Manual Supplement
00809-0300-4811, Rev BA
October 2008

Rosemount 3300 Series with HART to Modbus Converter

This instruction is a supplement to the Rosemount 3300 Series Reference Manual (Document No. 00809-0100-4811).

⚠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 gauge 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 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.

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 3300 transmitter is off and the lines to any other external power source are disconnected or not powered while wiring the gauge.

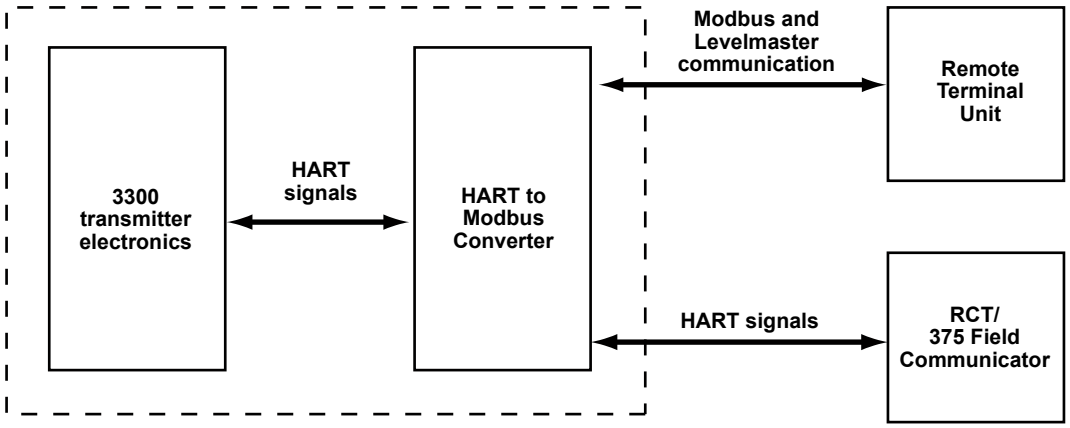
Probes covered with plastic and/or with plastic discs may generate an ignition-capable level of electrostatic charge under certain extreme conditions. Therefore, when the probe is used in a potentially explosive atmosphere, appropriate measures must be taken to prevent electrostatic discharge.

INTRODUCTION

The Rosemount 3300 Series transmitter is a Modbus compatible measurement device that supports communication with a Remote Terminal Unit (RTU) using a subset of read, write, and diagnostic commands used by most Modbus compatible host controllers. It also supports communication through Levelmaster ASCII protocol.

The HART to Modbus Converter (HMC) module is located inside the Rosemount 3300 transmitter enclosure and provides power to and communicates with the 3300 transmitter through a HART interface.

Figure 1-1. System Overview



During normal operation, the HMC “mirrors” the contents of process variables from the 3300 transmitter to the Modbus registers. To configure the 3300 transmitter, it is possible to connect a configuration tool to the HMC. See *“Transmitter Configuration” on page 1-7* for more information.

WORKFLOW

Overview of workflow for commissioning a Rosemount 3300 transmitter with Modbus protocol:

1. Mount the transmitter on the tank.
2. Connect the power and communication wires.
3. Configure the 3300 transmitter through Rosemount Radar Configuration Tools (RCT) or a 375 Field Communicator:
   - Tank geometry, product data
   - Communication settings
4. Configure host.
5. Verify output values as reported by the 3300 transmitter.

MECHANICAL INSTALLATION

For instructions on how to mount the Rosemount 3300 transmitter, refer to Rosemount 3300 Series Reference Manual (Document No. 00809-0100-4811).

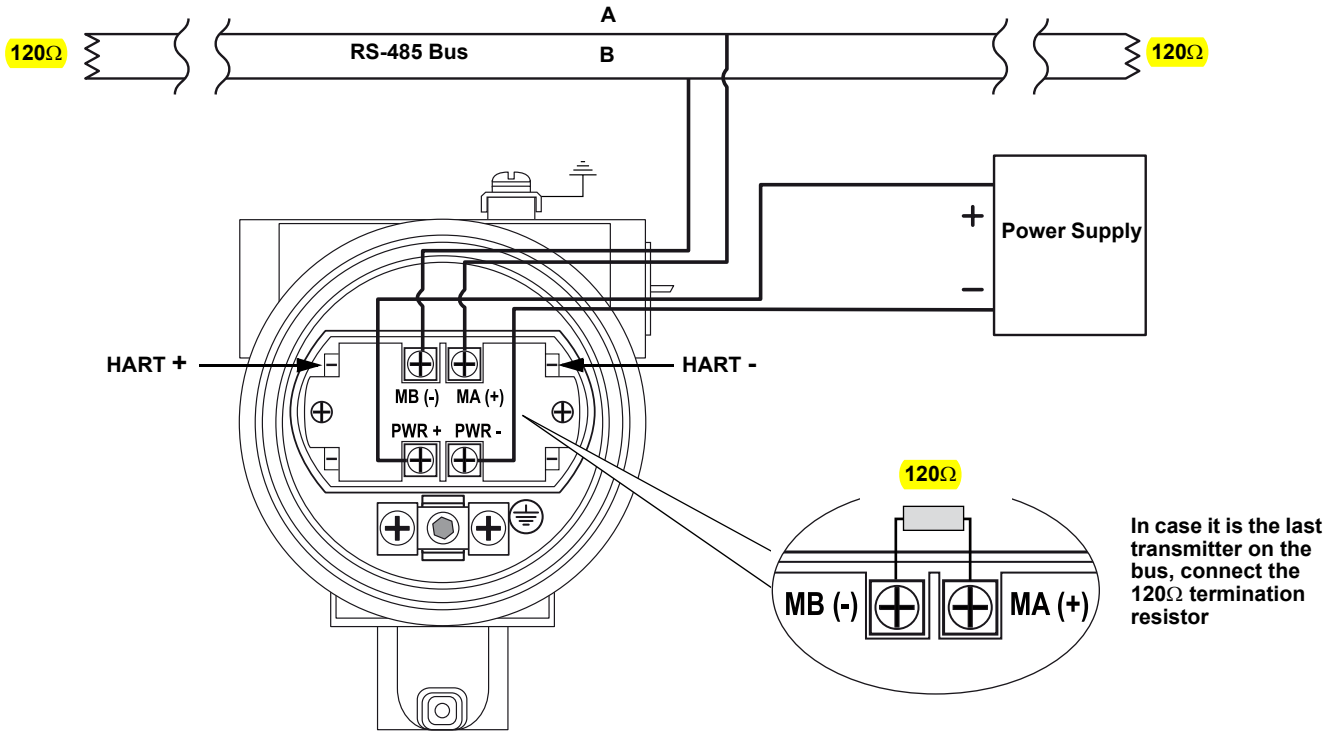
ELECTRICAL INSTALLATION

NOTE
For general electrical installation requirements, including grounding requirements, refer to Rosemount 3300 Series Reference Manual (Document No. 00809-0100-4811).

To connect the Rosemount 3300:

1. Make sure the power supply is disconnected.
2. Remove the cover on the transmitter housing terminal side (see label). Do not remove the cover in an explosive atmosphere with a live circuit.
3. Pull the cable through the cable gland/conduit. For the RS-485 bus, use shielded twisted pair wiring, preferably with an impedance of 120Ω (typically 24 AWG) in order to comply with the EIA-485 standard and EMC regulations. The maximum cable length is 4000 ft/1200 m.
4. Make sure that the transmitter housing is grounded, then connect wires according to Figure 1-2 and Table 1-1. Connect the lead that originates from the “A” line from the RS-485 bus to the terminal marked MA (+), and the lead that originates from the “B” line to the terminal marked MB (-).
5. If it is the last transmitter on the bus, connect the 120Ω termination resistor.
6. Connect the leads from the positive side of the power supply to the terminal marked PWR +, and the leads from the negative side of the power supply to the terminal marked PWR -. The power supply cables must be suitable for the supply voltage and approved for use in hazardous areas, where applicable.
7. Attach and tighten the housing cover. Tighten the cable gland, then plug and seal any unused terminals, and connect the power supply.

Figure 1-2. Field Wiring Connections



Connection Terminals

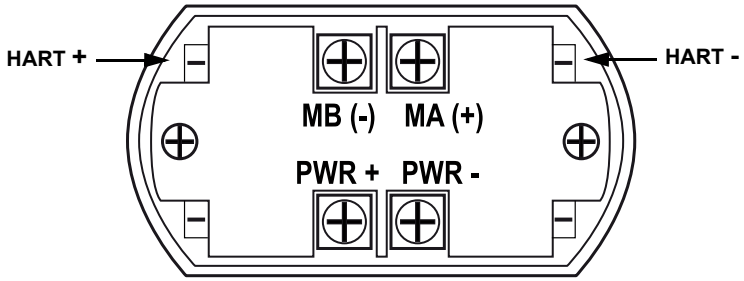
The connection terminals are described in Table 1-1 below:

Table 1-1. Connection Terminals

Connector label	Description	Comment
HART +	Positive HART connector	Connect to PC with RCT software, 375 Field Communicator, or other HART configurators.
HART -	Negative HART connector	
MA (+)	Modbus RS-485 **A** connection (RX/TX+)(1)	Connect to RTU
MB (-)	Modbus RS-485 **B** connection (RX/TX-)(1)	
PWR +	Positive Power input terminal	Apply +8 VDC to +30 VDC
PWR -	Negative Power input terminal	

(1) The designation of the connectors do not follow the EIA-485 convention, which states that RX/TX- should be referred to as 'A' and RX/TX+ as 'B'.

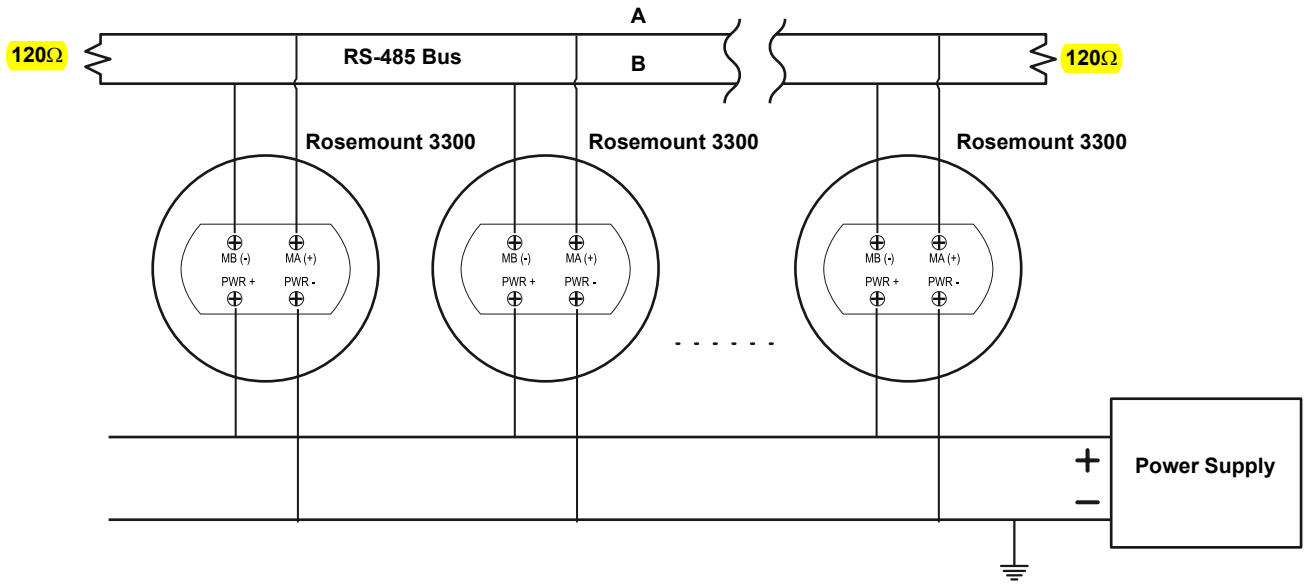
Figure 1-3. Connection Terminals for Rosemount 3300 with HART to Modbus Converter



RS-485 Bus

- The 3300 transmitter does not provide electrical isolation between the RS-485 bus and the transmitter power supply
- Maintain a bus topology and minimize stub length
- Figure 1-4 identifies multidrop wiring topology where up to 32 devices may be wired on one RS-485 bus
- The RS-485 bus needs to be terminated once at both ends, but should not be terminated elsewhere on the bus

Figure 1-4. Multidrop Connection of 3300 Transmitters



TRANSMITTER CONFIGURATION

The Rosemount 3300 can be configured using the Rosemount Configuration Tools (RCT) PC software or a 375 Field Communication Unit. Configuration is done by sending HART commands through the HART to Modbus Converter (HMC) to the 3300 transmitter electronics.

To configure the 3300 transmitter, connect the communicator or PC to the HART terminals, see Figure 1-3 on page 1-5. Both the configuration tool and the RS-485 bus can be connected simultaneously. Configuration data is sent with HART commands through the HMC to the 3300 transmitter electronics, as illustrated in Figure 1-1 on page 1-3. Note that the power supply must be connected during configuration, see also “Electrical Installation” on page 1-4.

NOTE
Measurement data is not updated to the Modbus Master when a configuration tool is connected.

NOTE
The Rosemount 3300 can also be configured in RCT by using the MA (+), MB(-). For more information, see “RCT Communication with MA(+), MB(-)” on page 1-36.

Configuration data such as Tank Height, Upper Null Zone, dielectric constants, and other basic parameters are configured in the same way as for a standard Rosemount 3300 transmitter. For more information, see the Guided Wave Radar Level and Interface Transmitter Quick Installation Guide (Document No. 00825-0100-4811).

Make sure that the measurement unit of the Primary Variable (PV) matches the configuration of the Modbus Host since the transmitter output value does not include any information on associated measurement units.

For further information on basic configuration, see the Rosemount 3300 Series Reference Manual (Document No. 00809-0100-4811).

NOTE
The 3300 transmitter with Modbus protocol is configured to HART short address 1 at factory. This reduces power comsumption by locking the analog output at 4 mA.

PROTOCOL DESCRIPTION

The Rosemount 3300 level transmitter can communicate with RTUs using Modbus RTU (often referred to as just “Modbus”), Modbus ASCII, and Levelmaster (also known as “Siemens” or “Tank” protocol).

Table 1-2. List of RTUs’ Supported Protocols

RTU	Protocols
ABB Totalflow	Modbus RTU, Levelmaster
Bristol ControlWave Micro	Modbus RTU
Fisher ROC	Modbus RTU
Kimray DACC 2000/3000	Levelmaster
ScadaPack	Modbus RTU
Thermo Electron Autopilot	Modbus RTU, Levelmaster

Modbus ASCII is not commonly used, since it doubles the amount of bytes for the same message as the Modbus RTU.

If you do not have any of these RTUs, check your RTU manual to see which protocols it supports.

Proceed to the chapter where setup of the protocol is described.

Modbus RTU Communication Setup

The Rosemount 3300 is configured with the default Modbus RTU address 246. The 3300 is configured with the following Modbus RTU communication parameter default setting:

Table 1-3. Modbus RTU Communication Parameters

Parameter	Default Value	Configurable Values
Baud Rate	9600	1200, 2400, 4800, 9600, 19200
Start Bits(1)	One	One
Data Bits(1)	Eight	Eight
Parity	None	None, Odd, Even
Stop Bits	One	One or Two
Address range	246	1-255

(1) Start Bits and Data Bits cannot be changed.

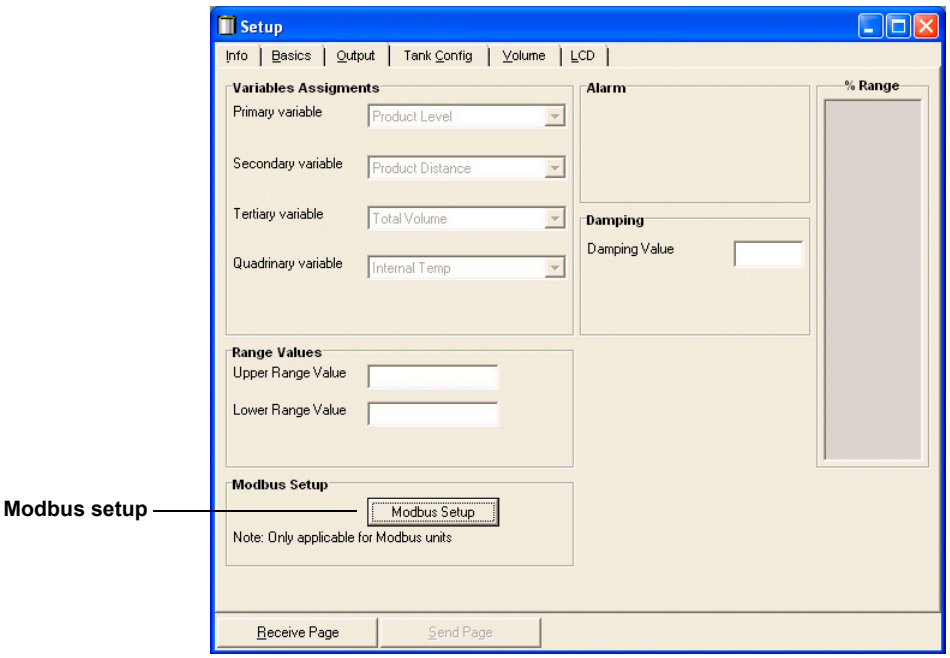
NOTE
It takes 30 seconds for a change of Modbus RTU communication parameters to take effect.

Using the RCT Setup to change Modbus RTU communication parameters

NOTE
To change Modbus RTU communication parameters, the Rosemount 3300 must use HART address 1, the default address.

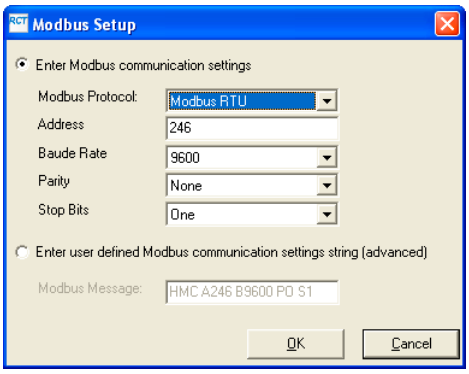
To change the Modbus RTU address and communication parameters[1] in the Rosemount Configuration Tool (RCT):

1. Start the RCT.
2. In the RCT workspace Project Bar, click the **Setup** icon to open the *Setup* window:



Modbus setup

3. Select the **Output** tab.
4. Click the **Modbus Setup** button.



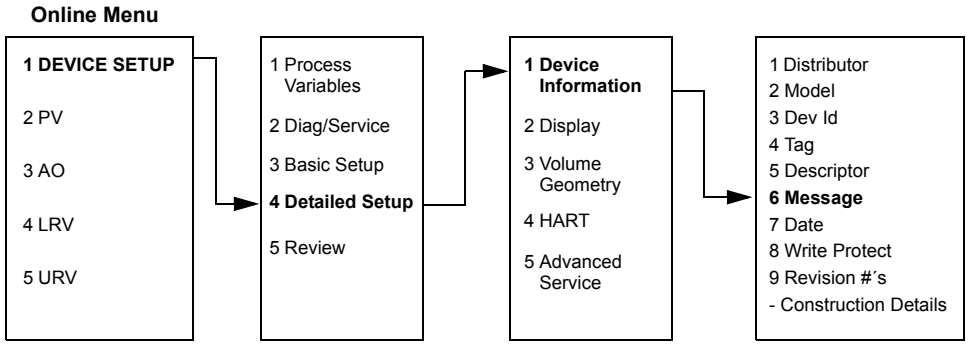
5. In the *Modbus Setup* window, type the desired Modbus RTU address.
6. Enter the baude rate, parity, and stop bits, then click the **OK** button.

(1) The Modbus Setup function is available in RCT version 2.03.0002 and later.

Using a Rosemount 375 Field Communicator to change Modbus RTU communication parameters

When using the **375 Field Communicator,** the Message Area is available with HART command [1,4,1,6]:

Figure 1-5. Message Area is Available via HART Command



For example: You want to use address 44 for the 3300 transmitter, and the following communication parameters are used by the host:

Table 1-4. Communication Parameters Used by the Host (example)

Parameter	Value
Baud Rate	4800
Start Bits	One
Data Bits	Eight
Parity	Odd
Stop Bits	Two

To configure the 3300 transmitter to communicate with the Host in this example, the following text string is written to the HART Slave 1 Message Area:

HMC A44 B4800 PO S2.

Note: Only values that differ from the current values need to be included in the text string.

HMC: These three letters are used for safety and will eliminate the risk of changing the configuration data by mistake.

A44: **A** indicates that the following number is the new address (address 44). Leading zeroes are not needed.

B4800: **B** indicates that the following number is the new baud rate (1200, 2400, 4800, 9600, 19200).

PO: **P** identifies the following letter as parity type (O = odd, E = even, and N = none).

S2: **S** indicates that the following figure is the number of stop bits (1 = one, 2 = two).

Only values that differ from the current values need to be included. For example, if only the address is changed, the following text string is written into the 3300 (HART Slave 1) Message Area:

HMC A127,

indicates that 127 is the new address.

Modbus ASCII Communication Setup

Modbus ASCII communication setup can be carried out using the Rosemount Configuration Tool (RCT). The parameter, default, and configurable values are shown in Table 1-5 below.

NOTE
It takes 30 seconds for a change of Modbus communication parameters to take effect.

NOTE
To change Modbus ASCII communication parameters, the Rosemount 3300 must use HART address 1, the default address.

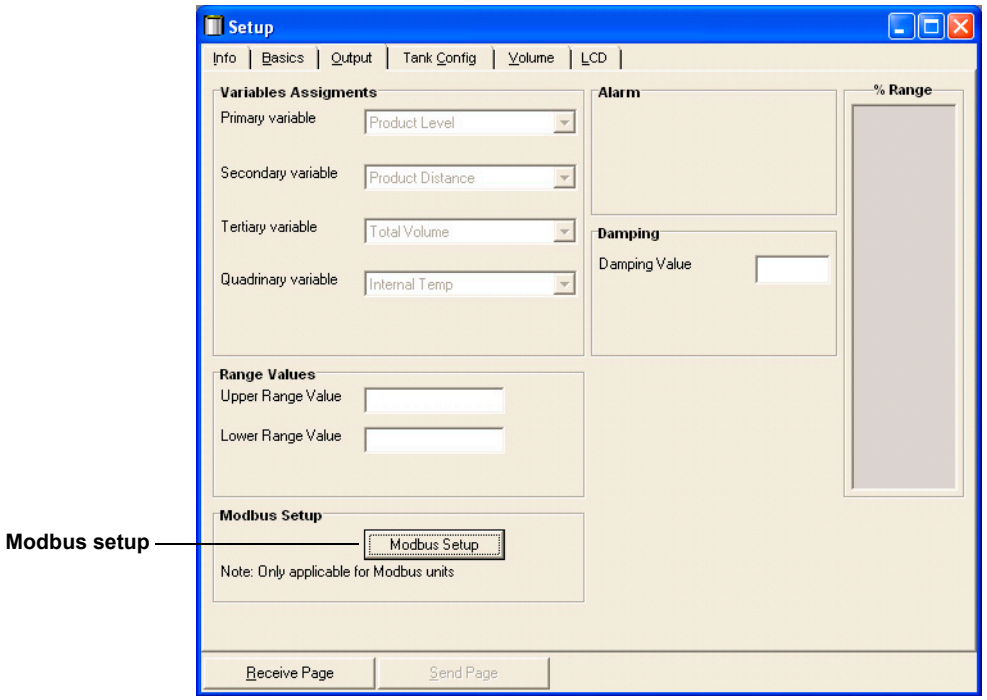
Table 1-5. Modbus ASCII Communication Parameters

Parameter	Default value	Configurable values
Baud Rate	9600	1200, 2400, 4800, 9600, 19200
Start Bits	One	One
Data Bits	Seven	Seven, Eight
Parity	None	None, Odd, even
Stop Bits	One	One or Two
Address	1	1-255

Using the RCT Setup to change Modbus communication parameters

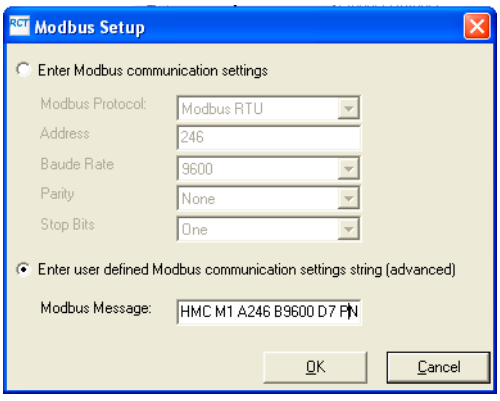
To change the Modbus address and communication parameters in the Rosemount Configuration Tool (RCT):

1. Start the RCT.
2. In the RCT workspace Project Bar, click the **Setup** icon to open the Setup window:



Modbus setup

3. Select the **Output** tab.
4. Click the **Modbus Setup** button.



“Modbus ASCII Parameter Configuration Example” on page 1-13 shows how to enter messages in this area.

Modbus ASCII Parameter Configuration Example

Example: You want to use address 246 for the 3300 transmitter and the host uses the following parameters:

Table 1-6. Parameters Used by the Host (in case of Modbus ASCII, example)

Parameter	Value
Baud Rate	9600
Start Bits	One
Data Bits	Seven
Parity	None
Stop Bits	One

To configure the 3300 transmitter to communicate with the Host in this example, the following text string is written to the Modbus Message area.

HMC M1 A246 B9600 D7 PN S1.

NOTE
Include all the parameters when writing to the message area.

Note that an address must be unique on the bus.

HMC: These three letters are used for safety and will eliminate the risk of changing the configuration data by mistake.

M1: This means that the Modbus ASCII protocol is to be used.

A246: **A** indicates that the following number is the new address (address 246). Leading zeroes are not needed.

B9600: **B** indicates that the following number is the new baud rate (1200, 2400, 4800, 9600, 19200).

D7: **D** indicates that the following data bits are to be used (7 = seven, 8 = eight).

PN: **P** identifies the following letter as parity type (O = odd, E = even, and N = none).

S1: **S** indicates that the following figure is the number of stop bits (1 = one, 2 = two).

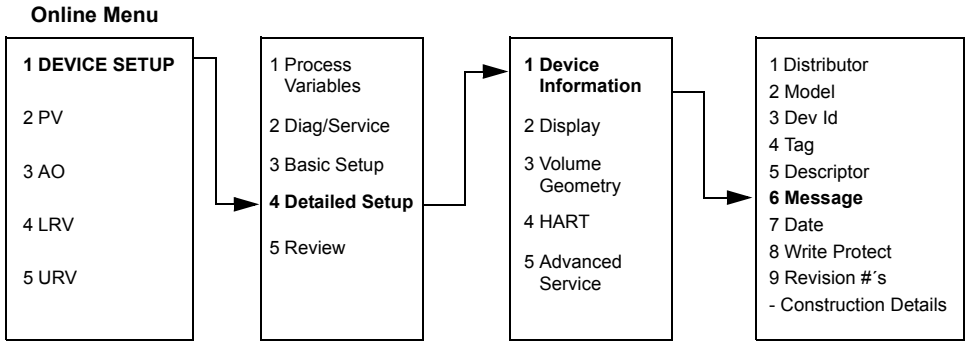
Note: Start Bits are not configurable and cannot be set.

Using a Rosemount 375 Field Communicator to change Modbus ASCII communication parameters

When using the **375 Field Communicator,** the Message Area is available with HART command [1,4,1,6].

In the message area Modbus ASCII parameters can be configured as described in “Modbus ASCII Parameter Configuration Example” on page 1-13.

Figure 1-6. HART Command [1,4,1,6]



Levelmaster Communication Setup

Use the Rosemount Configuration Tool (RCT) to setup Levelmaster communication. The default and configurable parameter values can be found in Table 1-7.

NOTE
It takes 30 seconds for a change of Levelmaster communication parameters to take effect.

NOTE
To change Levelmaster communication parameters, the Rosemount 3300 must use HART address 1, the default address.

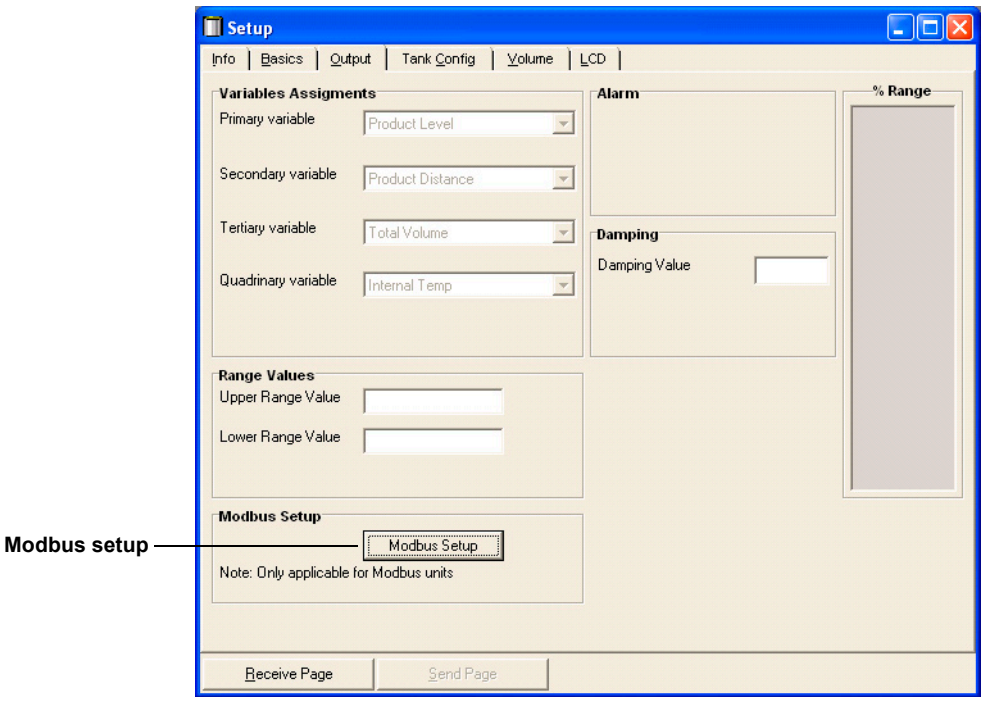
Table 1-7. Levelmaster Communication Parameters

Parameter	Default value	Configurable value
Baud Rate	9600	1200, 2400, 4800, 9600, 19200
Start Bits	One	One
Data Bits	Seven	Seven, Eight
Parity	None	None, Odd, Even
Stop Bits	One	One or Two
Address	1	1-99

Using the RCT Setup to change Levelmaster communication parameters

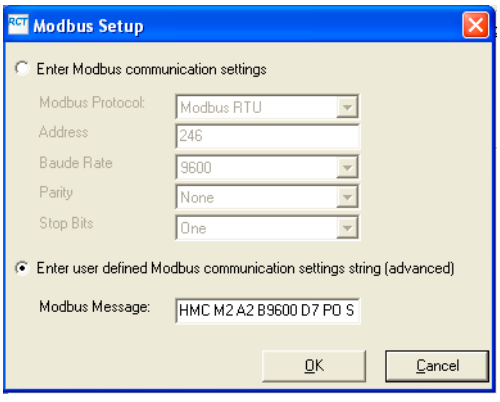
To change the Levelmaster address and communication parameters in the Rosemount Configuration Tool (RCT):

1. Start the RCT.
2. In the RCT workspace Project Bar, click the **Setup** icon to open the Setup window:



Modbus setup

3. Select the **Output** tab.
4. Click the **Modbus Setup** button.



“Levelmaster Parameter Configuration Example” on page 1-17 shows how to enter messages in this area.

Levelmaster Parameter Configuration Example

Example: You want to use address 2 for the 3300 transmitter and the host uses the following parameters:

Table 1-8. Parameters Used by the Host (in case of Levelmaster, example)

Parameter	Value
Baud Rate	9600
Start Bits	One
Data Bits	Seven
Parity	None
Stop Bits	One

To configure the 3300 transmitter to communicate with the Host in this example, the following text string is written to the Modbus Message area.

HMC M2 A2 B9600 D7 PN S1.

NOTE
Include all the parameters when writing to the message area.

Note that an address must be unique on the bus.

HMC: These three letters are used for safety and will eliminate the risk of changing the configuration data by mistake.

M2: This means that the Levelmaster protocol is to be used.

A2: **A** indicates that the following is the new address (address 2). Leading zeroes are not needed.

B9600: **B** indicates that the following number is the new baud rate (1200, 2400, 4800, 9600, 19200).

D7: **D** indicates that the following data bits are to be used (7 = seven, 8 = eight).

PN: **P** identifies the following letter as parity type (O = odd, E = even, and N = none).

S1: **S** indicates that the following figure is the number of stop bits (1 = one, 2 = two).

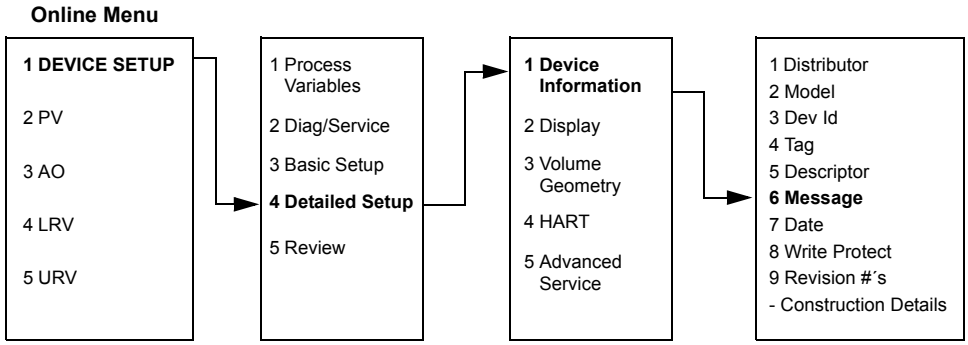
Note: Start Bits are not configurable and cannot be set.

Using a Rosemount 375 Field Communicator to change Levelmaster communication parameters

When using the **375 Field Communicator,** the Message Area is available with HART command [1,4,1,6].

In the message area Levelmaster parameters can be configured as described in “Levelmaster Parameter Configuration Example” on page 1-17.

Figure 1-7. HART Command [1,4,1,6]



NOTE
See “Detailed Levelmaster information” section for more detailed protocol specifications.

Host specific information

Kimray DACC 2000/3000

This table shows input types in Kimray IMI software and the corresponding value. The communication port must be configured to use “Tank Levels” protocol.

Table 1-9. Kimray Input Types and Corresponding Values

Kimray Inp type	3300 variable	Format
Tank Level1	PV	ddd.dd.alt. -dd.dd
Tank Level2	SV	ddd.dd.alt -dd.dd

COMMON MODBUS HOST CONFIGURATION

When using Modbus RTU or Modbus ASCII, the registers to receive status and variables must be configured in the host system.

The transmission of single-precision (4 bytes) IEEE 754 floating point numbers can be rearranged in different byte orders specified by the Floating Point Format Code. The format code information, stated for each Remote Terminal Unit (RTU) respectively, specifies which registers to poll from the 3300 transmitter in order for the RTU to correctly interpret floating point numbers. The byte transmission order for each format code is demonstrated in Table 1-10 below.

Table 1-10. Byte Transmission Order is Specified by the Floating Point Format Code

Format Code	Byte transmission order
0	**ABCD**
1	**CDAB**
2	**DCBA**
3	**BADC**

NOTE
Some Modbus hosts cannot read the information described here using input Registers (Modbus function code 4). The Input Register information can also be read using Holding Register (Function code 3). In this case, Input Register number + 5000 is used as Holding Register number.

Input Registers

The register area starting with 1300 can be configured to have any of the four format codes. The configuration is done by setting FloatingPointFormatCode register (holding register 3000) to 0-3, as shown in Table 1-10. This configuration can be done with the Rosemount Radar Master program.

NOTE
Depending on the slave number the 3300 transmitter is using, different registers must be used with the default slave number being 1.

Table 1-11. Output Variables for the Configurable Floating Point Format Code

Register Name	Register Number	Note
Slave 1 Status Conf	1300	Bit information in bitfield. Bit 0: Invalid Measurement Slave 1 PV. Bit 1: Invalid Measurement Slave 1 Non PV. Bit 2: Invalid Measurement Slave 1 Non PV. Bit 3: Invalid Measurement Slave 1 Non PV. Bit 14: HART bus busy (slave in burst or other master present) Bit 15: HTM Task not running (option not available). Note: Bit 1-3 is set when Invalid Measurement of Slave 1 Non PV. i.e. all three bits are set simultaneously.
Slave 1 PV Conf	1302	Primary variable from slave 1 represented in IEEE 754 format, using the byte order set in the FloatingPointFormatCode register.
Slave 1 SV Conf	1304	Secondary variable from slave 1 represented in IEEE 754 format, using the byte order set in the FloatingPointFormatCode register.
Slave 1 TV Conf	1306	Tertiary variable from slave 1 represented in IEEE 754 format, using the byte order set in the FloatingPointFormatCode register.
Slave 1 FV Conf	1308	Fourth variable from slave 1 represented in IEEE 754 format, using the byte order set in the FloatingPointFormatCode register.
Slave 2 data	1310-1318	Same data as for Slave 1.
Slave 3 data	1320-1328	Same data as for Slave 1.
Slave 4 data	1330-1338	Same data as for Slave 1.
Slave 5 data	1340-1348	Same data as for Slave 1.

The Rosemount 3300 register area starting with register 2000 is used for hosts that require Floating Point Format Code 0 (see Table 1-12).

When Floating Point Format Code 1 is required, the register area starting with register 1400 is used (see Table 1-13).

Floating Point Format Codes 2 and 3 use register areas 2100 and 2200, respectively (see Table 1-14 and Table 1-15).

Table 1-12. Output Variables for Floating Point Format Code 0

Register Name	Register Number	Note
Slave 1 Status	2000	Bit information in bitfield: Bit 0: Invalid Measurement Slave 1 PV. Bit 1: Invalid Measurement Slave 1 SV. Bit 2: Invalid Measurement Slave 1 TV. Bit 3: Invalid Measurement Slave 1 FV. Bit 14: HART bus busy (slave in burst or other master present) Bit 15: HTM Task not running (option not available). Note: Bit 1-3 is set when Invalid Measurement of Slave 1 Non PV, i.e. all three bits are set simultaneously.
Slave 1 PV	2002	Primary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 0.
Slave 1 SV	2004	Secondary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 0.
Slave 1 TV	2006	Tertiary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 0.
Slave 1 FV (QV)	2008	Fourth variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 0.

Table 1-13. Output Variables for Floating Point Format Code 1

Register Name	Register Number	Note
Slave Status	1400	Bit information in bitfield: Bit 0: Invalid Measurement Slave 1. Bit 1: Invalid Measurement Slave 2. Bit 2: Invalid Measurement Slave 3. Bit 3: Invalid Measurement Slave 4. Bit 4: Invalid Measurement Slave 5. Bit 8: Slave with short address 0 is used, but not alone on bus. Only one HART slave can be connected on the bus if the slave is in Analog Current mode (this is the case if short address = 0 by HART definition). Bit 9: Slave with short address > 5 detected on bus. Maximum of five HART Slaves can be connected on the HART Bus. Their short address MUST be between 1 and 5. Bit 14: HART bus busy (slave in burst or other master present) Bit 15: HTM Task not running (option not available).
Slave 1 PV	1402	Primary variable from slave 1.

Register Name	Register Number	Note
Slave 1 SV	1414	Secondary variable from slave 1.
Slave 1 TV	1426	Tertiary variable from slave 1.
Slave 1 FV (QV)	1438	Fourth variable from slave 1.

Table 1-14. Output Variables for Floating Point Format Code 2

Register Name	Register Number	Note
Slave 1 Status	2100	Bit information in bitfield: Bit 0: Invalid Measurement Slave 1 PV. Bit 1: Invalid Measurement Slave 1 SV. Bit 2: Invalid Measurement Slave 1 TV. Bit 3: Invalid Measurement Slave 1 FV. Bit 14: HART bus busy (slave in burst or other master present) Bit 15: HTM Task not running (option not available). Note: Bit 1-3 is set when Invalid Measurement of Slave 1 Non PV, i.e. all three bits are set simultaneously.
Slave 1 PV	2102	Primary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 2.
Slave 1 SV	2104	Secondary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 2.
Slave 1 TV	2106	Tertiary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 2.
Slave 1 FV (QV)	2108	Fourth variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 2.

Table 1-15. Output Variables for Floating Point Format Code 3

Register Name	Register Number	Note
Slave 1 Status	2200	Bit information in bitfield: Bit 0: Invalid Measurement Slave 1 PV. Bit 1: Invalid Measurement Slave 1 SV. Bit 2: Invalid Measurement Slave 1 TV. Bit 3: Invalid Measurement Slave 1 FV. Bit 14: HART bus busy (slave in burst or other master present) Bit 15: HTM Task not running (option not available). Note: Bit 1-3 is set when Invalid Measurement of Slave 1 Non PV, i.e. all three bits are set simultaneously.
Slave 1 PV	2202	Primary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 3.
Slave 1 SV	2204	Secondary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 3.
Slave 1 TV	2206	Tertiary variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 3.
Slave 1 FV (QV)	2208	Fourth variable from slave 1 represented in IEEE 754 format, using Floating Point Format Code 3.

Measurement Units

Measurement units for the various HART slaves are stored in input registers as a Unit Code presented in Table 1-16. Conversion from Unit Code to measurement unit is given in Table 1-17 on page 1-24.

Table 1-16. Measurement units and corresponding input registers

Register Name	Register Number	Note
Slave 1 PV Units	104	See Table 1-17 for conversion from Unit Code to Measurement Unit.
Slave 1 SV Units	108	
Slave 1 TV Units	112	
Slave 1 FV (QV) Units	116	

Table 1-17. Conversion of Unit Code to Measurement Unit

Unit Code	Measurement Unit	Unit Code	Measurement Unit
Volume		**Length**	
40	US Gallon	44	Feet
41	Liters	45	Meters
42	Imperial Gallons	47	Inches
43	Cubic Meters	48	Centimeters
46	Barrels	49	Millimeters
111	Cubic Yards	**Temperature**	
112	Cubic Feet	33	Degree Fahrenheit
113	Cubic Inches	32	Degree Celcius

SPECIFIC MODBUS HOST CONFIGURATION

The Remote Terminal Unit needs to be configured to communicate and correctly interpret data when reading input registers from the Rosemount 3300 transmitter.

Baud Rate

The specified Baud Rates below are recommendations. If other Baud Rates are used, make sure that the 3300 and the RTU are configured for the same communication speed.

Floating Point Format Code

See Section “Common Modbus Host Configuration” on page 1-19.

RTU Data Type

The RTU Data Type specifies which configuration to use in the RTU in order for the RTU to correctly interpret a floating point number transmitted from the 3300 transmitter with Modbus.

Input Register Base Number

Data registers in the 3300 transmitter with Modbus are numbered exactly as they are transmitted in the Modbus communication. Some RTUs use different naming conventions and to configure the RTU to poll the correct registers from the 3300 Modbus, an Input Register Base Number is stated for each RTU respectively. E.g. if the input register base number is 1 for the RTU, the 3300 Modbus input register 1402 has to be entered in the RTU address as input register 1403.

Fisher ROC 809

Figure 1-8. Wiring Diagram for Connecting 3300 Modbus to Fischer ROC 809

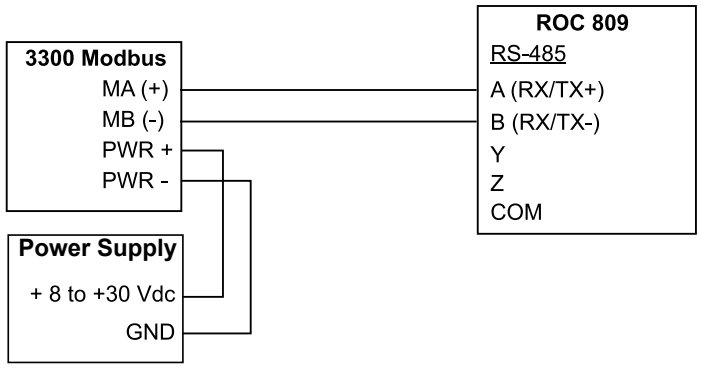


Table 1-18. Parameter Values (in case of Fisher ROC 809)

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	Conversion Code 66
Input Register Base Number	0

The Input Register Base Number needs to be added to the Input Register address of the 3300 transmitter. In this case, register 1300 needs to have 1300 entered as the address.

ABB TotalFlow

Figure 1-9. Wiring diagram for connecting 3300 Modbus to ABB TotalFlow

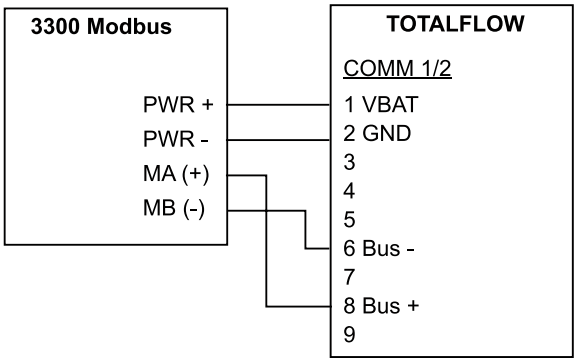


Table 1-19. Parameter Values (in case of ABB TotalFlow)

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	16 Bit Modicon
Input Register Base Number	1

The Input Register Base Number needs to be added to the Input Register address of the 3300 transmitter. In this case, register 1302 needs to have 1303 entered as the address etc.

Thermo Electron Autopilot

Figure 1-10. Wiring Diagram for Connecting 3300 Modbus to Thermo Electron Autopilot

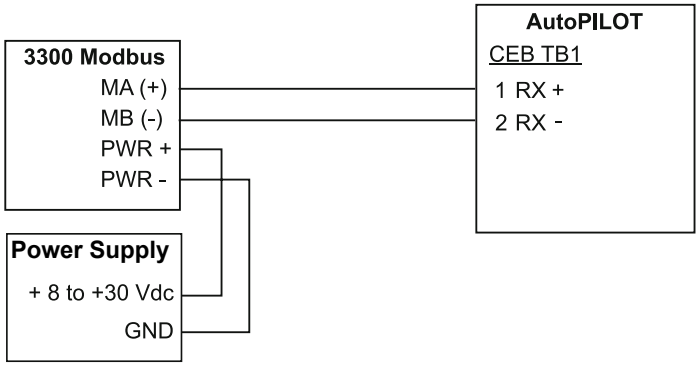


Table 1-20. Parameter Values (in case of Thermo Electron Autopilot)

Parameter	Value
Baud Rate	9600
Floating Point Format Code	1
RTU Data Type	IEEE Flt 2R
Input Register Base Number	0

The Input Register Base Number needs to be added to the Input Register address of the 3300 transmitter. In this case, register 1302 needs to have 1302 entered as the address etc.

Bristol ControlWave Micro

Figure 1-11. Wiring Diagram for Connecting 3300 Modbus to Bristol ControlWave Micro

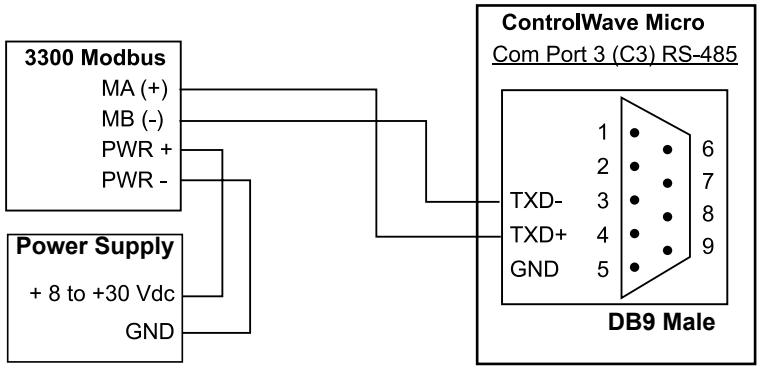


Table 1-21. Parameter Values (in case of Bristol ControlWave Micro)

Parameter	Value
Baud Rate	9600
Floating Point Format Code	2 (FC 4)
RTU Data Type	32-bit registers as 2 16-bit registers
Input Register Base Number	1

The Input Register Base Number needs to be added to the Input Register address of the 3300 transmitter. In this case, register 1302 needs to have 1303 entered as the address etc.

ScadaPack

Figure 1-12. Wiring Diagram for Connecting 3300 Modbus to SCADAPack 32

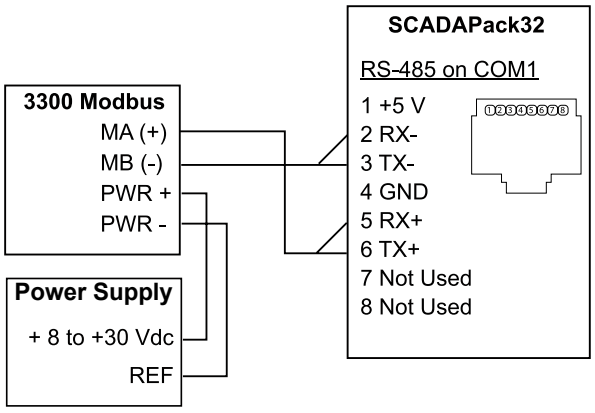


Table 1-22. Parameter Values (in case of SCADAPack 32)

Parameter	Value
Baud Rate	9600
Floating Point Format Code	0
RTU Data Type	Floating Point
Input Register Base Number	30001

The Input Register Base Number needs to be added to the Input Register address of the 3300 transmitter. In this case, register 1302 needs to have 31303 entered as the address etc.

TROUBLESHOOTING

No communication on RS-485 bus (MA, MB)

- Check that the cables are connected
- Check that PWR+ is connected to + and PWR- is connected to - on the power supply
- Make sure the 3300 transmitter is supplied with 8-30 VDC
- Try alternating MA/MB if you are unsure of the polarity
- If an RS-232/RS-485 converter is used, make sure it is properly installed and configured
- The last 3300 transmitter may need a terminating 120Ω resistor connected between MA and MB

No 3300 communication in RCT

- Using HART+, HART-
  - HART modem is not properly connected
  - Polling address is incorrect in RCT (default 1)
- Using MA (+), MB (-)
  - See *No communication on RS-485 bus*
  - Polling address is incorrect in RCT (default 1)
  - Cycle the power and wait 20 seconds before polling

No communication with Modbus RTU protocol

- See *No communication on RS-485 bus*
- Make sure the ”Modbus RTU Communication Setup” is done properly
- Make sure the Modbus RTU address is unique on the bus
- Cycle the power and try to connect
- Check the RTU communication settings

No communication with Modbus ASCII protocol

- See *No communication on RS-485 bus*
- Make sure the ”Modbus ASCII Communication Setup” is done properly
- Make sure the Modbus ASCII address is unique on the bus
- Cycle the power, waiting 40 seconds before communication begins
- Check the RTU communication settings

No communication with Levelmaster protocol

- See *No communication on RS-485 bus*
- Make sure the ”Levelmaster Communication Setup” is done properly
- Make sure the Levelmaster address is unique on the bus
- Cycle the power, waiting 40 seconds before communication begins
- Check the RTU communication settings

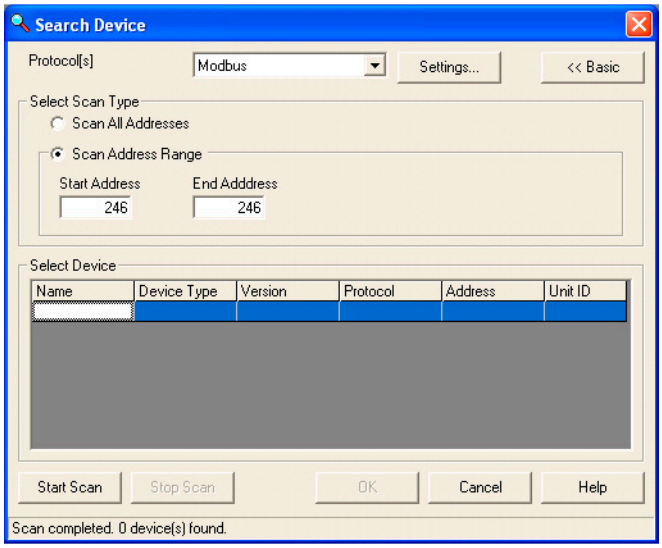
HMC FIRMWARE UPGRADE IN ROSEMOUNT RADAR MASTER

The HMC's firmware is upgraded with Rosemount Radar Master (RRM). A detailed description on how to carry out the firmware upgrade is shown on the following pages.

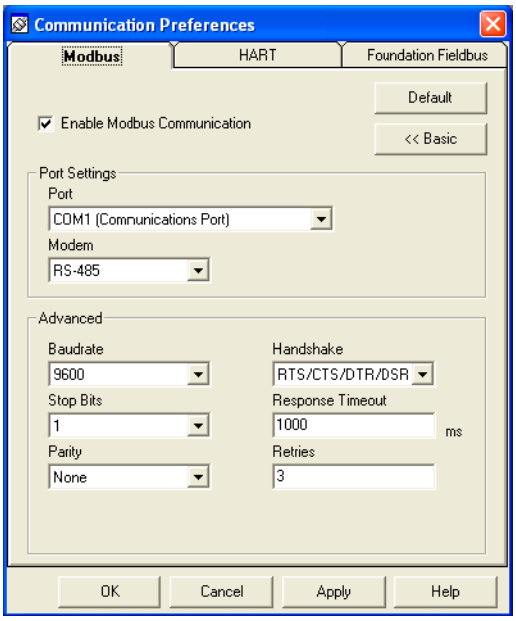
NOTE
During firmware upgrade, the HMC Modbus RTU address must be 246, the default address. Make sure to disconnect other Modbus RTU devices that are connected and have address 246.

NOTE
Do not interrupt communication between the PC and the 3300 level transmitter during the firmware upload.

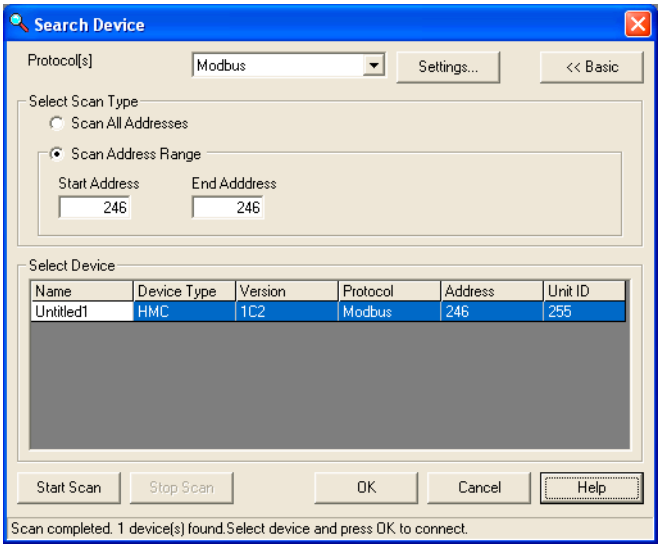
1. Connect the HMC to a PC as described in "Electrical Installation", Connection Terminals, and RS-485 bus on page 1-4.
2. Start RRM and open the *Search Device* window.



3. Click the **Settings** button in the *Search Device* window.

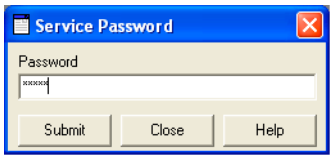


4. Ensure that the above communication settings are used.
5. Open the *Search Device* window.

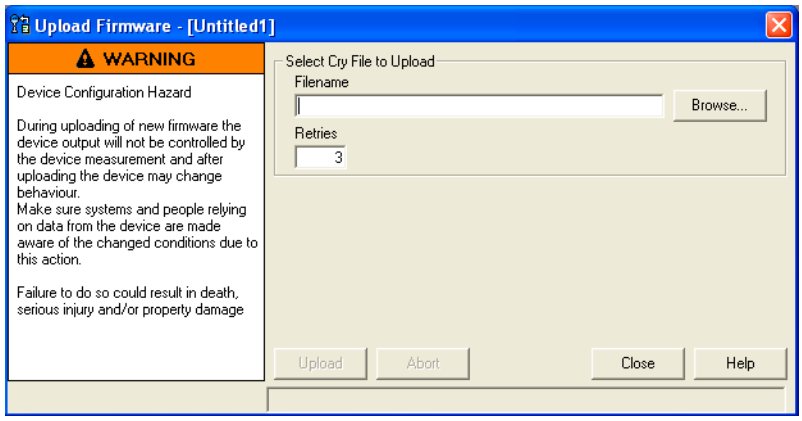


6. Search for HMCs by selecting “Scan Address Range”, and choose a start and end address for Modbus. The default HMC Modbus address is 246.
7. Click the **Start Scan** button.
8. Click **OK** to connect when the device is found.

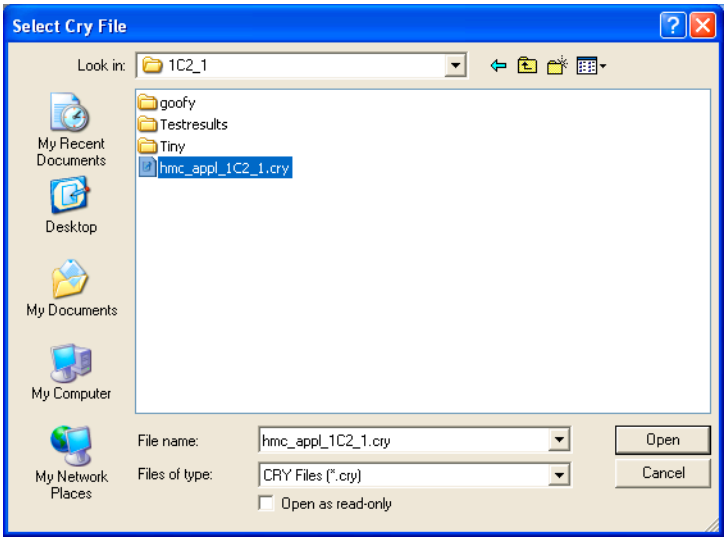
9. From the Service menu, choose the **Enter Service Mode** option.



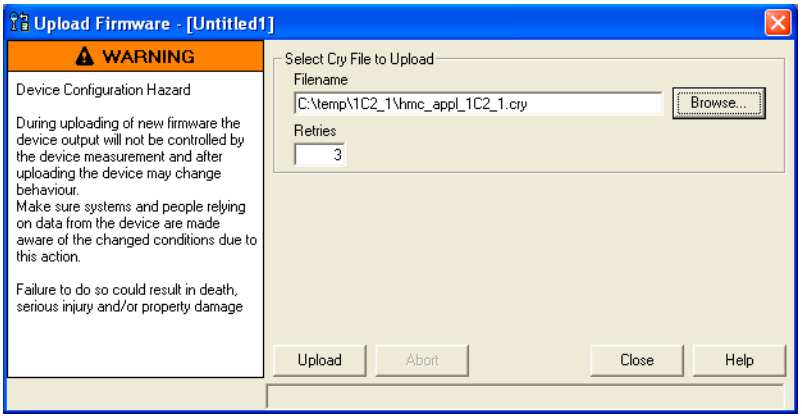
10. Type password, “admin”.
11. From the Service menu, choose the **Upload Firmware** option.



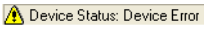
12. Click **Browse.**

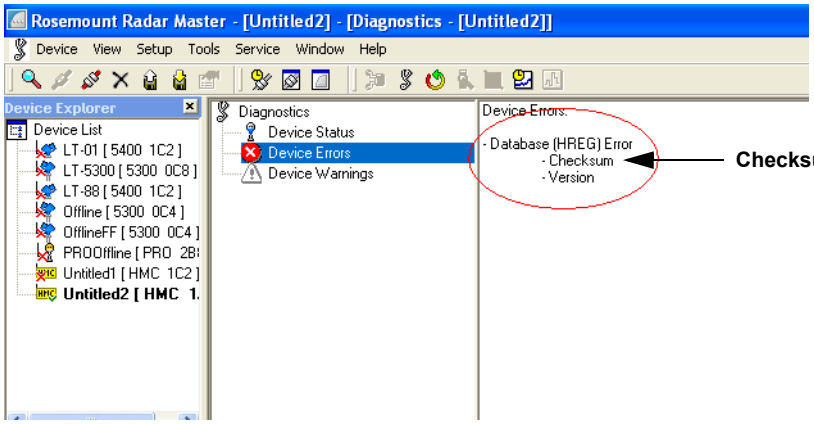


13. Select the upgrade **“.cry”** file.
14. Click **Open**.

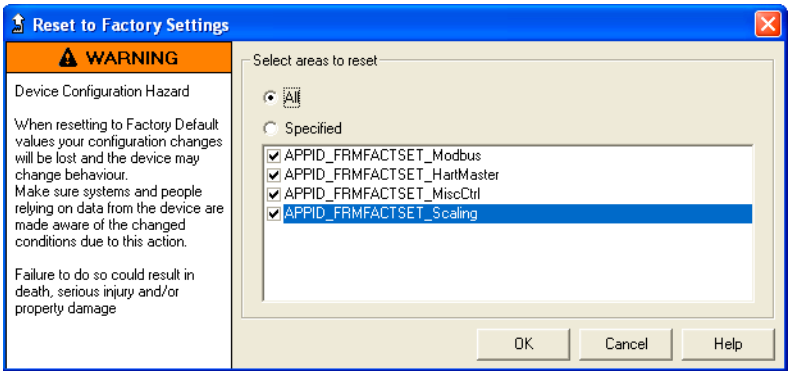


15. Click the **Upload** button to start the firmware upgrade.
16. When upload is finished, click the alert symbol.

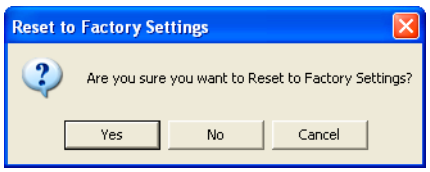




17. Click **Device Errors** and check for “Checksum”.
18. If it is on the list, choose the **Factory Settings** option from the Tools menu.



19. Select **All** and click **OK**.



20. Select **“Yes”**.
21. The Checksum error will no longer be on the list.
22. Now you can start using the HMC.

RCT COMMUNICATION WITH MA(+), MB(-)

The 3300 level transmitter can be configured with RCT using the MA (+), MB (-) connectors.

When the power and communication wires are connected, start configuring the transmitter using the RCT.

NOTE
The 3300 level transmitter must use HART address 1 to communicate with the 3300.

NOTE
Switch the power off, then switch it on and wait 20 seconds before connecting to the 3300. This can be done by clicking the Search for Device button in RCT.

The PC communicates with the 3300 by tunnelling the HART protocol over RS-485, using a RS-232/RS-485 Converter. To communicate with the 3300 transmitter, the COM port used for serial communication (RS-232) must be selected in RCT. Check the Device Manager in Windows if you are unsure which COM port to use. See Help, Contents in RCT to see how to use a specific COM port.

NOTE
Make sure the 3300 transmitter is alone on bus. Disconnect or turn off power from any other devices.

LEVELMASTER PROTOCOL DESCRIPTION

Implemented functions of the Levelmaster protocol

Here is a description of the implemented functions of Levelmaster protocol in the HMC.

Table 1-23. Implemented Functions of Levelmaster Protocol

Input format	Description	Output format
UnnN?	Return ID number	UnnNnnCcccc
UnnNmm	Set ID number	UnnNOKCcccc
UnnF?	Return number of floats	UnnFxCcccc
UnnFx?	Set number of floats	UnnFOKCcccc
Unn?	Return floats and other data	UnnDddd.ddFfffEeeee WwwwCcccc(1)

(1) In this case, number of floats is set to 1. If number of floats is set to 2, the Output Format would be: UnnDddd.ddDddd.ddFfffEeeeeWwwwCcccc

NOTE
If one float is sent, it is “Float1”. If two floats are sent, it is “Float 1” before “Float 0”.

Explanation of letters and expressions used in previous tables:

Table 1-24. Letters and Expressions Used in Previous Tables

Letter	Description
nn	nn is used to identify slave to respond, nn is a number 00-99 or ** (wildcard). The EmulCtrl Address Holding register can be configured to a higher value than 99. In that case, the address will be truncated to 99.
mm	mm is the new ID number for the slave; mm is a number 00-99.
x	x is the number of floats returned when slave receives Unn?, x is a number 0-2.
cccc	Is the 16 bit CRC checksum, cccc are hexadecimal characters.
ddd.dd	ddd.dd is the distance value from slave 1. Note that the first d can also be a '-' (minus).
Float 1	Slave 1 PV.
Float 0	Slave 1 SV.
fff	The temperature value. Configured by Holding Register 3208 in HMC.(1)
eeee	An error value. Bit 0: Invalid SV value (Float 0). Bit 8: Invalid Temperature value. Bit 12: Invalid PV value (Float 1).
Wwww	A warning value, not used in this implementation.

(1) Any of the four available variables from any of the five HART slaves can be selected as the temperature source.
The least four significant bits (bit 0-3) select the variable number. Bits 4-7 select the HART slave address. If invalid values are used, the temperature value will be invalid, with no Error bit set.
For example, if we want to use FV from HART Slave 3 as temperature source, we have to write the value 34 Hex (52 decimal).

SPECIFICATIONS

Table 1-25. Specifications

Power consumption	< 0.5 W (with HART adress=1)
Signal wiring	Two-wire half duplex RS-485 Modbus. Use shielded twisted pair wiring, preferably with an impedance of 120Ω (typically 24 AWG), in order to comply with EIA-485 standard and EMC regulations.
Power supply cabling	The power supply cables must be suitable for the supply voltage and approved for use in hazardous areas, where applicable.
Bus termination	Standard RS-485 bus termination per EIA-485

See the Rosemount 3300 Series Reference Manual (Document No. 00809-0100-4811) for further specifications.

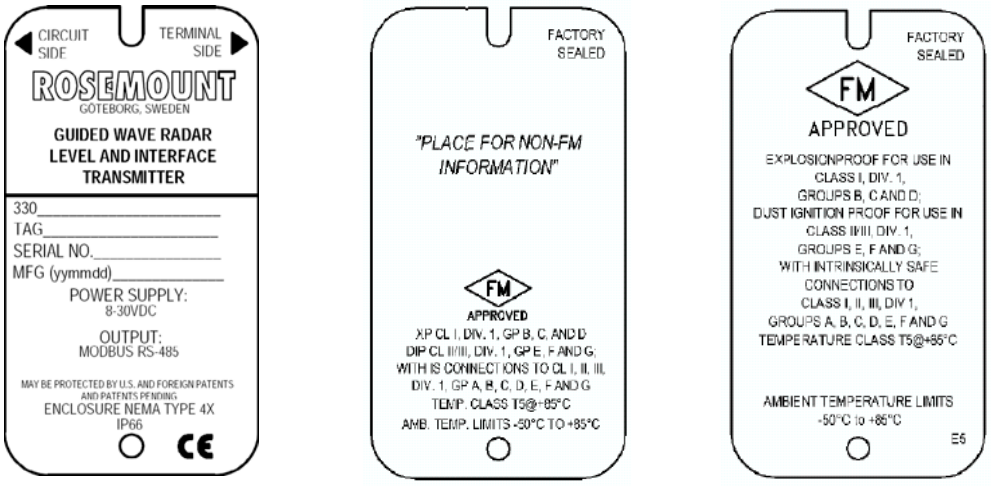
HAZARDOUS LOCATIONS CERTIFICATIONS

The Rosemount 3300 Series Guided Wave Radar Level and Interface Transmitters that have the following labels have been certified to comply with the requirements of the noted approval agencies.

Factory Mutual (FM) Approvals

Project ID: 3013394

Figure 1-13. Approval Labels Factory Mutual (FM) and Name Plate

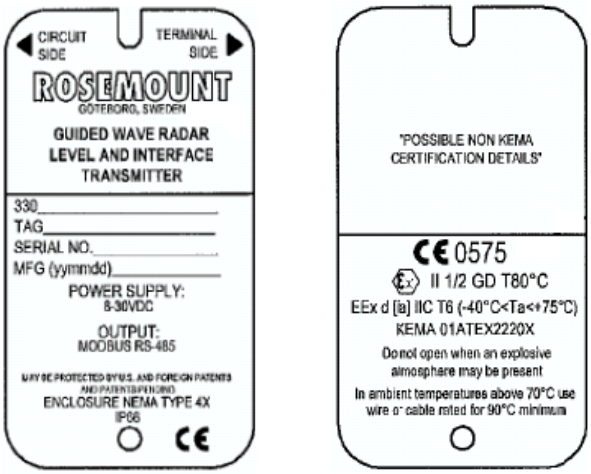


For connection in ambients above 70 °C, use wiring rated for 90 °C minimum.

E5 Explosion-proof for use in Class I, Div. 1, Groups B, C, and D;
Dust-ignition-proof for use in Class II/III, Div. 1, Groups E, F, and G;
With Intrinsically Safe connections to Class I, II, III, Div. 1,
Groups A, B, C, D, E, F, AND G.
Temperature class T5 @ +85 °C.
Ambient temperature limits: -50°C to + 85°C.
Factory Sealed.
Approval valid for Modbus and HART® option.

ATEX APPROVAL CE

Figure 1-14. Approval Label
ATEX Approval and Name Plate



E1 Flameproof:

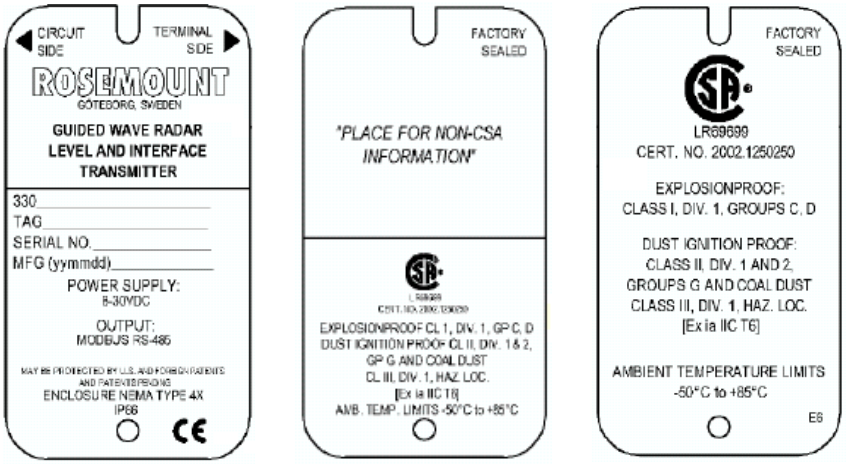
II 1/2 GD T80°C.
EEx d [ia] IIC T6 (-40°C<T_a<+75°C).
KEMA 01ATEX2220X.
U_m = 250 V.
Approval valid for Modbus and HART® option.

SPECIAL CONDITIONS FOR SAFE USE (X):

When used in a potentially explosive atmosphere where the use of equipment-category 1 apparatus is required, appropriate measures must be taken to prevent electrostatic discharge.

CANADIAN STANDARDS ASSOCIATION (CSA) APPROVAL

Figure 1-15. Approval Label Canadian Standards Association (CSA) Approval and Name Plate



Cert. no 2002.1250250.

E6 Explosion-proof: Class I, Div. 1, Groups C and D.
Dust-ignition-proof:
Class II, Div. 1 and 2, Groups G and coal dust.
Class III, Div. 1, Haz. Loc.
[Ex ia IIC T6].

Ambient temperature limits -50°C to +85°C.
Factory sealed.
Approval valid for Modbus and HART® option.

Rosemount 3300 Series

Manual Supplement
00809-0300-4811, Rev BA
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00809-0300-4811 Rev BA 09/08

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