Reference Manual
00809-0100-2230, Rev BB
August 2014

Rosemount 2230

Graphical Field Display

FOUNDATION

ROSEMOUNT®
Tank Gauging

www.rosemount-tg.com

EMERSON™
Process Management

Rosemount 2230

Graphical Field Display

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 Process Management/Rosemount Tank Gauging representative.

Spare Parts

Any substitution of non-recognized spare parts may jeopardize safety. Repair, e.g. substitution of components etc, may also jeopardize safety and is under no circumstances allowed.

Rosemount Tank Radar AB will not take any responsibility for faults, accidents, etc caused by non-recognized spare parts or any repair which is not made by Rosemount Tank Radar AB.

Cover Photo: 2230_coverphoto_2.jpg

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Section 1 Introduction

1.1 SAFETY MESSAGES

Procedures and instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Refer to the safety messages listed at the beginning of each section before performing an operation preceded by this symbol.

⚠WARNING

Failure to follow these installation guidelines could result in death or serious injury:

- Make sure only qualified personnel perform the installation.
- Use the equipment only as specified in this manual. Failure to do so may impair the protection provided by the equipment.

Explosions could result in death or serious injury:

- Verify that the operating environment of the transmitter is consistent with the appropriate hazardous locations certifications.
- Before connecting a hand held communicator in an explosive atmosphere, make sure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices.
- Do not remove the cover in explosive atmospheres when the circuit is alive.
- Substitution of components may impair Intrinsic Safety.
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

Electrical shock could cause death or serious injury.

- Use extreme caution when making contact with the leads and terminals.

⚠WARNING

Any substitution of non-recognized parts may jeopardize safety. Repair, e.g. substitution of components etc., may also jeopardize safety and is under no circumstances allowed.

1.2 SYMBOLS

The CE marking symbolizes the conformity of the product with the applicable European Community Directives.

The EC-Type Examination Certificate is a statement of a Notified Certification Body declaring that this product meets the Essential Health and Safety Requirements of the ATEX directive.

The FM APPROVED Mark indicates that the equipment is approved by FM Approvals according to applicable Approval Standards and is applicable for installation in hazardous locations.

Protective Earth.

Ground.

75 C

External cabling must be approved for use in min. 75°C.

1.3 MANUAL OVERVIEW

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1.4 TECHNICAL DOCUMENTATION

The Rosemount Tank Gauging System includes the following documents:

Document	Reference Number
Rosemount Raptor System Data Sheet	704010EN
Rosemount 5900S Reference Manual	00809-0100-5900
Rosemount 2410 Reference Manual	300530EN
Rosemount 2240S Reference Manual	00809-0100-2240
Rosemount 2230 Reference Manual	00809-0100-2230
Rosemount Raptor System Configuration Manual	300510EN
Rosemount Raptor Wireless Tank Gauging System Reference Manual	300570EN
Rosemount 5300 Product Data Sheet	00813-0100-4530
Rosemount 5400 Product Data Sheet	00813-0100-4026
Rosemount 5300 Series Reference Manual	00809-0100-4530
Rosemount 5400 Series Reference Manual	00809-0100-4026
Rosemount TankMaster WinOpi Reference Manual	303028EN
Rosemount Raptor Installation Drawings	

1.5 PRODUCT RECYCLING/ DISPOSAL

Recycling of equipment and packaging should be taken into consideration and disposed of in accordance with local and national legislation/regulations.

The label below is put on Rosemount Tank Gauging products as a recommendation to customers if scrapping is considered.

Recycling or disposal should be done following instructions for correct separation of materials when breaking up the units.

Figure 1-1. A green label is placed on the housing

1.6 PACKING MATERIAL

Rosemount Tank Radar AB is fully certified according to ISO 14001 environmental standards. By recycling the corrugated paperboard, or wooden boxes, used for shipping our products you can contribute to take care of the environment.

1.6.1 Reuse and Recycling

Experience has shown that wooden boxes can be used several times for various purposes. After careful disassembly the wooden parts may be reused. Metal waste may be converted.

1.6.2 Energy recovery

Products which have served their time may be divided into wood and metal components and the wood can be used as fuel in sufficient ovens.

Due to its low moisture content (approximately 7%) this fuel has a higher calorific value than ordinary wood fuel (moisture content approximately 20%).

When burning interior plywood the nitrogen in the adhesives may increase emissions of nitrogen oxides to the air 3-4 times more than when burning bark and splinter.

NOTE!
Landfill is not a recycling option and should be avoided.

Section 2 Overview

2.1 INTRODUCTION

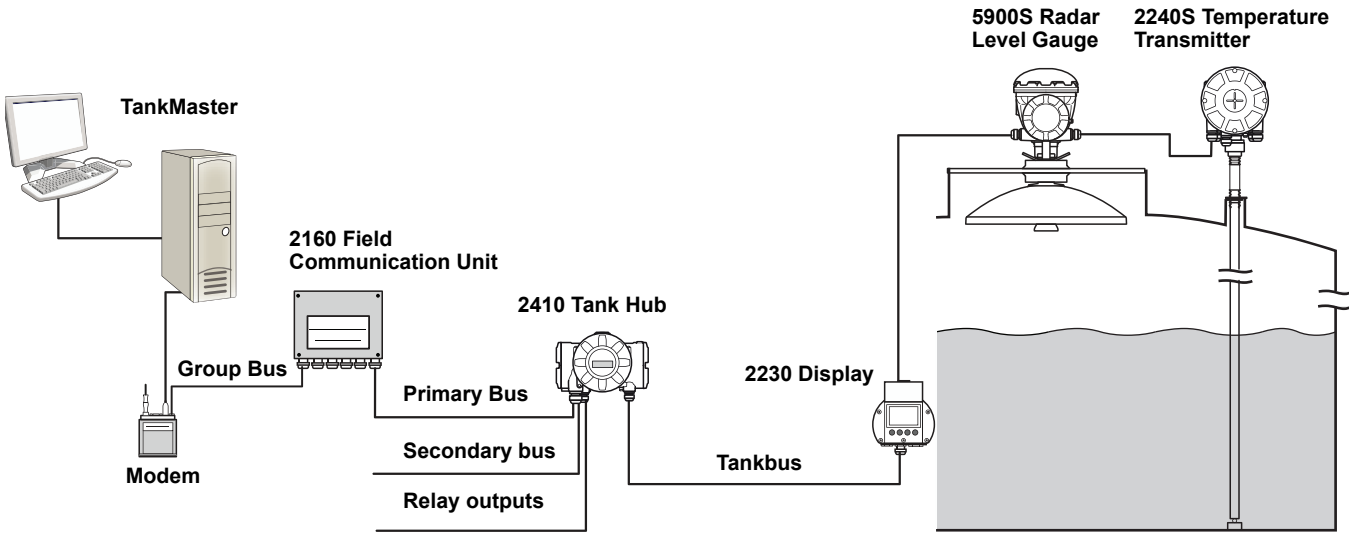
The Rosemount 2230 Graphical Field Display presents inventory tank gauging data such as level, temperature, and pressure. The 2230 Display communicates with the Rosemount 2410 Tank Hub via the intrinsically safe 2-wire **Tankbus**(1). The 2230 also supports installation in Foundation fieldbus systems.

A 2230 connected to the multiple tank version of the 2410 Tank Hub allows you to view data from several tanks. It is possible to configure presentation of measurement variables for each tank individually.

The four softkeys at the front of the 2230 allow you to navigate through the different menus and provides all tank data, directly on the field.

Data from a group of tanks is buffered by a 2160 Field Communication Unit (FCU), and is distributed via the Group Bus to a TankMaster PC, or a host system, whenever the FCU receives a request for data. In case no FCU is included in the system, the 2410 Tank Hub can communicate directly with the host computer.

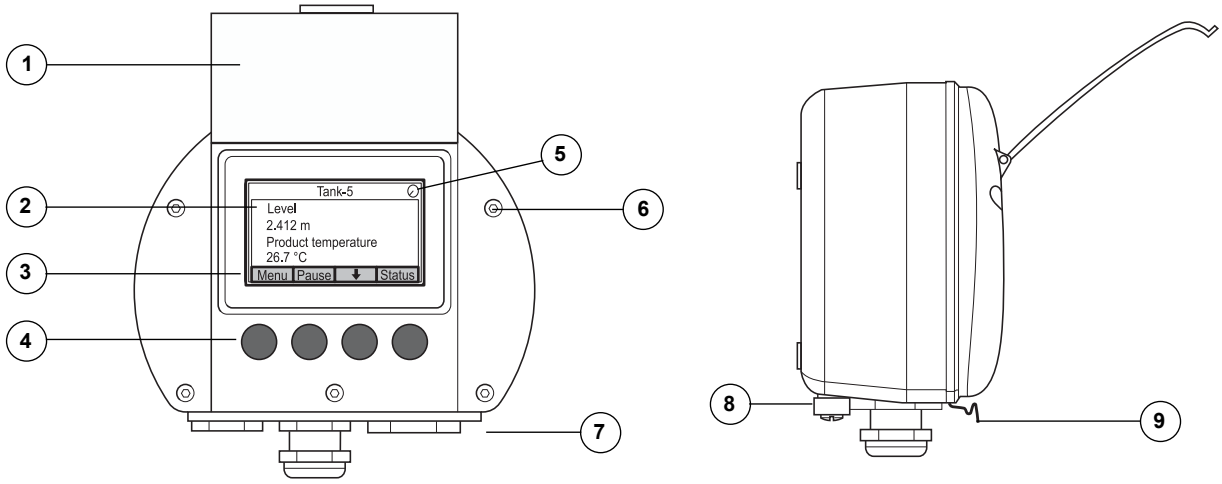
Figure 2-1. System integration



(1) The intrinsically safe Tankbus complies with the FISCO FOUNDATION™ fieldbus standard. See reference document IEC/TS 60079-27.

2.2 2230 COMPONENTS

Figure 2-2. Rosemount 2230 components



1. Weather protection lid(1)
2. Display
3. Menu
4. Soft keys
5. Activity indicator
6. Cover screw
7. Cable entries: two M20 x 1.5 and one M25 x 1.5 (optional: ½ - 14 NPT and ¾ - 14 NPT adapters)
8. Ground screw
9. Locking spring for weather protection

(1) It is recommended that the lid is closed whenever possible to protect the LCD from exposure by ultraviolet radiation from the sun.

2.3 SYSTEM OVERVIEW

The Rosemount Tank Gauging state-of-the art inventory and custody transfer radar tank level gauging system is developed for a wide range of applications at refineries, tank farms and fuel depots, and fulfills the highest requirements on performance and safety.

The field devices on the tank communicate over the intrinsically safe *Tankbus*. The Tankbus is based on a standardized fieldbus, the FISCO(1) FOUNDATION™ fieldbus, and allows integration of any device supporting that protocol. By utilizing a bus powered 2-wire intrinsically safe fieldbus the power consumption is minimized. The standardized fieldbus also enables integration of other vendors' equipment on the tank.

The Rosemount Tank Gauging product portfolio includes a wide range of components to build small or large customized tank gauging systems. The system includes various devices, such as radar level gauges, temperature transmitters, and pressure transmitters for complete inventory control. Such systems are easily expanded thanks to the modular design.

The versatile Rosemount Tank Gauging system is compatible with, and can emulate, all major tank gauging systems. Moreover, the well-proven emulation capability enables step-by-step modernization of a tank farm, from level gauges to control room solutions.

It is possible to replace old mechanical or servo gauges with modern Rosemount Tank Gauging gauges, without replacing the control system or field cabling. It is further possible to replace old HMI/SCADA-systems and field communication devices without replacing the old gauges.

There is a distributed intelligence in the various system units which continuously collect and process measurement data and status information. When a request for information is received an immediate response is sent with updated information.

The flexible Rosemount Tank Gauging system supports several combinations to achieve redundancy, from control room to the different field devices. Redundant network configuration can be achieved at all levels by doubling each unit and using multiple control room work stations.

(1) See documents IEC 61158-2 and IEC/TS 60079-27

Figure 2-3. Rosemount Tank Gauging System architecture

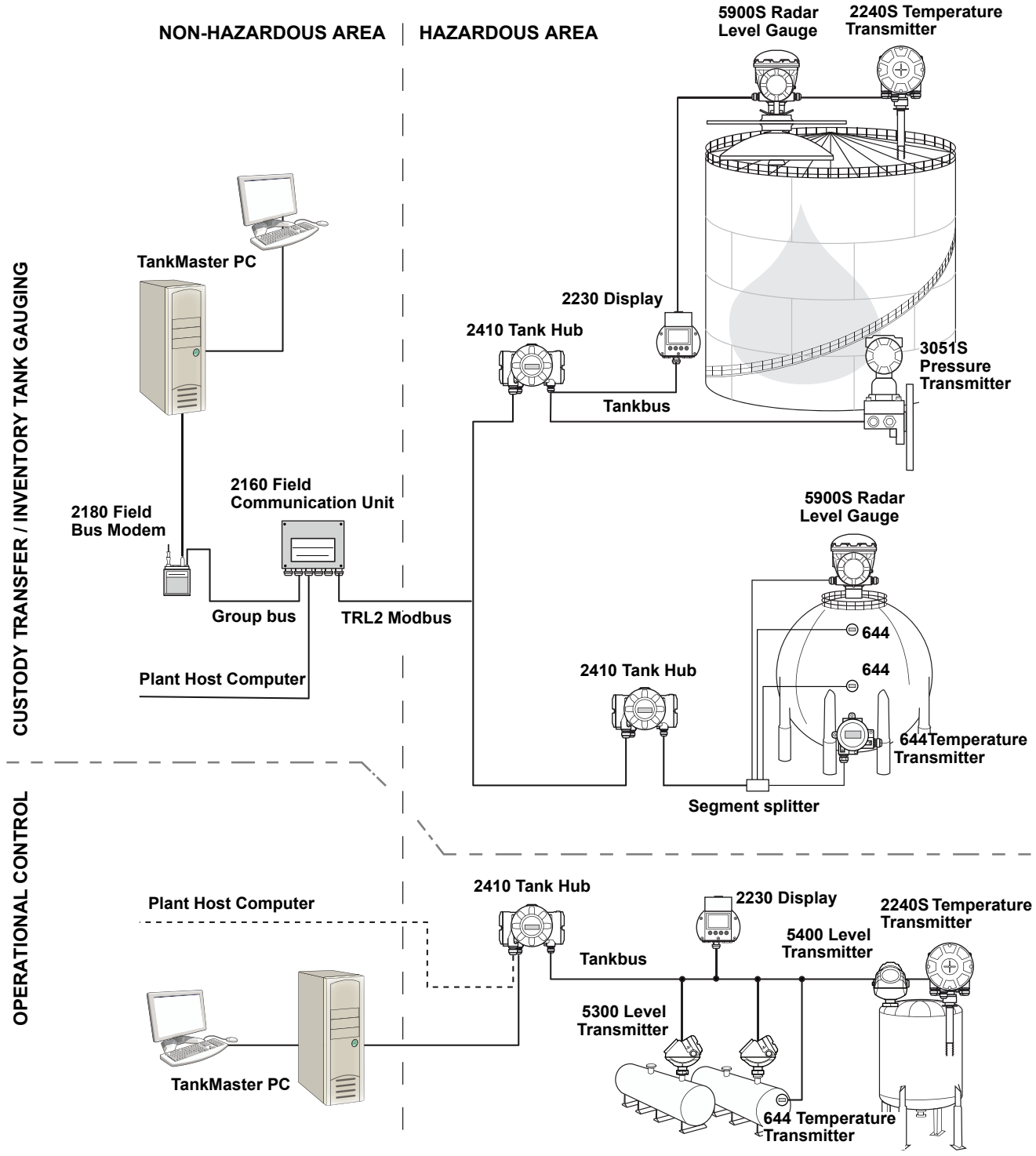


Figure 2-4. Rosemount Tank Gauging system architecture for wireless systems

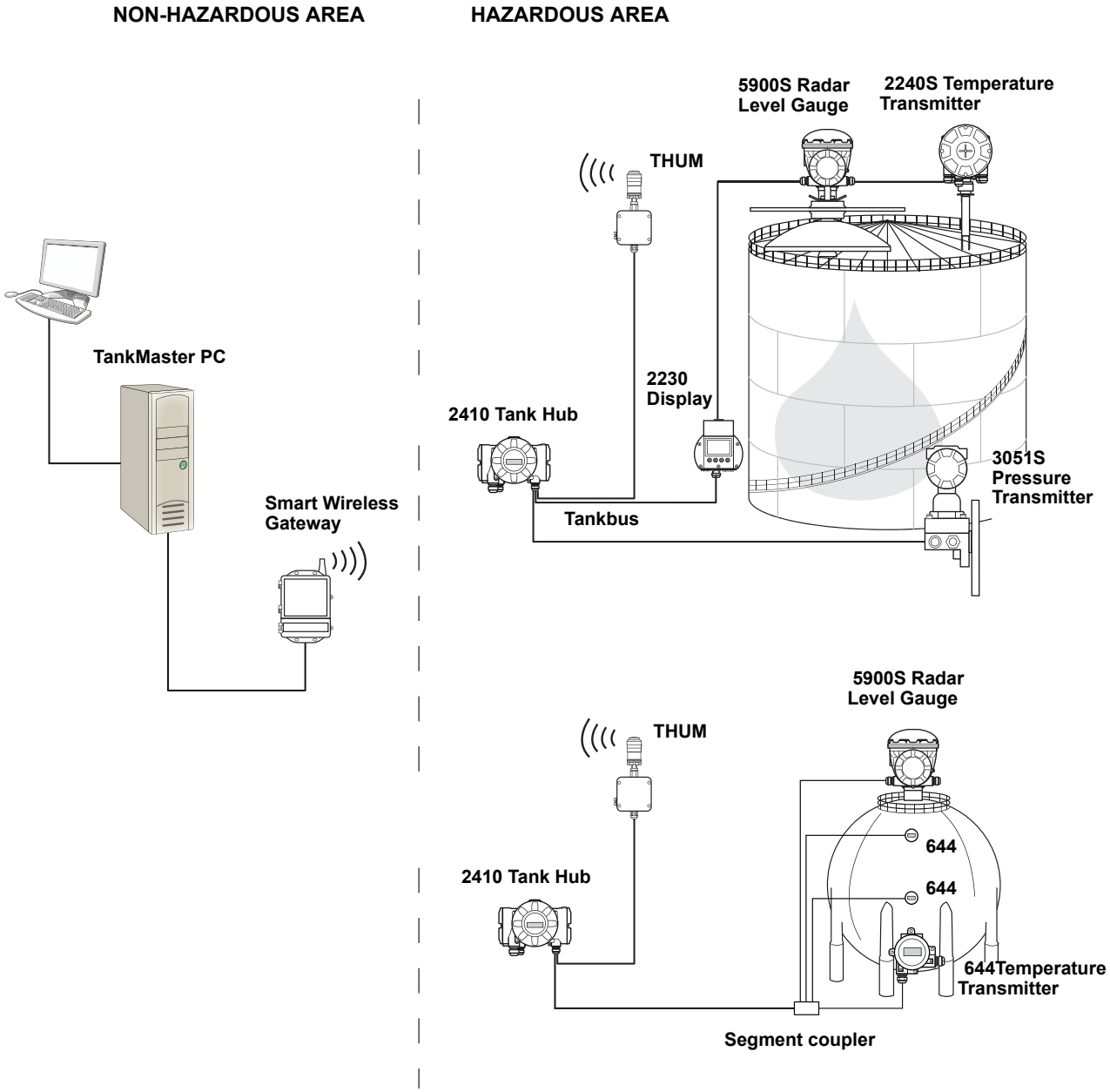
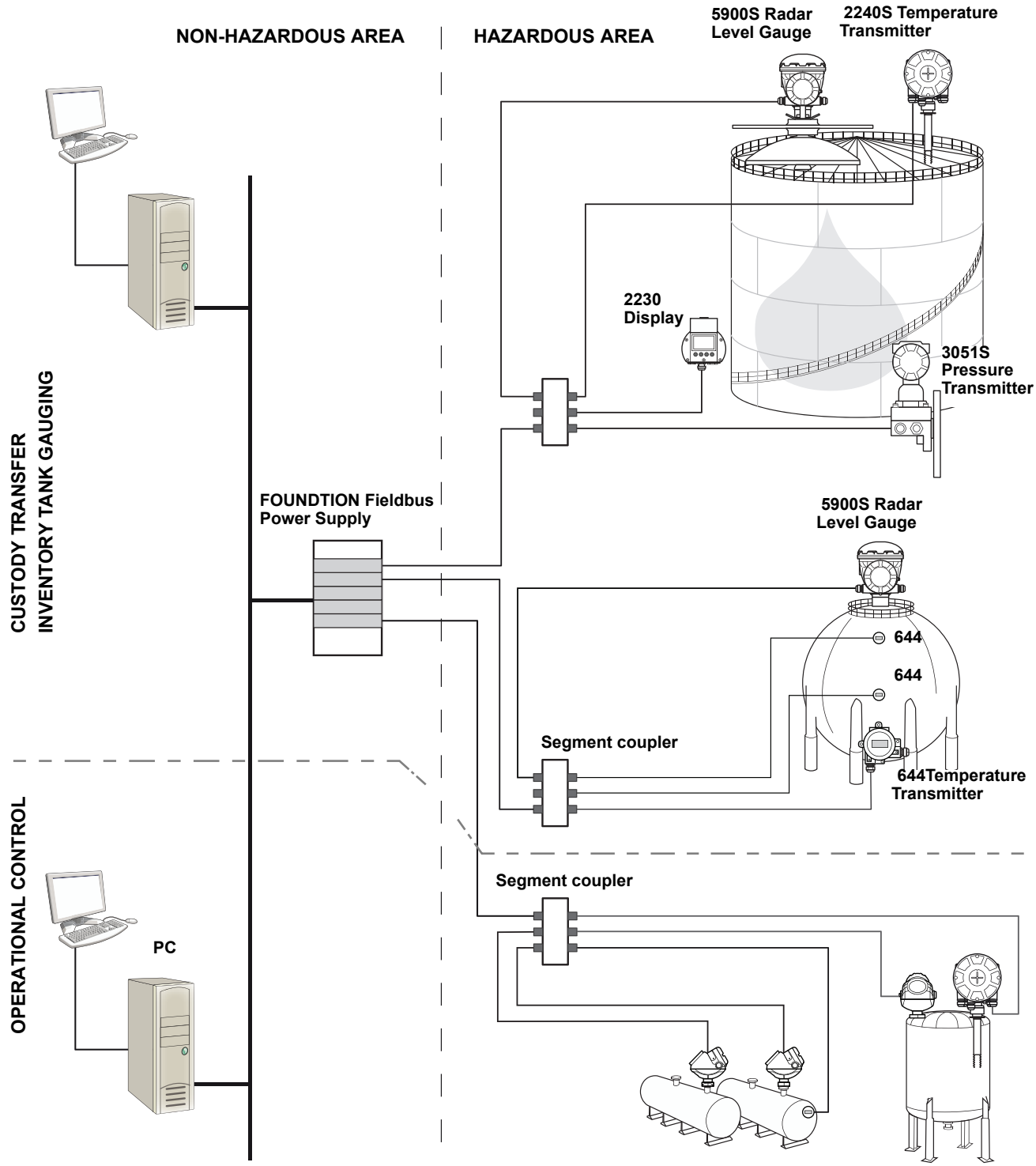


Figure 2-5. Rosemount Tank Gauging system architecture in a Foundation fieldbus network



TankMaster HMI Software

TankMaster is a powerful Windows-based Human Machine Interface (HMI) for complete tank inventory management. It provides configuration, service, set-up, inventory, and custody transfer functions for Rosemount Tank Gauging systems and other supported instruments.

TankMaster is designed to be used in the Microsoft Windows XP and Vista environment providing easy access to measurement data from your Local Area Network.

The *TankMaster WinOpi* program lets the operator monitor measured tank data. It includes alarm handling, batch reports, automatic report handling, historical data sampling as well as inventory calculations such as Volume, Observed Density and other parameters. A plant host computer can be connected for further processing of data.

The *TankMaster WinSetup* program is a graphical user interface for installation, configuration and service of the different devices in the Rosemount Tank Gauging system.

Rosemount 2160 Field Communication Unit

The 2160 Field Communication Unit (FCU) is a data concentrator that continuously polls and stores data from field devices such as radar level gauges and temperature transmitters in a buffer memory. Whenever a request for data is received, the FCU can immediately send data from a group of tanks from the updated buffer memory.

Rosemount 2410 Tank Hub

The Rosemount 2410 Tank Hub acts as a power supply to the connected field devices in the hazardous area using the intrinsically safe Tankbus.

The 2410 collects measurement data and status information from field devices on a tank. It has two external buses for communication with various host systems.

There are two versions of the 2410 for single tank or multiple tanks operation. The 2410 multiple tanks version supports up to 10 tanks and 16 devices. With the Rosemount 5300 and 5400 level transmitters the 2410 supports up to 5 tanks.

The 2410 is equipped with two relays which support configuration of up to 10 “virtual” relay functions allowing you to specify several source signals for each relay.

The 2410 supports Intrinsically Safe (IS) and Non-Intrinsically Safe (Non-IS) analog 4-20 mA inputs/outputs. By connecting a Smart Wireless THUM Adapter to the IS HART 4-20 mA output, the 2410 is capable of wireless communication with a Smart Wireless Gateway in a WirelessHART network.

Rosemount 5900S Radar Level Gauge

The *Rosemount 5900S* Radar Level Gauge is an intelligent instrument for measuring the product level inside a tank. Different antennas can be used in order to meet the requirements of different applications. The 5900S can measure the level of almost any product, including bitumen, crude oil, refined products, aggressive chemicals, LPG and LNG.

The *Rosemount 5900S* sends microwaves towards the surface of the product in the tank. The level is calculated based on the echo from the surface. No part of the 5900S is in actual contact with the product in the tank, and the antenna is the only part of the gauge that is exposed to the tank atmosphere.

The *2-in-1* version of the 5900S Radar Level Gauge has two radar modules in the same transmitter housing allowing two independent level measurements using one antenna.

Rosemount 5300 Guided Wave Radar

The Rosemount 5300 is a premium 2-wire guided wave radar for level measurements on liquids, to be used in a wide range of medium accuracy applications under various tank conditions. Rosemount 5300 includes the 5301 for liquid level measurements and the 5302 for liquid level and interface measurements.

Rosemount 5400 Radar Level Transmitter

The Rosemount 5400 is a reliable 2-wire non-contact radar level transmitter for liquids, to be used in a wide range of medium accuracy applications under various tank conditions.

Rosemount 2240S Multi-Input Temperature Transmitter

The *Rosemount 2240S* Multi-input Temperature Transmitter can connect up to 16 temperature spot sensors and an integrated water level sensor.

Rosemount 2230 Graphical Field Display

The Rosemount 2230 Graphical Field Display presents inventory tank gauging data such as level, temperature, and pressure. The four softkeys allow you to navigate through the different menus to provide all tank data, directly in the field. The Rosemount 2230 supports up to 10 tanks. Up to three displays can be configured by using the TankMaster WinSetup configuration software.

Rosemount 644 Temperature Transmitter

The Rosemount 644 is used with single spot temperature sensors.

Rosemount 3051S Pressure Transmitter

The 3051S series consists of transmitters and flanges suitable for all kinds of applications, including crude oil tanks, pressurized tanks and tanks with / without floating roofs.

By using a 3051S Pressure Transmitter near the bottom of the tank as a complement to a 5900S Radar Level Gauge, the density of the product can be calculated and presented. One or more pressure transmitters with different scalings can be used on the same tank to measure vapor and liquid pressure

Rosemount 2180 Field Bus Modem

The Rosemount 2180 field bus modem (FBM) is used for connecting a TankMaster PC to the TRL2 communication bus. The 2180 is connected to the PC using either the RS232 or the USB interface.

Rosemount Smart Wireless Gateway and Rosemount Smart Wireless THUM Adapter

A THUM Adapter allows wireless communication between a 2410 Tank Hub and a Smart Wireless Gateway. The gateway is the network manager that provides an interface between field devices and the TankMaster inventory software or host / DCS systems.

See the *Raptor System Data Sheet* (Document no. 704010en) for more information on the various devices and options.

2.3.1 System Start-up

The standard start-up procedure of a Rosemount Tank Gauging system that includes devices such as the 2160 Field Communication Unit, 2410 Tank Hub, 5900S Radar Level Gauge, and the 2240S Multi-input Temperature Transmitter can be summarized as follows:

1. Install the devices on the appropriate locations.
2. Assign Modbus addresses(1) for the Rosemount 2410 Tank Hub, for level gauges such as the 5900S Radar Level Gauge, and for auxiliary tank devices (ATD) such as the 2240S Multi-input Temperature Transmitter. The Modbus addresses will be stored in the built-in databases of the *Rosemount 2410 Tank Hub* and the *Rosemount 2160 Field Communication Unit*.
3. Verify that the total current consumption of devices connected to the Tankbus does not exceed 250 mA(2). In a Smart Wireless System the maximum current is 200 mA.
4. Wire the devices.
   - Connect field devices to the Tankbus.
     Note! Devices must be configured in the tank database(1)(2) of the Rosemount 2410 Tank Hub in order to be able to communicate on the Tankbus.
   - Connect the Rosemount 2410 Tank Hub to the Rosemount 2160 Field Communication Unit.
   - Connect the Rosemount 2160 Field Communication Unit to the control room PC with TankMaster software. The 2160 may be connected via a Rosemount 2180 Field Bus Modem, or directly via RS 232 or RS 485.
5. Install the TankMaster software in the control room PC.
6. Configure the devices by using the TankMaster WinSetup configuration tool as described in the *Rosemount Raptor System Configuration Manual* (Document no. 300510EN).

FOUNDATION Fieldbus

To start up *Rosemount Tank Gauging* devices in a FOUNDATION fieldbus system:

1. Prepare the start-up by recording information that will be needed for configuration of various field devices as described in the *Rosemount Raptor System Configuration* manual. This may for example include tank geometry, antenna type, number of temperature elements and other configuration parameters.
2. Connect the field devices, such as the Rosemount 5900S Radar Level Gauge and the Rosemount 2240S Multi-input Temperature Transmitter, to the FOUNDATION fieldbus network.
3. Configure the field devices by using the AMS Device Manager.

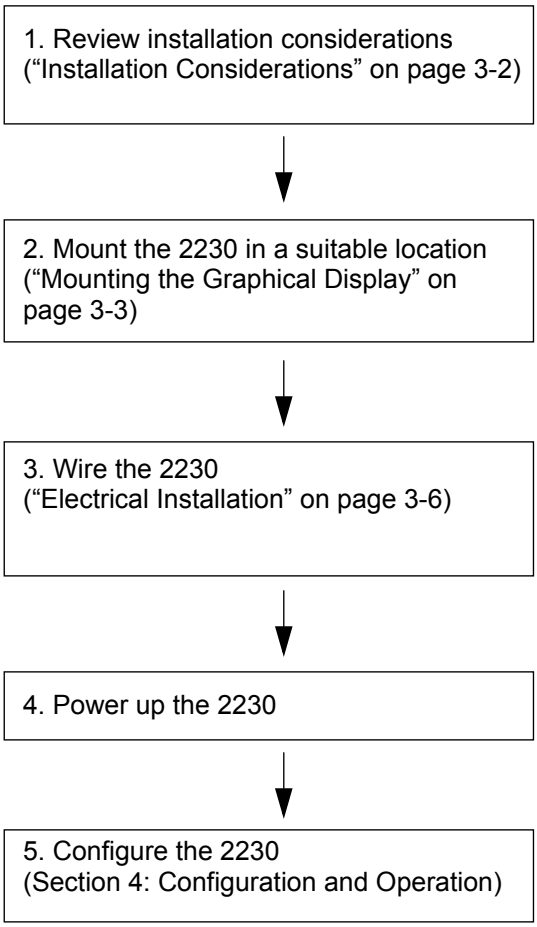
See the Reference Manual for the respective field device and the *Rosemount Raptor System Configuration* manual (Document No. 300510) for more information on how to configure various Raptor devices. See section “Technical Documentation” on page 1-4 for a list of available documentation.

(1) See the Rosemount Raptor System Configuration Manual (Document no. 300510) for more information

(2) See the Rosemount 2410 Tank Hub Reference Manual, Document No. 300530 for more information

2.4 INSTALLATION PROCEDURE

Follow these steps for proper installation of the Rosemount 2230 Graphical Field Display:



Section 3 Installation

3.1 SAFETY MESSAGES

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

⚠WARNING

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

Make sure only qualified personnel perform the installation.

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 service other than those contained in this manual unless you are qualified.

Substitution of components may impair Intrinsic Safety.

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

⚠WARNING

Explosions could result in death or serious injury:

Verify that the operating environment of the display is consistent with the appropriate hazardous locations certifications.

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

Do not remove the device cover in explosive atmospheres when the circuit is alive.

⚠WARNING

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

Avoid contact with leads and terminals.

Make sure the main power to the Tank Hub is off and the lines to any other external power source are disconnected or not powered while wiring the device.

3.2 MECHANICAL INSTALLATION

3.2.1 Installation Considerations

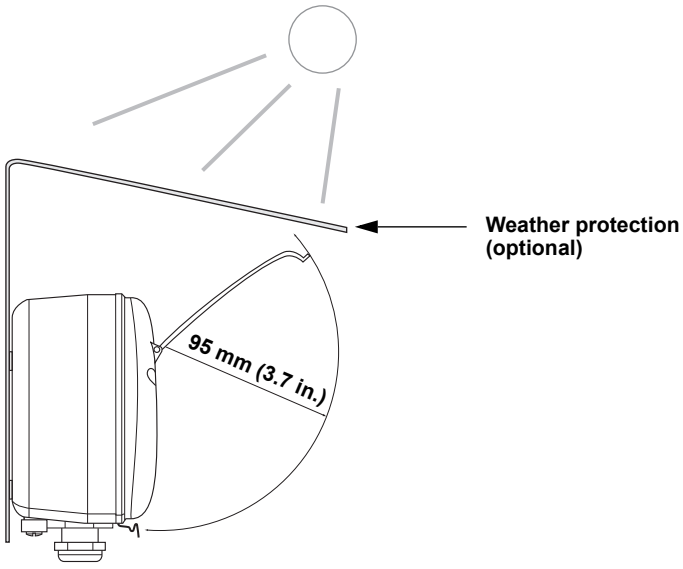
The Rosemount 2230 Graphical Field Display can be installed either on the tank roof or at the foot of the tank for a flexible and convenient read-out of tank data.

The 2230 is designed for mounting on a plate, on a wall, or on a pipe. The display is attached to the plate with four M4 screws. It is important to provide space for opening the weather protection lid which prevents degradation of the LCD display due to sunlight exposure.

Consider the following when finding an appropriate location for the Rosemount 2230 Graphical Field Display:

- Mount the 2230 in a location where it is protected from excessive sun light. This will reduce exposure to ultra violet (UV) radiation and extend the life-time of the LCD.
- In case the 2230 can not be protected from sun light and UV radiation, it is recommended that the weather protection lid (see “2230 Components” on page 2-2) is closed whenever the 2230 is not used.
- An optional weather protection is available as an alternative method to protect the 2230.
- When mounting the 2230 display ensure that sufficient space is provided for opening the lid, see Figure 3-1.

Figure 3-1. Space required for opening the lid



3.2.2 Mounting the Graphical Display

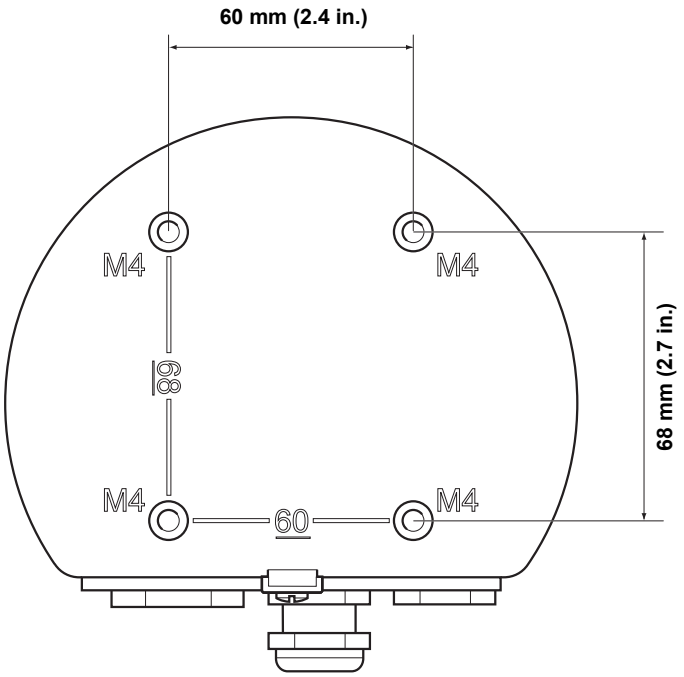
The Rosemount 2230 Graphical Field Display is designed for mounting on a plate, wall, or pipe.

Mounting on a Plate

The 2230 display can be mounted on a plate by attaching four M4 screws to the back of the display. To mount the 2230:

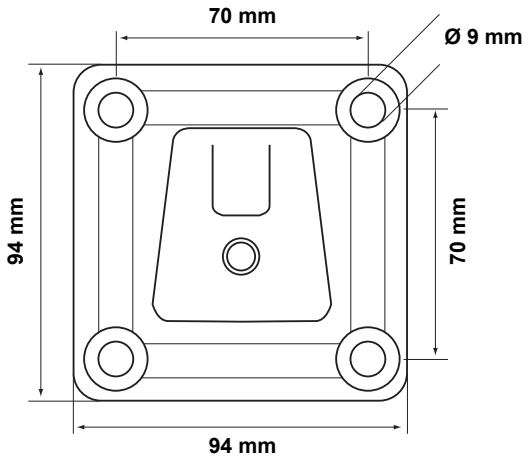
1. Drill four holes in the plate according to the hole pattern on the back of the 2230 display as illustrated in Figure 3-2.
2. Mount the 2230 on the plate using four M4 screws. Note that the M4 screws that are shipped with the 2230 display can be used as long as the plate thickness does not exceed 5 mm (0.2 in.).

Figure 3-2. Mounting hole pattern

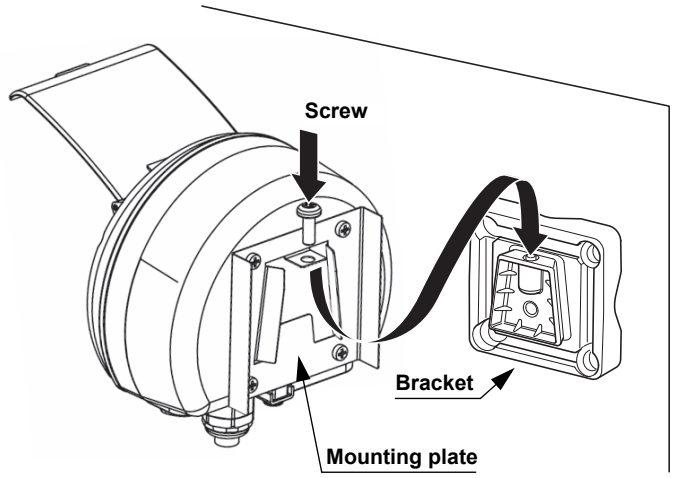


Wall Mounting with Bracket

The Rosemount 2230 Graphical Field Display can be mounted on a wall by using the optional mounting kit supplied by Rosemount Tank Gauging.



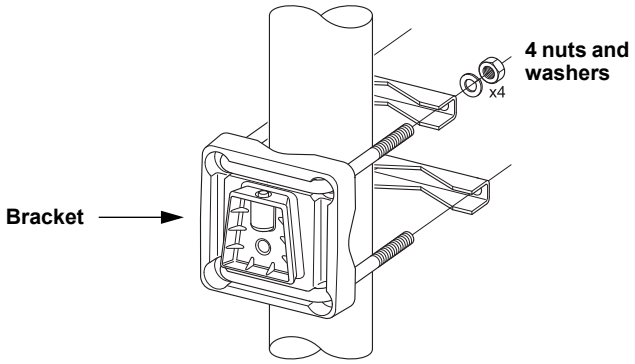
1. Mount the bracket on the wall by using four M8 screws and flat washers. **Note**! Countersunk screws are not suitable.



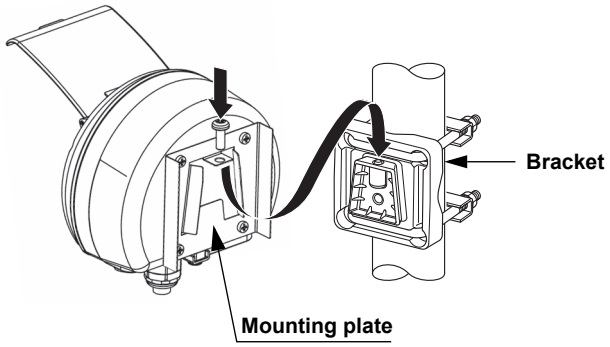
2. Attach the mounting plate to the back of the 2230 housing.
3. Attach the 2230 display to the bracket on the wall and tighten the locking screw.

Pipe Mounting

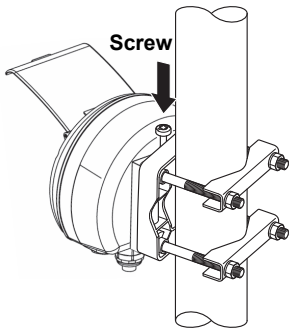
The 2230 can be mounted on pipes ranging from a diameter of 33 to 60 mm by using an optional mounting kit supplied by Rosemount Tank Gauging.



1. Attach the bracket to the pipe.
2. Ensure that the 2230 is placed in a direction so that the display is clearly visible and wiring can be properly connected.
3. Tighten the nuts. Use moderate torque to ensure that the bracket does not break.



4. Attach the mounting plate to the back of the 2230 housing.
5. Attach the 2230 to the bracket by sliding it from the top downwards.



6. Secure the 2230 to the bracket by tightening the locking screw.

3.3 ELECTRICAL INSTALLATION

3.3.1 Cable/Conduit Entries

The electronics housing has three entries, two M20×1.5 and one M25×1.5 (Optional: adapters for two ½ - 14 NPT and one ¾- NPT). Minifast and eurofast adapters are also available. The connections are made in accordance with local or plant electrical codes.

Make sure that unused ports are properly sealed to prevent moisture or other contamination from entering the electronics housing.

NOTE!
Use a enclosed metal plug to seal the unused entry/entries. The plastic plugs mounted at delivery are not sufficient as seal!

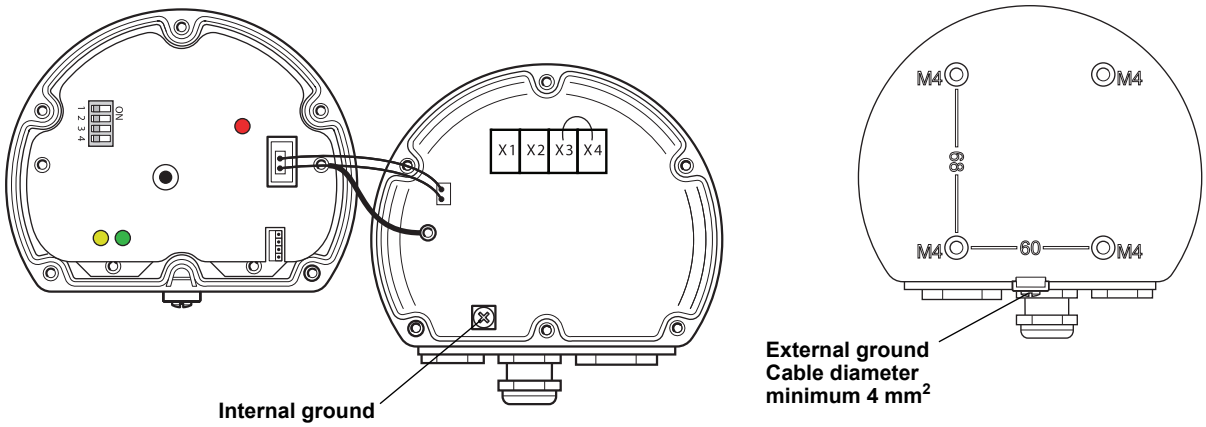
3.3.2 Grounding

The housing should always be grounded in accordance with national and local electrical codes. Failure to do so may impair the protection provided by the equipment. The most effective grounding method is direct connection to earth ground with minimal impedance.

There is an external grounding screw located at the bottom of the housing and an internal grounding screw located inside the housing, see Figure 3-3.

The internal ground screw is identified by a ground symbol: ⏚.

Figure 3-3. Grounding screws



NOTE!
When grounding the display via threaded conduit, make sure the connection provides sufficient low impedance.

Grounding - FOUNDATION™ Fieldbus

Signal wiring of the fieldbus segment must not be grounded. Grounding one of the signal wires will shut down the entire fieldbus segment.

Shield Wire Connection

To protect the fieldbus segment from noise, grounding techniques for shield wire usually require a single grounding point for shield wire to avoid creating a ground loop. The ground point is typically at the power supply (Rosemount 2410 Tank Hub).

The Rosemount Tank Gauging devices are designed for “daisy-chain” connection of shield wiring in order to enable a continuous shield throughout the Tankbus network. The shield wire terminal in the 2230 is not connected to ground. It merely provides electrical continuity to daisy-chained Tankbus cables.

3.3.3 Cable Selection

Use shielded twisted pair wiring for the Rosemount 2230 in order to comply with FISCO(1) requirements and EMC regulations. The cables must be approved for use in hazardous areas, where applicable. In the U.S. explosion-proof conduits may be used in the vicinity of the vessel.

We recommend cable size 0.75 mm^2 (18 AWG) in order to facilitate wiring. Cables within the range 22 AWG to 16 AWG (0.5 t o1.5 mm^2) can be used in order to minimize the voltage drop to the 2230 display.

Tankbus cabling must be approved for use in minimum 85°C to match requirements for all devices in a Rosemount Tank Gauging system.

The FISCO specification requires that cables for the Tankbus comply with the following parameters:

Table 3-1. FISCO cable parameters

Parameter	Value
Loop resistance	15Ω/km to 150Ω/km
Loop inductance	0.4 mH/km to 1 mH/km
Capacitance	45 nF/km to 200 nF/km
Maximum length of each spur cable	60 m in apparatus class IIC and IIB
Maximum length of each trunk cable	1000 m in apparatus class IIC and 1900 m in apparatus class IIB

3.3.4 Hazardous Areas

When the Rosemount 2230 is installed in a hazardous area, national and local regulations and specifications in applicable certificates must be observed, see Appendix B: Product Certifications.

3.3.5 Power Requirements

The Rosemount 2230 is powered over the intrinsically safe Tankbus by the Rosemount 2410 Tank Hub. The 2410 feeds the intrinsically safe fieldbus segment by acting as a FISCO power supply on the Tankbus (9 - 17.5 Vdc, polarity insensitive). The 2230 has a current consumption of 30 mA.

See the *Rosemount 2410 Reference Manual* (Document no. 305030EN) for more information.

When installed in a FOUNDATION fieldbus system, the Rosemount 2230 is powered by the FF segment with standard fieldbus power supplies.

(1) See IEC 61158-2 and IEC/TS 60079-27:2002.

3.3.6 The Tankbus

The Rosemount Tank Gauging system is easy to install and wire. Devices can be “daisy-chained” thus reducing the number of segment couplers.

In a Rosemount Tank Gauging system devices communicate with a Rosemount 2410 Tank Hub via the intrinsically safe Tankbus. The Tankbus complies with the FISCO(1) FOUNDATION fieldbus standard. The Rosemount 2410 acts as power supply to the field devices on the Tankbus.

Termination

A terminator is needed at each end of a FOUNDATION Fieldbus network. Generally, one terminator is placed in the fieldbus power supply, and the other one in the last device in the fieldbus network.

NOTE!
Ensure that there are **two** terminators on the fieldbus.

The Rosemount 2410 Tank Hub acts as power supply. Since the 2410 normally is the first device in the fieldbus segment, the built-in termination is enabled at factory.

Other devices such as the Rosemount 5900S Radar Level Gauge, the Rosemount 2230 Graphical Field Display, and the Rosemount 2240S Multi-input Temperature Transmitter also have built-in terminators which can easily be enabled by inserting a jumper in the terminal block when necessary.

Segment design

When designing a FISCO fieldbus segment a few requirements need to be considered. Cabling has to comply with FISCO requirements as described in “Cable Selection” on page 3-7.

You will also have to ensure that the total operating current of the connected field devices is within the output capability of the Rosemount 2410 Tank Hub. The 2410 is able to deliver 250 mA. In a Smart Wireless System the maximum current is 200 mA. Consequently, the number of field devices has to be considered so that the total current consumption is less than the available current. See section “Power Budget” in the Rosemount 2410 Reference Manual (Document No. 300530EN) for more information

Another requirement is to ensure that all field devices have at least 9 V input voltage at their terminals. Therefore you will have to take into account the voltage drop in the fieldbus cables.

Distances are normally quite short between the Rosemount 2410 Tank Hub and field devices on the tank. In many cases you can use existing cables as long as the FISCO requirements are fulfilled (see “Cable Selection” on page 3-7).

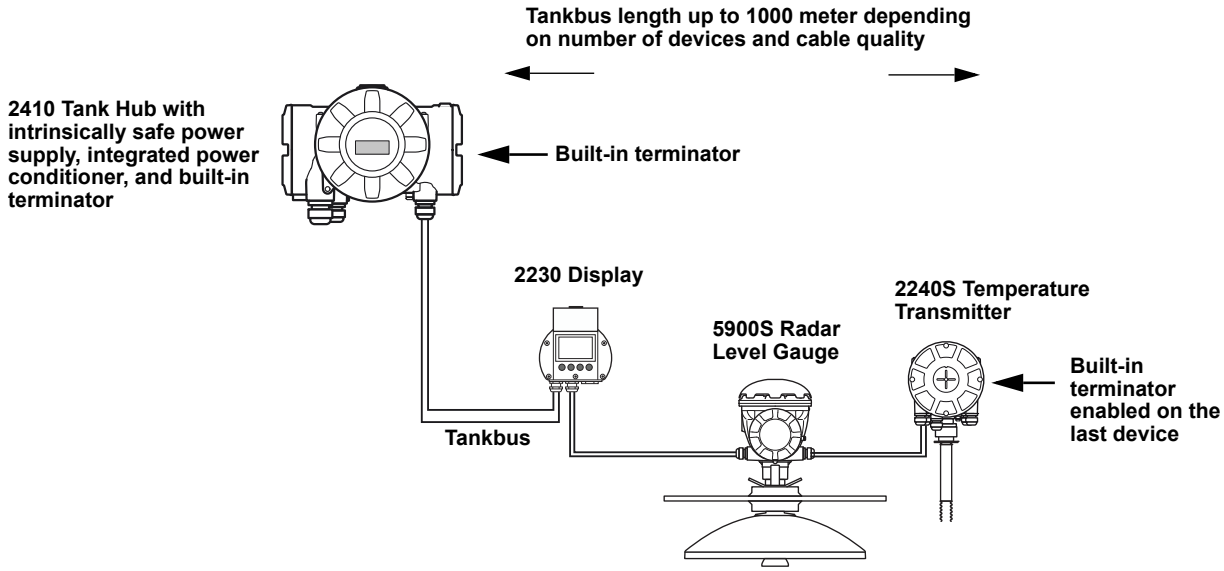
See section ”The Tankbus” in the *Rosemount 2410 Reference Manual* (Document no. 305030EN) for more information on segment design of a Rosemount Tank Gauging system.

(1) FISCO=Fieldbus Intrinsically Safe Concept

3.3.7 Typical installations

The example below in Figure 3-4 illustrates a system with terminators at both ends of the fieldbus segment as required in a FOUNDATION fieldbus system. In this case terminators are enabled in the Rosemount 2410 Tank Hub and a field device at the end of the network segment.

Figure 3-4. Example of Tankbus connection for a single tank



The maximum distance between the 2410 Tank Hub and the field devices on the tank depends on the number of devices connected to the Tankbus and the quality of cables.

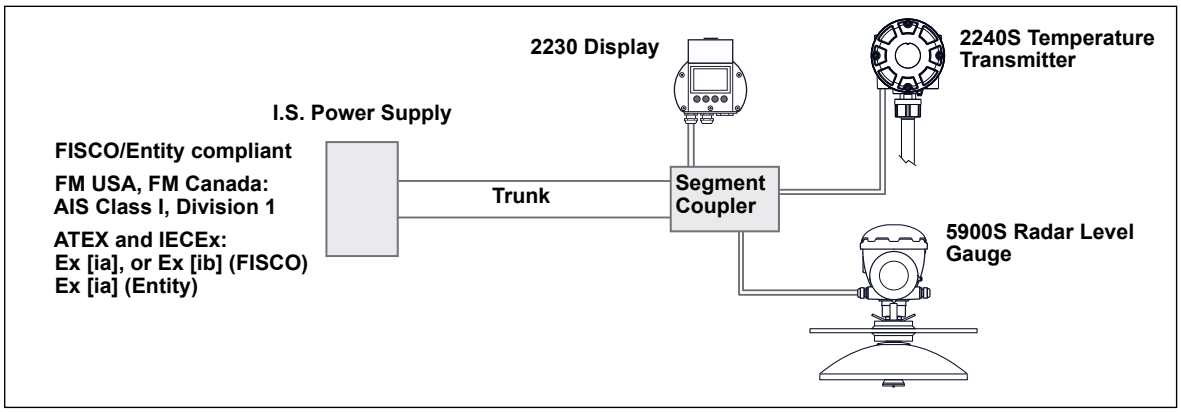
See chapter “Electrical Installation” in the *Rosemount 2410 Reference Manual* (Document no. 305030EN) for more information about cable selection, power budget, and the 2410 Tankbus.

See also “Typical Installations” in the *Rosemount 2410 Reference Manual* (Document no. 305030EN) for more examples of how to install Rosemount Tank Gauging systems that include the 2410 Tank Hub.

3.3.8 2230 in FOUNDATION fieldbus systems

The Rosemount 2230 Display supports the FOUNDATION fieldbus (FF) technology and lets you integrate a 2230 into an existing FF network. As long as the power supply meets certain requirements (see Figure 3-5 and Figure 3-6) the 2230(1) will be able to operate as any other FF device.

Figure 3-5. Example of an I.S. FOUNDATION fieldbus system

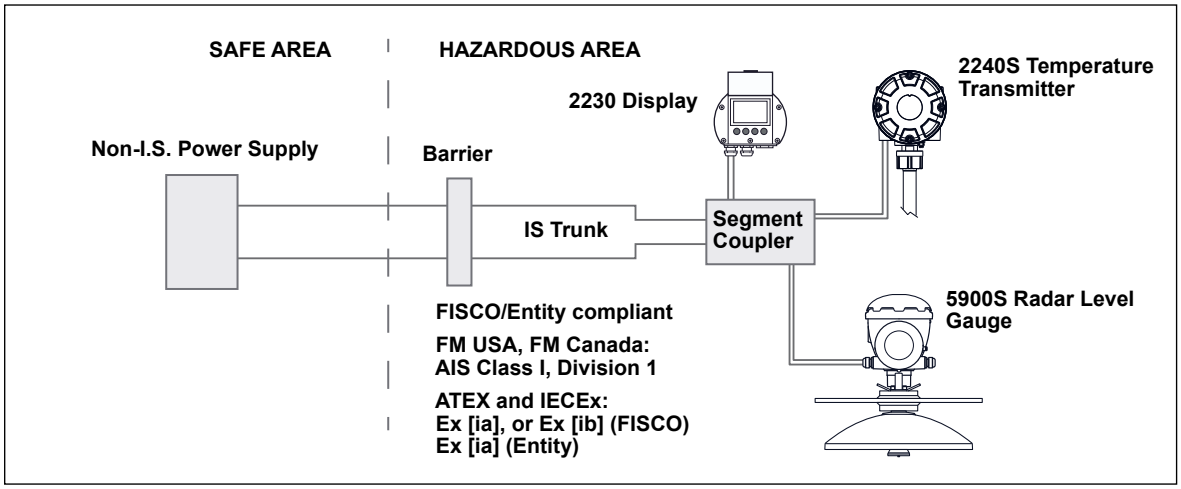


Ensure that the power supply is able to provide the total current needed for all the connected devices. See “Power Requirements” on page 3-7 for further information.

Ensure that the 2230 and other devices connected to the FOUNDATION fieldbus (FF) system are compliant with the FISCO or Entity parameters of the power supply.

Ensure that the short circuit protection of the Segment Coupler(2) matches the current consumption of the connected devices.

Figure 3-6. Example of a Non-I.S. FOUNDATION fieldbus system



(1) See Appendix B: Product Certifications for 2230 approval information
(2) See the Rosemount 2410 Reference Manual (Document No. 300530EN) for more information on the Segment Coupler.

3.3.9 Wiring

Use the following wiring procedure for the Rosemount 2230:

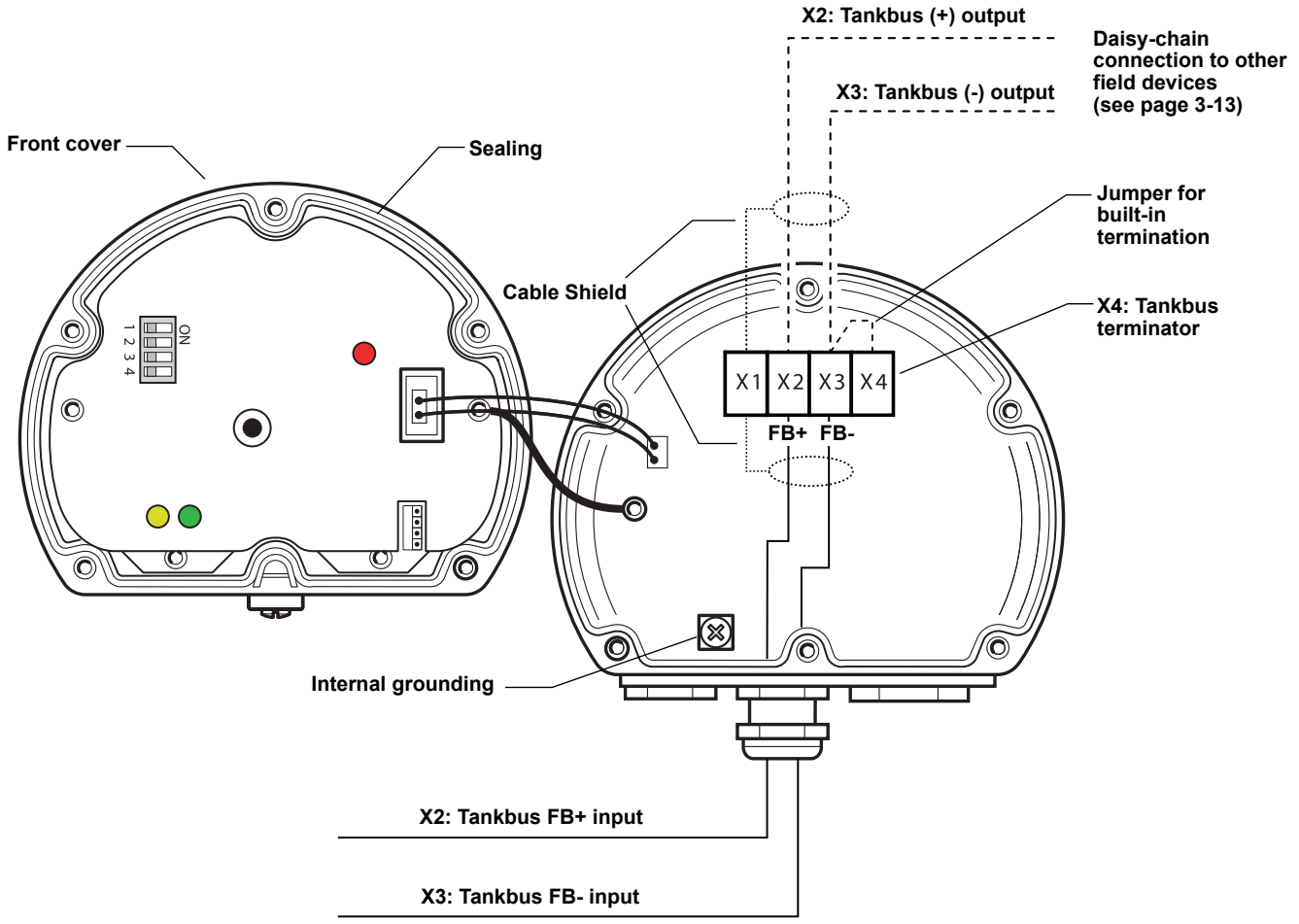
1. Unscrew and remove all screws at the front of the display.
2. Remove the cover carefully. Take care of the locking spring for the weather protection hatch, see “2230 Components” on page 2-2.

NOTE!
Do not disconnect the cables between the display front and the circuit board. Ensure that the compartment is protected against water in case of rain.

3. Run the Tankbus cable through the gland.
4. Connect the Tankbus wires to the **X2** and **X3** terminals as illustrated in Figure 3-7 on page 3-12. Ensure that the positive lead is connected to the terminal marked **FB+** and the negative lead to the terminal marked **FB-**.
5. Connect the cable shield to the “Shield Loop Through” (X1) terminal.
6. If the 2230 display is the last device on the Tankbus, connect a jumper for the built-in termination. See “The Tankbus” on page 3-8 for more information on termination.
7. Replace the cover. Make sure that the sealing and the locking device for the weather protection hatch are placed in the correct positions.
8. Firmly tighten the screws on the front cover.

NOTE!
Ensure that o-rings and seats are in good condition prior to mounting the cover in order to maintain the specified level of ingress protection. The same requirements apply for cable inlets and outlets (or plugs). Cables must be properly attached to the cable glands.

Figure 3-7. 2230 cable connections



Daisy-Chain Connection

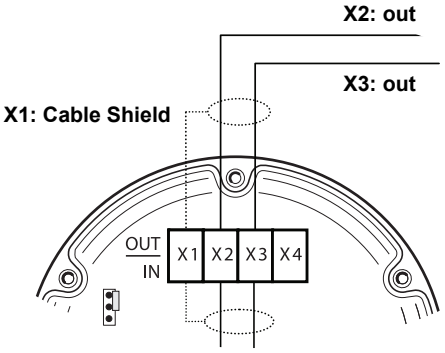
You may use the daisy-chain option in order to connect the Rosemount 2230 to other field devices on the Tankbus:

1. Unscrew and remove all six screws on the front of the Rosemount 2230. Remove the cover carefully. Take care of the locking device for the weather protection hatch.

NOTE!
Do not disconnect the cables between the display front and the circuit board.

2. Disconnect the termination jumper from the X3 terminal, see Figure 3-7 on page 3-12.
3. Run the new Tankbus cable into the 2230 compartment through a suitable gland.
4. Connect the outgoing Tankbus wires to the X2-out and X3-out terminals as shown in Figure 3-8.

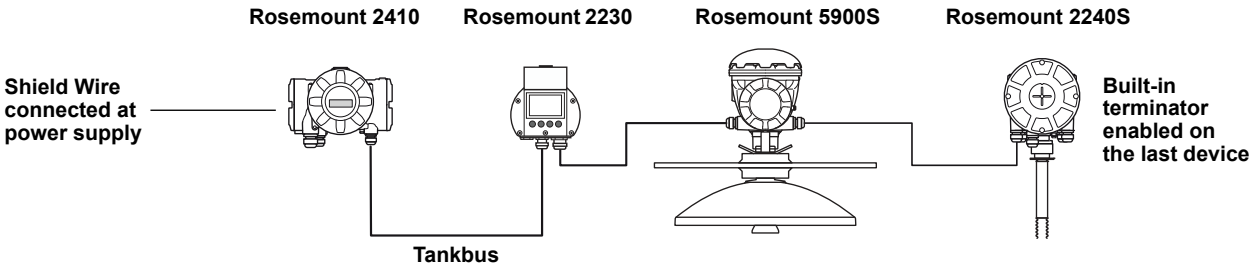
Figure 3-8. Daisy-chain wiring



5. Connect the cable shield to the X1 terminal.
6. Replace the cover. Make sure the sealing and the locking device for the weather protection hatch are placed in the correct positions.
7. Firmly tighten the six screws on the front cover.

Figure 3-9. Wiring diagram for Rosemount 2230

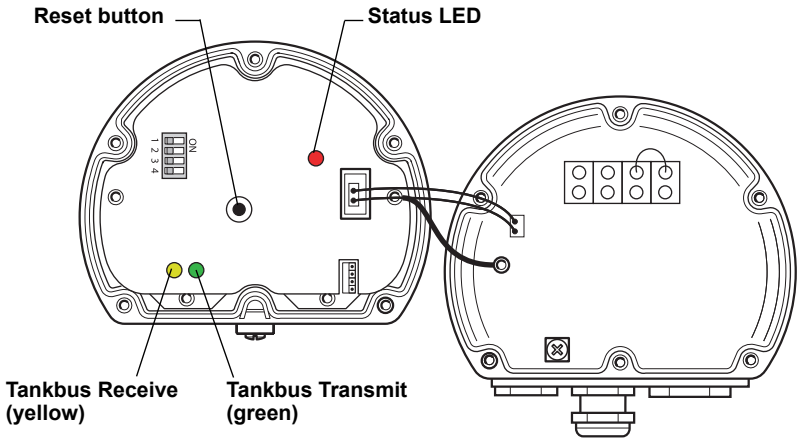
As illustrated in Figure 3-9 the Rosemount 2230 can be daisy-chained to other field devices via the Tankbus.



3.4 LED SIGNALS AND RESET BUTTON

The Rosemount 2230 has three LED signals that show communication and status.

Figure 3-10. LED Signals



Status LED

Using different blinking sequences, the status LED indicates error codes. In normal operation the LED flashes every other second. When an error occurs, the LED flashes a sequence that corresponds to a code number followed by a five second pause. This sequence is continuously repeated (for more information see “Device Error Signals” on page 5-6).

Communication LED:s

Tankbus communication is indicated by a pair of LED:s, see Figure 3-10. When you connect the Tankbus cables you can check the communication status with the LED:s.

Reset Button

You may use the Reset button to force a restart of the Rosemount 2230 display. Restarting the 2230 has the same effect as switching off and on the power supply.

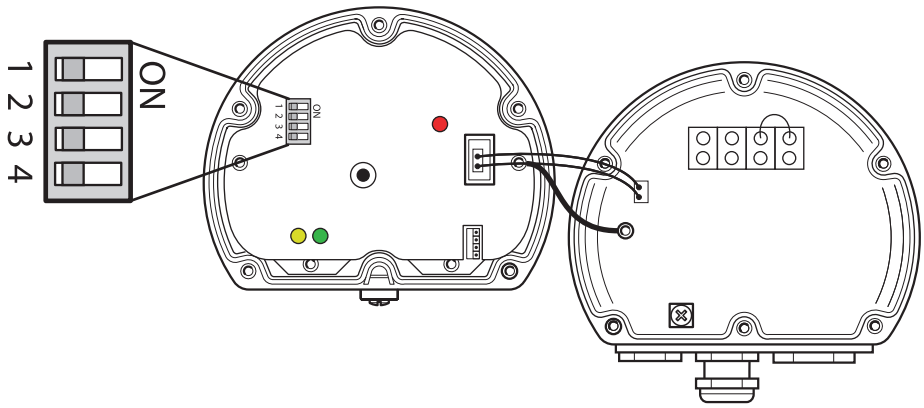
The Restart option will connect the Rosemount 2230 display to the Rosemount 2410 Tank Hub and perform start-up tests of software and hardware.

3.5 SWITCHES

3.5.1 DIP Switches

The Rosemount 2230 is equipped with four DIP switches as illustrated in Figure 3-11.

Figure 3-11. DIP Switches



The switches control the following settings:

Table 3-2. Rosemount 2230 DIP Switches

Number	Name	Description
1	**Simulate**	Enables simulation for test of Field Diagnostics in open FF systems.
2	**Write Protect**	Enables write protection of configuration data.
3	**Spare**	Not used
4	**Spare**	Not used

NOTE!
Manual configuration may override the switch setting.

Simulate Switch

The Simulate switch is used for simulation of Field Diagnostics conditions, useful when testing the alarm setup.

Write Protect Switch

The Write Protect switch can be used to protect the Rosemount 2230 from unintentional changes of the current configuration. See also “Write Protection” on page 5-25.

3.6 AMBIENT TEMPERATURE

The Rosemount 2230 is equipped with a temperature sensor for measuring ambient temperature. The temperature can be displayed on the field display and in the TankMaster software.

The ambient temperature affects the readability and response time of the LCD. This is particularly notable in extremely cold weather. The 2230 automatically adjusts the LCD contrast based on the ambient temperature. The temperature sensor also controls the minimum toggle time used by the 2230 Display.

Section 4 Configuration and Operation

4.1 SAFETY MESSAGES

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

⚠WARNING

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

Make sure only qualified personnel perform the installation.

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 service other than those contained in this manual unless you are qualified.

⚠WARNING

Explosions could result in death or serious injury:

Verify that the operating environment of the display is consistent with the appropriate hazardous locations certifications.

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

Do not remove the device cover in explosive atmospheres when the circuit is alive.

4.2 INTRODUCTION

This chapter provides information about configuration and operation of the Rosemount 2230 Graphical Field Display.

For information on how to use TankMaster WinSetup to configure the 2230, see the *Raptor System Configuration Manual (Document no.300510EN)*.

4.2.1 The 2230 Graphical Field Display

The Rosemount 2230 is a graphical display designed for viewing tank data in tough environments. It features adjustable LCD contrast, backlight, multi-language support, and communication failure indication.

The Rosemount 2230 can be used in systems based on the Rosemount 2410 Tank Hub as well as in Foundation fieldbus networks. The 2230 automatically detects which kind of system it is connected to.

The four softkeys allow you to navigate through the different menus and to select various functions for tank data viewing and service.

Menu: opens the Main Menu with various options for configuration of the 2230 display.

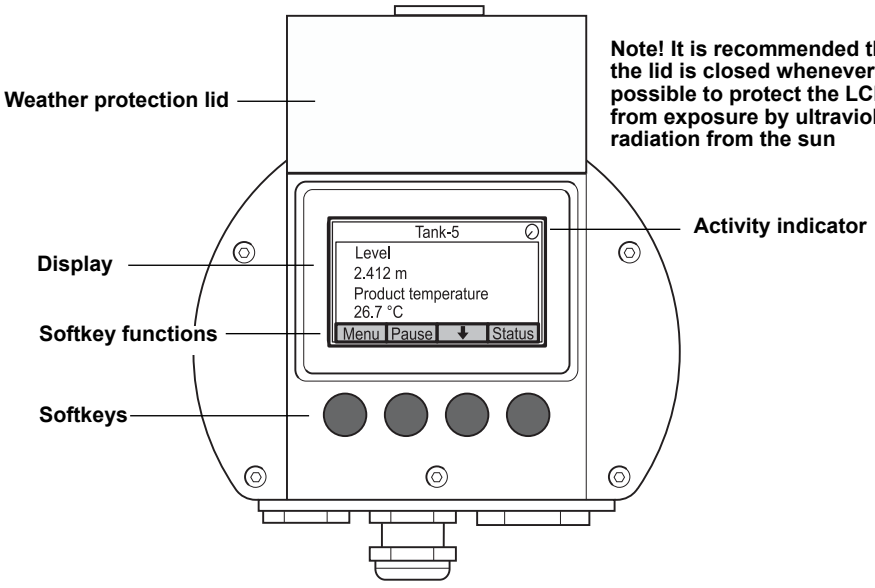
Pause: stops toggling the measurement variables until the Resume button is pressed.

Down arrow ⬇: lets you scroll through the list of measurement variables and tanks.

Status: lets you view the current status of the presented measurement variable. See also “Status Information” on page 5-12.

A symbol in the upper right-hand corner of the display indicates that the 2230 is operating and communicates on the Tankbus.

Figure 4-1. The Rosemount 2230 display



The Rosemount 2230 is powered by the Tankbus (see “Power Requirements” on page 3-7).

Adjusting the display contrast

The 2230 automatically adjusts display contrast to optimize for changes of ambient temperature. The contrast can be manually adjusted when further fine-tuning is desired. To increase the display contrast, press the two buttons on the right-hand side simultaneously. To decrease the contrast, press the two buttons on the left-hand side. It takes approximately 10 seconds to adjust from minimum to maximum contrast.

The contrast can also be adjusted by using the Contrast service command: <Menu><Service><LCD Contrast>.

4.2.2 Configuration Tools

Different tools are available for configuration of a Rosemount 2230.

In Rosemount 2410 Tank Hub systems:

- Rosemount TankMaster Winsetup

In FOUNDATION fieldbus systems:

- Rosemount 475 Field Communicator
- AMS Device Manager for FOUNDATION fieldbus systems
- FOUNDATION fieldbus hosts supporting DD4

TankMaster is an Emerson Process Management/Rosemount Tank Gauging inventory management software package for installation and configuration of tank gauging field devices. The WinSetup package provides you with powerful and easy-to-use tools for installation and configuration. See the *Raptor System Configuration Manual (Document no. 300510EN)* for more information on how to configure the 2230 Display by using TankMaster Winsetup.

For DeltaV users, the DD can be found at www.easydeltav.com. For other hosts that use Device Descriptions (DD) and DD Methods for device configuration, the latest DD versions can be found on FOUNDATION'S website at www.fieldbus.org.

4.2.3 Activity and Alarm Indication

The Rosemount 2230 display shows a warning symbol for simulated or manual measurement values as illustrated in Figure 4-2 and Figure 4-3.

Figure 4-2. Simulated or manual value

Manual or simulated measurement values are indicated by an alarm symbol as shown in Figure 4-2.

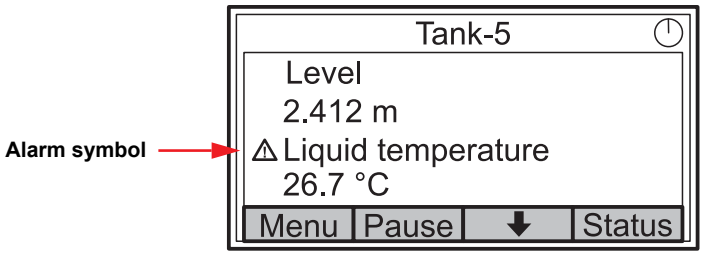


Figure 4-3. Invalid value

For invalid measurement data, the alarm symbol is displayed and no data appears in the measurement value field as illustrated in Figure 4-3.

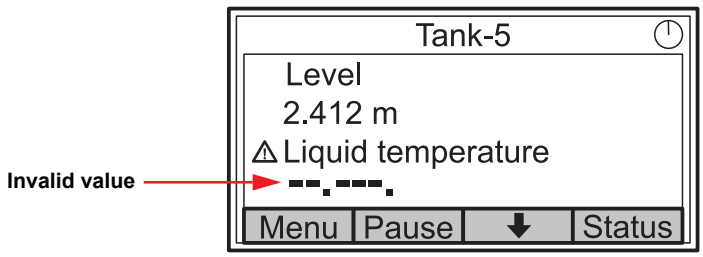
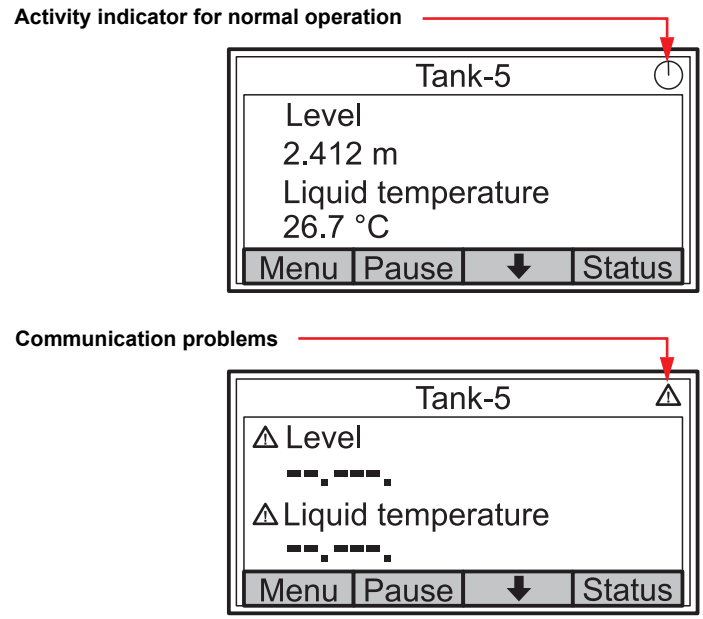


Figure 4-4. Activity indicator

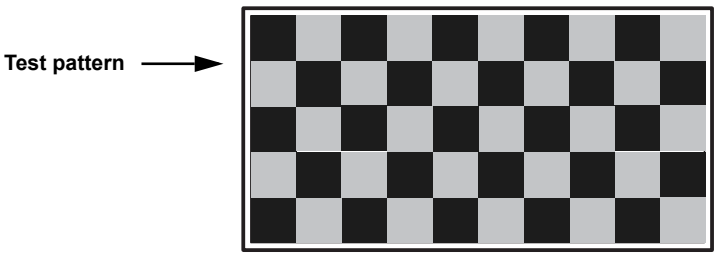
The activity indicator spins continuously to indicate that the 2230 is operating normally. In case of a communication problem an alarm symbol is displayed instead.



4.2.4 Start-Up Procedure

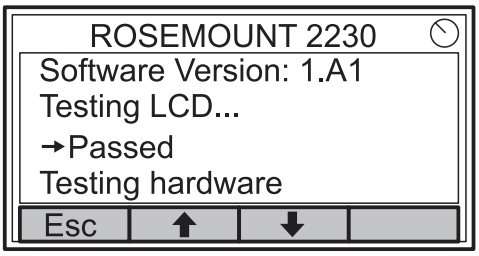
When the Rosemount 2230 display is powered on, a test of the LCD screen is performed.

Figure 4-5. Test screen



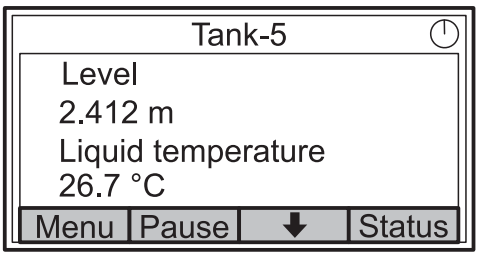
After the LCD test is done the start-up screen will appear.

Figure 4-6. Start-up screen



Once the start-up procedure is finished the 2230 will return to the view that was used last time the 2230 was powered.

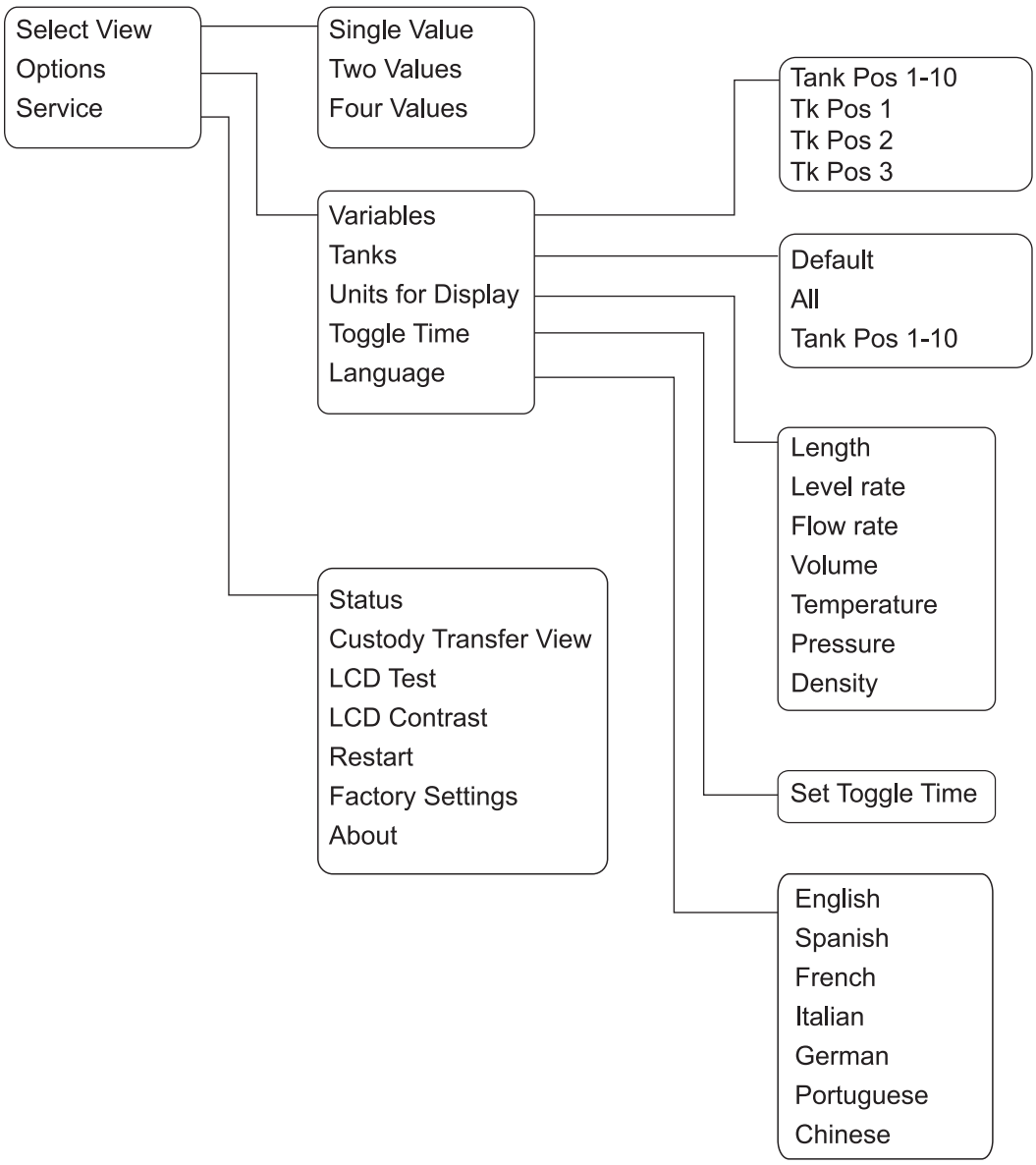
Figure 4-7. View Mode



4.3 MENU TREE

The Rosemount 2230 lets you navigate in a menu structure as illustrated in Figure 4-8:

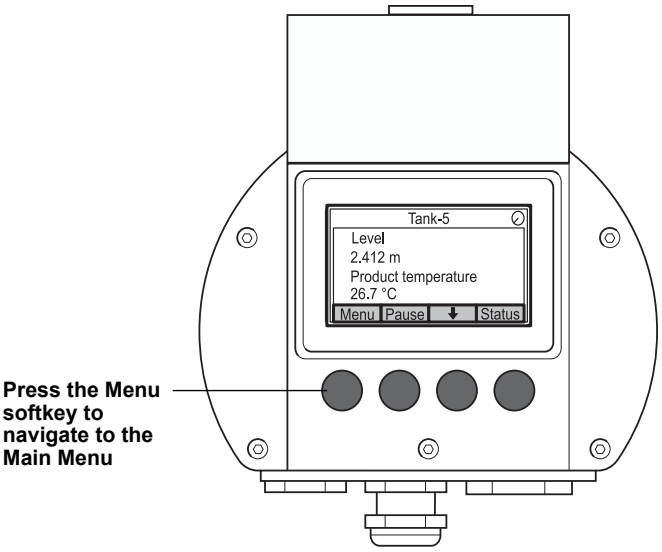
Figure 4-8. Rosemount 2230 Menu Tree



4.4 THE MAIN MENU

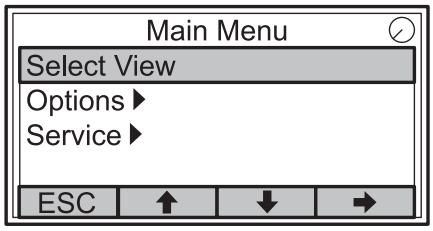
In normal operation the Rosemount 2230 display is in View Mode and shows the current measurement values for the selected tanks. In case of an alarm, a graphical symbol appears on the screen.

Figure 4-9. Rosemount 2230 Graphical Field Display in View Mode



To navigate from View Mode to the Main Menu, press the **Menu** softkey on the left-hand side.

Figure 4-10. The Main menu



The Main Menu includes the following options:

Select View which lets you select the preferred view, see section “The Select View Menu” on page 4-9.

Options which lets you select variables and tanks to display, as well as measurement units, toggle time, and language. See section “The Options Menu” on page 4-10.

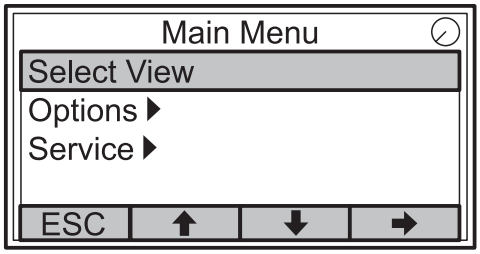
Service which includes the functions Status, Custody Transfer View, LCD Test, Restart, and Factory Settings. It also includes the About option which shows the current software version. See section “The Service Menu” on page 4-17.

4.5 THE SELECT VIEW MENU

In the Select View menu, you can specify the number of measurement values to be displayed in View Mode. To configure the Select View menu:

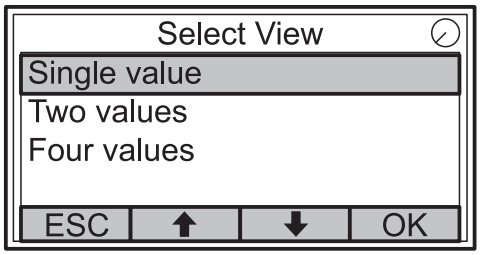
1. In View Mode, press the <Menu> button to navigate to the Main menu.

Figure 4-11. The Main menu



2. Highlight the **Select View** menu item using the ↑ and ↓ softkeys.
3. Press the → softkey.

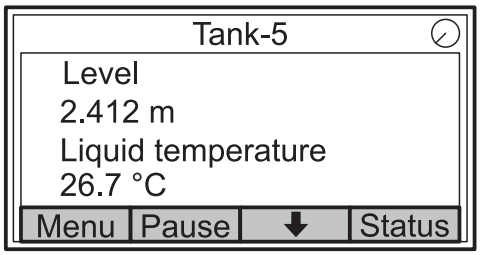
Figure 4-12. The Select View menu



4. In the Select View Menu, use the up and down arrow softkeys to navigate to the desired option.
5. Press the <OK> softkey to select the desired option. The Rosemount 2230 returns to View Mode.

For example, using the Two Values option will present a view as illustrated in Figure 4-13:

Figure 4-13. Example of display configuration with Two values



4.6 THE OPTIONS MENU

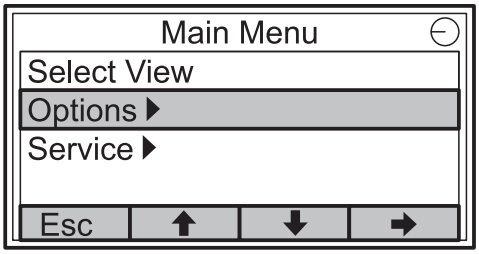
In the Options Menu, the following items are available for a Rosemount 2230 in a Rosemount 2410 Tank Hub system:

- Variables(1)
- Tanks(1)
- Units for Display
- Toggle Time
- Language

To choose an item in the Options menu:

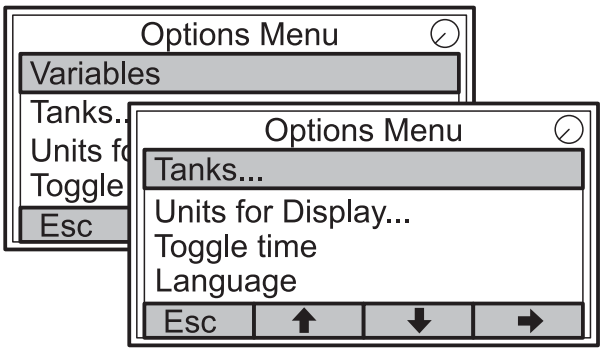
1. In View Mode, press the <Menu> button to open the Main menu:

Figure 4-14. The Main menu



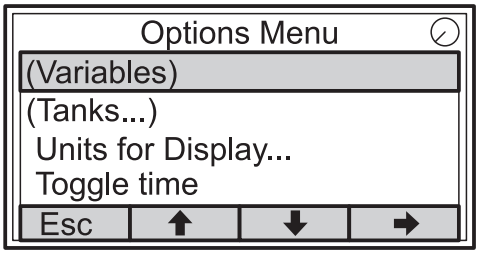
2. Highlight the **Options** menu item by using the ↑ and ↓ softkeys.
3. Press the → softkey.

Figure 4-15. The Options menu



In Foundation fieldbus systems some options are not available. This is indicated as illustrated below:

Figure 4-16. The Options menu in a Foundation fieldbus system



4. In the Options Menu, use the up and down arrow softkeys to navigate to the desired menu item.
5. Press the → softkey to continue to the selected menu.

(1) Not available in Foundation fieldbus systems

4.6.1 Variables

In the Select Variables menu(1), you can choose which variables to present in View Mode. The following options are available:

- **Tank Pos 1-10**(2) lets you configure a common set of variables to be presented for all tanks
- **Tk Pos 1, 2, 3...** lets you configure variables individually for each tank

For a list of available variables see Table 4-1 on page 4-12.

Select Variables Menu

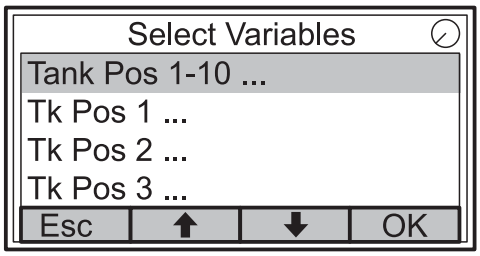
The Select Variables menu allows you to select variables to be displayed in View Mode. Option “Tank Pos 1-10” can be used to specify a common set of variables to be used for all tanks connected to the same 2410 Tank Hub. In addition to this you can configure tanks individually by specifying a unique set of variables for each tank. Note that the individual configuration will be added to the configuration that is common for all tanks.

For a list of selectable variables, see Table 4-1 on page 4-12.

To select variables:

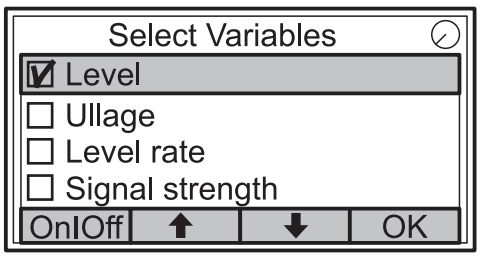
1. In View Mode, press <Menu> <Options> <Variables>.

Figure 4-17. The Select Variables menu



2. Use the up and down arrow softkeys to navigate to the desired Tank Position item.
3. Press the <OK> softkey to continue to the Selected Variables list.

Figure 4-18. The Select Variables Custom option



4. In the Select Variables list, choose the variables you wish to show in View Mode.
5. When finished, press <OK> to return to View Mode.

(1) Not available in Foundation fieldbus systems
(2) Tank Position refers to the position in the tank database for the 2410 Tank Hub.

Table 4-1. Selectable variables

Variable	Description
Level	Product level in the displayed tank.
Ullage	Ullage is the distance from the Tank Reference Point to the product surface.
Level Rate	How the product in the tank moves when emptying or filling the tank.
Signal Strength	The signal strength of the radar level gauge.
Free Water Level	The level of water in the bottom of the tank. Available when a water level sensor is connected to the tank.
Vapor Pressure	Measured vapor pressure.
Liquid Pressure	Measured liquid pressure.
Air Pressure	Measured air pressure in the tank.
Ambient Temperature	Air temperature outside the tank.
Vapor Temperature	Temperature of vapor inside the tank.
Liquid Average Temperature	Averagte temperature of the product in the tank.
Tank Temperature	Average temperature of the product and vapor in the tank.
Temperature 1 To 16	Individual temperature of each selected temperature spot element.
Observed Density	Calculated density based on the product level and pressure.
Reference Density	Reference density as specified with the configuration tool.
Flow rate	Measured flow rate.
Tot Obs Volume	Total observed product volume in the tank.
User defined 1 t o5	Custom measurement variable.
Middle Pressure	Measured pressure from transmitter P2.
Tank Height	Tank Reference Height
ΔLevel	Difference between two product levels.
Bargraph Level	Product level presented in a bar graph.
Bargraph Ullage	Ullage value presented in a bar graph.

Select Variables in TankMaster WinSetup

Variables to present in the View Mode can also be configured by using the TankMaster WinSetup configuration program. For more information see the Raptor System Configuration Manual (Document no.300510EN).

4.6.2 Select Tanks

In the Select Tanks menu(1), you can specify which tanks to show in View Mode. The following items are available:

- **Default** which lets you view all tanks that are configured in the Tank Database of the 2410 Tank Hub
- **All** which displays all available tanks in View Mode
- **Tank Pos 1-10** which lets you choose the tanks to present in View Mode

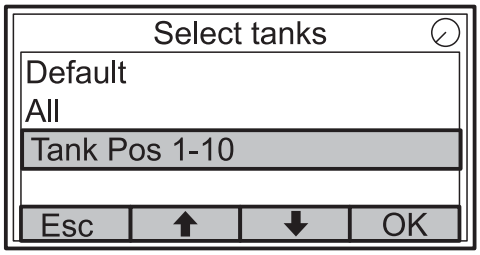
Tank Position 1-10

The *Tank Pos 1-10* menu lets you select which tanks to present in View Mode. Up to ten tanks can be displayed. Note that the tanks need to be configured in the tank database of the Rosemount 2410 Tank Hub(2).

To select tanks:

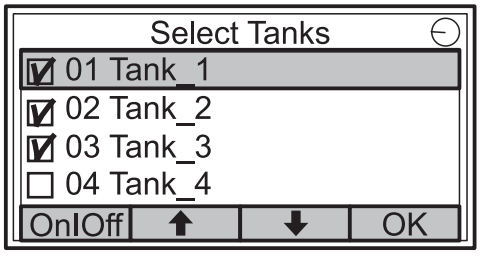
1. In View Mode, press <Menu> <Options> <Select Tanks>:

Figure 4-19. The Select Tanks menu



2. Use the up and down arrow softkeys to navigate to the **Tank Pos 1-10** menu item.
3. Press the <OK> softkey to continue to the list of tanks:

Figure 4-20. The Select Tanks Custom option



4. Use the up and down arrow softkeys to navigate to the desired tank.
5. Press the <On/Off> softkey to select the tank.
6. When finished, press the <OK> softkey to return to View Mode.

(1) Not available in Foundation fieldbus systems
(2) See the Rosemount 2410 Tank Hub Reference Manual (Document no. 300530en)

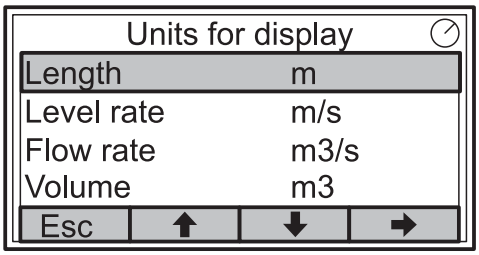
4.6.3 Units for Display

In the Units for Display menu, you can see which measurement units that are used for the displayed variables. The available measurement units are listed in Table 4-2 on page 4-15.

To change measurement unit:

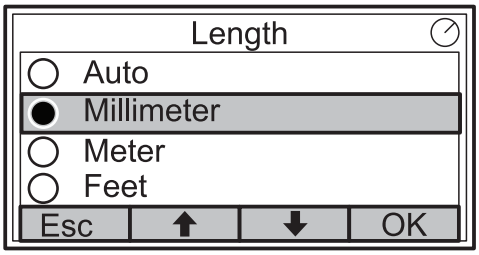
1. In View Mode, press <Menu> <Options> <Units for Display>:

Figure 4-21. The Units for Display menu



2. Use the up and down arrow softkeys to navigate to the desired variable menu item. In the example above, the Length variable was chosen.
3. Press the ➡ softkey to continue to the list of options for the selected variable.

Figure 4-22. Select unit for Length



4. Use the up and down arrow softkeys to navigate to the desired measurement unit.
5. Press the <OK> softkey to select the unit and return to the Units for Display list.

See Table 4-2 for a list of available measurement units.

Table 4-2. Available measurement units for the Rosemount 2230

Variable	Available Measurement Units
Auto	When Auto is selected the unit that will appear on the display is controlled by the Multiple Analog Output Block configuration. See “Configuration Using AMS Device Manager” on page 4-34.
Length	The following units are available for Level and Ullage: • Millimeter • Meter • Feet • Imperial 1/16
Level rate	The following units are available for Level rate: • Meter/second • Meter/hour • Feet/second • Feet/hour
Flow rate	The following units are available for Flow rate: • Cubic meter/hour • Barrel/hour • US gallon/hour • UK gallon/hour • Liter/minute
Volume	The following units are available for Volume: • Cubic meter • Barrel • US gallon • UK gallon • Liter
Temperature	The following units are available for Temperature: • Degrees Celsius • Degrees Fahrenheit • Kelvin
Pressure	The following units are available for Pressure: • Bar • Pascal • Kilo pascal • Atmosphere • PSI • Bar Absolute • Bar Gauge • PSI Absolute • PSI Gauge
Density	The following units are available for Density: • Kilogram/Cubic m • Kilogram/Liter • Degrees API
Voltage	Millivolt

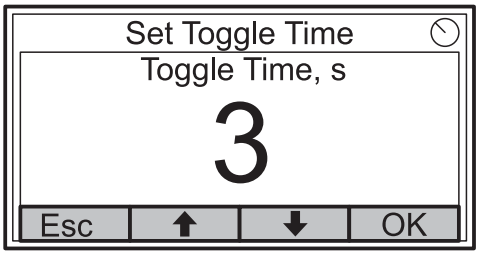
4.6.4 Toggle Time

The Toggle Time parameter specifies the time period that each value, or set of values, is presented on the display.

To set the Toggle Time:

1. From View Mode, press <Menu> <Options> <Toggle Time>:

Figure 4-23. Set Toggle time



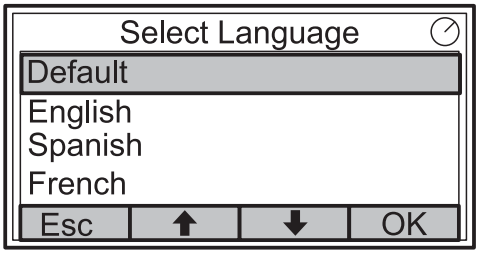
2. Use the up and down arrow softkeys to increase or decrease the Toggle Time.
3. Press the <OK>softkey to select the desired value and return to View Mode.

4.6.5 Language

To set the display Language:

1. Use the up and down arrow softkeys and navigate to the preferred language option:

Figure 4-24. Set display language



2. Press the <OK> softkey to select the language and return to View Mode.

4.7 THE SERVICE MENU

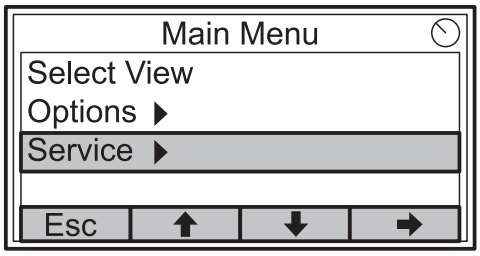
In the Service Menu, the following items are available:

- Status
- Custody Transfer View(1)
- LCD Test
- LCD Contrast
- Restart
- Factory Settings(1)
- About

To choose a Service menu item:

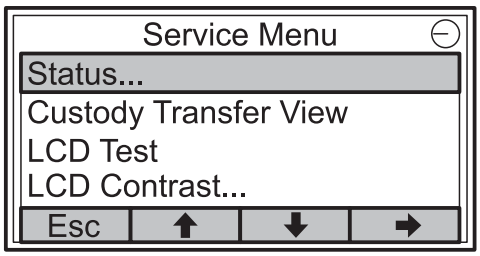
1. In View Mode, press the <Menu> button to open the Main menu:

Figure 4-25. Service option in the Main menu



2. Use the ↑ and ↓ softkeys to navigate to the **Service** option.
3. Press the → softkey.

Figure 4-26. The Service menu



4. Use the up and down arrow softkeys to navigate to the desired menu item.
5. Press the → softkey to continue to the selected menu.

(1) Not available in Foundation fieldbus systems

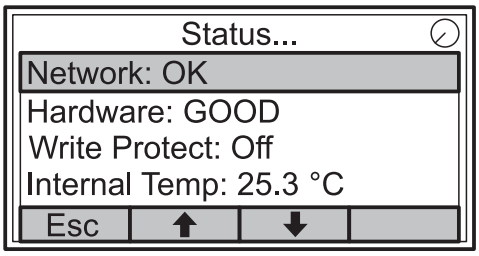
4.7.1 Status

The Status screen shows the current status of the 2230. Various error messages and warnings can be displayed in case of software or hardware malfunctions. See “Troubleshooting” on page 5-7 for more information.

To view the current status information:

1. In the View Mode, press <Menu> <Service> <Status>:

Figure 4-27. Rosemount 2230 status



2. Press <Esc> to return to the Service menu.

See “Status Information” on page 5-2 for information on various status messages.

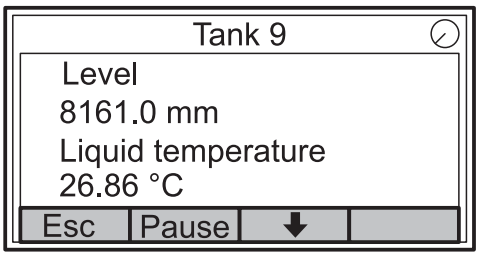
4.7.2 Custody Transfer View

The Custody Transfer view presents Level and Liquid Temperature for each tank.

To open the Custody Transfer view:

1. In View Mode, press <Menu> <Service> <Custody Transfer>:

Figure 4-28. Custody Transfer view



2. Press the <Esc> softkey to return to View Mode.
3. Press the <Pause> softkey to pause the display toggling.
4. Press the down arrow ⬇ softkey to display the next tank.

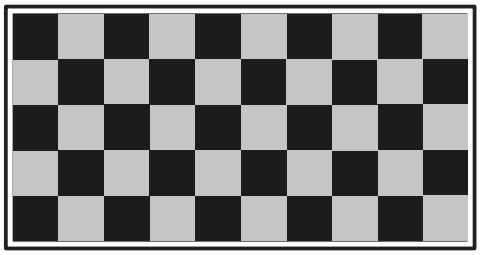
4.7.3 LCD Test

In the LCD test two checkered patterns will be displayed testing the whole display area.

To open the LCD Test view:

1. In View Mode, press <Menu><Service><LCD Test>:

Figure 4-29. LCD test



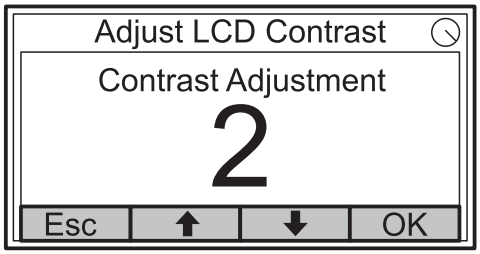
2. After the test is completed, the display will return to normal View Mode.

4.7.4 LCD Contrast

To adjust the LCD contrast:

1. In View Mode, press <Menu><Service><LCD Contrast>:

Figure 4-30. The LCD Contrast option



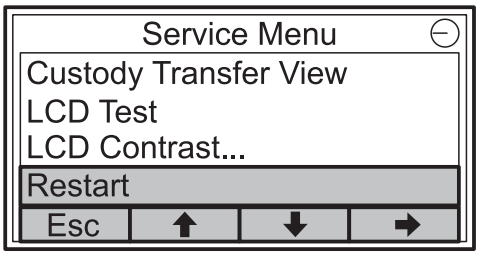
2. Use the up and down arrow softkeys to increase or decrease the LCD contrast.
3. Press the <OK>softkey to select the desired value and return to View Mode

4.7.5 Restart

To restart the 2230:

1. In View Mode, press <Menu><Service>:

Figure 4-31. The Restart option



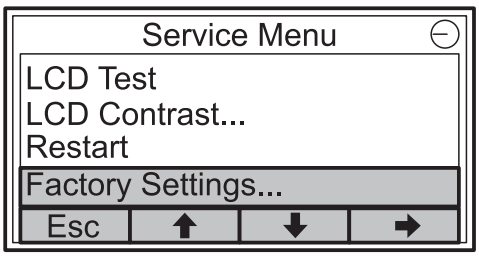
2. Choose the Restart option and press the ➡ softkey.
   The Restart option will perform start-up tests of software and hardware. In aTankbus system it will connect the Rosemount 2230 *Graphical Field Display* to the *Rosemount 2410* Tank Hub.

4.7.6 Factory Settings

To restore the 2230 to factory settings:

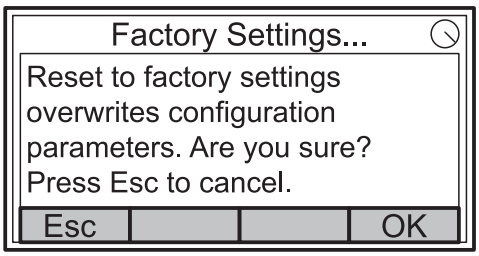
1. In View Mode, press <Menu><Service>:

Figure 4-32. The Factory Settings option



2. Choose the Factory Settings option and press the ➡ softkey.

Figure 4-33. Confirm Factory Settings



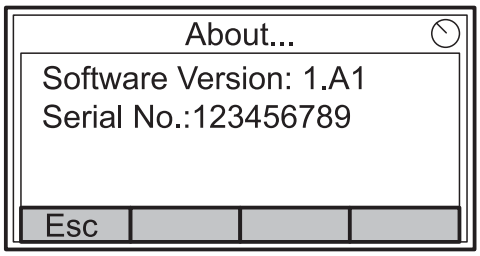
3. Press the <OK> softkey to restore the 2230 to factory settings, or press the <Esc> softkey to cancel.
4. When the Rosemount 2230 is restored to factory settings, all user configuration will be lost.

4.7.7 About

To view the About information:

1. In View Mode, press <Menu><Service>.
2. Choose the About option and press the ➡ softkey.

Figure 4-34. Software revisions for Rosemount 2230



3. The About option will present the current software version and the 2230 serial number.
4. Press the <Esc> softkey to return to the Service menu.

4.8 FOUNDATION FIELDBUS OVERVIEW

This section provides a brief overview of FOUNDATION Fieldbus block operation with the Rosemount 2230 Graphical Field Display.

For detailed information about FOUNDATION Fieldbus technology and function blocks used in the Rosemount 2230 Series, refer to *Appendix C: Foundation fieldbus Block Information* and the FOUNDATION Fieldbus Block Manual (Document No. 00809-0100-4783).

4.8.1 Block Operation

Function blocks within the fieldbus device perform the various functions required for process control, such as analog input (AI) functions, as well as proportional-integral derivative (PID) functions. The standard function blocks provide a common structure for defining function block inputs, outputs, control parameters, events, alarms, and modes, and combining them into a process that can be implemented within a single device or over the fieldbus network. This simplifies the identification of characteristics that are common to function blocks.

In addition to function blocks, fieldbus devices contain two other block types to support the function blocks; the **Resource block** and the **Transducer block**.

Resource blocks contain the hardware specific characteristics associated with a device; they have no input or output parameters. The algorithm within a resource block monitors and controls the general operation of the physical device hardware. There is only one resource block defined for a device.

Transducer blocks connect function blocks to local input/output functions. They read sensor hardware and write to effector (actuator) hardware.

Resource Block

The Resource block contains diagnostics, hardware, electronics, and mode handling information. There are no linkable inputs or outputs to the Resource Block.

Main Transducer Block (TB1100)

The Main Transducer Block contains parameters for configuration of the Rosemount 2230 Graphical Field Display. It contains device information including diagnostics and the ability to configure, set to factory defaults and restart the 2230 Display.

Register Transducer Block (TB1200)

The Register Transducer Block allows a service engineer to access all database registers in the device.

Multiple Analog Output Block

A Multiple Analog Output (MAO) Block accepts output values from field devices and assigns them to specified I/O channels in order to make them available for the display.

Display Transducer Block (TB1300)

The Display Transducer Block includes parameters for setup of the Rosemount 2230 Graphical Field Display for use in a Fieldbus system. It handles mapping of the MAO block inputs to the various field device outputs.

4.9 DEVICE CAPABILITIES

4.9.1 Link Active Scheduler

The Rosemount 2230 can be designated to act as the backup Link Active Scheduler (LAS) in the event that the LAS is disconnected from the segment. As the backup LAS, the 2230 will take over the management of communications until the host is restored.

The host system may provide a configuration tool specifically designed to designate a particular device as a backup LAS. Otherwise, this can be configured manually.

4.9.2 Device Addressing

Foundation fieldbus devices use addresses divided into four sub ranges as shown in Table 4-3.

Table 4-3. Address Ranges for FOUNDATION fieldbus devices

Address range (decimal)	Address range (hexadecimal)	Allocation
0 through 15	00 through 0F	Reserved.
16 through 247	10 through F7	Permanent devices. Address range 16 - 247 is subdivided into addresses that are LAS capable (lower end) and not LAS capable (upper end).
248 through 251	F8 through FB	New or decommissioned devices
252 through 255	FC through FF	Temporary (“visitor”) devices. Example: 375/475 communicator.

The Link Active Scheduler device (LAS device) probes a list of addresses to allow devices to come online during normal operation. The LAS can "skip" probing certain addresses in the range to speed up how long it takes to detect new devices on the bus.

4.9.3 Capabilities

Virtual Communication Relationship (VCRs)

Table 4-4. VCR’s

Maximum number of VCR’s	38
Number of client and server VCR’s	20
Number of publisher VCR’s	20
Number of subscribers VCR’s	32
Number of source VCR’s	2
Number of sink VCR’s	0

4.10 GENERAL BLOCK INFORMATION

4.10.1 Modes

⚠ Changing Modes

To change the operating mode, set the MODE_BLK.TARGET to the desired mode. After a short delay, the parameter MODE_BLOCK.ACTUAL should reflect the mode change if the block is operating properly.

Permitted Modes

It is possible to prevent unauthorized changes to the operating mode of a block. To do this, configure MODE_BLOCK.PERMITTED to allow only the desired operating modes. It is recommended to always select OOS as one of the permitted modes.

Types of Modes

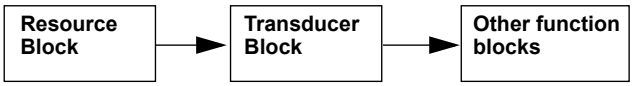
For the procedures described in this manual, it will be helpful to understand the following modes:

AUTO
The functions performed by the block will execute. If the block has any outputs, these will continue to update. This is typically the normal operating mode.

Out of Service (OOS)
The functions performed by the block will not execute. If the block has any outputs, these will typically not update and the status of any values passed to downstream blocks will be “BAD”. To make some changes to the configuration of the block, change the mode of the block to OOS. When the changes are complete, change the mode back to AUTO.

MAN
In this mode, variables that are passed out of the block can be manually set for testing or override purposes.

NOTE
When an upstream block is set to OOS, this will impact the output status of all downstream blocks. The figure below describes the hierarchy of blocks:



4.10.2 Factory Configuration

The following fixed configuration of function blocks is provided:

Table 4-5. Available function blocks for the 2230

Function Block	Index	Default Tag	Available
Multiple Analog Output	1400	MAO_1400	Permanent
Multiple Analog Output	1500	MAO_1500	Permanent
Multiple Analog Output	1600	MAO_1600	Permanent
Multiple Analog Output	1700	MAO_1700	Permanent

4.11 MULTIPLE ANALOG OUTPUT BLOCKS

To show input data from MAO blocks on the display, the 2230 needs to be configured by using FOUNDATION fieldbus parameters available in the Display Transducer Block (see “Display Transducer Block” on page C-10).

4.11.1 Configure the MAO Blocks

The MAO Block is used for receiving measurement data from devices such as the Rosemount 5900S Radar Level Gauge. The Rosemount 2230 is supplied with four pre-configured MAO blocks according to Table 4-5 on page 4-25. Each MAO block has eight inputs.

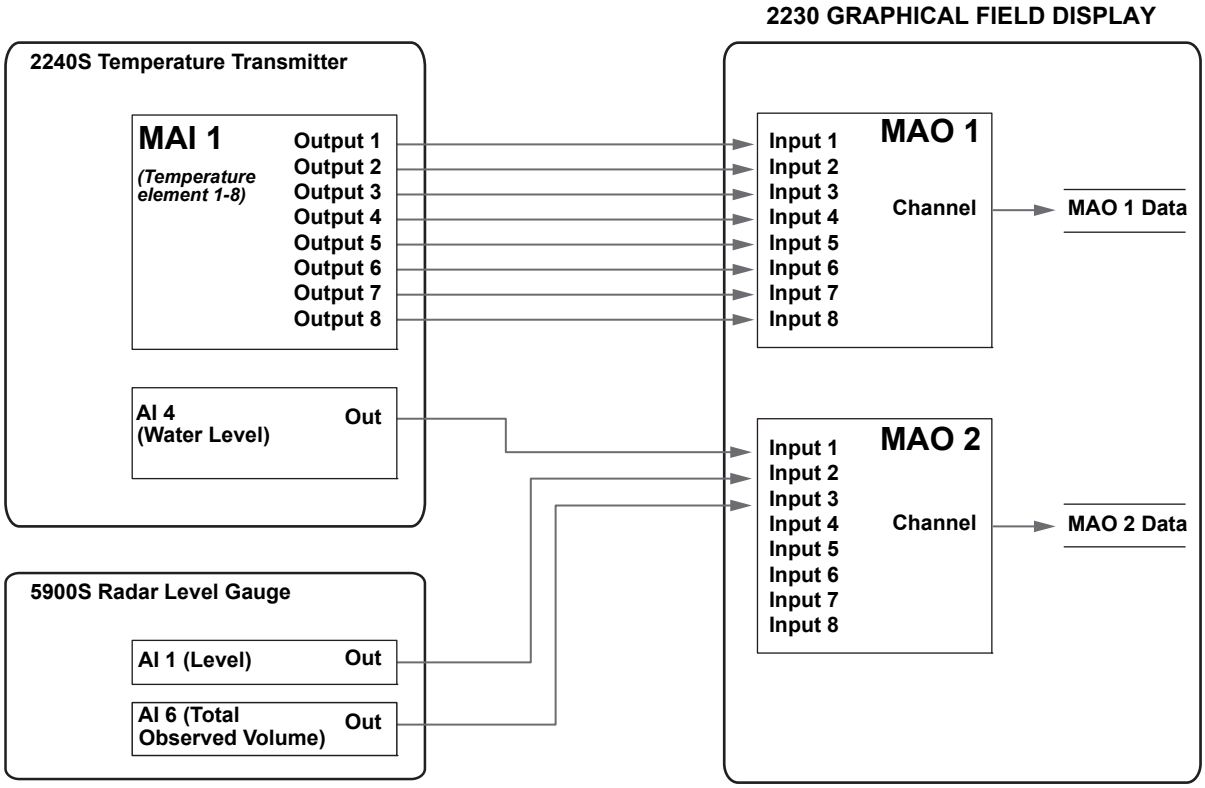
Note that the CHANNEL parameter value has to be equal to 1 (auto) in order to provide data output from the MAO block.

An example of a setup with a Rosemount 2230 receiving data from a Rosemount 5900S and a Rosemount 2240S is shown in Figure 4-35 on page 4-26.

4.11.2 Application Example

A 2230 Graphical Field Display configured for receiving level and temperature measurement data from devices such as the Rosemount 5900S Radar Level Gauge and the Rosemount 2240S Temperature Transmitter.

Figure 4-35. Example of a function block configuration for the Rosemount 2230



AI <n>=factory supplied Analog Input block no. <n>

In the example above (Figure 4-35) a 2230 Graphical Field Display receives data from two field devices; a Rosemount 2240S Temperature Transmitter and a Rosemount 5900S Radar Level Gauge.

Temperature from eight elements is output from the 2240S via the Multiple Analog Input Block 1 to the Multiple Analog Output Block 1 of the 2230 Display.

Water Level is output from the 2240S via the Analog Input Block 4 to the Multiple Analog Output Block 2 of the 2230 Display.

A 5900S outputs product *Level* and *Total Observed Volume* via Analog Input blocks 1 and 6 to the Multiple Analog Output Block 2 of the 2230 Display.

For output of measurement data the 2230 Display can be configured by using the AMS Device Manager as described in “Configuration Using AMS Device Manager” on page 4-34.

4.12 RESOURCE BLOCK

4.12.1 FEATURES and FEATURES_SEL

The FEATURES parameter is read only and defines which features are supported by the 2230. Below is a list of the FEATURES the 2230 supports.

FEATURES_SEL is used to turn on any of the supported features that are found in the FEATURES parameter. The default setting of the Rosemount 2230 is HARD W LOCK. Choose one or more of the supported features if any.

UNICODE

All configurable string variables in the 2230, except tag names, are octet strings. Either ASCII or Unicode may be used. If the configuration device is generating Unicode octet strings, you must set the Unicode option bit.

REPORTS

The 2230 supports alert reports. The Reports option bit must be set in the features bit string to use this feature. Then, the transmitter will actively report alerts. If it is not set, the host must poll for alerts.

MULTI-BIT ALARM

The 2230 supports Multi-bit alarms. With the multi-bit option enabled each condition may send a message when it occurs and when it clears so that there is no masking of active conditions.

SOFT W LOCK and HARD W LOCK

Inputs to the security and write lock functions include the hardware security switch, the hardware and software write lock bits of the FEATURE_SEL parameter, and the WRITE_LOCK parameter.

The WRITE_LOCK parameter prevents modification of parameters within the device except to clear the WRITE_LOCK parameter. During this time, the block will function normally updating inputs and outputs and executing algorithms. When the WRITE_LOCK condition is cleared, a WRITE_ALM alert is generated with a priority that corresponds to the WRITE_PRI parameter.

The FEATURE_SEL parameter enables the user to select a hardware or software write lock or no write lock capability. To enable the hardware security function, enable the HARDW_LOCK bit in the FEATURE_SEL parameter. When this bit has been enabled the WRITE_LOCK parameter becomes read only and will reflect the state of the hardware switch.

In order to enable the software write lock, the SOFTW_LOCK bit must be set in the FEATURE_SEL parameter. Once this bit is set, the WRITE_LOCK parameter may be set to “Locked” or “Not Locked.” Once the WRITE_LOCK parameter is set to “Locked” by the software lock, all user requested writes shall be rejected.

The following table displays all possible configurations of the WRITE_LOCK parameter.

Table 4-6. Possible configuration of the WRITE_LOCK parameter.

FEATURE_SEL HARDW_LOCK bit	FEATURE_SEL SOFTW_LOCK bit	SECURITY SWITCH	WRITE_LOCK	WRITE_LOCK Read/Write	Write access to blocks
0 (off)	0 (off)	NA	1 (unlocked)	Read only	All
0 (off)	1 (on)	NA	1 (unlocked)	Read/Write	All
0 (off)	1 (on)	NA	2 (locked)	Read/Write	Function Blocks Only
0 (off)	1 (on)	NA	2 (locked)	Read/Write	None
1 (on)	0 (off)(1)	0 (unlocked)	1 (unlocked)	Read only	All
1 (on)	0 (off)	1 (locked)	2 (locked)	Read only	Function Blocks Only
1 (on)	0 (off)	1 (locked)	2 (locked)	Read only	None

(1) The hardware and software write lock select bits are mutually exclusive and the hardware select has the highest priority. When the HARDW_LOCK bit if set to 1 (on), the SOFTW_LOCK bit is automatically set to 0 (off) and is read only.

4.12.2 MAX_NOTIFY

The MAX_NOTIFY parameter value is the maximum number of alert reports that the resource can have sent without getting a confirmation, corresponding to the amount of buffer space available for alert messages. The number can be set lower, to control alert flooding, by adjusting the LIM_NOTIFY parameter value. If LIM_NOTIFY is set to zero, then no alerts are reported.

4.12.3 Field Diagnostic Alerts

The Resource Block acts as a coordinator for Field Diagnostic alerts. There are four alarm parameters (FD_FAIL_ALM, FD_OFFSPEC_ALM, FD_MAINT_ALM, and FD_CHECK_ALM) which contain information regarding some of the device errors which are detected by the transmitter software.

There is a FD_RECOMMEN_ACT parameter which is used to display the recommended action text for the highest priority alarm. FD_FAIL_ALM has the highest priority followed by FD_OFFSPEC_ALM, FD_MAINT_ALM, and FD_CHECK_ALM which has the lowest priority.

Failure Alarms

A *Failure* alarm indicates a condition within a device that will make the device or some part of the device non-operational. This implies that the device is in need of repair and must be fixed immediately. There are five parameters associated with FD_FAIL_ALM specifically, they are described below.

FD_FAIL_MAP
This parameter contains a list of conditions in the device which makes the device non-operational that will cause an alarm to be sent. Below is a list of the conditions with the highest priority first. This priority is not the same as the FD_FAIL_PRI parameter described below. It is hard coded within the device and is not user configurable.

1. Electronics Failure - FF I/O Board
2. Internal Communication Failure
3. Electronics Failure - Main Board
4. Memory Failure - FF I/O Board
5. Database Error
6. Software Failure

FD_FAIL_MASK
This parameter will mask any of the failed conditions listed in FD_FAIL_MAP. A bit on means that the condition is masked out from alarming and being broadcast to the host through the alarm parameter.

FD_FAIL_PRI
Designates the alarming priority of the FD_FAIL_ALM, see “Alarm Priority” on page 4-32. The default is 0 and the recommended values are between 8 and 15.

FD_FAIL_ACTIVE
This parameter displays which of the conditions is active.

FD_FAIL_ALM
Alarm indicating a condition within a device which makes the device non-operational.

Out of Specification Alarms

An *Out of Specification* alarm indicates that the device operates out of the specified measurement range. If the condition is ignored, the device will eventually fail. There are five parameters associated with FD_OFFSPEC_ALM, they are described below.

FD_OFFSPEC_MAP
The FD_OFFSPEC_MAP parameter contains a list of conditions indicating that the device or some part of the device operates out of specification. Below is a list of the conditions with the highest priority first. This priority is not the same as the *FD_OFFSPEC_PRI* parameter described below. It is hard coded within the device and is not user configurable.

Below is a list of the conditions:

1. Invalid Model Code
2. Internal Temperature Out of Limits
3. MAO Fault State Mode Enabled

FD_OFFSPEC_MASK
The FD_OFFSPEC_MASK parameter will mask any of the failed conditions listed in FD_OFFSPEC_MAP. A bit on means that the condition is masked out from alarming and being broadcast to the host through the alarm parameter.

FD_OFFSPEC_PRI
This parameter designates the alarming priority of the FD_OFFSPEC_ALM, see “Alarm Priority” on page 4-32. The default is 0 and the recommended values are 3 to 7.

FD_OFFSPEC_ACTIVE
The FD_OFFSPEC_ACTIVE parameter displays which of the conditions is detected as active.

FD_OFFSPEC_ALM
An alarm indicating that the device operates out of the specified measurement range. If the condition is ignored, the device will eventually fail.

Maintenance Alarms

A *Maintenance* alarm indicates that the device or some part of the device needs maintenance soon. If the condition is ignored, the device will eventually fail. There are five parameters associated with FD_MAINT_ALM, they are described below.

FD_MAINT_MAP
The FD_MAINT_MAP parameter contains a list of conditions indicating that the device or some part of the device needs maintenance soon. The priority is not the same as the MAINT_PRI parameter described below. It is hard coded within the device and is not user configurable.

Note that maintenance alarms are not enabled by default for the Rosemount 2230.

FD_MAINT_MASK
The FD_MAINT_MASK parameter will mask any of the failed conditions listed in FD_MAINT_MAP. A bit on means that the condition is masked out from alarming and being broadcast to the host through the alarm parameter.

FD_MAINT_PRI
FD_MAINT_PRI designates the alarming priority of the FD_MAINT_ALM, see “Alarm Priority” on page 4-32. The default is 0 and the recommended values are 3 to 7.

FD_MAINT_ACTIVE
The FD_MAINT_ACTIVE parameter displays which of the conditions is active.

FD_MAINT_ALM
An alarm indicating that the device needs maintenance soon. If the condition is ignored, the device will eventually fail.

Function Check Alarms

A *Function Check* alarm indicates that the device is temporary non-valid due to some activities, for example maintenance, on the device.

There are five parameters associated with FD_CHECK_ALM, they are described below.

FD_CHECK_MAP
The FD_CHECK_MAP parameter contains a list of informative conditions that do not have a direct impact on the primary functions of the device. Below is a list of the conditions:

1. Check function

FD_CHECK_MASK
The FD_CHECK_MASK parameter will mask any of the failed conditions listed in FD_CHECK_MAP. A bit on means the condition is masked out from alarming and being broadcast to the host through the alarm parameter.

FD_CHECK_PRI
FD_CHECK_PRI designates the alarming priority of the FD_CHECK_ALM, see “Alarm Priority” on page 4-32. The default is 0 and the recommended values are 1 or 2.

FD_CHECK_ACTIVE
The FD_CHECK_ACTIVE parameter displays which of the conditions is active.

FD_CHECK_ALM
FD_CHECK_ALM is an alarm indicating that the device output is temporary invalid due to on-going work on the device.

4.12.4 Recommended Actions for Alerts

The FD_RECOMMEN_ACT and RECOMMENDED_ACTION parameters display text strings that will give a recommended course of action to take based on which type and which specific event of the alerts that is active (See Table 5-11 on page 5-16).

4.12.5 Alarm Priority

Alarms are grouped into five levels of priority:

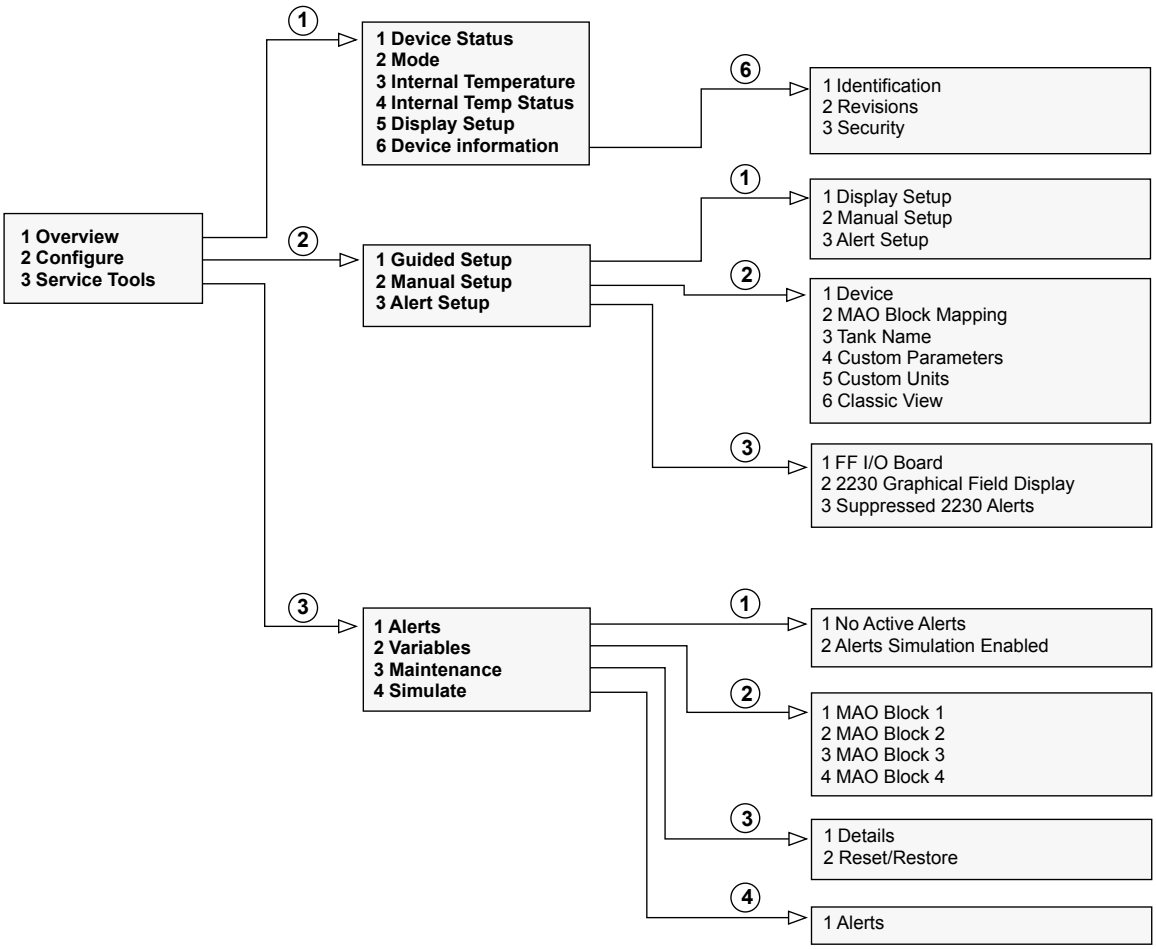
Table 4-7. Alarm level priority

Priority Number	Priority Description
0	The priority of an alarm condition changes to 0 after the condition that caused the alarm is corrected.
1	An alarm condition with a priority of 1 is recognized by the system, but is not reported to the operator.
2	An alarm condition with a priority of 2 is reported to the operator, but does not require operator attention (such as diagnostics and system alerts).
3-7	Alarm conditions of priority 3 to 7 are advisory alarms of increasing priority.
8-15	Alarm conditions of priority 8 to 15 are critical alarms of increasing priority.

4.13 475 FIELD COMMUNICATOR MENU TREE

The 2230 can be configured by using a 475 Field Communicator. The menu tree below shows the available options for configuration and service.

Figure 4-36. Field Communicator Menu Tree



4.14 CONFIGURATION USING AMS DEVICE MANAGER

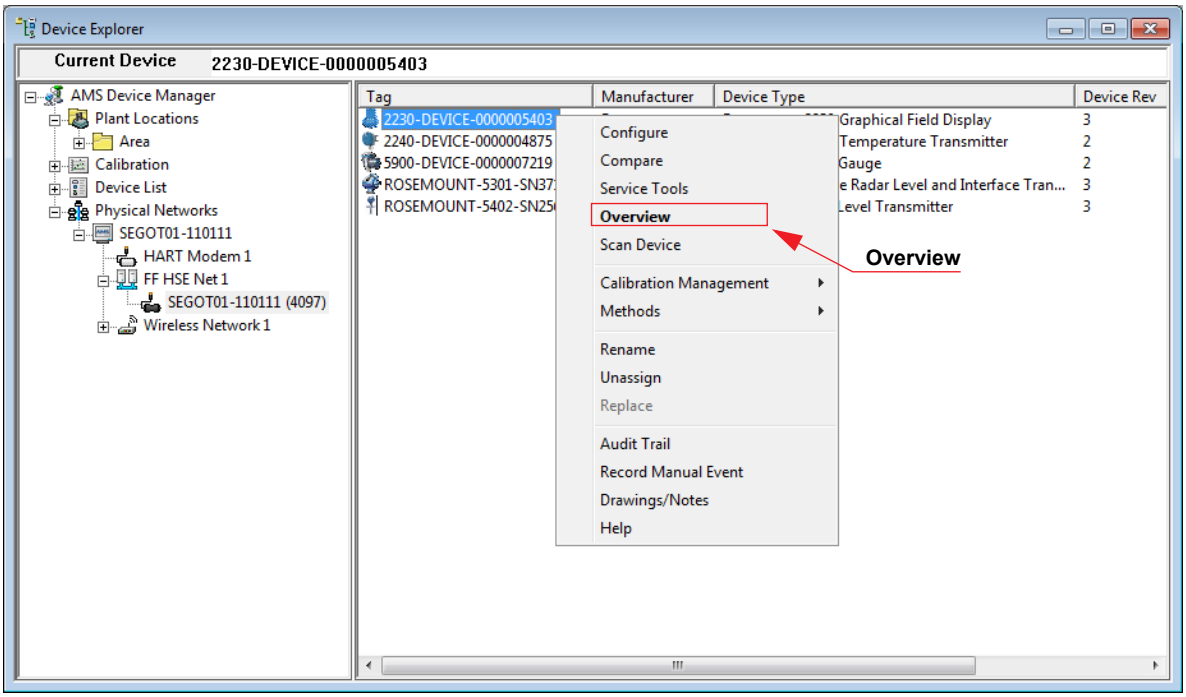
The Rosemount 2230 Graphical Field Display supports DD Methods to facilitate device configuration. The following description shows how to use the AMS Device Manager application to configure the Rosemount 2230 in a FOUNDATION fieldbus system.

4.14.1 Starting the Guided Setup

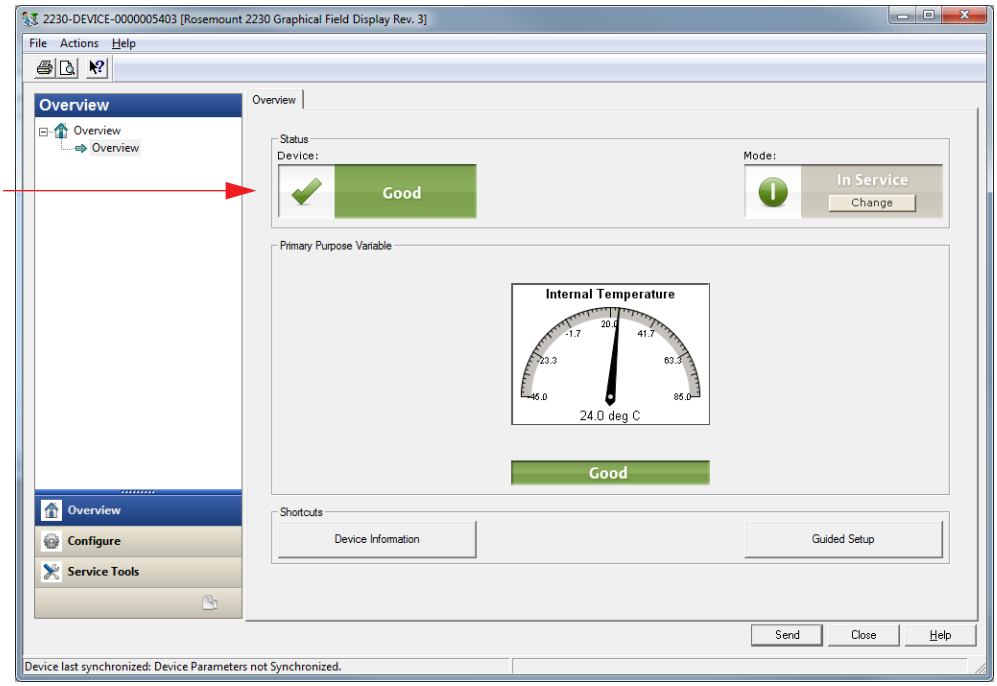
Before starting the Guided Setup it is recommended to configure the Multiple Analog Output (MAO) blocks and connect them to appropriate tank process variables using Control Studio or a similar application.

To configure the Rosemount 2230 in AMS:

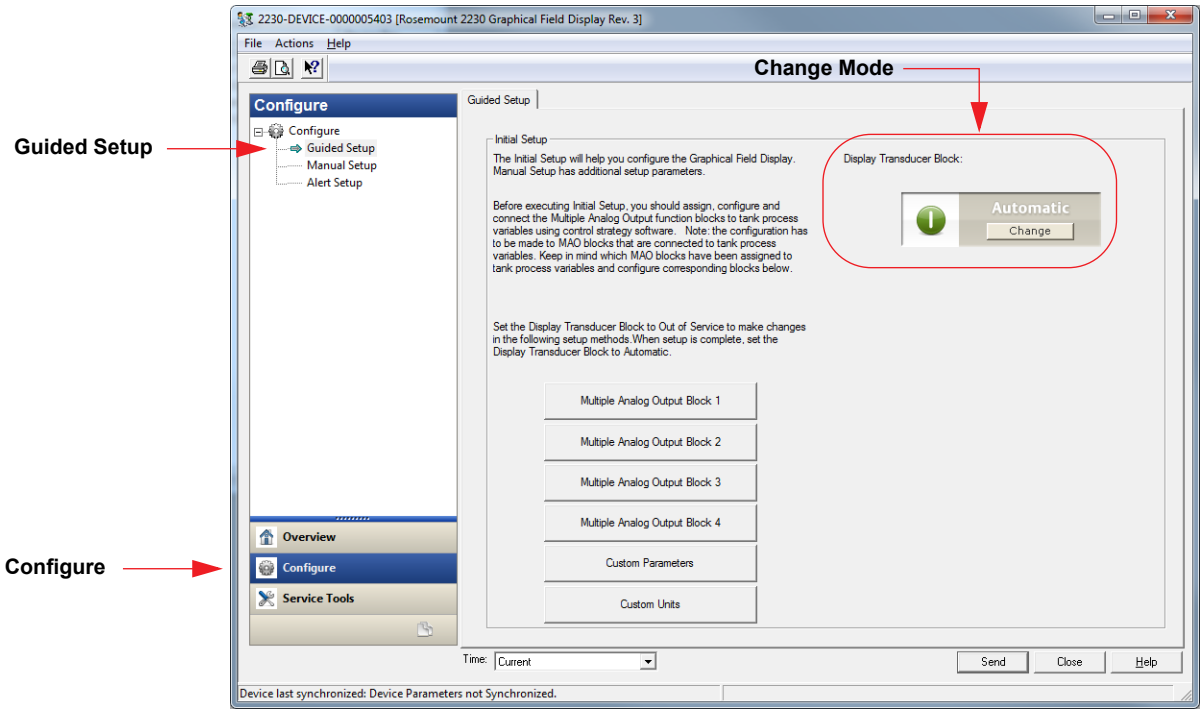
1. From the Start menu; open the AMS Device Manager application.
2. Open the View>Device Explorer.
3. Click the right mouse button or double-click the desired device icon to open the list of menu options:



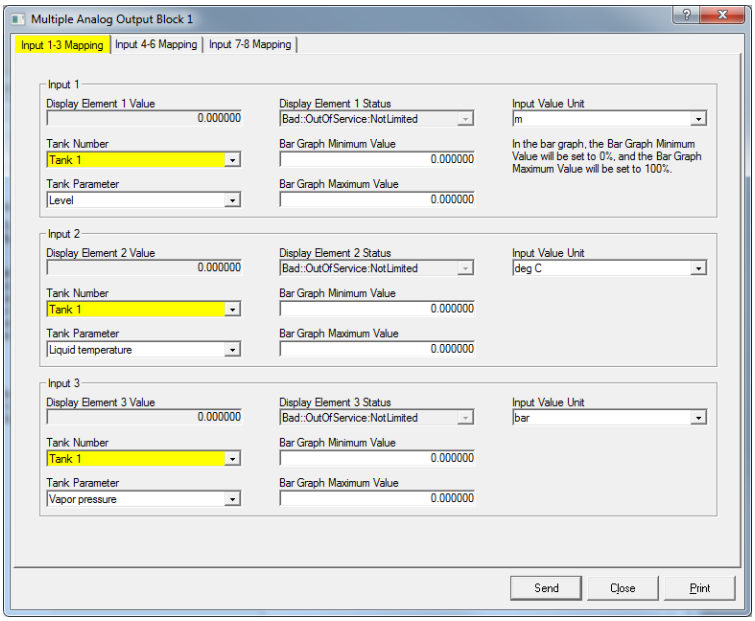
4. Choose the Overview option.



5. The *Overview* window shows information about the current device status; *Good* or *Bad*. It also gives you access to more detailed information by pressing the Device Information button.
6. Select the **Configure**>**Guided Setup** option to open the *Guided Setup* window.



7. Set the Display Transducer Block to Out Of Service (OOS) mode by clicking the **Change** button.
8. Now proceed with configuration of Multiple Analog Output (MAO) blocks by pressing the appropriate button; Multiple Analog Output Block (#).



9. The *Multiple Analog Output Block* window lets you map tanks and tank parameters from the Multiple Analog Output (MAO) block inputs 1 - 8 to the tanks and tank parameters in the 2230 Display Transducer block. This configuration is required in order to make the field device parameters available on the display output. See section “Multiple Analog Output Blocks” on page 4-25 for more information on MAO blocks.

   Note that *MAO Block 1* to *MAO Block 4* refer to index number 1400 to 1700 (MAO_1400 - MAO_1700). See section “Factory Configuration” on page 4-25 for more information.

   For each tank you may not configure more than one Tank Parameter of a certain type. This means that for each tank you may specify one Level, one Liquid Temperature, etc.

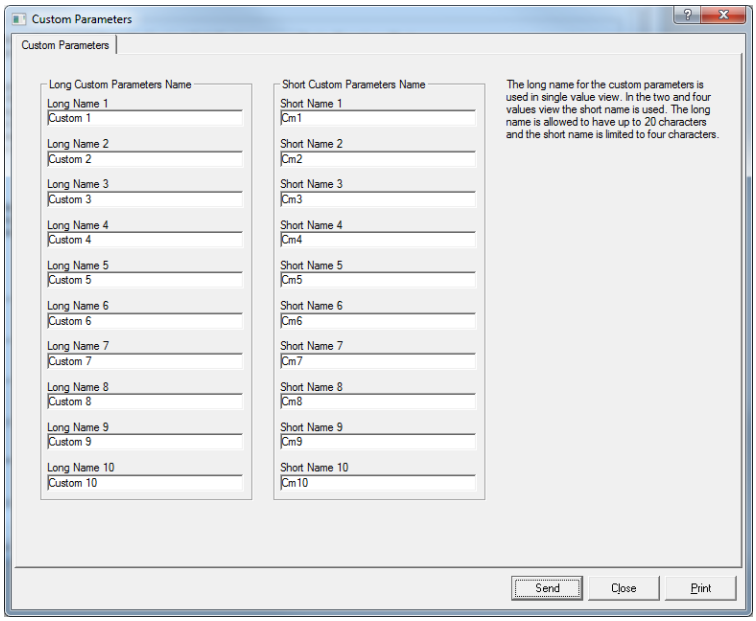
   The Bar Graph Minimum and Maximum Value correspond to 0 % and 100 %, respectively. In case you don’t want any bar graph to be displayed simply leave Minimum Value=0 and Maximum Value=0.

   Configure all inputs that are used for the MAO Block.

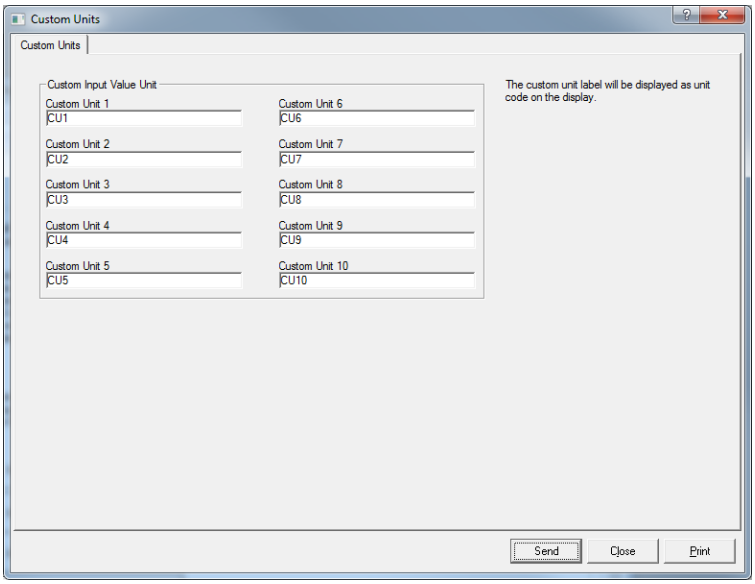
   Note that tank names can be configured in the *Manual Setup* window, see “Manual Setup” on page 4-39.

   In case there is no tank parameter available that matches the output from a specific device in the fieldbus network, a custom parameter can be used instead. A custom parameter can be anything from any device in the network. Custom parameters can be configured in the *Custom Parameters* window as described below.

10. Configure all the MAO Blocks that are used. Ensure that unused MAO block inputs are unconfigured, i.e. that there are no tank numbers or tank parameters configured for these inputs.
11. Click the Send button to store the current configuration in the device configuration database.
12. Once the MAO Block mapping is finished, you may proceed with configuration of custom parameters if needed. Return to the *Guided Setup* window and click the Custom Parameters button to open the *Custom Parameters* window.



13. The *Custom Parameters* window lets you specify names for various custom parameters:
    - The *Long Custom Parameter Name* is used for the Single Value view and the Two Values View on the 2230 Display. It may be up to 20 characters long.
    - The *Short Custom Parameter Name* is used for the Four Values View on the 2230 Display. It may be up to four characters long.
14. Click the Send button to store the current configuration in the device configuration database.
15. Proceed with configuration of custom units by clicking the Custom Units button.



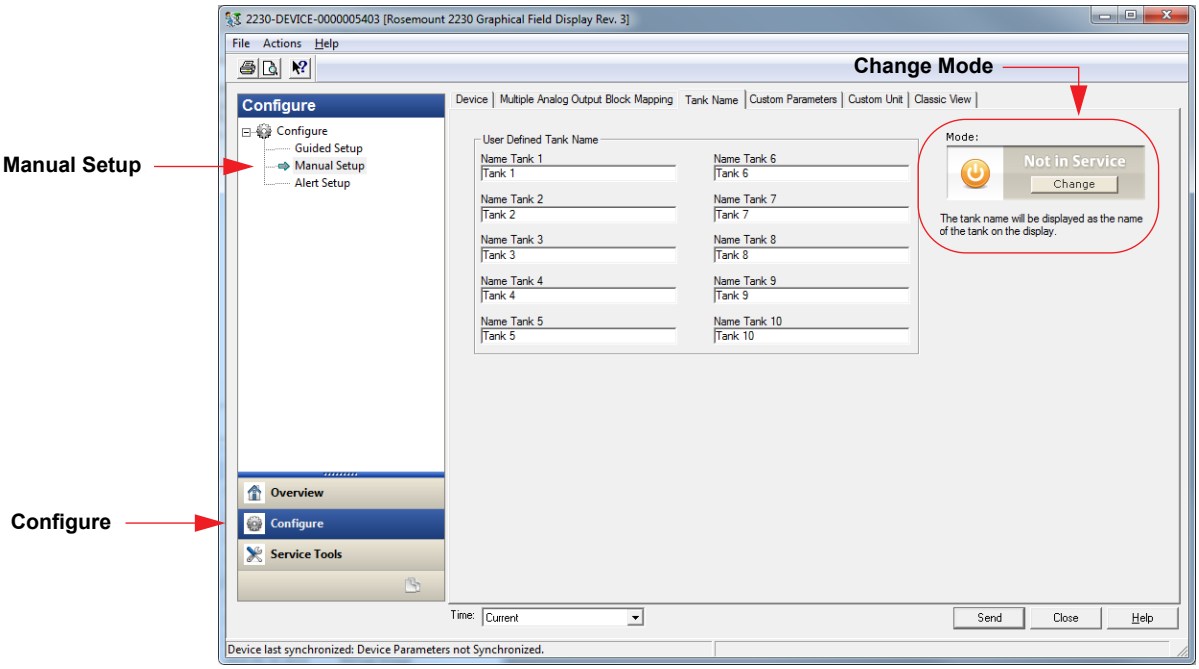
16. In the *Custom Units* window specify units for the various custom parameters. The unit label can be specified anyway you like. It does not need to be a standard unit such as metric or imperial units.
17. Click the Send button to store the current configuration in the device configuration database.
18. In case you wish to extend device configuration with options not available in the *Guided Setup* window, return to the *Overview* window, select the **Configure**>**Manual Setup** option, and choose the desired tab (see “Manual Setup” on page 4-39).

4.14.2 Manual Setup

In case you wish to configure device options not available in the *Guided Setup* window, for example specifying tank names, you may use the Manual Setup option.

To open Manual Setup:

1. Open the AMS Device Manager application.
2. In the Device Explorer, right-click or double-click the desired device icon to open the list of menu options (see “Starting the Guided Setup” on page 4-34).
3. Select the **Configure>Manual Setup** option.
4. Select the desired tab.



5. Set the device to Out Of Service (OOS) mode by clicking the **Change** button.
6. Choose the desired tab and configure the device. The various tabs gives you access to various configuration options such as block parameter mapping, configuration of custom parameters and units, as well as tank name specification. The Device tab lets you configure display units, display view and language. It also provides the option to write protect the 2230 (see “Write Protection” on page 5-25).
7. When configuration is finished, click the Apply button to store the current configuration in the device database.
8. Click the **Change** button to set the device to operating (Auto) mode.
9. Click the **OK** button to close the window.

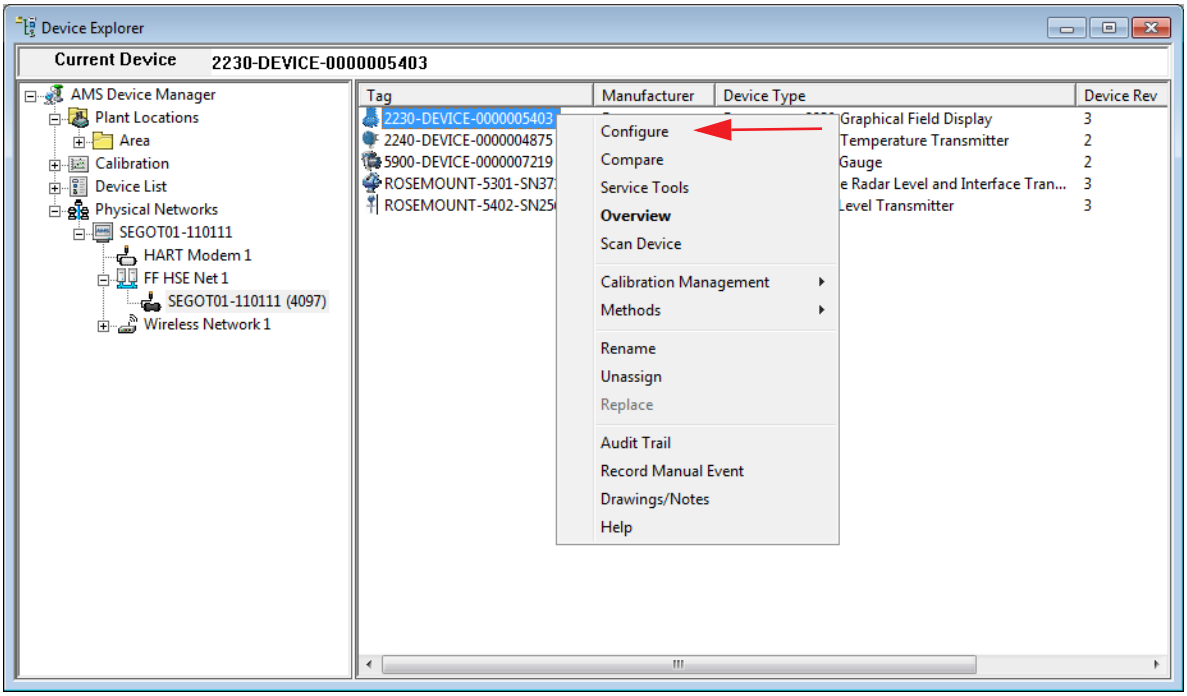
4.15 ALERT SETUP

The *Alert Setup* window allows you to configure and enable/disable Alerts.

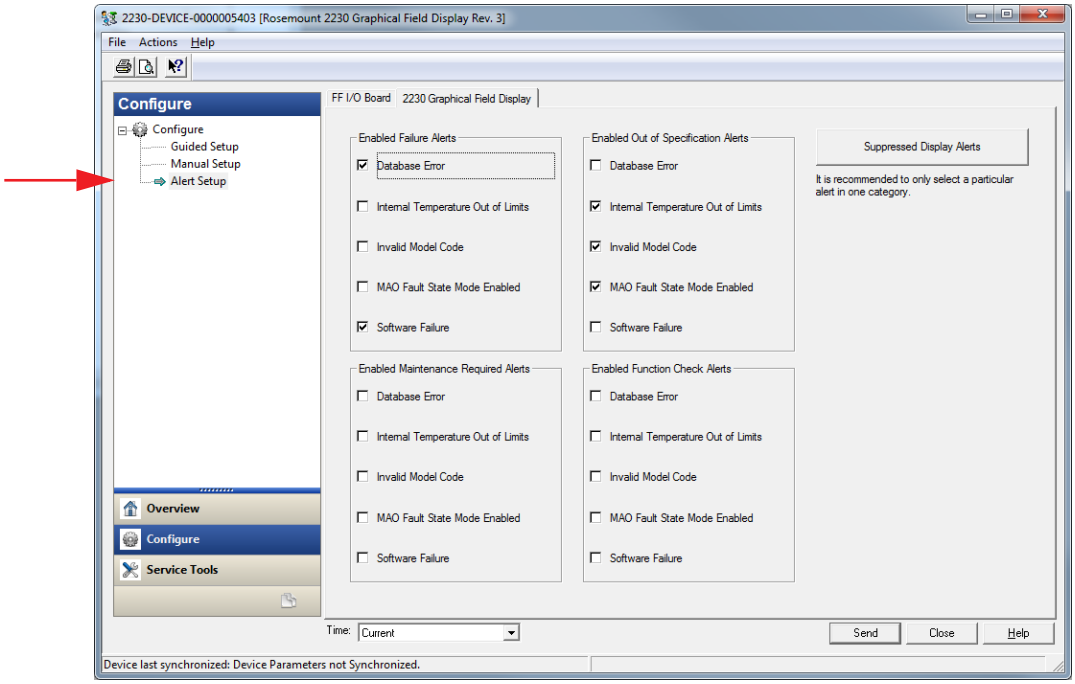
For details on how to view active alerts see “Viewing Active Alerts in AMS” on page 5-14.

To open the *Alert Setup* window:

1. From the Start menu; open the AMS Device Manager application.
2. Open the *View>Device Explorer*.
3. Right-click or double-click the desired device icon to open the list of menu options.



4. Choose the **Configure** option.
5. Select the **Alert Setup** option.



6. Select the desired tab (*FF I/O Board* or *2230 Graphical Field Display*).
7. Configure alerts for the different error types.
8. You may change the configuration for each error type by selecting the appropriate check box to match your requirements. Note that it is possible to map an error condition to several alert categories if desired. For information on the default setup of error types and alerts (Failure, Maintenance, Out of Specification, and Function Check) see “Alert Default Settings” on page 4-42.
9. Note that when simulating alerts, only alerts which are setup according to the default configuration will be simulated, see section “Alert Default Settings” on page 4-42.
10. Once the configuration is finished, click the OK button to save the current alert setup.

4.15.1 Alert Default Settings

The following default settings are used for the FF I/O Board and the 2230 Graphical Field Display. You may configure error types in a different way if you like. For example, the *Internal Temperature Out of Limits* error is configured as a *Out of Specification* alert for the 2230 by default. The *Alert Setup* window allows you to enable the alert as Failed or Function Check instead.

FF I/O Board

Table 4-8. Default Alert configuration for FF I/O Board

Error type	Default configuration	Enabled / Disabled
Check Function	Function Check	Enabled
Electronics failure Main Board	Failed alert	Enabled
Electronics failure FF I/O Board	Failed alert	Enabled
Memory Failure FF I/O Board	Failed alert	Enabled
Internal communication failure	Failed alert	Enabled

2230 Graphical Field Display

Table 4-9. Default Alert configuration for 2230 Graphical Field Display

Error type	Default configuration	Enabled / Disabled
Database error	Failed alert	Enabled
Internal Temperature Out of Limits	Out of Specification alert	Enabled
Invalid Model Code	Out of Specification alert	Enabled
MAO Fault State Mode Enabled	Out of Specification alert	Enabled
Software failure	Failed alert	Enabled

Section 5 Service and Troubleshooting

5.1 SAFETY MESSAGES

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

⚠WARNING

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

Make sure only qualified personnel perform the installation.

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 service other than those contained in this manual unless you are qualified.

⚠WARNING

Explosions could result in death or serious injury:

Verify that the operating environment of the display is consistent with the appropriate hazardous locations certifications.

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

Do not remove the device cover in explosive atmospheres when the circuit is alive.

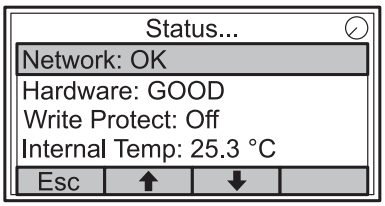
5.2 SERVICE

5.2.1 Status Information

The Status screen lets you view the current status of the *Rosemount 2230*. To open the status information screen:

1. In the View Mode, press <Menu> <Service> <Status>:

Figure 5-1. Rosemount 2230 status



2. Use the ↑ and ↓ softkeys to view the various status messages.
3. Press <Esc> to return to the Service menu.

Various Status messages that may appear on the 2230 display are listed in Table 5-1:

Table 5-1. Status Information

Status Message
Network
Hardware
Write Protect
Internal Temperature
Maximum Temperature
Minimum Temperature
Operation time
Last restart

5.2.2 Viewing Input and Holding Registers

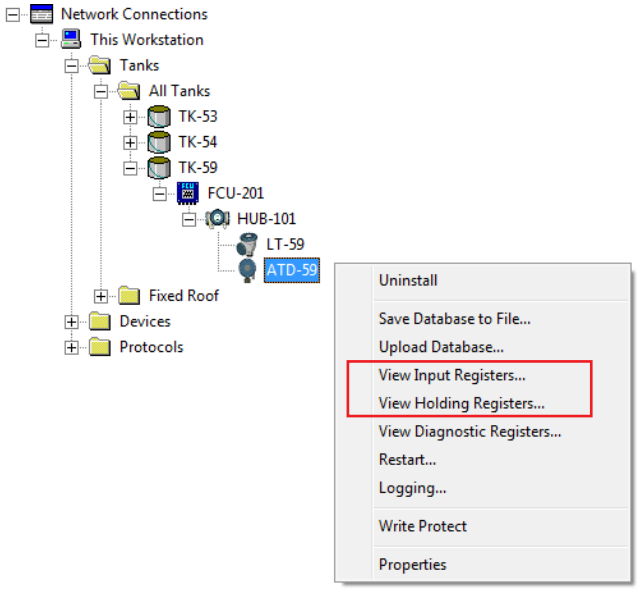
Measured data is continuously stored in the *Rosemount 2230* **Input Registers.** They can be used for verifying that the Rosemount 2230 works properly and for advanced troubleshooting.

The **Holding Registers** store various configuration parameters which are used to control the display presentation.

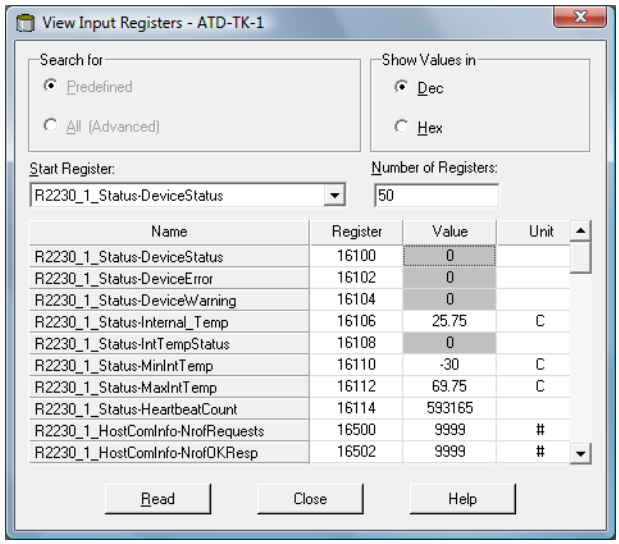
By using the TankMaster WinSetup configuration tool most holding registers can be edited by simply typing a new value in the appropriate value input field.

To view Input and Holding registers for the 2230 display:

1. Start the TankMaster WinSetup program



2. In the TankMaster WinSetup workspace window, click the right mouse button on the ATD device icon. The ATD device represents all the non-level devices such as the 2230 display.
3. Choose the View Input Registers (or View Holding Registers) option, or from the Service menu choose Devices > View Input / View Holding Registers.



4. The **Predefined** option lists a basic selection of useful registers.
5. Choose the desired **Start Register** and enter the **Number of Registers** to read.
6. Click the **Read** button to update the Value column with the current register values.

In FOUNDATION fieldbus systems you may view Holding/Input registers by using AMS Device Manager as described in “Viewing Input/Holding Registers” on page 5-20.

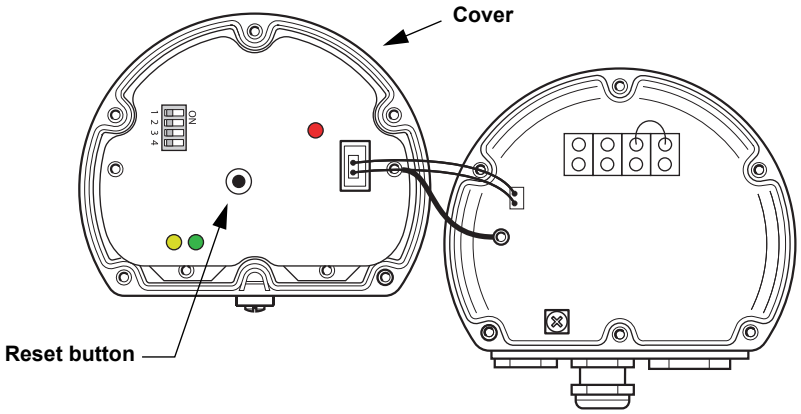
5.2.3 Restarting the 2230 Display

To restart the *Rosemount 2230* choose one of the following options:

- choose the Restart option in the Service menu, see “Restart” on page 4-20
- press the Reset button inside the display cover, see Figure 5-2
- use the Restart command in TankMaster WinSetup (Right click>Restart)
- in FOUNDATION fieldbus systems you may use the Service Tools/Restart option in AMS Device Manager

In Tankbus systems the Restart option will connect the *Rosemount 2230 Display* to the *Rosemount 2410 Tank Hub* and perform start-up tests of software and hardware.

Figure 5-2. Reset button

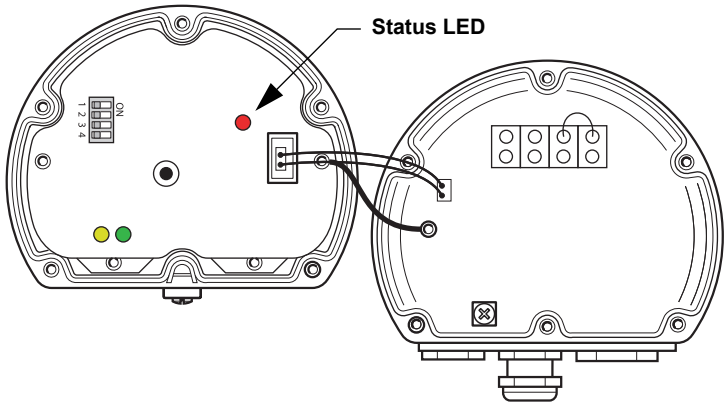


NOTE!
Ensure that o-rings and seats are in good condition prior to mounting the cover in order to maintain the specified level of ingress protection. Cables must be properly attached to the cable glands.

5.2.4 Device Error Signals

A Light Emitting Diode (LED) inside the 2230 cover is used for presentation of device status using different blinking sequences.

Figure 5-3. Error signals



In normal operation the LED flashes once every other second. When an error occurs, a sequence of LED flashes presents a code number followed by a five second pause. The flash sequence is continuously repeated.

The following error codes can be presented by the LED:

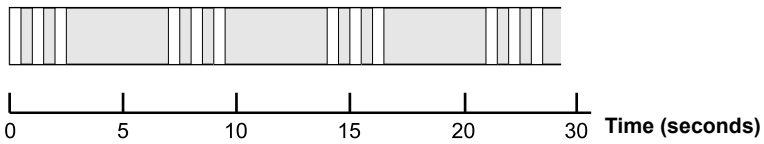
Table 5-2. Status LED error codes

LED Status Code	Error Type
0	RAM error
1	FPROM error
2	HREG error
3	SW error
4	Other memory error
9	Internal temperature error
11	Measurement error

See “Device Errors” on page 5-10 for more information about the different error messages.

Example

Error code 3 is displayed as the following flash sequence:



NOTE!
Only the first detected error is indicated.

NOTE!
Ensure that o-rings and seats are in good condition prior to mounting the cover in order to maintain the specified level of ingress protection. Cables must be properly attached to the cable glands.

5.3 TROUBLESHOOTING

Table 5-3 provides summarized maintenance and troubleshooting suggestions for the most common operating problems.

5.3.1 General

This section covers problems which are not related to the type of system in which the Rosemount 2230 operates.

Table 5-3. Troubleshooting chart for the 2230 display

Symptom	Possible cause	Action
No communication with the Rosemount 2230	Wiring	• Check that wires are properly connected to the terminals • Check for dirty or defective terminals • Check wire insulation for possible short circuits to ground • Check that there are no multiple shield grounding points • Check that the cable shield is grounded at the power supply end only • Check that the cable shield is continuous throughout the fieldbus network • Check that the shield inside the instrument housing does not come into contact with the housing • Check that there is no water in conduits • Use shielded twisted pair wiring • Connect wiring with drip loops
	Cables are too long	• Check that the input voltage on the device terminal is 9 V or more
	Hardware failure	• Check the 2230 Display if other devices such as the 2410 Tank Hub are detected by the host system. In a FOUNDATION fieldbus system you can check the Device Live List to confirm that the host can detect other devices. • Contact Emerson Process Management/Rosemount TankGauging service department
	Software failure	• Restart the 2230. Use for example the Restart command in TankMaster WinSetup. • Restart all devices by disconnecting and connecting the power supply to the 2410 Tank Hub • Contact Emerson Process Management/Rosemount TankGauging service department
The Status LED is blinking error codes	• Hardware errors • Software errors	• See “Device Error Signals” on page 5-6 • Check Device Status information. See “Status Information” on page 5-2 and “Viewing Input and Holding Registers” on page 5-3) • See “Device Errors” on page 5-10
Configuration can not be saved	Write protection switch is set to the ON position	Check write protection switch on the 2230
Invalid measurement data (--.---)	Device failure	Check the field devices for possible hardware or software failure
Warning symbol appears in front of measurement value	Simulation mode active	Stop simulation mode in WinSetup (open WinSetup *Set Simulation Mode* window and click the Stop button)
Nothing appears on the LCD display	• No power supply • FISCO fuse broken • Contrast settings	Check status LED (see “Device Error Signals” on page 5-6). If Status LED does not light: • check power on Tankbus wiring • check FISCO fuse If Status LED lights: • check contrast settings of the LCD display

5.3.2 Tankbus System

This section covers systems with field devices connected to a Rosemount 2410 Tank Hub.

Table 5-4. Troubleshooting chart for Tankbus related problems

Symptom	Possible cause	Action
No communication with the Rosemount 2230	Incorrect Tankbus termination	• Check that there are two terminators on the Tankbus. Normally the built-in termination in the 2410 Tank Hub is enabled. • Check that terminations are placed at both ends of the Tankbus
	Too many devices on the Tankbus	• Check that the total current consumption of the devices on the Tankbus is less than 250 mA. See the *Rosemount 2410 Reference Manual* (Document no. 305030en) for more information. • Remove one or more devices from the Tankbus. The 2410 Tank Hub supports a single tank. The multiple tank version of the 2410 supports up to 10 tanks.
	Incorrect configuration of 2160 Field Communication Unit (FCU)	• Check the Modbus communication address specified for the ATD device that represents the 2230 display in the 2160 FCU Slave Database. For the single tank version, the ATD address is equal to the Modbus address of the 2410 Tank Hub itself. • Check configuration of communication parameters for the FCU Fieldbus ports • Check that the correct communication channel is selected • See the *Raptor System Configuration Manual* (Document no. 300510EN) for more information on how to configure the 2160 FCU
	Incorrect configuration of tank database in 2410 Tank Hub	• Check the 2410 tank database; ensure that the 2230 device is available and mapped to the right tank • 2410 Tank Database; check that the *ATD Modbus* address is equal to the *2410 Temp* Modbus address in the FCU Slave Database • See the *Raptor System Configuration Manual* (Document no. 300510EN) for more information on how to configure the 2410 tank database
	Connection to 2410 Tank Hub	• Check wiring to the 2410 Tank Hub • Check the 2410 Tank Hub; check the Error LED or the integral display for information

Symptom (continued)	Possible cause	Action
	Configuration of communication protocol	In TankMaster WinSetup: • open the Protocols folder and check that the protocol channel is enabled • check the protocol channel configuration (right-click the protocol channel MbMaster icon, choose the Properties option, and check port, parameters, modem)
	Field Bus Modem (FBM)	• Check that the FBM is connected to the right port on the control room PC • Check that the FBM is connected to the right port on the 2160 Field Communication Unit (FCU)
	Connection to 2160 FCU	• Check that the right field bus port on the 2160 FCU is connected to the Primary bus on the 2410 Tank Hub • Check communication port LED:s inside the Field Communication Unit 2160 (FCU)
Activity indicator shows a warning symbol	Communication failure	Check that the 2230 is configured in the 2410 tank database. See the *Raptor System Configuration Manual* (Document no. 300510EN) for more information on how to configure the 2410 tank database.

5.3.3 Foundation Fieldbus System

This section covers Rosemount Tank Gauging systems in FOUNDATION fieldbus networks.

Table 5-5. Troubleshooting chart for Foundation Fieldbus related problems

Symptom	Possible cause	Action
No communication with the Rosemount 2230	No temporary address available in the FOUNDATION fieldbus segment	There is more than four new devices on the FOUNDATION fieldbus segment. Wait until a temporary address is available.
	The device address is within a range that is not probed by the Link Active Scheduler (LAS)	Make sure that the device address is scanned by the LAS.
	Missing or too many terminations	Ensure that there are two terminations on the FOUNDATION fieldbus segment.
Configuration can not be saved	• Write protection switch is set to the ON position • Software Write Protect is enabled	• Check write protection switch on the 2230 • Disable software write protect. See “Write Protection” on page 5-25.
Activity indicator shows a warning symbol	• Communication failure • Out of Service (OOS)	• See “No communication with the Rosemount 2230” • Set the device to “Auto” mode
Wrong unit appears on the display	• Incorrect configuration in AMS Device Manager. Measurement unit that was chosen in the Display Setup window does not match selected unit in the Manual Setup window	Ensure that the “Default” option is selected for Unit in the Manual Setup window
Cannot commission the 2230 to Foundation fieldbus segment	• Missing Device Description (DD)	Add Rosemount 2230 DD to the FF host

5.3.4 Device Errors

Table 5-6 shows a list of error messages for the *Rosemount 2230*. Detailed information about the different error types can be found in Input registers 1100 - 1134 as shown in Table 5-6.

Table 5-6. Device Errors

Message	Description	Action
RAM Error	Input register no. 1100(1). The following bits indicate a serious RAM problem. Bit 0: RAM	Contact Emerson Process Management/Rosemount TankGauging service department.
FPROM Error	Input register no. 1102. The following bits indicate a serious FPROM problem or wrong software versions loaded. Bit 0: Checksum Error Bit 4: Boot Checksum Bit 5: Boot Version (Invalid version number) Bit 6: Application Checksum Bit 7: Application Version (Invalid version number)	
Hreg Error	Input register no. 1104. The following bits indicate a serious Holding register problem. NOTE: the Holding register default values are used in case of an error. Bit 0: Checksum Error Bit 1: Limit Error. One or more Holding register is out of range. Bit 2: Version Error. Invalid SW version detected. Bit 3: HREG Read Error. Bit 4: HREG Write Error. Failed to program a cell in the EEPROM.	
SW Error	Input register no. 1106. Bit 0: Undefined SW error. Bit 1: Task not running Bit 2: Out of stack space Bit 3: Unused RAM access. Bit 4: Divide by zero error Bit 5: Reset counter overflow Bit 15: Simulated SW error	
Other Memory Error	Input register no. 1108. Bit 0: NVRAM_Access	
Display Error	Input register no. 1112.	Not used
Modem Error	Input register no. 1114.	Not used
Internal Temperature Error	Input register no. 1118. Bit 0: Internal temperature out of range Bit 1: Communication error with temp chip Bit 2: Device error	Contact Emerson Process Management/Rosemount TankGauging service department.
Measurement Error	Input register no. 1122.	Not used

Message	Description	Action
Configuration Error	Input register no. 1124. Bit 1: Unit Not Supported	Choose a supported measurement unit
numHiddenErrors	Input register no. 1132. Number of hidden errors.	Contact Emerson Process Management/Rosemount TankGauging service department.
numOtherErrors	Input register no. 1134. Number of other errors.	

(1) The register number refers to the internal Input Register of the 2230 database.
Note that Input Register data from the 2230 display is temporarily stored in the Input Register database of the 2410 Tank Hub. The Input Registers presented in TankMaster WinSetup refer to the internal register area of the 2410. Therefore, for tank 1 you will have to add 16000 to the 2230 internal register number as given by Table 5-6 in order to find the register presented by WinSetup. For the second and third 2230 display you will have to add 18000 and 20000, respectively.

5.3.5 Device Warnings

Device warnings are signaled in the Input Register *Device Warnings.* Warnings are less serious than errors. Detailed information about the different warning types can be found in Input registers 1050 - 1070.

Table 5-7. Device warnings

Message	Description	Action
RAM warning	Input register no. 1050(1). The application software could not be started. Bit 0: Stack low	Contact Emerson Process Management/Rosemount TankGauging service department.
FPROM warning	Input register no. 1052	Not used
Hreg warning	Input register no. 1054. Bit 0: Default Holding register values used	Contact Emerson Process Management/Rosemount TankGauging service department.
Other memory warning	Input register no. 1056	Not used
Display warning	Input register no. 1058	Not used
Modem warning	Input register no. 1060	Not used
Other hardware warning	Input register no. 1062	Not used
Measurement warning	Input register no. 1064	Not used
ITEMP warning	Input register no. 1066. Bit 0: The internal temperature is out of range	Contact Emerson Process Management/Rosemount TankGauging service department.
Software warning	Input register no. 1068. Bit 1: Stack low (less then 10% left of stack) Bit 2: Software startup	
Configuration warning	Input register no. 1070 Bit 11: Invalid Model Code String Bit 12: Invalid Model Code	

(1) The register number refers to the internal Input Register of the 2230 database. The Input Registers presented in TankMaster WinSetup refer to the internal register area of the 2410. For tank 1 add 16000 to the 2230 internal register number as given by Table 5-7 in order to find the register presented by WinSetup. For the second and third 2230 display you will have to add 18000 and 20000, respectively.

5.3.6 Status Information

Status information is available for each measurement variable via the Status button in the View menu.

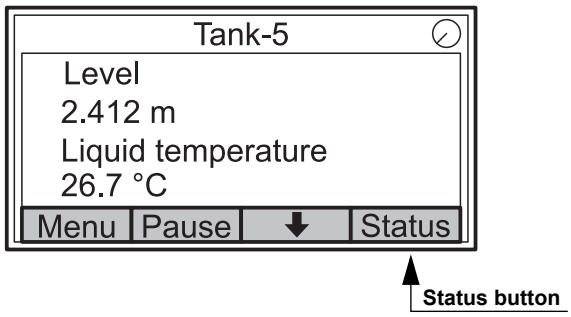


Table 5-8. Status Information

Status	Description	Action
Invalid_TV_Value	Invalid source value.	
InvalidSourceConfig	The source value (Tank Variable) is invalid due to one of the following reasons: • Incorrect configuration • Out of service in FF • Incorrect configuration of measurement units	
DataFrozen	Tank measurement variable not updated for a configurable time or the source data is frozen.	
Saturated Low	Tank measurement variables is outside lower range or saturated.	
Saturated High	Tank measurement variables is outside upper range or saturated.	
Simulated	The tank measurement variable is simulated.	
Manual Value	The tank measurement variable value is manual (constant).	
Approved Value	The tank measurement variable value is inside approval range and the device is write protected.	
Invalid Value	The tank measurement variable value is invalid.	

5.4 RESOURCE BLOCK

Table 5-9. Resource Block BLOCK_ERR messages

Condition Name	Description
Block configuration error	Configuration Error is used to indicate that you have selected an item in FEATURES_SEL or CYCLE_SEL that was not set in FEATURES or CYCLE_TYPE, respectively
Simulate active	This indicates that the simulation switch is in place. This is not an indication that the I/O blocks are using simulated data
Power up	
Out of Service	The actual mode is Out Of Service
Device Fault State	Set and cleared using SET_FSTATE and CLR_FSTATE

5.5 TRANSDUCER BLOCK

Error conditions that may appear in the Transducer block.

Table 5-10. Transducer Block BLOCK_ERR messages

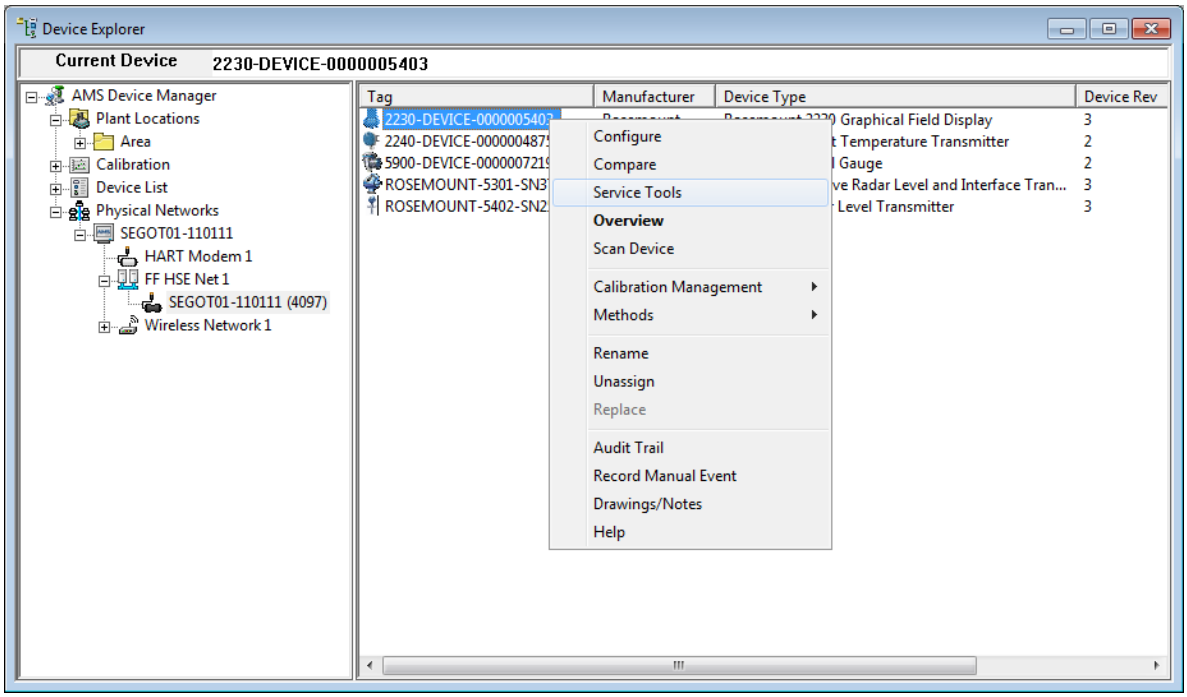
Condition Name	Description
Other error	Set whenever XD_ERROR is non-zero. See also “Service Tools In AMS” on page 5-17.
Out of Service	The actual mode is out of service.

5.6 ALERTS

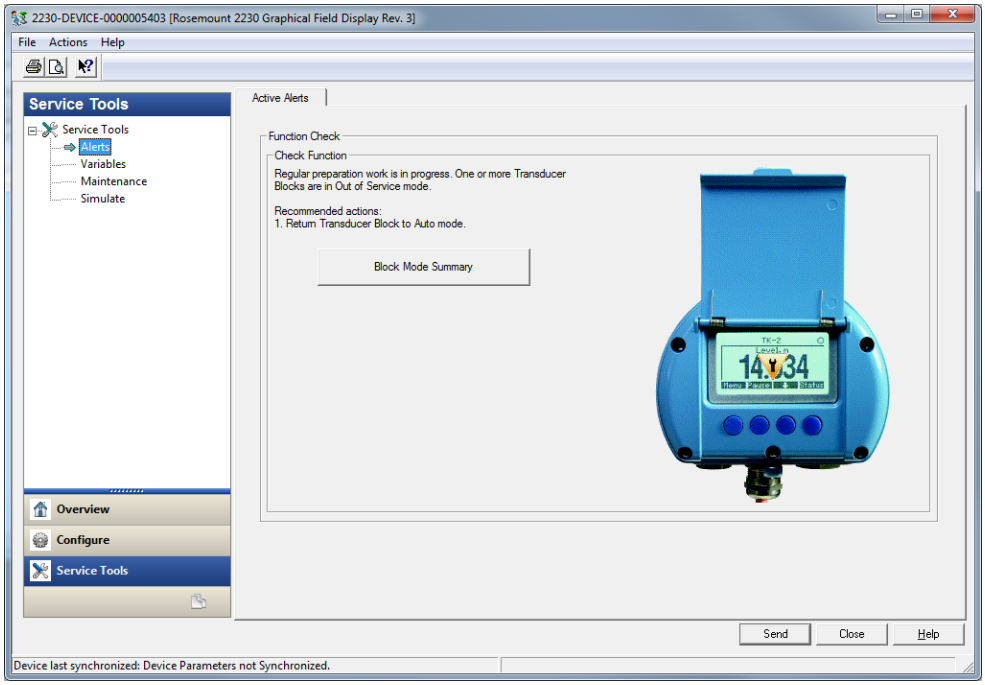
The AMS Device Manager lets you view active alerts. The alarm parameters FD_FAIL_ALM, FD_OFFSPEC_ALM, FD_MAINT_ALM, and FD_CHECK_ALM contain information regarding some of the device errors. Active error conditions are displayed in the FD_xxx_ACTIVE parameter and can easily be listed by using the Service Tools option in AMS. See “Field Diagnostic Alerts” on page 4-29 and “Alert Setup” on page 4-40 for more information on the different alert types.

5.6.1 Viewing Active Alerts in AMS

1. From the Start menu; open the AMS Device Manager application.
2. Open the *View>Device Explorer*.
3. Right-click or double-click the desired device icon to open the list of menu options:



4. Choose the **Service Tools** option.
5. In the Navigation Pane select the **Alerts** option.



6. The Active Alerts tab shows the alerts that are currently active. All types of alerts can be shown; Failed, Maintenance, Out of Specification, and Check Function. A brief description of the error is presented as well as the recommended action.
7. Alerts are listed in order of priority beginning with Failed. By scrolling down you will see Out of Specification, Maintenance, and Function Check alerts as well.
8. Click the **Device Status** button (if available) to view a summary of active device information such as errors and warnings.

   The *Device Status* window shows Errors, Warnings, and Status information related to the 2230 display. Note that this window does not show active alerts.

5.6.2 Recommended Actions

The FD_RECOMMEN_ACT and RECOMMENDED_ACTION parameters display text strings that will give a recommended course of action to take based on which type and which specific event of the alert that is active. Table 5-11 provides recommended actions for Field Diagnostic Alerts as given by the alert default setting for the Rosemount 2230 Display.

Table 5-11. Recommended actions for Field Diagnostics Alerts.

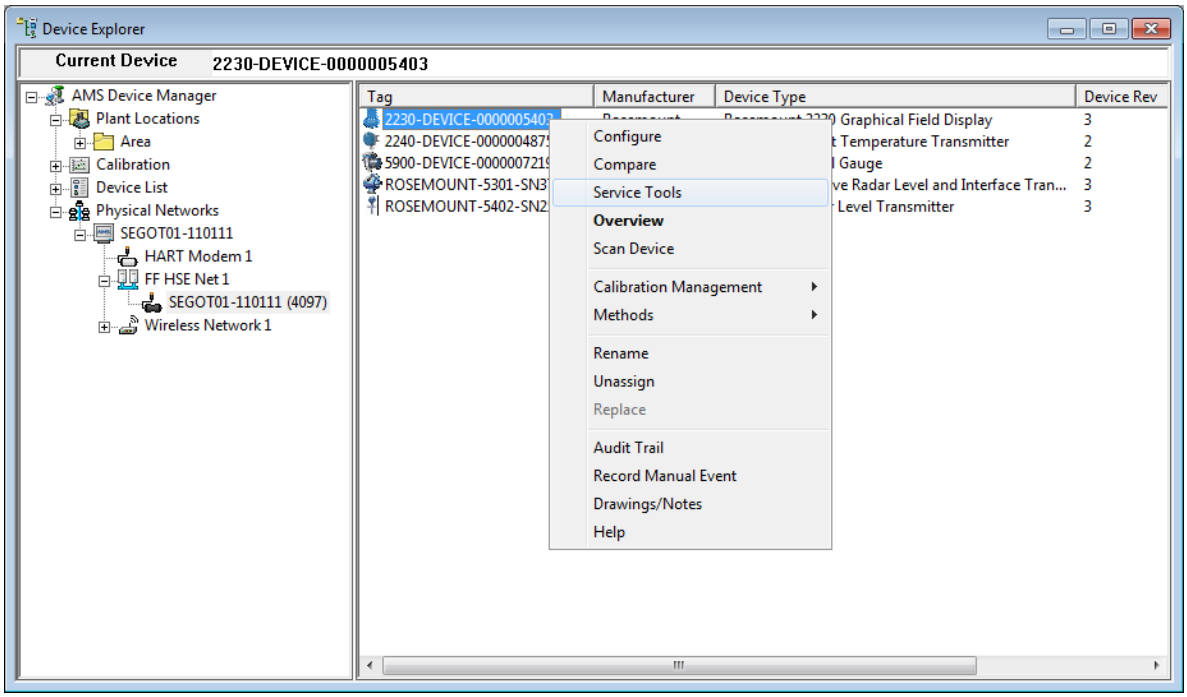
Alert Type	Description	Recommended Action
Failure	Software Failure	1. Restart the device. 2. Load default database to the device and reconfigure the device. 3. Contact Rosemount Tank Gauging Service Department.
	Database Error	1. Restart the device. 2. Load default database to the device. 3. Reconfigure the device.
	Memory Failure - FF I/O Board	1. Perform a Factory Reset - FF I/O Board. 2. If error persists, it may indicate a faulty memory chip. Replace the transmitter head.
	Electronics failure - Main Board	Replace the device.
	Internal Communication Failure	1. Restart the device 2. Replace the device.
	Electronics failure - FF I/O Board	Replace the device.
Out of Specification	MAO Fault State Mode Enabled. One or several MAO blocks are configured with fault-state mode enabled.	Turn fault state mode off in MAO block
	Internal Temperature Out of Limits	Check ambient temperature at installation site
	Invalid Model Code	Contact Rosemount Tank Gauging Service Department.
Function Check	Check Function. One or more Transducer Blocks are in Out of Service mode.	Return transducer block to Auto mode

5.7 SERVICE TOOLS IN AMS

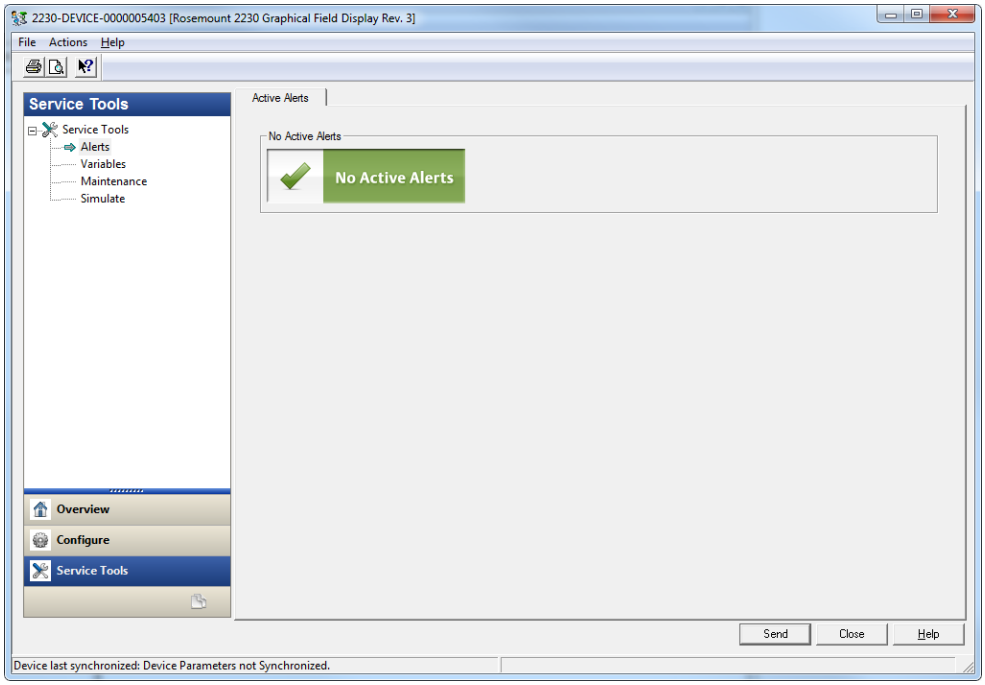
5.7.1 Service Tools Window

AMS Device Manager supports a number of service functions for the 2230 display. To access the service tools:

1. Start AMS Device Manager and open the *View>Device Explorer*.
2. Right-click or double-click the desired 2230 device icon to open the list of menu options.



3. Choose **Service Tools**.



4. In the Navigation Pane select the desired Service Tools option.

The following Service Tool options are available:

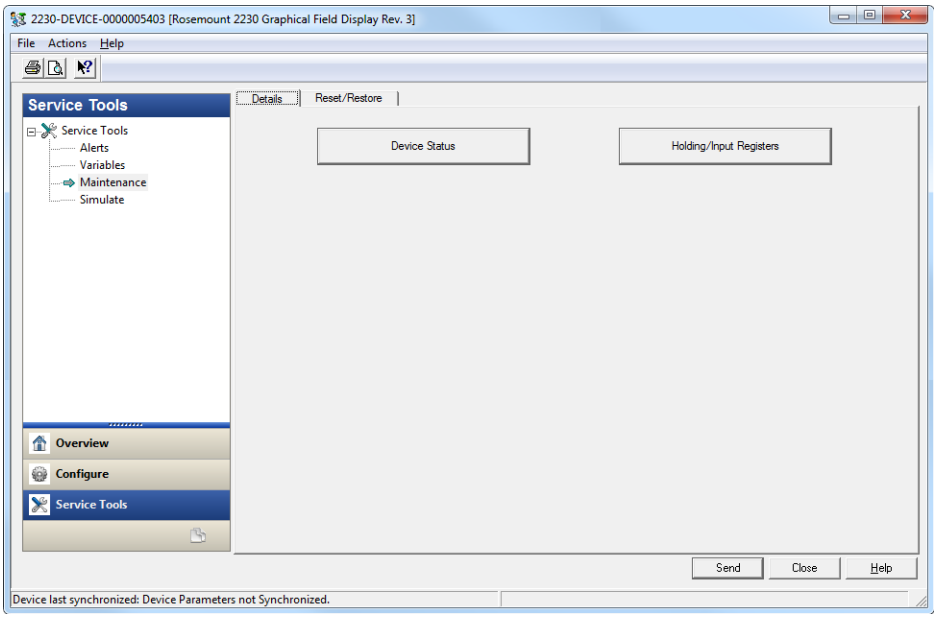
Table 5-12. Service Tools options

Service Tools	Tabs	Options
Alerts	Active Alerts	
Variables	MAO Block 1-4	
	Internal Temperature	
Maintenance	Details	Device Status
		Holding/Input Registers
	Reset/Restore	Restart Communication
		Factory Reset - Device Configuration
		Factory Reset - FF I/O Board
Simulate	Alerts	

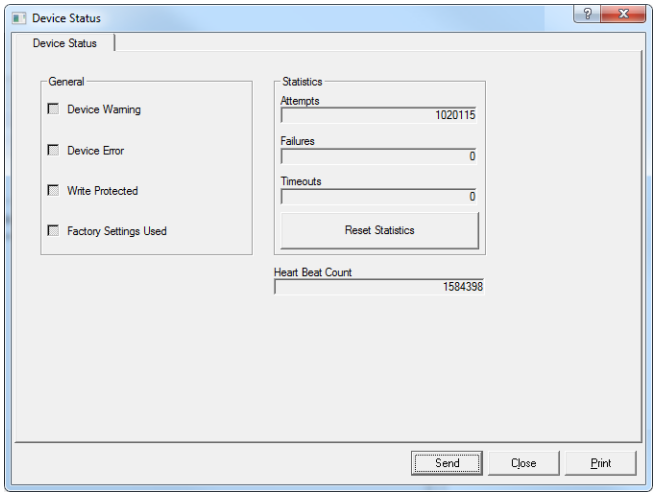
5.7.2 Device Status

To view the current device status:

1. In AMS Device Manager open Service Tools window as shown in section “Service Tools Window” on page 5-17.
2. In the Navigation Pane select the **Maintenance** option.



3. Select the **Details** tab.
4. Click the **Device Status** button.



In the *Device Status* tab, the current status of the 2230 is grouped in separate categories. In the General pane check boxes indicate the current status of the 2230 Display.

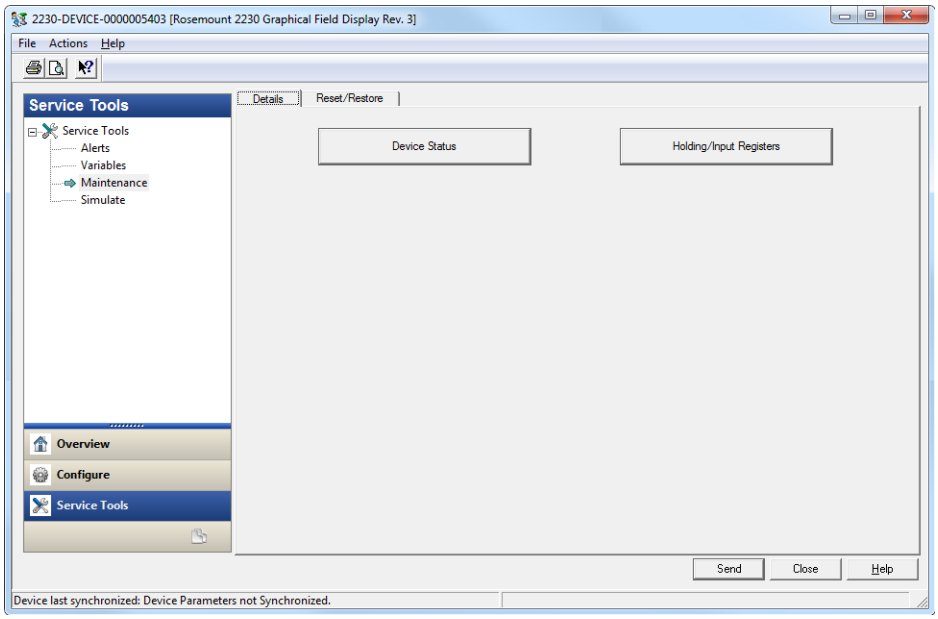
5.7.3 Viewing Input/Holding Registers

Measurement data is continuously updated in the *Rosemount 2230* **Input Registers.** They can be used for verifying that the Rosemount 2230 works properly and for advanced troubleshooting.

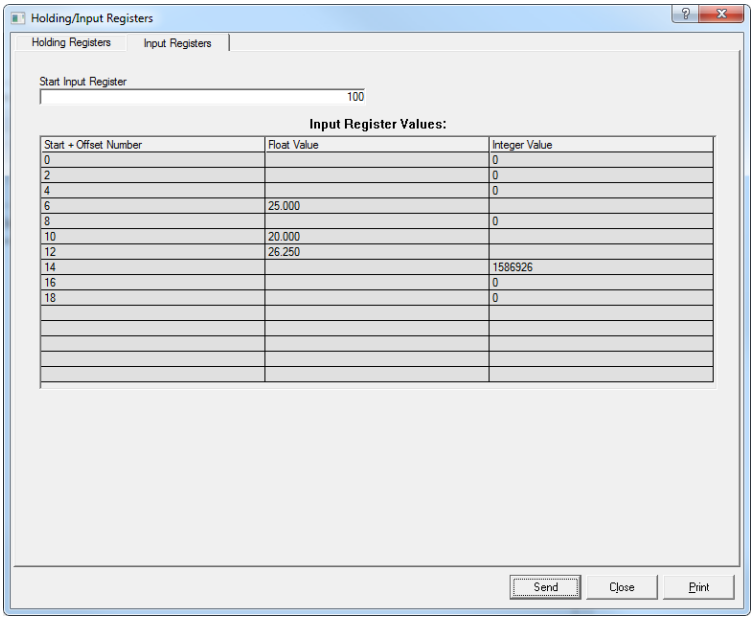
The **Holding Registers** store various configuration parameters which are used to control the display presentation.

To view Input or Holding registers for a Rosemount 2230:

1. In AMS Device Manager open Service Tools as shown in *"Service Tools Window" on page 5-17*.
2. In the Navigation Pane select the **Maintenance** option.



3. Select the **Details** tab.
4. Click the **Holding/Input Registers** button.



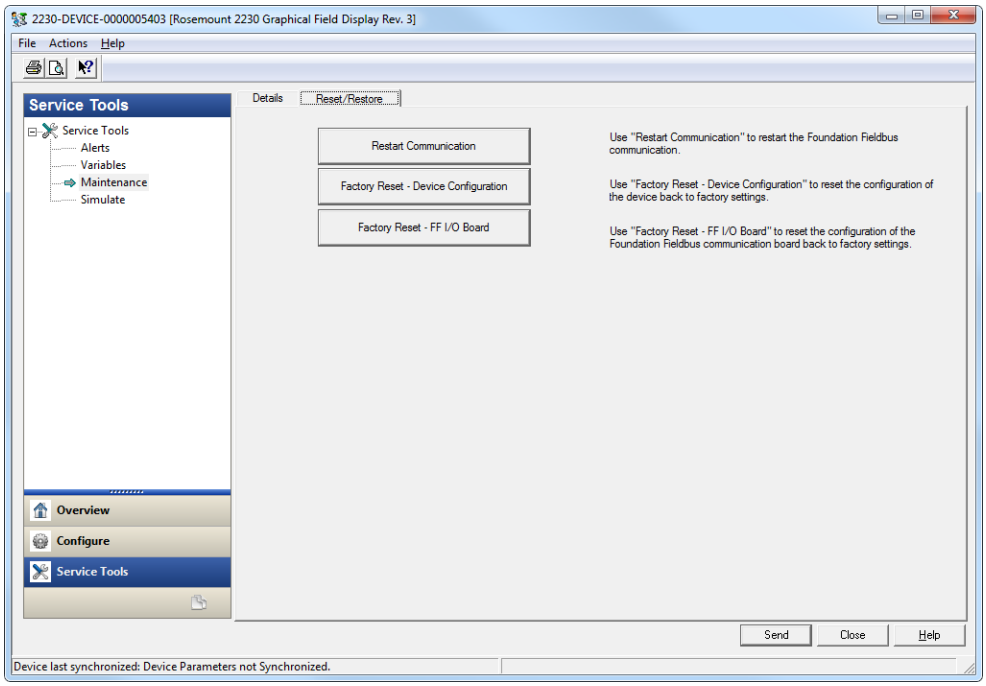
5. Select one of the tabs *Holding Registers* or *Input Registers*, depending on what type of register you are interested in.
6. Type a start value in the Start Holding/Input Register field, and click the Send button to view the current register values.

WARNING!
Writing to Holding registers may cause the device to change behavior. Make sure systems and people relying on data from the device are made aware of the changed conditions due to this action. Failure to do so could result in death, serious injury and/or property damage.

5.7.4 Reset/Restore

The Service Tools/Maintenance option lets you restart the Rosemount 2230 Display if needed. You may also reset the 2230 to factory configuration:

1. In AMS Device Manager open **Service Tools** as shown in *"Service Tools Window" on page 5-17*.
2. In the Navigation Pane select the **Maintenance** option.



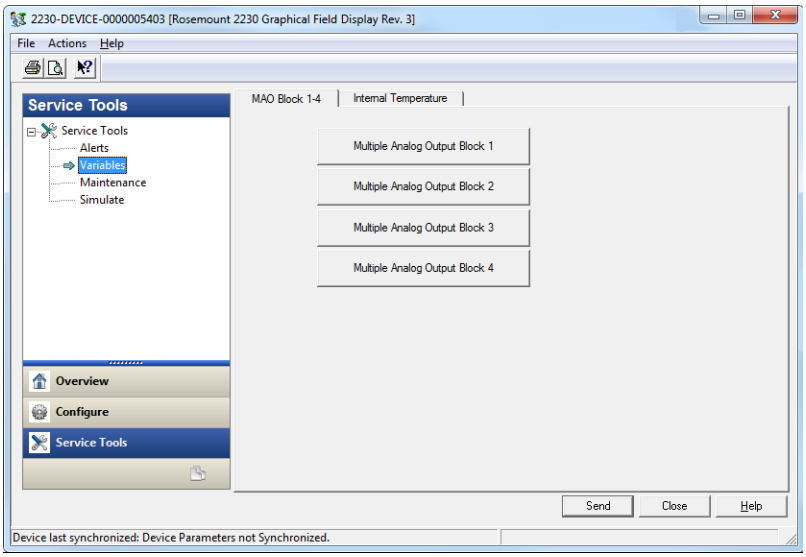
3. Select the **Reset/Restore** tab.
4. Click the desired button. You may choose between the following options:
   - Restart communication - restarts the Foundation fieldbus communication
   - Factory Reset - Device Configuration. This option will reset the device specific configuration to the factory settings.
   - Factory Reset - FF I/O Board. This option will reset the Foundation fieldbus communication board to the factory configuration
5. Click the OK to close the window when finished.

5.7.5 Variables

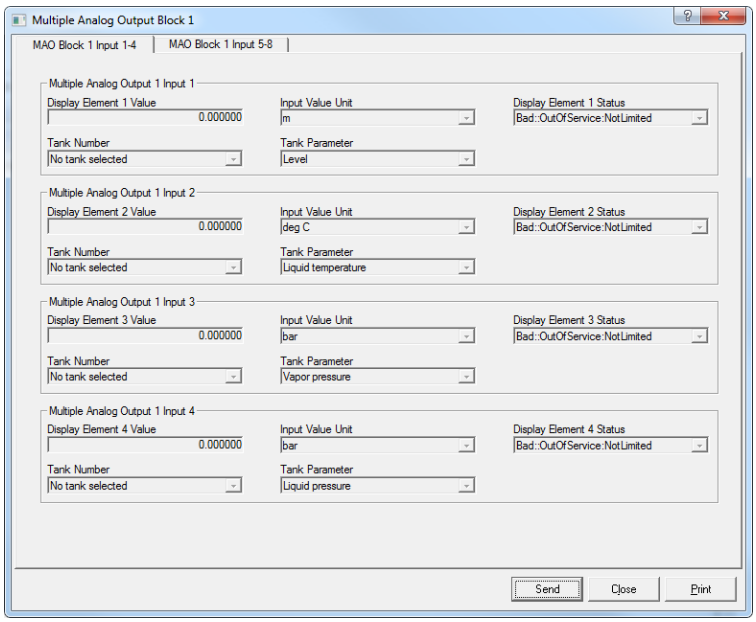
The Service Tools/Variables option lets you view the current values of the Multiple Analog Output Block inputs as well as the Internal Temperature of the 2230 Display.

To reset a Rosemount 2230 Display to factory configuration:

1. In AMS Device Manager open **Service Tools** as shown in *"Service Tools Window" on page 5-17*.
2. In the Navigation Pane select the **Variables** option.



3. View the desired variables by selecting the appropriate tab. For each MAO Block there is a button which lets you view all the inputs for the selected block:

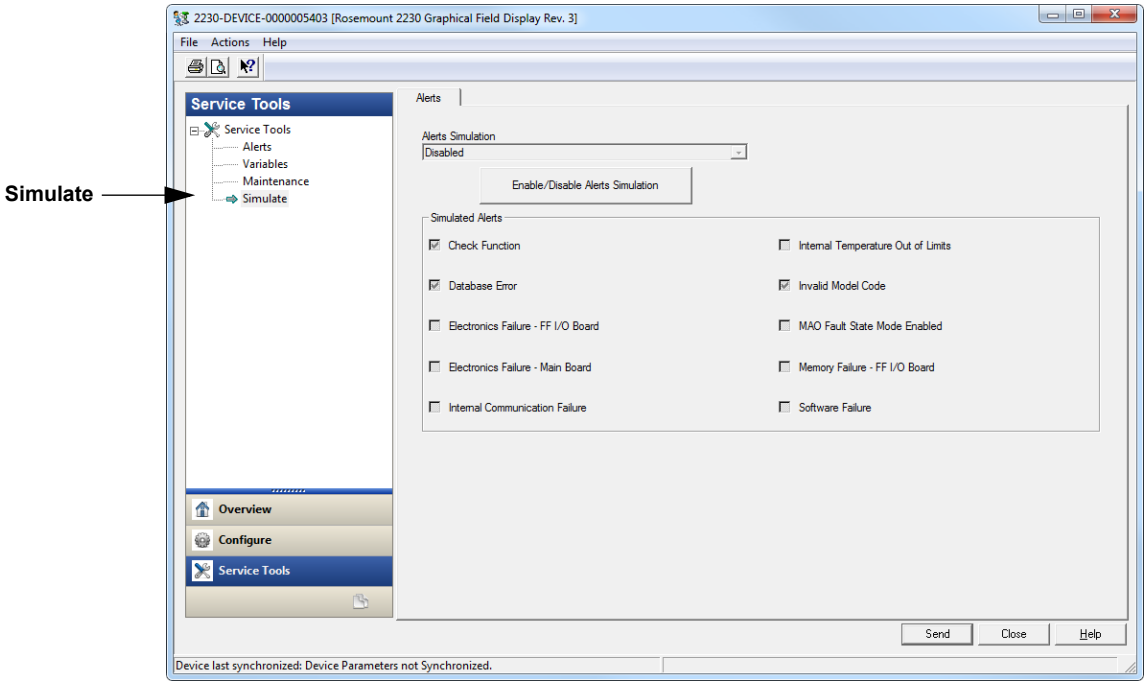


5.7.6 Simulation

The Service Tools/Maintenance option lets you simulate Field Diagnostics alerts.

To start simulation:

1. Ensure that the Simulation switch is set to “ON” (see “Write Protection” on page 5-25).
2. In AMS Device Manager open **Service Tools** as shown in *“Service Tools Window” on page 5-17*.
3. In the Navigation Pane select the **Simulate** option.



4. Check the error conditions that you wish to simulate.
5. Click the Enable/Disable Alerts Simulation button to enable simulation of alerts.
6. Click the Send button to start simulation.

5.7.7 Active Alerts

See “Viewing Active Alerts in AMS” on page 5-14.

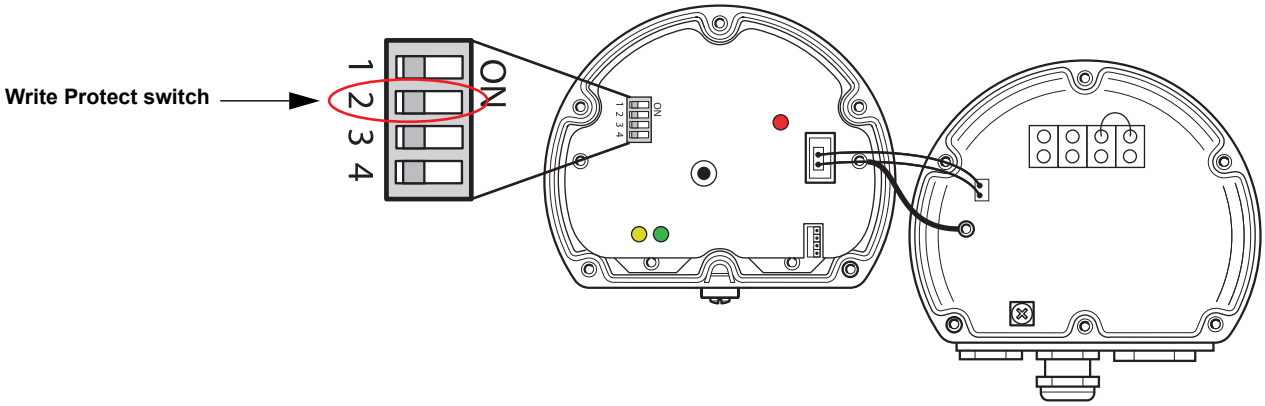
5.8 WRITE PROTECTION

There are two write protection options available for the 2230 Display; hardware switch and software protection.

Hardware Switch

The Write Protect switch enables write protection of configuration data and FOUNDATION fieldbus parameters. The switch is located inside the cover of the 2230 Display as illustrated in Figure 5-4.

Figure 5-4. Write Protect switch



Foundation Fieldbus

In order to enable the hardware switch the HARDW_LOCK bit in the FEATURE_SEL parameter must be enabled. See “FEATURES and FEATURES_SEL” on page 4-27 for more information.

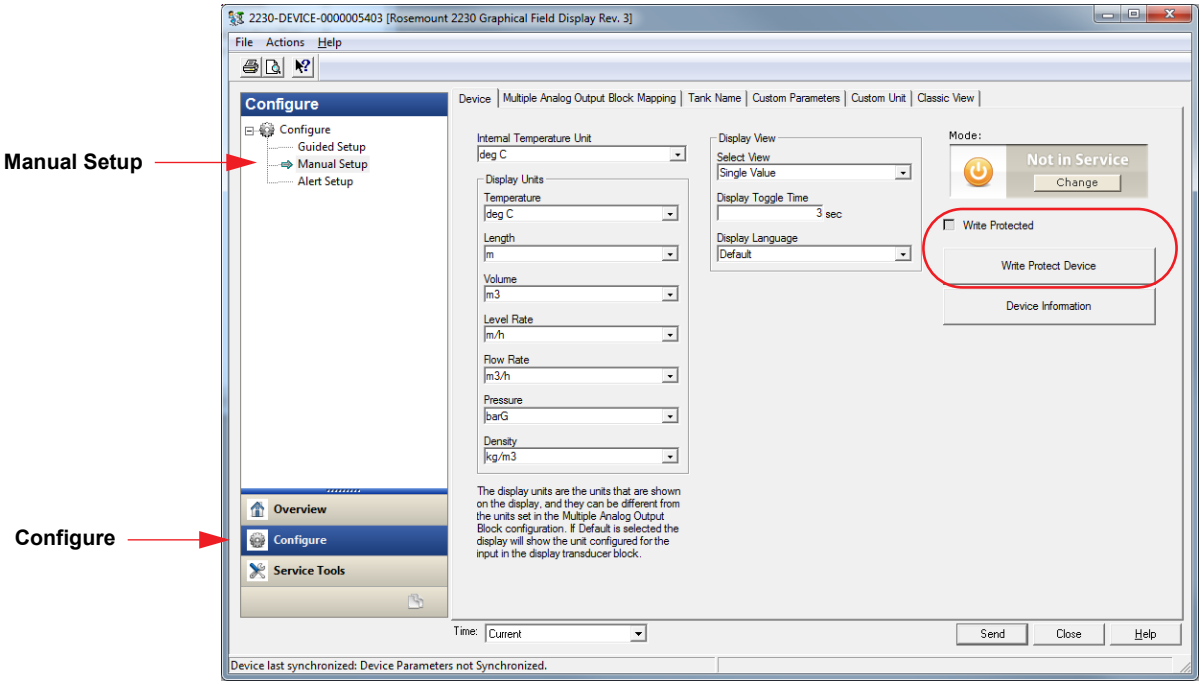
Software Write Protection in AMS

When the Rosemount 2230 Display is used in FOUNDATION fieldbus systems it can be software write protected in order to prevent changes of the configuration database and FIELDBUS parameters.

To enable software write protection:

1. Open the AMS Device Manager Software.
2. Select the Configure>Manual Setup option.
3. Select the *Device* tab.
4. Enable write protection by clicking the **Write Protect Device** button. When the 2230 is software write protected, the push buttons on the front of the 2230 housing can no longer be used to change device configuration. All holding registers and Fieldbus parameters will be protected.

Write protection can be disabled at anytime by clicking the Write Protect Device button again.



Appendix A Reference Data

A.1 SPECIFICATIONS

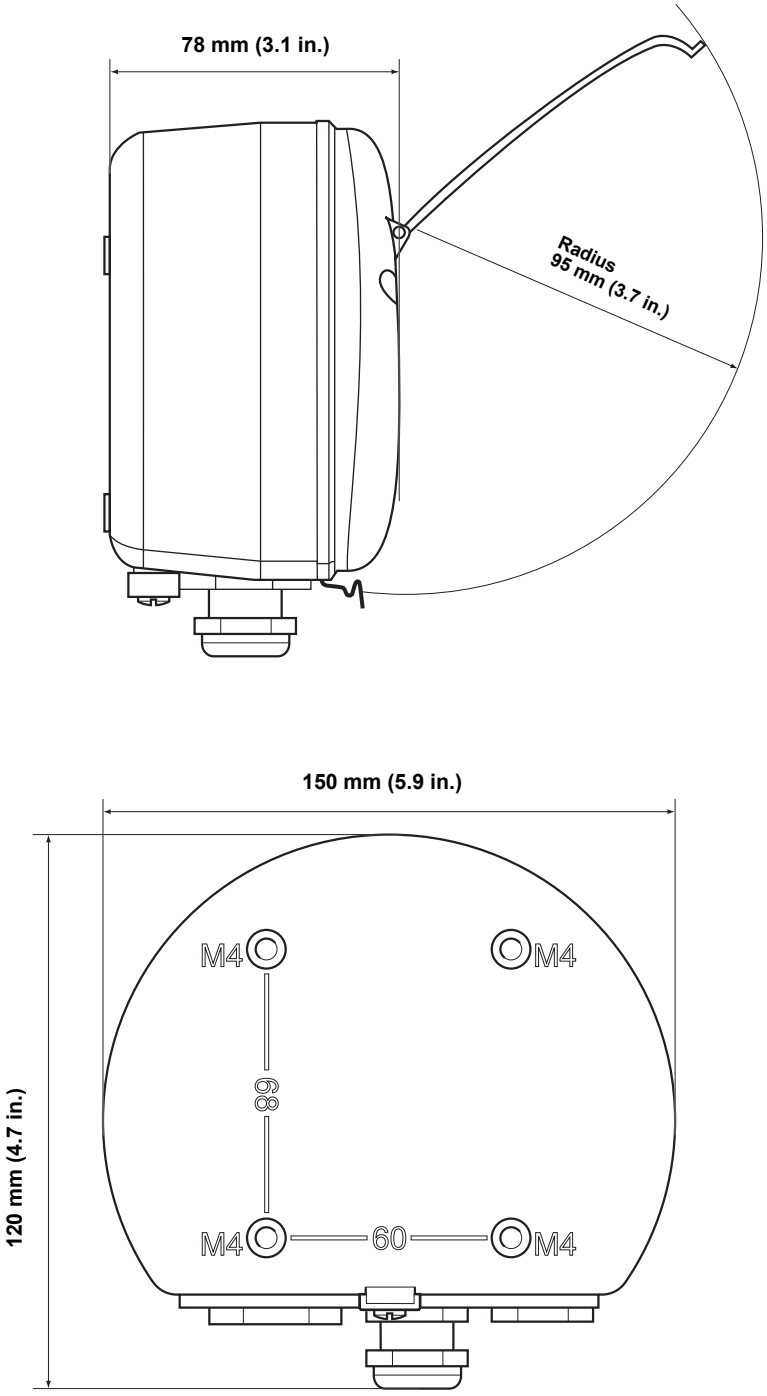
General	
Product	Rosemount 2230 Graphical Field Display
Toggle time	The time each value or set of values are shown on the display: 2-30 s
Language selection possibilities	English, French, German, Spanish, Italian, and Portuguese
Variables to display	Level, level rate, ullage, signal strength, volume (TOV), liquid average temperature, 1-16 spot temperature, vapor average temperature, ambient temperature, free water level, vapor pressure, liquid pressure, air pressure, observed density, and flow rate
Units to display	Level, free water level, and ullage: meter, millimeter, feet, or imperial 1/16 Level rate: meter/second, meter/hour, feet/second, or feet/hour Flow rate: $meter^3$/hour, liter/minute, $feet^3$/hour, barrel/hour, or US gallon/hour Total Observed Volume (TOV): $meter^3$, liters, $feet^3$, barrel, or US gallon Temperature: °F, °C, or °K. Pressure: psi, psiA, psiG, bar, barA, barG, atm, Pa, or kPa Density: kg/m^3, kg/liter, or °API Signal strength: mV
Hazardous location certifications and IS parameters	ATEX, FM-C, FM-US, and IECEx.
CE-mark	Complies with applicable EU directives (EMC, ATEX)
Ordinary location certification	Complies with FM 3810:2005 and CSA: C22.2 No. 1010.1
Electric	
Power supply	Input voltage U_i for FOUNDATION™ fieldbus: • 9.0 to 17.5 VDC in FISCO applications • 9.0 to 30 VDC in Entity applications
IS parameters	See “Product Certifications” on page B-1
Bus current draw	30 mA
Display type	Back-lit LCD monochrome display. 128x64
Start-up time	5 s
Update rate	New values to display once every two seconds
Response time	< 0.5 s from released button to new image
Cable entry(1) (connection/glands)	Three entries, two M20×1.5 and one M25×1.5. Optional: • ½ - 14 NPT conduit / cable adapter • Metal cable glands (½ - 14 NPT) • 4-pin male Eurofast connector or A size Mini 4-pin male Minifast connector
Tankbus cabling	AWG 0.5-1.5 mm^2 (22-16), shielded twisted pairs
Built-in termination	Yes (to be connected if required)

FOUNDATION™ fieldbus characteristics	
Polarity sensitive	No
Quiescent current draw	30 mA
Lift-off minimum voltage	9.0 VDC
Device capacitance / inductance	See Appendix B: Product Certifications
Class (Basic or Link Master)	Link Master (LAS)
Number of available VCRs	Maximum 38. Client and server=20, Publisher=20, Subscribers=20, Source=2, Sink=0.
Links	Maximum 32
Minimum slot time / maximum response delay / minimum intermessage delay	8 /5 /8
Blocks and Execution time	1 **Resource** block, 3 **Transducer** blocks (Main, Register, Display) 4 **Multiple Analog Output** (MAO) blocks: 15 ms, For more information, see the FOUNDATION™ fieldbus Blocks manual (document number 00809-0100-4783)
Instantiation	No
Conforming FOUNDATION™ fieldbus	ITK 6
Field Diagnostics support (NAMUR 107)	Yes
Action support wizards	Write protect device, factory reset - device configuration, reset statistics, start/stop alerts simulation, restart communication
Advanced diagnostics	Software, memory/database, electronics, internal communication, configuration, model code, internal temperature, MAO fault state
Mechanical	
Housing material	Polyurethane-covered die-cast aluminum
Dimensions (width x height x depth)	150 x 120 x 78 mm (5.9 x 4.7 x 3.1 in.)
Weight	1.2 kg (2.6 lbs)
Environment	
Ambient temperature	-20 to 70 °C (-4 to 158 °F)
Storage temperature	-30 to 85 °C (-22 to 185 °F)
Humidity	0-100% relative humidity, non-condensing
Ingress protection	IP 66 and 67 (Nema 4)
Metrology sealing possibility	Yes
Write protect switch	Yes

(1) Make sure that unused ports are properly sealed to prevent moisture or other contamination from entering the electronics housing. Use the enclosed metal plug for this purpose.

A.2 DIMENSIONAL DRAWINGS

Figure A-1. Dimensional drawings



A.3 ORDERING INFORMATION

Model (Pos 1)	Product Description	Note
2230	Graphical Field Display	
Code (Pos 2)	**Default Language**	**Note**
E	English	
S	Spanish	
G	German	
F	French	
P	Portuguese	
I	Italian	
C	Chinese	
Code (Pos 3)	**Tankbus: Power and Communication**	**Note**
F	Bus powered 2-wire FOUNDATION™ fieldbus (IEC 61158)	
Code (Pos 4)	**Software**	**Note**
S	Standard	
Code (Pos 5)	**Hazardous Location Certification**	**Note**
I1	ATEX Intrinsic Safety	
I2	Brazil Inmetro Intrinsic Safety	
I5	FM-US Intrinsic Safety	
I6	FM-Canada Intrinsic Safety	
I7	IECEx Intrinsic Safety	
KA	ATEX Intrinsic Safety+FM-US Intrinsic Safety	
KC	ATEX Intrinsic Safety+IECEx Intrinsic Safety	
KD	FM-US Intrinsic Safety+FM-Canada Intrinsic Safety	
NA	No Hazardous Location Certification	
Code (Pos 6)	**Custody Transfer Type Approval**	**Note**
R	OIML R85 E performance certification	
C(1)	PTB Eich (German W&M)	
N	NMi (the Netherlands W&M)	
0	None	
Code (Pos 7)	**Housing**	**Note**
A	Standard enclosure	Polyurethane-covered aluminium. IP 66/67
Code (Pos 8)	**Cable/Conduit Connections**	**Note**
1	1/2–14 NPT and 3/4-14 NPT Adapters	Female thread. Includes 2 plugs and 3 adapters
2	M20 x 1.5 and M25 x 1.5	Female thread. Includes 2 plugs
G	Metal Cable Glands (M20 x 1.5 and M25 x 1.5)	Min. temperature -20˚C (-4˚F). ATEX / IECEx Exe approved. Includes 2 plugs
E	Eurofast Male, M20 x 1.5 and M25 x 1.5	3 plugs included
M	Minifast Male, M20 x 1.5 and M25 x 1.5	3 plugs included
Code (Pos 9)	**Mechanical Installation**	**Note**
W	Wall installation kit included	
P	Mounting kit for both wall and pipe installation	(1-2 in. vertical and horizontal pipes)
Code	**Options – none or multiple selections are possible**	**Note**
ST	Engraved SST tag plate	Provide tag information in order
Model Code Example: 2230 - E F S I1 0 A 1 W - ST		

(1) Requires 5900S Radar Level Gauge and 2410 Tank Hub with corresponding Custody Transfer Type Approval

Appendix B Product Certifications

B.1 SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operations. Information that raises potential safety issues is indicated by a warning symbol (⚠). Please 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 environment of the transmitter is consistent with the appropriate hazardous locations certifications.

Before connecting a HART-based communicator in an explosive atmosphere, make sure 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 alive.

⚠WARNING

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

Make sure the transmitter 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 service other than those contained in this manual unless you are qualified.

Any substitution of non-recognized spare parts may jeopardize safety. Repair, for e.g. substitution of components etc. may also jeopardize safety and is under no circumstances allowed.

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.

Make sure the mains power to the Radar Transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the transmitter.

Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

B.2 EU CONFORMITY

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount Tank Gauging web site at www.rosemount-tg.com. A hard copy may be obtained by contacting our local sales representative.

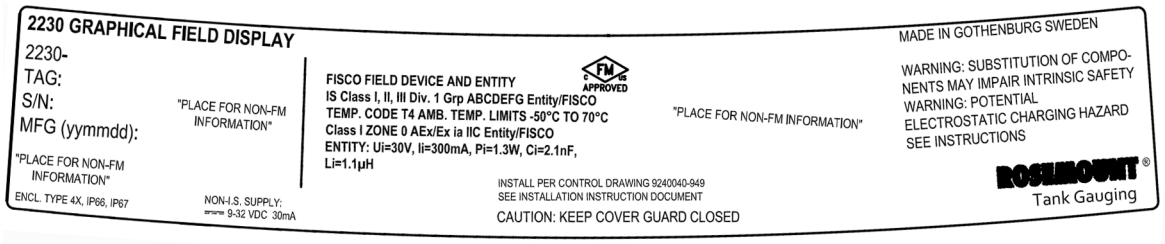
B.3 HAZARDOUS LOCATIONS CERTIFICATIONS

The Rosemount 2230 Graphical Field Displays that have the following labels attached have been certified to comply with the requirements of the approval agencies noted.

B.3.1 Factory Mutual US Approvals

Certificate of Compliance: 3037177

Figure B-1. Factory Mutual Intrinsic Safety US Approval Label



I5

FISCO Field Device (Fieldbus Terminals)

Intrinsically Safe for Class I, II, III Division 1, Groups A, B, C, D, E, F and G

Temperature Class T4, Ambient Temperature Limits: -50 °C to +70 °C

Class I Zone 0 AEx ia IIC T4 (-50 °C ≤ Ta ≤ +70 °C)

Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=2.1nF, Li=1.1µH

Entity (Fieldbus Terminals)

Intrinsically Safe for Class I, II, III Division 1, Groups A, B, C, D, E, F and G

Temperature Class T4, Ambient Temperature Limits: -50 °C to +70 °C

Class I Zone 0 AEx ia IIC T4 (-50 °C ≤ Ta ≤ +70 °C)

Ui=30V, Ii=300mA, Pi=1.3W, Ci=2.1nF, Li=1.1µH

Install per Control Drawing 9240040-949

Special Conditions of Use

1. The non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore particularly when it is used for applications that specifically require Division 1 and Group II, Zone 0 located equipment, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Additionally, the equipment shall only be cleaned with a damp cloth.

2. The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

3. The associated apparatus through which the equipment is supplied shall provide galvanic isolation between the input and output of the associated apparatus.

B.3.2 Factory Mutual Canadian Approvals

Certificate of Compliance: 3037177C.

Figure B-2. Factory Mutual Intrinsic Safety Canadian Approval Label

I6

FISCO Field Device (Fieldbus Terminals)

Intrinsically Safe for Class I, II, III Division 1, Groups A, B, C, D, E, F and G

Temperature Class T4, Ambient Temperature Limits: -50 °C to +70 °C

Ex ia IIC

Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=2.1nF, Li=1.1µH

Entity (Fieldbus Terminals)

Intrinsically Safe for Class I, II, III Division 1, Groups A, B, C, D, E, F and G

Temperature Class T4, Ambient Temperature Limits: -50 °C to +70 °C

Ex ia IIC

Ui=30V, Ii=300mA, Pi=1.3W, Ci=2.1nF, Li=1.1µH

Install per Control Drawing 9240040-949

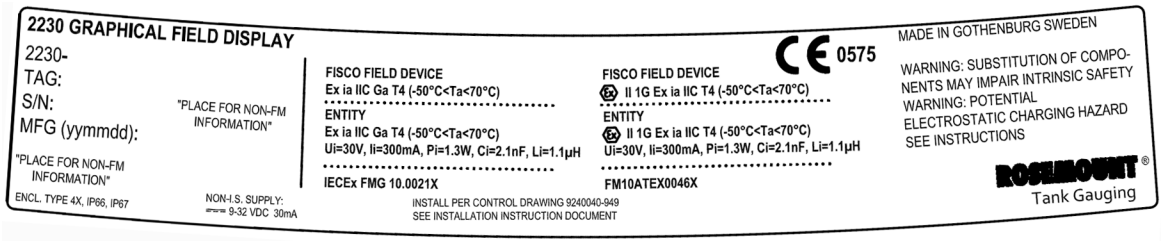
Special Conditions of Use

1. The associated apparatus through which the equipment is supplied shall provide galvanic isolation between the input and output of the associated apparatus.

B.3.3 European ATEX Directive Information

The Rosemount 2230 Graphical Field Displays that have the following labels attached have been certified to comply with Directive 94/9/EC of the European Parliament and the Council as published in the Official Journal of the European Communities No. L 100/1 on 19-April-1994.

Figure B-3. ATEX Intrinsic Safety Approval Label



I1 The following information is provided as part of the label of the transmitter:

- Name and address of the manufacturer (Rosemount)
- CE Conformity Marking

CE 0575

- Model number
- Serial number of the device
- Year of construction
- ATEX EC-Type Examination Certificate Number FM10ATEX0046X
- Install per Control Drawing: 9240040-949

FISCO Field Device (Fieldbus Terminals)

Ex II 1 G

- Ex ia IIC T4 (-50 °C ≤ Ta ≤ +70 °C)
- Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=2.1nF, Li=1.1µH

Entity (Fieldbus Terminals)

Ex II 1 G

- Ex ia IIC T4 (-50 °C ≤ Ta ≤ +70 °C)
- Ui=30V, Ii=300mA, Pi=1.3W, Ci=2.1nF, Li=1.1µH

Specific Conditions of Certification (X)

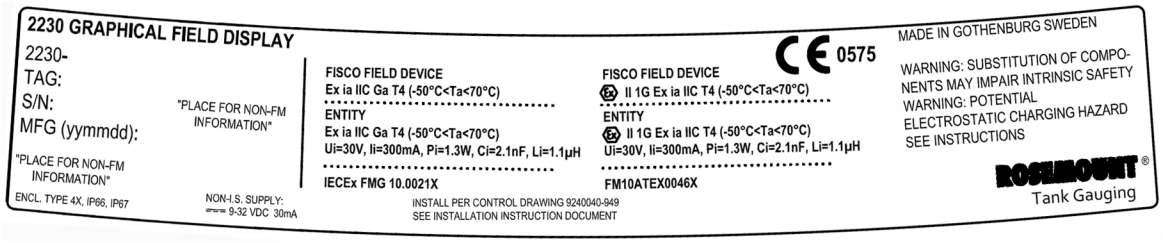
1. The non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore particularly when it is used for applications that specifically require Group II, Zone 0 located equipment, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Additionally, the equipment shall only be cleaned with a damp cloth.

2. The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

3. The associated apparatus through which the equipment is supplied shall provide galvanic isolation between the input and output of the associated apparatus.

B.3.4 IECEx Approval

Figure B-4. IECEx Intrinsic Safety Approval Label



I7 The following information is provided as part of the label of the transmitter:

- Name and address of the manufacturer (Rosemount)
- Model number
- Serial number of the device
- IECEx Certificate of Conformity Number IECEx FMG 10.0021X
- Install per Control Drawing: 9240040-949

FISCO Field Device (Fieldbus Terminals)

- Ex ia IIC Ga T4 (-50 °C ≤ Ta ≤ +70 °C)
- Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=2.1nF, Li=1.1µH

Entity (Fieldbus Terminals)

- Ex ia IIC Ga T4 (-50 °C ≤ Ta ≤ +70 °C)
- Ui=30V, Ii=300mA, Pi=1.3W, Ci=2.1nF, Li=1.1µH

Specific Conditions of Certification (X)

1. The non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic charge. Therefore particularly when it is used for applications that specifically require Group II, Zone 0 located equipment, the equipment shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. Additionally, the equipment shall only be cleaned with a damp cloth.

2. The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

3. The associated apparatus through which the equipment is supplied shall provide galvanic isolation between the input and output of the associated apparatus.

B.4 APPROVAL DRAWINGS

Follow the installation guidelines presented in Factory Mutual system control drawings in order to maintain certified ratings for installed devices.

The following drawings are included in the documentation for the Rosemount 2230 Graphical Field Display:

9240040-949 System Control Drawing for hazardous location installation of intrinsically safe FM approved apparatus.

See the “Manuals & Drawings” CD ROM that is shipped with the 2230 Graphical Field Display for electronic copies of the system control drawings.

Drawings are also available on the Rosemount Tank Gauging web site: www.rosemount-tg.com.

Appendix C FOUNDATION fieldbus Block Information

C.1 RESOURCE BLOCK

This section contains information on the Resource Block of the Rosemount 2230S Graphical Field Display.

The resource block defines the physical resources of the device. The resource block also handles functionality that is common across multiple blocks. The block has no linkable inputs or outputs.

Table C-1. Resource Block Parameters

Index Number	Parameter	Description
01	ST_REV	The revision level of the static data associated with the function block.
02	TAG_DESC	The user description of the intended application of the block.
03	STRATEGY	The strategy field can be used to identify grouping of blocks.
04	ALERT_KEY	The identification number of the plant unit.
05	MODE_BLK	The actual, target, permitted, and normal modes of the block: Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for actual
06	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
07	RS_STATE	State of the function block application state machine.
08	TEST_RW	Read/write test parameter - used only for conformance testing.
09	DD_RESOURCE	String identifying the tag of the resource which contains the Device Description for this resource.
10	MANUFAC_ID	Manufacturer identification number – used by an interface device to locate the DD file for the resource.
11	DEV_TYPE	Manufacturer’s model number associated with the resource - used by interface devices to locate the DD file for the resource.
12	DEV_REV	Manufacturer revision number associated with the resource - used by an interface device to locate the DD file for the resource.
13	DD_REV	Revision of the DD associated with the resource - used by an interface device to locate the DD file for the resource. The DD_REV specifies the minimum DD revision that is compatible with the device (within the same device revision). A vendor can release an updated DD with the DD_REVISION higher than the DD_REV. This allows a vendor to release an updated DD files set that will be compatible with an existing device revision in the field. The host can always load a higher DD_REVISION for a given DEV_REV/DEV_REVISION. As per Foundation requirement the DD_REV will always be 01.
14	GRANT_DENY	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Not used by device.
15	HARD_TYPES	The types of hardware available as channel numbers.
16	RESTART	Allows a manual restart to be initiated. Several degrees of restart are possible. They are the following: 1 Run – is the passive state of the parameter 2 Restart resource – not used 3 Restart with defaults – intended to reset parameters to default values, i.e. their value before any configuration was done 4 Restart processor – does a warm start of CPU

Index Number	Parameter	Description
17	FEATURES	Used to show supported resource block options. The supported features are: • HARD_WRITE_LOCK_SUPPORT • SOFT_WRITE_LOCK_SUPPORT • REPORT_SUPPORT • UNICODE_SUPPORT • MULTI_BIT ALARM • FAULT_STATE_SUPPORT
18	FEATURES_SEL	Used to select resource block options.
19	CYCLE_TYPE	Identifies the block execution methods available for this resource.
20	CYCLE_SEL	Used to select the block execution method for this resource. The Rosemount 2230 supports the following: Scheduled: Blocks are only executed based on the function block schedule. Block Execution: A block may be executed by linking to another blocks completion.
21	MIN_CYCLE_T	Time duration of the shortest cycle interval of which the resource is capable.
22	MEMORY_SIZE	Available configuration memory in the empty resource. To be checked before attempting a download.
23	NV_CYCLE_T	Minimum time interval specified by the manufacturer for writing copies of NV parameters to non-volatile memory. Zero means it will never be automatically copied. At the end of NV_CYCLE_T, only those parameters which have changed need to be updated in NVRAM.
24	FREE_SPACE	Percent of memory available for further configuration. Zero in a pre-configured device.
25	FREE_TIME	Percent of the block processing time that is free to process additional blocks.
26	SHED_RCAS	Time duration at which to give up on computer writes to function block RCas locations. Shed from RCas shall never happen when SHED_ROUT = 0
27	SHED_ROUT	Time duration at which to give up on computer writes to function block ROut locations. Shed from ROut shall never happen when SHED_ROUT = 0
28	FAULT_STATE	Condition set by loss of communication to an output block, fault promoted to an output block or physical contact. When FAIL_SAFE condition is set, then output function blocks will perform their FAIL_SAFE actions.
29	SET_FSTATE	Allows the FAIL_SAFE condition to be manually initiated by selecting Set.
30	CLR_FSTATE	Writing a Clear to this parameter will clear the device FAIL_SAFE if the field condition has cleared.
31	MAX_NOTIFY	Maximum number of unconfirmed notify messages possible.
32	LIM_NOTIFY	Maximum number of unconfirmed alert notify messages allowed.
33	CONFIRM_TIME	The time the resource will wait for confirmation of receipt of a report before trying again. Retry will not happen when CONFIRM_TIME=0.
34	WRITE_LOCK	When hardware write protection is selected, WRITE_LOCK becomes an indicator of the jumper setting and is unavailable for software write protection. When software write lock is selected, and WRITE_LOCK is set, no writings from anywhere else are allowed, except to clear WRITE_LOCK. Block input will continue to be updated.
35	UPDATE_EVT	This alert is generated by any change to the static data.
36	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alarm is entered in the subcode field. The first alarm to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alarm reporting task, another block alarm may be reported without clearing the Active status, if the subcode has changed.
37	ALARM_SUM	The current alarm status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	ACK_OPTION	Selection of whether alarms associated with the function block will be automatically acknowledged.
39	WRITE_PRI	Priority of the alarm generated by clearing the write lock.
40	WRITE_ALM	This alert is generated if the write lock parameter is cleared.
41	ITK_VER	Major revision number of the inter operability test case used in certifying this device as interoperable. The format and range are controlled by the Fieldbus Foundation.

Index Number	Parameter	Description
42	FD_VER	A parameter equal to the value of the major version of the Field Diagnostics specification that this device was designed to.
43	FD_FAIL_ACTIVE	This parameter reflects the error conditions that are being detected as active as selected for this category. It is a bit string, so that multiple conditions may be shown.
44	FD_OFFSPEC_ACTIVE	
45	FD_MAINT_ACTIVE	
46	FD_CHECK_ACTIVE	
47	FD_FAIL_MAP	This parameter maps conditions to be detected as active for this alarm category. Thus the same condition may be active in all, some, or none of the 4 alarm categories.
48	FD_OFFSPEC_MAP	
49	FD_MAINT_MAP	
50	FD_CHECK_MAP	
51	FD_FAIL_MASK	This parameter allows the user to suppress any single or multiple conditions that are active, in this category, from being broadcast to the host through the alarm parameter. A bit equal to '1' will mask i.e. inhibit the broadcast of a condition, and a bit equal to '0' will unmask i.e. allow broadcast of a condition.
52	FD_OFFSPEC_MASK	
53	FD_MAINT_MASK	
54	FD_CHECK_MASK	
55	FD_FAIL_ALM	This parameter is used primarily to broadcast a change in the associated active conditions, which are not masked, for this alarm category to a Host System.
56	FD_OFFSPEC_ALM	
57	FD_MAINT_ALM	
58	FD_CHECK_ALM	
59	FD_FAIL_PRI	This parameter allows the user to specify the priority of this alarm category.
60	FD_OFFSPEC_PRI	
61	FD_MAINT_PRI	
62	FD_CHECK_PRI	
63	FD_SIMULATE	This parameter allows the conditions to be manually supplied when simulation is enabled. When simulation is disabled both the diagnostic simulate value and the diagnostic value tracks the actual conditions. The simulate jumper is required for simulation to be enabled and while simulation is enabled the recommended action will show that simulation is active. Elements: see Table C-2 on page C-5.
64	FD_RECOMMEN_ACT	This parameter is a device enumerated summarization of the most severe condition or conditions detected. The DD help should describe by enumerated action, what should be done to alleviate the condition or conditions. 0 is defined as Not Initialized, 1 is defined as No Action Required, all others defined by manufacturer.
65	FD_EXTENDED_ACTIVE	An optional parameter or parameters to allow the user finer detail on conditions causing an active condition in the FD_*_ACTIVE parameters.
66	FD_EXTENDED_MAP	An optional parameter or parameters to allow the user finer control on enabling conditions contributing to the conditions in FD_*_ACTIVE parameters.
67	COMPATIBILITY_REV	This parameter is used when replacing field devices. The correct value of this parameter is the DEV_REV value of the replaced device.
68	HARDWARE_REVISION	Hardware revision.
69	SOFTWARE_REV	Software revision of source code with resource block.
70	PD_TAG	PD tag description of device.
71	DEV_STRING	This is used to load new licensing into the device. The value can be written but will always read back with a value of 0.
72	DEV_OPTIONS	Indicates which miscellaneous device licensing options are enabled.
73	OUTPUT_BOARD_SN	Output board serial number. For the 2230 Display this is the same as Main Label Device ID which can be found on the main label that is attached to the housing.
74	FINAL_ASSY_NUM	Final assembly number given by manufacturer.
75	DOWNLOAD_MODE	Gives access to the boot block code for over-the-wire downloads. 0 = Uninitialized 1 = Run mode 2 = Download mode
76	HEALTH_INDEX	Parameter representing the overall health of the device, 100 being perfect and 1 being non-functioning. The value is based on the active PWA alarms.

Index Number	Parameter	Description
77	FAILED_PRI	Designates the alarming priority of the FAILED_ALM and also used as switch b/w FD and legacy PWA. If value is greater than or equal to 1 then PWA alerts will be active in device else device will have FD alerts.
78	RECOMMENDED_ACTION	Enumerated list of recommended actions displayed with a device alert.
79	FAILED_ALM	Alarm indicating a failure within a device which makes the device non-operational.
80	MAINT_ALM	Alarm indicating the device needs maintenance soon. If the condition is ignored, the device will eventually fail.
81	ADVISE_ALM	Alarm indicating advisory alarms. These conditions do not have a direct impact on the process or device integrity.
82	FAILED_ENABLE	Enabled FAILED_ALM alarm conditions. Corresponds bit for bit to the FAILED_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected. This parameter is the Read Only copy of FD_FAIL_MAP.
83	FAILED_MASK	Mask of FAILED_ALM. Corresponds bit of bit to FAILED_ACTIVE. A bit on means that the condition is masked out from alarming. This parameter is the Read Only copy of FD_FAIL_MASK.
84	FAILED_ACTIVE	Enumerated list of failure conditions within a device. All open bits are free to be used as appropriate for each specific device. This parameter is the Read Only copy of FD_FAIL_ACTIVE.
85	MAINT_PRI	Designates the alarming priority of the MAINT_ALM
86	MAINT_ENABLE	Enabled MAINT_ALM alarm conditions. Corresponds bit for bit to the MAINT_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected. This parameter is the Read Only copy of FD_OFFSPEC_MAP
87	MAINT_MASK	Mask of MAINT_ALM. Corresponds bit of bit to MAINT_ACTIVE. A bit on means that the condition is masked out from alarming. This parameter is the Read Only copy of FD_OFFSPEC_MASK.
88	MAINT_ACTIVE	Enumerated list of maintenance conditions within a device. This parameter is the Read Only copy of FD_OFFSPEC_ACTIVE.
89	ADVISE_PRI	Designates the alarming priority of the ADVISE_ALM
90	ADVISE_ENABLE	Enabled ADVISE_ALM alarm conditions. Corresponds bit for bit to the ADVISE_ACTIVE. A bit on means that the corresponding alarm condition is enabled and will be detected. A bit off means the corresponding alarm condition is disabled and will not be detected. This parameter is the Read Only copy of FD_MAINT_MASK & FD_CHECK_MASK.
91	ADVISE_MASK	Mask of ADVISE_ALM. Corresponds bit by bit to ADVISE_ACTIVE. A bit on means that the condition is masked out from alarming. This parameter is the Read Only copy of FD_MAINT_MASK & FD_CHECK_MASK.
92	ADVISE_ACTIVE	Enumerated list of advisory conditions within a device. All open bits are free to be used as appropriate for each specific device. This parameter is the Read Only copy of FD_MAINT_ACTIVE & FD_CHECK_ACTIVE.

Table C-2. FD_SIMULATE elements

1	Diagnostic Simulate Value	Bit string	4	Writable. Used for diagnostics when simulation is enabled
2	Diagnostic Value	Bit string	4	Current diagnostics detected by the device.
3	Enable	Unsigned 8	1	Enable/Disable simulation. Dynamic, so simulation will always be disabled after a device restart.

C.2 REGISTER TRANSDUCER BLOCK

The Register Transducer Block (TB 1200) allows access to Database registers and Input registers of the Rosemount 2230 Graphical Field Display. This makes it possible to read a selected set of registers directly by accessing the memory location.

The Register Transducer Block is only available with advanced service.

⚠CAUTION

Since the Register Transducer Block allows access to most registers in the 2230, which includes the registers set by the Methods and Configuration screens in the Level Transducer Block it should be handled with care and ONLY to be changed by trained and certified service personnel, or as guided by Emerson Process Management/Rosemount Tank Gauging support personnel.

Table C-3. Register Transducer Block parameters

Index Number	Parameter	Description
1	ST_REV	The revision level of the static data associated with the function block. The revision value increments each time a static parameter value in the block is changed.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	UPDATE_EVT	This alert is generated by any change to the static data
8	BLOCK_ALM	The 2230 transducer block does not support update of BLOCK_ALM information, and it does not publish BLOCK_ALM on segment/FF bus.
9	TRANSDUCER_DIRECTORY	Directory that specifies the number and starting indices of the transducers in the transducer block.
10	TRANSDUCER_TYPE	Identifies the transducer.
11	XD_ERROR	A transducer block alarm sub code.

12	COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item ID's of the data collections in each transducer within a transducer block.
13	TRANSDUCER_TYPE_VER	
14	RB_PARAMETER	
15-44	INP_REG_n_TYPE	Describes characteristics of input register n. Indicates requested value is displayed as a floating point (/ decimal) number.
	INP_REG_n_FLOAT	Input register n value, displayed as floating point number
	INP_REG_n_INT_DEC	Input register n (=1 to 10) value, displayed as decimal number
45-74	DB_REG_n_TYPE	Describes characteristics of holding register n. Indicates requested value is displayed as a floating point (/ decimal) number.
	DB_REG_n_FLOAT	Holding register n value, displayed as floating point number.
	DB_REG_n_INT_DEC	Holding register n (=1 to 10) value, displayed as decimal number.
75	RM_COMMAND	Defines what action to perform; Read Input/Holding Register, Restart Device, Poll Program Complete.
76	RM_DATA	
77	RM_STATUS	
78	INP_SEARCH_START_NBR	Input register search start number
79	DB_SEARCH_START_NBR	Holding register search start number

C.3 MAIN TRANSDUCER BLOCK

The Main Transducer (TB1100) block contains parameters for configuration of the Rosemount 2230 Graphical Field Display. It contains device information including diagnostics and the ability to configure, set to factory defaults and restart the 2230 Display.

Table C-4. Main Transducer Block parameters

Index Number	Parameter	Description
1	ST_REV	The revision level of the static data associated with the function block. The revision value increments each time a static parameter value in the block is changed.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	UPDATE_EVT	This alert is generated by any change to the static data.
8	BLOCK_ALM	The 2230 transducer block does not support update of BLOCK_ALM information, and it does not publish BLOCK_ALM on segment/FF bus.
9	TRANSDUCER_DIRECTORY	Directory that specifies the number and starting indices of the transducers in the transducer block.
10	TRANSDUCER_TYPE	Identifies the transducer.
11	XD_ERROR	A transducer block alarm subcode. Provides additional error codes related to transducer blocks.
12	COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item ID’s of the data collections in each transducer within a transducer block.
13	TRANSDUCER_TYPE_VER	
14	HOUSING_TEMPERATURE	Temperature inside device housing
15	HOUSING_TEMP_UNIT	Measurement unit for temperature
16	ENV_DEVICE_MODE	Restart/Reset Device to factory default
17	DIAGN_DEVICE_ALERT	Tank Hub diagnostic information, see Table C-5 on page C-9.
18	DEVICE_VERSION_NUMBER	Device software version number
19	DIAGN_REVISION	Internal revision number
20	SERIAL_NO	Main Label Device ID (serial number)
21	STATS_ATTEMPTS	Internal communication attempts
22	STATS_FAILURES	Internal communication failures
23	STATS_TIMEOUTS	Internal communication timeouts
24	FF_WRITE_PROTECT	FF write protect status. The device is write protected by a hardware switch.
25	P1451_SLAVE_STATS	P1451 Slave Stats

26	P1451_HOST_STATS	P1451 Host Stats
27	SB_HEART_BEAT_CNT	This number should be incrementing. It is an indication that the device is alive.
28	SLAVE_REQ_ID	Slave request ID
29	DEVICE_COMMAND	Device command
30	DEVICE_STATUS	Sensor application device status
31	FF_SUPPORT_INFO	
32	SENSOR_DIAGNOSTICS	
33	MODEL_CODE	Shows device model code
34	RAW_DISPLAY_DATA_1	Raw Display Data
35	RAW_DISPLAY_DATA_2	Raw Display Data
36	RAW_DISPLAY_DATA_3	Raw Display Data
37	RAW_DISPLAY_DATA_4	Raw Display Data
38	DEVICE_MODEL	Shows device model
39	DISPLAY_LANGUAGE	Select the preferred language to use for the display. If Default is selected then the language is determined by the model code.
40	DISPLAY_VIEW_MODE	The preferred view is selected; Single Value, Two Values or Four Values. The Single Value view presents large-size digits, 25 mm.
41	DISPLAY_TOOGLE_TIME	The time each value or set of values are shown on the display: 2-30 s.
42	CONNECTED_TANKS	Connected tanks
43	DISPLAY_OPTIONS	Display options
44	DISPLAY_UNIT_LENGTH	Unit for all length parameters shown on display
45	DISPLAY_UNIT_VOLUME	Unit for all volume parameters shown on display
46	DISPLAY_UNIT_TEMPERATURE	Unit for all temperature parameters shown on display
47	DISPLAY_UNIT_LEVELRATE	Unit for all level rate parameters shown on display
48	DISPLAY_UNIT_FLOW_RATE	Unit for all level rate parameters shown on display
49	DISPLAY_UNIT_PRESSURE	Unit for all level rate parameters shown on display
50	DISPLAY_UNIT_DENSITY	Unit for all density parameters shown on display

C.3.1 Diagnostic Device Alerts

Table C-5 lists conditions reported in the DIAGN_DEVICE_ALERT parameter.

Table C-5. Diagnostic Device Alerts

Value	Description
	No alarm active
0x00100000	Database error
0x00200000	Hardware error
0x00400000	Configuration error
0x00800000	Software error
0x20000000	Simulation mode
0x40000000	Write protected

C.4 DISPLAY TRANSDUCER BLOCK

The Display Transducer block (TB 1300) includes parameters for setup of the 2230 Graphical Field Display for use in a FOUNDATION Fieldbus system.

Table C-6. Display Transducer Block

Index Number	Parameter	Description
1	ST_REV	The revision level of the static data associated with the function block. The revision value increments each time a static parameter value in the block is changed.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	UPDATE_EVT	This alert is generated by any change to the static data.
8	BLOCK_ALM	The 2230 transducer block does not support update of BLOCK_ALM information, and it does not publish BLOCK_ALM on segment/FF bus.
9	TRANSDUCER_DIRECTORY	Directory that specifies the number and starting indices of the transducers in the transducer block.
10	TRANSDUCER_TYPE	Identifies the transducer.
11	TRANSDUCER_TYPE_VER	
12	XD_ERROR	A transducer block alarm subcode. Provides additional error codes related to transducer blocks.
13	COLLECTION_DIRECTORY	A directory that specifies the number, starting indices, and DD Item ID’s of the data collections in each transducer within a transducer block.
14	MAO_1_INPUT_1	TANK_NUMBER TANK_PARAMETER ENGINEERING_UNIT MIN_VALUE MAX_VALUE
15	MAO_1_INPUT_2	
16	MAO_1_INPUT_3	
17	MAO_1_INPUT_4	
18	MAO_1_INPUT_5	
19	MAO_1_INPUT_6	
20	MAO_1_INPUT_7	
21	MAO_1_INPUT_8	
22	MAO_2_INPUT_1	
23	MAO_2_INPUT_2	
24	MAO_2_INPUT_3	

25	MAO_2_INPUT_4	
26	MAO_2_INPUT_5	
27	MAO_2_INPUT_6	
28	MAO_2_INPUT_7	
29	MAO_2_INPUT_8	
30	MAO_3_INPUT_1	
31	MAO_3_INPUT_2	
32	MAO_3_INPUT_3	
33	MAO_3_INPUT_4	
34	MAO_3_INPUT_5	
35	MAO_3_INPUT_6	
36	MAO_3_INPUT_7	
37	MAO_3_INPUT_8	
38	MAO_4_INPUT_1	
39	MAO_4_INPUT_2	
40	MAO_4_INPUT_3	
41	MAO_4_INPUT_4	
42	MAO_4_INPUT_5	
43	MAO_4_INPUT_6	
44	MAO_4_INPUT_7	
45	MAO_4_INPUT_8	
46	CUSTOM_TMV_1	Set the preferred name for the custom tank parameter 1
47	CUSTOM_TMV_1_SHORT	Set the preferred short name for the custom tank parameter 1. The name can have maximum 4 characters.
48	CUSTOM_TMV_2	Set the preferred name for the custom tank parameter 2
49	CUSTOM_TMV_2_SHORT	Set the preferred short name for the custom tank parameter 2. The name can have maximum 4 characters.
50	CUSTOM_TMV_3	Set the preferred name for the custom tank parameter 3
51	CUSTOM_TMV_3_SHORT	Set the preferred short name for the custom tank parameter 3. The name can have maximum 4 characters.
52	CUSTOM_TMV_4	Set the preferred name for the custom tank parameter 4
53	CUSTOM_TMV_4_SHORT	Set the preferred short name for the custom tank parameter 4. The name can have maximum 4 characters.
54	CUSTOM_TMV_5	Set the preferred name for the custom tank parameter 5
55	CUSTOM_TMV_5_SHORT	Set the preferred short name for the custom tank parameter 5. The name can have maximum 4 characters.
56	CUSTOM_TMV_6	Set the preferred name for the custom tank parameter 6
57	CUSTOM_TMV_6_SHORT	Set the preferred short name for the custom tank parameter 6. The name can have maximum 4 characters.
58	CUSTOM_TMV_7	Set the preferred name for the custom tank parameter 7.
59	CUSTOM_TMV_7_SHORT	Set the preferred short name for the custom tank parameter 7. The name can have maximum 4 characters.
60	CUSTOM_TMV_8	Set the preferred name for the custom tank parameter 8
61	CUSTOM_TMV_8_SHORT	Set the preferred short name for the custom tank parameter 8. The name can have maximum 4 characters.
62	CUSTOM_TMV_9	Set the preferred name for the custom tank parameter 9
63	CUSTOM_TMV_9_SHORT	Set the preferred short name for the custom tank parameter 9. The name can have maximum 4 characters.
64	CUSTOM_TMV_10	Set the preferred name for the custom tank parameter 10
65	CUSTOM_TMV_10_SHORT	Set the preferred short name for the custom tank parameter 10. The name can have maximum 4 characters.
66	CUSTOM_UNIT_1	Set the preferred text to show on the display for custom unit 1.

67	CUSTOM_UNIT_2	Set the preferred text to show on the display for custom unit 2.
68	CUSTOM_UNIT_3	Set the preferred text to show on the display for custom unit 3.
69	CUSTOM_UNIT_4	Set the preferred text to show on the display for custom unit 4.
70	CUSTOM_UNIT_5	Set the preferred text to show on the display for custom unit 5.
71	CUSTOM_UNIT_6	Set the preferred text to show on the display for custom unit 6.
72	CUSTOM_UNIT_7	Set the preferred text to show on the display for custom unit 7.
73	CUSTOM_UNIT_8	Set the preferred text to show on the display for custom unit 8.
74	CUSTOM_UNIT_9	Set the preferred text to show on the display for custom unit 9.
75	CUSTOM_UNIT_10	Set the preferred text to show on the display for custom unit 10.
76	TANK_NAME_1	Set the preferred name for tank number 1.
77	TANK_NAME_2	Set the preferred name for tank number 2.
78	TANK_NAME_3	Set the preferred name for tank number 3.
79	TANK_NAME_4	Set the preferred name for tank number 4.
80	TANK_NAME_5	Set the preferred name for tank number 5.
81	TANK_NAME_6	Set the preferred name for tank number 6.
82	TANK_NAME_7	Set the preferred name for tank number 7.
83	TANK_NAME_8	Set the preferred name for tank number 8.
84	TANK_NAME_9	Set the preferred name for tank number 9.
85	TANK_NAME_10	Set the preferred name for tank number 10.

C.5 MULTIPLE ANALOG OUTPUT BLOCK

The Multiple Analog Output Block (MAO_1400 to MAO_1700) accepts output values from field devices and assigns them to specified I/O channels in order to make them available for the display.

Table C-7. Multiple Analog Output Block

Index Number	Parameter	Description
1	ST_REV	The revision level of the static data associated with the function block. The revision value increments each time a static parameter value in the block is changed.
2	TAG_DESC	The user description of the intended application of the block.
3	STRATEGY	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	ALERT_KEY	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	MODE_BLK	The actual, target, permitted, and normal modes of the block. Target: The mode to “go to” Actual: The mode the “block is currently in” Permitted: Allowed modes that target may take on Normal: Most common mode for target
6	BLOCK_ERR	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	CHANNEL	Defines the output that drives the field device.
8	IN_1	Numbered input parameter for multiple output function blocks
9	IN_2	Numbered input parameter for multiple output function blocks
10	IN_3	Numbered input parameter for multiple output function blocks
11	IN_4	Numbered input parameter for multiple output function blocks
12	IN_5	Numbered input parameter for multiple output function blocks
13	IN_6	Numbered input parameter for multiple output function blocks
14	IN_7	Numbered input parameter for multiple output function blocks
15	IN_8	Numbered input parameter for multiple output function blocks
16	MO_OPTS	Options that the user may select to alter multiple output block processing. In case a Fault State option is set, the 2230 will send a Field Diagnostic alert.
17	FSTATE_TIME	
18	FSTATE_VAL1	The preset analog value to use when failure occurs in IN_1. Ignored if the “Fault state to value 1” in the MO_OPTS parameter is false.

19	FSTATE_VAL2	The preset analog value to use when failure occurs in IN_2. Ignored if the “Fault state to value 2” in the MO_OPTS parameter is false.
20	FSTATE_VAL3	The preset analog value to use when failure occurs in IN_3. Ignored if the “Fault state to value 3” in the MO_OPTS parameter is false.
21	FSTATE_VAL4	The preset analog value to use when failure occurs in IN_4. Ignored if the “Fault state to value 4” in the MO_OPTS parameter is false.
22	FSTATE_VAL5	The preset analog value to use when failure occurs in IN_5. Ignored if the “Fault state to value 5” in the MO_OPTS parameter is false.
23	FSTATE_VAL6	The preset analog value to use when failure occurs in IN_6. Ignored if the “Fault state to value 6” in the MO_OPTS parameter is false.
24	FSTATE_VAL7	The preset analog value to use when failure occurs in IN_7. Ignored if the “Fault state to value 7” in the MO_OPTS parameter is false.
25	FSTATE_VAL8	The preset analog value to use when failure occurs in IN_8. Ignored if the “Fault state to value 8” in the MO_OPTS parameter is false.
26	FSTATE_STATUS	Shows which points are in fault state.
27	UPDATE_EVT	This alert is generated by any change to the static data.
28	BLOCK_ALM	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status parameter. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.

C.6 SUPPORTED UNITS

The 2230 Graphical Field Display supports the following units:

Table C-8. Temperature

DD Value	Display	Description
1000	K	Kelvin
1001	°C	Degree Celsius
1002	°F	Degree Fahrenheit

Table C-9. Length

DD Value	Display	Description
1010	m	Meter
1012	cm	Centimeter
1013	mm	Millimeter
1018	ft	Feet
132090	Imp 16	Imperial 1/16 inch

Table C-10. Volume

DD Value	Display	Description
1034	m^3	Cubic meter
1038	L	Liter
1043	ft^3	Cubic feet
1048	Gallon	US gallon
1049	ImpGal	Imperial gallon
1051	Bbl	Barrel

Table C-11. Level Rate

ID	Display	Description
1061	m/s	Meter / second
1063	m/h	Meter / hour
1067	ft/s	Feet / second
1073	ft/h	Feet / hour

Table C-12. Flow Rate

ID	Display	Description
1349	m^3/s	Cubic meter / hour
1352	L/min	Liter / minute
1364	gal/h	US gallon / hour
1373	bbl/h	Barrel / hour

Table C-13. Pressure

ID	Display	Description
1130	Pa	Pascal
1133	kPa	Kilo Pascal
1137	Bar	Bar
1140	atm	Atmospheres
1141	psi	Pounds / square inch
1142	psiA	Pounds / square inch (absolute)
1143	psiG	Pounds / square inch (gauge)
1590	bar G	Bar Gauge relative
1597	bar A	Bar Absolute

Index

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