

Model 3201 Hydrostatic Interface Unit

- *Microprocessor-based electronics*
- *Performs system calculations including transfer variables*
- *Software configurable for specific tank applications*
- *Digital and 4–20 mA communication output*
- *Contact input option*
- *Power and digital communication over a single twisted pair of wires*
- *Multidrop capability*
- *Explosion-proof design*
- *Easy-to-read user-configurable display*
- *Performs self-diagnostics*



Content

Specifications	page Level-43
Hazardous Locations Certifications	page Level-45
Dimensional Drawings	page Level-46
Ordering Information	page Level-48

Model 3201

INTRODUCTION

The Rosemount® Model 3201 Hydrostatic Interface Unit (HIU) is the calculation and communication center for the Rosemount Hydrostatic Tank Gauging (HTG) System. The HIU performs tank calculations for on-line measurements of mass, density, standard density, volume, standard volume, level, flow rate, time to transfer, and many other variables.

Field-mounted alongside liquid storage tanks, the HIU is the interface between tank-mounted sensors and the control room. One HIU is dedicated to each storage tank in the HTG System and contains the tank database in nonvolatile memory. The user can configure each HIU to show any or all of the measurements. Additionally, system alarms may be displayed.

MICROPROCESSOR-BASED ELECTRONICS

The Model 3201 HIU uses the same stand-alone modular concept employed on all of the HTG system components. Because the HIU is microprocessor-based, it can be software configured to operate on any tank design. The HIU easily accommodates a change in individual tank architecture without hardware changes or alterations. This modular concept allows for maximum system flexibility to meet today's tank farm requirements with tomorrow's expansion in mind.

All calculations for an assigned tank are performed within the HIU. The control room interface or HART-based communications device simply polls and displays calculated data from the HIU without any further manipulations. This independent operation by the HIU and other HTG devices allows all the system components to be interchanged without hardware modifications. In addition, dedicated, distributed, microprocessor power delivers integrity for your tank system architecture.

FIGURE 1. The Hydrostatic Gauging System Components.



HTG-008AB

COMMUNICATION FLEXIBILITY

The Model 3201 HIU communicates with a variety of protocols to facilitate ready integration to many tank gauging systems. The Modbus™ Communication and Power (MCAP) output is sent to the Model 3402 Application Interface Module (AIM) where it is converted to a standard RS-485 or RS-232 signal. This Modbus communication signal supplies all HIU measurements, alarms, and configuration data to a wide variety of host systems, including Fisher-Rosemount Control Systems, other distributed control systems, host computers, and personal computers. "Rosemount Hydrostatic Tank Gauging System" on page 43 shows the system architecture.

The Modbus protocol increases the level of automation in tank farms by passing information from a Rosemount HIU to other Modbus-compatible devices. This allows integration of functions such as pump and valve control with the high-accuracy measurements from the HTG system.

The Model 3201 HIU also accommodates host systems requiring a standard analog input. The HIU has one 4–20 mA output that can be assigned to represent any of the variables within the HIU.

EASY AND COST EFFECTIVE INSTALLATION

The Model 3201 HIU implements a MCAP wiring architecture that offers the capability to minimize tank gauging installation costs. The HIU is powered and communicates over a single twisted pair of wires providing for cost-effective installations. Up to 14 HIU's can be multidropped together off the same pair of wires. The two sets of MCAP terminals in each HIU remove the need to double lug the multidropped wire, thereby keeping installation simple and easy.

HIU FEATURE AND BENEFIT SUMMARY

Microprocessor-based electronics

provide maximum system flexibility to accommodate various tank architectures.

Configuration flexibility

allows the user to easily change configuration data either locally or from the control room.

Performs all tank calculations including transfer variables

adding to the system for capabilities.

Software configurable for specific tank applications

offers the flexibility to handle many applications.

Digital and 4–20 mA communication output

for easy integration of HTG tank information into control systems or other host computers.

System diagnostics

monitor system faults and the HIU displays these messages in an easy-to-read format.

Power and digital communication over a single pair of wires

along with multidropping capabilities, allows for ease of installation and cost savings in field wiring.

Explosion-proof design

makes it suitable for use in hazardous areas.

User-configurable display

allows the user to select any variables, units, and alarms for display purposes.

2 by 12 character liquid crystal display

provides easy-to-read characters from any viewing angle.

Supplies power to tank-mounted equipment

providing required voltage for up to five HART-compatible devices including the pressure transmitters, as well as the temperature measuring device.

APPLICATION FLEXIBILITY

The Model 3201 HIU meets the challenge of a wide variety of tank gauging applications. The HIU accommodates an extensive combination of tank shapes, sensor configurations, and product types. Whether your tank is an upright cylinder, a horizontal cylinder, a sphere, a bullet, or any other shape, the 100-point strapping table, which is integral to the HIU configuration database, can accurately define this shape. Easy user configuration allows any hardware combination of pressure transmitters, a Resistance Temperature Detector (RTD), water bottom level measuring transmitters, and other HART[®] compatible devices, including the HART Level Encoder. The level encoder attaches to a traditional level gauge to provide a HART signal which can be received by the HIU. Together, the level encoder and the HIU offer the flexibility to integrate existing traditional level gauges with HTG as well as offering the capability to provide a hybrid system.

The HIU can handle numerous industry-specific applications. For example, density corrections can be done per API Standard 2540 for the petroleum industry. In addition, density versus temperature behavior can be defined using a polynomial-based density correlation for non-petroleum applications. This density correlation capability opens up a wide variety of additional HTG applications including °Brix (sugar content), °Baumé (acid concentration), %Plato (alcohol concentration), and others.

Model 3201

In addition to these applications, the HIU also calculates numerous transfer variables based on mass, gross volume, standard volume, or level. This provides operators in the field or in the control room with all the information necessary for normal tank farm operations. The transfer variables include transfer target and endpoint, available product, room left in the tank, flow rate, time until the transfer is complete, elapsed time of transfer, amount transferred, and amount remaining to be transferred. Other variables include a warning alarm triggered at a user defined time before the transfer is complete.

Whether your product is light or heavy and your industry is petroleum, chemical, food and beverage, pharmaceutical, or any other industry, the Model 3201 HIU offers the flexibility to handle any application.

Alarm Capabilities

The Model 3201 HIU furnishes extensive alarm capabilities, including four level alarms, a standard density (cross-contamination) alarm, an unauthorized activity (based on mass) alarm, two temperature alarms, two ullage pressure alarms, two flow rate alarms, a transfer warning alarm, and a transfer complete alarm. In addition, system operation alarms indicate overall system status. During alarms; such as RTD out of product, floating roof in critical zone, and product below the middle transmitter, the HIU continues to operate using the best available data. The user may choose to override the “best available data” by manually entering another value.

All system alarms are available for local display on the HIU or through a HART-based communications device. These system alarms may also be sent back to the control room via the MCAP communications highway.

Self-Diagnostics Capability

The Model 3201 HIU continually performs diagnostics on itself, on all tank-mounted equipment, and on the communications link to the control room interface. These diagnostics ensure communication security, proper system functionality, and easy troubleshooting. Additional diagnostics are performed during power up and upon user request.

Display Options

Alarms	Temperature
Process	Degrees Celsius
Software Status	Degrees Fahrenheit
Hardware Status (Diagnostics)	
Level	Pressure
Meters	Kilo Pascals
Feet-Decimal	Pascals
Feet-Fractional	Millibars
	Kilograms/Centimeter Squared
	Grams/Centimeter Squared
	Torr @ 0 °C
	mm Hg @ 0 °C
	mm H2O @ 68 °F
	Pounds/Inch Squared
	Atmospheres
	Inches H2O @ 68 °F
	Bar Hg @ 0 °C
	Bar H2O @ 68°F
True/Effective Mass	Time
Kilograms	Days
Metric Tons	Hours
Pounds	Minutes
Long Tons	Seconds
Short Tons	
Standard/Gross Volume	Flow Rate
Meters	Volume/Time
Liters	Mass/Time
U.S. Gallons	Level/Time
Imperial Gallons	
Oil Barrels	
Feett Cubed	
Standard Density	
Kilograms/Meters Cubed	
Pounds/Feet Cubed	
Specific Gravity	
Degrees API	
Degrees Brix	
Degrees Balling	
Degrees Baume Light	
Degrees Baume Heavy	
Saccharine	
Measured Density	
Kilograms/Meters Cubed	
Pounds/Feet Cubed	
Pounds/Gallon	
Specific Gravity	

Specifications

Functional Specifications

Power Input

(May be supplied by the Model 3402 AIM.) 15 to 50 V dc

Analog Output Power Requirements

(Must be loop powered) 12 to 50 V dc

Environmental

Operating Temperature Range

With Display: -4 to 158 °F (-20 to 70 °C).
 Without Display: -40 to 185 °F (-40 to 85 °C).

Operating Humidity Range

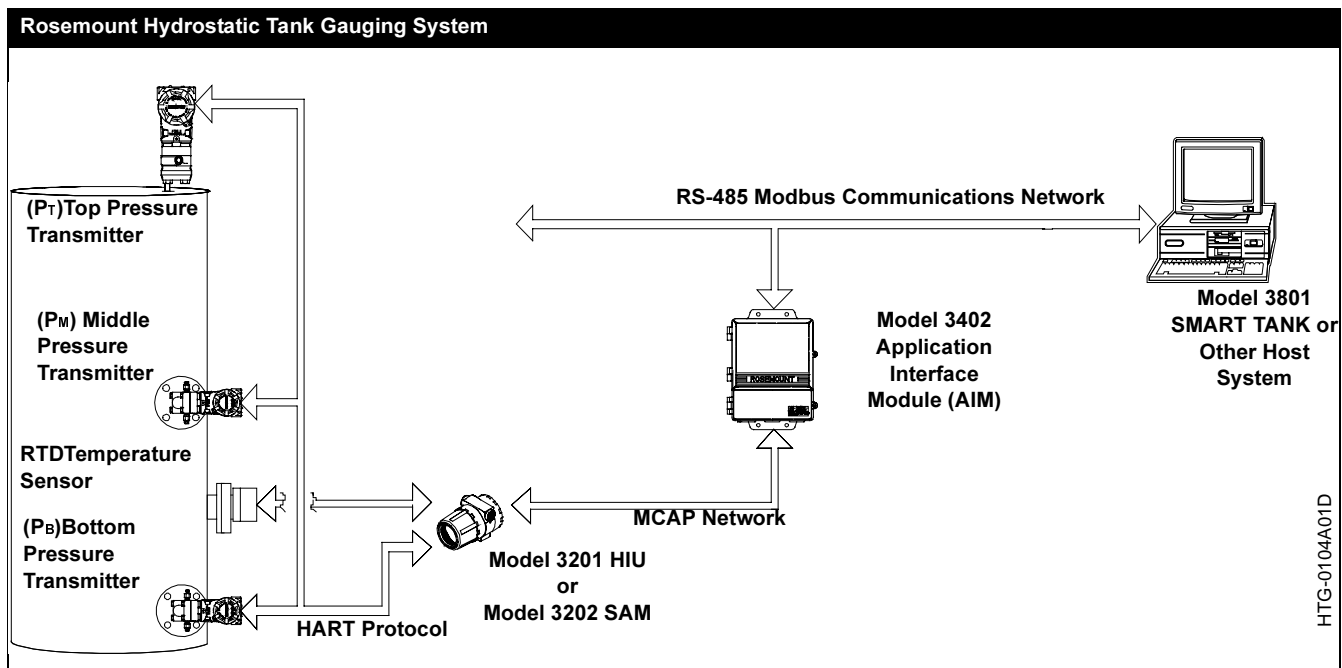
0-95% relative humidity (non-condensing).

Surge Protection

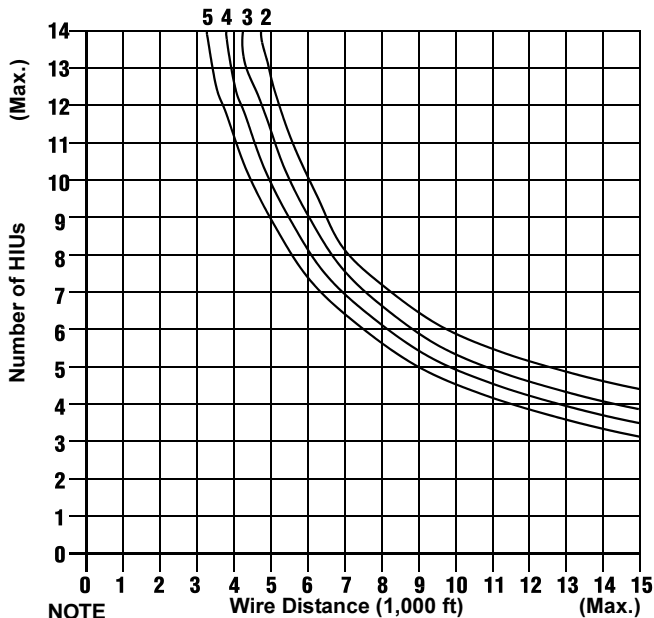
Surge protection is provided on the Model 3201 MCAP lines, and on the 4–20 mA output lines. As shown in Table 1, the surge protection meets the requirements of ANSI/IEEE C62.41-1980 categories A & B.

TABLE 1. ANSI/IEEE C62.41-1980 Testing Definition.

Location Category	Waveform	Medium Exposure Amplitude	Type of Load
A	.5µs –100KHz	6KV 200A	High Impedance Low Impedance
B	1.2 × 50µs	6KV	High Impedance
B	8 × 20µs	3KA	Low Impedance
B	.5µs –100KHz	6KV 500A	High Impedance Low Impedance



Load Limitations



NOTE
Graph uses 18 AWG wire. 18 AWG wire is recommended for MCAP communications.

24 V dc HIU Wire Requirements Equation (Worst Case)⁽¹⁾

$$V_{ps} - V_{min} > R_{\Omega/1000\text{ ft}} \times 2 \times D \times A \times N$$

Where:

V_{ps} = Power Supply Voltage

(47 Volts Max. for AIM-STD Output)⁽²⁾

V_{min} = HIU Supply Voltage (15 Volts Min.)

$R_{\Omega/1000\text{ ft}}$ = Wire Resistance/1,000 ft (Graphed with 18 AWG)

D = Wire Distance (1,000 ft)

A = HIU Draw (AMPs)

N = Number of HIUs

Resistance per 1,000 ft	HIU Draw (AMPs)
20 AWG = 12.35 ohms	HIU W/2 HART Devices = 0.0315
⁽³⁾ 18 AWG = 7.765 ohms	HIU W/3 HART Devices = 0.0357
16 AWG = 4.884 ohms	HIU W/4 HART Devices = 0.0399
12 AWG = 3.071 ohms	HIU W/5 HART Devices = 0.0441
10 AWG = 1.931 ohms	HIU W/6 HART Devices = 0.0483

(1) Equation is based on all of the HIUs at the very end of the MCAP network.

(2) I.S. output options for the AIM. Use 30.5 Volts max.

(3) Graph uses 18 AWG wire. 18 AWG wire is recommended for MCAP communications.

3201-0182A

Performance Specifications

RTD Input Accuracy

The product temperature measured by the Model 3201 will be within $\pm 0.5^\circ\text{C}$ of the ideal RTD temperature value. This error includes all effects of linearity, hysteresis, ambient temperature effect, and ambient temperature hysteresis.

Analog Output Accuracy

The 4–20 mA output current will be within $\pm 0.1\%$ of full scale current. This D/A conversion error includes all effects of linearity, hysteresis, ambient temperature effect, and ambient temperature hysteresis.

Math Accuracy

Calculations are performed with an accuracy of seven significant digits.

Display

24-digit (2 rows of 12 characters) liquid crystal. User-selectable display and display units.

Temperature Input

Series 58C Platinum Resistance Temperature Sensor. IEC 751, DIN 43760 and BS1904 conformance.

$R_0 = 100\text{ ohm}$, $\alpha = 0.00385$, 3- or 4-wire.

Temperature Sensing Range

Series 58C 100-ohm platinum: -40 to 392°F (-40 to 200°C).

Other 100-ohm platinum (max): -40 to 527°F (-40 to 275°C).

Turn-on Time

The HIU will begin polling HART devices, and respond to Modbus messages within 3 seconds of power being applied.

Digital HART Communication Inputs

Top Pressure Transmitter: Models 1151S, 3051C, and 3001C.

Middle Pressure Transmitter: Models 1151S, 3051C, 3001C, 3001CL, and 3001CH.

Bottom Pressure Transmitter: Models 1151S, 3051C, 3001C, 3001CL, and 3001CH.

Water Bottom Pressure Transmitter: Models 1151S, 3051C.

HART Water Bottom Capacitance Probe.

Data Communication Outputs to Control Room

Digital: 2-wire MCAP to a Model 3402 AIM. AIM converts the HIU digital signal to a standard 2- or 4-wire RS-485, and RS-232 Modbus signal for communication to the control room.

Analog: 4–20 mA signal is user-assignable to represent any of the variables within the HIU. Power for the analog signal must be provided by the host system.

Physical Specifications

Weight

HIU is approximately 4.2 lb without options. Add 0.6 lb for meter option (M1) and 1.6 lb for mounting bracket option (B1), and 0.25 lb. for CESI/CENELEC flameproof certification option (E8).

Remote Mounting Distance

500 ft (152.4 m) between HIU and tank-mounted equipment due to maximum RTD leadwire length.

Wiring

Digital (MCAP): 1 twisted shielded pair, 18 AWG. Analog (4–20 mA): 1 twisted pair, 18 AWG.

Product Data Sheet

00813-0100-4640, Rev BA
Catalog 2002 – 2003

Model 3201

Hazardous Locations Certifications

Factory Mutual (FM) Approval

E5 Explosion Proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof for Class II, Division 1, Groups E, F, and G. Suitable for Class III, Division 1, indoor and outdoor (NEMA 4X) hazardous locations.

Canadian Standards Association (CSA) Approval

E6 Explosion Proof for Class I, Division 1, Groups C and D. Dust-Ignition Proof for Class II, Division 1, Groups E, F, and G. Suitable for Class III, Division 1, indoor and outdoor hazardous locations, CSA enclosure 4; factory sealed.

CESI/CENELEC Flameproof Certification

E8 With Display:

EEx d IIB T6.

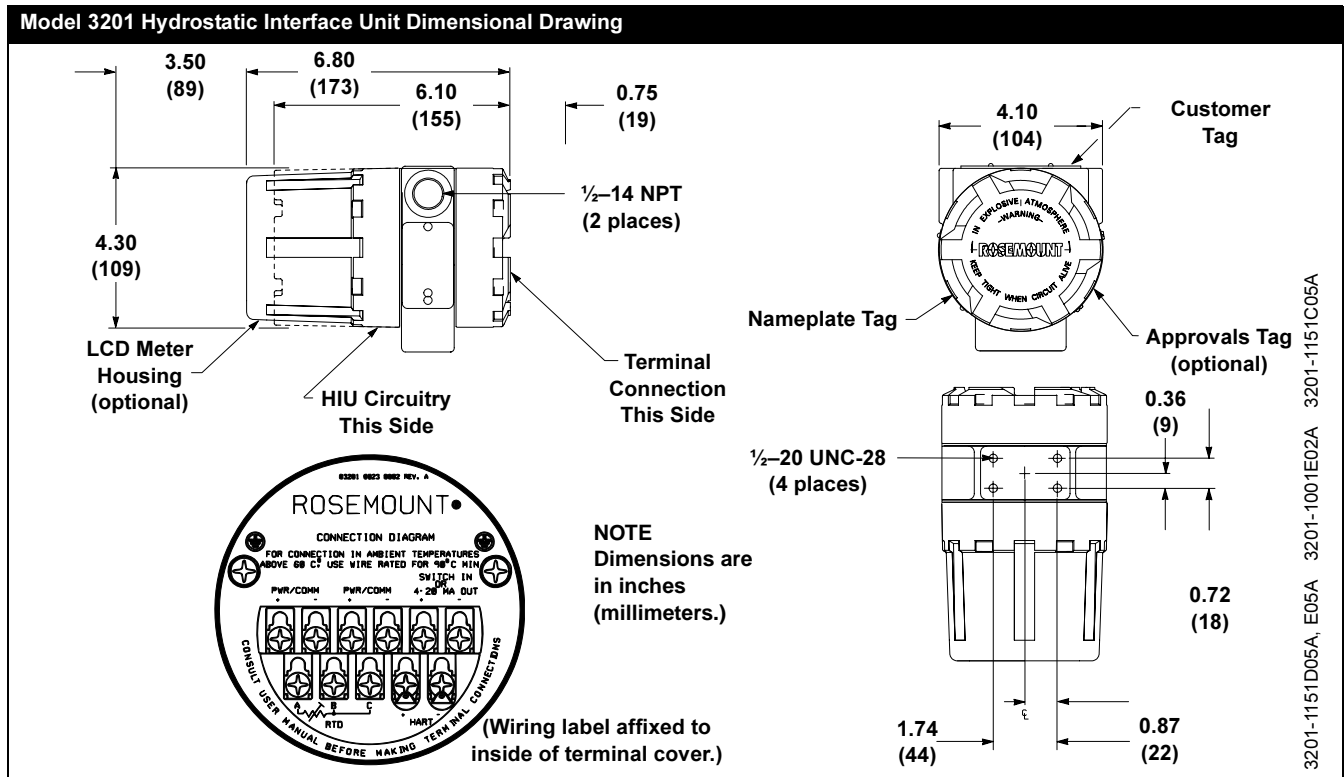
EEx d IIB T5 ($T_{amb} = 60\text{ }^{\circ}\text{C}$). IP65.

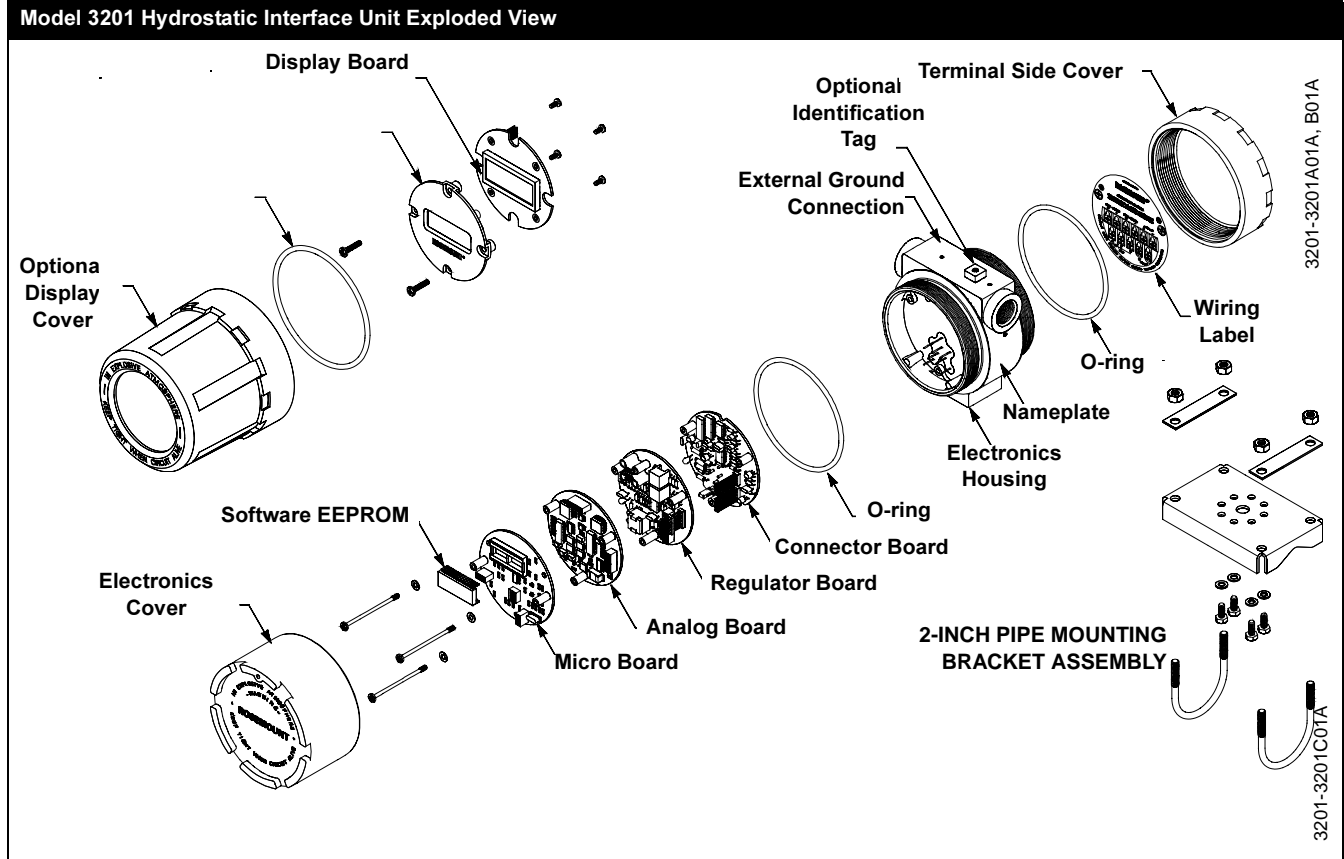
Without Display:

EEx d IIC T6.

EEx d IIC T5 ($T_{amb} = 60\text{ }^{\circ}\text{C}$). IP65.

Dimensional Drawings





Ordering Information

Model	Product Description
3201	Hydrostatic Interface Unit
Code	Software
A	Hydrostatic Tank Gauging
Code	Outputs
A	Digital and 4–20 mA
Code	Conduit
1	½–14 NPT
2	M20 × 1.5 Female (CM20)
3	PG 13.5 (via adapters)
Code	Options
M1	Liquid Crystal Display
B1	Mounting Bracket
C1	Custom Configuration (Should be included with each Model 3201 unit. Must consult factory if this option is not included.)
E5	Factory Mutual (FM) Explosion-proof Approval
E6	Canadian Standards Association (CSA) Explosion-proof Approval
E7	Standards Association of Australia (SAA) Flameproof
E8	CESI/CENELEC Flameproof Certification
N7	Standards Association of Australia (SAA) Non-Incendive
S0011	Software Package for APEX Hybrid System
Typical Model Number: 3201 A A 1 M1 B1 C1 E5	

ROSEMOUNT SMART FAMILY® INSTRUMENTS

Rosemount SMART FAMILY instruments include pressure, temperature, level, and flow measurement.

All SMART FAMILY instruments are designed to communicate using HART (Highway Addressable Remote Transducer) protocol with the hand-held HART Communicator and Fisher-Rosemount Control Systems.

ACCESSORIES

Part number: 03601-0010-0001
PC based software package for configuration and monitoring of tanks (replaces Model 3601 PC Config)
Windows based WIN 95/NT.

Hydrostatic Tank Gauging

- 00813-0100-4635 Model 3001C Hydrostatic Pressure Transmitter
- 00813-0100-4638 Model 3001CL Flush-mount Hydrostatic Pressure Transmitter
- 00813-0100-4640 Model 3201 Hydrostatic Interface Unit
- 00813-0100-4641 Model 3402 Application Interface Module
- 00813-0100-4646 Model 3202 Smart Application Module
- 00813-0100-4702 Model 3001CH Hydrostatic Pressure Transmitter for High Process Temperatures

SMART FAMILY Companion Products

- 00813-0100-4275 HART Communicator

Product Data Sheet

00813-0100-4640, Rev BA
Catalog 2002 – 2003

Model 3201

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