

Rosemount™ 2410 Tank Hub

GPE emulation instruction



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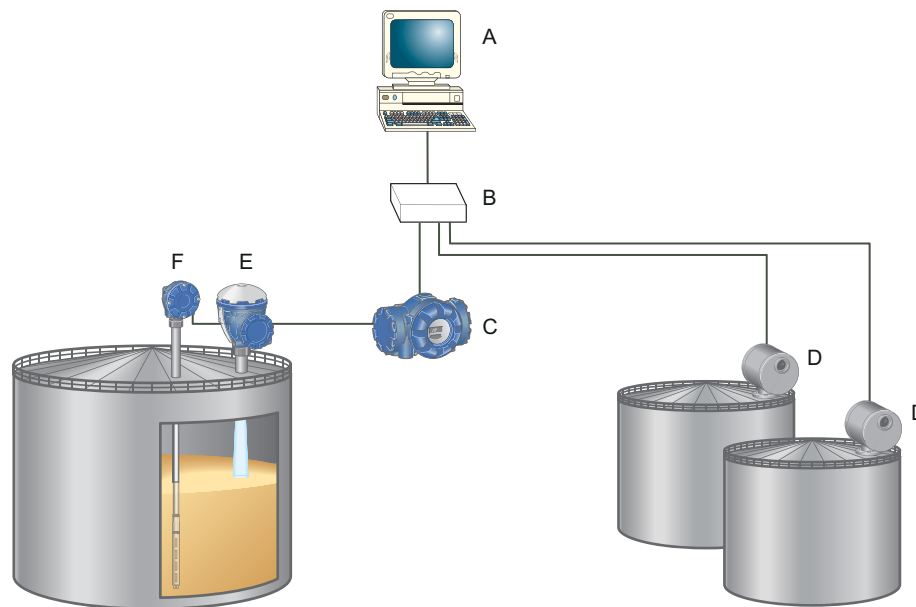
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1 Introduction

The purpose of this document is to provide guidelines on how to change from other manufacturer's devices to Rosemount equipment by exchanging gauges. When a gauge is replaced with a Rosemount gauge, it is necessary to configure the Rosemount 2410 Tank Hub for emulation.

The Rosemount field devices, for example Rosemount 5900 Radar Level Gauge and Rosemount 2240S Temperature Transmitter, are connected to the tank hub using the intrinsically safe Tankbus as usual. Emulation is done in the tank hub only. Each tank hub can emulate up to 10 tanks (10 separate gauges)⁽¹⁾.

Figure 1-1: Rosemount Devices Replacing Old Gauges in an Existing GPE System



- A. Existing GPE host
- B. Existing data polling unit
- C. Rosemount 2410 Tank Hub
- D. GPE gauges
- E. Rosemount 5900S Radar Level Gauge
- F. Rosemount 2240S Temperature Transmitter with sensor

(1) Tank hub version "Multiple tanks" can emulate up to 10 tanks (10 gauges). Tank hub version "Single tank" can emulate up to 2 tanks (2 gauges).

1.1 Emulation capabilities

Emulation enables the replacement of old devices with Rosemount devices in another vendor's existing tank gauging system. The Rosemount device will perform just like the replaced gauge, using the other vendor's protocol to communicate.

By using the other vendor's field and control room communication protocol with modern Rosemount tank gauging devices, the legacy system can be modernized step-by-step. The legacy system can be upgraded while tanks are in operation and existing wiring can be re-used.

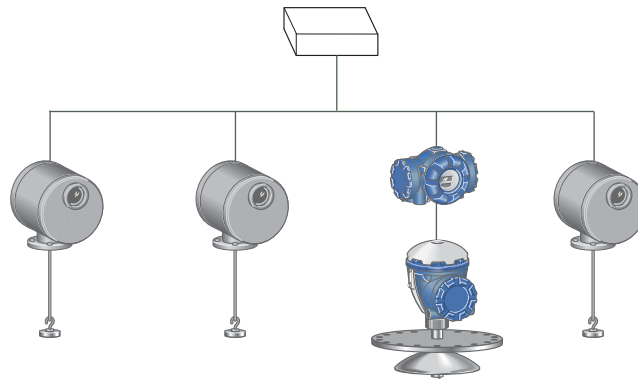
The tank hub can emulate replaced devices, acting as either slave or master. The tank hub slave emulation is described in this document.

Tank hub acting as slave

When an old gauge from another vendor is replaced with a tank hub connected to a Rosemount field device, the tank hub will act as a slave answering requests and sending data upwards towards the host.

A stepwise "bottom-up" upgrade is done by replacing legacy gauges to begin with, and changing the complete control system at a later occasion.

Figure 1-2: Tank Hub Slave Emulation



1.2 GPE system characteristics

The tank hub can emulate up to 10 tank positions⁽²⁾, each supporting:

- Level
- Average liquid temperature
- Analog input⁽³⁾

Gauge types

The tank hub can emulate two different GPE transmitters, 31422 and 31423. There is also support for two special Rosemount proprietary gauge types. See all available gauge types described in [Table 1-1](#).

The selected gauge type applies to all tank positions for the tank hub.

Table 1-1: Gauge Types

Gauge types	Description
31422	GPE gauge type supplying level and temperature data. Relay K1/ alarm contact status can be mapped to the most significant level character, see Table 5-1 for further information.
31423	GPE gauge type supplying level and temperature data. Analog input is also supported. Relay K1/ alarm contact status can be mapped to the most significant level character, see Table 5-1 for further information.
RTG High Resolution	Rosemount proprietary gauge type with higher resolution for level and temperature data. Relay K1/ alarm contact status is also supported.
High Res Temp	Rosemount proprietary gauge type that delivers the average temperature in 1/10 Fahrenheit. The rest of the response is identical as for the 31423 gauge type.

Protocol and electrical interface

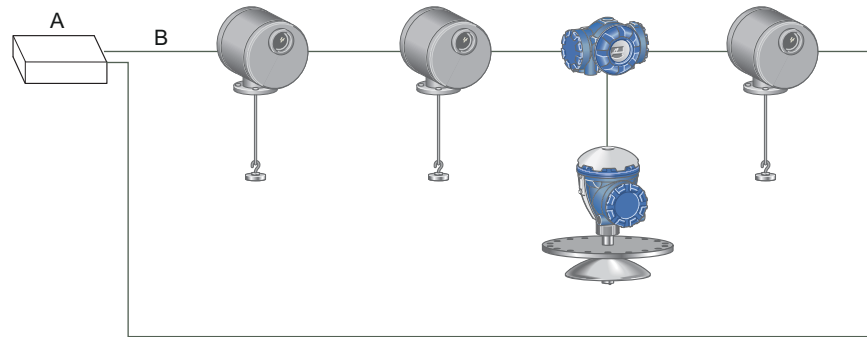
Table 1-2: Protocol and Electrical Interface

Protocol	Electrical interface
GPE	RS485
	20 mA current loop

(2) Tank hub version "Multiple tanks" can emulate up to 10 tanks (10 gauges), tank hub version "Single tank" can emulate up to 2 tanks (2 gauges).

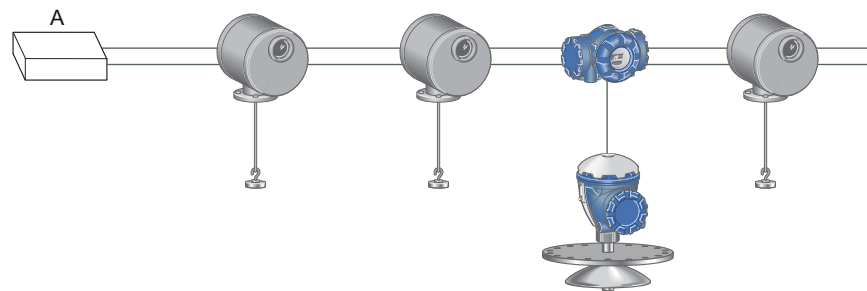
(3) Requires tank hub equipped with analog input option.

Figure 1-3: GPE Connection: Digital Current Loop - Devices Connected in Series



- A. GPE master
- B. 0-20 mA

Figure 1-4: GPE Connection: RS485 - Devices Connected in Parallel



- A. GPE master

GPE protocol description

The GPE protocol is based on an request/reply schedule.

The request is normally 3 bytes and contains the address of the gauge and what data is requested. Depending on how the address is represented, different data is requested, with or without analog input information.

The reply, 10-14 bytes, contains; level, average temperature, and if requested also analog input value.

1.3 Rosemount 2410 Tank Hub communication

The tank hub has slots for two independent communication boards, primary and secondary field bus, for TRL2 Modbus®, RS485 Modbus, emulation, or wireless communication.

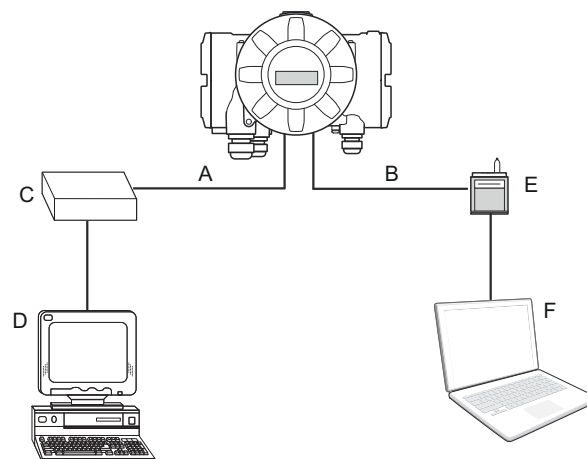
Support for GPE emulation is selected in the model code, refer to Rosemount 2410 [Product Data Sheet](#) for more information. There are three alternatives available for GPE emulation:

- [Example 1: RS485 Modbus on primary bus](#)
RS485 is available on the primary bus, preferably combined with TRL2 on the secondary bus.
- [Example 2: Digital current loop on secondary bus](#)
GPE (digital current loop) is available on the secondary bus, where the primary bus can be used for regular TRL2 or RS485 communication.
- [Example 3: Wireless communication in combination with GPE emulation](#)
RS485 or GPE (digital current loop) is available on the primary bus, where the secondary bus is used for *WirelessHART*® for normal communication.

Example 1: RS485 Modbus on primary bus

When the RS485 protocol is used for GPE emulation, the primary field bus is connected to the GPE host. The secondary field bus can be used to configure the tank hub for emulation, using a TRL2 modem like the Rosemount 2180 Field Bus Modem (FBM), see [Figure 1-5](#).

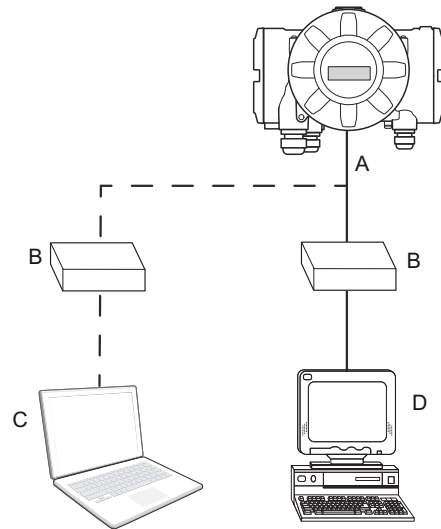
Figure 1-5: Emulation on Primary Bus and Configuration on Secondary Bus



- A. Primary bus: RS485 Modbus
- B. Secondary bus: TRL2 Modbus
- C. RS485 converter
- D. GPE host
- E. FBM
- F. Rosemount TankMaster™ PC

It is possible to use the RS485 protocol for both emulation and configuration⁽⁴⁾. In that case, the primary bus is first used for configuration and thereafter switched to the GPE host in order to start emulation, as shown in [Figure 1-6](#).

Figure 1-6: Emulation and Configuration on Primary Bus



- A. Primary bus: RS485 Modbus
- B. RS485 converter
- C. Rosemount TankMaster™ PC
- D. GPE host

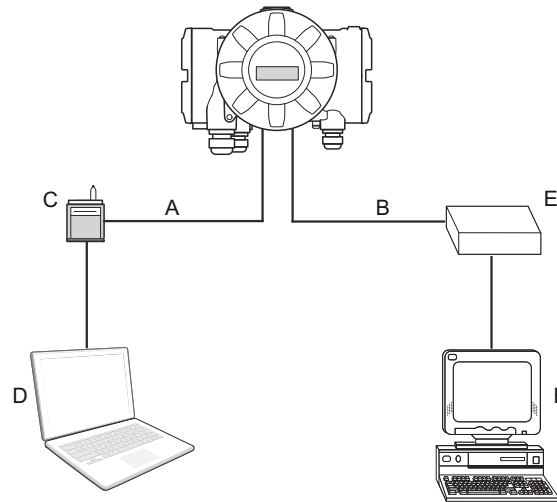
⁽⁴⁾ When using the RS485 protocol for configuring, different communication parameters must be used. See [Table 3-1](#).

Example 2: Digital current loop on secondary bus

The digital current loop interface is connected to the Rosemount 2410 secondary field bus.

Configuration is usually performed with a FBM connected to the primary bus. The primary bus can be used for regular TRL2 or RS485 Modbus communication.

Figure 1-7: Configuration on Primary Bus and Emulation on Secondary Bus



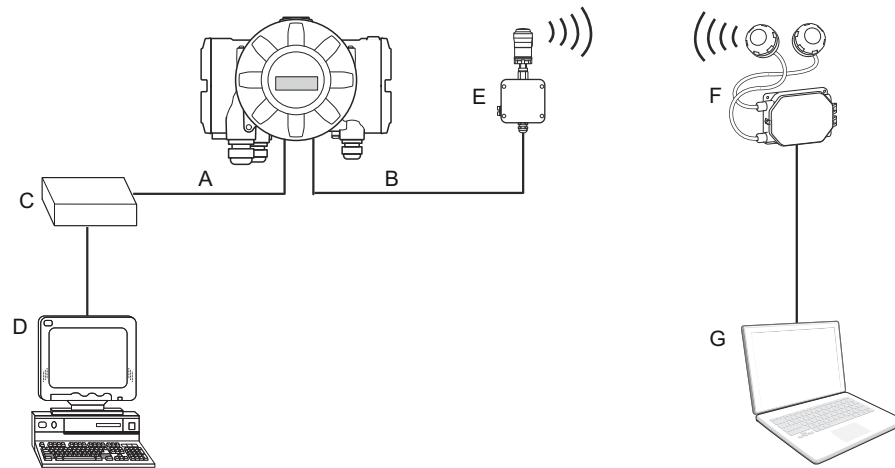
- A. Primary bus: TRL2 Modbus
- B. Secondary bus: Digital current loop
- C. FBM
- D. Rosemount TankMaster™ PC
- E. DCL modem
- F. GPE host

Example 3: Wireless communication in combination with GPE emulation

The tank hub supports Emerson's wireless technology, which is based on *WirelessHART*, the emerging industry standard for wireless field networks. The Emerson Wireless THUM™ Adapter acts as a wireless data link between the tank hub and an Emerson Wireless Gateway.

The tank hub can simultaneously combine wireless and GPE communication. The primary field bus communicates via digital current loop or RS485 Modbus, and the secondary field bus via *WirelessHART*. With this tank hub communication configuration, control room redundancy is achieved.

Figure 1-8: Emulation on Primary Bus and Wireless Communication on Secondary Bus

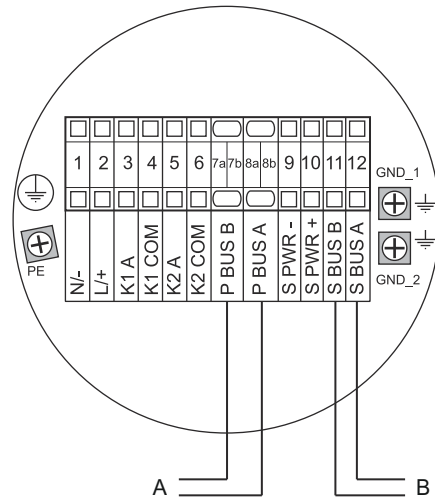


- A. Primary bus: Digital current loop or RS485 Modbus
- B. Secondary bus: WirelessHART
- C. DCL modem or RS485 converter
- D. GPE host
- E. Emerson Wireless THUM Adapter
- F. Emerson Wireless Gateway
- G. Rosemount TankMaster PC

2 Electrical installation

2.1 Rosemount 2410 Tank Hub connections

Figure 2-1: Terminal Block in the Explosion-Proof/Flameproof Compartment



- A. Primary field bus
- B. Secondary field bus

Table 2-1: Terminal Assignment for Non-Intrinsically Safe Side

Terminal	Designation	Function
1	N/-	Power, Neutral / DC -
2	L/+	Power, Line / DC +
3	K1 A	Relay 1 output (optional). Hardware configurable NO/NC.
4	K1 com	Relay 1 common
5	K2 A	Relay 2 output (optional). Hardware configurable NO/NC.
6	K2 com	Relay 2 common
7a/7b ⁽¹⁾	P Bus B	Primary communication bus RS485 B Primary communication bus DCL -
8a/8b ⁽¹⁾	P Bus A	Primary communication bus RS485 A Primary communication bus DCL +
9	S Pwr -	Secondary bus power - (N/A)
10	S Pwr +	Secondary bus power + (N/A)
11 ⁽¹⁾	S Bus B	Secondary communication bus DCL -
12 ⁽¹⁾	S Bus A	Secondary communication bus DCL +

Table 2-1: Terminal Assignment for Non-Intrinsically Safe Side (continued)

Terminal	Designation	Function
PE	PE	Power supply protective ground
GND_1	GND_1	Housing chassis/shield Primary bus
GND_2	GND_2	Housing chassis/shield Secondary bus

(1) Refer to [Electrical drawings](#) for additional information.

Electrical drawings

- RS485: [Electrical Installation Drawing \(D9240041-952\)](#)
- Digital current loop/Wireless: [Electrical Installation Drawing \(D7000006-457\)](#)
- Digital current loop on secondary bus: [Electrical Installation Drawing \(D7000002-526\)](#)

3 Configuration

The Rosemount 2410 Tank Hub is configured by using the TankMaster WinSetup configuration program⁽⁵⁾. WinSetup is a user-friendly software package that includes basic configuration options as well as advanced configuration and service functions.

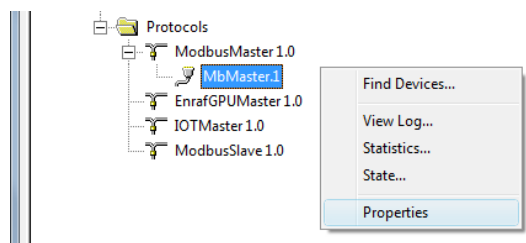
Configuration of the Rosemount 2410 emulation function can be performed with the WinSetup program using the FBM or a RS485 converter, depending on the tank hub configuration. A tank hub where the secondary field bus communicates via WirelessHART®, can be configured by wireless communication with an Emerson Wireless Gateway.

3.1 Set up Modbus communication protocol

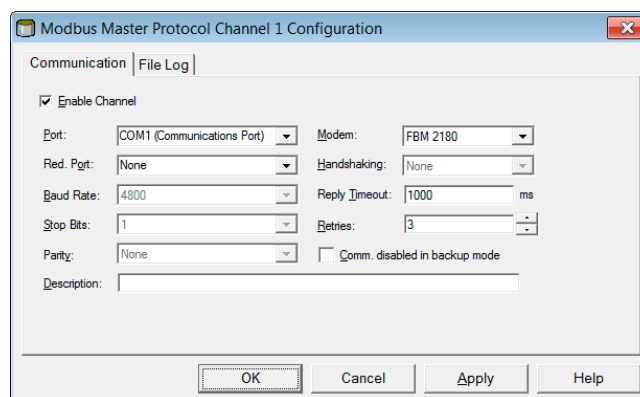
This section describes how to configure the Modbus Master protocol channel for communication. To specify PC communication port and the standard communication parameters, do the following:

Procedure

1. Open the **Protocols** folder in the *TankMaster WinSetup* workspace window.
2. Select the **Modbus Master** icon.



3. Right click the proper **MBMaster** icon and select **Properties** to configure the protocol channel.
4. Select the **Communication** tab.



(5) See the Rosemount Tank Gauging System [Configuration Manual](#) for more information on how to use the TankMaster WinSetup software to configure the Rosemount 2410 Tank Hub.

- Set the communication parameters:

Table 3-1: Communication Parameters

	FBM	RS485 converter
Port	The COM port the FBM is connected to	The COM port the converter is connected to
Baud rate	4800	9600
Stop bits	1	1
Parity	None	None
Modem	FBM 2180	RS-485
Handshaking	None	RTS/CTS
Reply timeout	1000 ms	1000 ms
Retries	3	3
Description	Text describing the configured channel	Text describing the configured channel

- Select the **Enable Channel** check box to activate the protocol channel.
- Select **OK** to store the current configuration and close the configuration window.

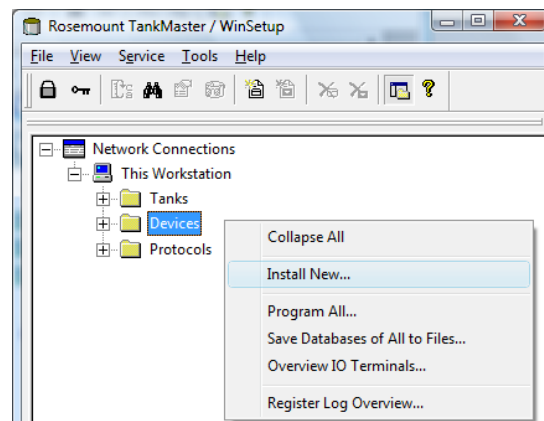
3.2 Install Rosemount 2410 Tank Hub in WinSetup

The TankMaster WinSetup wizard is the recommended tool for installing the tank hub. The installation wizard manages basic configuration of the tank hub.

Perform the following steps to start the installation wizard in TankMaster WinSetup:

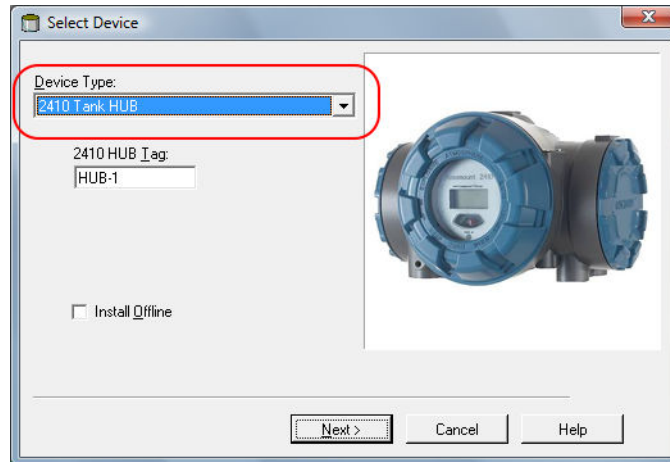
Procedure

- In the *TankMaster WinSetup* workspace window select the **Devices** folder.

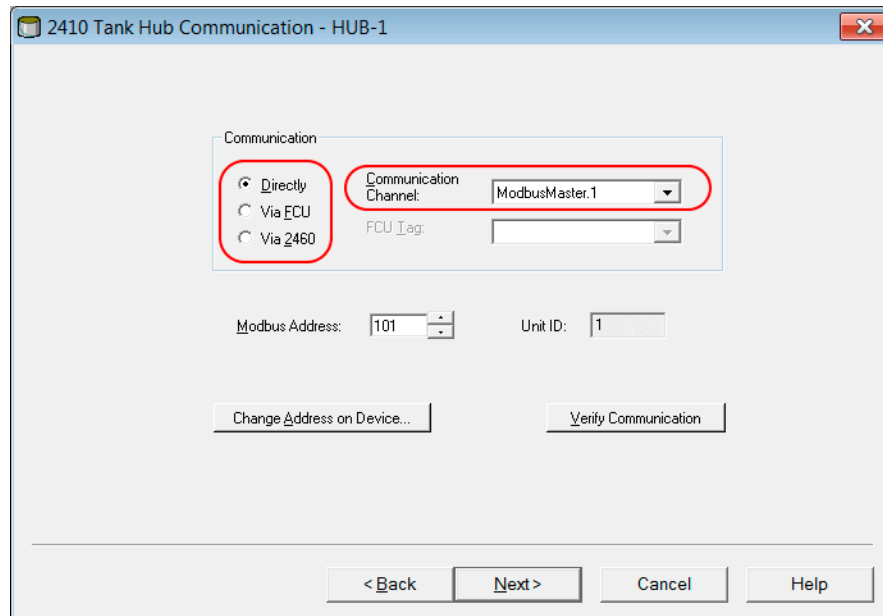


- Right click and select **Install New** or, from the **Service** menu, select the **Devices/Install New** option. The *Select Device* window opens.

- From the **Device Type** drop-down list, select the **2410 Tank Hub** option.

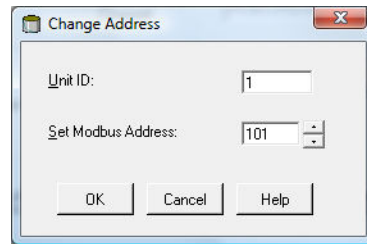


- Type a name in the **2410 HUB Tag** field. The 2410 Hub Tag will be used as an identifier for the tank hub in various windows and dialogs.
- Select **Next**. The **2410 Tank Hub Communication** window opens.
- Ensure TankMaster communicates directly with the tank hub and that the proper communication channel is chosen.



- Default Modbus Address is 247 for the tank hub. It is recommended to change it to an address between 101-199. To change the address, do the following:

- a) In the **2410 Tank Hub Communication** window select **Change Address on Device...** to open the **Change Address** window.



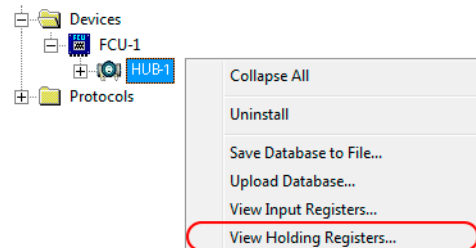
- b) Enter the **Unit ID** and select the new Modbus Address. When changing the device address, the Unit ID is used as a unique identifier of the device. The Unit ID can be found on a label mounted on the device.
 - c) Select **OK** to confirm the address settings and close the **Change Address** window.
 - d) In the **2410 Tank Hub Communication** window select **Verify Communication** to check that communication is established between the TankMaster work station and the tank hub. The **Unit ID** will appear when TankMaster detects the tank hub.
8. In the **2410 Tank Hub Communication** window select **Next** to continue the installation procedure of the tank hub.
 9. Continue configuration of the tank hub following the standard installation procedure.

3.3 Configure specific variables for emulation

The tank hub holding registers are used to configure the GPE emulation variables.

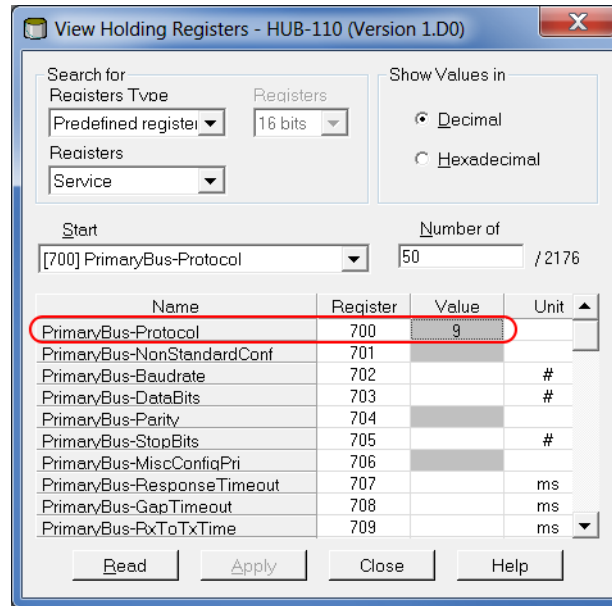
Procedure

1. In the **TankMaster WinSetup** workspace window, right click the tank hub device icon.
2. To view the holding registers, select the **View Holding Registers** option.

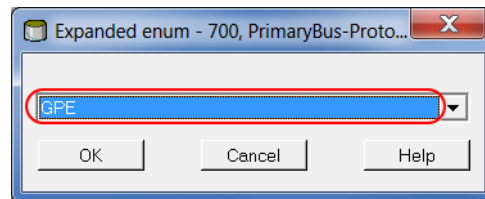


3. Enable GPE emulation by selecting the GPE protocol in holding register 700 (RS485) or holding register 750 (digital current loop).

a) Double-click the grey colored Value field.



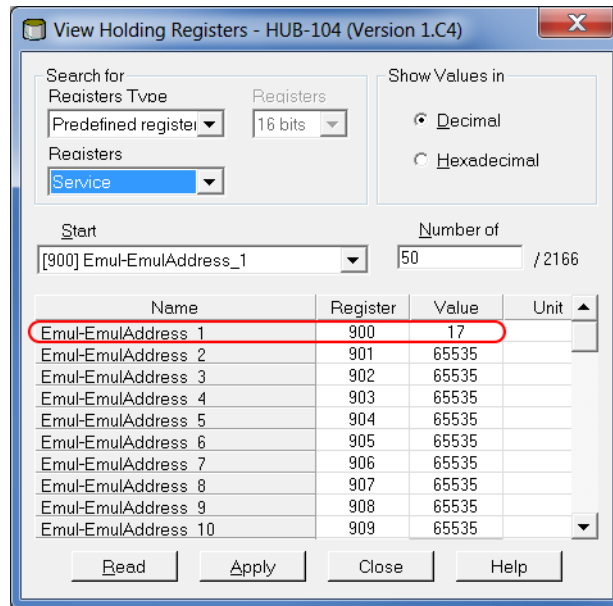
b) From the drop-down menu select GPE and then select the OK button. The value 9 will appear in the Value field when the GPE protocol is selected.



Note

When replacing a GPE gauge with a Rosemount device, the Rosemount device must have the same GPE address as the gauge being replaced.

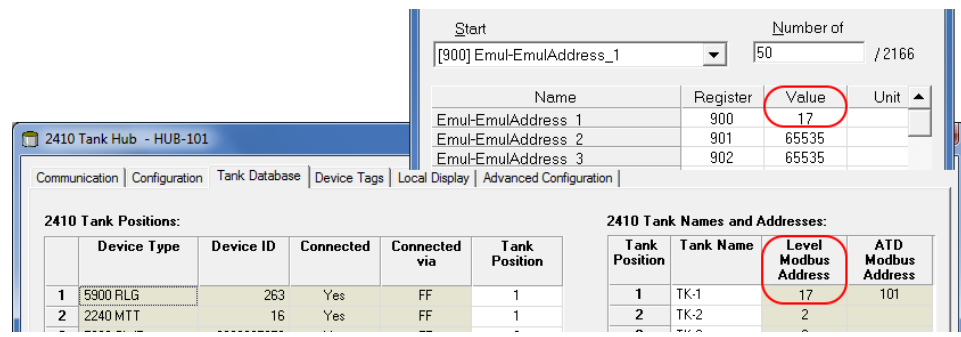
4. Enter the required emulation address in holding registers 900-909. Valid GPE addresses are 0-99.⁽⁶⁾



Enter required emulation address in the **Value** field.

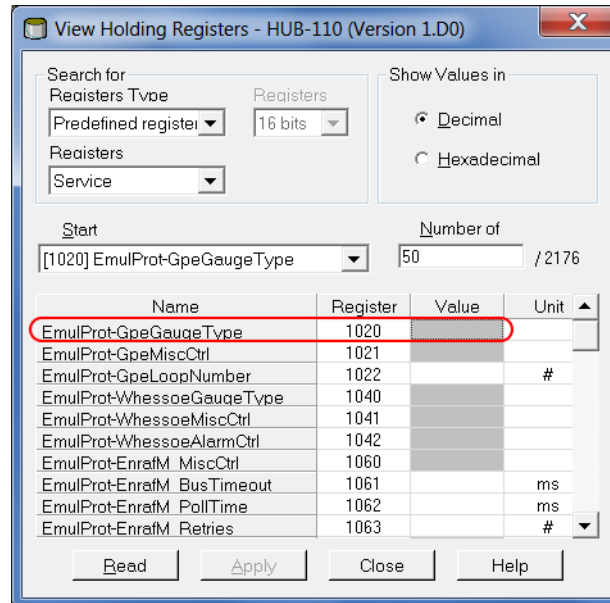
Tip

In the **Tank Database** tab, set the Modbus address to the same as the chosen GPE address for each device.

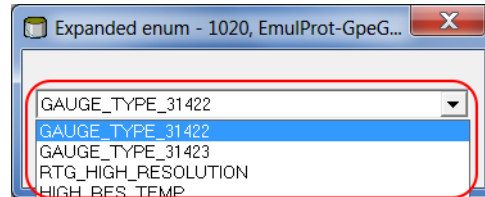


⁽⁶⁾ Emulation address is by default set to “65535” for tank positions that are not in use.

5. Select the gauge type in holding register 1020.
 - a) Double-click the grey colored Value field.



- b) From the drop-down menu select desired GPE transmitter, and select the OK button.



Related information

[Optional configuration and settings](#)

3.4 Verify GPE communication parameters

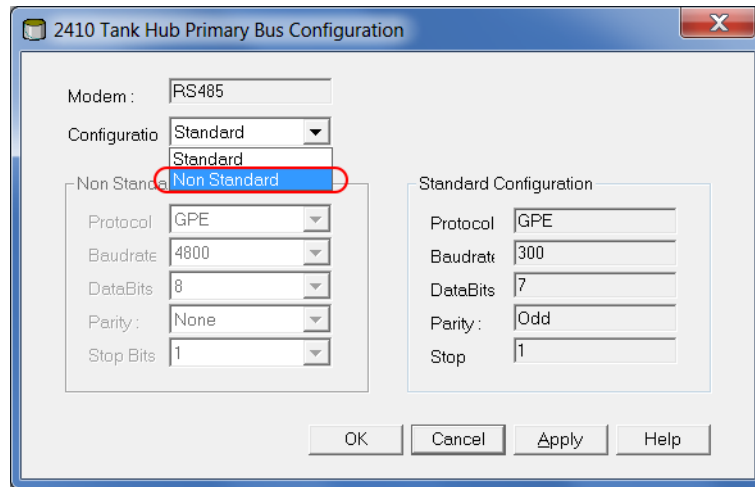
Once GPE emulation is selected (see [Step 3](#)), the GPE emulation communication parameters is automatically configured to default values:

Baud rate	300
Data bits	7
Parity	Odd
Start bit	1
Stop bit	1

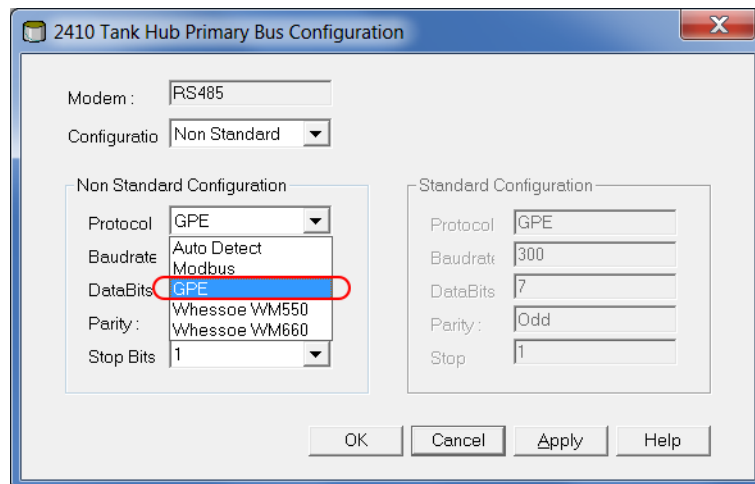
Procedure

To change the communication parameters (optional), do the following:

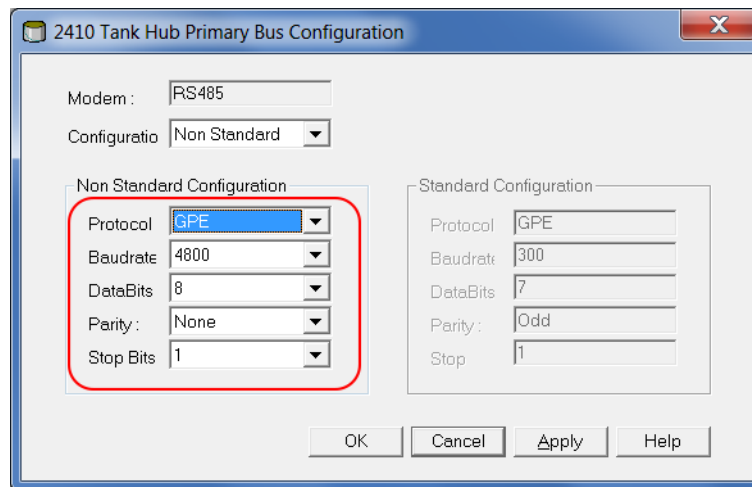
- a) In the **Workspace** window, right click the Rosemount 2410 icon and select **Properties**. Select the **Configuration** tab, and continue by selecting the **Primary Bus** button (RS485) or the **Secondary Bus** button (digital current loop).
- b) From the **Configuration** drop-down list select **Non Standard**.



- c) From the **Protocol** drop-down list select protocol **GPE**.



- d) Specify the communication parameters according to the GPE tank gauging system characteristics.



3.5 Configure field devices

When the tank hub configuration is completed, the Rosemount field devices, for example Rosemount 5900 Radar Level Gauge or Rosemount 2240S Multi-input Temperature Transmitter, must be configured as well. The field devices are configured as usual, for further information see the Rosemount Tank Gauging System [Configuration Manual](#).

Procedure

1. Configure the field devices by using the *Properties* window of each device.
2. Verify that level and temperature values are valid.

3.6 Start GPE emulation

3.6.1 Tank hub with primary and secondary field bus

Procedure

1. If not already connected, connect the tank hub to the GPE host.
2. The tank hub will now act like a GPE gauge.

3.6.2 Tank hub with primary field bus

Procedure

1. When the tank hub configuration is completed, disconnect TankMaster.
2. Connect the tank hub to the GPE host.
3. The tank hub will now act like a GPE gauge.

4 Troubleshooting

4.1 Communication status

Table 4-1: Troubleshooting Chart

Problem	Cause
No communication with the tank hub using TRL2 bus.	<ol style="list-style-type: none"> 1. Incorrect Modbus address. 2. Incorrect communication parameter settings. Check LCD Display during startup, for used settings.
No communication with the tank hub using the GPE bus.	<ol style="list-style-type: none"> 1. Host GPE address is not the same as configured in the tank hub. 2. GPE bus baud rate is not the same as configured in the tank hub. 3. GPE bus number of stop bits is not the same as configured in the tank hub. 4. Wrong type of GPE transmitter is emulated. 5. GPE emulation is not enabled. 6. The host is not including the loop select byte. Make sure bit 1 in holding register GpeMiscControl (1021) is cleared (see Loop number selection for further information). 7. The host has an inter-byte time between the transmitted bytes in the request. Make sure bit 1 in holding register GpeMiscControl (1021) is set and loop number = 5 in holding register GpeLoopNumber (1022). 8. Wrong modem is installed in the tank hub. 9. Tank hub software is older than 1.B7.
Temperature value is received by the hos but is incorrect.	<ol style="list-style-type: none"> 1. The tank hub is configured with wrong GPE transmitter type. 2. Wrong unit type (only applicable for High Resolution mode).
No Relay status is available in the host.	<ol style="list-style-type: none"> 1. Enable Alarm Contact (bit 9) is not set in holding register GpeMisControl (1021). 2. Polarity is not correct. Change value of bit 10 in holding register GpeMiscControl (1021). 3. Relay K1 is not correctly configured in tank hub.

Check message status

Verify that communication is working properly by checking the input registers as described in [Table 4-2](#). See [Table 4-3](#) for troubleshooting actions.

Table 4-2: Messages Input Registers

Register number		Input register	Description
Primary bus	Secondary bus		
1206	1256	RecMessages	Total queries received
1208	1258	MessagesToMe	Number of received queries addressed to me
1210	1260	SentMessages	Number of sent messages

Table 4-3: Messages Troubleshooting Chart

Symptom	Action
Input register RecMessages does not enumerate	Check that: <ul style="list-style-type: none"> the tank hub is powered. cables are properly connected. the tank hub is in GPE mode. the tank hub is configured for GPE emulation.
Input register MessagesToMe does not enumerate	Check that the GPE address is correct
Input register SentMessages does not enumerate	Check that the host is sending proper requests

4.2 Digital current loop modem

Check LEDs

If the tank hub is mounted in a safe zone, it is possible to use the LEDs on the DCL modem for trouble shooting. Dismount the front cover to discover the red and green LEDs:

- Red LED: Always on, flashing when the Rosemount 2410 is transmitting.
- Green LED: On when there is 20 mA in the loop.

Note

The tank hub front cover must only be dismounted in a safe zone.

5 Optional configuration and settings

5.1 Engineering units

Engineering units are not separately configured for GPE emulation:

- Length unit is feet despite the tank hub unit configuration.
- Average temperature unit is Fahrenheit despite the tank hub unit configuration.

Exception:

- RTG High Resolution gauge type:
 - Length unit is meters.
 - Average temperature unit is configurable between Fahrenheit and Celsius. The temperature unit is controlled by the standard tank hub Modbus configuration, using holding register SysCtrl-Tr12_PresCtrl (6104). Note, this setting is done automatically by TankMaster WinSetup during the device installation.
- High Res Temp gauge type:
 - Average temperature unit is 1/10 Fahrenheit.

5.2 Loop number selection

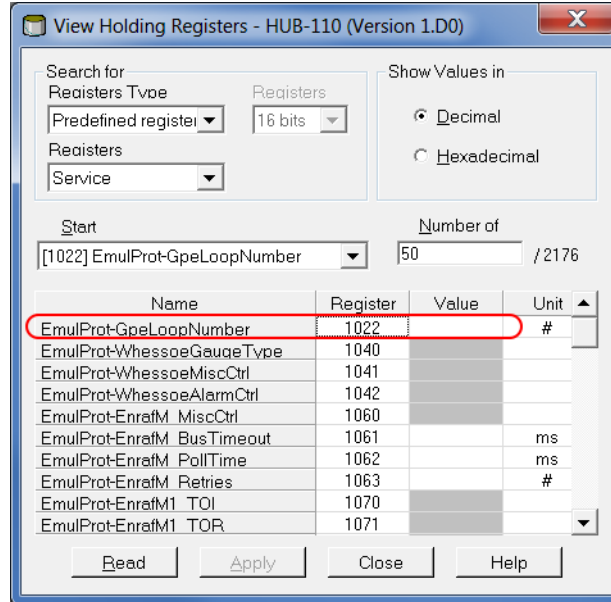
The tank hub answers requests on all loops (0-4) as default. To synchronize the messages on the bus, the tank hub can be set to only reply requests on a specific loop. This to support hosts that are transmitting requests with a relative large inter-byte time. There will be no GAP timeout when a specific loop has been selected for the tank hub.

The desired loop number (0-4) is set in holding register GpeLoopNumber (1022). Note that to enable the loop check, bit 1 must be set in holding register GpeMiscCtrl (1021). When the loop check is enabled, the tank hub requires a loop select byte in the request. All emulation addresses within the tank hub will use the same loop number. If value 5 is written to holding register GpeLoopNumber (1022), the tank hub will respond on any loop(0-4), but will require a loop select byte in the request from the host.

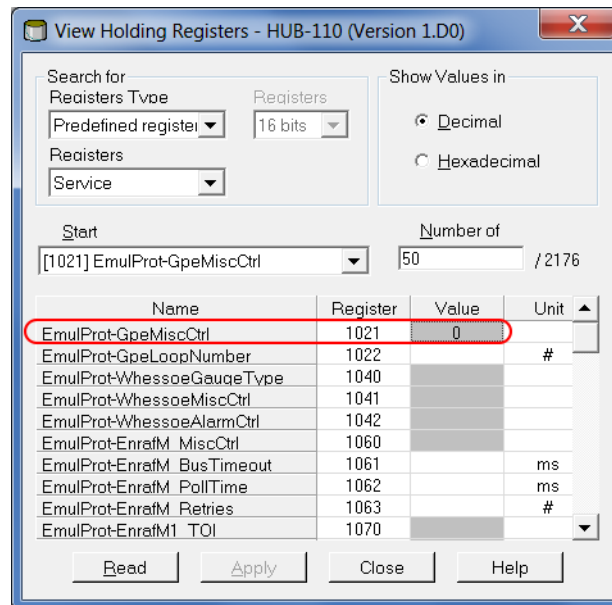
To select a specific loop, do the following:

Procedure

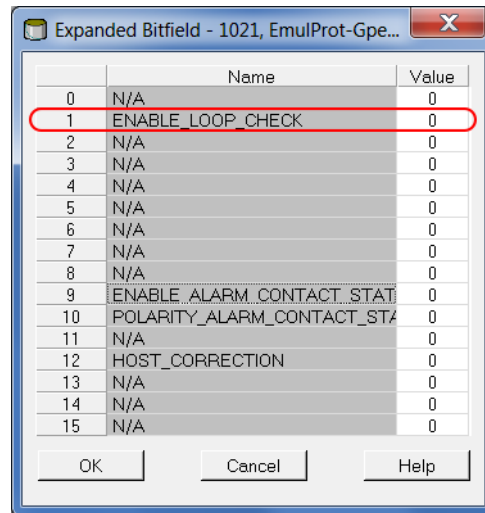
1. Enter the desired loop number in the **Value** field for holding register GpeLoopNumber(1022).



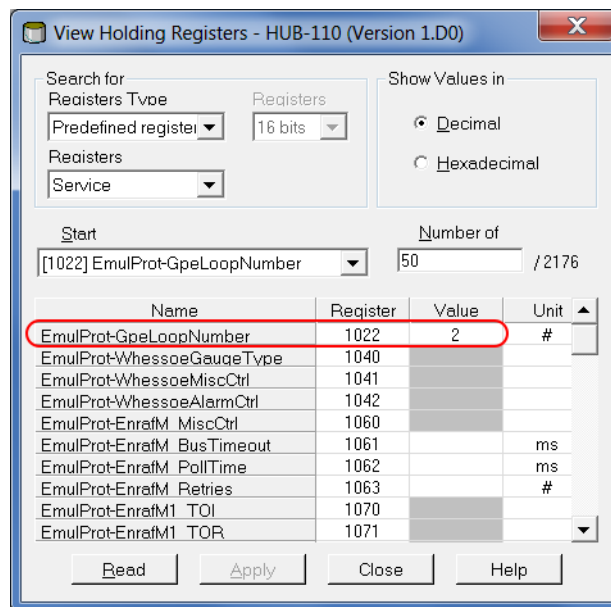
2. Enable the loop check by setting bit 1 in holding register GpeMiscCtrl(1021).
 - a) Double-click the grey colored **Value** field.



- b) In the **Expanded Bitfield - 1021** window, double-click the **ENABLE_LOOP_CHECK Value** field to enable the loop check.



- 3. The tank hub will now only reply on requests on the selected loop number.



Example: Holding register GpeLoopber(1022) is set to value 2. The tank hub will only reply on loop 2.

5.3 Miscellaneous control register

Holding register GpeMiscCtrl (1021) is used for the following functions:

- Enable loop check
- Enable relay K1/alarm contact status
- Invert relay K1/alarm contact status polarity
- Host correction

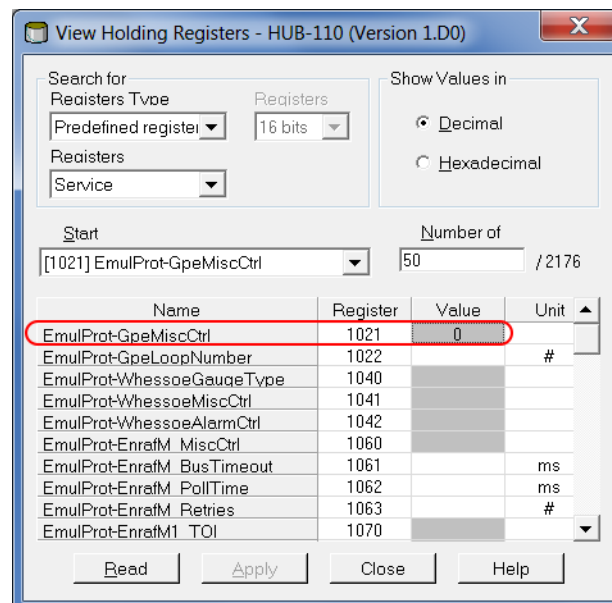
Table 5-1: Holding Register GpeMiscControl (1021) Bits

Bit	Name	Default value	Definition
1	Enable_loop_check	0x0	Bit 1 enables the loop check function described in Loop number selection .
9	Enable_alarm_contact_status	0x0	By setting bit 9, the Relay K1 status is mapped to the most significant level character in the tank hub reply.
10	Polarity_alarm_contact_status	0x0	By setting bit 10, the alarm contact status bit polarity is inverted.
12	Host_correction	0x0	By setting bit 12, the tank hub will compensate for a host metric/imperial conversion error in some host versions.

Use holding register GpeMiscControl (1021) to set the optional configuration bits:

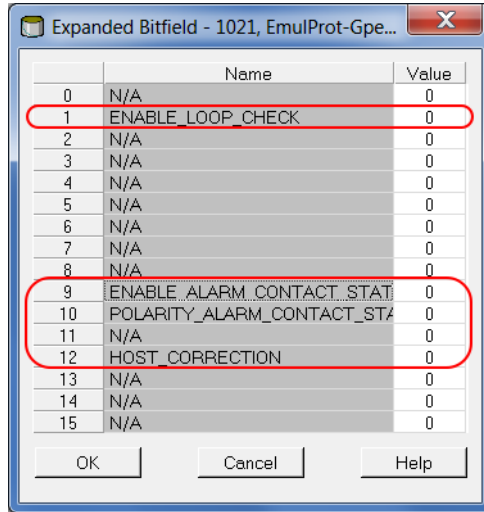
Note

Double-click the grey colored Value field.



Note

In the *Expanded Bitfield - 1201* window, double-click the **Value** field to enable/disable each option.



5.4 Advanced communication settings

In some cases, response time or other communication parameters used by the GPE host system or field devices may differ from the standard values. In these situations, the communication parameters can be changed in the tank hub modem settings by writing to the holding registers described in [Table 5-2](#).

Table 5-2: Advanced Communication Settings

Holding register	Register number	Default value	Description
ResponseTimeout	757	0	Maximum time in ms from the request to when the reply has to be transmitted by the tank hub. If set to 0, the protocols default response time will be used.
GapTimeout	758	0	Maximum time in ms between characters in a request. If set to 0, an appropriate gap timeout will be calculated from the used baud rate.
RxToTxTime	759	0	Minimum time in ms from the request to the response. If set to 0, the default response time for the used protocol will be used.
TxToRxTime	760	0	Minimum time in ms from the response to the request. If set to 0, the default response time for the used protocol will be used.
ActiveBeforeTx	761	0	Active wait period (RTS) in ms before start of transmission. If set to 0, the default response time for the used protocol will be used.
ActiveAfterTx	762	0	Active wait period (RTS) in ms after start of transmission. If set to 0, the default response time for the used protocol will be used.

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