

# Model 3201 Hydrostatic Interface Unit Modbus™ Protocol



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## Model 3201 Hydrostatic Interface Unit Modbus™ Protocol

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SECTION  
1

# Overview of the HIU-Modbus Implementation

## INTRODUCTION

This Protocol Guide explains the operation of the Rosemount<sup>®</sup> implementation of the Modbus<sup>™</sup> Protocol per Modicon<sup>®</sup> document PI-MBUS-300 Rev B (1985) implemented in the Model 3201 Hydrostatic Interface Unit (HIU). This Protocol Guide supplements the Model 3201 Hydrostatic Interface Unit (HIU) Product Manual. For detailed instructions on operating the HIU, consult the HIU Product Manual, MAN 4640.

## MODBUS IMPLEMENTATION

A Rosemount implementation of the Modbus protocol provides a standard form of digital communications for the Hydrostatic Tank Gauging (HTG) application. An effort has been made to parallel the PLC implementation to the greatest extent possible, so that the HIU communicates with existing Modbus hosts.

Check compatibility carefully to ensure that the HIU is properly configured for the data format expected by the Host. Exceptions made because of the unique requirements of the HTG application have been noted. However, this is no guarantee that the interpretation made here will be the same as that followed by the Modbus host.

A Rosemount implementation of the Modbus protocol provides for the passing of measured and calculated variables, configuration information, and diagnostics in data registers. Data is sent in these registers as floating-point values, integer values, numeric codes relating to configuration lists, status summary words (packed bits), or individual status flags (single bits).

The Modbus Communication and Power (MCAP) output from the HIU is transmitted to the Model 3402 Application Interface Module (AIM) where it is converted to a standard RS-485 or RS-232 Modbus signal.

Table 1-1 lists the Modbus functions implemented in the HIU:.

TABLE 1-1. Modbus Functions Implemented in the HIU.

Function Code	Function	Information Type	Modbus Nomenclature
01	Read	Bits	Read output status (logic coils)
02	Read	Bits	Read input status (discrete inputs)
03	Read	Integer, Code, Status word, Floating Point	Read output registers(holding registers)
04	Read	Integer, Code, Status word, Floating Point	Read input registers
05	Write	Bits	Force single coil
06	Write	Integer, Code, Status word, Floating Point	Preset single register
08	N/A	Repeat of "loopback" message	Loopback test
15	Write	Bits	Force multiple coils
16	Write	Integer, Code, Status word, Floating Point	Preset multiple registers
17	Read	Code	Return Slave ID
Exception: Because the HIU does not distinguish between inputs and outputs, function codes 01 and 02 as they apply to bits, and function codes 03 and 04 as they apply to numeric values refer to the same data registers. For example, either function code 03 or function code 04 can be used to read the integer form of the true mass variable at data address 0053.			



# SECTION 2

# Modbus Functions and Data Format

## INTRODUCTION

The Modbus data in the HIU is arranged in integer registers, floating-point registers, and status bits. The assignments for these registers are found in Sections 5, 6, and 7.

Function codes 03, 04, 06, and 16 are used with integer registers and floating point registers.

Function codes 01, 02, 05, and 15 are used with status bits.

Both integer and floating-point registers have space reserved to reorder the registers for maximum communication throughput.

A complete description of all the preceding commands, except floating point, can be found in "Modicon Modbus Protocol Reference Guide" (document number PI-MBUS-300 Rev B).

### NOTE

When reading or writing data to the HIU and using commands 03, 04, or 16, the maximum allowable registers to read and write to with a single command is 125 (as defined by Gould Modicon).

## User-assignable Registers

The data written or returned in the first fifty integer or twenty five floating-point registers can be assigned by the user. This provides a means of arranging non-consecutive register information in a sequential order so that it can efficiently be accessed with a multiple-register read or write command. Registers 0 through 49 in the integer map contain the assigned data for either integer or floating-point registers. Integer registers 200 through 249 contain the register assignments for the integer and floating-point map. The registers containing data assignments are codes representing the register number of the associated data. In addition to the configuration of the data register assignments via Modbus, the register assignments may be configured via a HART-based communicator.

## Integer Registers

### Modbus Message Glossary

This table defines terminology used in the communication examples.

**Address:** user-assigned address of the slave device.

**Function Code:** the function the slave is to perform.

**Start Reg. HO:** high-order data address byte of the first register to read or write.

**Start Reg. LO:** low-order data address byte of the first register to read or write.

**# of Reg. HO:** high-order byte of the number of registers to read or write.

**# of Reg. LO:** low-order byte of the first register to read or write.

**Byte Count:** number of data bytes.

**Data MSB:** data register's most significant byte.

**Data LSB:** data register's least significant byte.

**Status Bit HO:** high-order data address byte of the first bit to read or write.

**Status Bit LO:** low-order data address byte of the first bit to read or write.

**Error Check:** message checksum LRC (Longitudinal Redundancy Check) in ASCII mode, or CRC (Cyclical Redundancy Check) in RTU mode.

Integer registers are the most commonly used type of Modbus data and are supported by most Modbus hosts. In the HIU Implementation, the Modbus registers are arranged in one of the following four formats:

1. Integer Data - a scaled number from 0 to the maximum Modbus integer
2. Character Data - 2 ASCII characters per 16 bit register (ex. date, password)
3. Coded Data - Multiple choice configuration data chosen from a coded list
4. Packed Bits - Register form of 16 packed single bits

The integer, character, and coded data registers contain all of the information needed to configure and read process data. Any Integer register may be read with function code 03 or function code 04. These same registers may be written one at a time with function code 06 or multiple registers can be written with function code 16.

The HIU rejects the entire message if an attempt is made to write a register with data that is out-of-bounds or not considered to be of legal value. Out-of-bounds data includes coded data values outside of the values listed in each coded data table, integer values larger than the maximum Modbus integer and reserved registers with values other than zero. This rejection scheme has been chosen to add security by helping to prevent the accidental writing of data to incorrect registers.

### Integer Data

The integer data is a whole number between 0 and the maximum Modbus integer (inclusive). The maximum Modbus integer is a user-configurable variable that is a whole number between 0 and 65,535 (inclusive). The integer data must also be scaled for each data type by entering the desired units, a zero point, and a full scale point. For the integer value to be correctly interpreted, these scaling factors must match the format expected by the host system. Scaling of the integer parameters is accomplished through floating-point registers or by using a HART-based interface. Table 2-1 shows an example of integer data written to the HIU.

The following communication example shows the request for one register starting at register 56 (0038 Hex).

For this example, assume: Zero = 1 meter

Full Scale = 15 meters

Maximum Modbus Integer = 65,534

The data returned for data address 56 is 16,676 (4124 Hex). This value must be scaled using the following formula to give it meaning.

$$\text{Result} = \left[ \frac{\text{Data} \times (\text{Full Scale} - \text{Zero})}{\text{Max MODBUS Integer}} \right] + \text{Zero}$$

$$\text{Result} = \left[ \frac{16,676 \times (15 - 1)}{65,534} \right] + 1$$

$$\text{Result} = 4.56 \text{ meters}$$

TABLE 2-1. Integer Data.

Host Request						
Address	Function Code	Start Reg HO	Start Reg LO	# of Reg HO	# of Reg LO	Error Check
01	03	00	38	00	01	XX <sup>1</sup>
HIU Request						
Address	Function Code	Byte Count	Data MSB	Data LSB	Error Check	
01	03	02	41	24	XX <sup>1</sup>	
Integer: Hexadecimal Representation: 4124						
Decimal Equivalent: 16,676						
<sup>1</sup> In all communication examples, the error check value is dependent on the mode of transmission.						

If a variable goes out-of-bounds (outside the zero or full scale points), a value equal to the maximum Modbus integer +1 is returned. When writing to any register that contains a variable that is a dynamic output from the HIU, the value will be written over on the next system update.

### Character Data

Character data, such as dates or passwords, are returned in registers in ASCII data format. Each Modbus register represents two ASCII characters. Table 2-2 shows an example of character data written to the HIU.

TABLE 2-2. Integer Data.

Host Request						
Address	Function Code	Start Reg HO	Start Reg LO	# of Reg HO	# of Reg LO	Byte Count
01	10	00	6B	00	02	04
(HIU Request Continued)						
Data HO	Data LO	Data HO	Data LO	Error Check		
54	65	73	74	XX		
HIU Response						
Address	Function Code	Start Reg HO	Start Reg LO	# of Reg HO	# of Reg LO	Error Check
01	10	00	6B	00	02	04
Character Data						
Hexadecimal Representation			54	65	73	74
ASCII Character			T	E	S	T

### Coded Data

Coded Data represents a table look-up value. Data written to these registers must be a valid table entry or the entire message is rejected. Table 2-3 shows an example coded data at data address 88 (0058 Hex) representing pressure units. The value 11 (000B Hex) returned from the HIU corresponds to kPa in the pressure unit look-up table.

TABLE 2-3. Coded Data.

Host Request						
Address	Function Code	Start Reg HO	Start Reg LO	# of Reg HO	# of Reg LO	Error Check
01	03	00	58	00	01	XX
HIU Response						
Address	Function Code	Byte Count	Data MSB	Data LSB	Error Check	
01	03	02	00	0B	XX	
Coded Data						
Hexadecimal Representation:			000B (decimal 11)			
Pressure Units Table Representation:			kPA			

### Packed Bits

Packed bits represent 16 individual status bits packed into one register. The status bits have been packed this way for systems that prefer handling only register information. These bits may also be read or written individually using a bit command. The bits within the packed registers are grouped by data or function type. Table 2-4 shows an example of packed bits with alarm status information at data address 76 (004C Hex) returned by the HIU.

TABLE 2-4. Packed Bits.

Host Request						
Address	Function Code	Start Reg HO	Start Reg LO	# of Reg HO	# of Reg LO	Error Check
01	03	00	4C	00	01	XX
HIU Response						
Address	Function Code	Byte Count	Data MSB	Data LSB	Error Check	
01	03	02	00	12	XX	
Packed Bit Data						
Binary Representation (bits 16-0):			0000 0000 0001 0010			
Bit #1 is on indicating Lo Alarm						
Bit #4 is on indicating an Unauthorized Mass Movement						

Status bits that are defined as reserved have 0 as their only legal value. A write command that contains a packed bit register with reserved bit of value 1 will be rejected.

### FLOATING-POINT REGISTERS

Although not specifically addressed by the Modbus protocol specification, floating-point numbers have been implemented per IEEE 754. Floating point numbers reduce the complexity required in scaling integer values and provide a means to transmit numbers used by the HIU that are not easily scaled, such as the K0 through K4 configuration parameters.

#### Floating-point Data

The HIU is capable of a two 16-bit registers format. An example and description follow.

#### NOTE

Although this type of data does not require scaling, it is important that the measurement unit selected in the HIU be the same as that expected by the host. In addition, where possible, data is available in both integer and floating-point formats.

#### The Two 16-bit Registers Format

Function code 03 or 04 are used to read floating-point registers in this format. Function codes 06 or 16 are used to write floating-point registers in this format. An example of reading a floating-point register from the HIU is shown in Table 2-5.

TABLE 2-5. Reading a Two 16-bit Floating-point Register.

Host Request							
Address	Function Code	Start Reg HO	Start Reg LO	# of Reg HO	# of Reg LO	Error Check	
01	03	01	60	00	02	XX	
HIU Response							
Address	Function Code	Byte Count	Data MSB	Data	Data	Data	Error Check
01	03	04	42	C8	00	00	XX
Floating Point							
Hexadecimal Representation :			42C8000				
Decimal Equivalent:			100.00				

Floating-point registers that are defined as reserved have 0 as their only legal value. A write command to a reserved floating-point register with a value other than zero will be rejected.

Section 6 lists floating-point register assignments using the two 16-bit registers format.

## STATUS BITS

In the HIU Implementation, status bits contain alarms, commands, and status information. The state of a Modbus status bit is defined as either ON (true) or OFF (false). The ON state is represented by a “1.” The status bits may be read with function code 1 or 2. They may be written one at a time with function code 5 or multiple bits may be written with function code 15. Status bits that are defined as reserved have zero as their only legal value. When writing bits, the entire write message will be rejected if reserved bits are not written with a value of zero. This rejection scheme has been chosen to add security by helping to prevent the accidental writing of data to incorrect bits. An example of a read message for bits 2 through 6 as returned by the HIU is shown in Table 2-6.

TABLE 2-6. Status Bits.

Host Request						
Address	Function Code	Start Bit HO	Start Bit LO	# of Bit HO	# of Bit LO	Error Check
01	02	00	02	00	04	XX
HIU Response						
Address	Function Code	Byte Count	Data	Error Check		
01	02	01	12	XX		
Status Bit Data						
Binary Representation (bits): 1 0010						
Bit #2: HI Alarm OFF						
Bit #3: HI Alarm ON						
Bit #4: Unauthorized Mass Movement Alarm OFF						
Bit #5: Standard Density Alarm OFF						
Bit #6: Critical Zone Alarm ON						

## EXCEPTION RESPONSES

The exception responses returned by the HIU are listed in Table 2-7.

TABLE 2-7. Exception Responses.

Exception	Response	Reason
01	Illegal Function	Message is not allowed
02	Illegal Data Address	Data address (bit or register) requested is not defined
03	Illegal Data Value	Data value being written is out of range

Messages that are received with a parity error, checksum error or message format error will be ignored. In addition, the HIU will reject any write message that is sent containing a data register or bit defined as reserved if it does not have a value of 0. An entire block will be rejected if this convention is not followed for every reserved register or bit within the block.

## DATA OUT OF RANGE

When integer data calculated by the HIU is outside the zero, and full scale points or is out of range, the value of the maximum Modbus integer + 1 is returned. The “data out of range” convention does not apply to the status bits, packed status bits, character data, and coded data.

## LOOPBACK TEST

Per the Modbus specification, function code 8 initiates a loopback test. The purpose of this test is to check the communication system. It does not affect the operation of the HIU. The HIU supports only diagnostic code 00. This is a request to return query data. Upon receiving a loopback message containing this code, the HIU will echo the message sent by the master. The entire message returned will be identical to the message transmitted by the master, field-per-field. An example of a loopback message is shown in Table 2-8.

TABLE 2-8. Loopback Message.

Host Request						
Address	Function Code	Code HO	Code LO	Data	Data	Error Check
01	08	00	00	F3	26	XX
Host Response						
Address	Function Code	Code HO	Code LO	Data	Data	Error Check
01	08	00	00	F3	26	XX

# Modbus Hardware Implementation

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The Model 3201 HIU communicates and is powered using the same pair of wires. The protocol is Manchester-encoded Modbus (MCAP), which is then converted to standard RS-485/232 Modbus via the Model 3402 Application Interface Module (AIM).

The recommended wiring configurations are as follows:

### **MCAP Signal Wiring**

one twisted shielded pair, 18 AWG. Wiring distance is approximately 5,000 feet with 14 HIUs or SAMs in any combination with 2 HART devices connected to the HIU. For specific details on grounding and wiring connections, see the product manual for the Model 3201 HIU, MAN 4640.

### **Modbus Host Signal Wiring**

Modbus RS-485, one or two twisted shielded pair, 18 AWG. Wiring distance is approximately 5,000 feet. Modbus RS-232, standard serial communication with RJ45 type connector and 25- or 9-pin connector. Wiring distance is approximately 50 feet. For specific details on grounding and wiring connections, see the product manual for the Model 3402 AIM, MAN 4641.



SECTION  
4

# Modbus Configuration

The Model 3201 HIU needs to be configured to establish communications. The HART-based communicator allows the user to set the HIU Modbus port to match the Modbus host and Model 3402 AIM.

HIUs are addressed to provide a unique identifier for the host. The HIU address is configurable through a HART-based communicator. This address may range from 1 to 247 and must be unique. Each HIU only responds when a query has been sent to its unique address by the host device.

In addition to the choice of transmission mode and associated configuration parameters, the HIU must be configured for a transmission speed or baud rate. Allowable MCAP baud rate values for the Model 3201 HIU include: 38400 or 9600. These parameters can also be configured using the HART-based Communicator connected directly to the HIU. A summary of the configuration information required by the HIU in order to implement Modbus is given in Table 4-1.

TABLE 4-1. Modbus Configuration Summary.

Configuration Item	Valid Entries	Modbus Configurable	HART-based Communicator
Modbus Address	1 to 247	Yes	Yes
Baud Rate	38400, 9600	Yes	Yes
Maximum Integer Size	Whole Number 0-65,534	Yes	Yes
Integer Scaling Factors	Floating Point #	Yes	Yes
Unit Selection	Coded List	Yes	Yes



SECTION  
5

# Integer Register Assignments

User-assignable Registers				
	Data Address	Read Only	Read/Write	Data Type
Integer Register 0	0000	30001	40001	Any
Integer Register 1	0001	30002	40002	Any
Integer Register 2	0002	30003	40003	Any
Integer Register 3	0003	30004	40004	Any
Integer Register 4	0004	30005	40005	Any
Integer Register 5	0005	30006	40006	Any
Integer Register 6	0006	30007	40007	Any
Integer Register 7	0007	30008	40008	Any
Integer Register 8	0008	30009	40009	Any
Integer Register 9	0009	30010	40010	Any
Integer Register 10	0010	30011	40011	Any
Integer Register 11	0011	30012	40012	Any
Integer Register 12	0012	30013	40013	Any
Integer Register 13	0013	30014	40014	Any
Integer Register 14	0014	30015	40015	Any
Integer Register 15	0015	30016	40016	Any
Integer Register 16	0016	30017	40017	Any
Integer Register 17	0017	30018	40018	Any
Integer Register 18	0018	30019	40019	Any
Integer Register 19	0019	30020	40020	Any
Integer Register 20	0020	30021	40021	Any
Integer Register 21	0021	30022	40022	Any
Integer Register 22	0022	30023	40023	Any
Integer Register 23	0023	30024	40024	Any
Integer Register 24	0024	30025	40025	Any
Integer Register 25	0025	30026	40026	Code
Integer Register 26	0026	30027	40027	Code
Integer Register 27	0027	30028	40028	Code
Integer Register 28	0028	30029	40029	Code
Integer Register 29	0029	30030	40030	Code
Integer Register 30	0030	30031	40031	Code
Integer Register 31	0031	30032	40032	Code
Integer Register 32	0032	30033	40033	Code
Integer Register 33	0033	30034	40034	Code
Integer Register 34	0034	30035	40035	Code
Integer Register 35	0035	30036	40036	Code
Integer Register 36	0036	30037	40037	Code

<b>User-assignable Registers (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Integer Register 37	0037	30038	40038	Code
Integer Register 38	0038	30039	40039	Code
Integer Register 39	0039	30040	40040	Code
Integer Register 40	0040	30041	40041	Code
Integer Register 41	0041	30042	40042	Code
Integer Register 42	0042	30043	40043	Code
Integer Register 43	0043	30044	40044	Code
Integer Register 44	0044	30045	40045	Code
Integer Register 45	0045	30046	40046	Code
Integer Register 46	0046	30047	40047	Code
Integer Register 47	0047	30048	40048	Code
Integer Register 48	0048	30049	40049	Code
Integer Register 49	0049	30050	40050	Code

<b>System Resolution</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Maximum Modbus Integer Size	0050	30051	40051	Integer

<b>Process Variables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Effective Mass	0051	30052	40052	Integer
True Mass	0052	30053	40053	Integer
Measured Density	0053	30054	40054	Integer
Standard Density (variable)	0054	30055	40055	Integer
Flow Rate	0055	30056	40056	Integer
Product Level	0056	30057	40057	Integer
Water Bottom Level (variable)	0057	30058	40058	Integer
Product Volume	0058	30059	40059	Integer
Standard Product Volume	0059	30060	40060	Integer
Water Bottom Volume	0060	30061	40061	Integer
Ullage Volume	0061	30062	40062	Integer
Product Temperature (variable)	0062	30063	40063	Integer
Ambient Temperature	0063	30064	40064	Integer
T <sub>B</sub>	0064	30065	40065	Integer
T <sub>M</sub>	0065	30066	40066	Integer
T <sub>T</sub>	0066	30067	40067	Integer
Vapor Mass	0067	30068	40068	Integer
Vapor Density	0068	30069	40069	Integer
Roof Mass (variable)	0069	30070	40070	Integer
P <sub>T</sub>	0070	30071	40071	Integer
P <sub>B</sub>	0071	30072	40072	Integer
P <sub>M</sub>	0072	30073	40073	Integer
Available Product	0073	30074	40074	Integer

<b>Process Variables (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Product Status Alarm Enables	0074	30075	40075	Bit
0-Not Enough Ullage for Transfer Alarm 1-Not Enough Product for Transfer Alarm 2-High Flow Rate Alarm 3-Low Flow Rate Alarm 4-Transfer Complete Alarm 5-Transfer Near Completion (Warning) Alarm 6-Tank Fill Directional Alarm 7-Tank Empty Directional Alarm 8-Reserved 9-Reserved 10-Reserved 11-Reserved 12-Reserved 13-Reserved 14-Reserved 15-Reserved				
Product Status Alarms	0075	30076	40076	Bits
0-Not Enough Ullage for Transfer Alarm 1-Not Enough Product for Transfer Alarm 2-High Flow Rate Alarm 3-Low Flow Rate Alarm 4-Transfer Complete Alarm 5-Transfer Near Completion (Warning) Alarm 6-Tank Fill Directional Alarm 7-Tank Empty Directional Alarm 8-Reserved 9-Reserved 10-Reserved 11-Reserved 12-Reserved 13-Reserved 14-Water Bottom Level in Manual 15-Standard Density in Manual				
Alarm Status - Internal State	0076	30077	40077	Bits
Bit #0 Low Critical Level Alarm Bit #1 Low Advisory Level Alarm Bit #2 High Advisory Level Alarm Bit #3 High Critical Level Alarm Bit #4 Unauthorized Mass Movement Alarm Bit #5 Standard Density Alarm Bit #6 Critical Zone Alarm Bit #7 Low Temperature Alarm Bit #8 High Temperature Alarm Bit #9 Hardware Input 1 Alarm Bit #10 Reserved Bit #11 Reserved Bit #12 Reserved Bit #13 Low P <sub>T</sub> Alarm Bit #14 High P <sub>T</sub> Alarm Bit #15 Unauthorized Mass Movement Alarm Enabled				

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

Process Variables (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Alarm Status Enables	0077	30078	40078	Bits
Bit #0 Low Critical Level Alarm Enabled Bit #1 Low Advisory Level Alarm Enabled Bit #2 High Advisory Level Alarm Enabled Bit #3 High Critical Level Alarm Enabled Bit #4 Unauthorized Mass Movement Alarm Enabled Bit #5 Standard Density Alarm Enabled Bit #6 Critical Zone Alarm Enabled Bit #7 Low Temperature Alarm Enabled Bit #8 High Temperature Alarm Enabled Bit #9 Reserved Bit #10 Reserved Bit #11 Reserved Bit #12 Hardware Input 1 Alarm Enable Bit #13 Low P <sub>r</sub> Alarm Enable Bit #14 High P <sub>r</sub> Alarm Enable Bit #15 Reserved				
Alarm Output Control/State	0078	30079	40079	Bits
Bit #0 MCAP Write Protect Switch Bit #1 HART Write Protect Switch Bit #2 Alarm Fail Hi/Lo Switch Bit #3 Switch Input State Bit #4 Reserved Bit #5 Reserved Bit #6 Reserved Bit #7 Reserved Bit #8 Reserved Bit #9 Reserved Bit #10 Reserved Bit #11 Reserved Bit #12 Reserved Bit #13 Reserved Bit #14 Reserved Bit #15 Reserved				
System Diagnostics	0079	30080	40080	Bits
Bit #0 Top Transmitter Failure Bit #1 Top Transmitter Communication Failure Bit #2 Middle Transmitter Failure Bit #3 Middle Transmitter Communication Failure Bit #4 Bottom Transmitter Failure Bit #5 Bottom Transmitter Communication Failure Bit #6 Bad Product Temperature Bit #7 RTD Out of Range Bit #8 Water Bottom Device Failure Bit #9 Water Bottom Device Communication Failure Bit #10 $P_B \leq P_M$ Bit #11 $P_B \leq P_T$ Bit #12 $P_M \leq P_T$ Bit #13 $P_B \leq P_T$ Bit #14 $P_M \leq P_T$ Bit #15 Reserved				

<b>Process Variables (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
HIU Status	0080	30081	40081	Bits
Bit #0 Reserved Bit #1 Reserved Bit #2 Not Calculating Density Bit #3 Level Out of Strapping Point Range Bit #4 RTD Not Immersed Bit #5 Not Calculating Bit #6 Constant Data Incomplete or Incorrect Bit #7 Calculation Error (Overflow, divide by 0.) Bit #8 Reserved Bit #9 Microprocessor Board Failure Bit #10 Surface Mount Analog Board Failure Bit #11 Reserved Bit #12 Reserved Bit #13 Reserved Bit #14 Reserved Bit #15 Reserved				
HIU Commands	0081	30082	40082	Bits
Bit #0 Reserved Bit #1 Reserved Bit #2 Reset HIU Bit #3 Reserved Bit #4 Tank Inactive Bit #5 Reserved Bit #6 Level in Manual Bit #7 Temperature in Manual Bit #8 Reserved Bit #9 Reserved Bit #10 Reserved Bit #11 Reserved Bit #12 Reserved Bit #13 Reserved Bit #14 Test HART Carrier Bit #15 Fixed Current Mode				

<b>Process Variable Units</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Mass Units	0082	30083	40083	Code
0 metric ton 1 kg 2 lb 3 long ton 4 short ton				
Density Units	0083	30084	40084	Code
0 kg/m <sup>3</sup> 1 lb/ft <sup>3</sup> 2 lb/gal 3 specific gravity 4 °API 5 °Brix 6 °Baumé heavy 7 °Baumé light 8 °Brix				

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

<b>Process Variable Units (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Standard Density Units	0084	30085	40085	Code
0 kg/m <sup>3</sup> 1 lb/ft <sup>3</sup> 2 lb/gal 3 specific gravity 4 °API 5 °Brix 6 °Baumé heavy 7 °Baumé light 8 °Brix				
Volume Units	0085	30086	40086	Code
0 m <sup>3</sup> 1 liters 2 U.S. gal 3 Imperial gal 4 bbl 5 ft <sup>3</sup>				
Level Units	0086	30087	40087	Code
0 meters 1 feet (decimal) 2 feet (fractional)				
Temperature Units	0087	30088	40088	Code
0 °C 1 °F				
Pressure Units	0088	30089	40089	Code
0 inH <sub>2</sub> O at 68 °F 1 inHg at 0 °C 2 ftH <sub>2</sub> O at 68 °F 3 mmH <sub>2</sub> O at 68 °F 4 mmHg at 0 °C 5 psi 6 bar 7 mbar 8 g/cm <sup>2</sup> 9 kg/cm <sup>2</sup> 10 Pa 11 kPa 12 Torr at 0 °C 13 Atmospheres				
Maximum Fill Height	0089	30090	40090	Integer
Tank Capacity	0090	30091	40091	Integer

<b>PV Alarm Variables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Mass Setpoint	0091	30092	40092	Integer
Mass Deviation	0092	30093	40093	Integer
Mass Deadband	0093	30094	40094	Integer
Standard Density Setpoint	0094	30095	40095	Integer
Standard Density Deviation	0095	30096	40096	Integer
Standard Density Deadband	0096	30097	40097	Integer
Low Critical Level Alarm Setpoint	0097	30098	40098	Integer
Low Advisory Level Alarm Setpoint	0098	30099	40099	Integer
High Advisory Level Alarm Setpoint	0099	30100	40100	Integer
High Critical Level Alarm Setpoint	0100	30101	40101	Integer
Low Temperature Alarm Setpoint	0101	30102	40102	Integer

<b>PV Alarm Variables (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
High Temperature Alarm Setpoint	0102	30103	40103	Integer
Temperature Deadband	0103	30104	40104	Integer
Solid Temperature Setpoint	0104	30105	40105	Integer
Low P <sub>T</sub> Setpoint	0105	30106	40106	Integer
High P <sub>T</sub> Setpoint	0106	30107	40107	Integer

<b>Installation Information</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
HIU Tag	0107	30108	40108	Character
HIU Tag	0108	30109	40109	Character
HIU Tag	0109	30110	40110	Character
HIU Tag	0110	30111	40111	Character
HIU Tag	0111	30112	40112	Character
HIU Tag	0112	30113	40113	Character
HIU Tag	0113	30114	40114	Character
HIU Tag	0114	30115	40115	Character
HIU Serial Number	0115	30116	40116	Character
HIU Serial Number	0116	30117	40117	Character
HIU Serial Number	0117	30118	40118	Character
HIU Serial Number	0118	30119	40119	Character
HIU Serial Number	0119	30120	40120	Character
HIU Serial Number	0120	30121	40121	Character
HIU Serial Number	0121	30122	40122	Character
HIU Serial Number	0122	30123	40123	Character
HIU Manufacturing Date	0123	30124	40124	Character
HIU Manufacturing Date	0124	30125	40125	Character
HIU Manufacturing Date	0125	30126	40126	Character
Date	0126	30127	40127	
Date	0127	30128	40128	
Date	0128	30129	40129	
Reserved	0129	30130	40130	
Reserved	0130	30131	40131	
Reserved	0131	30132	40132	

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Reserved	0132	30133	40133	
Local Display Selection #1	0133	30134	40134	Bits
Bit #0 Level Display Enable Bit #1 True Mass Display Enable Bit #2 Effective Mass Display Enable Bit #3 Standard Volume Display Enable Bit #4 Measured Volume Display Enable Bit #5 Standard Density Display Enable Bit #6 Measured Density Display Enable Bit #7 Product Temperature Display Enable Bit #8 Error Display Enable Bit #9 Test All Display Enable Bit #10 Test Blank Display Enable Bit #11 Transfer Time Bit #12 Flow Rate Display Enable Bit #13 Standard Temperature Display Enable Bit #14 P <sub>B</sub> Display Enable Bit #15 P <sub>M</sub> Display Enable				
P <sub>T</sub> Type	0134	30135	40135	Code
0-None 1-Reserved 2-Smart Standard 3-Smart Monitor				
P <sub>M</sub> Type	0135	30136	40136	Code
0-None 1-Installed				
P <sub>B</sub> Type	0136	30137	40137	Code
Temperature Device Type	0137	30138	40138	Code
0-None 1-Copper RTD 2-Platinum RTD 3-ASU 4-P <sub>B</sub> Temperature 5-Smart				
Water Bottom Type	0138	30139	40139	Code
0-None 1-Capacitance Probe 2-Pressure Transmitter				
Roof Type	0139	30140	40140	Code
0-None 1-Fixed 2-Floating-Volume Deducted from Strap Table 3-Floating-Volume Not Deducted from Strap Table				
Calculation Method for Standard Density	0140	30141	40141	Code
0-None 1-API Constants (K0,K1) 2-Polynomial (K0, K1, K2, K3, K4)				
Latitude, degrees	0141	30142	40142	Integer
Latitude, minutes	0142	30143	40143	Integer
Latitude, seconds	0143	30144	40144	Integer
H <sub>B</sub>	0144	30145	40145	Integer
H <sub>BM</sub>	0145	30146	40146	Integer
Height of RTD	0146	30147	40147	Integer

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Height of Outlet	0147	30148	40148	Integer
Calculation Method for Volume	0148	30149	40149	Code
0-Strapping Table 1-Upright Cylinder 2-Horizontal Cylinder 3-Upright Bullet 4-Horizontal Bullet 5-Sphere				
Pin Height	0149	30150	40150	Integer
Critical Zone Above Pin	0150	30151	40151	Integer
Standard Density (constant)	0151	30152	40152	Integer
Standard Density Reference Temperature	0152	30153	40153	Integer
Water Bottom Level (constant)	0153	30154	40154	Integer
Roof Mass (constant)	0154	30155	40155	Integer
Pressure Deadband	0155	30156	40156	Integer
Product Temperature (constant)	0156	30157	40157	Integer
Reserved	0157	30158	40158	
Reserved	0158	30159	40159	
Reserved	0159	30160	40160	
Reserved	0160	30161	40161	
Reserved	0161	30162	40162	
Reserved	0162	30163	40163	
Reserved	0163	30164	40164	
Reserved	0164	30165	40165	
Reserved	0165	30166	40166	
Reserved	0166	30167	40167	
Reserved	0167	30168	40168	
Reserved	0168	30169	40169	
Reserved	0169	30170	40170	
Reserved	0170	30171	40171	
Reserved	0171	30172	40172	
Reserved	0172	30173	40173	
Reserved	0173	30174	40174	
Reserved	0174	30175	40175	
Reserved	0175	30176	40176	
Reserved	0176	30177	40177	
Reserved	0177	30178	40178	
Reserved	0178	30179	40179	
Reserved	0179	30180	40180	
Reserved	0180	30181	40181	
Reserved	0181	30182	40182	
Product Name	0182	30183	40183	Character
Product Name	0183	30184	40184	Character
Product Name	0184	30185	40185	Character
Product Name	0185	30186	40186	Character
Product Name	0186	30187	40187	Character
Product Name	0187	30188	40188	Character
Product Name	0188	30189	40189	Character

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Product Name	0189	30190	40190	Character
Level Switch Type	0190	30191	40191	Code
0-None 1-Calculate on Open 2-Calculate on Close 3-Calculate on Both 4-Monitor				
H <sub>BS</sub>	0191	30192	40192	Integer
No. of Strapping Points	0191	30192	40192	Integer
Software Version	0191	30192	40192	Character
Software Version	0191	30192	40192	Character
Software Version	0191	30192	40192	Character
Software Version	0191	30192	40192	Character
Local Display Selection #2	0191	30192	40192	Bits
Bit #0 Vapor True Mass Display Enable Bit #1 Vapor Density Display Enable Bit #2 Amount Transferred Display Enable Bit #3 Amount Remaining Display Enable Bit #4 Elapsed Time Display Enable Bit #5 Reserved Bit #6 Reserved Bit #7 Reserved Bit #8 Reserved Bit #9 Reserved Bit #10 Reserved Bit #11 Reserved Bit #12 Reserved Bit #13 Reserved Bit #14 Reserved Bit #15 Reserved				
Volume Calculation Method	0198	30199	40199	Code
Local Display Selection #3	0199	30200	40200	Bits
Bit #0 P <sub>T</sub> Display Enable Bit #1 Special 1 Display Enable Bit #2 Special 2 Display Enable Bit #3 Special 3 Display Enable Bit #4 Special 4 Display Enable Bit #5 Special 5 Display Enable Bit #6 Roof Mass Display Enable Bit #7 Tank Capacity Display Enable Bit #8 Ullage Display Enable Bit #9 Water Bottom Volume Display Enable Bit #10 Water Bottom Level Display Enable Bit #11 Available Product Display Enable Bit #12 Tank Alarm Display Enable Bit #13 Status Alarm Display Enable Bit #14 Diagnostic Alarm Display Enable Bit #15 Liquid True Mass Display Enable				

User Assignment For Integer Registers				
	Data Address	Read Only	Read/Write	Data Type
Assign User Register 0	0200	30201	40201	Integer
Assign User Register 1	0201	30202	40202	Integer
Assign User Register 2	0202	30203	40203	Integer
Assign User Register 3	0203	30204	40204	Integer
Assign User Register 4	0204	30205	40205	Integer
Assign User Register 5	0205	30206	40206	Integer

<b>User Assignment For Integer Registers (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Assign User Register 6	0206	30207	40207	Integer
Assign User Register 7	0207	30208	40208	Integer
Assign User Register 8	0208	30209	40209	Integer
Assign User Register 9	0209	30210	40210	Integer
Assign User Register 10	0210	30211	40211	Integer
Assign User Register 11	0211	30212	40212	Integer
Assign User Register 12	0212	30213	40213	Integer
Assign User Register 13	0213	30214	40214	Integer
Assign User Register 14	0214	30215	40215	Integer
Assign User Register 15	0215	30216	40216	Integer
Assign User Register 16	0216	30217	40217	Integer
Assign User Register 17	0217	30218	40218	Integer
Assign User Register 18	0218	30219	40219	Integer
Assign User Register 19	0219	30220	40220	Integer
Assign User Register 20	0220	30221	40221	Integer
Assign User Register 21	0221	30222	40222	Integer
Assign User Register 22	0222	30223	40223	Integer
Assign User Register 23	0223	30224	40224	Integer
Assign User Register 24	0224	30225	40225	Integer
Assign User Register 25	0225	30226	40226	Integer
Assign User Register 26	0226	30227	40227	Integer
Assign User Register 27	0227	30228	40228	Integer
Assign User Register 28	0228	30229	40229	Integer
Assign User Register 29	0229	30230	40230	Integer
Assign User Register 30	0230	30231	40231	Integer
Assign User Register 31	0231	30232	40232	Integer
Assign User Register 32	0232	30233	40233	Integer
Assign User Register 33	0233	30234	40234	Integer
Assign User Register 34	0234	30235	40235	Integer
Assign User Register 35	0235	30236	40236	Integer
Assign User Register 36	0236	30237	40237	Integer
Assign User Register 37	0237	30238	40238	Integer
Assign User Register 38	0238	30239	40239	Integer
Assign User Register 39	0239	30240	40240	Integer
Assign User Register 40	0240	30241	40241	Integer
Assign User Register 41	0241	30242	40242	Integer
Assign User Register 42	0242	30243	40243	Integer
Assign User Register 43	0243	30244	40244	Integer
Assign User Register 44	0244	30245	40245	Integer
Assign User Register 45	0245	30246	40246	Integer
Assign User Register 46	0246	30247	40247	Integer
Assign User Register 47	0247	30248	40248	Integer
Assign User Register 48	0248	30249	40249	Integer
Assign User Register 49	0249	30250	40250	Integer

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Tank Material	0250	30251	40251	Code
0-Carbon Steel (.0000117) 1-304 SST (.0000173) 2-316 SST (.0000160) 3-Monel (.0000140) 4-Aluminum (.0000234) 5-Nickel (.0000133) 6-User Defined				
Loop Counts	0251	30252	40252	Integer
Variable Assignment	0252	30253	40253	Integer
Pressure Threshold	0253	30254	40254	Integer
Constant P <sub>T</sub>	0254	30255	40255	Integer
Local Display Selection #4	0255	30256	40256	Bits
0-NMI Approved True Mass Display Enable 1-NMI Approved Effective Mass Display Enable 2-NMI Approved Standard Volume Display Enable 3-NMI Approved Gross Volume Display Enable 4-NMI Approved Standard Density Display Enable 5-NMI Approved Standard Measured Display Enable 6-NMI Approved Vapor Density Display Enable 7-Reserved 8-Reserved 9-Reserved 10-Reserved 11-Reserved 12-Reserved 13-Reserved 14- Reserved 15- Reserved				
Reserved	0256	30257	40257	
Reserved	0257	30258	40258	
Reserved	0258	30259	40259	
Reserved	0259	30260	40260	
HART Write Protection	0260	30261	40261	Bits
0-Write Protect V Constants 1-Write Protect K Constants and Density Method 2-Write Protect Product Temperature 3-Write Protect Standard Density 4-Write Protect Standard Reference Temperature 5-Write Protect Water Bottom Level 6-Write Protect Level Alarms 7-Write Protect Density Alarms 8-Write Protect Mass Alarms 9-Write Protect P <sub>T</sub> Alarms 10-Write Protect Display Selects 11-Reserved 12-Reserved 13-Reserved 14-Reserved 15-Reserved				

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
MCAP Write Protection	0261	30262	40262	
0-Write Protect V Constants 1-Write Protect K Constants and Density Method 2-Write Protect Product Temperature 3-Write Protect Standard Density 4-Write Protect Standard Reference Temperature 5-Write Protect Water Bottom Level 6-Write Protect Level Alarms 7-Write Protect Density Alarms 8-Write Protect Mass Alarms 9-Write Protect P <sub>T</sub> Alarms 10-Write Protect Display Selects 11-Reserved 12-Reserved 13-Reserved 14-Reserved 15-Reserved				
Reserved	0262	30263	40263	
Reserved	0263	30264	40264	
Reserved	0264	30265	40265	
Reserved	0265	30266	40266	
Reserved	0266	30267	40267	
Reserved	0267	30268	40268	
Reserved	0268	30269	40269	
Transfer Method	0269	30270	40270	
0-Mass 1-Gross Volume 2-Standard Volume 3-Level				

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Flow Unit Select	0270	30271	40271	40271
0-kg/sec				
1-kg/min				
2-kg/hour				
3-kg/day				
4-MTon/sec				
5-MTon/min				
6-MTon/hour				
7-MTon/day				
8-lb/sec				
9-lb/min				
10-lb/hour				
11-lb/day				
12-STon/sec				
13-STon/min				
14-STon/hour				
15-STon/day				
16-LTon/sec				
17-LTon/min				
18-LTon/hour				
19-LTon/day				
20-m3/sec				
21-m3/min				
22-m3/hour				
23-m3/day				
24-ltr/sec				
25-ltr/min				
26-ltr/hour				
27-ltr/day				
28-gal/sec				
29-gal/min				
30-gal/hour				
31-gal/day				
32-lgal/sec				
33-lgal/min				
34-lgal/hour				
35-lgal/day				
36-bbl/sec				
37-bbl/min				
38-bbl/hour				
39-bbl/day				
40-ft3/sec				
41-ft3/min				
42-ft3/hour				
43-ft3/day				
44-m/sec				
45-m/min				
46-m/hour				
47-m/day				
48-in/sec				
49-in/min				
50-in/hour				
51-in/day				
52-ft/sec				
53-ft/min				
54-ft/hour				
55-ft/day				

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
Transfer Unit Select	0271	30272	40272	Code
0-m 1-ft 2-ft 3-m <sup>3</sup> 4-liter 5-usgal 6-igal 7-bbls 8-ft <sup>3</sup> 9-mTon 10-kg 11-lbs 12-LTon 13-STon				
Time Unit Select	0272	30273	40273	Code
0-Seconds 1-Minutes 2-Hours 3-Days				
Flow Calculation Period	0273	30274	40274	Integer
Transfer Warning Time	0274	30275	40275	Integer
Transfer Setpoint	0275	30276	40276	Integer
Transfer Setpoint Delta	0276	30277	40277	Integer
Amount Remaining	0277	30278	40278	Integer
Amount Transferred	0278	30279	40279	Integer
Elapsed Time	0279	30280	40280	Integer
Transfer Completion Time	0280	30281	40281	Integer
Low Flow Setpoint	0281	30282	40282	Integer
High Flow Setpoint	0282	30283	40283	Integer
Flow Deadband	0283	30284	40284	Integer
Mass Capacity	0284	30285	40285	Integer
Reserved	0285	30286	40286	
Reserved	0286	30287	40287	
Reserved	0287	30288	40288	
Reserved	0288	30289	40289	
Reserved	0289	30290	40290	
Baud Rate	0290	30291	40291	Code
0-9600 bps 1-19200 bps 2-38400 bps				
Modbus Address	0291	30292	40292	Integer
Reserved	0292	30293	40293	
Reference Counts	0293	30294	40294	Integer
HART Try Counter	0294	30295	40295	Integer
HART Error Counter	0295	30296	40296	Integer
HART Zero Command	0296	30297	40297	Integer
HART Zero Acknowledge	0297	30298	40298	Integer

Installation Information (Continued)				
	Data Address	Read Only	Read/Write	Data Type
HART Device Poll	0298	30299	40299	Bits
0-Slave 1				
1-Slave 2				
2-Slave 3				
3-Slave 4				
4-Slave 5				
5-Slave 6				
6-Slave 7				
7-Reserved				
8-Reserved				
9-Reserved				
10-Reserved				
11-Reserved				
12-Reserved				
13-Reserved				
14-Reserved				
15-Reserved				
Reserved	0299	30300	40300	

SECTION  
6

# Floating-point Register Assignments

## TWO 16-BIT REGISTERS FORMAT

<b>Reserved Registers</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Reserved	0300	30301	40301	
Reserved	0302	30303	40303	
Reserved	0304	30305	40305	
Reserved	0306	30307	40307	
Reserved	0308	30309	40309	
Reserved	0310	30311	40311	
Reserved	0312	30313	40313	
Reserved	0314	30315	40315	
Reserved	0316	30317	40317	
Reserved	0318	30319	40319	
Reserved	0320	30321	40321	
Reserved	0322	30323	40323	
Reserved	0324	30325	40325	
Reserved	0326	30327	40327	
Reserved	0328	30329	40329	
Reserved	0330	30331	40331	
Reserved	0332	30333	40333	
Reserved	0334	30335	40335	
Reserved	0336	30337	40337	
Reserved	0338	30339	40339	
Reserved	0340	30341	40341	
Reserved	0342	30343	30343	
Reserved	0344	30345	40345	
Reserved	0346	30347	40347	
Reserved	0348	30349	40349	

<b>Process Variables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Effective Mass	0350	30351	40351	Float
True Mass	0352	30353	40353	Float
Measured Density	0354	30355	40355	Float
Standard Density (variable)	0356	30357	40357	Float
Reserved	0358	30359	40359	
Product Level	0360	30361	40361	Float
Water Bottom Level (variable)	0362	30363	40363	Float
Product Volume	0364	30365	40365	Float
Standard Product Volume	0366	30367	40367	Float

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

<b>Process Variables (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Water Bottom Volume	0368	30369	40369	Float
Ullage Volume	0370	30371	40371	Float
Product Temperature (variable)	0372	30373	40373	Float
Ambient Temperature	0374	30375	40375	Float
$T_B$	0376	30377	40377	Float
$T_M$	0378	30379	40379	Float
$T_T$	0380	30381	40381	Float
Time to Complete	0382	30383	40383	Float
Flow Rate	0384	30385	40385	Float
Roof Mass (variable)	0386	30387	40387	Float
$P_T$	0388	30389	40389	Float
$P_B$	0390	30391	40391	Float
$P_M$	0392	30393	40393	Float
Available Product	0394	30395	40395	Float
Vapor Mass	0396	30397	40397	Float
Vapor Density	0398	30399	40399	Float
RTD Resistance	0400	30401	40401	Float
Reserved	0402	30403	40403	

<b>PV Alarm Variables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Mass Setpoint	0404	30405	40405	Float
Mass Deviation	0406	30407	40407	Float
Mass Deadband	0408	30409	40409	Float
Standard Density Setpoint	0410	30411	40411	Float
Standard Density Deviation	0412	30413	40413	Float
Standard Density Deadband	0414	30415	40415	Float
Low Critical Level Alarm Setpoint	0416	30417	40417	Float
Low Advisory Level Alarm Setpoint	0418	30419	40419	Float
High Advisory Level Alarm Setpoint	0420	30421	40421	Float
High Critical Level Alarm Setpoint	0422	30423	40423	Float
Level Deadband	0424	30425	40425	Float
Low Temperature Alarm Setpoint	0426	30427	40427	Float
High Temperature Alarm Setpoint	0428	30429	40429	Float
Temperature Deadband	0430	30431	40431	Float
Solid Temperature Setpoint	0432	30433	40433	Float
Transfer Setpoint	0434	30435	40435	Float

<b>Zero and Full Scale Variables for Integer Modbus</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Mass Zero Scaling	0436	30437	40437	Float
Mass Full Scale Scaling	0438	30439	40439	Float
Density Zero Scaling	0440	30441	40441	Float
Density Full Scale Scaling	0442	30443	40443	Float
Standard Density Zero Scaling	0444	30445	40445	Float
Standard Density Full Scale Scaling	0446	30447	40447	Float

<b>Zero and Full Scale Variables for Integer Modbus (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Volume Zero Scaling	0448	30449	40449	Float
Volume Full Scale Scaling	0450	30451	40451	Float
Temperature Zero Scaling	0452	30453	40453	Float
Temperature Full Scale Scaling	0454	30455	40455	Float
Level Zero Scaling	0456	30457	40457	Float
Level Full Scale Scaling	0458	30459	40459	Float
Pressure Zero Scaling	0460	30461	40461	Float
Pressure Full Scale Scaling	0462	30463	40463	Float
Flow Zero Scaling	0464	30465	40465	Float
Flow Full Scale Scaling	0466	30467	40467	Float
Transfer Setpoint Zero Scaling	0468	30469	40469	Float
Transfer Setpoint Full Scale Scaling	0470	30471	40471	Float

<b>Correction Information</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
K00 Density Correction Coefficient	0472	30473	40473	Float
K01 Density Correction Coefficient	0474	30475	40475	Float
K02 Density Correction Coefficient	0476	30477	40477	Float
K03 Density Correction Coefficient	0478	30479	40479	Float
K04 Density Correction Coefficient	0480	30481	40481	Float
V00 Density Correction Coefficient	0482	30483	40483	Float
V01 Density Correction Coefficient	0484	30485	40485	Float
V02 Density Correction Coefficient	0486	30487	40487	Float
V03 Density Correction Coefficient	0488	30489	40489	Float
V04 Density Correction Coefficient	0490	30491	40491	Float
Reserved	0492	30493	40493	
Reserved	0494	30495	40495	
Pressure Threshold	0496	30497	40497	Float
Capacity	0498	30499	40499	Float
Local Elevation	0500	30501	40501	Float
Standard Density (constant)	0502	30503	40503	Float
Standard Density Reference Temperature	0504	30505	40505	Float
Water Bottom Level (constant)	0506	30507	40507	Float
Roof Mass (constant)	0508	30509	40509	Float
$P_r$ (constant)	0510	30511	40511	Float
Product Temperature (constant)	0512	30513	40513	Float
Installation Temperature	0514	30515	40515	Float
Strapping Temperature	0516	30517	40517	Float
Strapping Density	0518	30519	40519	Float
$H_B$	0520	30521	40521	Float
$H_{BM}$	0522	30523	40523	Float
Height of RTD	0524	30525	40525	Float
Height of Outlet	0526	30527	40527	Float
$H_{BT}$	0528	30529	40529	Float
Pin Height	0530	30531	40531	Float
Critical Zone Above Pin	0532	30533	40533	Float
Thermal Expansion Coefficient	0534	30535	40535	Float

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

<b>Strapping Table Values</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Strapping Level #1	0536	30537	40537	Float
Strapping Volume #1	0538	30539	40539	Float
Strapping Level #2	0540	30541	40541	Float
Strapping Volume #2	0542	30543	40543	Float
Strapping Level #3	0544	30545	40545	Float
Strapping Volume #3	0546	30547	40547	Float
Strapping Level #4	0548	30549	40549	Float
Strapping Volume #4	0550	30551	40551	Float
Strapping Level #5	0552	30553	40553	Float
Strapping Volume #5	0554	30555	40555	Float
Strapping Level #6	0556	30557	40557	Float
Strapping Volume #6	0558	30559	40559	Float
Strapping Level #7	0560	30561	40561	Float
Strapping Volume #7	0562	30563	40563	Float
Strapping Level #8	0564	30565	40565	Float
Strapping Volume #8	0566	30567	40567	Float
Strapping Level #9	0568	30569	40569	Float
Strapping Volume #9	0570	30571	40571	Float
Strapping Level #10	0572	30573	40573	Float
Strapping Volume #10	0574	30575	40575	Float
Strapping Level #11	0576	30577	40577	Float
Strapping Volume #11	0578	30579	40579	Float
Strapping Level #12	0580	30581	40581	Float
Strapping Volume #12	0582	30583	40583	Float
Strapping Level #13	0584	30585	40585	Float
Strapping Volume #13	0586	30587	40587	Float
Strapping Level #14	0588	30589	40589	Float
Strapping Volume #14	0590	30591	40591	Float
Strapping Level #15	0592	30593	40593	Float
Strapping Volume #15	0594	30595	40595	Float
Strapping Level #16	0596	30597	40597	Float
Strapping Volume #16	0598	30599	40599	Float
Strapping Level #17	0600	30601	40601	Float
Strapping Volume #17	0602	30603	40603	Float
Strapping Level #18	0604	30605	40605	Float
Strapping Volume #18	0606	30607	40607	Float
Strapping Level #19	0608	30609	40609	Float
Strapping Volume #19	0610	30611	40611	Float
Strapping Level #20	0612	30613	40613	Float
Strapping Volume #20	0614	30615	40615	Float
Strapping Level #21	0616	30617	40617	Float
Strapping Volume #21	0618	30619	40619	Float
Strapping Level #22	0620	30621	40621	Float
Strapping Volume #22	0622	30623	40623	Float
Strapping Level #23	0624	30625	40625	Float
Strapping Volume #23	0626	30627	40627	Float
Strapping Level #24	0628	30629	40629	Float

<b>Strapping Table Values (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Strapping Volume #24	0630	30631	40631	Float
Strapping Level #25	0632	30633	40633	Float
Strapping Volume #25	0634	30635	40635	Float
Strapping Level #26	0636	30637	40637	Float
Strapping Volume #26	0638	30639	40639	Float
Strapping Level #27	0640	30641	40641	Float
Strapping Volume #27	0642	30643	40643	Float
Strapping Level #28	0644	30645	40645	Float
Strapping Volume #28	0646	30647	40647	Float
Strapping Level #29	0648	30649	40649	Float
Strapping Volume #29	0650	30651	40651	Float
Strapping Level #30	0652	30653	40653	Float
Strapping Volume #30	0654	30655	40655	Float
Strapping Level #31	0656	30657	40657	Float
Strapping Volume #31	0658	30659	40659	Float
Strapping Level #32	0660	30661	40661	Float
Strapping Volume #32	0662	30663	40663	Float
Strapping Level #33	0664	30665	40665	Float
Strapping Volume #33	0666	30667	40667	Float
Strapping Level #34	0668	30669	40669	Float
Strapping Volume #34	0670	30671	40671	Float
Strapping Level #35	0672	30673	40673	Float
Strapping Volume #35	0674	30675	40675	Float
Strapping Level #36	0676	30677	40677	Float
Strapping Volume #36	0678	30679	40679	Float
Strapping Level #37	0680	30681	40681	Float
Strapping Volume #37	0682	30683	40683	Float
Strapping Level #38	0684	30685	40685	Float
Strapping Volume #38	0686	30687	40687	Float
Strapping Level #39	0688	30689	40689	Float
Strapping Volume #39	0690	30691	40691	Float
Strapping Level #40	0692	30693	40693	Float
Strapping Volume #40	0694	30695	40695	Float
Strapping Level #41	0696	30697	40697	Float
Strapping Volume #41	0698	30699	40699	Float
Strapping Level #42	0700	30701	40701	Float
Strapping Volume #42	0702	30703	40703	Float
Strapping Level #43	0704	30705	40705	Float
Strapping Volume #43	0706	30707	40707	Float
Strapping Level #44	0708	30709	40709	Float
Strapping Volume #44	0710	30711	40711	Float
Strapping Level #45	0712	30713	40713	Float
Strapping Volume #45	0714	30715	40715	Float
Strapping Level #46	0716	30717	40717	Float
Strapping Volume #46	0718	30719	40719	Float
Strapping Level #47	0720	30721	40721	Float
Strapping Volume #47	0722	30723	40723	Float

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

<b>Strapping Table Values (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Strapping Level #48	0724	30725	40725	Float
Strapping Volume #48	0726	30727	40727	Float
Strapping Level #49	0728	30729	40729	Float
Strapping Volume #49	0730	30731	40731	Float
Strapping Level #50	0732	30733	40733	Float
Strapping Volume #50	0734	30735	40735	Float
Strapping Level #51	0736	30737	40737	Float
Strapping Volume #51	0738	30739	40739	Float
Strapping Level #52	0740	30741	40741	Float
Strapping Volume #52	0742	30743	40743	Float
Strapping Level #53	0744	30745	40745	Float
Strapping Volume #53	0746	30747	40747	Float
Strapping Level #54	0748	30749	40749	Float
Strapping Volume #54	0750	30751	40751	Float
Strapping Level #55	0752	30753	40753	Float
Strapping Volume #55	0754	30755	40755	Float
Strapping Level #56	0756	30757	40757	Float
Strapping Volume #56	0758	30759	40759	Float
Strapping Level #57	0760	30761	40761	Float
Strapping Volume #57	0762	30763	40763	Float
Strapping Level #58	0764	30765	40765	Float
Strapping Volume #58	0766	30767	40767	Float
Strapping Level #59	0768	30769	40769	Float
Strapping Volume #59	0770	30771	40771	Float
Strapping Level #60	0772	30773	40773	Float
Strapping Volume #60	0774	30775	40775	Float
Strapping Level #61	0776	30777	40777	Float
Strapping Volume #61	0778	30779	40779	Float
Strapping Level #62	0780	30781	40781	Float
Strapping Volume #62	0782	30783	40783	Float
Strapping Level #63	0784	30785	40785	Float
Strapping Volume #63	0786	30787	40787	Float
Strapping Level #64	0788	30789	40789	Float
Strapping Volume #64	0790	30791	40791	Float
Strapping Level #65	0792	30793	40793	Float
Strapping Volume #65	0794	30795	40795	Float
Strapping Level #66	0796	30797	40797	Float
Strapping Volume #66	0798	30799	40799	Float
Strapping Level #67	0800	30801	40801	Float
Strapping Volume #67	0802	30803	40803	Float
Strapping Level #68	0804	30805	40805	Float
Strapping Volume #68	0806	30807	40807	Float
Strapping Level #69	0808	30809	40809	Float
Strapping Volume #69	0810	30811	40811	Float
Strapping Level #70	0812	30813	40813	Float
Strapping Volume #70	0814	30815	40815	Float
Strapping Level #71	0816	30817	40817	Float

<b>Strapping Table Values (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Strapping Volume #71	0818	30819	40819	Float
Strapping Level #72	0820	30821	40821	Float
Strapping Volume #72	0822	30823	40823	Float
Strapping Level #73	0824	30825	40825	Float
Strapping Volume #73	0826	30827	40827	Float
Strapping Level #74	0828	30829	40829	Float
Strapping Volume #74	0830	30831	40831	Float
Strapping Level #75	0832	30833	40833	Float
Strapping Volume #75	0834	30835	40835	Float
Strapping Level #76	0836	30837	40837	Float
Strapping Volume #76	0838	30839	40839	Float
Strapping Level #77	0840	30841	40841	Float
Strapping Volume #77	0842	30843	40843	Float
Strapping Level #78	0844	30845	40845	Float
Strapping Volume #78	0846	30847	40847	Float
Strapping Level #79	0848	30849	40849	Float
Strapping Volume #79	0850	30851	40851	Float
Strapping Level #80	0852	30853	40853	Float
Strapping Volume #80	0854	30855	40855	Float
Strapping Level #81	0856	30857	40857	Float
Strapping Volume #81	0858	30859	40859	Float
Strapping Level #82	0860	30861	40861	Float
Strapping Volume #82	0862	30863	40863	Float
Strapping Level #83	0864	30865	40865	Float
Strapping Volume #83	0866	30867	40867	Float
Strapping Level #84	0868	30869	40869	Float
Strapping Volume #84	0870	30871	40871	Float
Strapping Level #85	0872	30873	40873	Float
Strapping Volume #85	0874	30875	40875	Float
Strapping Level #86	0876	30877	40877	Float
Strapping Volume #86	0878	30879	40879	Float
Strapping Level #87	0880	30881	40881	Float
Strapping Volume #87	0882	30883	40883	Float
Strapping Level #88	0884	30885	40885	Float
Strapping Volume #88	0886	30887	40887	Float
Strapping Level #89	0888	30889	40889	Float
Strapping Volume #89	0890	30891	40891	Float
Strapping Level #90	0892	30893	40893	Float
Strapping Volume #90	0894	30895	40895	Float
Strapping Level #91	0896	30897	40897	Float
Strapping Volume #91	0898	30899	40899	Float
Strapping Level #92	0900	30901	40901	Float
Strapping Volume #92	0902	30903	40903	Float
Strapping Level #93	0904	30905	40905	Float
Strapping Volume #93	0906	30907	40907	Float
Strapping Level #94	0908	30909	40909	Float
Strapping Volume #94	0910	30911	40911	Float

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<b>Strapping Table Values (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Strapping Level #95	0912	30913	40913	Float
Strapping Volume #95	0914	30915	40915	Float
Strapping Level #96	0916	30917	40917	Float
Strapping Volume #96	0918	30919	40919	Float
Strapping Level #97	0920	30921	40921	Float
Strapping Volume #97	0922	30923	40923	Float
Strapping Level #98	0924	30925	40925	Float
Strapping Volume #98	0926	30927	40927	Float
Strapping Level #99	0928	30929	40929	Float
Strapping Volume #99	0930	30931	40931	Float
Strapping Level #100	0932	30933	40933	Float
Strapping Volume #100	0934	30935	40935	Float

<b>Installation Information</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
H <sub>ES</sub>	0936	30937	40937	Float
Reserved	0938	30939	40939	
Reserved	0940	30941	40941	
Tank Diameter	0942	30943	40943	Float
Tank Height	0944	30945	40945	Float
Lower Range Value	0946	30947	40947	Float
Upper Range Value	0948	30949	40949	Float
Low P <sub>r</sub> Setpoint	0950	30951	40951	Float
High P <sub>r</sub> Setpoint	0952	30953	40953	Float
Pressure Deadband	0954	30955	40955	Float
Maximum Fill Height	0956	30957	40957	Float
Pressure Hysteresis	0958	30959	40959	Float
Time Zero	0960	30961	40961	Float
Time Full Scale	0962	30963	40963	Float
Flow Calculation Period	0964	30965	40965	Float
Transfer Warning Time	0966	30967	40967	Float
Elapsed Time	0968	30969	40969	Float
Amount Remaining	0970	30971	40971	Float
Amount Transferred	0972	30973	40973	Float
Transfer Setpoint Delta	0974	30975	40975	Float
Low Flow Setpoint	0976	30977	40977	Float
High Flow Setpoint	0978	30979	40979	Float
Flow Deadband	0980	30981	40981	Float
Special 1	0982	30983	40983	Float
Special 2	0984	30985	40985	Float
Special 3	0986	30987	40987	Float
Special 4	0988	30989	40989	Float
Special 5	0990	30991	40991	Float
HWB	0992	30993	40993	Float
Mass Capacity	0994	30995	40995	Float
Reserved	0996	30997	40997	
Reserved	0998	30999	40999	

**SECTION  
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# Status Bit Assignments

<b>Alarms Status - Internal State</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Low Critical Level Alarm	0000	10001	00001	Bit
Low Advisory Level Alarm	0001	10002	00002	Bit
High Advisory Level Alarm	0002	10003	00003	Bit
High Critical Level Alarm	0003	10004	00004	Bit
Unauthorized Mass Movement Alarm	0004	10005	00005	Bit
Standard Density Alarm	0005	10006	00006	Bit
Critical Zone Alarm	0006	10007	00007	Bit
Low Temperature Alarm	0007	10008	00008	Bit
High Temperature Alarm	0008	10009	00009	Bit
Hardware Input 1 Alarm	0009	10010	00010	Bit
Reserved	0010	10011	00011	
Reserved	0011	10012	00012	
Reserved	0012	10013	00013	
Low P <sub>T</sub> Alarm	0013	10014	00014	Bit
High P <sub>T</sub> Alarm	0014	10015	00015	Bit
Mass Alarm Enable	0015	10016	00016	Bit

<b>Alarm Status Enables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Low Critical Level Alarm Enabled	0016	10017	00017	Bit
Low Advisory Level Alarm Enabled	0017	10018	00018	Bit
High Advisory Level Alarm Enabled	0018	10019	00019	Bit
High Critical Level Alarm Enabled	0019	10020	00020	Bit
Unauthorized Mass Movement Alarm Enabled	0020	10021	00021	Bit
Standard Density Alarm Enabled	0021	10022	00022	Bit
Critical Zone Alarm Enabled	0022	10023	00023	Bit
Low Temperature Alarm Enabled	0023	10024	00024	Bit
High Temperature Alarm Enabled	0024	10025	00025	Bit
Reserved	0025	10026	00026	
Reserved	0026	10027	00027	
Reserved	0027	10028	00028	
Hardware Input 1 Alarm Enabled	0028	10029	00029	Bit
Low P <sub>T</sub> Alarm Enable	0029	10030	00030	Bit
High P <sub>T</sub> Alarm Enable	0030	10031	00031	Bit
Reserved	0031	10032	00032	

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<b>Alarm Output Control/State</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
MCAP Write Protect Switch	0032	10033	00033	Bit
HART Write Protect Switch	0033	10034	00034	Bit
Switch Input State	0034	10035	00035	Bit
Reserved	0035	10036	00036	
Reserved	0036	10037	00037	
Reserved	0037	10038	00038	
Reserved	0038	10039	00039	
Reserved	0039	10040	00040	
Reserved	0040	10041	00041	
Reserved	0041	10042	00042	
Reserved	0042	10043	00043	
Reserved	0043	10044	00044	
Reserved	0044	10045	00045	
Reserved	0045	10046	00046	
Reserved	0046	10047	00047	
Reserved	0047	10048	00048	

<b>System Diagnostics</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Top Transmitter Failure	0048	10049	00049	Bit
Top Transmitter Communication Failure	0049	10050	00050	Bit
Middle Transmitter Failure	0050	10051	00051	Bit
Middle Transmitter Communication Failure	0051	10052	00052	Bit
Bottom Transmitter Failure	0052	10053	00053	Bit
Bottom Transmitter Communication Failure	0053	10054	00054	Bit
Bad Product Temperature	0054	10055	00055	Bit
RTD Out of Range	0055	10056	00056	Bit
Water Bottom Device Failure	0056	10057	00057	Bit
Water Bottom Device Communication Failure	0057	10058	00058	Bit
$P_B \leq P_M$	0058	10059	00059	Bit
$P_B \leq P_T$	0059	10060	00060	Bit
$P_M \leq P_T$	0060	10061	00061	Bit
$P_B \leq P_T$	0061	10062	00062	Bit
$P_M \leq P_T$	0062	10063	00063	Bit
Reserved	0063	10064	00064	

<b>HIU Status</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Reserved	0064	10065	00065	
Reserved	0065	10066	00066	
Not Calculating Density	0066	10067	00067	Bit
Level Out of Strapping Point Range	0067	10068	00068	Bit
RTD Not Immersed	0068	10069	00069	Bit
Not Calculating	0069	10070	00070	Bit
Constant Data Incomplete / Incorrect	0070	10071	00071	Bit
Calculation Error (Overflow, divide by 0.)	0071	10072	00072	Bit
Reserved	0072	10073	00073	

<b>HIU Status (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Microprocessor Board Failure	0073	10074	00074	Bit
Surface Mount Analog Board Failure	0074	10075	00075	Bit
Reserved	0075	10076	00076	
Reserved	0076	10077	00077	
Reserved	0077	10078	00078	
Reserved	0078	10079	00079	
Reserved	0079	10080	00080	

<b>HIU Commands</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Reserved	0080	10081	00081	
Reserved	0081	10082	00082	
Reset HIU	0082	10083	00083	Bit
Reserved	0083	10084	00084	
Tank Inactive	0084	10085	00085	Bit
Reserved	0085	10086	00086	
Level in Manual	0086	10087	00087	Bit
Temperature in Manual	0087	10088	00088	Bit
Reserved	0088	10089	00089	
Reserved	0089	10090	00090	
Reserved	0090	10091	00091	
Reserved	0091	10092	00092	
Reserved	0092	10093	00093	
Reserved	0093	10094	00094	
Test HART Carrier	0094	10095	00095	Bit
Fixed Current Mode	0095	10096	00096	Bit

<b>Local Display Selection</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Display Level	0096	10097	00097	Bit
Display True Mass	0097	10098	00098	Bit
Display Effective Mass	0098	10099	00099	Bit
Display Standard Volume	0099	10100	00100	Bit
Display Measured Volume	0100	10101	00101	Bit
Display Standard Density	0101	10102	00102	Bit
Display Measured Density	0102	10103	00103	Bit
Display Product Temperature	0103	10104	00104	Bit
Reserved	0104	10105	00105	
Display Test All	0105	10106	00106	Bit
Display Test Blank	0106	10107	00107	Bit
Display Transfer Time	0107	10108	00108	Bit
Display Flow Rate	0108	10109	00109	Bit
Display Standard Reference Temperature	0109	10110	00110	Bit
Display P <sub>B</sub>	0110	10111	00111	Bit
Display P <sub>M</sub>	0111	10112	00112	Bit
Display P <sub>T</sub>	0112	10113	00113	Bit
Display Special 1	0113	10114	00114	Bit

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<b>Local Display Selection (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Display Special 2	0114	10115	00115	Bit
Display Special 3	0115	10116	00116	Bit
Display Special 4	0116	10117	00117	Bit
Display Special 5	0117	10118	00118	Bit
Display Roof Mass	0118	10119	00119	Bit
Display Tank Capacity	0119	10120	00120	Bit
Display Ullage	0120	10121	00121	Bit
Display Water Bottom Volume	0121	10122	00122	Bit
Display Water Bottom Level	0122	10123	00123	Bit
Display Available Product	0123	10124	00124	Bit
Display Tank Alarm	0124	10125	00125	Bit
Display Status Alarm	0125	10126	00126	Bit
Display Diagnostic Alarm	0126	10127	00127	Bit
Display Liquid True Mass	0127	10128	00128	Bit
Display Vapor True Mass	0128	10129	00129	Bit
Display Vapor Density	0129	10130	00130	Bit
Display Amount Transferred	0130	10131	00131	Bit
Display Amount Remaining	0131	10132	00132	Bit
Display Elapsed Time	0132	10133	00133	Bit
Reserved	0133	10134	00134	
Reserved	0134	10135	00135	
Reserved	0135	10136	00136	
Reserved	0136	10137	00137	
Reserved	0137	10138	00138	
Reserved	0138	10139	00139	
Reserved	0139	10140	00140	
Reserved	0140	10141	00141	
Reserved	0141	10142	00142	
Reserved	0142	10143	00143	
Reserved	0143	10144	00144	
Reserved	0144	10145	00145	
Reserved	0145	10146	00146	
Reserved	0146	10147	00147	
Reserved	0147	10148	00148	
Reserved	0148	10149	00149	
Reserved	0149	10150	00150	
Reserved	0150	10151	00151	
Reserved	0151	10152	00152	
Reserved	0152	10153	00153	
Reserved	0153	10154	00154	
Reserved	0154	10155	00155	
Reserved	0155	10156	00156	
Reserved	0156	10157	00157	
Reserved	0157	10158	00158	
Test HART Carrier	0158	10159	00159	Bit
Fixed Current Mode	0159	10160	00160	Bit
Poll Slave 1	0160	10161	00161	Bit
Poll Slave 2	0161	10162	00162	Bit

<b>Local Display Selection (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Poll Slave 3	0162	10163	00163	Bit
Poll Slave 4	0163	10164	00164	Bit
Poll Slave 5	0164	10165	00165	Bit
Poll Slave 6	0165	10166	00166	Bit
Reserved	0166	10167	00167	
Reserved	0167	10168	00168	
Reserved	0168	10169	00169	
Reserved	0169	10170	00170	
Reserved	0170	10171	00171	
Reserved	0171	10172	00172	
Reserved	0172	10173	00173	
Reserved	0173	10174	00174	
Reserved	0174	10175	00175	
Reserved	0175	10176	00176	

<b>HART Write Protect Selections</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
V Constants	0176	10176	00177	Bit
K Constants	0177	10178	00178	Bit
Product Temperature	0178	10179	00179	Bit
Standard Density	0179	10180	00180	Bit
Standard Temperature	0180	10181	00181	Bit
Water Bottom Level	0181	10182	00182	Bit
Level Alarms	0182	10183	00183	Bit
Density Alarms	0183	10184	00184	Bit
Mass Alarms	0184	10185	00185	Bit
P <sub>r</sub> (Ullage Pressure) Alarms	0185	10186	00186	Bit
Display Select	0186	10187	00187	Bit
Reserved	0187	10188	00188	
Reserved	0188	10189	00189	
Reserved	0189	10190	00190	
Reserved	0190	10191	00191	
Reserved	0191	10192	00192	

<b>Modbus Write Protect Selections</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
V Constants	0192	10193	00193	Bit
K Constants	0193	10194	00194	Bit
Product Temperature	0194	10195	00195	Bit
Standard Density	0195	10196	00196	Bit
Standard Temperature	0196	10197	00197	Bit
Water Bottom Level	0197	10198	00198	Bit
Level Alarms	0198	10199	00199	Bit
Density Alarms	0199	10200	00200	Bit
Mass Alarms	0200	10201	00201	Bit
P <sub>r</sub> (Ullage Pressure) Alarms	0201	10202	00202	Bit
Display Select	0202	10203	00203	Bit

## Rosemount Model 3201 Hydrostatic Interface Unit Modbus Protocol

<b>Modbus Write Protect Selections (Continued)</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Reserved	0203	10204	00204	
Reserved	0204	10205	00205	
Reserved	0205	10206	00206	
Reserved	0206	10207	00207	
Reserved	0207	10208	00208	

<b>Product Transfer Status Alarms</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Not Enough Ullage for Transfer Alarm	0208	10209	00209	Bit
Not Enough Product in Transfer Alarm	0209	10210	00210	Bit
High Flow Rate Alarm	0210	10211	00211	Bit
Low Flow Rate Alarm	0211	10212	00212	Bit
Transfer Complete Alarm	0212	10213	00213	Bit
Transfer Near Completion (Warning) Alarm	0213	10214	00214	Bit
Tank Fill Directional Alarm	0214	10215	00215	Bit
Tank Empty Directional Alarm	0215	10216	00216	Bit
Reserved	0216	10217	00217	
Reserved	0217	10218	00218	
Reserved	0218	10219	00219	
Reserved	0219	10220	00220	
Reserved	0220	10221	00221	
Reserved	0221	10222	00222	
Water Bottom Level in Manual	0222	10223	00223	Bit
Standard Density in Manual	0223	10224	00224	Bit

<b>Product Transfer Status Alarm Enables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Not Enough Ullage for Transfer Alarm Enables	0224	10225	00225	Bit
Not Enough Product in Transfer Alarm Enables	0225	10226	00226	Bit
High Flow Rate Alarm Enables	0226	10227	00227	Bit
Low Flow Rate Alarm Enables	0227	10228	00228	Bit
Transfer Complete Alarm Enables	0228	10229	00229	Bit
Transfer Near Completion (Warning) Alarm Enables	0229	10230	00230	Bit
Tank Fill Directional Alarm Enables	0230	10231	00231	Bit
Tank Empty Directional Alarm Enables	0231	10232	00232	Bit
Reserved	0232	10233	00233	
Reserved	0233	10234	00234	
Reserved	0234	10235	00235	
Reserved	0235	10236	00236	
Reserved	0236	10237	00237	
Reserved	0237	10238	00238	
Reserved	0238	10239	00239	
Reserved	0239	10240	00240	

<b>NMI Approved Display Enables</b>				
	<b>Data Address</b>	<b>Read Only</b>	<b>Read/Write</b>	<b>Data Type</b>
Display NMI Approved True Mass	0240	10241	00241	Bit
Display NMI Approved Effective Mass	0241	10242	00242	Bit
Display NMI Approved Standard Volume	0242	10243	00243	Bit
Display NMI Approved Gross Volume	0243	10244	00244	Bit
Display NMI Approved Standard Density	0244	10245	00245	Bit
Display NMI Approved Measured Density	0245	10246	00246	Bit
Display NMI Approved Vapor Density	0246	10247	00247	Bit
Reserved	0247	10248	00248	
Reserved	0248	10249	00249	
Reserved	0249	10250	00250	
Reserved	0250	10251	00251	
Reserved	0251	10252	00252	
Reserved	0252	10253	00253	
Reserved	0253	10254	00254	
Reserved	0254	10255	00255	
Reserved	0255	10256	00256	



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