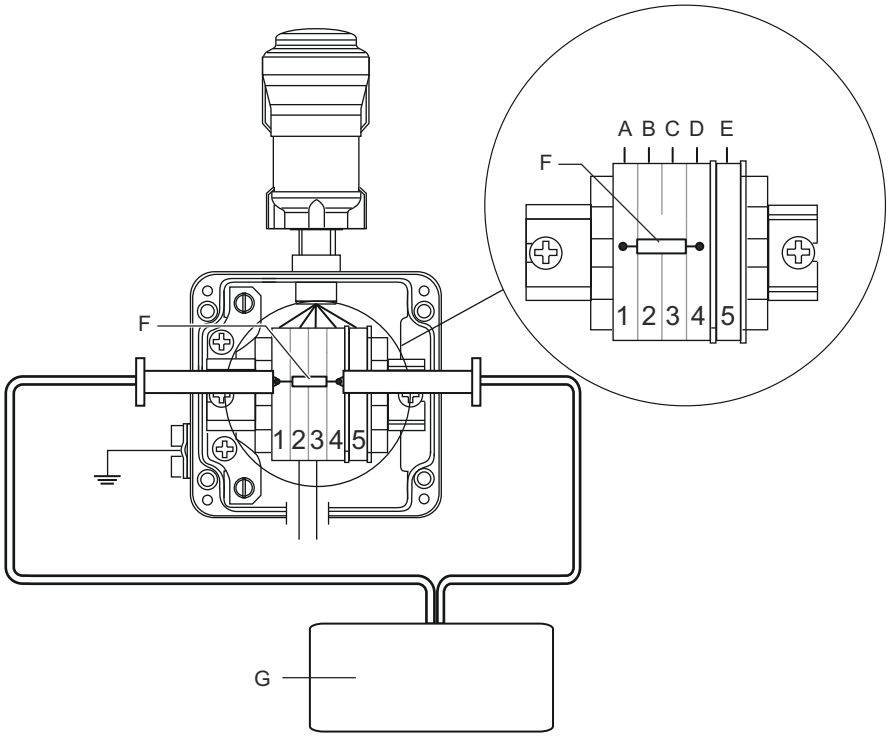
Make sure the devices are grounded in accordance with national and local electrical codes. For further information, also see the electrical installation drawings listed in References.

4.5.2 Wiring

HART® Modem Connected to THUM Adapter

Connect the HART modem(6) in parallel with the resistor located in the THUM connection box.

Figure 4-8: HART Modem Connected to THUM Adapter



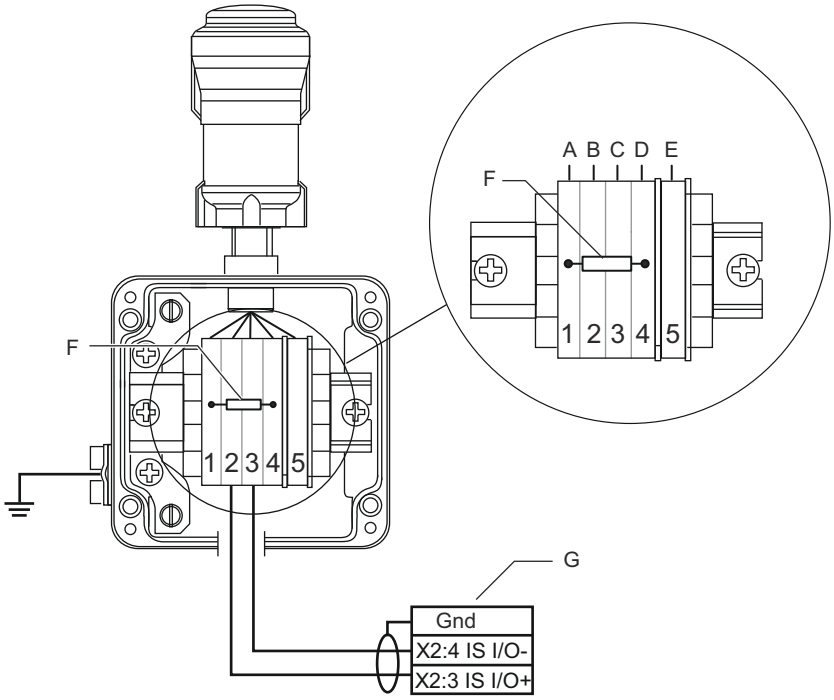
A. YELLOW
B. RED LOOP +
C. BLACK LOOP -
D. WHITE
E. GREEN GROUND
F. Resistor
G. HART modem

(6) Supported HART modems are: MACTek® VIATOR® HART RS-232 serial modem, and MACTek VIATOR HART USB modem.

THUM Adapter Connected to Rosemount 2410 Tank Hub

The THUM Adapter is powered by the tank hub.

Figure 4-9: THUM Adapter Connection Box



A. YELLOW
B. RED LOOP +
C. BLACK LOOP -
D. WHITE
E. GREEN GROUND
F. Resistor
G. Rosemount 2410 Tank Hub

Note
The connection box shall be externally grounded.

Connection	Description
1	Resistor
2	Loop +
3	Loop -
4	Resistor
5	Ground not connected

⚠ Only intrinsically safe circuitry is allowed to be connected.

Note
The THUM does not limit the current in the loop. The special resistor, located inside the THUM connection box, must not be removed or exchanged.

Resistor for Rosemount 2410 Tank Hub: 220 ohm

For further details on electrical installation, see:

- Electrical Installation Drawing 2410 Tank Hub to Wireless 775 Assy (Drawing No. 9150070-991)
- Rosemount 2410 Tank Hub Reference Manual

Emerson Wireless Gateway

For wiring information see:

- Emerson Wireless 1410S Gateway and 781S Smart Antenna Reference Manual
- Emerson Wireless 1410S Gateway QSG
- Emerson Wireless 781S Smart Antenna QSG

4.5.3 Power supply

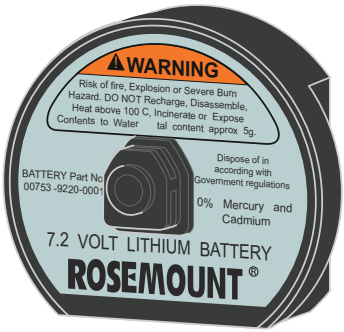
Emerson Wireless Gateway

For power supply information see:

- Emerson Wireless 1410S Gateway and 781S Smart Antenna Reference Manual
- Emerson Wireless 1410S Gateway QSG
- Emerson Wireless 781S Smart Antenna QSG

701PBK Black Power Module

Figure 4-10: SmartPower Long Life Power Module



Rosemount wireless devices, such as Rosemount 702, are powered by the 701PBK Black Power Module.

The power module is intrinsically safe, which means it can be changed in hazardous locations. The power module is designed with short circuit protection. There is no need to remove the wireless device from the process in order to switch power modules. The power module alerts when battery status is low. It is easy to replace using a fail-safe connection.

Replace a power module

To replace a power module, do the following:

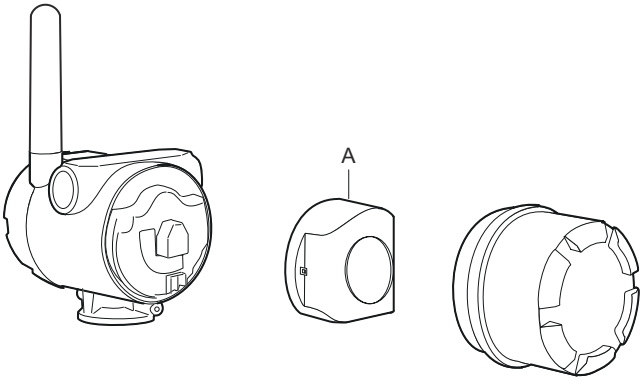
Prerequisites

⚠ Be sure to follow local regulations regarding intrinsic safety when replacing the power module.

Procedure

1. Open the power module cover by hand.

Figure 4-11: How to Replace a Power Module



A. Power module

2. Replace the power module.
3. Close the enclosure by hand.
4. Verify the wireless device operation.

5 Commissioning

5.1 Safety messages

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that potentially raises safety issues is indicated by a warning symbol (⚠). Refer to the following safety messages before performing an operation preceded by this symbol.

⚠ WARNING

Explosions could result in death or serious injury.

Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

Before connecting a handheld communicator in an explosive atmosphere, be sure that the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.

Do not remove the transmitter cover in explosive atmospheres when the circuit is live.

⚠ WARNING

Failure to follow safe installation and servicing guidelines could result in death or serious injury.

Ensure the device is installed by qualified personnel and in accordance with applicable code of practice.

Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Do not perform any services other than those contained in this manual unless you are qualified.

To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

⚠ WARNING

High voltage that may be present on leads could cause electrical shock.

Avoid contact with leads and terminals.

Ensure the mains power to the device is off and the lines to any other external power source are disconnected or not powered while wiring the device.

5.2 Commissioning introduction

The wireless devices can be commissioned once they are configured and installed properly. The following steps are included in the commissioning procedure:

Procedure

1. Start up the devices
2. Verify that all devices are connected to the network
3. Verify network device status
4. Verify network design rules
5. Optional: View network live using the AMS Wireless SNAP-ON software

Related information

View network live

5.2.1 Log on to the Emerson Wireless Gateway's integrated web server

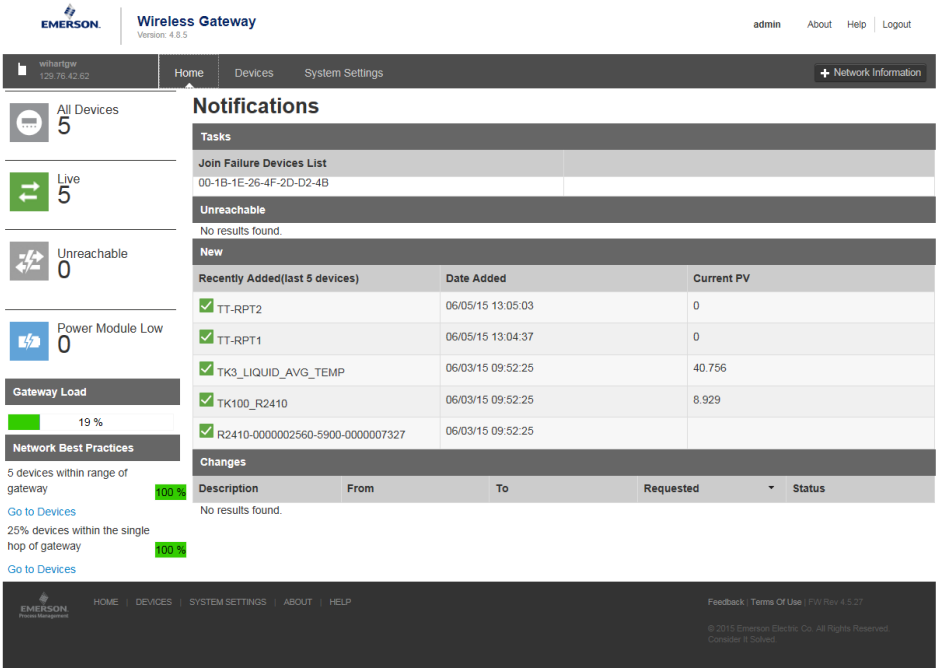
During the commissioning use the Emerson Wireless Gateway's integrated web server. To log on to the Emerson Wireless Gateway's integrated web server, do the following:

Procedure

1. Open a standard web browser (typically Microsoft® Internet Explorer).
2. Enter the current IP address of the Emerson Wireless Gateway's integrated web server in the address bar.
3. Acknowledge the security to proceed.
4. Enter `admin` for User Name and `default` for the Password.

   The initial view of the gateway's web server is illustrated in Figure 5-1.

Figure 5-1: Emerson Wireless Gateway's Integrated Web Server



Need help?
For further instructions on how to log on to the Gateway, see the Emerson 1410S Wireless Gateway Reference Manual.

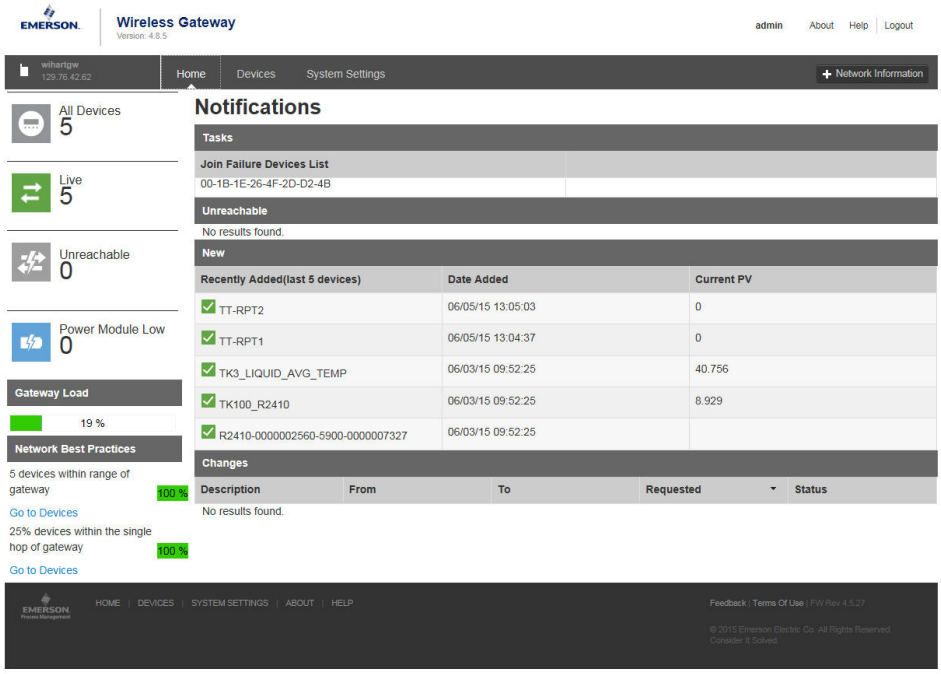
5.3 Starting up devices

5.3.1 Set Active Advertising mode

Before powering up the devices, make sure the Gateway is in Active advertising mode. The Active advertising mode makes the network search for new devices, which makes the devices join the network faster. To set the Active advertising mode, do the following:

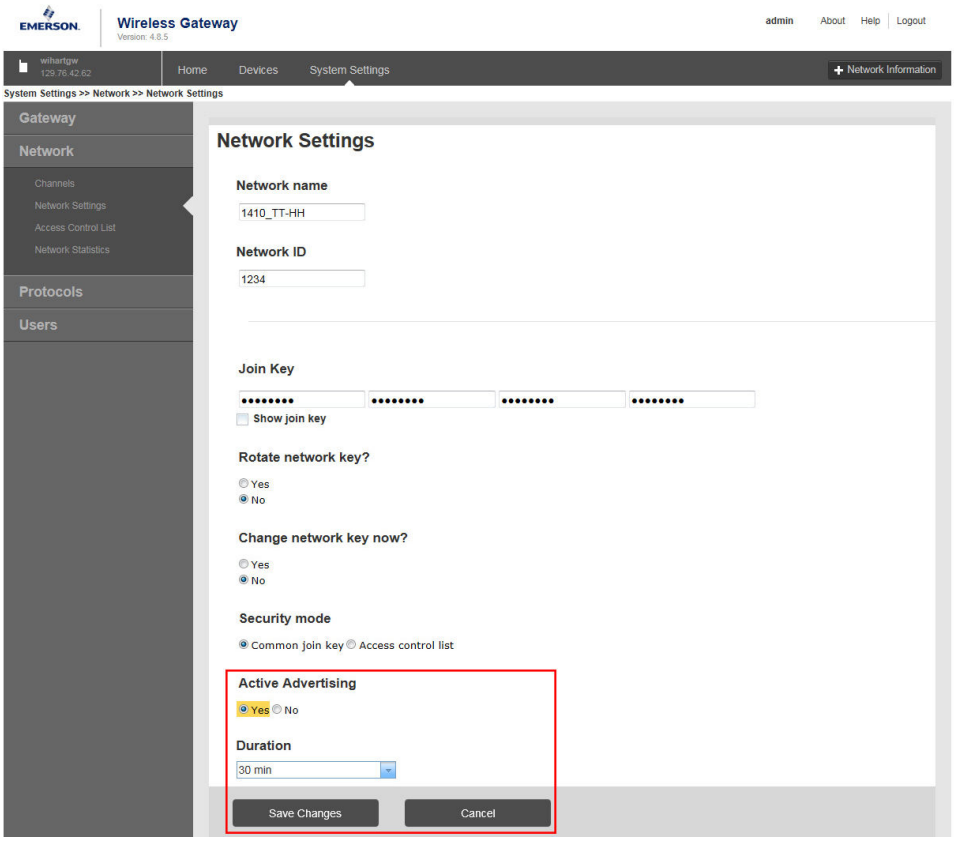
Procedure

1. Open the ***Network Information*** window and click the **Turn on Active Advertising** button, or navigate to **System Settings** → **Network** → **Network Settings**.



2. Under *Active Advertising*, select the **Yes** check box.
3. Enter the desired Active advertising duration and click the **Save Changes** button.

   The Active advertising mode is power consuming for the device's power modules. Don't set the duration time longer than needed. A proper duration time is 30-60 minutes.



The Active advertising mode is now activated and will be deactivated after the duration time has passed.

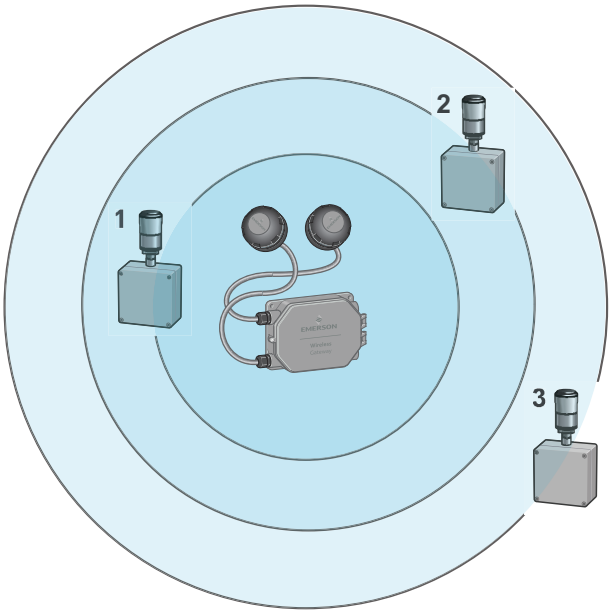
4. Click on **Home** in the menu bar to get to the ***Overview*** page.

5.3.2 Starting the devices

To start up the devices, use the following guidelines:

- The gateway should be up and running before any wireless devices are powered
- If any repeaters are included these shall be started up before the THUM Adapters
- The THUM Adapters should be started up beginning with the one closest to the gateway (see Figure 5-2)

Figure 5-2: Starting Up Order

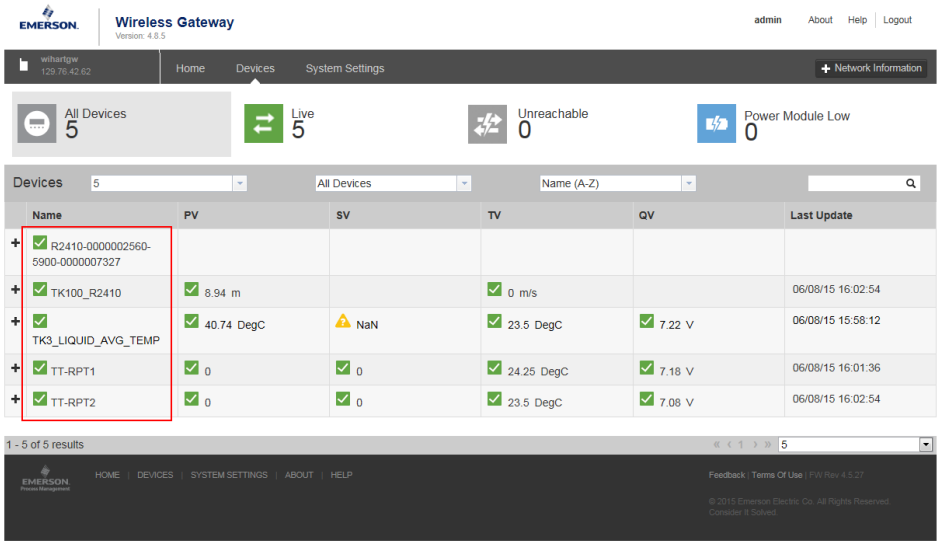


5.4 Verify network device connection

To verify device operation and connection to the network, do the following:

Procedure

1. Log on to the gateway's integrated web server. Click on **Devices** in the menu bar.

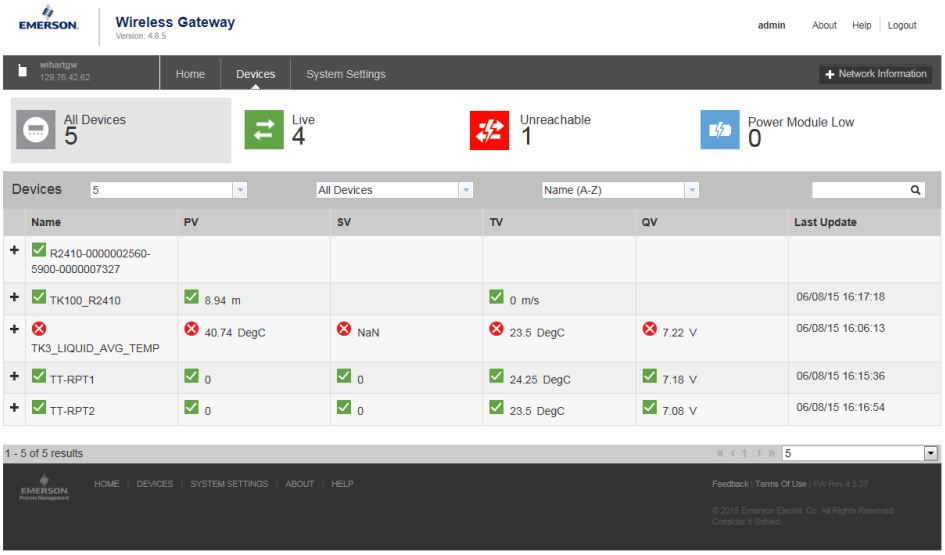


2. Verify that all wireless devices appear. A green check box indicates that the device is working properly.

   When started up, the devices will join the wireless network. The time required to join the network depends on network size and number of devices.

Note
It normally takes 5 to 30 minutes for a device to join the wireless network.

A red status indicator shows that there is a malfunctioning device.



5.5 Verify network device status

When all devices have joined the network, the network device status must be verified. Verify the number of active neighbors, reliability, signal strength and path stability. To verify that all connected devices fulfill the network device status requirements, do the following:

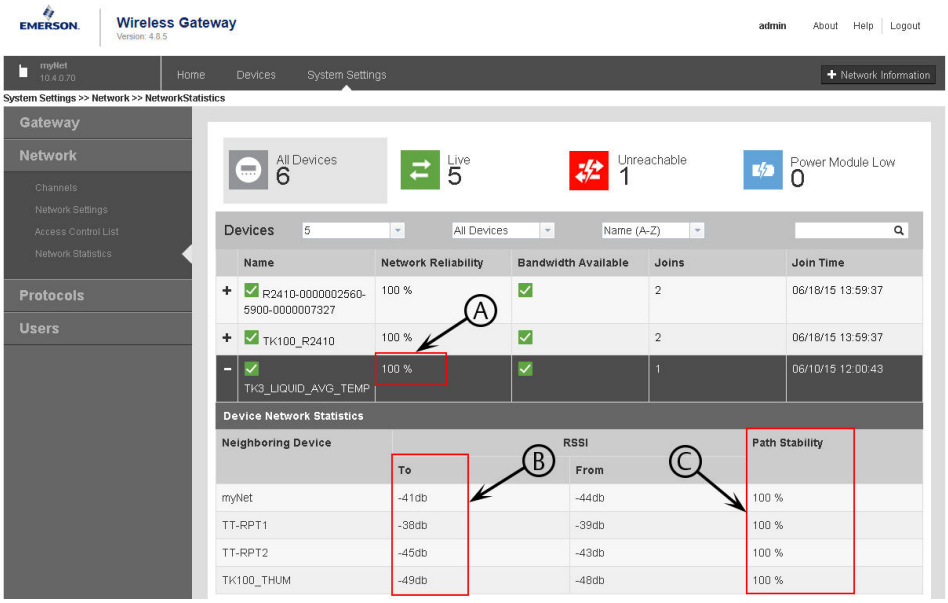
Prerequisites

See the network device status requirements in Network device status requirements.

Procedure

1. Log on to the gateway's integrated web server.
2. Navigate to **System Settings** → **Network Statistics**, click on each device and check the Device Network statistics for each Neighboring Device.
3. Verify that the device has at least two neighbors with signal strength greater than -75dB and path stability at least 60%.

Figure 5-3: Device Network Statistics



A. Reliability
B. Signal Strength
C. Path Stability

Need help?

If the network device status requirements are not fulfilled, let the network settle for up to 24 hours, then verify again. If requirements are still not fulfilled, try to relocate the THUM Adapter or repeater and verify again.

Example

"TK100_R2410" has three active neighbors meaning that there are three communication paths for the device (see Figure 5-3). Additionally the path stability is greater than 60% to all neighbors. There are four neighboring devices in the picture:

- TK100_THUM

- TT-RPT2
- TT-RPT1

5.5.1 Network device status requirements

- The devices must have at least two active neighbors. It is recommended that the devices have three neighbors or more
- Reliability should be greater than 99%
- The signal strength to each neighbor should be greater than -75db
- The path stability to each neighbor should be at least 60%

5.6 Verify network design rules

During the commissioning, make sure to verify the network design rules described in Design.

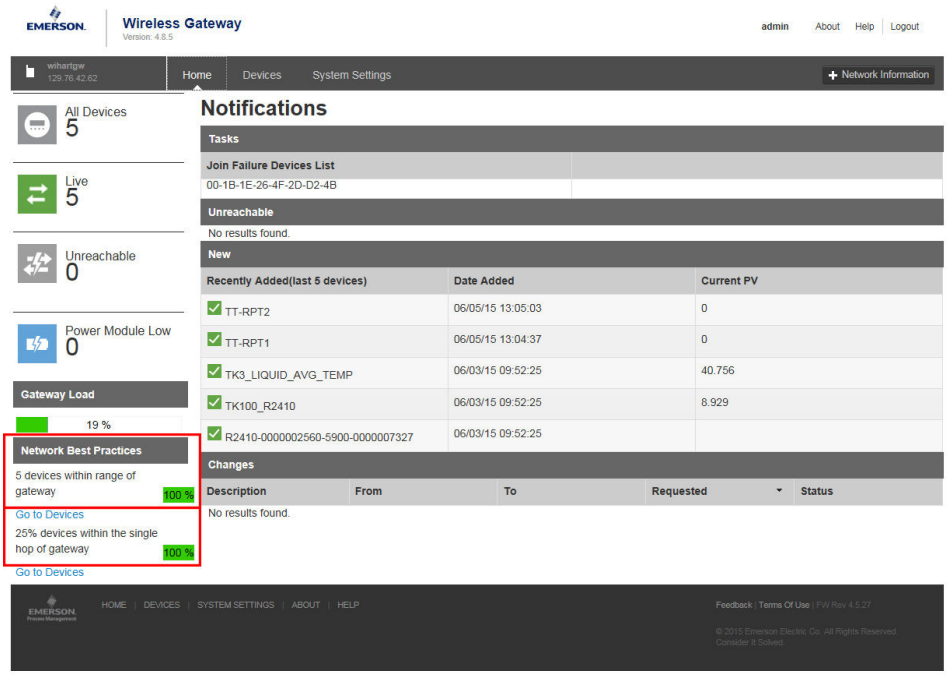
The design rules are worked out to ensure a secure margin when implementing a wireless network. This will eliminate any potential pinch points or isolated devices.

5.6.1 Rule of 5 and Rule of 25%

The network should have a minimum of 5 devices within effective range of the gateway. For networks with more than 20 devices, at least 25% of the device shall be within effective range of the gateway. Do the following to verify the network design rules:

Procedure

1. Log on to the gateway's integrated web server.
2. In the lower left corner, verify the Rule of 5 and Rule of 25%.

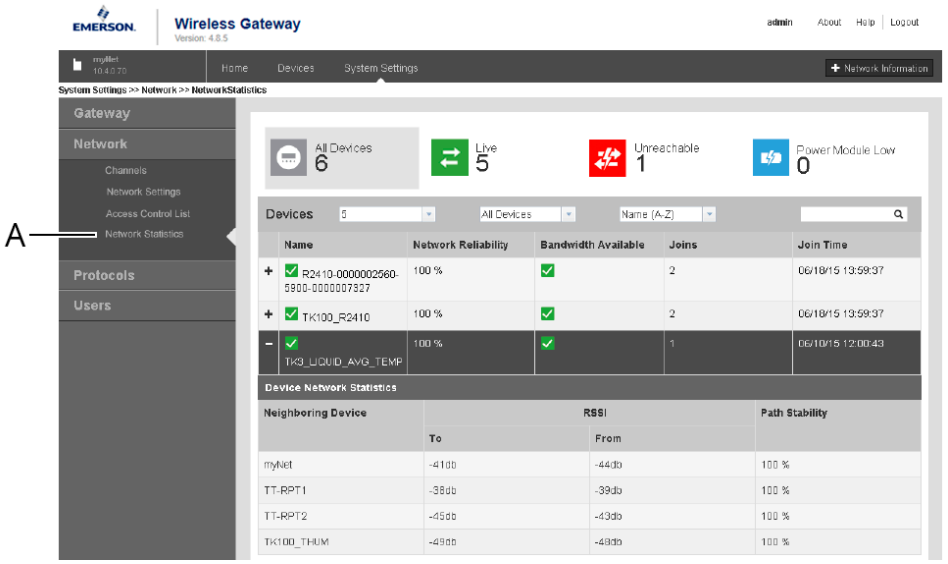


5.6.2 Rule of 3

The wireless network should be designed for a minimum of three neighbors once commissioned. Verify that each device has at least two neighbors.

Procedure

1. Go to **System Settings** → **Network Statistics**.



A. Network Statistics

2. Click on each device and check **Neighboring Device**.

5.7 View network live

AMS Wireless SNAP-ON

After commissioning the wireless network, the optional software tool AMS Wireless SNAP-ON can be used to view the network diagram in live mode. All formed communication paths are shown in a graphical layout.

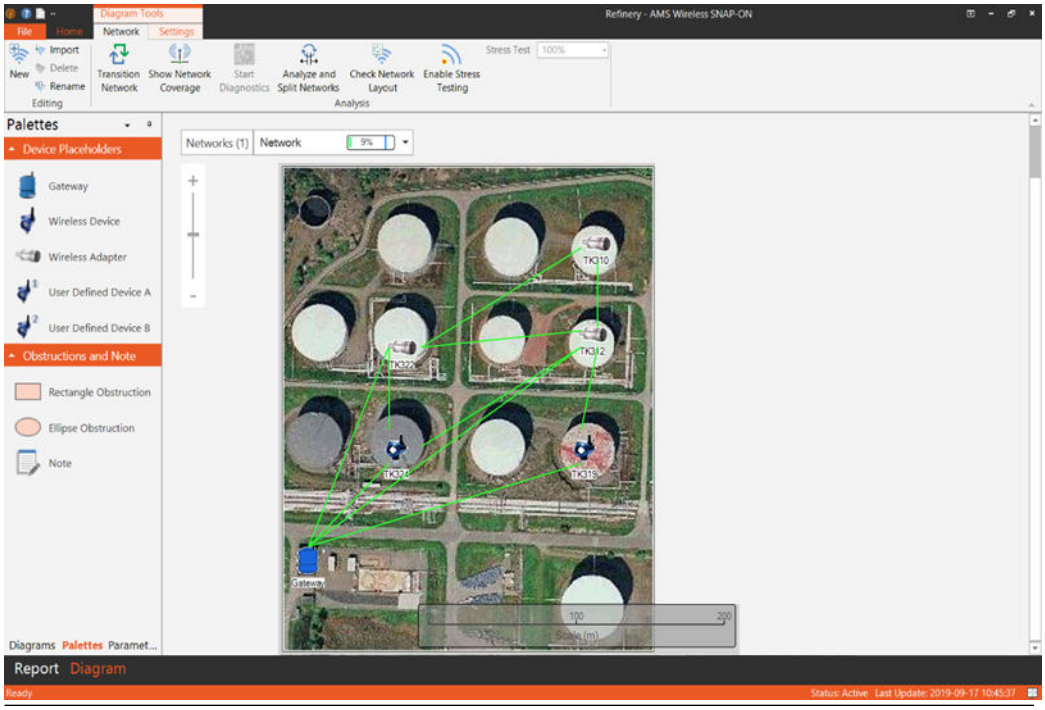
Viewing the network diagram in live mode gives a good overall picture on how the mesh network is formed. The graphical layout can be used to view any pinch points or areas that requires a repeater to be added or relocated.

The mesh network continuously changes in order to optimize stability and minimize number of hops when the environment changes.

The AMS Wireless SNAP-ON can be used to:

- Identify devices in the wireless network that may not be able to communicate effectively
- Evaluate the condition of the network by displaying key data such as layout issues, status, PV, device battery life, and average reliability of wireless devices
- Export report data to Excel spreadsheets
- Export diagrams in jpg or .bmp formats

Figure 5-4: The graphical layout in AMS Wireless SNAP-ON



6 TankMaster Setup

6.1 Introduction

This section provides a description of how to install a Wireless Tank Gauging system in Rosemount TankMaster. The TankMaster setup can be summarized in the following steps:

Prerequisites

Prior to performing the TankMaster setup, ensure that the Emerson Wireless Gateway is properly wired and configured (see the Emerson Wireless 1410S Gateway Reference Manual, document no. 00809-0600-4410). Devices such as the Rosemount 2410 Tank Hub, the Rosemount 5900S Radar Level Gauge, and the Rosemount 2240S Multi-input Temperature Transmitter must be connected to the Tankbus, see the reference manual for the respective device.

Procedure

1. Install and configure the Emerson Wireless Gateway.
2. Install the Rosemount 2410 Tank Hub and the field devices (5900S, 2240S, 2230 etc.) connected to the Tankbus.
3. Configure the field devices (see reference manuals for each device).

Related information

References

6.2 Installing gateway and field devices

To install and configure a WirelessTank Gauging system in Rosemount TankMaster™ WinSetup:

Procedure

1. Configure HART® communication protocols.
2. Install the Emerson Wireless Gateway and the Rosemount 2410 Tank Hub in TankMaster WinSetup.
3. Install and configure field devices.
4. Install and configure tanks.
5. Verify HART communication.

6.2.1 Communication setup

Prior to installing the Emerson Wireless Gateway in TankMaster, ensure that TankMaster is properly configured for wireless communication with the gateway and the field devices.

HART®-IP protocol setup

Ensure that the HART-IP protocol is enabled for the Emerson Wireless Gateway.

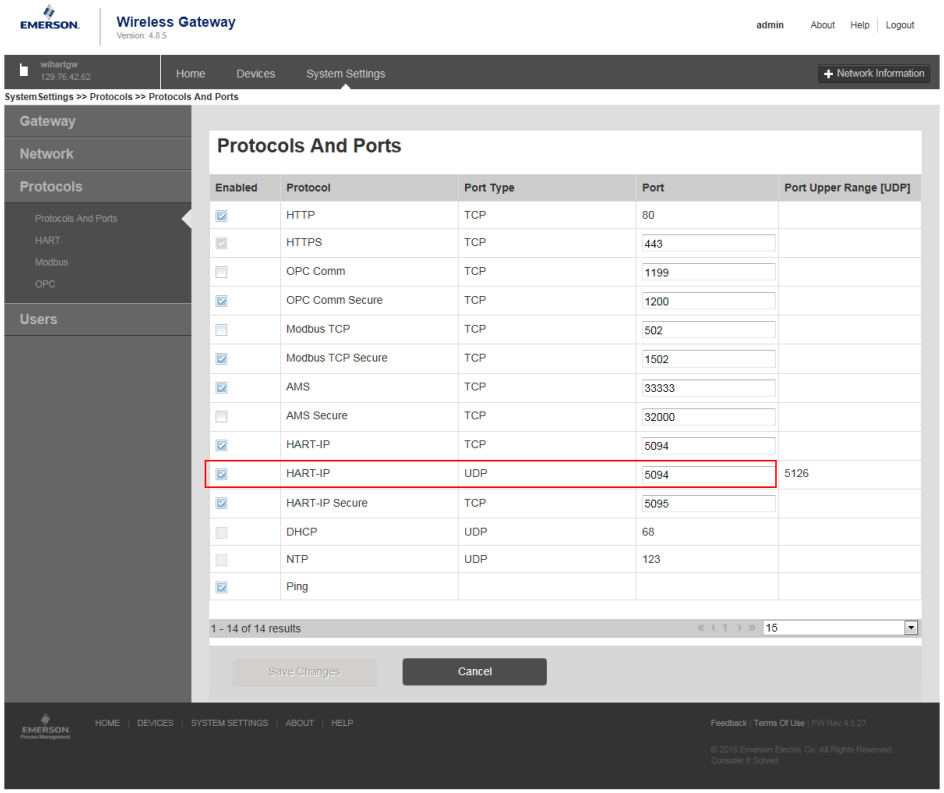
Procedure

1. Open a standard web browser (typically Microsoft® Internet Explorer).

2. Enter the current IP address of the Emerson Wireless Gateway's integrated web server in the web browser's address bar.
3. Enter `admin` for User Name and `default` for the Password.

Need help?
For further instructions on how to log on to the Gateway, see the Emerson Wireless 1410S Gateway Reference Manual (Document No. 00809-0600-4410).

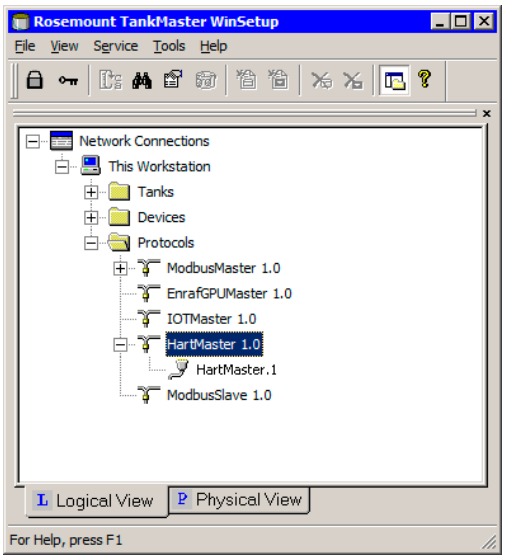
4. Navigate to **System Settings** → **Protocols** → **Protocols and Ports**.
5. Ensure that the **HART-IP** check box is selected. It is recommended to note the Port Number. This will allow you to verify the port number in the HartMaster Protocol Setup.



HartMaster protocol setup

Procedure

1. In the ***Rosemount TankMaster WinSetup*** workspace window, open the **Protocols** folder.
2. Select the **HartMaster 1.0** icon which represents the protocol to be configured.



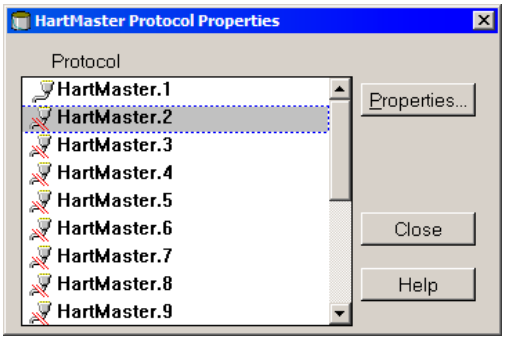
3. Right-click and select **Properties** (or choose **Protocols/Properties** from the **Service** menu).

   The ***Protocol Properties*** window shows a list of enabled and disabled protocol channels.

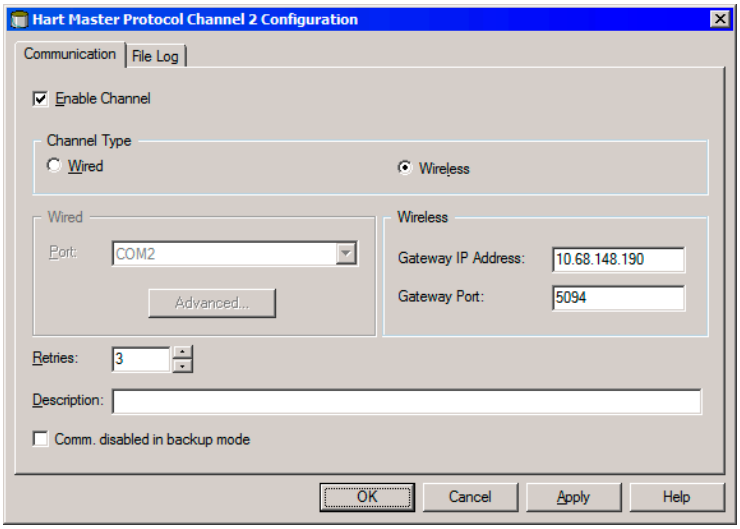
4. Select the desired channel, and then click the **Properties** button to configure the protocol channel.

Example

In this example HartMaster Channel 2 was chosen.

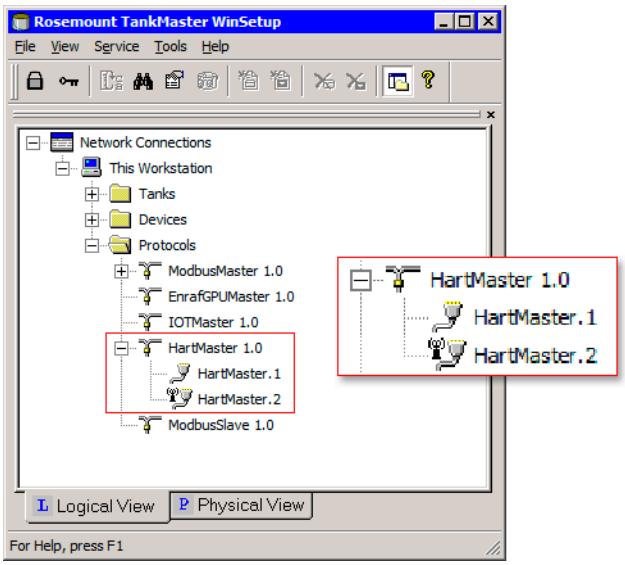


5. Select the **Enable Channel** check box.



6. Under *Channel Type*, select **Wireless**.
7. Enter the gateway's IP address and verify the Port number as noted in the HART-IP Protocol Setup for the gateway.
8. Click the **Apply** button to save the configuration, or click the **OK** button to save the current configuration and close the window.

   The HartMaster protocol channel is now configured and activated for communication between TankMaster and devices connected via the *Wireless*HART protocol such as the Emerson Wireless 775 THUM™ Adapter and the Emerson Wireless Gateway. This is indicated by the protocol channel icon in the Network Connections tree structure (in the left-hand part of the workspace).



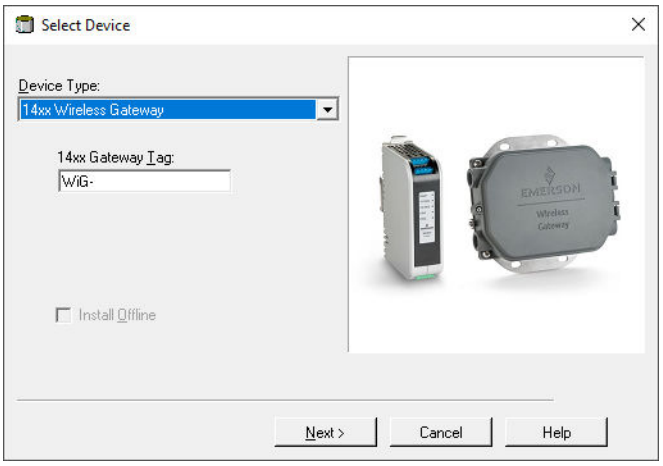
6.2.2 Gateway installation

The Wireless Tank Gauging system supports Emerson Wireless 1410S1/S2 Gateways as well as Emerson Wireless 1410/1420 Gateways. To install and configure a Wireless Tank Gauging system in TankMaster:

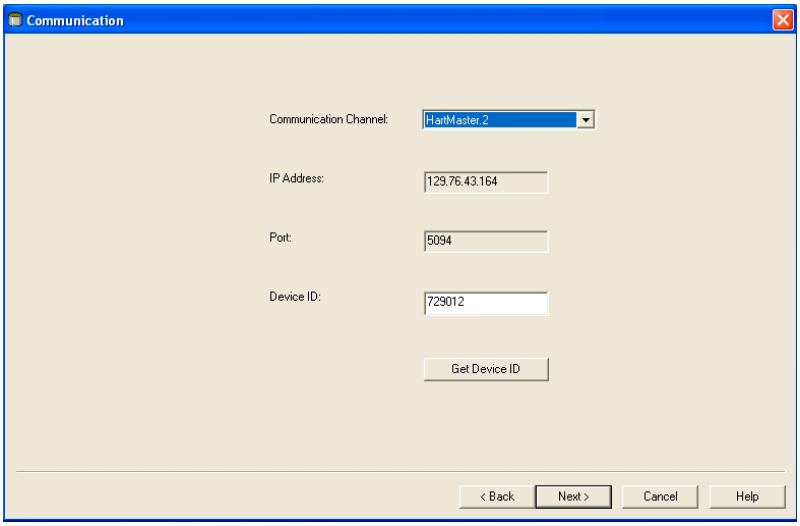
Procedure

1. In the ***TankMaster WinSetup*** workspace, select the **Devices** folder.
2. Click the right mouse button and select the **Install New** option.
3. In the **Device Type** list, select **14xx Wireless Gateway**.

   Use this for both Emerson Wireless 1410S Gateway and Emerson Wireless 1410/1420 Gateways.

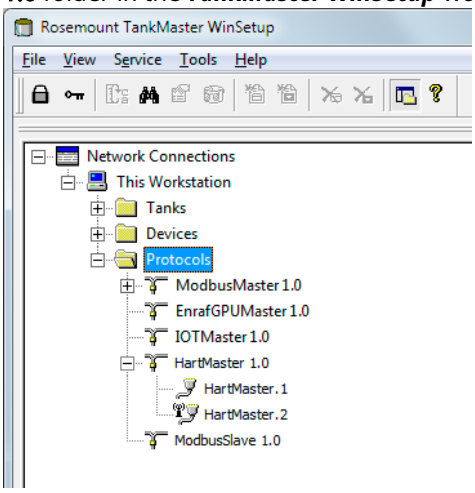


4. Enter a tag to be used for identification of the Gateway in TankMaster.
5. Click the **Next** button.
6. Choose a channel enabled for wireless communication.

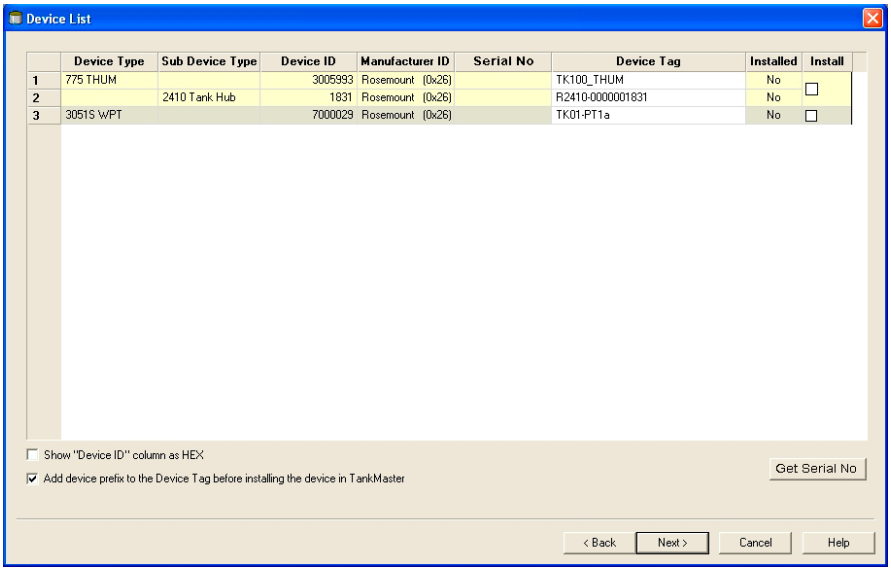


7. Verify **IP Address** and **Device ID** to ensure that the right Gateway is connected.

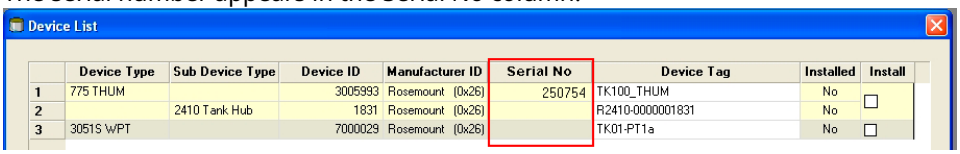
Need help?
You can find out which channels are enabled by opening the **Protocols/HartMaster 1.0** folder in the ***TankMaster WinSetup*** workspace:



8. In the ***Communication*** window click the **Next** button to proceed.
   The ***Device List*** window will appear showing devices online in the network. The ***Device List*** window has several configuration options that you may use as described below.



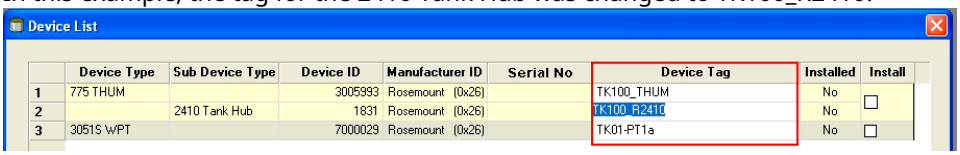
9. To identify a device by its serial number, select the row in which the device is listed and click the **Get Serial No** button.
   The serial number appears in the Serial No column.



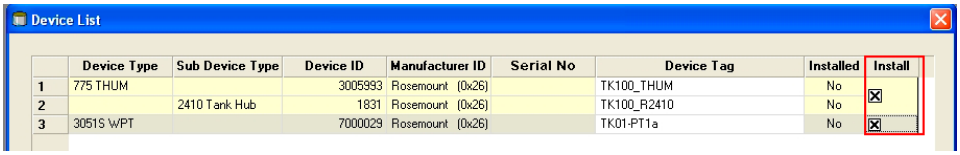
10. In case you would like to change an existing Device Tag you can enter a new tag in the corresponding field.

Example

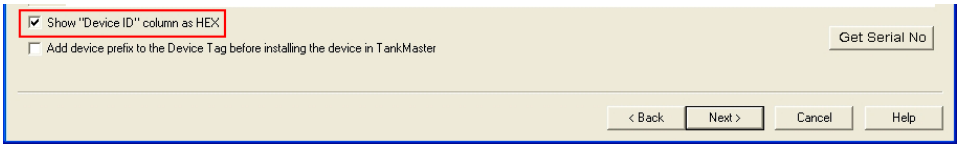
In this example, the tag for the 2410 Tank Hub was changed to TK100_R2410.



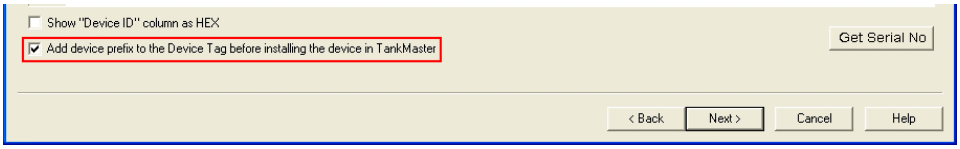
11. The **Install** check boxes let you select which devices to install in WinSetup. Note that devices can be installed at a later occasion if necessary from the Gateway's ***Properties/Device List*** window.



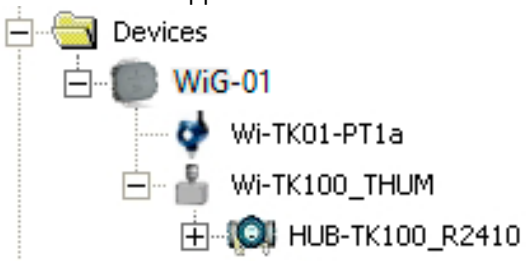
12. In case you prefer to view the Device ID in hexadecimal format, you may select the **Show Device ID" column as HEX** check box.



13. The **Add device prefix...** check box lets you specify how the Device Tag will appear in various TankMaster windows. The prefix can be specified in the **Service → Preferences → Tag Prefixes** window.

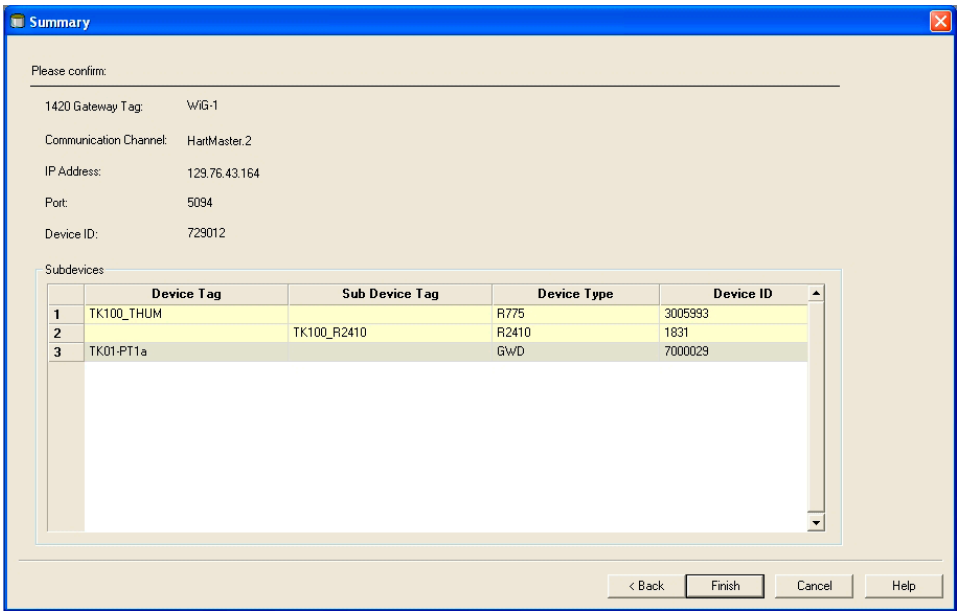


By selecting the **Add device prefix...** check box, a prefix will be added to the tag when the device appears in the TankMaster workspace and various windows:

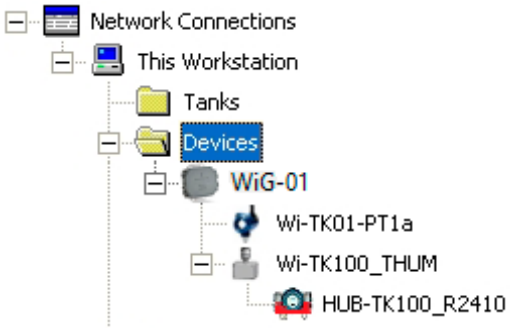


14. In the ***Device List*** window click the **Next** button to open the ***Summary*** window.

    The ***Summary*** window shows IP address, port number, and ID for the Gateway to be installed. You will also find the communication channel that WinSetup will use to communicate with the Gateway and wireless devices (HartMaster2 in the example below).



15. In the *Subdevices* pane you will find the devices selected in the *Install* column in the ***Device List*** window. Verify that the right devices appear in the list.
16. Click the **Finish** button to save the configuration and close the ***Summary*** window. Now the Gateway and the installed devices will appear in the ***TankMaster WinSetup*** workspace. A red icon indicates that a device needs to be configured in order to be fully operating.



Installing field devices connected to the 2410 Tank Hub

For standard devices such as the Rosemount 5900S and the Rosemount 2240S the following installation procedure automatically installs these devices in TankMaster.

Prerequisites

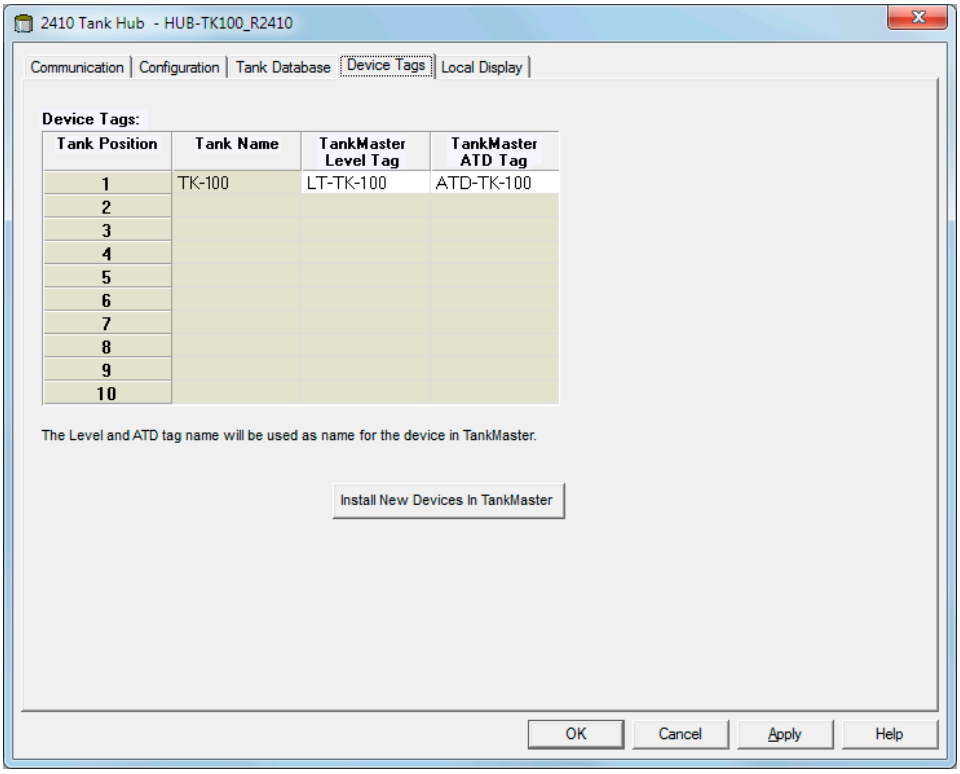
For devices which can not be installed as level device or ATD in a WirelessTank Gauging system see Installing generic FOUNDATION™ Fieldbus devices for information on how to install generic FF devices.

Procedure

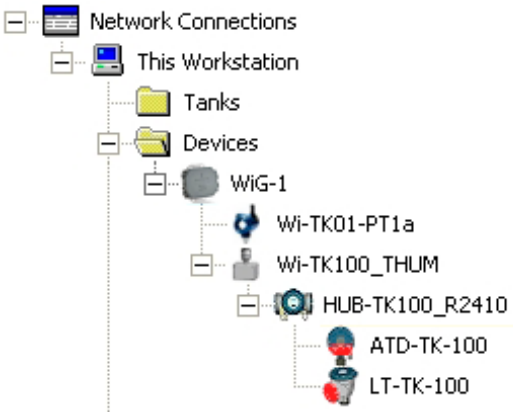
1. Click the right mouse button on the Rosemount 2410 icon marked red and choose the **Properties** option.
2. Configure the Tank Database.

Need help?
See the Rosemount 2410 Reference Manual (Document No. 00809-0100-2410) and the Rosemount Tank Gauging System Configuration Manual (Document No. 00809-0300-5100) for more information.

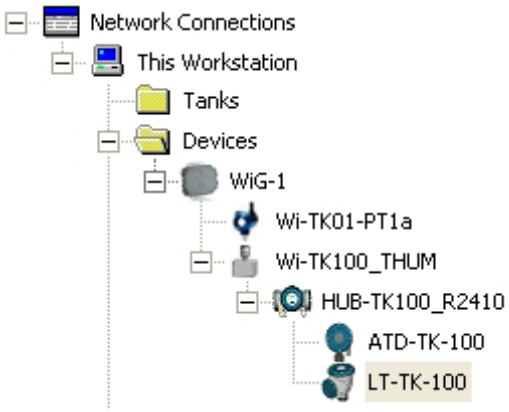
3. In the ***Properties*** window, select the **Device Tags** tab.



4. Click the **Install New Devices in TankMaster** button.
5. Click **OK** to close the ***Properties*** window.
   Now the devices connected to the Tankbus will be installed and appear in the ***TankMaster WinSetup*** workspace.



6. A red icon for a field device connected to the Tank Hub indicates that it needs to be configured. To configure a device, click the right mouse button and choose **Properties**. See the reference manual for further details on how to configure a particular device.



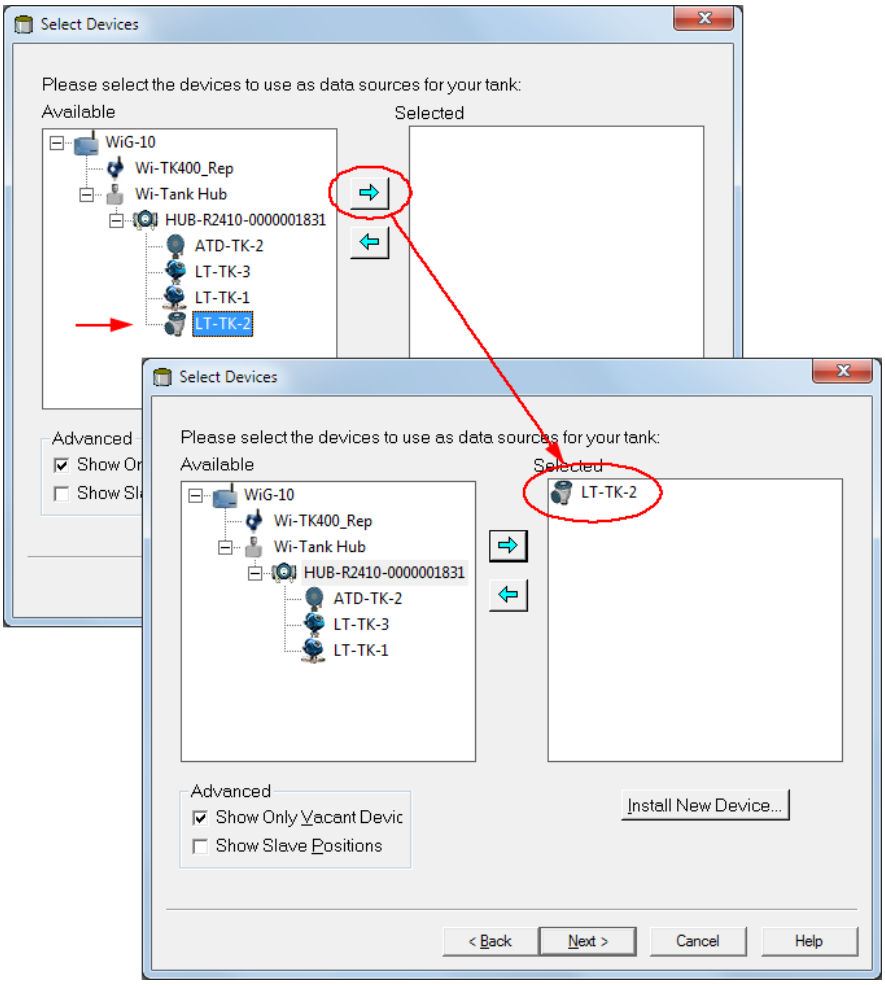
Once a device is configured the icon with a red marking is replaced by the standard icon.

Note
The TankMaster server does not request data from devices marked with red icons.

Note
After installation in WinSetup of devices connected to the Rosemount 2410 Tank Hub, it may take a few minutes until they are available in the Gateway's Web Server. Devices marked red in the ***TankMaster WinSetup*** workspace must be available in the Gateway before they can be configured in WinSetup.

Note
In case the THUM™ Adapter configuration is changed, for example update rate settings, the Tank Hub and other field devices will be marked red again. Then right-click the corresponding device icon, choose **Properties**, and click **OK**.

7. Install the tank to associate with the Rosemount 2410 Tank Hub:
   a) In the ***TankMaster WinSetup*** workspace, click the right mouse button on the Tanks folder and choose the **Install New...**.
   b) Follow the installation wizard.
   c) In the ***Select Devices*** window, choose the device to associate with the tank and click the "move right" arrow.



8. Continue the installation wizard.

Need help?

See the Rosemount Tank Gauging System Configuration Manual (Document No. 00809-0300-5100) for detailed information on how to install tanks in TankMaster WinSetup.

Postrequisites

Verify HART Master communication. See Hart master communication for more information. Ensure that all wireless HartMaster channels are verified.

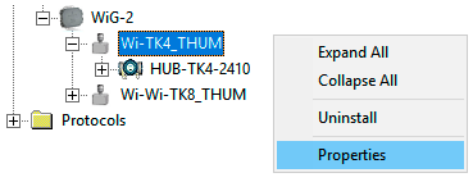
Replacing an Emerson 775 Wireless THUM™ Adapter

In case you need to replace a THUM Adapter in a Rosemount Wireless Tank Gauging system, you need to configure the device in TankMaster WinSetup to enable communication with the wireless network. All you need to do is locate the THUM adapter in the TankMaster workspace and configure the **Device ID**.

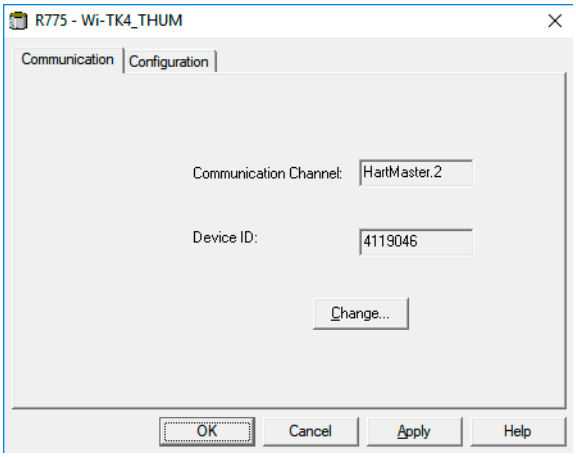
Follow this procedure to replace an Emerson 775 Wireless THUM Adapter.

Procedure

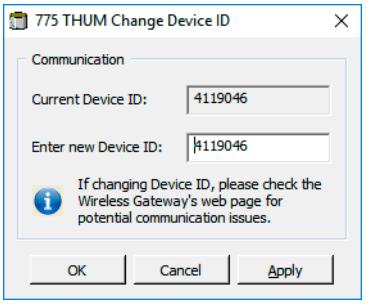
1. In the ***WinSetup*** workspace, click the right mouse button and select **Properties**.



2. Select the ***Communication*** tab.



3. Click the **Change** button to open the ***Change Device ID*** window.



4. Enter the **Device ID** and click **Apply**.
5. Click **OK** to close the window.
6. Verify that the new THUM adapter communicates with the wireless network as expected.

A HARTMaster Configuration

A.1 HART® modem

A HART modem is required for wired HART communication between TankMaster and connected devices.

Supported HART modems are:

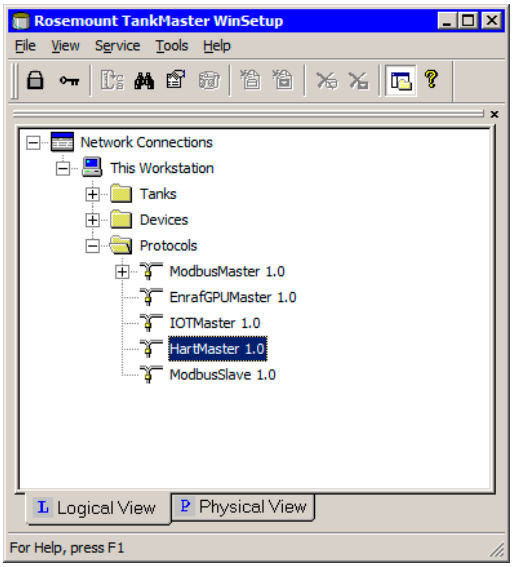
- MACTek® VIATOR® HART RS-232 serial modem
- MACTek VIATOR HART USB modem

A.1.1 Protocol configuration for wired communication

To configure a HART modem for communication with TankMaster WinSetup, do the following:

Procedure

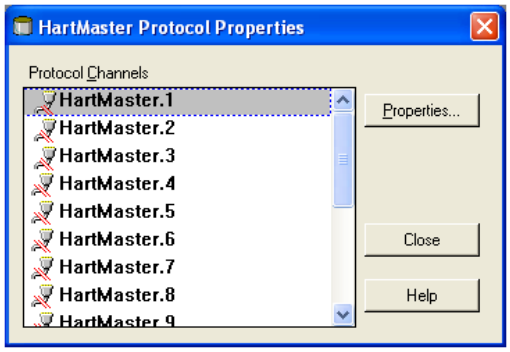
1. Open the **Protocols** folder in the ***TankMaster WinSetup*** workspace window.



2. Select the **HartMaster 1.0** icon which represents the protocol to be configured.

3. Right-click and select **Properties** (or choose **Protocols/Properties** from the **Service** menu).

   The ***Protocol Properties*** window shows a list of enabled and disabled protocol channels.

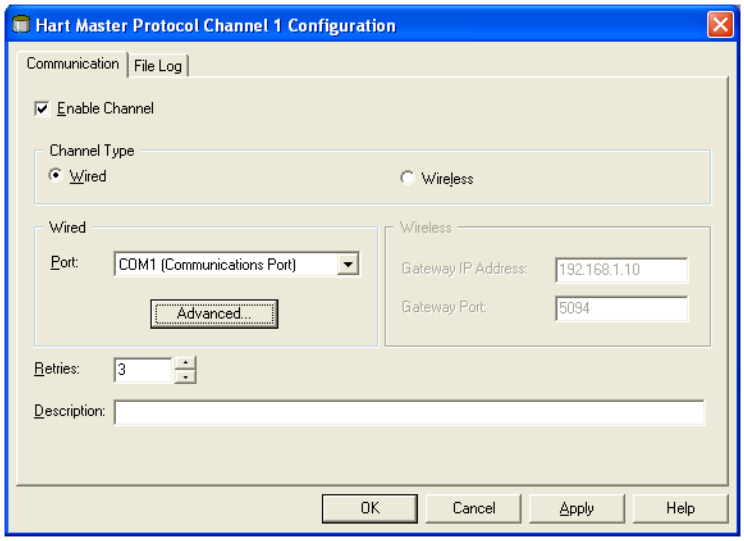


4. Select the desired channel.

Example

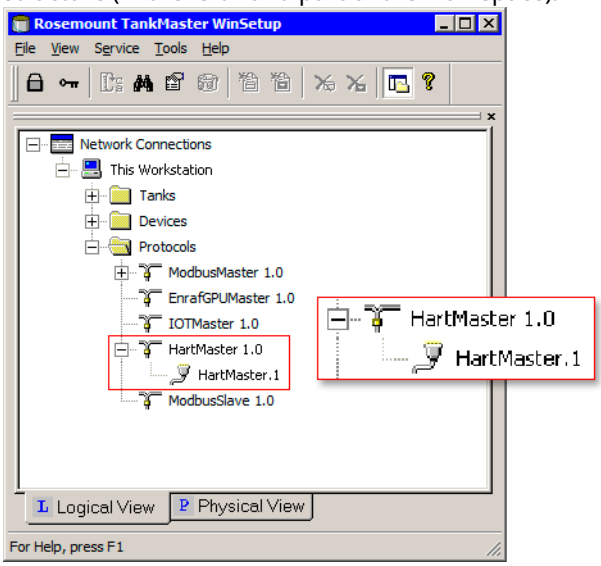
In this example, HartMaster Channel 1 was chosen.

5. Click the **Properties** button to configure the protocol channel.
6. Select the **Enable Channel** check box.



7. Under *Channel Type*, select **Wired**.
8. Choose the PC communication Port (COM1 [Communications Port] in this example) that the HART modem is connected to.

9. Click the **OK** button to save the current configuration and close the window. The HartMaster protocol channel is now configured and activated for communication between TankMaster and devices connected via a HART modem. This is indicated by the protocol channel icon in the Network Connections tree structure (in the left-hand part of the workspace).



A.2 Gateway communication

To configure TankMaster for wireless communication with the Emerson Wireless Gateway and the Tank Gauging field devices, do the following:

A.2.1 HART®-IP protocol setup

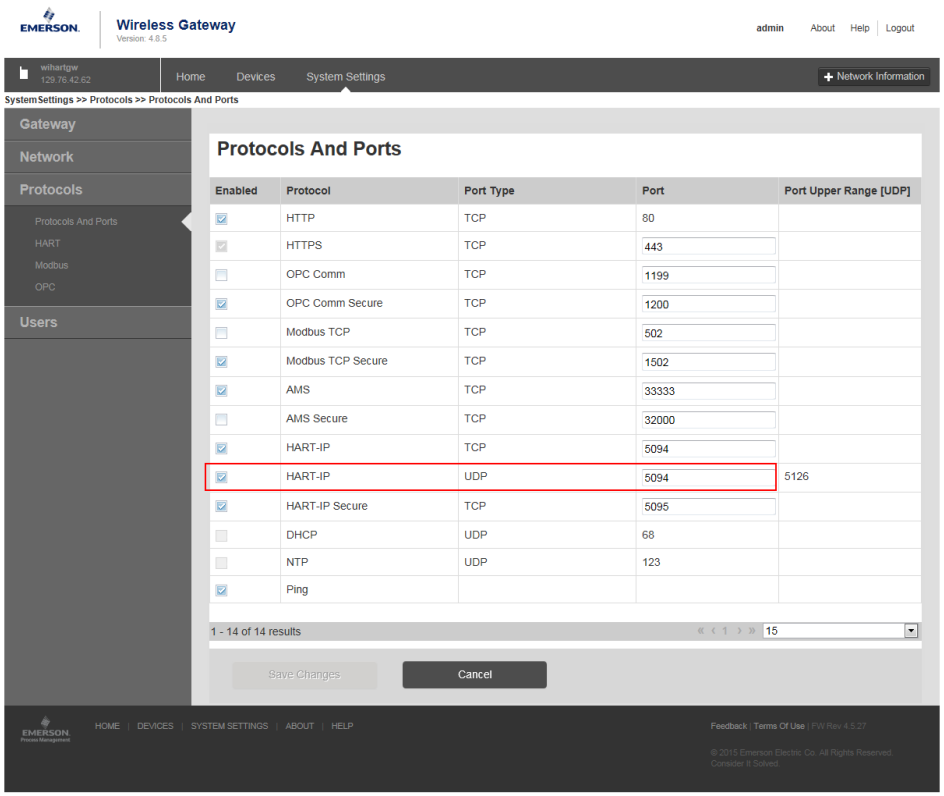
Ensure that the HART-IP protocol is enabled for the Emerson Wireless Gateway.

Procedure

1. Open a standard web browser (typically Microsoft® Internet Explorer).
2. Enter the current IP address of the Emerson Wireless Gateway's integrated web server in the web browser's address bar.
3. Enter `admin` for User Name and `default` for the Password.

Need help?
For further instructions on how to log on to the Gateway, see the Emerson Wireless 1410S Gateway Reference Manual (Document No. 00809-0600-4410).

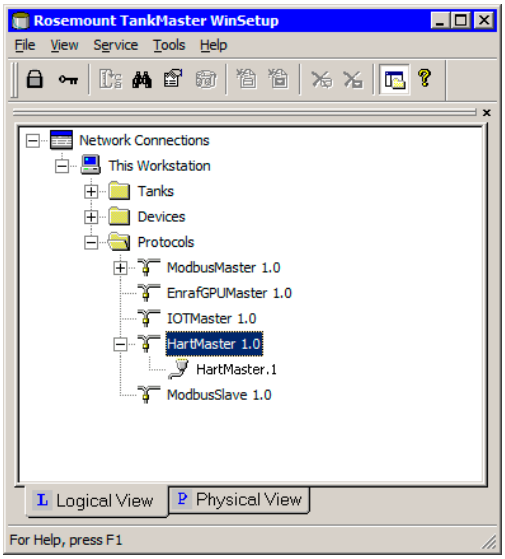
4. Navigate to **System Settings** → **Protocols** → **Protocols and Ports**.
5. Ensure that the **HART-IP** check box is selected. It is recommended to note the Port Number. This will allow you to verify the port number in the HartMaster Protocol Setup.



A.2.2 HartMaster protocol setup

Procedure

1. In the ***Rosemount TankMaster WinSetup*** workspace window, open the **Protocols** folder.
2. Select the **HartMaster 1.0** icon which represents the protocol to be configured.



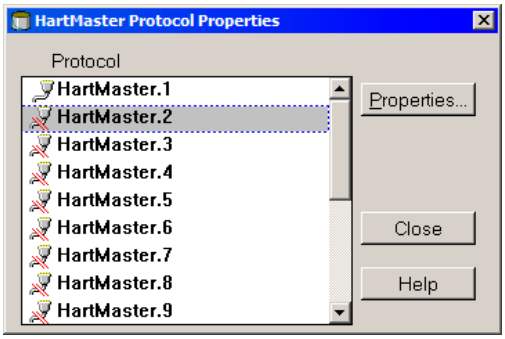
3. Right-click and select **Properties** (or choose **Protocols/Properties** from the **Service** menu).

   The ***Protocol Properties*** window shows a list of enabled and disabled protocol channels.

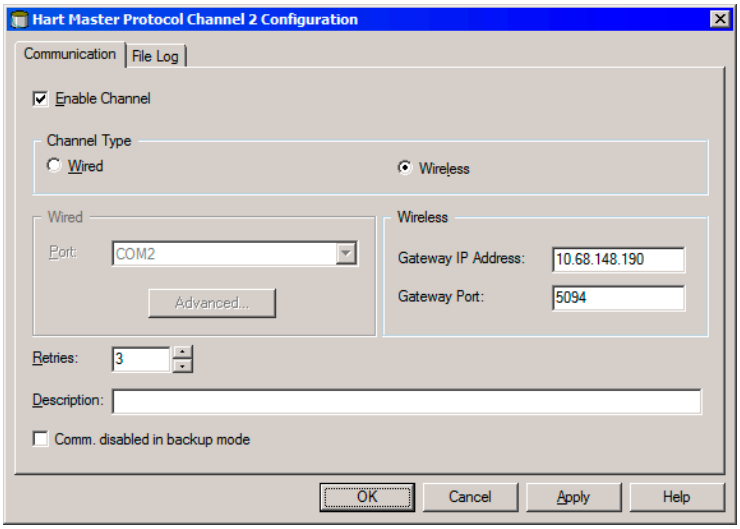
4. Select the desired channel, and then click the **Properties** button to configure the protocol channel.

Example

In this example HartMaster Channel 2 was chosen.

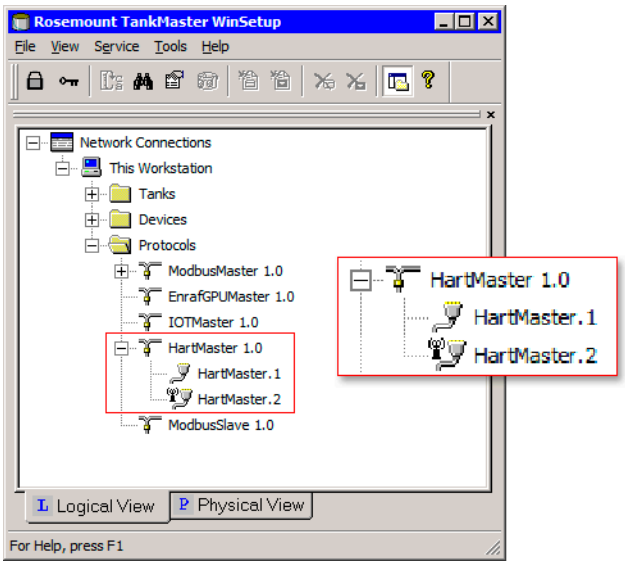


5. Select the **Enable Channel** check box.



6. Under *Channel Type*, select **Wireless**.
7. Enter the gateway's IP address and verify the Port number as noted in the HART-IP Protocol Setup for the gateway.
8. Click the **Apply** button to save the configuration, or click the **OK** button to save the current configuration and close the window.

   The HartMaster protocol channel is now configured and activated for communication between TankMaster and devices connected via the *Wireless*HART protocol such as the Emerson Wireless 775 THUM™ Adapter and the Emerson Wireless Gateway. This is indicated by the protocol channel icon in the Network Connections tree structure (in the left-hand part of the workspace).



B Device Identification

B.1 Device main label

The serial number can be used to identify the Emerson 775 Wireless THUM™ Adapter and field devices in the wireless network. This may be useful if the device has been commissioned without a configured HART tag. Once the device has been identified, a correct HART tag can be configured using TankMaster WinSetup configuration software.

The serial number is found on device main labels and in the Device List window in TankMaster WinSetup.

Figure B-1: THUM Adapter Label with Serial Number

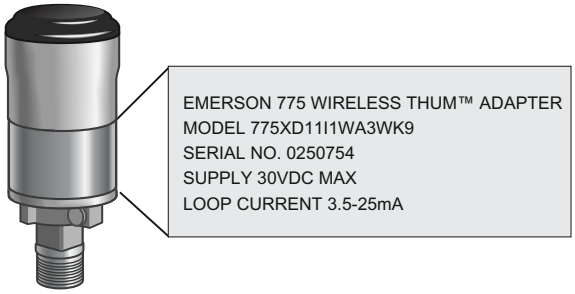
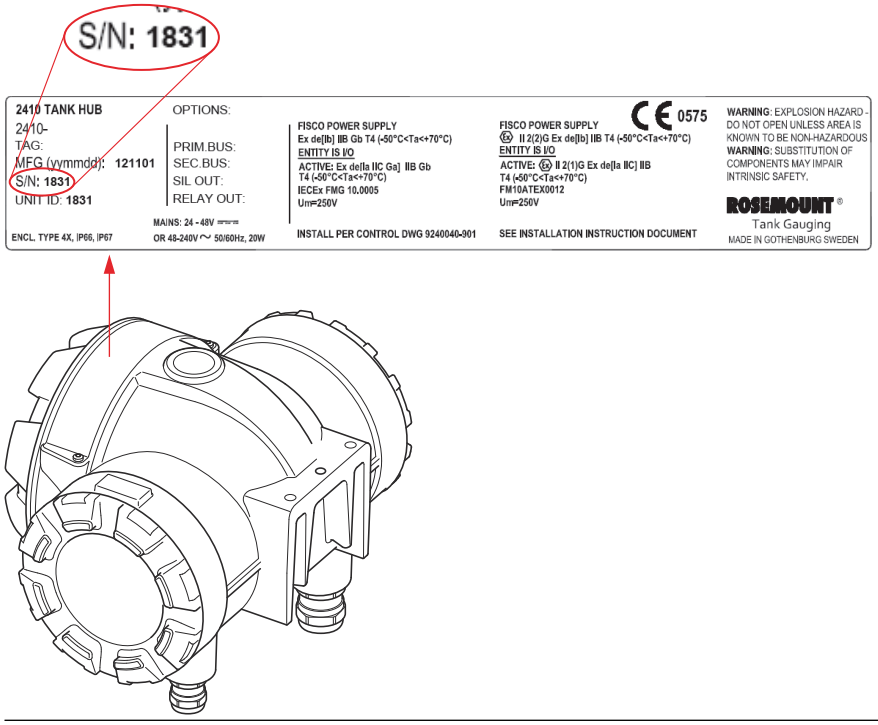


Figure B-2: 2410 Tank Hub Label with Serial Number

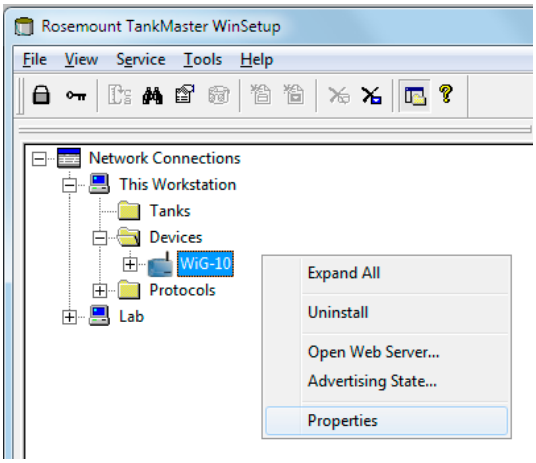


B.2 Serial number in TankMaster WinSetup

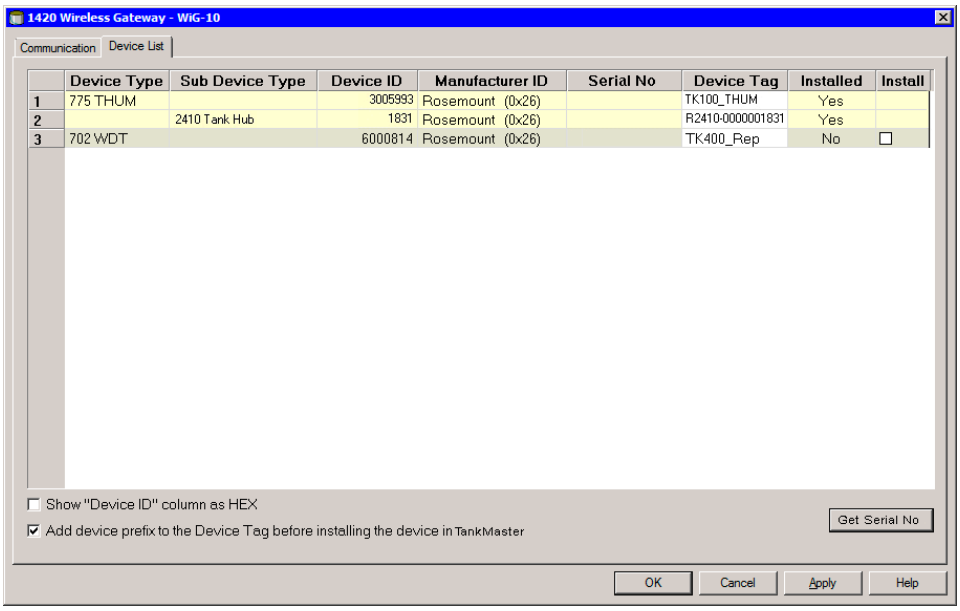
To view the serial number in WinSetup, do the following:

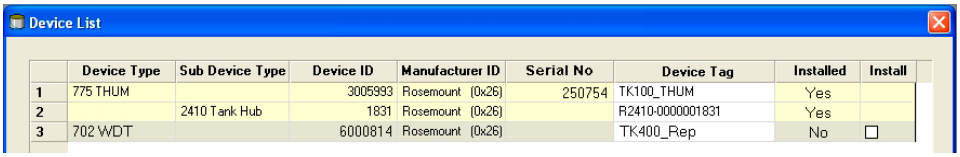
Procedure

1. Open the WinSetup program.
2. Right click on the Gateway icon, and select the **Properties** option.



3. Select the **Device List** tab, and then click the **Get Serial No** button to show the serial number in the *Assembly No* field.



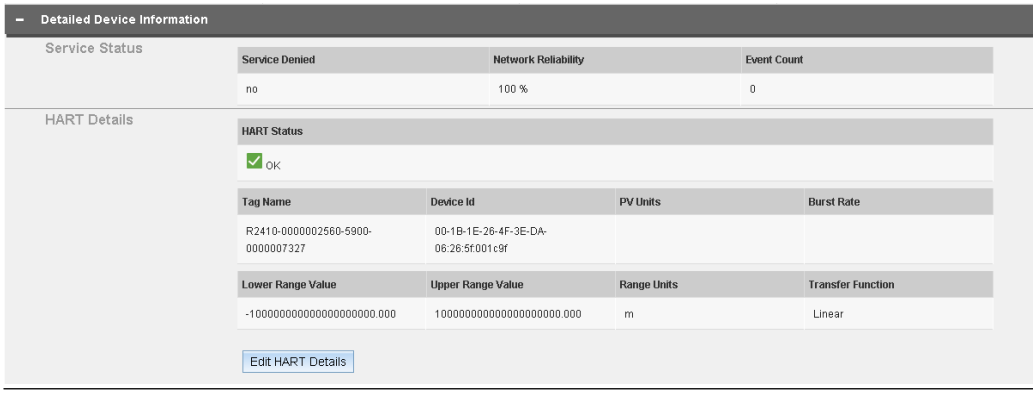


C HART® Tags

C.1 Rosemount 2410 Tank Hub

HART tags are automatically assigned to devices in the wireless network. For the Rosemount 2410 Tank Hub the default HART tag is given by “R2410-xxxxxxxxxx” where “x” is a text string including the Device ID. HART tags can be found in the Emerson Wireless Gateway Web Server.

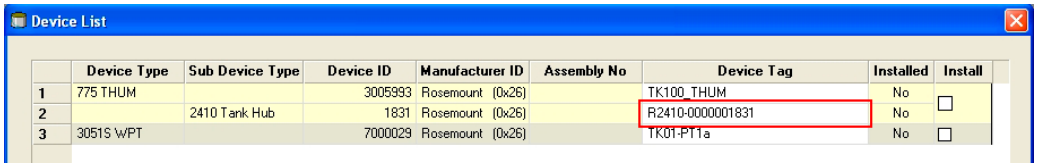
Figure C-1: Emerson Wireless Gateway Web Server



When the gateway is installed in TankMaster WinSetup, devices connected to the wireless network will appear in the ***Device List*** window.

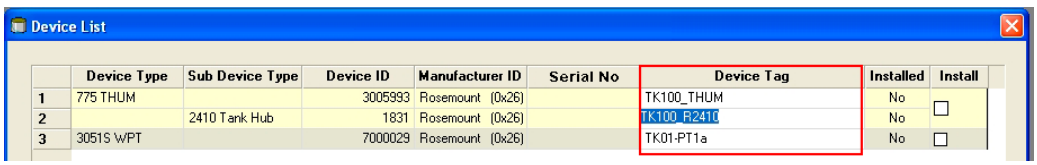
The HART tag for the Rosemount 2410 that was shown in the Gateway Web Server also appears in the ***Device List*** window.

Figure C-2: Device List Window



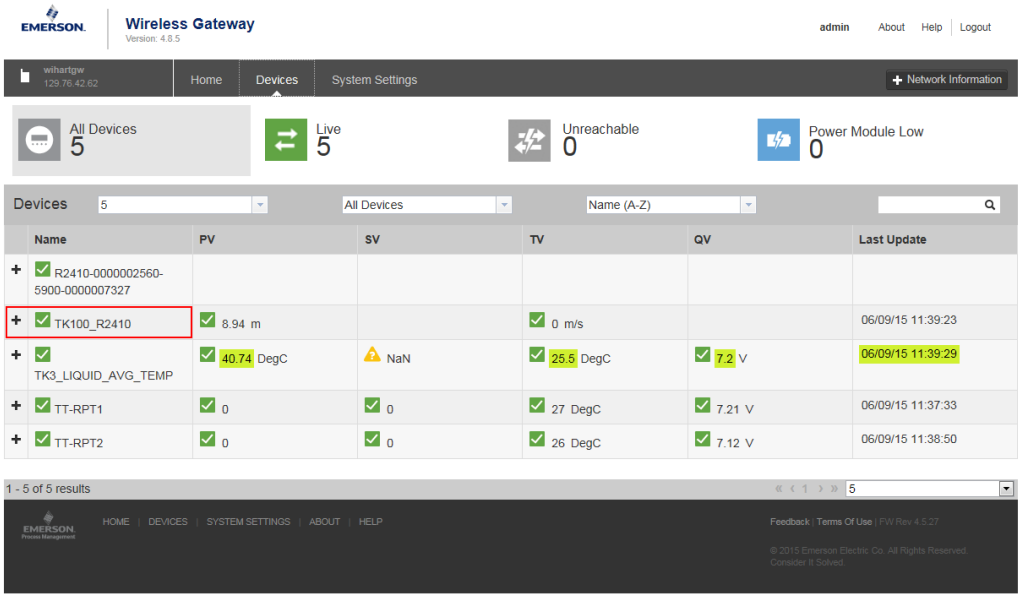
The HART Tag / Device Tag can be changed if desired. In the example below the tag is changed to TK100_R2410.

Figure C-3: Changing the HART Tag / Device Tag



The tank hub's HART Tag / Device Tag will appear in the Gateway Web Server as well.

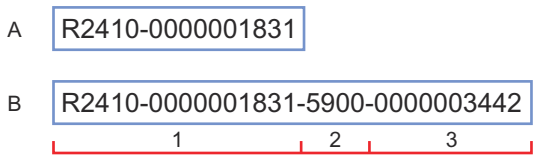
Figure C-4: Edited HART Tag / Device Tag



C.2 Connected field devices

Field devices connected to the 2410 Tank Hub via the Tankbus will automatically be assigned a HART Tag based on the default HART Tag for the 2410. This applies for devices which can be configured via the wireless network, such as the Rosemount 5900S, 2240S, 5300, and 5400. The example below shows the HART Tag for a 5900S Radar Level Gauge connected to a 2410 Tank Hub:

Figure C-5: HART Tag for a Field Device



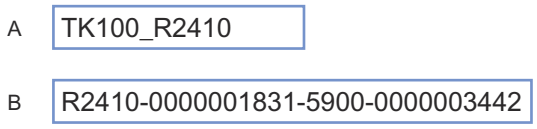
A. 2410 HART Tag
B. 5900S HART Tag

As illustrated in Figure C-5, the HART Tag for a field device consists of three parts: 2410 HART Tag + Device Type + Device ID. In the example above these parts are given by:

Item	Description
1. 2410 HART Tag	R2410-0000001831
2. Device Type	5900
3. Device ID	3442

If the HART Tag for the 2410 is changed, the tag for connected devices will remain:

Figure C-6: HART Tag for a Field Device



A. New 2410 HART Tag
B. 5900S HART Tag

D Installing generic FOUNDATION™ Fieldbus devices

D.1 Introduction

Wireless devices which are fully supported by TankMaster can be installed in WinSetup as level devices or Auxiliary Tank Devices (ATD)[7]. For these devices output variables are automatically mapped to the appropriate tank measurement variables such as Level, Average Liquid Temperature etc.

For example, a Rosemount 2240S Multi-input Temperature Transmitter is installed as an Auxiliary Tank Device (ATD) in TankMaster WinSetup. The temperature output of the 2240S is automatically mapped to the appropriate tank measurement variables for temperature, and the level output from the Water Level Sensor is automatically mapped to the Free Water Level variable.

For devices which can not be installed as level device or ATD in a WirelessTank Gauging system, such as the Rosemount 644 Temperature Transmitter, the tank measurement variables must be configured manually by mapping the appropriate database registers. This section describes how to perform such a variable mapping.

(7) For more information on how to configure a Tank Gauging system, see the Rosemount System Configuration Manual (document number 00809-0300-5100).

D.2 Installation procedure

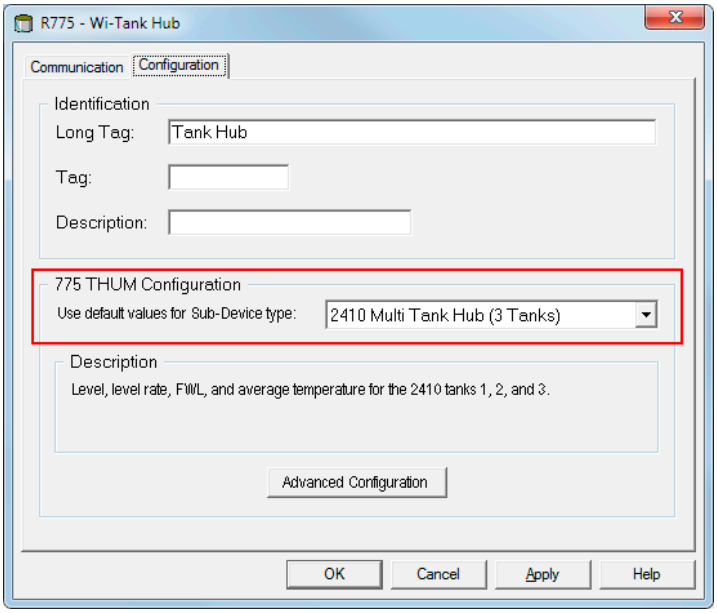
The following example shows how to configure a wireless Rosemount 644 temperature transmitter for average temperature on tank no. 3. The tank will be designated TK-3.

Procedure

1. Verify that the THUM™ Adapter is configured for the right combination of tank hub and number of tanks.

Example

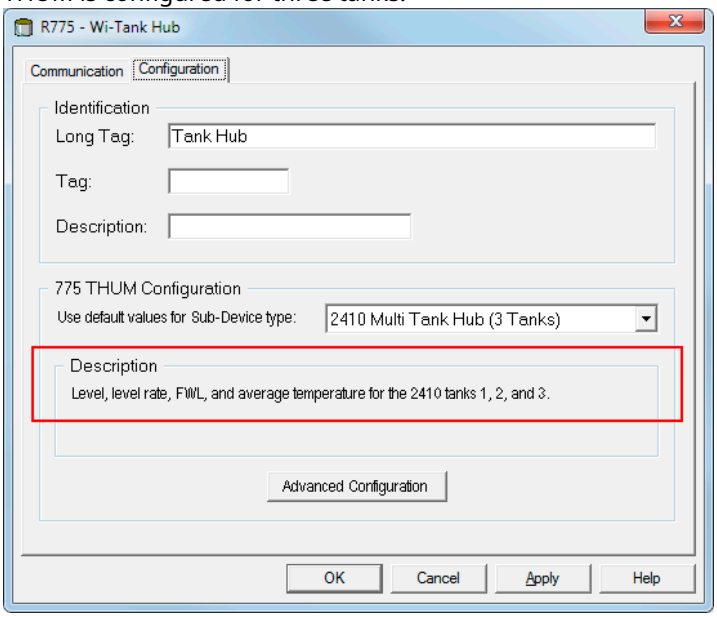
In this example the THUM Adapter is configured for a multiple tanks version of the Rosemount 2410 Tank Hub with three tanks.



2. Verify that the desired tank measurement variables are included in the *Description* pane.

Example

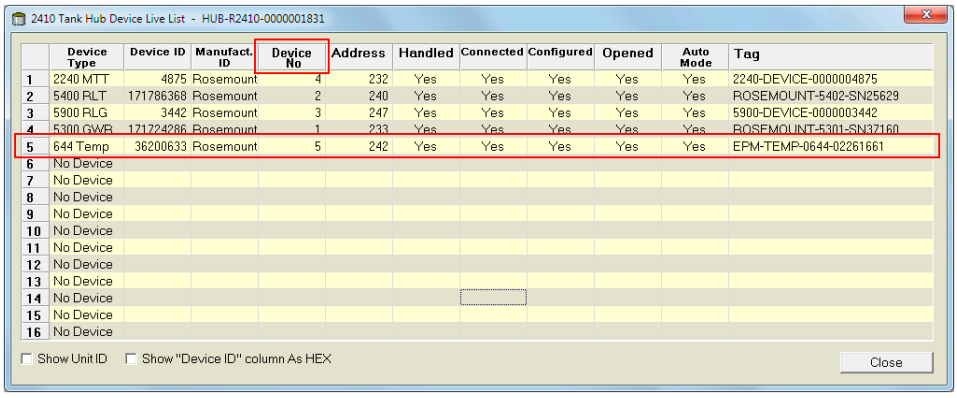
In this example the “average temperature” appears in the list as required, and the THUM is configured for three tanks.



3. Click the **Advanced Configuration** button in case you need to add a variable.
4. Verify that the device appears on the Tankbus. Open the ***Device Live List*** and find the Device No. for the particular device.

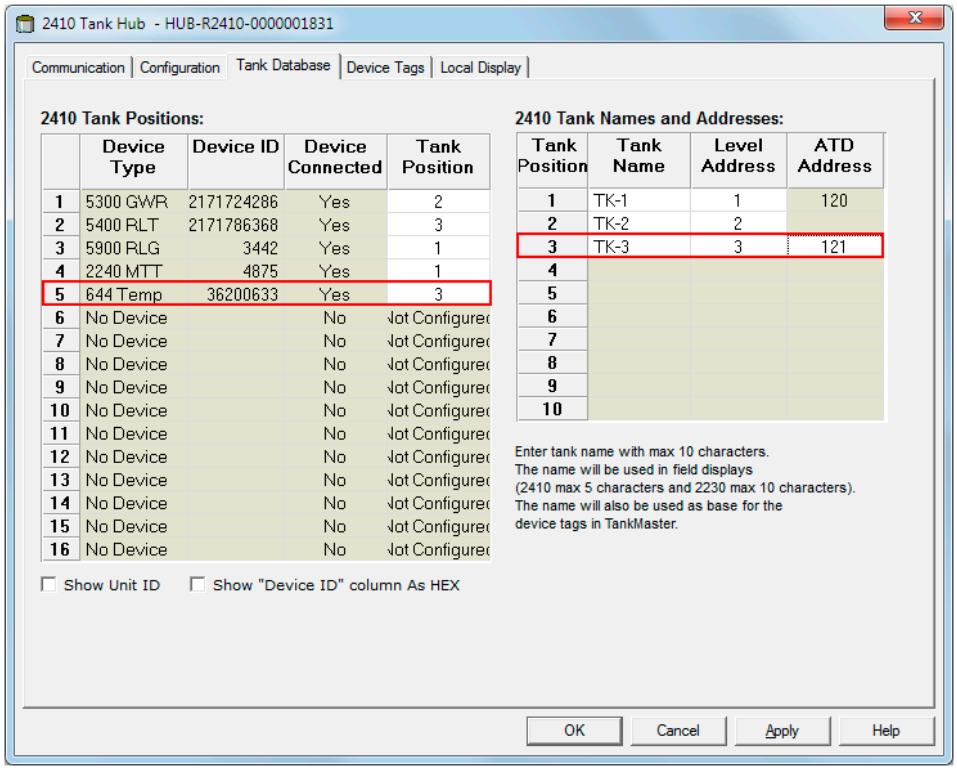
Example

In the example below the ***Device Live List*** shows that the device is assigned No. 5 on the Tankbus.



	Device Type	Device ID	Manufact. ID	Device No	Address	Handled	Connected	Configured	Opened	Auto Mode	Tag
1	2240 MTT	4875	Rosemount	4	232	Yes	Yes	Yes	Yes	Yes	2240-DEVICE-0000004875
2	5400 RLT	171786368	Rosemount	2	240	Yes	Yes	Yes	Yes	Yes	ROSEMOUNT-5402-SN25629
3	5900 RLG	3442	Rosemount	3	247	Yes	Yes	Yes	Yes	Yes	5900-DEVICE-0000003442
4	5300 GWR	171724286	Rosemount	1	233	Yes	Yes	Yes	Yes	Yes	ROSEMOUNT-5301-SN37160
5	644 Temp	36200633	Rosemount	5	242	Yes	Yes	Yes	Yes	Yes	EPM-TEMP-0644-02261661
6	No Device										
7	No Device										
8	No Device										
9	No Device										
10	No Device										
11	No Device										
12	No Device										
13	No Device										
14	No Device										
15	No Device										
16	No Device										

5. Configure the tank database. Ensure that the device is configured for the tank position that is associated with the desired tank.



6. Ensure that the Level Address and ATD Address fields are properly configured for each tank position[8].

(8) See the Rosemount System Configuration Manual (Document No. 00809-0300-5100) for information on Modbus address configuration.

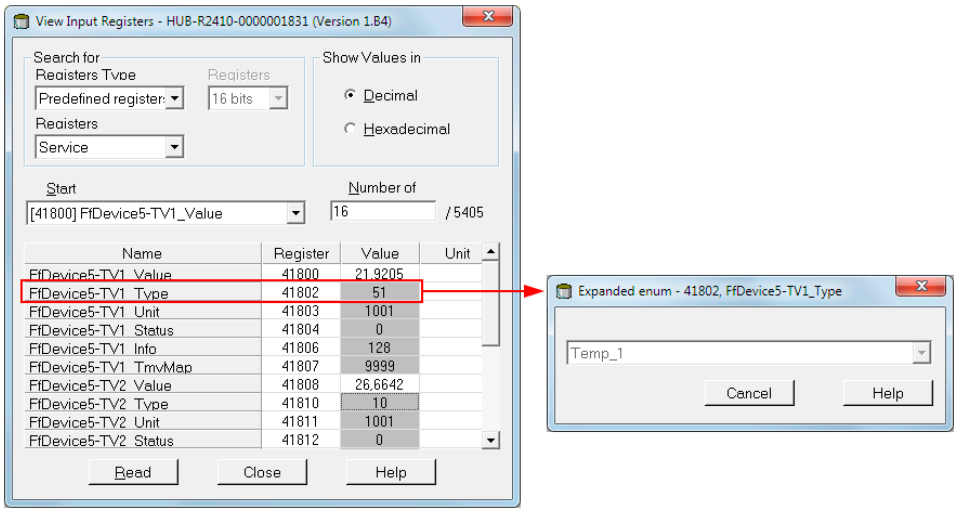
7. Verify that measurement values are transmitted from the connected device (644 transmitter) to the tank hub by viewing the appropriate Rosemount 2410 Tank Hub input registers.

   Transmitter Variables (TV) are listed starting with Input Register 41000 for the first device on the Tankbus.

   ### Example

   In this example the Rosemount 644 Temperature Transmitter is number 5 on the Tankbus, and the transmitter variables are listed in Input Register 41800 and above (see Table D-1).

   In this example we want to collect the temperature output value from the connected 644 transmitter. The transmitter variable type (TV Type) "Temp_1" is assigned number 51 in the "Value" column. Note the TV_Type number. It will be used to map the temperature value from the 644 transmitter to the desired tank measurement variable in the 2410 holding registers.



8. Open the ***View Holding Registers*** window for the Rosemount 2410 to map the 644 transmitter variable to the appropriate tank measurement variable.

   This means that we will tell the tank hub which measurement variable in the temperature transmitter to use for the desired tank measurement variable, in this case the Average Liquid Temperature.

9. Ensure that the used Holding Registers match the tank number.

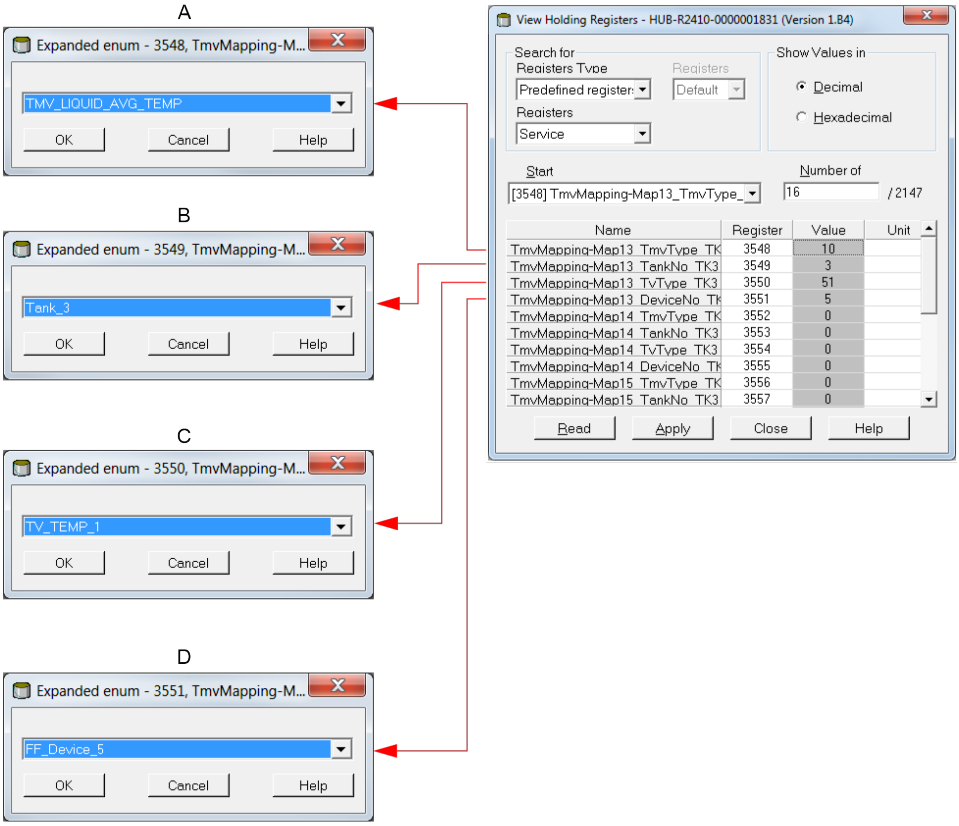
Example

In this example we will use registers 3548 - 3551 which are associated with tank 3 (TK3), see Table D-2 for a list of Holding Registers.

Note

This example is not applicable for measuring the Average Liquid Temperature using multiple temperature sensors.

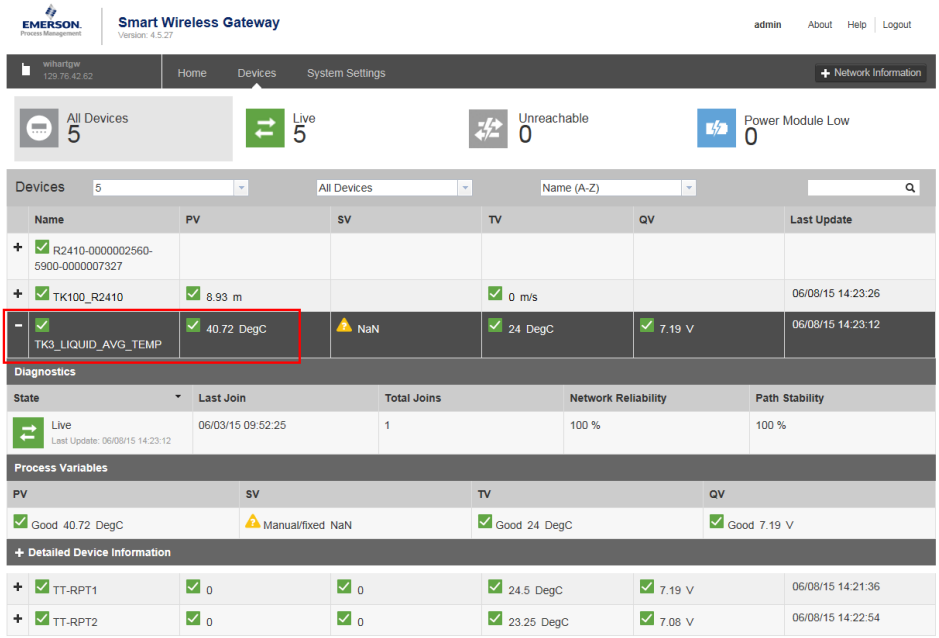
Figure D-1: Mapping the Rosemount 644 Transmitter Measurement Values



A. Tank Measurement Variable (Tmv)=Liquid Average Temperature
B. Map measurement value to tank no. 3
C. Collect temperature value from transmitter variable 51=Temp_1
D. Collect temperature value from device no. 5 on the Tankbus

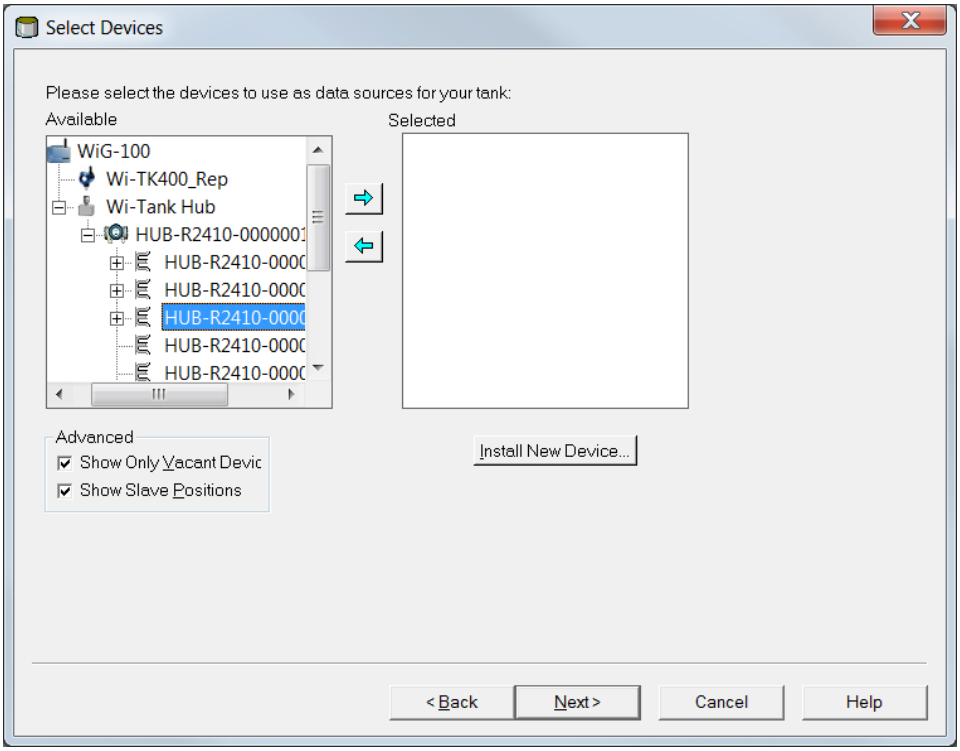
10. Check that the mapped tank measurement value (TK3_LIQUID_AVG_TEMP) appears in the Gateway Web Server under Tank Hub Transmitter variables.

Example



11. Now install tank TK-3 in the WinSetup workspace. Click the right mouse button on the Tanks folder and choose the **New** option.
12. Choose the desired tank type, for example Fixed Roof or any other appropriate tank type.

13. In the ***Select Devices*** window ensure that the **Show Slave Positions** check box is selected.



14. Choose the tank hub slave position that matches the tank number.

    Example

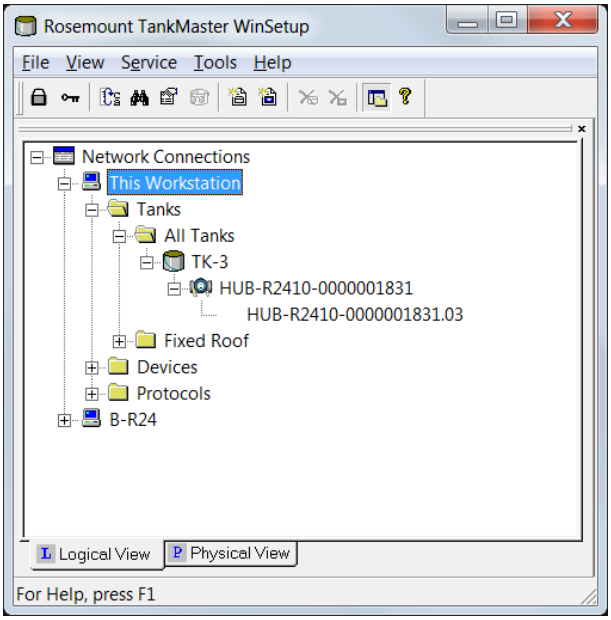
    In this example we will choose slave position 3.

15. Click the right arrow to move the selected slave position to the Selected pane.
16. Click the **Next** button and continue the tank installation.

17. When the tank installation is completed, verify that it is properly installed in the WinSetup workspace.

Example

In this example TK-3 is installed and associated with position 3 in the Tank Hub's database.



D.2.1 FF Device Input Registers

Table D-1: FF Device Input Registers

Device No.	Name	Input Register	Definition
1	TV1_Value	41000	Device 1 TV1 value
	TV1_Type	41002	Device 1 TV1 type
	TV1_Unit	41003	Device 1 TV1 unit
	TV1_Status	41004	Device 1 TV1 status
	TV1_Info	41006	Device 1 TV1 info
	TV1_TmvMap	41007	Device 1 TV1 default map
	TV2_Value	41008	Device 1 TV2 value
	TV2_Type	41010	Device 1 TV2 type
	TV2_Unit	41011	Device 1 TV2 unit
	TV2_Status	41012	Device 1 TV2 status
	TV2_Info	41014	Device 1 TV2 info
	TV2_TmvMap	41015	Device 1 TV2 default map
	-	-	-
	TV20_Value	41052	Device 1 TV20 value
	TV20_Type	41054	Device 1 TV20 type
	TV20_Unit	41055	Device 1 TV20 unit
	TV20_Status	41056	Device 1 TV20 status
	TV20_Info	41058	Device 1 TV20 info
	TV20_TmvMap	41059	Device 1 TV20 default map
2	TV1_Value	41200	See Device 1
3	TV1_Value	41400	See Device 1
4	TV1_Value	41600	See Device 1
5	TV1_Value	41800	See Device 1
6	TV1_Value	41400	See Device 1
7	TV1_Value	42200	See Device 1
8	TV1_Value	41400	See Device 1
9	TV1_Value	41400	See Device 1
10	TV1_Value	41400	See Device 1
11	TV1_Value	41400	See Device 1
12	TV1_Value	41400	See Device 1
13	TV1_Value	41400	See Device 1
14	TV1_Value	41400	See Device 1
15	TV1_Value	43800	See Device 1
16	TV1_Value	44000	Device 16 TV1 value
	TV1_Type	44002	Device 16 TV1 type

Table D-1: FF Device Input Registers *(continued)*

Device No.	Name	Input Register	Definition
	TV1_Unit	44003	Device 16 TV1 unit
	TV1_Status	44004	Device 16 TV1 status
	TV1_Info	44006	Device 16 TV1 info
	TV1_TmvMap	44007	Device 16 TV1default map
	TV2_Value	44008	Device 16 TV2 value
	TV2_Type	44010	Device 16 TV2 type
	TV2_Unit	44011	Device 16 TV2 unit
	TV2_Status	44012	Device 16 TV2 status
	TV2_Info	44014	Device 16 TV2 info
	TV2_TmvMap	44015	Device 16 TV2 default map
	-	-	-
	TV20_Value	44052	Device 16 TV20 value
	TV20_Type	44054	Device 16 TV20 type
	TV20_Unit	44055	Device 16 TV20 unit
	TV20_Status	44056	Device 16 TV20 status
	TV20_Info	44058	Device 16 TV20 info
	TV20_TmvMap	44059	Device 16 TV20 default map

D.2.2 Holding Registers

You can map up to ten tanks and for each tank there are six tank measurement variables available for the desired transmitter variables. The Holding Registers are listed in Table D-2.

Table D-2: Mapping of Tank Measurement Variables to Transmitter Variable

Tank No.	Map	Holding register	Definition
1	Map1_TmvType_TK1	3500	TMV Type
	Map1_TankNo_TK1	3501	Tank number
	Map1_TvType_TK1	3502	TV Type
	Map1_DeviceNo_TK1	3503	Device number
	Map2_TmvType_TK1	3504	TMV Type
	Map2_TankNo_TK1	3505	Tank number
	Map2_TvType_TK1	3506	TV Type
	Map2_DeviceNo_TK1	3507	Device number
	Map3_TmvType_TK1	3508	TMV Type
	Map3_TankNo_TK1	3509	Tank number
	Map3_TvType_TK1	3510	TV Type
	Map3_DeviceNo_TK1	3511	Device number
	Map4_TmvType_TK1	3512	TMV Type
	Map4_TankNo_TK1	3513	Tank number
	Map4_TvType_TK1	3514	TV Type
	Map4_DeviceNo_TK1	3515	Device number
	Map5_TmvType_TK1	3516	TMV Type
	Map5_TankNo_TK1	3517	Tank number
	Map5_TvType_TK1	3518	TV Type
	Map5_DeviceNo_TK1	3519	Device number
	Map6_TmvType_TK1	3520	TMV Type
	Map6_TankNo_TK1	3521	Tank number
	Map6_TvType_TK1	3522	TV Type
	Map6_DeviceNo_TK1	3523	Device number
2	Map7_TmvType_TK2	3524	See Map 1
	Map8_TmvType_TK2	3528	See Map 1
	Map9_TmvType_TK2	3532	See Map 1
	Map10_TmvType_TK2	3536	See Map 1
	Map11_TmvType_TK2	3540	See Map 1
	Map12_TmvType_TK2	3544	See Map 1
3	Map13_TmvType_TK3	3548	See Map 1
	Map14_TmvType_TK3	3552	See Map 1

Table D-2: Mapping of Tank Measurement Variables to Transmitter Variable *(continued)*

Tank No.	Map	Holding register	Definition
	Map15_TmvType_TK3	3556	See Map 1
	Map16_TmvType_TK3	3560	See Map 1
	Map17_TmvType_TK3	3564	See Map 1
	Map18_TmvType_TK3	3568	See Map 1
10	Map55_TmvType_TK10	3716	See Map 1
	Map56_TmvType_TK10	3720	See Map 1
	Map57_TmvType_TK10	3724	See Map 1
	Map58_TmvType_TK10	3728	See Map 1
	Map59_TmvType_TK10	3732	See Map 1
	Map60_TmvType_TK10	3736	See Map 1

E Troubleshooting

E.1 Hart master communication

Table E-1: Troubleshooting Realtime Exception Errors

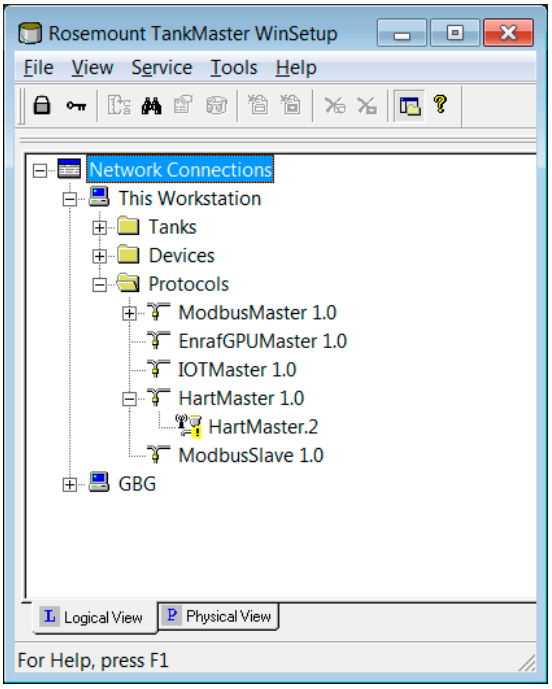
Symptom	Possible cause	Action
HART Master communication error	A wireless device is offline	• Verify that all wireless devices are online
	Incorrect configuration of Emerson 775 Wireless THUM™ Adapter	• Re-configure the THUM Adapter. See How to verify correct sub-device.
	Incorrect configuration of generic wireless device	• Update configuration. See How to disable parameters not burst by the generic wireless device.

E.1.1 How to verify correct sub-device

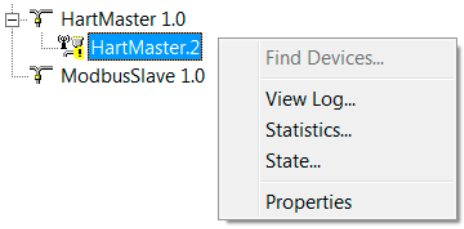
Check the HART Master channel to verify proper communication.

Procedure

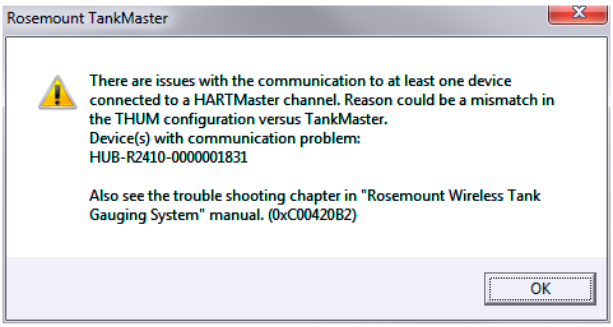
1. Open the ***TankMaster WinSetup*** workspace.
2. Expand the **Protocols** → **HartMaster** folder.



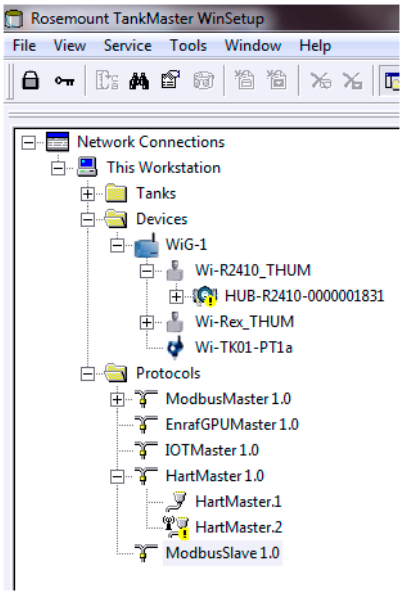
3. Click the right mouse button on the failing communication channel.



4. Choose the **State** option to find out which device that is not properly communicating on the HARTMaster channel.

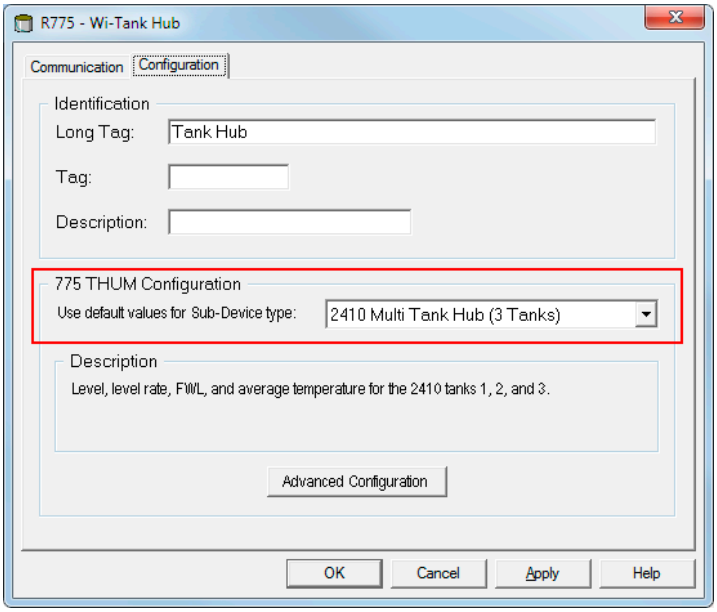


5. Expand the **Devices** folder.



6. Click the right mouse button on the THUM Adapter that the failing device is connected to.
7. Click the **Properties** option and select the **Configuration** tab.

8. Verify that correct type of sub-device is selected in the *775 THUM Configuration* pane.



9. Press the **Apply** button.
10. Click the right mouse button on the failing 2410 Tank Hub and choose the **Properties** option.
11. Press the **Apply** button.
12. Verify that the exclamation marks on the HARTMaster channel icon and device icons disappear after 5-10 minutes.

    An exclamation mark will be displayed on the device icon if the Emerson Wireless Gateway responds to requests from TankMaster with 'ACK' (acknowledge) messages for more than 15 minutes. This indicates that requested data is not available in the Gateway which may slow down the overall network performance.

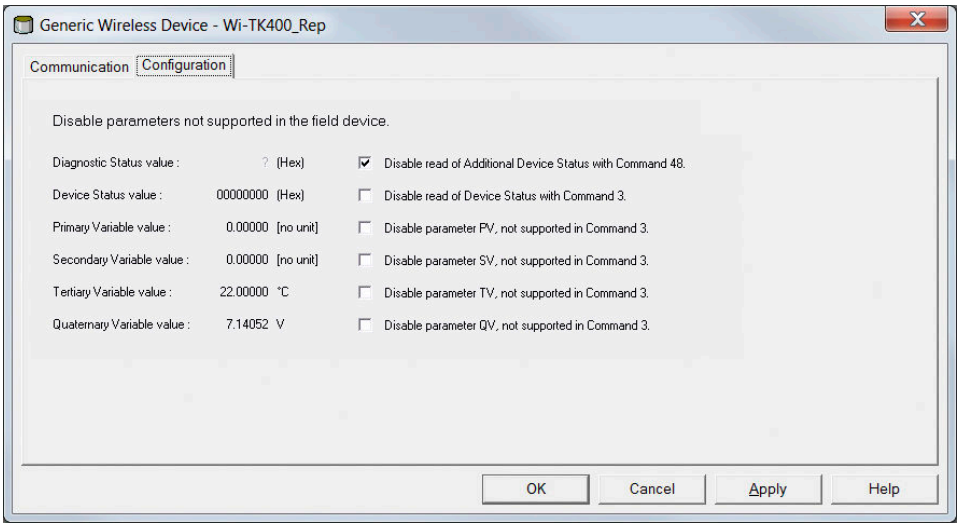
    Once TankMaster and Gateway are synchronized, the exclamation mark will disappear. This will happen as soon as all requests from TankMaster are being answered by the Gateway without any 'ACK' responses for at least 5 minutes.

E.1.2 How to disable parameters not burst by the generic wireless device

In order to avoid requests by TankMaster for data that is not burst by the field device, you will have to disable parameters that are not used. To configure a generic wireless device (for example a Rosemount 702):

Procedure

1. Click the right mouse button on the generic device icon.
2. Choose the **Properties** option.
3. Select **Disable read of Additional Device Status...**.



4. Click the **OK** button.

E.2 Network design

Check the following to find out if there are any network design related issues.

Table E-2: Network Design Related Issues

Symptom	Possible cause	Action
Unstable communication with field devices	Network design rule 5 is not fulfilled	• Ensure that the wireless network has a minimum of 5 devices within effective range of the gateway. See also Fortify the network and Verify network design rules.
	Network design rule 3 is not fulfilled	• Ensure that each device in the wireless network has a minimum of 3 neighbors within effective range. See also Fortify the network and Verify network design rules.
	Network design rule 25% is not fulfilled	• Ensure that the wireless network has a minimum of 25% of the devices within effective range of the gateway. See also Fortify the network and Verify network design rules.

E.3 THUM™ Adapter

Check the following to find out possible problems with the THUM Adapter.

Table E-3: Troubleshooting the THUM Adapter

Symptom	Action
Wired device does not turn on when THUM Adapter is added to loop	• Check the wiring and connections between THUM Adapter and wired device • Verify that enough voltage is being supplied to power both the THUM Adapter and wired device
Can not communicate with wired device or THUM Adapter	• Verify that wiring is correct • Verify that enough voltage is being supplied to power both THUM Adapter and wired device • Verify that correct resistance of 220 Ohm is installed. See Wiring.
THUM Adapter not joining network	• Verify network ID and join key • Wait longer (30 min.) • Verify THUM Adapter is within range of at least one other device • Verify network is in active network advertise • Power Cycle device to try again
Limited Bandwidth Error	• Reduce the Update Rate on THUM Adapter and wired device • Increase communication paths by adding more wireless points • Check that THUM Adapter has been online for at least an hour • Check that THUM Adapter is not routing through a “limited” routing node • Create a new network with an additional Emerson Wireless Gateway
Tank measurement variables are not presented for some tanks	• Check the THUM configuration. Ensure that the correct sub-device setting is used. See Connected Sub-device.

Related information

Emerson Wireless 775 THUM Adapter Reference Manual

E.4 Gateway

Check the following to find out possible problems with the Gateway.

Table E-4: Troubleshooting the Gateway

Symptom	Action
Web browser returns page not found	• Use the supplied crossover cable to connect the Gateway and PC/Laptop. • Verify the Gateway is properly powered. • Verify which Ethernet port is being used on the Gateway. • Verify the IP address for the Gateway (default primary port is 192.168.1.10, default secondary port is 192.168.2.10 or for DeltaV Ready Gateway's default primary port is 10.5.255.254, default secondary port is 10.9.255.254). • Verify the IP address of the PC/Laptop is in the same subnet range as the Gateway (i.e. If the Gateway IP is 155.177.0.xxx, then the PC/Lap IP address should be 155.177.0.yyy). • Disable internet browser proxy settings.
Can not find Gateway after changing IP address	• Verify the IP address of the PC/Laptop is in the same subnet range as the Gateway (i.e. If the Gateway IP is 155.177.0.xxx, then the PC/Lap IP address should be 155.177.0.yyy).
Can not find Gateway using Secondary Ethernet Port	• Verify which Ethernet port is being used on the Gateway. • Verify the IP address for the Gateway (default primary port is 192.168.1.10, default secondary port is 192.168.2.10). • Verify the IP address of the PC/Laptop is in the same subnet range as the Gateway (i.e. If the Gateway IP is 155.177.0.xxx, then the PC/Lap IP address should be 155.177.0.yyy).
Can not log into the Gateway	• Verify the user name and password. The default administrator user name is “admin” and the default password is “default”.
Wireless device does not appear on the network	• Verify the device has power. • Verify the device is within effective communications range. • Verify the proper Network ID has been entered into the device.
Wireless device appears in the join failure list	• Re-enter the Network ID and Join Key into the device
Wireless device appears with service denied	• Verify the total number of devices on the network. Maximum 70 nodes for Wireless Tank Gauging systems (with gateway that supports up to 200 nodes). • Go to **SETUP** → **NETWORK** → **BANDWIDTH** and click analyze bandwidth (Note: any changes will require the network to reform). • Reduce the update rate for the device.
Cannot establish communication with Gateway in TankMaster	• Verify IP-address in HartMaster • Verify Port number • Verify that Hart IP is enabled

Related information

Emerson Wireless 1410S Gateway and 781S Smart Antenna Reference Manual
Emerson Wireless 1410S Gateway Quick Start Guide
HARTMaster Configuration

00809-0100-5200
Rev. AD
2023

©2023 Emerson. All rights reserved.

Emerson Terms and Conditions of Sale are available upon request. The Emerson logo is a trademark and service mark of Emerson Electric Co. Rosemount is a mark of one of the Emerson family of companies. All other marks are the property of their respective owners.

ROSEMOUNT™

EMERSON™