Reference Manual
00809-0100-4738, Rev DA
May 2006

Rosemount 3095FB MultiVariable™ Transmitter
with Modbus® Protocol

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EMERSON™
Process Management

Rosemount 3095FB Multivariable™ Transmitter with Modbus™ Protocol

Rosemount 3095FB Software Revision 110
Rosemount 3095FB Configurator User Interface Software Revision 2.00

NOTICE

Read this manual before working with the product. For personal and system safety, and for optimum product performance, make sure you thoroughly understand the contents before installing, using, or maintaining this product.

Within the United States, Rosemount Inc. has two toll-free assistance numbers.

Customer Central: 1-800-999-9307 (*7:00 a.m. to 7:00 p.m. CST)*
Technical support, quoting, and order-related questions.

North American Response Center: 1-800-654-7768 (*24 hours a day – Includes Canada)*
Equipment service needs.

For equipment service or support needs outside the United States, contact your local Rosemount representative.

⚠CAUTION

The products described in this document are NOT designed for nuclear-qualified applications.

Using non-nuclear qualified products in applications that require nuclear-qualified hardware or products may cause inaccurate readings.

For information on Rosemount nuclear-qualified products, contact your local Rosemount Sales Representative.

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Table of Contents

Section 1 Introduction

USING THIS MANUAL

This manual provides installation, configuration, calibration, troubleshooting, and maintenance instructions for the Rosemount® 3095FB Multivariable™ Transmitter with Modbus™ Protocol and for its operation with the Rosemount 3095FB Configurator User Interface Software. This manual consists of the following chapters:

Section 2 **Installation**

- Install the 3095FB
- Installation flowchart
- Transmitter configuration data
- Installation considerations
- Field installation
- Options and accessories

Section 3 **RTU Communication**

Rosemount 3095FB *Modbus Protocol Guide, Revision F.*

Section 4 **Operation**

- How to use the configuration software
- Installing the software onto a personal computer
- Establishing communications
- Configuring the transmitter
- Creating a configuration file
- Calibrating the transmitter
- Explains each configurator software menu

Section 5 **Transmitter Maintenance and Troubleshooting**

- Troubleshooting instructions for dealing with potential mechanical or electrical difficulties.

Section 6 **Specifications and Reference Data**

- Specification data
- Spare parts information

Appendix A **Approvals**

- Factory Mutual (FM) certified drawings
- Canada Standards Association (CSA) certified drawings.

Appendix B **Product Certifications**

Appendix C **MODBUS Integration Guide**

Section 2 Installation

OVERVIEW

The information in this section covers installation considerations for the 3095FB MultiVariable Transmitter with Modbus protocol. A Quick Installation Guide (document number 00825-0100-4738) is shipped with every transmitter to describe basic pipe-fitting and wiring procedures for initial installation.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of the personnel performing the operation. Review all safety messages covered in this manual before continuing with the operation.

Warnings

⚠WARNING

Explosions can result in death or serious injury.

- Do not remove the transmitter covers in explosive environments when the circuit is live.
- Fully engage both transmitters covers to meet explosion-proof requirements.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.

⚠WARNING

Electrical shock can result in death or serious injury.

- Avoid contact with the leads and terminals.

⚠WARNING

Process leaks could result in death or serious injury.

- Install and tighten all four flange bolts before applying pressure.
- Do not attempt to loosen or remove flange bolts while the transmitter is in service.

⚠WARNING

Replacement equipment or spare parts not approved by Rosemount, Inc. for use as spare parts could reduce the pressure retaining capabilities of the transmitter and may render the instrument dangerous.

- Use only bolts supplied or sold by Rosemount, Inc. as spare parts.

⚠WARNING

Improper assembly of manifolds to traditional housing can damage sensor module.

- For safe assembly of manifold to traditional flange, bolts must break back plane of flange web (i.e. bolt hold) but must not contact module housing.

GENERAL CONSIDERATIONS

Measurement accuracy depends upon proper installation of the transmitter and impulse piping. Mount the transmitter close to the process and use minimal impulse piping to achieve best accuracy. Keep in mind the need for easy access, personnel safety, practical field calibration, and a suitable transmitter environment. Install the transmitter to minimize vibration, shock, and temperature fluctuation.

IMPORTANT
Install the enclosed pipe plug in unused conduit openings with a minimum of five threads engaged to comply with Explosion-Proof requirements. The transmitter is shipped with the plug installed on transmitters ordered with CSA Explosion-Proof approval.

MECHANICAL CONSIDERATIONS

"Dimensional Drawings" beginning on page A-5 show dimensional drawings. Figure 2-4 on page 2-9 shows installation examples.

NOTE
For steam service or for applications with process temperatures greater than the limits of the transmitter, do not blow down impulse piping through the transmitter. Flush lines with the blocking valves closed and refill lines with water before resuming measurement.

NOTE
When the transmitter is mounted on its side, position the Coplanar flange to ensure proper venting or draining. Mount the flange as shown in Figure 2-4 on page 2-9, keeping drain/vent connections on the bottom for gas service and on the top for liquid service.

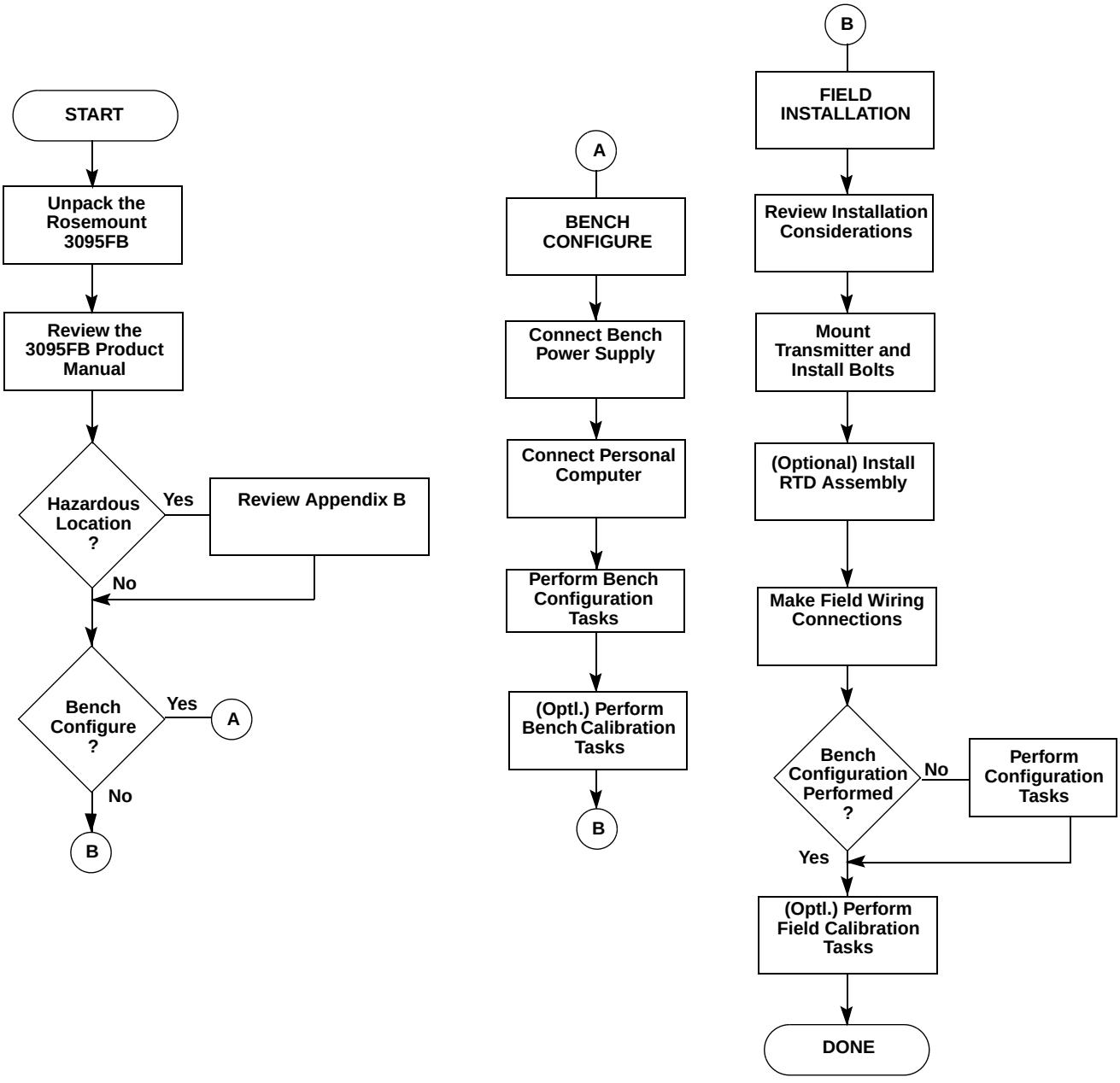
ENVIRONMENTAL CONSIDERATIONS

The following guidelines can help optimize transmitter performance. Mount the transmitter to minimize ambient temperature changes, vibration, mechanical shock, and external contact with corrosive materials. Appendix A: Range and Sensor Limits on page A-1 lists the transmitter temperature operating limits.

INSTALLATION PROCEDURES

Figure 2-1 details the full procedure for installing a new 3095FB.

Figure 2-1. Rosemount 3095FB Installation Flowchart



Review Installation Considerations

When choosing an installation location and position, take into account the need for access to the transmitter. For dimensional drawing information see page A-6.

Process Flange Orientation

Mount the process flanges with sufficient clearance for process connections. For safety reasons, place the drain/vent valves so the process fluid is directed away from you when the vents are used. In addition, consider the possible need for a testing or calibration input.

Housing Rotation

See “Consider Housing Rotation” on page 2-11.

Terminal Side of Electronics Housing

Mount the transmitter so that the terminal side is accessible. A 0.75-inch (19 mm) clearance is required for cover removal. Use a conduit plug on the unused side of the conduit opening.

Circuit Side of Electronics Housing

Provide 0.75 inches (19 mm) clearance if possible for cover removal. Three inches of clearance is required for cover removal if a display is installed.

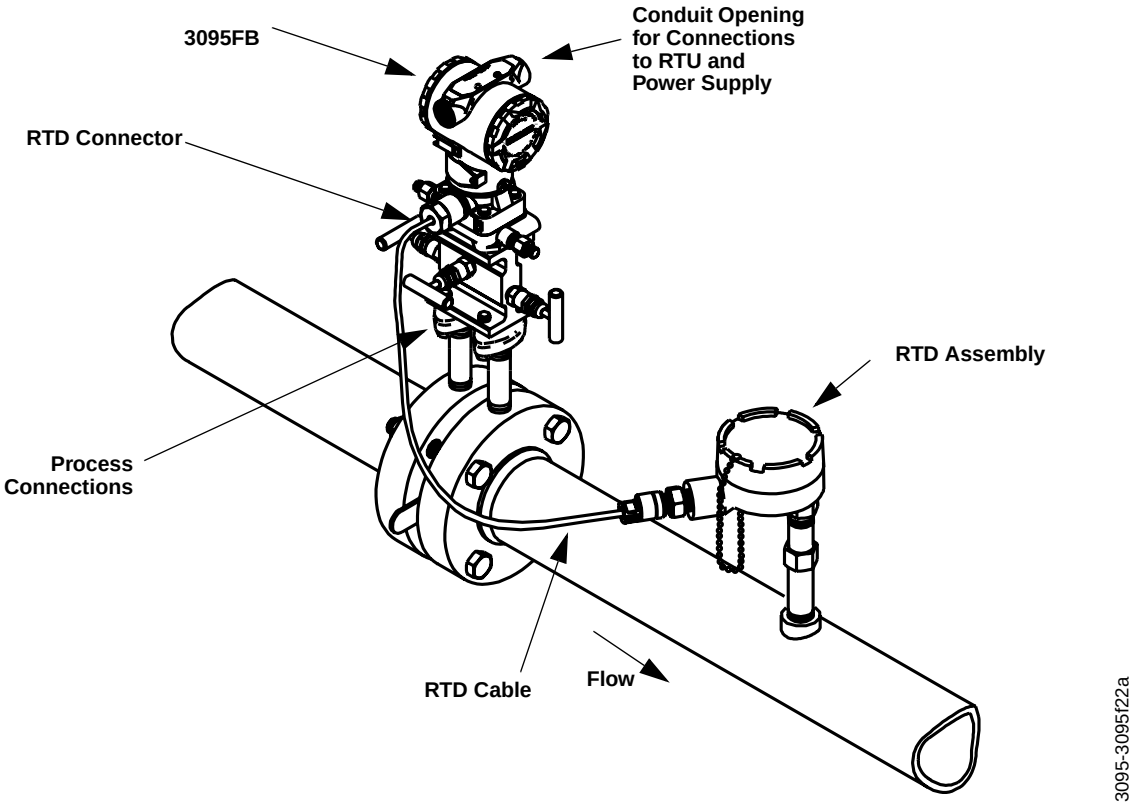
Cover Installation

Always install the electronics housing covers metal-to-metal to ensure a proper seal.

Mount the Transmitter

Figure 2-2 illustrates a typical 3095 installation site. Major components of the installation are identified in these figures.

Figure 2-2. Typical Rosemount 3095FB Installation Site



The 3095FB transmitter total weight varies depending on the components ordered (see Table 2-1). This weight must be securely supported.

Table 2-1. Transmitter Weight

Component	Weight
3095FB Without Options	6 lb (2,7 kg)
LCD Meter for Aluminum Housing	0.5 lb (0,2 kg)
SST Mounting Bracket for Coplanar Flange	1.0 lb (0,5 kg)
12 ft (3,66 m) cable	0.5 lb (0,2 kg)
24 ft (7,32 m) cable	2.2 lb (1,0 kg)

Mounting Brackets

Optional mounting brackets available with the 3095FB facilitate mounting to a panel, wall, or 2-inch pipe. The bracket option for use with the Coplanar flange is 316 SST with 316 SST bolts. Figure 2-3 shows bracket dimensions and mounting configurations for this option. When installing the transmitter to one of the mounting brackets, torque the bolts to 125 in-lb.

NOTE
Most transmitters are calibrated in the horizontal position. Mounting the transmitter in any other position will shift the zero point to the equivalent amount of liquid head caused by the varied mounting position. To reset zero point, refer to “Sensor Trim” on page 4-16.

Mounting Bolts

The following guidelines have been established to ensure a tight flange, adapter, or manifold seal. Use only bolts supplied with the transmitter or sold by Rosemount Inc. as a spare part to the Rosemount 3095FB transmitter.

The Rosemount 3095FB is shipped with the Coplanar flange installed with four 1.75-inch flange bolts. The following bolts also are supplied to facilitate other mounting configurations:

- Four 2.25-inch manifold/flange bolts for mounting the Coplanar flange on a three-valve manifold. In this configuration, the 1.75-inch bolts may be used to mount the flange adapters to the process connection side of the manifold.
- (Optional) If flange adapters are ordered, four 2.88-inch flange/adapter bolts for mounting the flange adapters to the Coplanar flange.

Figure 2-3 shows the optional mounting bracket and mounting configurations.

Stainless steel bolts supplied by Rosemount Inc. are coated with a lubricant to ease installation. Carbon steel bolts do not require lubrication. No additional lubricant should be applied when installing either type of bolt. Bolts supplied by Rosemount Inc. are identified by their head markings:

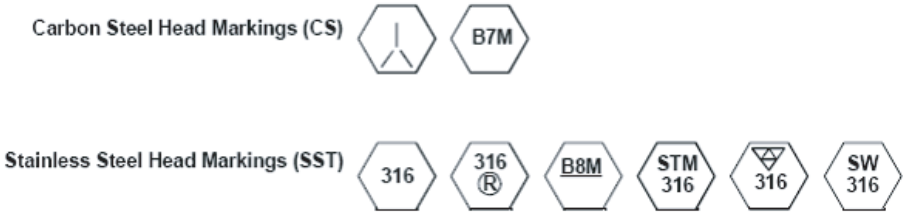
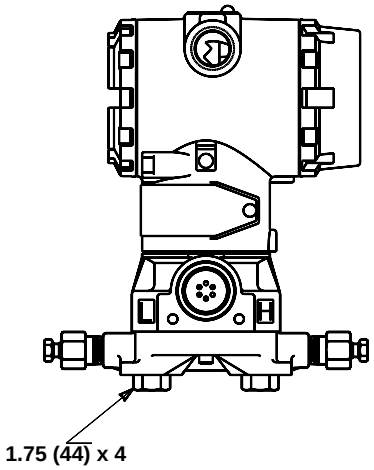
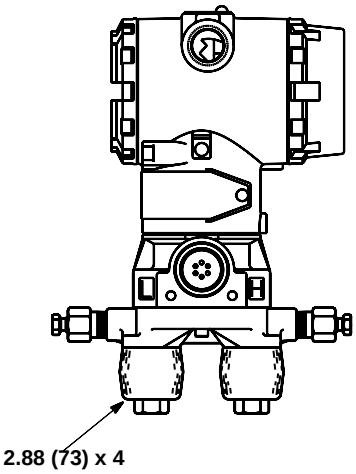


Figure 2-3. Optional Mounting Brackets and Mounting Configurations

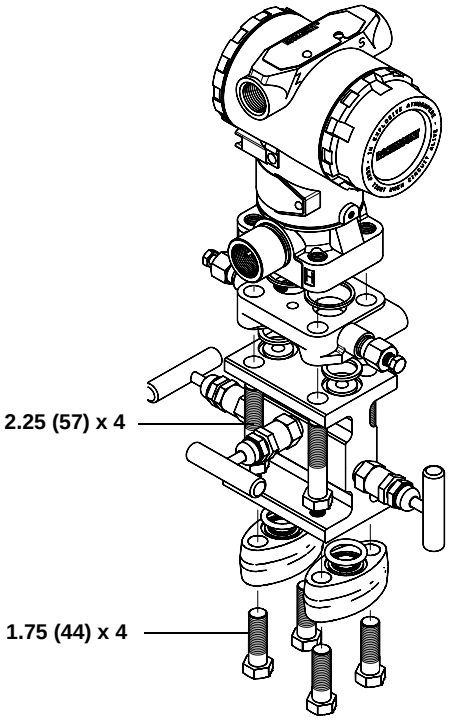
Description	Qty.	Size in. (mm)
Flange bolts	4	1.75 (44)
Flange/adapter bolts	4	2.88 (73)
Manifold/flange bolts	4	2.25 (57)



TRANSMITTER WITH FLANGE BOLTS



TRANSMITTER WITH OPTIONAL FLANGE ADAPTERS AND FLANGE/ADAPTER BOLTS



TRANSMITTER WITH 3-VALVE MANIFOLD MANIFOLD/FLANGE BOLTS FLANGE ADAPTERS AND FLANGE/ADAPTER BOLTS

3095-3095D05M, 3095C05A, fieldbus\3095\3095a29A

NOTE
Dimensions are in inches (millimeters)

Mounting Requirements

Refer to figure 2-4 for examples of the following mounting considerations:

Liquid Flow Measurement

- Place taps to the side of the line to prevent sediment deposits on the transmitter's process isolators.
- Mount the transmitter beside or below the taps so gases can vent into the process line.
- Mount drain/vent valve upward to allow gases to vent.

Gas Flow Measurement

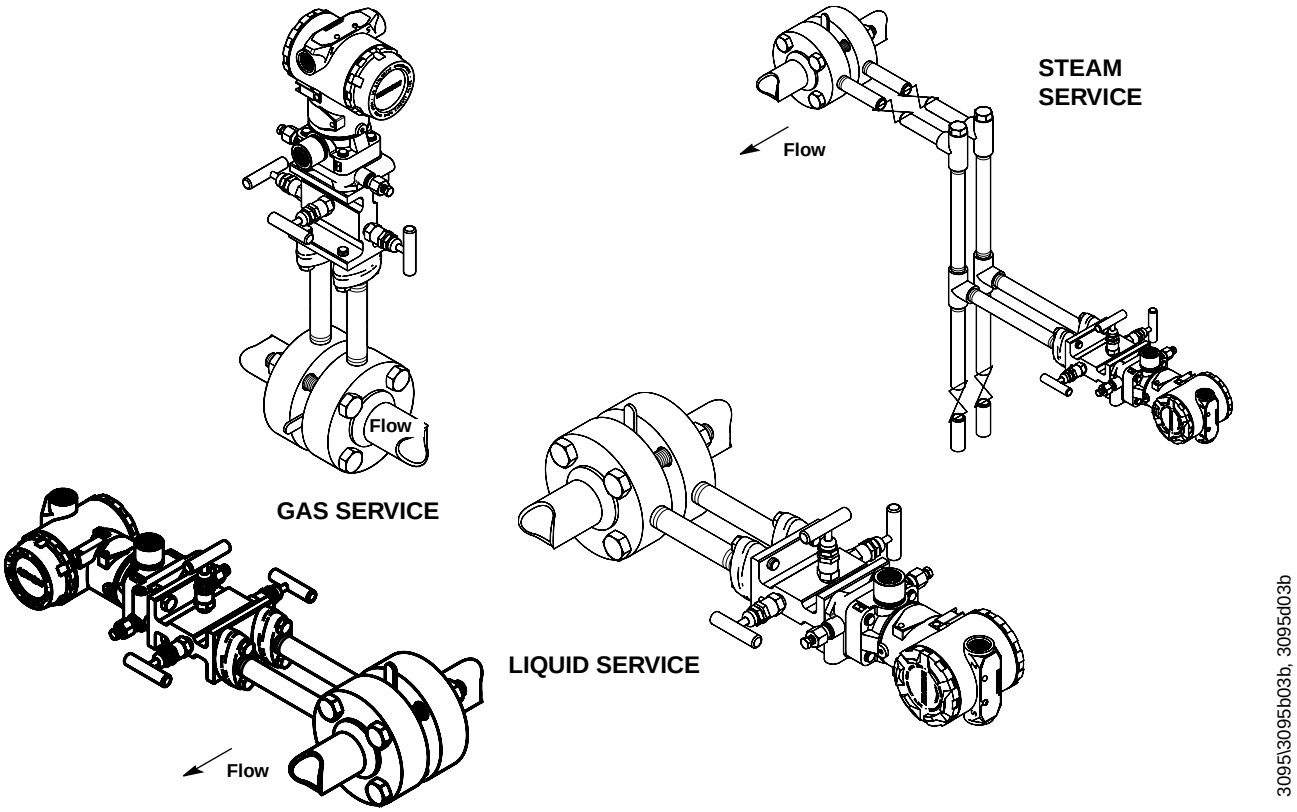
- Place taps in the top or side of the line.
- Mount the transmitter beside or above the taps so liquid will drain into the process line.

Steam Flow Measurement

- Place taps to the side of the line.
- Mount the transmitter below the taps to ensure that the impulse piping will stay filled with condensate.
- Fill impulse lines with water to prevent the steam from contacting the transmitter directly and to ensure accurate measurement start-up.

NOTE
In steam or other elevated temperature services, it is important that temperatures at the coplanar process flanges not exceed 250 °F (121 °C) for transmitters with silicone fill or 185 °F (85 °C) for inert fill.

Figure 2-4. Example Installations



Process Connections

The 3095 process connections on the transmitter flange are 1/4–18 NPT. Flange adapter unions with 1/2–14 NPT connections are available as options. These are Class 2 threads; use your plant-approved lubricant or sealant when making the process connections. The process connections on the transmitter flange are on $2^1/_8$-inch (54-mm) centers to allow direct mounting to a three- or five-valve manifold. By rotating one or both of the flange adapters, connection centers of 2, $2^1/_8$, or $2^1/_4$ inches (51, 54, or 57 mm) may be obtained.

Install and tighten all four flange bolts before applying pressure or process leakage will result. When properly installed, the flange bolts will protrude through the top of the module housing. Do not attempt to loosen or remove the flange bolts while the transmitter is in service.

To install adapters to a Coplanar flange, perform the following procedure:

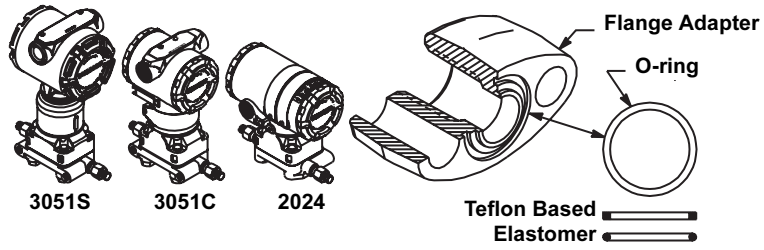
1. Remove the flange bolts.
2. Leaving the flange in place, move the adapters into position with the O-ring installed.
3. Clamp the adapters and the Coplanar flange to the transmitter module using the larger of the bolts supplied.
4. Tighten the bolts. Refer to “Mounting Bolts” on page 2-6 for torque specifications.

⚠WARNING

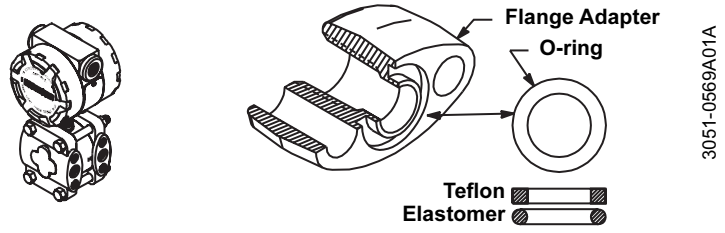
Failure to install proper flange adapter O-rings can cause process leaks, which can result in death or serious injury.

The two flange adapters are distinguished by unique O-ring grooves. Only use the O-ring that is designed for its specific flange adapter, as shown below.

ROSEMOUNT 3051S/ 3051/3001/3095/2024



ROSEMOUNT 1151



Refer to the Spare Parts list on page A-9 for the correct part numbers of the flange adapters and O-rings designed for Rosemount 3051 transmitters.

When compressed, Teflon® O-rings tend to cold flow, which aids in their sealing capabilities. Whenever you remove flanges or adapters, visually inspect the Teflon O-rings. Replace them if there are any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them. If you replace the O-rings, retorque the flange bolts after installation to compensate for cold flow.

Impulse Piping

The piping between the process and the transmitter must accurately transfer the pressure to obtain accurate measurements. There are five possible sources of error: pressure transfer, leaks, friction loss (particularly if purging is used), trapped gas in a liquid line, liquid in a gas line, and density variations between the legs.

The best location for the transmitter in relation to the process pipe depends on the process itself. Use the following guidelines to determine transmitter location and placement of impulse piping:

- Keep impulse piping as short as possible.
- For liquid service, slope the impulse piping at least 1 inch per foot (8 cm per m) upward from the transmitter toward the process connection.
- For gas service, slope the impulse piping at least 1 inch per foot (8 cm per m) downward from the transmitter toward the process connection.
- Avoid high points in liquid lines and low points in gas lines.
- Make sure both impulse legs are the same temperature.
- Use impulse piping large enough to avoid friction effects and blockage.
- Vent all gas from liquid piping legs.
- When using a sealing fluid, fill both piping legs to the same level.
- When purging, make the purge connection close to the process taps and purge through equal lengths of the same size pipe. Avoid purging through the transmitter.
- Keep corrosive or hot (above 250 °F [121 °C]) process material out of direct contact with the sensor module and flanges.
- Prevent sediment deposits in the impulse piping.
- Keep the liquid head balanced on both legs of the impulse piping.
- Avoid conditions that might allow process fluid to freeze within the process flange.

Consider Housing Rotation

The electronics housing can be rotated up to 180 degrees (left or right) to improve field access or to better view the optional LCD display. To rotate the housing, perform the following procedure:

1. Loosen the housing rotation set screw using a 5/64-in. hex wrench.
2. Turn the housing up to 180 degrees to the left or right of its original (as shipped) position. Do not rotate the housing more than 180 degrees without first performing a disassembly procedure (see “Disassembly Procedures” on page 5-5). Over-rotation will sever the electrical connection between the sensor module and the electronics module.
3. Retighten the housing rotation set screw.

Set Jumpers

Security

You can prevent changes to the transmitter configuration data with the write protection jumper. Security is controlled by the security (write protect) jumper located on the electronics board or display face. Position the jumper on the transmitter circuit board in the “ON” position to prevent accidental or deliberate change of configuration data.

If the transmitter write protection jumper is in the “ON” position, the transmitter will not accept any “writes” to its memory. Configuration changes, such as digital trim and reranging, cannot take place when the transmitter security is on.

AC Termination (AC)

The RS-485 bus needs to be terminated once at both ends, and should not be terminated elsewhere on the bus. Setting the AC TERMINATION (AC) switch to ON provides AC bus termination.

NOTE
The RTU may already provide one RS-485 bus termination.

Pull-down (B) and Pull-up (A)

These switches are used to put the RS-485 bus into the idle state. Set these switches either to both ON (idle state), or to both OFF (lets the bus float). If a transmitter has multiple communication errors, set these switches to ON (idle state).

NOTE
Only one device on an RS-485 bus should set the bus to the idle state. In some installations, the RTU might maintain the bus in the idle state when the RS-485 bus is inactive.

Baud Rate (S1 and S2)

Table 2-2 identifies four available baud rates for RS-485 Modbus communications.

Table 2-2. Baud Rate Settings

S1	S2	Baud Rate
OFF	OFF	1200
ON	OFF	2400
OFF	ON	4800
ON	ON	9600

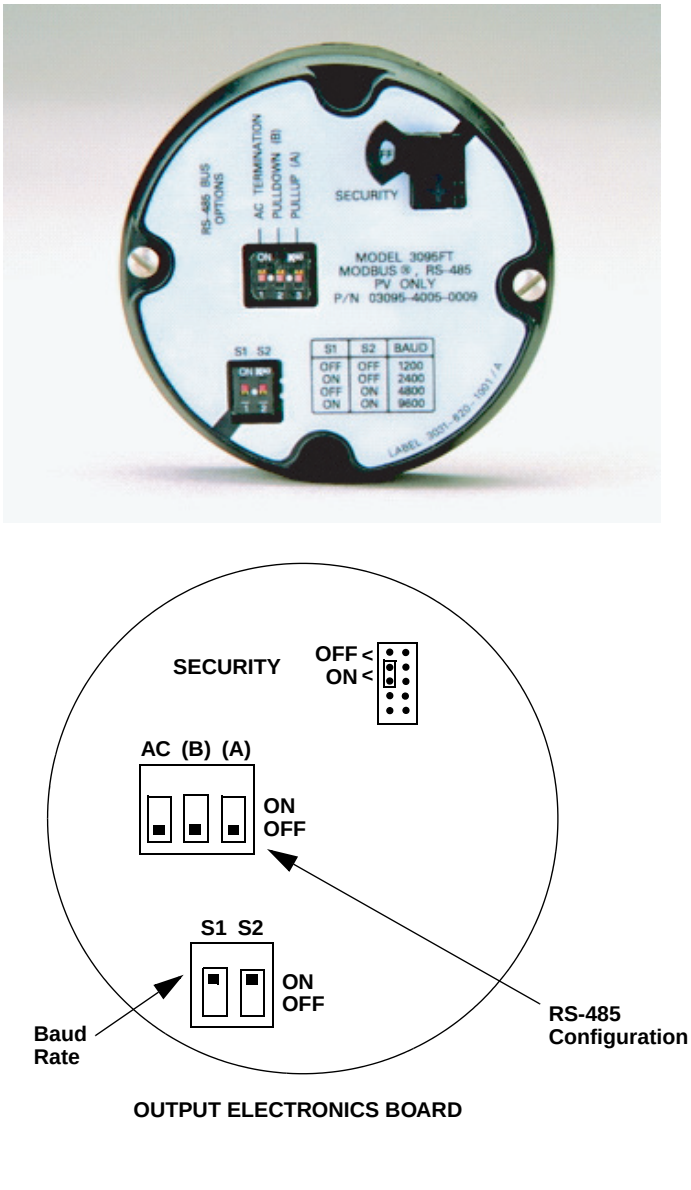
Configuring RS485 and Security Jumpers

When shipped from the factory, the RS-485 switches are all set to off, and the baud rate switches are set to 9600 (see Table 2-2).

To reposition the jumpers, follow the procedure described below.

1. If the transmitter is installed, remove power.
2. Remove the housing cover opposite the field terminal side. Do not remove the transmitter covers in explosive atmospheres when the circuit is live.
3. Remove the LCD meter if present.
4. Locate the switches on the output electronics board (see Figure 2-5), and then move the switch to the desired setting.
5. Reattach the transmitter cover. Transmitter covers must be fully engaged to meet Explosion-Proof requirements.

Figure 2-5. Output Board Switches



RTD Assembly (Optional)

The Rosemount 3095FB MultiVariable Transmitter is compatible with the Series 68 or Series 78 RTD Assembly.

NOTE
To meet ISSep/CENELEC Flameproof certification, only European Flameproof Cable Assemblies (Process Temperature Input Codes A, B, or C) may be used for RTD cable installation.

RTD Installation Procedure

All RTD Cable Assemblies use the 3095 RTD Cable Connector.

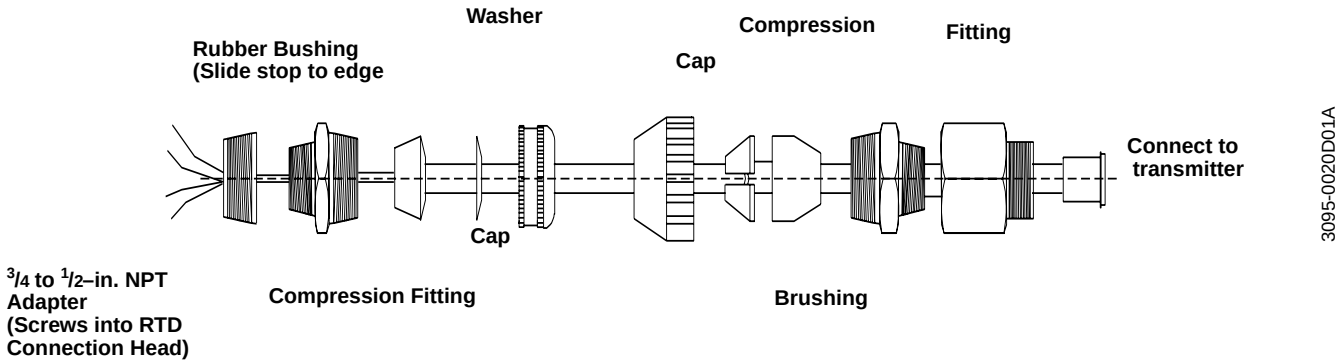
Identify the type of cable being used, and follow the installation steps specific to the type of cable.

- Armored Shielded RTD Cable
- Shielded RTD Cable (intended for conduit use)
- CENELEC Flameproof RTD Cable

Installing an Armored Shielded RTD Cable

Figure 2-6 details a standard armored shielded RTD cable.

Figure 2-6. Armored Shielded RTD Cable

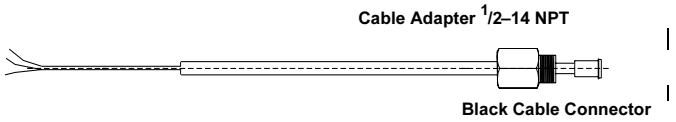


1. Fully engage the black cable connector to the 3095 RTD connector (figure 2-9).
2. Tighten the cable adapter until metal contacts metal (figure 2-10).
3. Install the compression fitting
4. Use pliers to tighten the cap onto the compression fitting (figure 2-11).

Installing a Shielded RTD Cable (intended for conduit use)

Figure 2-7 details a standard shielded RTD cable.

Figure 2-7. Shielded RTD Cable

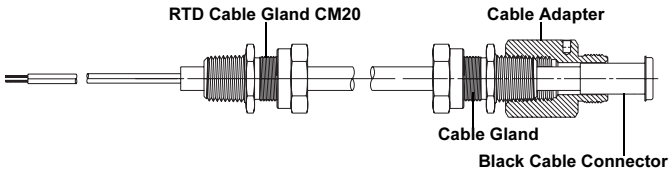


1. Fully engage the black cable connector to the 3095 RTD connector (figure 2-9).
2. Tighten the cable adapter until metal contacts metal (figure 2-10).

Installing a CENELEC Flameproof RTD Cable

Figure 2-8 details a CENELEC flameproof RTD cable.

Figure 2-8. CENELEC Flameproof RTD Cable



1. Fully engage the black cable connector to the 3095 RTD connector (figure 2-9).
2. Tighten the cable adapter and cable gland until metal contacts metal (figure 2-10).

Figure 2-9. Engaging the Black Cable Connector

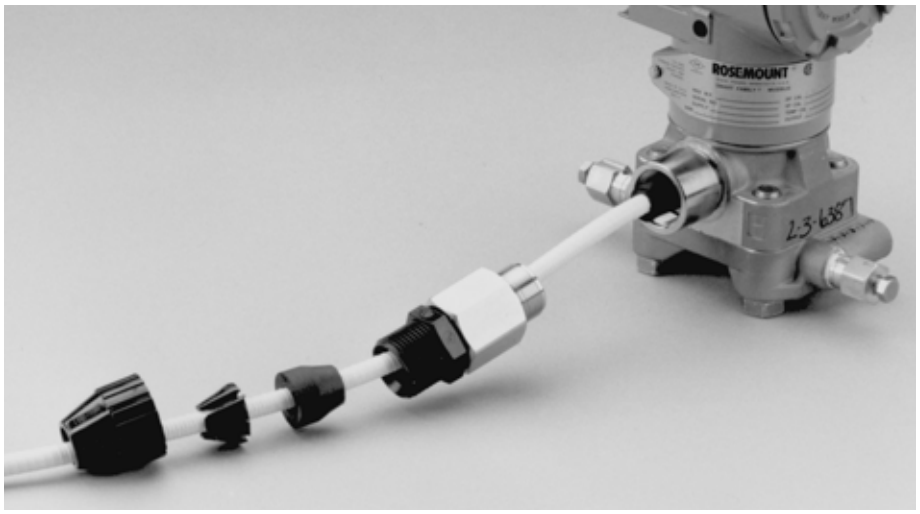


FIGURE 2-10. Tightening the Cable Adapter

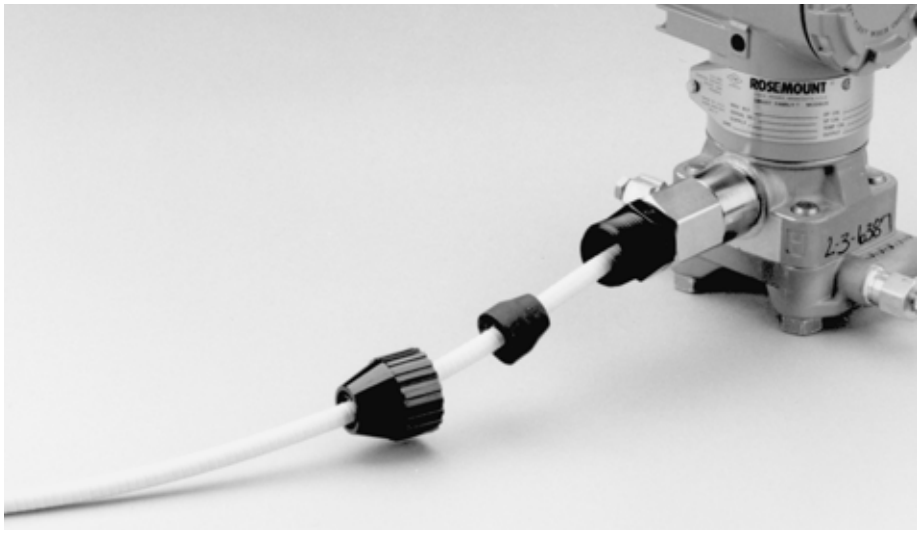


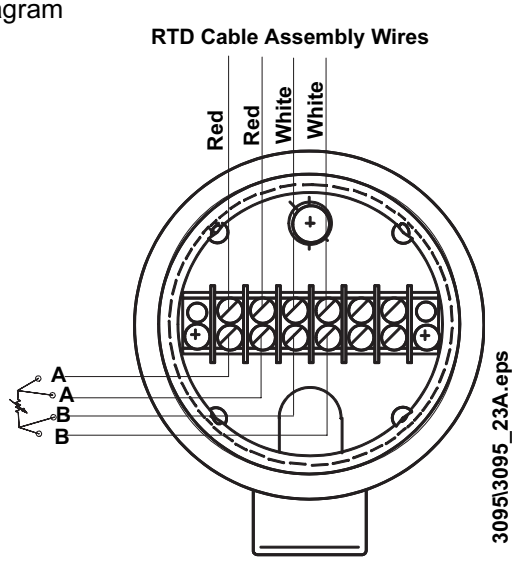
Figure 2-11. Tightening the Cap

Connecting the RTD to the Assembly

Make all necessary wiring connections inside the RTD Flat Connection Head as explained in the sensor wiring instructions included with the RTD.

Figure 2-12 illustrates a typical wiring configuration of the Rosemount RTD cable assembly with a 4-wire RTD.

Figure 2-12. RTD Sensor Wiring Diagram



Connect Wiring and Power Up

The transmitter terminal block is in the compartment of the electronics housing labeled “FIELD TERMINALS.” The other compartment contains the transmitter electronics module.

Refer to figure 2-13 to assist in wiring connections.

⚠WARNING

For explosion-proof installations, wiring connections must be made per Appendix B. For ALL installations, wiring connections must be made in accordance with local or national installation codes such as the NEC NFPA 70.

NOTES

- Do not run field wiring in conduit or open trays with other non-transmitter power wiring, or near heavy electrical equipment.
- Shielded wiring is not required, but twisted pairs should be used for best results. Twisted pair is required for RS-485 bus wiring.
- Runs under 1000 feet should be AWG 22 or larger. Runs from 1000 to 4000 feet should be AWG 20 or larger.
- Wiring should not exceed AWG 16.
- For connections in ambient temperatures above 140 °F (60 °C), use wiring rated for at least 194 °F (90 °C).
- All connections should be made before applying power to the device.

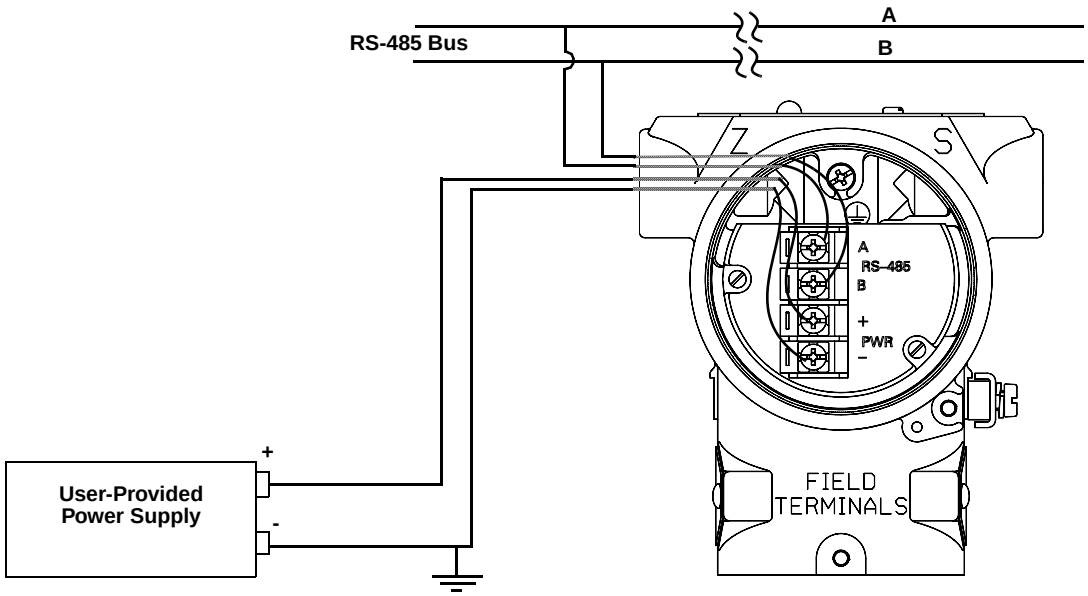
⚠CAUTION

Incorrect field wiring connections may damage the Rosemount 3095FB. Do not connect power wiring to the RS-485 terminals.

To make connections, perform the following procedure:

1. Remove the housing cover on the side marked “FIELD TERMINALS.” Do not remove the cover in explosive atmospheres when the circuit is live. All power to the transmitter is supplied over the signal wiring.
2. Connect the lead that originates at the positive side of the power supply to the terminal marked “+” and the lead that originates from the negative side of the power supply to the terminal marked “–”. Avoid contact with the leads and terminals.
3. Connect the lead that originates from the “A” line from the RS-485 bus to the terminal marked “A” and the lead that originates from the “B” line to the terminal marked “B.”
4. Plug and seal unused conduit connections on the transmitter housing to avoid moisture accumulation in the terminal side of the housing. If you do not seal the unused connections, mount the transmitter with the electrical housing positioned downward for drainage. Install wiring with a drip loop. Arrange the drip loop so the bottom is lower than the conduit connections and the transmitter housing.
5. Attach and tighten all housing covers. Transmitter covers must be fully engaged to meet Explosion-Proof requirements and to achieve the proper environmental seal.

Figure 2-13. Field Wiring Connections



Inductive-based transient protectors, including the Rosemount 470, can adversely affect the output of the 3095FB transmitter. Do not use the Rosemount 470 for transient protection with the 3095FB. If your application requires transient protection, install the Transient Protection Terminal Block (Section 5: Troubleshooting).

Signal Wiring Grounding

Do not run signal wiring in conduit or open trays with power wiring, or near heavy electrical equipment. You may ground the signal wiring at any one point on the signal loop, or leave it ungrounded. The negative terminal of the power supply is a recommended grounding point. Device must be properly grounded or earthed according to local electric codes.

Power Supply

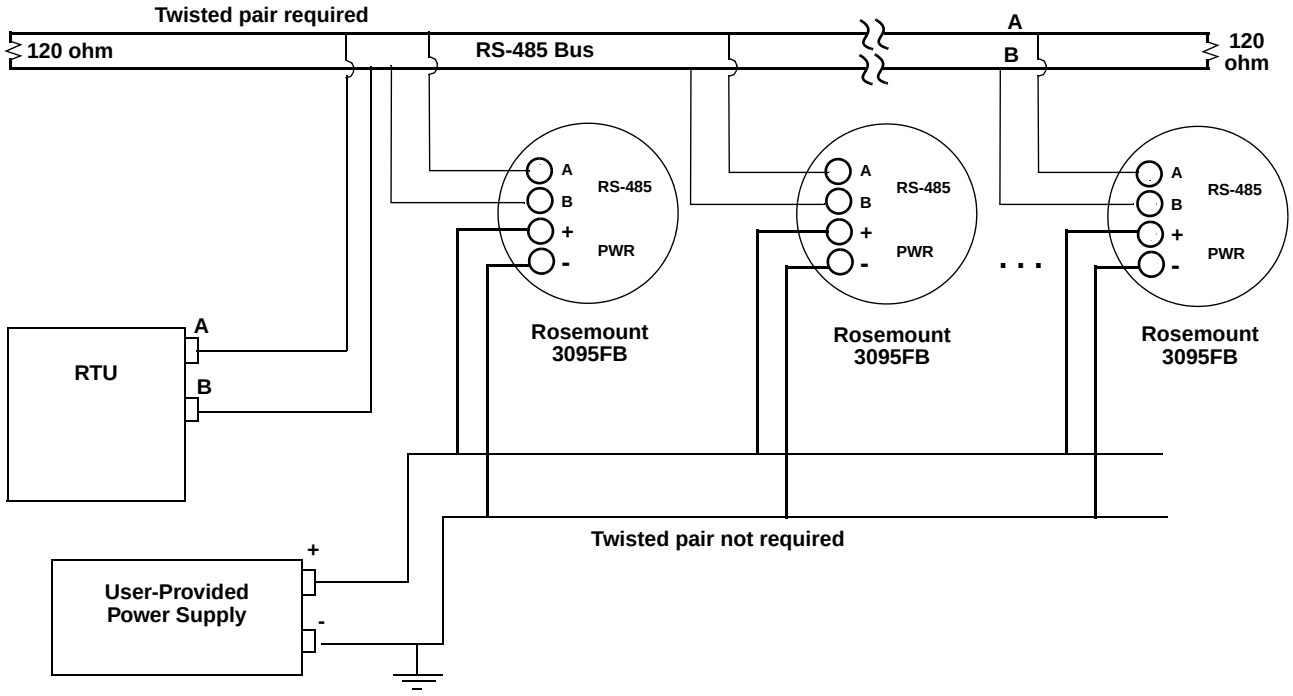
The transmitter requires between 7.5 and 30 V dc to operate and provide complete functionality. The dc power supply should provide power with less than 2% ripple.

RS-485 Bus

- The 3095FB does not provide electrical isolation between the RS-485 bus and the transmitter power supply.
- Maintain a bus topology and minimize stub length.
- Figure 2-14 identifies multidrop wiring topology. Up to 32 devices may be wired on one RS-485 bus.
- The RS-485 bus needs to be terminated once at both ends, and should not be terminated elsewhere on the bus. Setting the 3095FB AC termination (AC) switch to ON (see page 2-11) is one method to provide AC bus termination.

NOTE
The RTU may already provide one RS-485 bus termination.

Figure 2-14. RS-485 Multidrop Topology



HAZARDOUS LOCATIONS

The Rosemount 3095FB Transmitter has explosion-proof housing and circuitry. Individual transmitters are clearly marked with a tag indicating the certifications they carry. See Appendix B for specific approval categories and installation drawings.

NOTE
Once a device labeled with multiple approvals is installed, it should not be reinstalled using any other approval type(s). Permanently mark the certification label to distinguish the installed approval type from unused approval types.

Grounding the Transmitter Case

The transmitter case should always be grounded in accordance with national and local electrical codes. The most effective transmitter case grounding method is direct connection to earth ground with minimal impedance.

Methods for grounding the transmitter case include:

- **Internal Ground Connection:** The Internal Ground Connection screw is inside the FIELD TERMINALS side of the electronics housing. This screw is identified by a ground symbol, and is standard on all Rosemount 3095FB transmitters.
- **External Ground Assembly:** This assembly is included with the transient protection terminal block. The External Ground Assembly can also be ordered as a spare part (03031-0398-0001).

NOTE
Do not ground the RS-485 bus at any point on the bus.

NOTE
The transient protection terminal block does not provide transient protection unless the transmitter case is properly grounded. Use the above guidelines to ground the transmitter case. Do not run the transient protection ground wire with field wiring as the ground wire may carry excessive current if a lighting strike occurs. Grounding the transmitter case via threaded conduit connection may not provide sufficient ground.

ROSEMOUNT 305 INTEGRAL MANIFOLD

The Rosemount 3095FB can be fitted with a 305 Integral Manifold. Supported manifolds include:

- Traditional Manifold (Rosemount RM style only)
- 3-Valve Coplanar Manifold
- 5-Valve Coplanar Manifold

Integral Manifold Installation Procedure

To install a Rosemount 305 Integral Manifold to a 3095FB transmitter:

1. Inspect the Teflon sensor module O-rings. If the O-rings are undamaged, reusing them is recommended. If the O-rings are damaged (if they have nicks or cuts, for example), replace them with new O-rings.

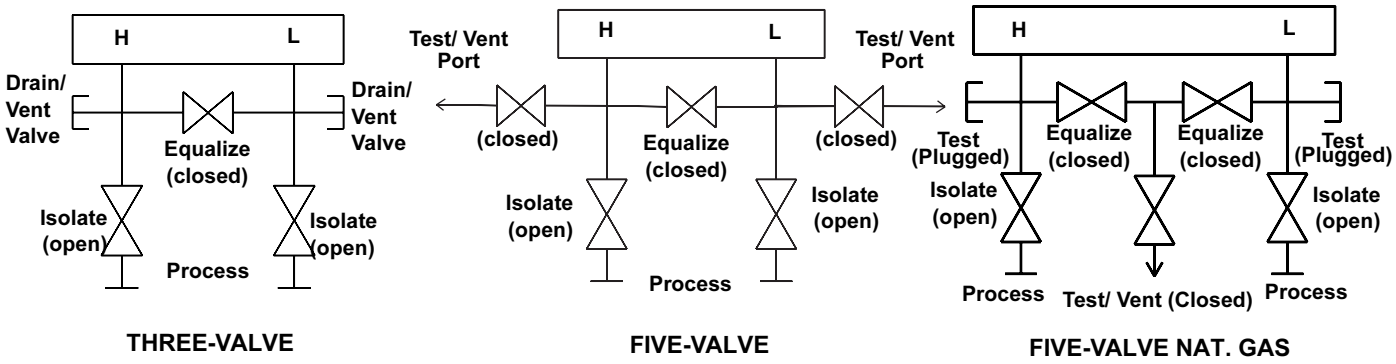
IMPORTANT
If replacing the O-rings, take care not to scratch or deface the O-ring grooves or the surface of the isolating diaphragm while you remove the damaged O-rings.

2. Install the Integral Manifold on the sensor module. Use the four 2.25-in. manifold bolts for alignment. Finger tighten the bolts, then tighten the bolts incrementally in a cross pattern to final torque value. See “Mounting Bolts” on page 2-6 for complete bolt installation information and torque values. When fully tightened, the bolts should extend through the top of the module housing.
3. If the Teflon O-rings have been replaced, the flange bolts should be re-tightened after installation to compensate for cold flow of the O-rings.

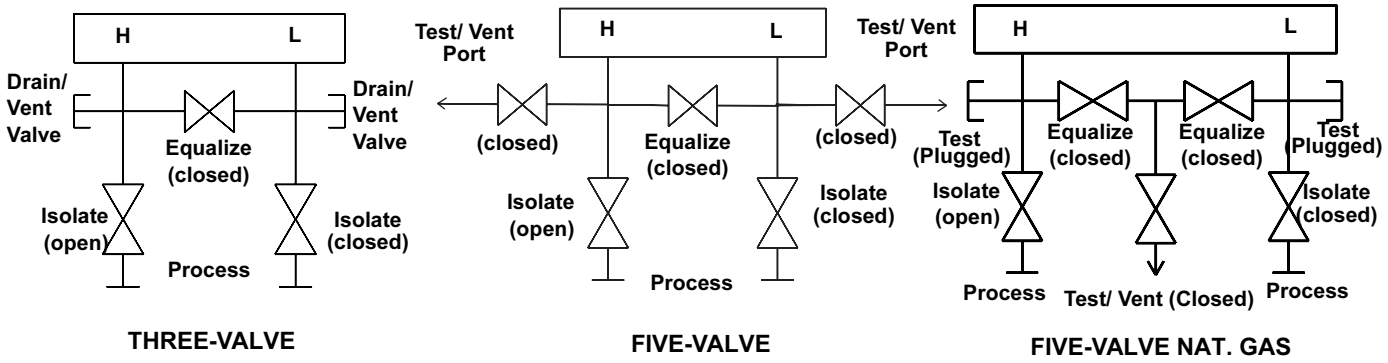
NOTE
Always perform a zero trim on the transmitter/manifold assembly after installation to eliminate mounting effects.

Integral Manifold Operation

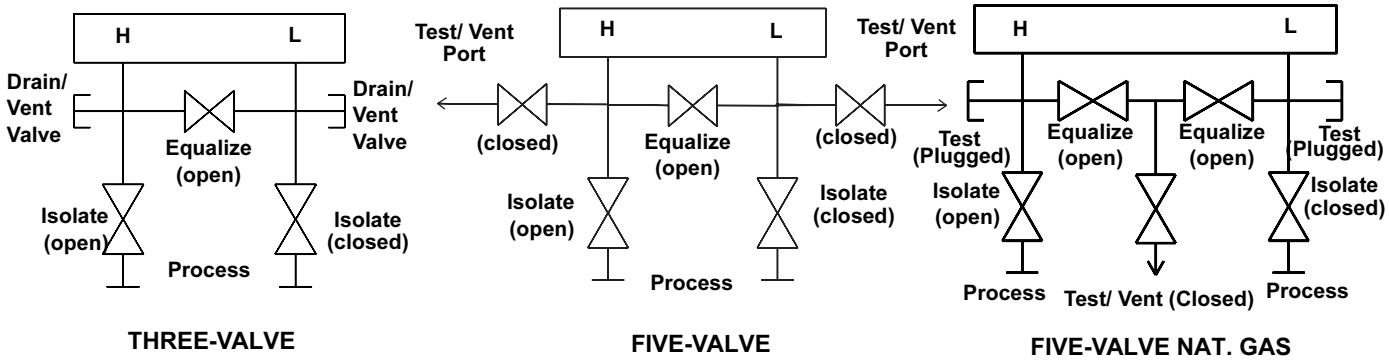
In normal operation the two block valves between the process and instrument ports will be open and the equalizing valve(s) will be closed.



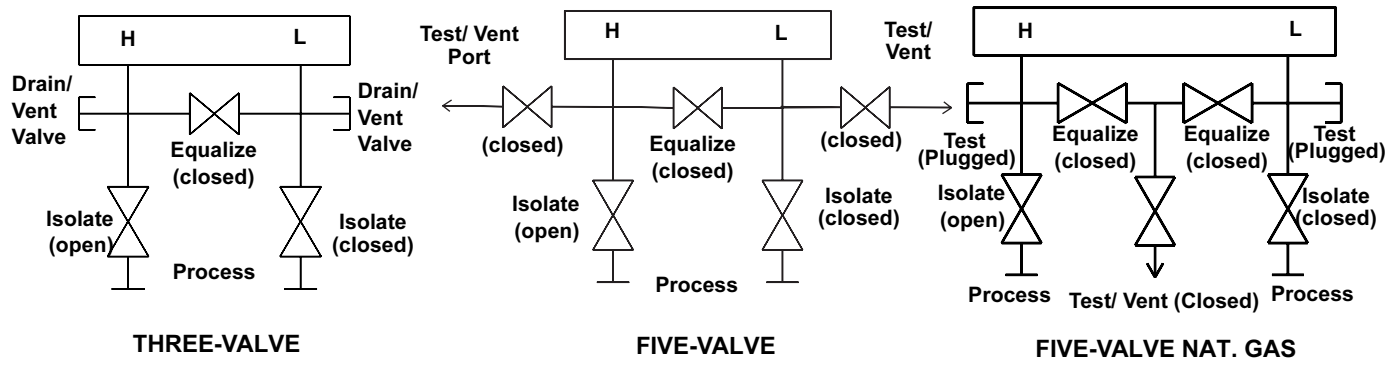
To check zero the 3095FB, close the block valve to the low pressure (downstream side) of the transmitter first.



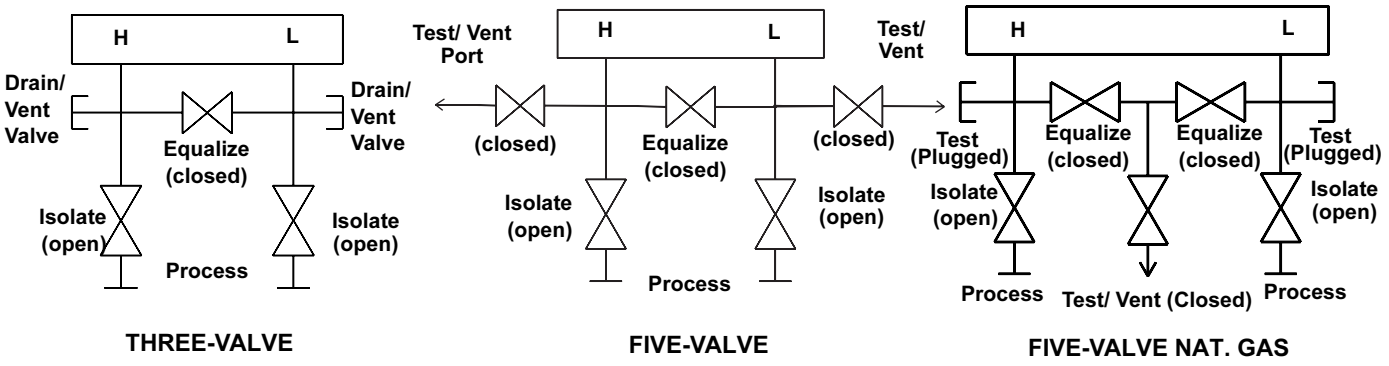
Next, open the center (equalize) valve(s) to equalize the pressure on both sides of the transmitter.



The manifold valves are now in the proper configuration for zeroing the transmitter. To return the transmitter to service, close the equalizing valve(s) first.



Next, open the block valve on the low pressure side of the transmitter.



Section 3 Modbus Communication

Review the *Modbus Protocol Guide for the Rosemount 3095FB Multivariable Transmitter with Modbus Protocol, Revision F* in the next few pages.

Use this document to determine which process variables and status bits you wish to retrieve from the Rosemount 3095FB.

Suggestions and Tips

We recommend that you review the *Modbus Protocol Guide* in the following manner:

1. Read Sections 1–3 to gain an overview of how the Rosemount 3095FB implements the Modbus RTU protocol.
2. Read Sections 4–9 as needed to determine which Rosemount 3095FB registers will require read/write actions in order to meet your process control needs.

NOTE
Be sure to consider Section 3: 8.0 in the *Modbus Protocol Guide.* The only way to detect transmitter exceptions is by polling the registers described in this section.

NOTE
Additional registers may be added to the *Modbus Protocol Guide* with future software revisions and upgrades.

NOTE
The following functions are only available for Rosemount 3095FB Transmitters with software revision 107 or greater:
- Configurable Floating Point Format (Section 3: 3.4)
- Scaled Integers (Section 3: 5.3)
- Duplicate Modbus Register Functionality including 32-bit floating point registers (Section 3: 2.3.1)

Rosemount 3095FB Multivariable Transmitter

with Modbus Protocol

Modbus Protocol Guide

Report Number: D9500114

Revision: F

TABLE OF CONTENTS

1.0 Introduction

The readers of this document are expected to have a general understanding of the Modbus protocol. If you do not have the required knowledge of the Modbus protocol, the Modbus documents referenced in Section 1.2, on page 4 of this document should be of help. Also Section 2.0, on page 6 of this document contains a brief overview of the Modbus protocol.

1.1 Purpose

The purpose of this document is to provide the information required to implement within a host, an effective exchange of data with the Rosemount 3095FB Multivariable Transmitter with Modbus Protocol. This document defines the Modbus interface and register layout in sufficient detail for the 3095FB.

1.2 References

Modicon Modbus Protocol Reference Guide

1.3 Abbreviations, Definitions, and Acronyms

Table 1-1 Glossary

Term	Description
AP	absolute pressure - above absolute zero pressure
C	degrees Celsius (5 / 9) * (T(F) - 32)
coil	A read/write bit register
Conventional Symbol	A symbol which is commonly used in the gas industry in equations or algorithms or other expressions
CRC	Cyclic Redundancy Check
default value	The initial value set by software. Some of these may be overwritten by the user via Modbus commands.
discrete input	A read only bit register
DP	differential pressure
F	degrees Fahrenheit (9 / 5) * T(C) + 32
FP	IEEE-754 floating point
floating point register	Two consecutive 16 bit registers that store an IEEE 754 floating point number

Table 1-1 Glossary

Term	Description
FS	full scale
GP	gage pressure - above atmospheric pressure
holding register	A read/write 16 bit register
inH2O	inches of water (at defined temperature)
input register	A read only 16 bit register
LCD	liquid crystal display
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PT	process temperature
PV(s)	process variable(s)
query	a request from the master (host) device for a slave device to perform an action
register	a 16 bit memory location that can be read/write or read only
response	a response from a slave device to a master (host) device
SP	static pressure
ST	sensor temperature
U16	16-bit unsigned integer 0 to 65535
U32	32-bit unsigned integer 0 to 4294967295
U8	8-bit unsigned integer
$	Signifies a hexadecimal number
%	Signifies a binary number

2.0 Overview of Modbus Conventions

The Rosemount 3095FB is a Modbus compatible measurement device. The transmitter supports 8-bit Remote Terminal Unit (RTU) data transmission mode with a subset of read commands, write commands, and diagnostic commands used by most Modbus compatible host controllers. The transmitter's microprocessor emulates Modbus read/write and read only coils and registers.

2.1 Physical Communications Layer

The communications parameters are set at 8 data bits, 1 stop bit, and no parity. These parameters are not configurable. The baud rate is selectable using dip switches on the 3095FB output board. Valid baud rates are 1200, 2400, 4800, and 9600.

2.2 Transactions on Modbus Networks

The Modbus protocol uses a master/slave technique, providing for one master and up to 247 slaves. Only the master can initiate a transaction.

Transactions are either a query/response type where only a single slave is addressed, or a broadcast/no response type where all slaves are addressed.

The host (master) controller can produce query frames or broadcast frames. Query frames generate a response frame from one slave device. Broadcast frames address all the slave devices, which do not respond. A query/response message includes one query frame and one response frame. A broadcast message includes one broadcast frame. Each frame has an address field, a function field, a data field, and an error check field.

Table 2-1 Format of Query and Response Frame

Address Field(U8)	Function Field(U8)	Data Field(Size varies with function)	Error Check Field(U16)

2.2.1 Address Field

In a query frame, the address field contains a slave's polling address. In a response frame, the address field contains the polling address of the responding slave device. In a broadcast frame, the address field contains a 0.

2.2.2 Function Field

In a query frame or a broadcast frame, the function field contains a function code, which indicates the read, write, or diagnostic command to be performed.

In a response frame, the function field contains a function code verifying the device's response to the command. If the most significant bit in the function field is set, the data field contains an exception response that explains any errors encountered while processing the command (see Section 2.5) in the *Modbus Protocol Guide*.

2.2.3 Data Field

The data field contains information that is specific to each individual function. Section 2.4 gives the data field layout for each function.

2.2.4 Error Check Field

The error check field contains a 16 bit CRC checksum that is used to verify the integrity of the message frame.

2.2.5 Broadcast mode and address 0

Any query message with a slave address of 0 is a broadcast message. Only Modbus function codes that write to a register or coil are valid in a broadcast message. Address 0 is reserved for broadcast messages and therefore is not a valid Modbus slave address.

2.3 Data Types

The transmitter's mapped addresses store and use data types supported by many Modbus-compatible PLCs and host controllers. Table 2-2 lists those data types according to their mapped addresses and corresponding function codes. To increase compatibility with many different kinds of hosts, the data types have been remapped to several different locations as shown in Table 2-2. The additional Modbus addresses were implemented in the 3095FB output board software beginning with Rev.107.

All the registers in this document are referenced to one. The registers in Modbus messages are referenced to zero. This means the number of the mapped address register (i.e. 0005) is one higher than the actual number (i.e. 0004) that is sent in the Modbus frame message.

There are a number of 8 bit values that are stored in 16 bit registers. The 8 bit value is stored in the Least Significant Byte of the 16 bit register. For example the value $24 would be stored as $0024. This does not apply to ASCII characters which are stored as two characters in each 16 bit register.

Floating point values are stored as single precision IEEE 754 floating point numbers. Since IEEE 754 floating point numbers are 32 bits long, they must be stored as either two 16-bit registers or as one 32-bit register. The 3095FB supports both types of floating point registers. See Section 2.3.1 for a more detailed explanation of the register mapping.

Table 2-2 Data Types According to Function Code and Mapped Address

Address start register	Address end register	Register size in bits	Accessible via function codes	Address type	Access	Description
1 * 1001 10001	**86 *** 1086 10086	1 1 1	01, 02, 05	Coil	Read/ write	Single ON/OFF bit per coil (Boolean). Shares the same register range with the Discrete Inputs. **See Section 2.3.2.**
			01, 02	Discrete input	Read-only	Single ON/OFF bit per coil (Boolean). Shares the same register range with the Discrete Inputs. S**ee Section 2.3.2.**
401 * 7401 20401	**488 *** 7444 20488	16 32 16	03, 04, 06**, 16, 69, 70	Floating point register	Read-only and read/ write	IEEE 754 floating point number. Accessed as either two 16-bit registers or one 32-bit register. S**ee Section 2.3.1.**
1 * 3001 30001 40001 50001	**214 *** 3214 30214 40214 50214	16 16 16 16 16	03, 04	Input registers	Read-only	One 16 bit unsigned integer per register. Shares the same register range with the Holding registers and ASCII registers. S**ee Section 2.3.1.**
			03, 04, 06, 16	Holding register	Read/ write	One 16 bit unsigned integer per register. Shares the same register range with the Input registers and ASCII registers. S**ee Section 2.3.1.**
			03, 04, 06, 16	ASCII characters	Read/ write	Two ASCII characters per 16 bit register. Shares the same register range with the Input registers and Holding registers. S**ee Section 2.3.1.**

* Base Address. The other register ranges are duplicate addresses for the base registers. Reading and writing to these duplicates is the same as reading and writing to the base registers.
** Floating Point numbers can only be written with function code 6 if the register is a 32-bit register.

2.3.1 Register Map (available for 3095FB output board Rev. 107 or later)

There are two base register blocks used in the register map. These register blocks contain the integer data and the floating point data. To improve connectivity with many different kinds of hosts, these base register blocks appear in other address ranges, as shown in Figure 2-1 .

2.3.1.1 Accessing Floating Point Registers

The host can access each floating point register in 3 different locations. To access the 16-bit floating point register pairs in the regions other than the base region, simply add the base register address (i.e. 401) to the desired range (i.e. 20,000), which gives the new register address (i.e. 20,401). The 32-bit floating point numbers do not match up one to one with the base floating point register pairs, because the 32-bit floating point registers take half the register space of the 16-bit floating point register pairs. To access the 32-bit floating point registers (7401-7444) use [Equation 1] or see for the complete layout of the 32-bit register block.

[Equation 1] 32-bit register address = 7401 + (base address - 401) / 2

Examples:

Differential Pressure = 7401 + (401 - 401) / 2 = 7401

Static Pressure = 7401 + (403 - 401) / 2 = 7402

Differential Pressure Damping = 7401 + (441 - 401) / 2 = 7421

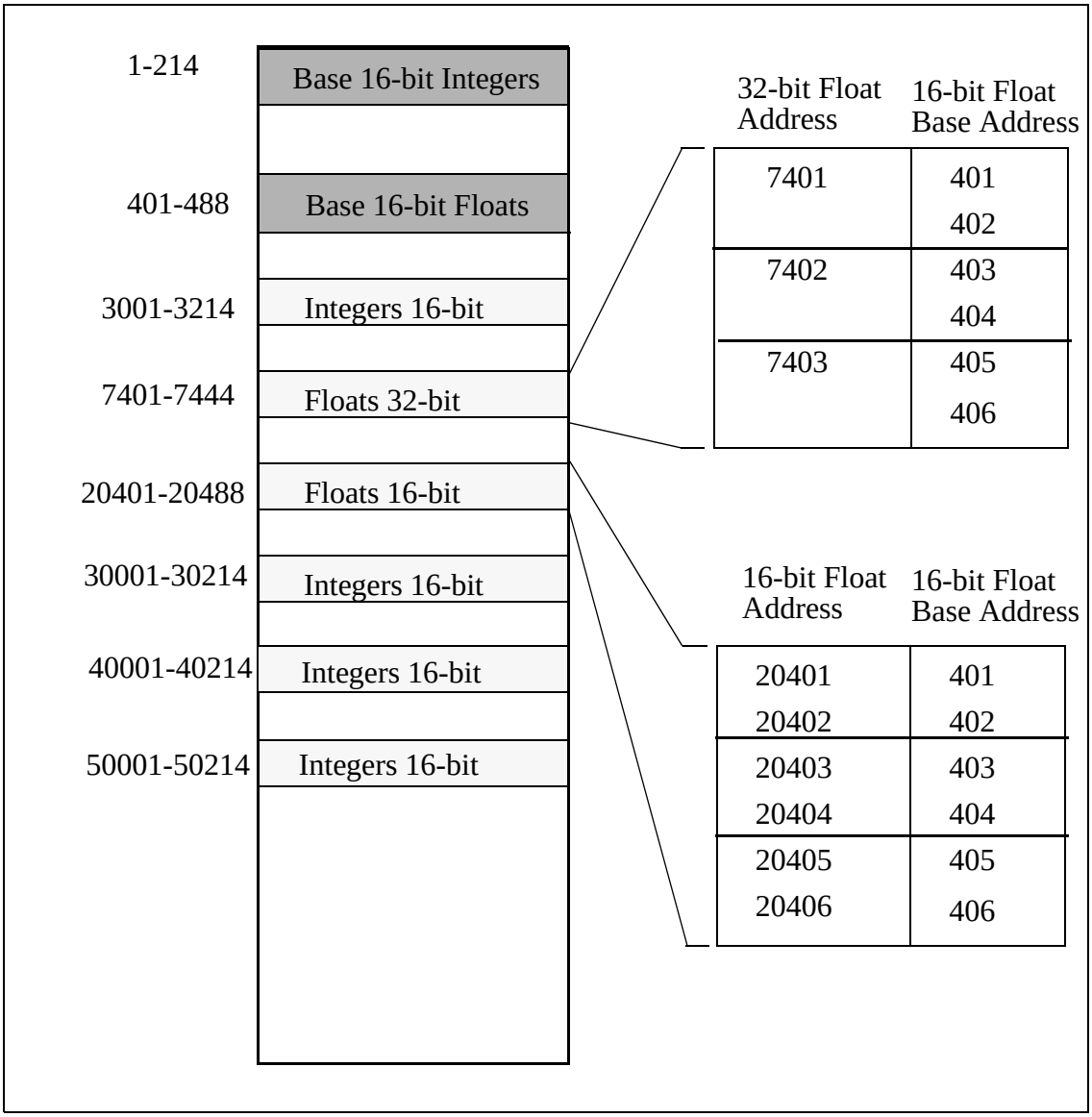
For example, the host can read the floating point value for Differential Pressure(DP) from 3 separate register locations. The DP can be read as 16-bit register pairs by reading registers 401-402 or 20401-20402. The DP can also be read as one 32-bit register at location 7401.

2.3.1.2 Accessing Integer Registers

The integer registers consist of the input registers, holding registers, and ASCII registers. The host can access each integer register in 5 different locations. To access the 16-bit registers in the regions other than the base region, simply add the base register address (i.e. 61) to the desired range (i.e. 3,000), which gives the new register address (i.e. 3,061).

For example, the host can read the Static Pressure (SP) Unit Code from 5 separate locations. The transmitter address can be read from registers 61, 3061, 30061, 40061, or 50061.

Figure 2-1 Register Map



2.3.2 Boolean Map (available for 3095FB output board Rev. 107 or later)

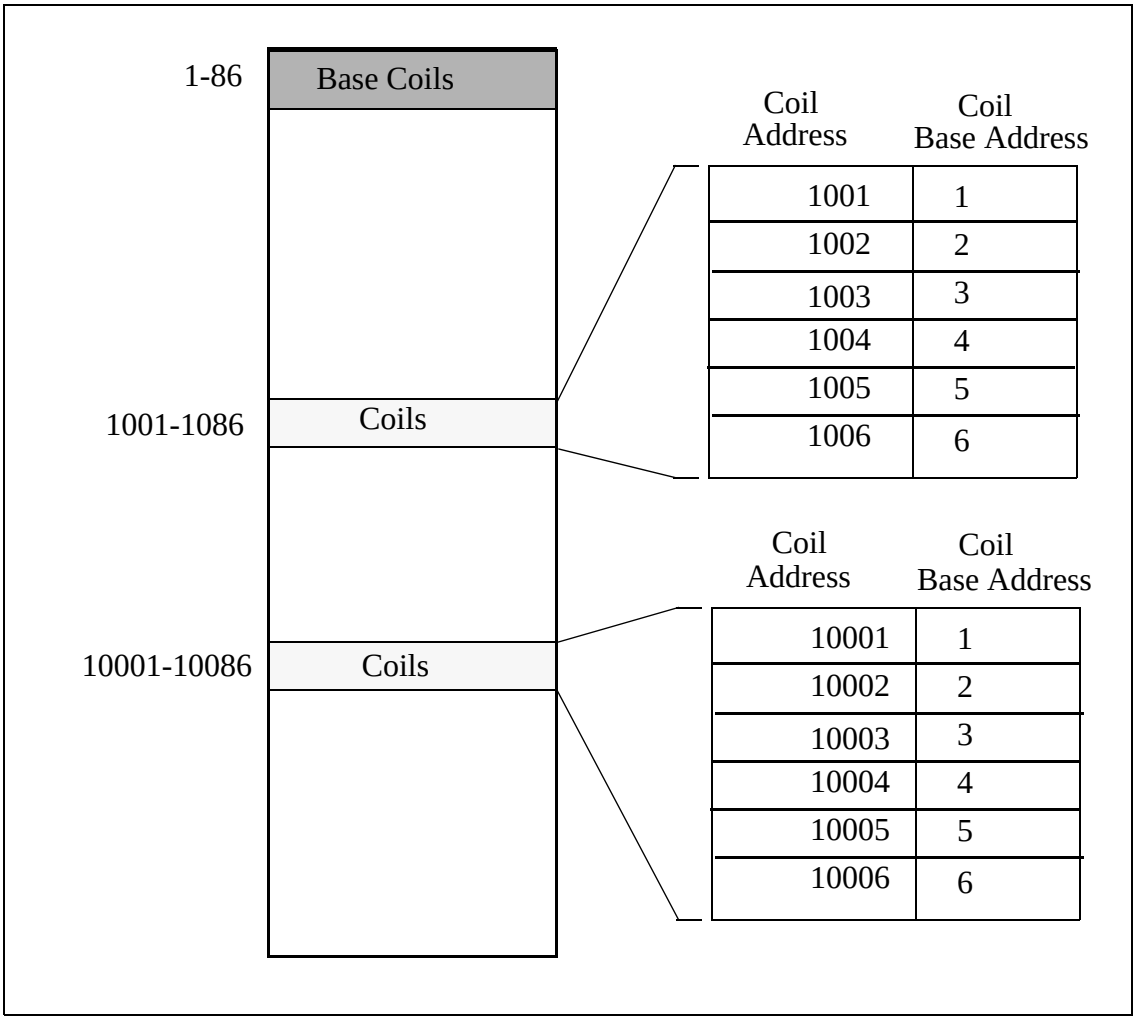
There is one base boolean register block used to store boolean data. To improve connectivity with many different kinds of host, this boolean register block has been duplicated in other address ranges, as shown in Figure 2-2 .

2.3.2.1 Accessing Boolean Data

The boolean registers can be accessed in 3 different locations. To access the boolean registers in the regions other than the base region, simply add the base register address (i.e. 1) to the desired range (i.e. 1,000), which gives the new register address (i.e. 1,001).

For example, the host can perform a self test by writing to any of 3 separate coil locations. A self test can be performed by writing to either coil 1, 1001, or 10001. Whichever coil location is most convenient for the host can be used.

Figure 2-2 Boolean Map



2.4 Modbus Function Codes

The transmitter supported function codes listed below include read, write, and diagnostic commands. See Section 2.6 for examples on reading and writing data with Modbus function codes.

Table 2-3 Explanation of Function Codes Supported by the Rosemount 3095FB

Function code	Command type	Description	Explanation of function code
01	Read	Read coil status	Read ON/OFF status of one coil or consecutive coils.
02	Read	Read input status	Read ON/OFF status of one discrete input or consecutive discrete inputs.
03	Read	Read holding registers	Read binary values of one or more holding registers.
04	Read	Read input registers	Read binary values in one or more input registers.
05	Write	Force coil	Set coil to a specified ON or OFF state.
06	Write	Load register	Write a binary value to a holding register.
08	Diagnostic	Loopback diagnostic	Sends diagnostic test message to transmitter to evaluate communications processing.
16	Write	Load multiple registers	Writes values to consecutive holding registers.
69	Read	Read multiple floating point registers	Read binary values of one or more 32 bit floating point registers. This function is specific to the 3095FB.
70	Write	Load multiple floating point registers	Write values to consecutive 32 bit floating point registers. This function is specific to the 3095FB.

Table 2-4 Format of Modbus Functions

START	ADDRESS	FUNCTION	DATA	CRC CHECK	END
3.5 char times	1 CHAR	1 CHAR	n CHARs	L CHAR, H CHAR	3.5 char times

query $01	start bit H	start bit L	bit cnt H	bit cnt L				
resp $01	byte cnt	bit7...bit0	bit15...bit8	...				
resp $81	error code							
query $02	start bit H	start bit L	bit cnt H	bit cnt L				
resp $02	byte cnt	bit7...bit0	bit15...bit8	...				
resp $82	error code							
query $03	start reg H	start reg L	reg cnt H	reg cnt L				
resp $03	byte cnt	data H	data L	...				
resp $83	error code							
query $04	start reg H	start reg L	reg cnt H	reg cnt L				
resp $04	byte cnt	data H	data L	...				
resp $84	error code							
query $05	bit addr H	bit addr L	FF/00	00				
resp $05	bit addr H	bit addr L	FF/00	00				
resp $85	error code							
query $06	reg addr H	reg addr L	data H	data L				
resp $06	reg addr H	reg addr L	data H	data L				
resp $86	error code							
query $08	00	00	data H	data L				
resp $08	00	00	data H	data L				
resp $88	error code							
query $10	start reg H	start reg L	reg cnt H	reg cnt L	byte cnt	data H	data L	...
resp $10	start reg H	start reg L	reg cnt H	reg cnt L				
resp $90	error code							

query $45	start reg H	start reg L	reg pair cnt H	reg pair cnt L				...
resp $45	byte cnt	data H	data L	...				
resp $C5	error code							
query $46	start reg H	start reg L	reg cnt H	reg cnt L	byte cnt	data H	data L	...
resp $46	start reg H	start reg L	reg pair cnt H	reg pair cnt L				
resp $C6	error code							

2.5 Exception Responses

If the transmitter cannot execute a command issued by a query, the most significant bit in the response function field is set, and the data field contains an exception response, which explains why the transmitter cannot execute the command.

If the transmitter receives a query that will take over 250 ms it will respond with the normal reply even though the command has not completed. Any subsequent query from the host will result in a Slave Busy (06) response until the first command finishes processing.

Table 2-5 Exception Responses

Exception Response	Description	Explanation of Exception Response
01	Illegal function	The received message function is not an allowable action for the transmitter
02	Illegal data address	The address referenced in the data field is not an allowable address for the memory location
03	Illegal data value	The value referenced in the data field is not allowed in the addressed memory location
04	Slave Device Failure	An unrecoverable error occurred while the slave was attempting to perform the requested action.
06	Slave device is busy	The slave is engaged in processing a long duration command. The host should retransmit the message later when the slave is free.

2.6 Examples of Modbus Commands

2.6.1 Reading and Writing Floating Point Data

Floating point values must be read or written in a single command to a series of two consecutive registers. If half of a floating point register is written the 3095FB will return the Modbus exception Illegal Data Value(03). There are two ways to read a floating point register pair, using function 03/04 or function 69. When using function 03/04 the user must always read at least 2 registers to get a valid floating point number, unless they are reading a 32-bit floating point register. Function 69 reads a register pair (two consecutive 16 bit registers). Function 03 and function 04 are interchangeable when working with the 3095FB. There are two ways to write a 16-bit register pair, using function 16 and function 70. When writing to a 32-bit register either function 6 or function 16 can be used.

The first three examples show the Modbus message for reading a Differential Pressure (DP) of 100.00. The last four examples show the Modbus message for writing a DP upper operating limit of 230.00.

See Section 3.4 for information on changing the byte transmission order of the floating point registers.

Function 04: Reading Floating Point Data from a 16-bit Register Pair

	Address	Function	Starting register	# of registers	Error check
Query	01	04	01 90	00 02	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	04	42 C8 00 00	XXXX

Function 04: Reading Floating Point Data from a 32-bit Register

	Address	Function	Starting register	# of registers	Error check
Query	01	04	1C E8	00 01	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	04	42 C8 00 00	XXXX

Function 69: Reading Floating Point Data using a 32-bit Function

	Address	Function	Starting register	# of register pairs	Error check
Query	01	45	01 90	00 01	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	45	04	42 C8 00 00	XXXX

Function 16: Writing Floating Point Data in a 16-bit Register Pair

	Address	Function	Starting register	# of registers	byte count	Register data bytes	Error check
Query	01	10	01 A0	00 02	04	43 66 00 00	XXXX
	Address	Function	Starting register	# of registers	Error check		
Response	01	10	01 A0	00 02	XXXX		

Function 06: Writing Floating Point Data in a single 32-bit Register

	Address	Function	Starting register	Register data bytes	Error check
Query	01	06	1C F0	43 66 00 00	XXXX
	Address	Function	Starting register	Register data bytes	Error check
Response	01	06	1C F0	43 66 00 00	XXXX

Function 16: Writing Floating Point Data in a 32-bit Register

	Address	Function	Starting register	# of registers	byte count	Register data bytes	Error check
Query	01	10	1C F0	00 01	04	43 66 00 00	XXXX
	Address	Function	Starting register	# of registers	Error check		
Response	01	10	1C F0	00 01	XXXX		

Function 70: Writing Floating Point Data using a 32-bit Function

	Address	Function	Starting register	# of register pairs	byte count	Register data bytes	Error check
Query	01	46	01 A0	00 01	04	43 66 00 00	XXXX
	Address	Function	Starting register	# of registers pairs	Error check		
Response	01	46	01 A0	00 01	XXXX		

2.6.2 Reading and Writing 16 Bit Registers

Function 04: Reading 16 Bit Register Data

	Address	Function	Starting register	# of registers	Error check
Query	01	04	00 12	00 01	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	02	00 86	XXXX

Function 16: Writing 16 Bit Register Data

	Address	Function	Starting register	# of registers	byte count	Register data bytes	Error check
Query	01	10	00 30	00 01	02	00 24	XXXX
	Address	Function	Starting register	# of registers	Error check		
Response	01	10	00 30	00 01	XXXX		

2.6.3 Reading and Writing Bit Registers

If the returned input quantity is not a multiple of eight bits, the remaining bits in the final data byte will be padded with zeros (toward the high end of the byte). In this case all four of the bits that were asked for were ON (0000 1111). The rest of the byte was padded with zeros.

Function 02: Reading Bit Registers

	Address	Function	Starting register	# of registers	Error check
Query	01	02	00 3A	00 04	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	02	01	0F	XXXX

When forcing a coil there are only two valid values that can be sent to the coil. The value $FF00 will force the coil to 1(ON) and $0000 will force the coil to 0(OFF).

Function 05: Forcing a Single Coil

	Address	Function	Coil address	Force data	Error check
Query	01	05	00 02	FF 00	XXXX
	Address	Function	Coil address	Force data	Error check
Response	01	05	00 02	FF 00	XXXX

3.0 Communications

3.1 Communication Options

The Transmitter Polling Address is used to identify the Modbus slave device to the host device. No two transmitters on the same multidrop loop can have the same Transmitter Polling Address.

The Turnaround Delay Time is the time in milliseconds that the 3095FB will wait to respond after receiving a query from the host. If the Turnaround Delay Time is set to zero the 3095FB will respond as fast as it can. With a simple polling of the PVs and Status Registers the 3095FB will respond after about 6 milliseconds. This may be too fast for some hosts. The default Turnaround Delay Time is 50 milliseconds.

Table 3-1 Communication Options

Modbus Access			DESCRIPTION		
Address	Address Type	Attributes	Functional Area	Data / Control	Default
0016	Holding register	R/W, WP	Communi-cations Options	Transmitter Polling Address range: 1 - 247	1
0131	Holding register	R/W, WP		Turnaround Delay Time (ms) range: 0 - 200 ms	50 ms

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 in the *Modbus Protocol Guide*)

3.2 Communication Statistics

The following registers provide some communication statistics that may be used to gather diagnostic information. The communications statistics will be reset when the 3095FB loses power or if a Master Reset is performed. The registers will be reset to zero when the value of the registers exceed the maximum value for an unsigned 16 bit number.

Table 3-2 Communication Statistics

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0145	Input register	RO	Communication Statistics	Framing Error Count
0146	Input register	RO		Noise Error Count
0147	Input register	RO		Overrun Error Count
0148	Input register	RO		CRC Error Count
0149	Input register	RO		Busy Count
0150	Input register	RO		Good Message Count

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

3.3 Write Protect Jumper

Once the transmitter has been configured, the configuration data can be protected by moving the write protection (WP) to the ON position. This jumper is located on the Output Electronics Board.

If the WP jumper is ON and the host tries to write to a register location that has the attribute Write Protected (WP), the Modbus exception Illegal Data Address (02) will be returned.

3.4 Floating Point Formats (available for 3095FB output board software Rev. 107 or later)

The 3095FB has the capability to rearrange the transmission byte order of the floating point registers. The floating point registers will still be in IEEE 754 format, only the transmission byte order will change. Writing the Floating Point Format Code affects both the reading and writing of the floating point registers. All the floating point registers in the transmitter are affected by this register. The available Floating Point Formats are shown in Table 3-5. Changing the Floating Point Format Code will not affect the transmission byte order of the integer data.

Table 3-3 Floating Point Format Code

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0132	Holding register	RW, WP	Communi-cation	Floating Point Format Code

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Table 3-4 Floating Point Format

	Byte Order			
Notation	A	B	C	D
IEEE 754 Floating Point Format	SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM
Example Number (100.25)	$42	$C8	$80	$00

Legend: S = sign bit; E= exponent bits; M = mantissa bits

Table 3-5 Available Floating Point Formats

Floating Point Format Code	Byte Transmission Order	Example Number (100.25)
0 (default)	A B C D	$42 C8 80 00
1	C D A B	$80 00 42 C8
2	D C B A	$00 80 C8 42
3	B A D C	$C8 42 00 80

Below is an example of a Modbus message for reading DP (register 401) of 100.25 for each of the Floating Point Format Codes.

Table 3-6 Floating Point Format Code = 0

	Address	Function	Starting register	# of registers	Error check
Query	01	04	01 90	00 02	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	04	42 C8 80 00	XXXX

Table 3-7 Floating Point Format Code = 1

	Address	Function	Starting register	# of registers	Error check
Query	01	04	01 90	00 02	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	04	80 00 42 C8	XXXX

Table 3-8 Floating Point Format Code = 2

	Address	Function	Starting register	# of registers	Error check
Query	01	04	01 90	00 02	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	04	00 80 C8 42	XXXX

Table 3-9 Floating Point Format Code = 3

	Address	Function	Starting register	# of registers	Error check
Query	01	04	01 90	00 02	XXXX
	Address	Function	Byte count	Register data bytes	Error check
Response	01	04	04	C8 42 00 80	XXXX

4.0 Sensor and Transmitter Information

4.1 Overview of Sensor and Transmitter Information

The sensor and transmitter information consists of integer data and ASCII character strings that provide data about the transmitter. The user can review or change sensor and transmitter information without affecting the operation of the transmitter. The transmitter information that are 8 bit values are stored in the Least Significant Byte of their 16 bit register space. For instance the value $24 would be stored as $0024.

4.2 Transmitter Info

Table 4-1 Transmitter Info

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0017	Input Register	RO	Materials of Construction	DP Sensor Range Code (U8) 2 -250 to 250 in H_2O @ 60 F 3 -830 to 830 in H_2O @ 60 F
0018	Input Register	RO		SP Sensor Range Code (U8) 3 0 to 800 psi 4 0 to 3,626 psi
0019	Input Register	RO		PT Sensor Range Code (U8) 2 -40 to 1200 F
0020	Input Register	RO		Module Isolator Code (U8) 2 316 Stainless Steel 3 Hastelloy C 4 Monel 5 Tantalum 15 Gold/Monel 253 Special
0021	Input Register	RO		Module Fill Fluid Code (U8) 1 Silicone 2 Inert 250 Not Used 253 Special
0022	Holding register	R/W, WP		flange material code (U8) 0 Carbon Steel 2 316 Stainless Steel 3 Hastelloy C^{TM} 4 Monel 24 Kynar 252 Unknown 253 Special

Table 4-1 Transmitter Info

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0023	Holding register	R/W, WP	Materials of Con-struction	flange type code (U8) 12 Conventional 13 Coplanar 14 Remote Seal 15 Lvl, 3 in, class 150 (ANSI) 16 Lvl, 4 in, class 150 (ANSI) 17 Lvl, 3 in, class 300 (ANSI) 18 Lvl, 4 in, class 300 (ANSI) 19 Lvl, DN 80, PN 40 20 Lvl, DN 100, PN 40 21 Lvl, DN 100, PN 10 / 16 22 Lvl, 2 in, class 150 (ANSI) 23 Lvl, 2 in, class 300 (ANSI) 24 Lvl, DN 50, PN 6 25 Lvl, DN 50, PN 40 250 Not Used 252 Unknown 253 Special
0024	Holding register	R/W, WP		drain/vent code (U8) 2 316 Stainless Steel 3 Hastelloy C^{TM} 4 Monel 251 None 252 Unknown 253 Special
0025	Holding register	R/W, WP		O-ring gasket material (U8) 10 PTFE (Teflon ^{R}) 11 Viton 12 Buna-N 13 Ethyl-Prop 250 Not Used 252 Unknown 253 Special

Table 4-1 Transmitter Info

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0026	Holding register	R/W, WP	Materials of Con-struction	remote seal type (U8) 2 CTW 3 EFW 4 PFW 5 RFW 6 RTW 7 SCW 8 SSW 9 High Temperature 10 FFW 11 UCW 12 TSW 250 Not Used 251 None 252 Unknown 253 Special
0027	Holding register	R/W, WP		remote seal fill fluid (U8) 2 Silicone Oil 3 Syltherm 800 4 Inert 5 Glycerin / H20 6 Prop Gly / H20 7 Neobee-M20 251 None 252 Unknown 253 Special
0028	Holding register	R/W, WP		remote seal isolator material (U8) 2 316 Stainless Steel 3 Hastelloy C 5 Tantalum 9 Cobalt-Chromium-Nickel 250 Not Used 251 None 252 Unknown 253 Special

Table 4-1 Transmitter Info

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0029	Holding register	R/W, WP	Materials of Con-struction	number of remote seals (U8) 1 One Seal 2 Two Seal 250 Not Used 251 None 252 Unknown
0030, 0031	Holding register	R/W, WP	transmitter info	user-entered date (U24) day/month/year i.e. April 26, 1996 = 0x001a, 0x0460
0032-0035	ASCII	R/W, WP		user-entered tag (U8x8)
0036-0043	ASCII	R/W, WP		user-entered descriptor(U8x16)
0044-0059	ASCII	R/W, WP		user entered message (U8x32)

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

4.3 Identify Transmitter

Table 4-2 Identify Transmitter

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0001	Input register	RO	identify transmitter	Manufacturer's Code (U8) 38 Rosemount
0002	Input register	RO		Transmitter Type Code (U8) 31 3095FB Multivariable Transmitter with Modbus Protocol
0003	Input register	RO		Output Board Software Rev Level (U8 + U8) MSB = integer part LSB = decimal part i.e. 0x6803 = rev. 104.3
0004	Input register	RO		Sensor Module Software Rev Level (U8)
0005, 0006	Input register	RO		Sensor Module Serial Number (U24)
0007, 0008	Input register	RO		Transmitter Serial Number (U24)
0009	Input register	RO		Hardware Rev Level (U8)
0010	Input register	RO		Modbus Specific Rev Level (U8)
0011	Input register	RO		Sensor Type (U8) %xxxx xxx1 absolute SP %xxxx xxx0 gage SP

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

5.0 Process Variables

5.1 Process Variables and Process Variable Unit Codes

Floating point values of process variables, and integer unit codes for the corresponding measurement units can be read from the registers shown below. The unit codes are 8 bit integers that are stored in the Least Significant Byte of their 16 bit register. For instance if the value $0001 is stored in register 40060 it would represent the unit code 1 (Inches of H_2O@ 60^o F).

Table 5-1 Process Variables

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0401, 0402	FP register	RO	PVs	DP
0403, 0404	FP register	RO		SP
0405, 0406	FP register	RO		PT

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Table 5-2 Unit Codes

Modbus Access		DESCRIPTION		
Address	Attributes	Variable	Integer Codes	Default
0060	R/W, WP	Differential Pressure	1 inches of water at 60 F 2 pascals 3 kilopascals 6 inches of water at 68 F	1
0061	R/W, WP	Static Pressure	3 kilopascals 4 Mega Pascals 5 Pounds per Square Inch	5

Table 5-2 Unit Codes

Modbus Access		DESCRIPTION			
Address	Attributes	Variable	Integer Codes		Default
0062	R/W, WP	Process Tempera-ture	20 21	Degrees Celsius Degrees Fahrenheit	21

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

5.2 Process Variable Limit Checking

There are essentially four different limits for each process variable. These are the Upper Range Limit(URL), Lower Range Limit(LRL), Upper Operating Limit(UOL), and the Lower Operating Limit(LOL). The host can only change the Upper and Lower Operating Limits. The Upper Range Limit and the Lower Range Limit are fixed and depend on the range of the sensor module.

The UOL and LOL cannot cross each other. Here is the formula that the transmitter uses to validate the operating limits sent by the host. The 3095FB will return the Modbus exception Illegal Data Value(03) if invalid operating limits are sent.

Lower Operating Limit:

LRL <= LOL <= (UOL - min_span)

Upper Operating Limit:

(LOL + min_span) <= UOL <= URL

min_span = URL/100

Table 5-3 Process Variable Sensor Limits

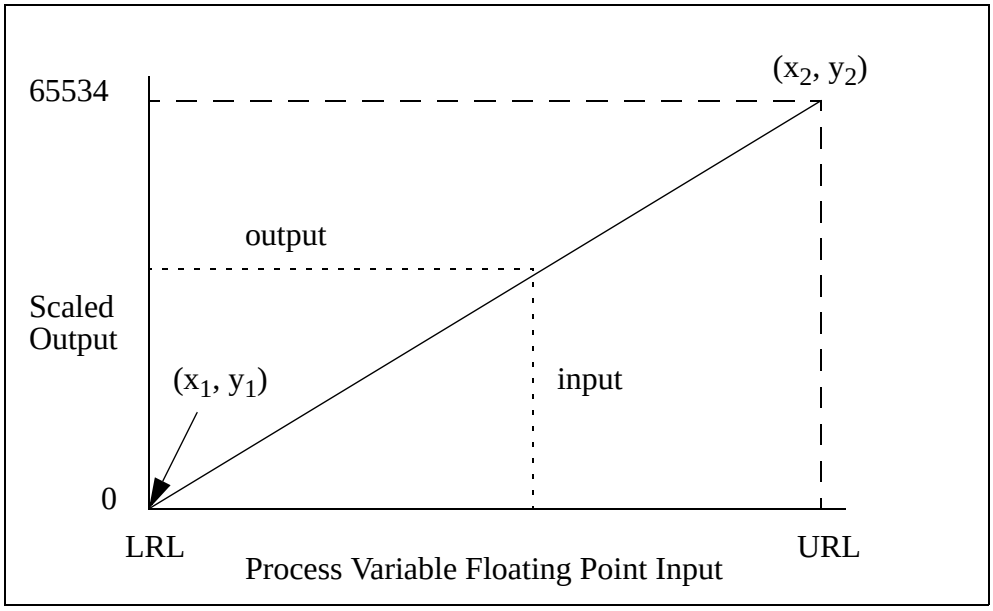
Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0413, 0414	FP register	RO	Sensor limits	DP upper range limit
0415, 0416	FP register	RO		DP lower range limit
0417, 0418	FP register	R/W, WP		DP upper operating limit
0419, 0420	FP register	R/W, WP		DP lower operating limit
0421, 0422	FP register	RO		SP upper range limit
0423, 0424	FP register	RO		SP lower range limit
0425, 0426	FP register	R/W, WP		SP upper operating limit
0427, 0428	FP register	R/W, WP		SP lower operating limit
0429, 0430	FP register	RO		PT upper range limit
0431, 0432	FP register	RO		PT lower range limit
0433, 0434	FP register	R/W, WP		PT upper operating limit
0435, 0436	FP register	R/W, WP		PT lower operating limit

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3located in the *Modbus Protocol Guide*)

5.3 Integer Scaling of Process Variables (available for 3095FB output board software Rev. 107 or later)

Integer scaling allows the 3095FB to represent the process variables (DP, PT, and SP) as 16 bit integers.

Figure 5-1 Scaled Integers



Where: x_1 = Minimum Measured Process Variable
x_2 = Maximum Measured Process Variable
y_1 = Minimum Scaled Integer Value
y_2 = Maximum Scaled Integer Value

Table 5-4 Process Variable Scaled Integers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0116	Input register	RO	PV Scaled Integers	DP
0117	Input register	RO		SP
0118	Input register	RO		PT

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3located in the *Modbus Protocol Guide*)

5.3.1 Defining Scaled Integers

There are two separate ways to configure the Scaled Integers. The next two sections describe the two methods. A holding register is provided to allow the user to choose which of the following methods is used to configure the Scaled Integers. Only the registers needed for that method will be enabled. The Modbus error ILLEGAL DATA VALUE will be returned if an attempt is made to write to a disabled register. See for implementation examples.

If the Scaled Integers are disabled, all the Scaled Integers will be set to 65535.

Table 5-5 Scaled Integer Method

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0204	Holding Register	R/W, WP		Scaled Integer Method 0 = Disable Scaled Integers (default) 1= Method 1 2= Method 2

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3)

5.3.1.1 Method 1: Define the Endpoints

The host can configure the scaled integers just by defining the endpoints (x_1,y_1 and x_2,y_2) for the line shown Figure 5-1 .

The 3095FB will reject endpoints that do not conform to the following limits.

Table 5-6 Limits for Defining Endpoints

Variable	Valid Range	Type	Description
x_1	$LRL \leq x_1 \leq (x_2 - min\_span)$	F32	Minimum Measured Value
x_2	$(x_1 + min\_span) \leq x_2 \leq URL$	F32	Maximum Measured Value
y_1	$0 \leq y_1 < y_2$	U16	Minimum Scaled Integer
y_2	$y_1 < y_2 \leq 65534$	U16	Maximum Scaled Integer

The values for x_1 and x_2 should be configured for the current unit codes. If the host changes unit codes after the scaled integers are configured using Method 1, the values for x_1 and x_2 will be changed to reflect the new unit codes.

Table 5-7 PV Scaled Integer Y Value

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0188	Holding register	RW	PV Scaled Integers	DP_y1
0189	Holding register	RW		DP_y2
0190	Holding register	RW		SP_y1
0191	Holding register	RW		SP_y2
0192	Holding register	RW		PT_y1
0193	Holding register	RW		PT_y2

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Table 5-8 PV Scaled Integer X Value

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0469, 0470	FP register	RW	PV Scaled Integers	DP_x1
0471, 0472	FP register	RW		DP_x2
0473, 0474	FP register	RW		SP_x1
0475, 0476	FP register	RW		SP_x2
0477, 0478	FP register	RW		PT_x1
0479, 0480	FP register	RW		PT_x2

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3)

5.3.1.2 Method 2: Define Scale and Offset

To configure the integer scaling of PVs using Method 2, follow this procedure:

1. Set a maximum integer.

2. Calculate the scale factor for each PV.

3. Calculate the offset for each PV

4. Write the values calculated above to the corresponding registers.

The following formula is used to calculate the scale factor and offset:

[Equation 2] y = A(x) - (B - 32,768)

Where: y = scaled integer output (see Table 5-4)
x = measured value of PV in current units (see Table 5-1)
A = scale factor (see Table 5-10)
B = offset of scaled integer (see Table 5-10)

Table 5-9 PV Scaled Integer Maximum Integer

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
125	Holding register	RW	PV Scaled Integers	Maximum Integer (applies to all PVs)

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Maximum Integer: The maximum integer is the upper limit for the scaled integer output. If the measured value derives an integer higher than the maximum integer or lower than 0, the maximum integer plus one will be returned. Also, if any of the error conditions described in Section 5.3.2 occur the affected scaled integers will be set to the maximum integer plus one. The maximum integer can be any value from 0 to 65534. The default maximum integer is 65534.

Table 5-10 Scale Factors and Offsets

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0198	Holding register	RW	PV Scaled Integers	DP Scale Factor
0199	Holding register	RW		DP Offset
0200	Holding register	RW		SP Scale Factor
0201	Holding register	RW		SP Offset
0202	Holding register	RW		PT Scale Factor
0203	Holding register	RW		PT Offset

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3)

Scale Factor: The scale factor is the linear slope of the line represented in Figure 5-1 . The scale factor is the ratio of the change of the scaled integers compared to the change of the measured process variable.

The Scale Factor and Offset must be configured for the current unit codes. If the unit codes are changed the Scale Factor and Offset must be recalculated.

[Equation 3] $A = (y_2 - y_1)/(x_2 - x_1)$

Offset: The offset is calculated using [Equation 4].

[Equation 4] $B = A(x_1) + 32768 - y_1$

5.3.2 Scaled Integer Error Conditions

If an error occurs the scaled output will be set to either $y_2 + 1$ (Method 1) or maximum integer + 1 (Method 2).

5.3.2.1 General Exceptions that Apply to All Scaled Outputs

Table 5-11 General Sensor Errors

Attributes	Description
AD	ST signal is above Upper Internal Limit
AD	ST signal is below Lower Internal Limit
AD	Sensor module is NOT updating
AD	Sensor microprocessor does not respond

If the calculated scaled output is greater than y_2 (Method 1) or less than y_1 (Method 1) the value returned is $y_2 + 1$.

If the calculated scaled output is greater than the maximum integer (Method 2) or less than zero (Method 2) the value returned is maximum integer + 1.

5.3.2.2 Exceptions that Apply to DP

The following exceptions apply only to the differential pressure.

Table 5-12 DP Exceptions

Attributes	Description
AD	DP signal above Upper Range Limit + 10%
W	DP signal above Upper Range Limit
W	DP signal below Lower Range Limit
AD	DP signal below Lower Range Limit - 10%
AD	SP signal above Upper Range Limit + 10%
AD	SP signal below Lower Range Limit - 10%
AD	SP sensor shorted
AD	SP signal is unreasonable - open bridge

5.3.2.3 Exceptions that Apply to SP

The following exceptions apply only to the static pressure.

Table 5-13 SP Exceptions

Attributes	Description
AD	SP signal above Upper Range Limit + 10%
W	SP signal above Upper Range Limit
W	SP signal below Lower Range Limit
AD	SP signal below Lower Range Limit - 10%
AD	SP sensor shorted
AD	SP signal is unreasonable - open bridge

5.3.2.4 Exceptions that Apply to PT

The following exceptions apply only to the process temperature.

Table 5-14 PT Exceptions

Attributes	Description
AD	PT signal above Upper Range Limit + 10%
W	PT signal above Upper Range Limit
W	PT signal below Lower Range Limit
AD	PT signal below Lower Range Limit - 10%

5.4 Untrimmed and Corrected Process Variables

A 24 bit integer will be provided that shows an integer representation of the process variables before they have been trimmed and damped.

The formula for interpreting the 24 bit numbers is shown below.

$$output = \frac{(input - 8388608)}{7601920} * URL$$

Where:

input = Untrimmed and Corrected Process Variable
output = Scaled Process Variable

Table 5-15 Untrimmed and Corrected Process Variables

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0076, 0077	Input register	RO	PVs Untrimmed and Corrected	DP (3 bytes)
0078, 0079	Input register	RO		SP (3 bytes)
0080, 0081	Input register	RO		PT (3 bytes)

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

5.5 Process Variable Default Values (PT)

The 3095FB allows for the enabling and disabling of the PT input. To disable the PT input turn the RTD present coil OFF. Likewise to enable the PT input turn the RTD present coil ON. If the RTD present coil is OFF the User Entered PT Value is used.

When entering a User Entered PT Value the current PT unit code is used. If the current PT unit code is ^{o}F then entering a floating point value of 60 in the register pair 455, 456 would set the User Entered PT Value to 60 ^{o}F. If at a later time the PT unit code is changed to ^{o}C then the User Entered PT Value will read as 15.556 ^{o}C.

Table 5-16 RTD Present

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0004	Coil	R/W, WP		RTD present (0=not present, 1 = present)

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Table 5-17 User Entered PT Value

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0455, 0456	FP register	R/W, WP		User Entered PT Value Default = 60 ^{o}F

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

6.0 Calibration

6.1 Calibration

Each process variable in the 3095FB [differential pressure (DP), static pressure (SP), and process temperature (PT)] can be trimmed. Two types of trims can be performed; offset (zero) trim and slope (span) trim. To perform a trim the user only has to write the applied value to the Modbus register while applying an accurate pressure or temperature to the 3095FB. For accurate trimming the user should wait for the process variable to stabilize before attempting to trim the transmitter. The 3095FB will do all the calculations needed to trim the transmitter. **The host should never write the offset (zero) and slope (span) trims at the same time.**

For example, if the user wants to trim the DP from 0 to 100 inches of H_2O@60 F there are four steps.

1. Apply the offset(zero) DP to the transmitter. In this case apply 0 inches of H_2O@60 F and wait for the transmitter to stabilize.
2. Write the IEEE 754 floating point number to the register pair 437, 438. In this case write a zero to the register pair.
3. Apply the slope(span) DP to the transmitter. In this case apply 100 inches of H_2O@60 F and wait for the transmitter to stabilize.
4. Write the IEEE 754 floating point number to the register pair 439,440. In this case write the number 100 to the register pair.

Table 6-1 Calibration

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0437, 0438	FP register	R/W, WP	DP calibration	DP offset (zero)
0439, 0440	FP register	R/W, WP		DP slope (span)
0443, 0444	FP register	R/W, WP	SP calibration	SP offset (zero)
0445, 0446	FP register	R/W, WP		SP slope (span)

Table 6-1 Calibration

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0449, 0450	FP register	R/W, WP	PT calibration	PT offset (zero)
0451, 0452	FP register	R/W, WP		PT slope (span)

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

6.1.1 Calibration Flag

A Modbus coil has been provided as a way of flagging the transmitter as being in a Calibration state. This coil is used only for informational use and does not affect the internal operation of the 3095FB. The host has complete control of the Calibration Flag. When the Calibration Flag is set, the corresponding status bit will turn ON.

It is recommended that this flag be turned on at the start of calibration, and then turned off when the calibration is complete. The Calibration Flag is useful if for some reason the person performing a calibration on the 3095FB gets called away in the middle of the calibration. The 3095FB may be in an unknown state, such as vented to atmosphere. If the Calibration Flag is set, the host that is polling the 3095FB will be able to see the Calibration status bit and mark the incoming data as unreliable.

Table 6-2 Calibration Flag

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0003	Coil	R/W, WP	Calibration	Calibration Flag

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

6.2 Damping

A damping factor can also be entered for each process variable. The damping will smooth the process variable reading when there are rapid input variations. The following damping values (in seconds) are available. The underlined value is the default.

0.108 0.216 0.432 <u>0.864</u> 1.728 3.456 6.912 13.824 27.648

If the new damping value, sent by the host, is not one of the valid options, the closest damping value will be selected. Only values of 0 to 30 seconds will be accepted by the 3095FB. If the value is outside of this range a Modbus exception Illegal Data Value (03) will be returned.

Table 6-3 Damping

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0441, 0442	FP register	R/W, WP	Damping	DP damping
0447, 0448	FP register	R/W, WP		SP damping
0453, 0454	FP register	R/W, WP		PT damping

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

6.3 Restore Factory Trim Defaults

Triggering the following coils will cause the 3095FB to revert to the Factory Trim Defaults. The 3095FB must then be recalibrated.

Table 6-4 Reset Factory Trim Defaults

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0031	Coil	R/W, WP	Reset Trim to Factory Defaults	DP
0032	Coil	R/W, WP		SP
0033	Coil	R/W, WP		PT

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

7.0 LCD Display Configuration

If the 3095FB includes an optional LCD display, the user may select which configuration parameters to display. This is accomplished by the use of the display bit map. The rate at which the LCD display is updated is also configurable between one and ten seconds.

Table 7-1 Transmitter Info

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0126	Holding register	R/W, WP	LCD	LCD Update Rate (1 - 10 seconds)
0127, 0128	Holding register	R/W, WP		LCD Display Bit Mask 0x0000 0001 Differential Pressure 0x0000 0002 Static Pressure 0x0000 0004 Process Temperature 0x0000 0008 Communication Setup

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

8.0 Exception Handling

There are a number of exceptions that may occur. The severity of these may range from a warning to a critical error. The LCD (if present) will display the error condition depending on the attributes of the exception. The following tables define the criteria and list the types of alarms and their attributes.

8.1 Diagnostic Status Bits

There are a number of diagnostic status bits that can give information about the status of the transmitter. The user can read the status bits as discrete inputs, input registers, or as floating point registers. This gives the user a variety of ways to get the status of the transmitter. These registers contain the exact same information. The status registers are placed next to the Floating Point PVs. **In a polling environment the host should retrieve the PVs and the Status Registers in a single query.** Table 8.1, on page 50 shows the register layout of the diagnostic status bits in each form (discrete input, input register, and floating point register). **The floating point status registers are in a bit mapped format.**

A value of zero will indicate that the condition is FALSE (OFF), and a value of one will indicate that the condition is TRUE (ON). All reserved bits will be forced to FALSE (OFF).

Meaning of Attributes:
A = Critical Alarm State (Critical Alarm status bit is set)
W = Warning State (Warning status bit is set)
D = LCD will display exception

Table 8-1 Mapping of Status Bits to Coils, Input Registers, and Floating Point Registers

Discrete Input Address	Input Register Address	Floating Point Register Address	Bit Position	Attributes	Description
0050	0119	0407	15	D	Calibration Flag
0051			14		Critical Alarm: The PVs may not be valid
0052			13		Warning: The PVs are outside specification
0053			12	AD	DP signal above Upper Range Limit + 10%
0054			11	W	DP signal above Upper Range Limit
0055			10		DP signal above Upper Operating Limit
0056			9		DP signal below Lower Operating Limit
0057			8	W	DP signal below Lower Range Limit

Table 8-1 Mapping of Status Bits to Coils, Input Registers, and Floating Point Registers

Discrete Input Address	Input Register Address	Floating Point Register Address	Bit Position	Attributes	Description
0058	0119 (cont)	0407 (cont)	7	AD	DP signal below Lower Range Limit - 10%
0059			6	AD	SP signal above Upper Range Limit + 10%
0060			5	W	SP signal above Upper Range Limit
0061			4		SP signal above Upper Operating Limit
0062			3		SP signal below Lower Operating Limit
0063			2	W	SP signal below Lower Range Limit
0064			1	AD	SP signal below Lower Range Limit - 10%
0065			0	AD	SP sensor shorted
0066	0120	0408	15	AD	SP signal is unreasonable - open bridge
0067			14	AD	PT signal above Upper Range Limit + 10%
0068			13	W	PT signal above Upper Range Limit
0069			12		PT signal above Upper Operating Limit
0070			11		PT signal below Lower Operating Limit
0071			10	W	PT signal below Lower Range Limit
0072			9	AD	PT signal below Lower Range Limit - 10%
0073			8	AD	RTD is disconnected
0074			7	AD	ST signal is above Upper Internal Limit
0075			6	AD	ST signal is below Lower Internal Limit
Not Available as Discrete Inputs			5		*Reserved*
			4		*Reserved*
			3		*Reserved*
			2		*Reserved*
			1		*Reserved*
			0		*Reserved*
	0121	0409	15	AD	Sensor module is NOT updating

Table 8-1 Mapping of Status Bits to Coils, Input Registers, and Floating Point Registers

Discrete Input Address	Input Register Address	Floating Point Register Address	Bit Position	Attributes	Description
	0121	0409	15	AD	Sensor module is NOT updating
Not Available as Discrete Inputs	0121 (cont)	0409 (cont)	14		*Reserved*
			13	AD	Sensor microprocessor does not respond
			12	AD	Sensor board eeprom burn failure
			11	AD	Sensor hardware incompatible with software
			10	AD	Sensor CRC error (Static Region)
			9	AD	Sensor CRC error (Dynamic Region)
			8		*Reserved*
			7		*Reserved*
			6		Flash output board eeprom soft (recoverable) error
			5	AD	Flash output board eeprom hard (non recoverable) error
			4		Flash output board eeprom time out
			3		*Reserved*
			2	AD	Nonvolatile Database CRC error
			1		Write Protect Status
			0		*Reserved*

**These registers are available at multiple Modbus addresses (see Section 2.3 located in the Modbus Protocol Guide)

Note: Not all of the diagnostic status bits are available as a discrete inputs. The rest of the diagnostic status bits can be read as either an input register or as a floating point register.

8.1.1 Critical Alarm

The Critical Alarm status bit is linked to the status bits that could cause the PVs to be incorrect. When a status bit with the Attribute A (Alarm) is set the Critical Alarm status bit is also set.

8.1.2 Warning

The Warning status bit is linked to the status bits that signify that the transmitter may be outside of specification. When a Status Bit with the Attribute W (Warning) is set the Warning Status Bit is also set.

9.0 Diagnostics

9.1 Self Test

A Self Test will verify the integrity of the some of the crucial areas of nonvolatile memory.

Table 9-1 Self Test

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0001	Coil	R/W	Diagnos-tics	self test

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

The procedure for performing a Self Test is as follows:

1. Force the Self Test coil ON. The 3095FB will return a normal response. The Self Test takes approximately 500 ms.
2. Any errors that are detected will show up in the following status bits. The following diagnostic status bits will be set or cleared by the Self Test, Master Reset, or cycling power.

Description
Sensor CRC error (Static Region)
Sensor CRC error (Dynamic Region)
Nonvolatile Database CRC error

9.2 Master Reset

Activating the Master Reset coil performs a software reset of the 3095FB. This is similar to shutting off the power and then reapplying power. The Master Reset takes approximately 500 milliseconds to complete.

Table 9-2 Master Reset

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0002	Coil	R/W	Diagnos-tics	Master Reset

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*

9.3 Restoring Nonvolatile Database to Factory Defaults

Forcing the coils shown below to ON will reset the variables shown in the table below. **The transmitter must then be reset to ensure data integrity.**

Table 9-3 Restoring Nonvolatile Database

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0035	Coil	R/W, WP	Restore Nonvola-tile Data-base	Restore Modbus Section 1 Transmitter Address 1 Turnaround Delay Time 50 ms Calibration Flag OFF
0036	Coil	R/W, WP		Restore Modbus Section 2 Message 32 spaces Descriptor 16 spaces Transmitter Tag 8 spaces User Entered Date April 10, 1996

Table 9-3 Restoring Nonvolatile Database

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0037	Coil	R/W, WP	Restore Nonvolatile Database	Restore Sensor Section 1 DP unit code: Inches H20 @ 60 F SP unit code: psi PT unit code: F RTD present flag: ON User Entered PT Value: 60 F Lower Operating Limits: Lower Range Limit Upper Operating Limits: Upper Range Limit
0039	Coil	R/W, WP		Restore Trim Section 1 DP damping: .864 SP damping: .864 PT damping: .864 Scale Integer Method: 0 DP_y1: 0 DP_y2: 65534 SP_y1: 0 SP_y2: 65534 PT_y1: 0 PT_y2: 65534 DP_x1: -250 DP_x2: 250 SP_x1: 0 SP_x2: 800 PT_x1: -40 PT_x2: 400 Maximum Integer: 65534 DP Scale Factor: 131 DP Offset: 18 SP Scale Factor: 81 SP Offset: 32768 PT Scale Factor: 148 PT Offset: 26848
0041	Coil	R/W, WP	Restore Nonvolatile Database	Restore LCD Section 1 LCD Bit Mask: 0x0000 000f LCD Update Rate: 3 seconds

Table 9-3 Restoring Nonvolatile Database

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0049	Coil	R/W, WP	Restore Nonvola-tile Data-base	Restore Mapping Section Mapping Addresses

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Appendix A: Modbus Mapping Assignments by Data Types

Read/Write Coils

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0001	Coil	R/W	Diagnos-tics	Self Test
0002	Coil	R/W		Master Reset
0003	Coil	R/W, WP		Calibration Mode (set by host)
0004	Coil	R/W, WP		RTD present (0=not present, 1 = present)
0031	Coil	R/W, WP	Reset Trim to Factory Defaults	DP
0032	Coil	R/W, WP		SP
0033	Coil	R/W, WP		PT
0035	Coil	R/W, WP	Restore Nonvola-tile Data-base	Restore Modbus Section 1
0036	Coil	R/W, WP		Restore Modbus Section 2
0037	Coil	R/W, WP		Restore Sensor Section 1
0039	Coil	R/W, WP		Restore Trim Section 1
0041	Coil	R/W, WP		Restore LCD Section 1
0049	Coil	R/W, WP		Restore Mapping Section

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Read Only Discrete Inputs

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0050-0075	Coil	RO	Diagnos-tics	Status bits

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Floating Point Register Pairs

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0300-0400	FP register			*Reserved for future use*
0401, 0402	FP register	RO	PVs	DP
0403, 0404	FP register	RO		SP
0405, 0406	FP register	RO		PT
0407, 0408	FP register	RO	Diagnos-tics	Status Bytes
0409, 0410	FP register	RO		Status Bytes
0411, 0412	FP register	RO		Status Bytes
0413, 0414	FP register	RO	Sensor lim-its	DP upper range limit

Floating Point Register Pairs

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0415, 0416	FP register	RO	Sensor limits	DP lower range limit
0417, 0418	FP register	R/W, WP		DP upper operating limit
0419, 0420	FP register	R/W, WP		DP lower operating limit
0421, 0422	FP register	RO		SP upper range limit
0423, 0424	FP register	RO		SP lower range limit
0425, 0426	FP register	R/W, WP		SP upper operating limit
0427, 0428	FP register	R/W, WP		SP lower operating limit
0429, 0430	FP register	RO		PT upper range limit
0431, 0432	FP register	RO		PT lower range limit
0433, 0434	FP register	R/W, WP		PT upper operating limit
0435, 0436	FP register	R/W, WP		PT lower operating limit
0437, 0438	FP register	R/W, WP	DP calibration	DP offset
0439, 0440	FP register	R/W, WP		DP slope
0441, 0442	FP register	R/W, WP		DP damping

Floating Point Register Pairs

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0443, 0444	FP register	R/W, WP	SP calibration	SP offset
0445, 0446	FP register	R/W, WP		SP slope
0447, 0448	FP register	R/W, WP		SP damping
0449, 0450	FP register	R/W, WP	PT calibration	PT offset
0451, 0452	FP register	R/W, WP		PT slope
0453, 0454	FP register	R/W, WP		PT damping
0455, 0456	FP register	R/W, WP	User Entered PT	User Entered PT Value
0457, 0458	FP register	RO	PVs	ST
0469, 0470	FP register	RW	PV Scaled Integers	DP_x1
0471, 0472	FP register	RW		DP_x2
0473, 0474	FP register	RW		SP_x1
0475, 0476	FP register	RW		SP_x2
0477, 0478	FP register	RW		PT_x1
0479, 0480	FP register	RW		PT_x2

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3)

Input Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0001	Input register	RO	Identify transmitter	manufacturer's code (U8)
0002	Input register	RO		transmitter type code (U8)
0003	Input register	RO		output board software rev level (U8)
0004	Input register	RO		sensor module software rev level (U8+U8)
0005, 0006	Input register	RO		sensor module serial number (U32)
0007, 0008	Input register	RO		transmitter serial number (U24)
0009	Input register	RO		hardware rev level (U8)
0010	Input register	RO		Modbus specific rev level (U8)
0011	Input register	RO		Sensor Type (U8)
0012-0015	Input register	RO		Reserved

Input Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0017	Input register	RO	Transmitter Info	DP Sensor Range Code (U8)
0018	Input register	RO		SP Sensor Range Code (U8)
0019	Input register	RO		PT Sensor Range Code (U8)
0020	Input register	RO		Module Isolator Code (U8)
0021	Input register	RO		Module Fill Fluid Code (U8)
0076, 0077	Input register	RO	PVs Untrimmed and Corrected Counts	DP (U24)
0078, 0079	Input register	RO		SP (U24)
0080, 0081	Input register	RO		PT (U24)
0082, 0083	Input register	RO		ST (U24)
0084, 0115	Input register	RO		Reserved
0116	Input register	RO	PV Scaled Integers	DP
0117	Input register	RO		SP
0118	Input register	RO		PT
0119-0124	Input register	RO	Diagnostics	Status Bytes(U16)

Input Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0145	Input register	RO	Communication Statistics	Framing Error Count
0146	Input register	RO		Noise Error Count
0147	Input register	RO		Overrun Error Count
0148	Input register	RO		CRC Error Count
0149	Input register	RO		Busy Count
0150	Input register	RO		Good Message Count

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Holding Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0016	Holding register	R/W, WP	Transmitter Info	transmitter address
0022	Holding register	R/W, WP		flange material code (U8)
0023	Holding register	R/W, WP		flange type code (U8)
0024	Holding register	R/W, WP		drain/vent code (U8)

Holding Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0025	Holding register	R/W, WP	Transmit-ter info	O-ring gasket material (U8)
0026	Holding register	R/W, WP		remote seal type (U8)
0027	Holding register	R/W, WP		remote seal fill fluid (U8)
0028	Holding register	R/W, WP		remote seal isolator material (U8)
0029	Holding register	R/W, WP		number of remote seals (U8)
0030, 0031	Holding register	R/W, WP		user-entered date
0060	Holding register	R/W, WP	Modbus units codes for PVs	DP
0061	Holding register	R/W, WP		SP
0062	Holding register	R/W, WP		PT
0063-0075	Holding register	R/W, WP	Reserved	Reserved
0125	Holding register	R/W, WP	PV Scaled Integers	Maximum Integer
0126	Holding register	R/W, WP	LCD	LCD Update Rate
0127, 0128	Holding register	R/W, WP		LCD Display Bit Mask
0131	Holding register	R/W, WP	Communi-cations	Turnaround Delay Time
0132	Holding register	R/W, WP		Floating Point Format Code

Holding Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0188	Holding register	R/W, WP	PV Scaled Integers	DP_y1
0189	Holding register	R/W, WP		DP_y2
0190	Holding register	R/W, WP		SP_y1
0191	Holding register	R/W, WP		SP_y2
0192	Holding register	R/W, WP		PT_y1
0193	Holding register	R/W, WP		PT_y2
0198	Holding register	R/W, WP		DP Scale Factor
0199	Holding register	R/W, WP		DP Offset
0200	Holding register	R/W, WP		SP Scale Factor
0201	Holding register	R/W, WP		SP Offset
0202	Holding register	R/W, WP		PT Scale Factor
0203	Holding register	R/W, WP		PT Offset
0204	Holding register	R/W, WP		Scaled Integer Method

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

ASCII Character Strings

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0032-0035	ASCII	R/W, WP	Transmit-ter info	user-entered tag (U8x8)
0036-0043	ASCII	R/W, WP		user-entered descriptor(U8x16)
0044-0059	ASCII	R/W, WP		user entered message (U8x32)

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Appendix B: Modbus Mapping Assignments by Register

Coils and Discrete Inputs

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0001	Coil	R/W	Diagnos-tics	Self Test
0002	Coil	R/W		Master Reset
0003	Coil	R/W, WP		Calibration Mode (set by host)
0004	Coil	R/W, WP		RTD present (0=not present, 1 = present)
0031	Coil	R/W, WP	Reset Trim to Factory Defaults	DP
0032	Coil	R/W, WP		SP
0033	Coil	R/W, WP		PT
0035	Coil	R/W, WP	Restore Nonvola-tile Data-base	Restore Modbus Section 1
0036	Coil	R/W, WP		Restore Modbus Section 2
0037	Coil	R/W, WP		Restore Sensor Section 1
0039	Coil	R/W, WP		Restore Trim Section 1
0041	Coil	R/W, WP		Restore LCD Section 1
0049	Coil	R/W, WP		Restore Mapping Section
0050-0075	Coil	RO	Diagnos-tics	Status bits

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0001	Input register	RO	Identify transmitter	manufacturer's code (U8)
0002	Input register	RO		transmitter type code (U8)
0003	Input register	RO		output board software rev level (U8)
0004	Input register	RO		sensor module software rev level (U8+U8)
0005, 0006	Input register	RO		sensor module serial number (U32)
0007, 0008	Input register	RO		transmitter serial number (U24)
0009	Input register	RO		hardware rev level (U8)
0010	Input register	RO		Modbus specific rev level (U8)
0011	Input register	RO		Sensor Type (U8)
0012-0015	Input register	RO		Reserved
0016	Holding register	R/W, WP	Transmitter info	Transmitter Polling Address

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0017	Input register	RO	Transmitter Info	DP Sensor Range Code (U8)
0018	Input register	RO		SP Sensor Range Code (U8)
0019	Input register	RO		PT Sensor Range Code (U8)
0020	Input register	RO		Module Isolator Code (U8)
0021	Input register	RO		Module Fill Fluid Code (U8)
0022	Holding register	R/W, WP		flange material code (U8)
0023	Holding register	R/W, WP		flange type code (U8)
0024	Holding register	R/W, WP		drain/vent code (U8)
0025	Holding register	R/W, WP		O-ring gasket material (U8)
0026	Holding register	R/W, WP		remote seal type (U8)
0027	Holding register	R/W, WP		remote seal fill fluid (U8)
0028	Holding register	R/W, WP		remote seal isolator material (U8)
0029	Holding register	R/W, WP		number of remote seals (U8)
0030, 0031	Holding register	R/W, WP		user-entered date

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0032-0035	ASCII	R/W, WP	Transmit-ter info	user-entered tag (U8x8)
0036-0043	ASCII	R/W, WP		user-entered descriptor(U8x16)
0044-0059	ASCII	R/W, WP		user entered message (U8x32)
0060	Holding register	R/W, WP	Modbus units codes for PVs	DP
0061	Holding register	R/W, WP		SP
0062	Holding register	R/W, WP		PT
0063-0075	Holding register	R/W, WP	Reserved	Reserved
0076, 0077	Input reg-ister	RO	PVs Untrimmed and Cor-rected Counts	DP (U24)
0078, 0079	Input reg-ister	RO		SP (U24)
0080, 0081	Input reg-ister	RO		PT (U24)
0082, 0083	Input reg-ister	RO		ST (U24)
0084-0115	Input reg-ister	RO		Reserved
0116	Input reg-ister	RO	PV Scaled Integers	DP
0117	Input reg-ister	RO		SP
0118	Input reg-ister	RO		PT

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0119-0124	Input register	RO	Diagnostics	Status Bytes(U16)
0125	Holding register	R/W, WP	PV Scaled Integers	Maximum Integer
0126	Holding register	R/W, WP	LCD	LCD Update Rate
0127, 0128	Holding register	R/W, WP		LCD Display Bit Mask
0129, 0130	Input register	RO		Reserved
0131	Holding register	R/W, WP	Communications Options	Turnaround Delay Time
0132	Holding register	R/W, WP		Floating Point Format Code
0132-0144	Holding register	R/W		Reserved
0145	Input register	RO	Communication Statistics	Framing Error Count
0146	Input register	RO		Noise Error Count
0147	Input register	RO		Overrun Error Count
0148	Input register	RO		CRC Error Count
0149	Input register	RO		Busy Count
0150	Input register	RO		Good Message Count

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0188	Holding register	R/W, WP	PV Scaled Integers	DP_y1
0189	Holding register	R/W, WP		DP_y2
0190	Holding register	R/W, WP		SP_y1
0191	Holding register	R/W, WP		SP_y2
0192	Holding register	R/W, WP		PT_y1
0193	Holding register	R/W, WP		PT_y2
0198	Holding register	R/W, WP		DP Scale Factor
0199	Holding register	R/W, WP		DP Offset
0200	Holding register	R/W, WP		SP Scale Factor
0201	Holding register	R/W, WP		SP Offset
0202	Holding register	R/W, WP		PT Scale Factor
0203	Holding register	R/W, WP		PT Offset
0204	Holding register	R/W, WP		Scaled Integer Method
0205-0400				*Reserved for future use*

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0401, 0402	FP register	RO	PVs	DP
0403, 0404	FP register	RO		SP
0405, 0406	FP register	RO		PT
0407, 0408	FP register	RO	Diagnos-tics	Status Bytes
0409, 0410	FP register	RO		Status Bytes
0411, 0412	FP register	RO		Status Bytes
0413, 0414	FP register	RO	Sensor lim-its	DP upper range limit
0415, 0416	FP register	RO		DP lower range limit
0417, 0418	FP register	R/W, WP		DP upper operating limit
0419, 0420	FP register	R/W, WP		DP lower operating limit
0421, 0422	FP register	RO		SP upper range limit
0423, 0424	FP register	RO		SP lower range limit
0425, 0426	FP register	R/W, WP		SP upper operating limit

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0427, 0428	FP register	R/W, WP	Sensor limits	SP lower operating limit
0429, 0430	FP register	RO		PT upper range limit
0431, 0432	FP register	RO		PT lower range limit
0433, 0434	FP register	R/W, WP		PT upper operating limit
0435, 0436	FP register	R/W, WP		PT lower operating limit
0437, 0438	FP register	R/W, WP	DP calibration	DP offset
0439, 0440	FP register	R/W, WP		DP slope
0441, 0442	FP register	R/W, WP		DP damping
0443, 0444	FP register	R/W, WP	SP calibration	SP offset
0445, 0446	FP register	R/W, WP		SP slope
0447, 0448	FP register	R/W, WP		SP damping
0449, 0450	FP register	R/W, WP	PT calibration	PT offset
0451, 0452	FP register	R/W, WP		PT slope
0453, 0454	FP register	R/W, WP		PT damping
0455, 0456	FP register	R/W, WP	User Entered PT	User Entered PT Value

Input and Holding Registers (includes Floating Point and ASCII registers)

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
0457, 0458	FP register	RO	PVs	ST
0469, 0470	FP register	RW	PV Scaled Integers	DP_x1
0471, 0472	FP register	RW		DP_x2
0473, 0474	FP register	RW		SP_x1
0475, 0476	FP register	RW		SP_x2
0477, 0478	FP register	RW		PT_x1
0479, 0480	FP register	RW		PT_x2

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Appendix C: Modbus Mapping of 32-bit Floating Point Registers

32-bit Floating Point Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
7401	FP register	RO	PVs	DP
7402	FP register	RO		SP
7403	FP register	RO		PT
7404	FP register	RO	Diagnos-tics	Status Bytes
7405	FP register	RO		Status Bytes
7406	FP register	RO		Status Bytes
7407	FP register	RO	Sensor lim-its	DP upper range limit
7408	FP register	RO		DP lower range limit
7409	FP register	R/W, WP		DP upper operating limit
7410	FP register	R/W, WP		DP lower operating limit
7411	FP register	RO		SP upper range limit
7412	FP register	RO		SP lower range limit
7413	FP register	R/W, WP		SP upper operating limit
7414	FP register	R/W, WP		SP lower operating limit
7415	FP register	RO		PT upper range limit
7416	FP register	RO		PT lower range limit
7417	FP register	R/W, WP		PT upper operating limit
7418	FP register	R/W, WP		PT lower operating limit
7419	FP register	R/W, WP	DP calibra-tion	DP offset
7420	FP register	R/W, WP		DP slope
7421	FP register	R/W, WP		DP damping

32-bit Floating Point Registers

Modbus Access			DESCRIPTION	
Address	Address Type	Attributes	Functional Area	Data / Control
7422	FP register	R/W, WP	SP calibration	SP offset
7423	FP register	R/W, WP		SP slope
7424	FP register	R/W, WP		SP damping
7425	FP register	R/W, WP	PT calibration	PT offset
7426	FP register	R/W, WP		PT slope
7427	FP register	R/W, WP		PT damping
7428	FP register	R/W, WP	User Entered PT	User Entered PT Value
7429	FP register	RO	PVs	ST
7435	FP register	RW	PV Scaled Integers	DP_x1
7436	FP register	RW		DP_x2
7437	FP register	RW		SP_x1
7438	FP register	RW		SP_x2
7439	FP register	RW		PT_x1
7440	FP register	RW		PT_x2

*Attributes: R/W = Read/Write, RO = Read Only, WP = Write Protected
**These registers are available at multiple Modbus addresses (see Section 2.3 located in the *Modbus Protocol Guide*)

Appendix D: Scaled Integer Examples

Example 1: Configure DP for -250 to 250 inches of water at 60 F with a scaled integer range of 0 to 65,534

Method 1:

1. Configure the Scaled Integer Method for Method 1
2. Write a 0 to register DP_y1 (see Table 5-7)
3. Write a 65,534 to register DP_y2 (see Table 5-7)
4. Write a -250 to register DP_x1 (see Table 5-8)
5. Write a 250 to register DP_x2 (see Table 5-8)

Method 2:

1. Configure the Scaled Integer Method for Method 2
2. The Scale Factor = $(y_2 - y_1)/(x_2 - x_1)$ = (65534 - 0) / (250 - (-250)) = 131.068
   Since the Scale Factor must be an integer, the Scale Factor = 131
3. The Offset = (Scale Factor * x_1) - y_1 + 32768 = (131 * (-250)) - 0 +32768 = 18
4. Write a 65,534 to register Maximum Integer (see Table 5-9)
5. Write a 131 to register DP Scale Factor (see Table 5-10)
6. Write a 18 to register DP Offset (see Table 5-10)

Due to the conversion of the scale factor to an integer value, the actual limits are:

7. x_1 = (y_1 + (Offset - 32768)) / Scale Factor = (0 + (18 - 32768)) / 131 = -250.0
8. x_2 = (y_2 + (Offset - 32768)) / Scale Factor = (65534 + (18 - 32768)) / 131 = 250.26

Example 2: Configure DP for 0 to 100 inches of water at 60 F with a scaled integer range of 0 to 10,000

Method 1:

1. Configure the Scaled Integer Method for Method 1
2. Write a 0 to register DP_y1 (see Table 5-7)
3. Write a 10,000 to register DP_y2 (see Table 5-7)
4. Write a 0 to register DP_x1 (see Table 5-8)
5. Write a 100 to register DP_x2 (see Table 5-8)

Method 2:

1. Configure the Scaled Integer Method for Method 2
2. The Scale Factor = $(y_2 - y_1)/(x_2 - x_1)$ = (10,000 - 0) / (100 - 0) = 100
3. The Offset = (Scale Factor * x_1) - y_1 + 32768 = (100 * 0) - 0 +32768 = 32768
4. Write a 10,000 to register Maximum Integer (see Table 5-9)
5. Write a 100 to register DP Scale Factor (see Table 5-10)
6. Write a 32,768 to register DP Offset (see Table 5-10)

Section 4 Operation

The 3095FB User Interface (UI) Software is a PC-based package that performs configuration and maintenance functions for the 3095FB transmitter.

SAFETY MESSAGES

Instructions and procedures in this section may require special precautions to ensure the safety of the personnel performing the operations. Please refer to the following safety messages before performing an operation preceded by this symbol.

⚠WARNING

Explosions could result in death or serious injury.

- Do not remove the transmitter cover in explosive atmospheres when the circuit is live.
- Verify that the operating atmosphere of the transmitter is consistent with the appropriate hazardous locations certifications.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

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

- Make sure only qualified personnel perform the installation.

Electrical shock could cause death or serious injury. If the sensor is installed in a high-voltage environment and a fault or installation error occurs, high voltage may be present on the transmitter leads and terminals:

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

INSTALLATION AND INITIAL SETUP

The following are the minimum system requirements to install the UI Software:

- IBM-compatible PC
- Pentium 800 MHz personal computer or above
- Operating System: Microsoft© Windows™ NT, 2000 or XP
- CD-ROM
- 800 x 600 256 color display

Installing the UI Software

The UI Software package is available with or without the RS232-485 converter and connecting cables. The complete UI package contains the UI software CD-ROM, and one RS232-485 converter with cables for connecting the computer to the 3095.

1. Insert the 3095FB UI CD in the CD-ROM drive.
2. On MS Windows, click Start > Run.
3. Type D:\setup.exe in the prompt window and click OK.

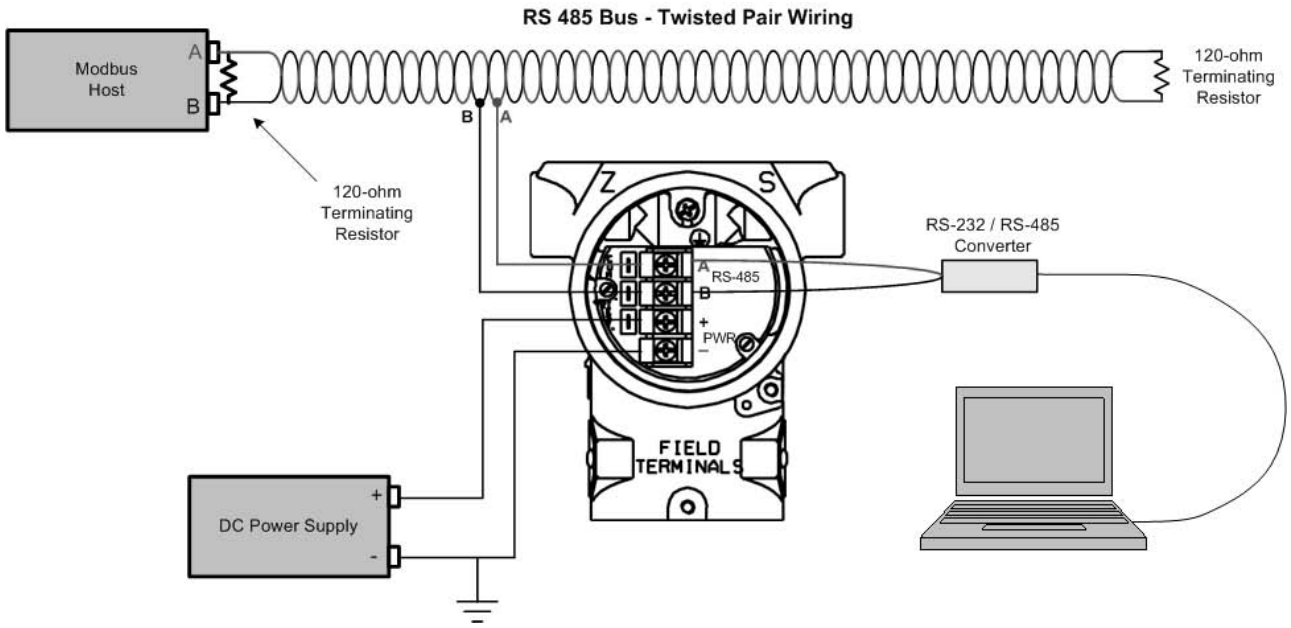
NOTE
If your CD-ROM is located at a drive letter other than “D”, type that letter instead of “D” in step 3 above (ex. E:\setup.exe).

4. Follow the onscreen instructions provided by installation wizard.

Connecting to a Personal Computer

Figure 4-1 shows how to interface a computer and 3095FB.

Figure 4-1. Connecting a Personal Computer to a Rosemount 3095FB



NOTE
The converter cables may be connected directly to the RS-485 bus or the transmitter terminals. Be sure to observe proper polarity.

1. Power the device as detailed in Section 2.
2. Connect the 9-pin RS232-485 converter to the 9-pin serial communications port on the PC.
3. Remove the cover of the transmitter above the side marked “Field Terminals.”

⚠WARNING

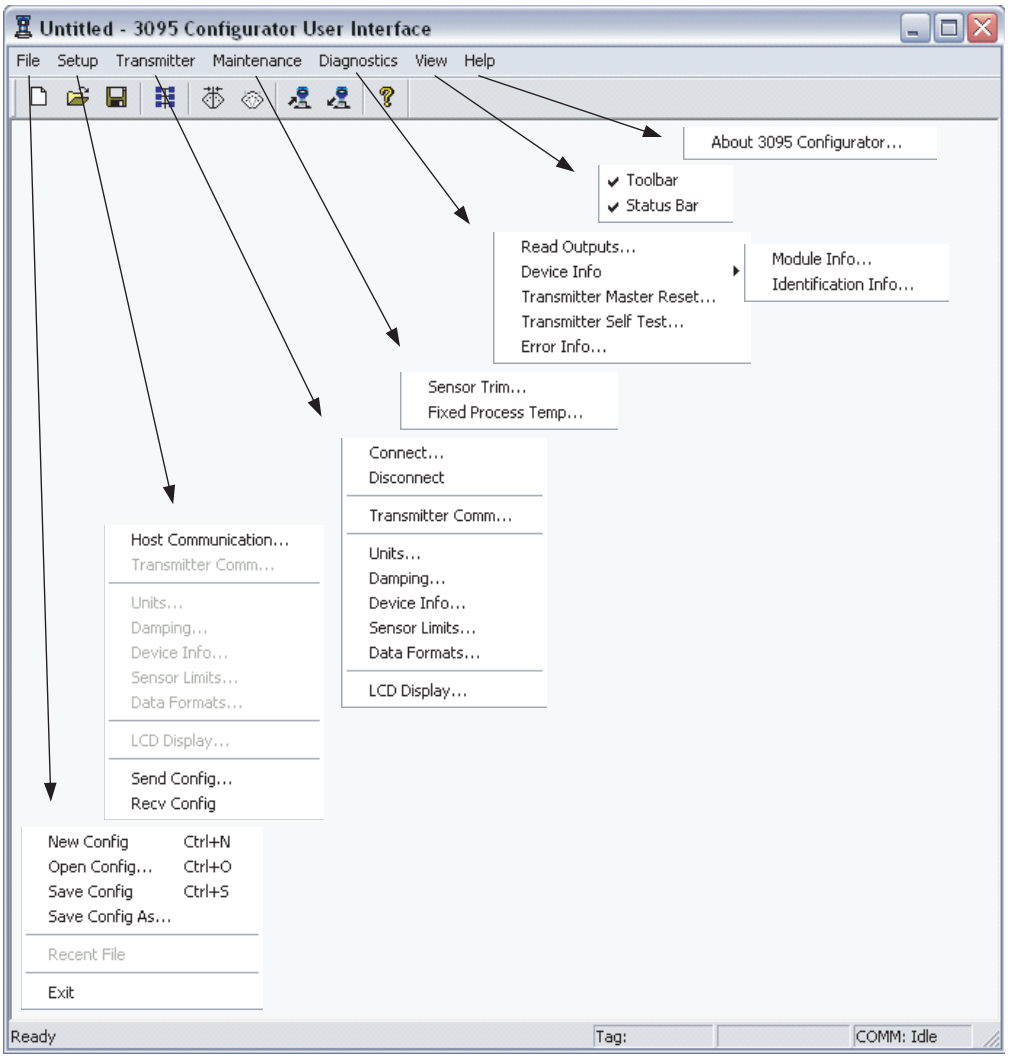
Explosions can cause death or serious injury. Do not remove the instrument cover in explosive atmospheres when the circuit is live.

4. Connect the red mini-grabber connector to the “A” terminal and the black mini-grabber connector to the “B” terminal.
5. Launch the 3095FB User Interface Software.

NAVIGATION & USE

Figure 4-2 shows the main screen that appears when a valid connection is established between the PC and the 3095FB transmitter.

Figure 4-2. 3095FB User Interface Software - Main Screen



Menu Categories

File

Contains screens for creating and saving 3095FB configuration files.

Setup

Contains screens for configuration while in “disconnect mode.”

Transmitter

Contains screens for configuring the transmitter that is currently connected to the PC via the RS232-485 connector.

Maintenance

Contains screens for calibrating the transmitter.

Diagnostics

Contains screens to assist in diagnostics and troubleshooting.

View

Enable/disable the toolbars that appear in the UI Software

Help

View the current revision of the UI Software.

Hot Keys

Hot keys provide convenient one-click access to nine of the more popular commands on the 3095FB UI Software.


Create a new configuration file


Open an existing configuration file


Save the active configuration file


Connect to the transmitter or change the multidrop address


Trim the sensors for each process variable


View or change the sensor limits for each process variable


Download the current configuration to the transmitter


Upload the current configuration from the transmitter


View the current revision of the UI software

CALIBRATION PROCEDURES

The following procedures outline the major steps for calibrating and configuring the 3095FB. Refer to the individual screen explanations for more detailed information.

NOTE
Whenever the UI software is about to change the configuration in the transmitter, a warning message will be displayed. It is impossible for the software to know whether the transmitter is on the bench or in the field, controlling extremely hazardous materials. These warnings are to remind you to put any automatic control loops to manual before changing or modifying the 3095FB configuration, and to return the control loops to automatic when you are finished with the configuration procedure.

Bench Configuration (Standard)

1. (If necessary) Select **Transmitter > Disconnect** to switch to disconnect mode.
2. (Optional) If a configuration file is already created, select **File > Open Config...** to retrieve those configuration settings.
3. Select **Setup > Units...**, to select the units of measure for each process variable.
4. Select **Setup > Damping...** to configure the damping for each process variable.
5. Select **Setup > Device Info...** to define basic transmitter information.
6. Select **Setup > Sensor Limits...** to define the upper and lower sensor limits for each process variable.
7. Click **Transmitter > Connect** to reestablish communication with the transmitter.
8. Select **Setup > Send Config...** to download the configuration to the transmitter.

Bench Calibration Procedure

After a transmitter is bench configured, the transmitter can be bench calibrated.

1. Select **Maintenance > Sensor Trim...** to trim each of the process variables.
2. Select **DP** and click **Offset and Slope Trim.**
3. Enter in the desired offset (zero) and slope (span) and click **Trim.**
4. Repeat for steps 3 and 4 for SP and PT process variables.

Field Calibration Procedure

To correct for mounting position effects, field calibrate the 3095FB after installation:

1. Select **Maintenance > Sensor Trim...** to trim each of the process variables.
2. Select **DP** and click **Offset.**
3. Enter in the desired offset value, and click **Trim.**
4. (Optional) Trim the SP sensor.
   a. Repeat steps 2 and 3 for the SP process variable if using an Absolute Sensor.
   b. For Gage Sensors, vent the GP sensor to atmosphere.

USER INTERFACE SOFTWARE SCREENS

This section goes over each of the screens found in the 3095FB User Interface Software.

File Menu

New Config

Create a completely new configuration file from scratch.

Open Config…

Load a configuration file that has previously been created and saved on the computer.

Save Config

Save the current configuration file under the same file name.

Save Config As…

Save the current configuration but with a new file name.

Exit

Shut down and exit the 3095FB UI Software.

Setup Menu

Setup > Host Communications…

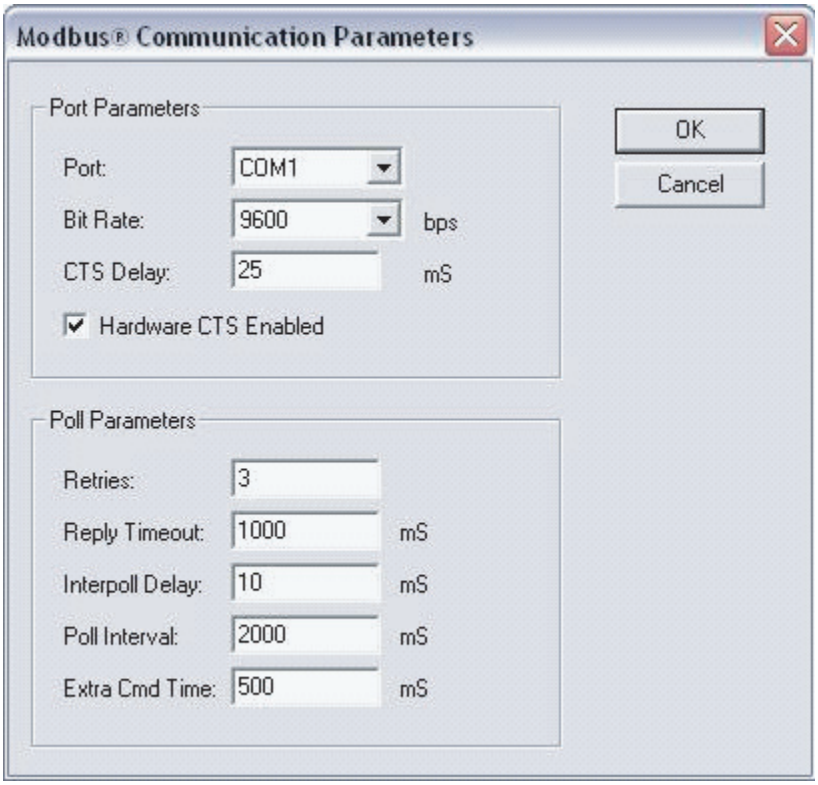
Port Parameters:

- **Port:** Specifies the serial port on the PC that the RS232-485 converter connects to. COM1 is the most common port in most laptop PCs.
- **Bit Rate:** Specifies the baud rate for the PC serial communication port. This baud rate must match the transmitter's baud rate as selected by the jumper positions on the electronics comm. board (see page 2-12).
- **CTS Delay:** Specifies the delay before a Clear-To-Send message is sent out. (Valid range is 0 – 9999 ms, recommended value is 25 ms.)
- **Hardware CTS Enabled:** Enable / Disable hardware Clear-To-Send.

Poll Parameters:

- **Retries:** Specifies the number of retries a Modbus command is resent before the computer declares failed communication. (Valid range is 0 -99, recommended value is 3.)
- **Reply Timeout:** Specifies the maximum response duration before the computer declares failed communication. (Valid range is 0 – 9999 ms, recommended value is 1000 ms.)
- **Interpoll Delay:** (Valid range is 0 – 99 ms, recommended value is 10 ms.)
- **Poll Interval:** (Valid range is 0 – 999,999 ms, recommended value is 2000 ms.)
- **Extra Cmd Time:** (Valid range is 0 – 9999 ms, recommended value is 500 ms.)

Figure 4-3. Host Communication Screen



Setup > Transmitter Comm…

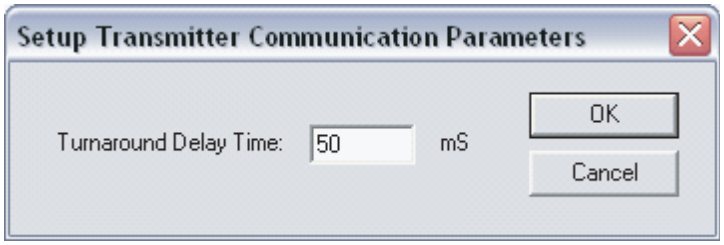
This screen sets the turnaround delay time between the transmitter and the Modbus host system. In some instances, the 3095FB responds too fast, and the host misses the response message.

Responses from the transmitter can be delayed from 0 – 200 ms. The default value is 50 ms.

⚠CAUTION

If the valid delay time value is less than 50 mS, communication problems may occur with the user interface.

Figure 4-4. Transmitter Comm. Screen



Setup > Units…

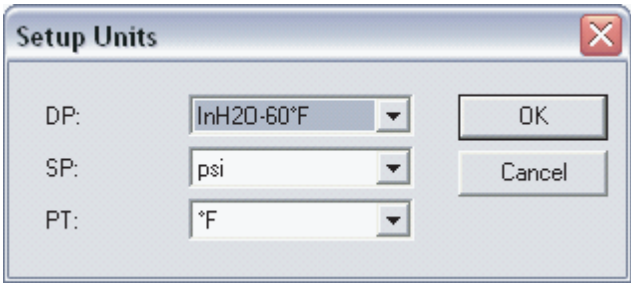
This screen defines the units of measure for the differential pressure, static pressure, and temperature measurements.

Units of measure are available per Table 4-1.

Table 4-1. Units of Measure

Differential Pressure	Static Pressure	Temperature
InH_20 - 60°F	PSI	°F
InH_20 - 68°F	kPa	°C
Pa	MPA	
kPa		

Figure 4-5. Units of Measure Screen



Setup > Damping…

The 3095FB has electronic damping that can change the response time of the transmitter to smooth the process variable reading when there are rapid input variations. Different damping values can be entered for the DP, SP, and PT process variables. Available damping values are shown in Table 4-2.

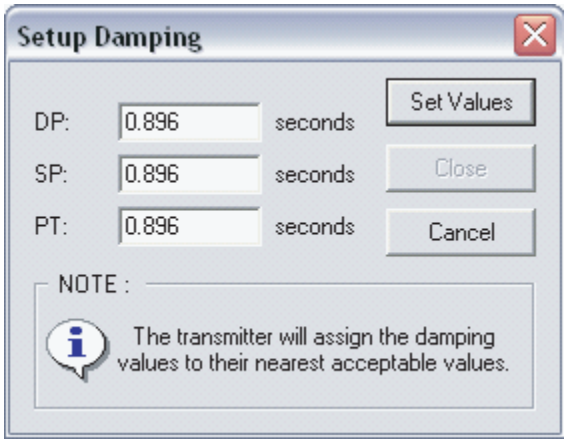
High damping values filter out process noise, but response time is decreased. Low damping values increase response time, but process noise can also be detected. The factory default damping value is 0.864.

To change the damping value, simply enter new values, and click ***Set Values***. If a new value is selected that is not available, the 3095FB automatically selects the closest damping value.

Table 4-2. Damping

Available Damping Values (in seconds)
0.108
0.216
0.432
0.864
1.728
3.456
6.912
13.824
27.648

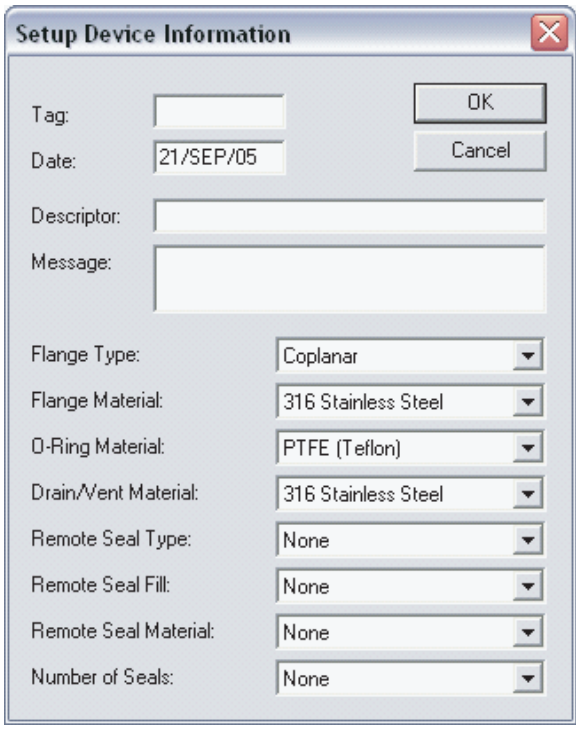
Figure 4-6. Damping Screen



Setup > Device Info…

This screen contains information that can be used to uniquely identify the transmitter. ***Tag, Date, Descriptor,*** and ***Message*** can all be used for transmitter identification purposes. Additionally, material information for the flange, o-ring, drain/vent, and remote seals can be assigned for reference purposes.

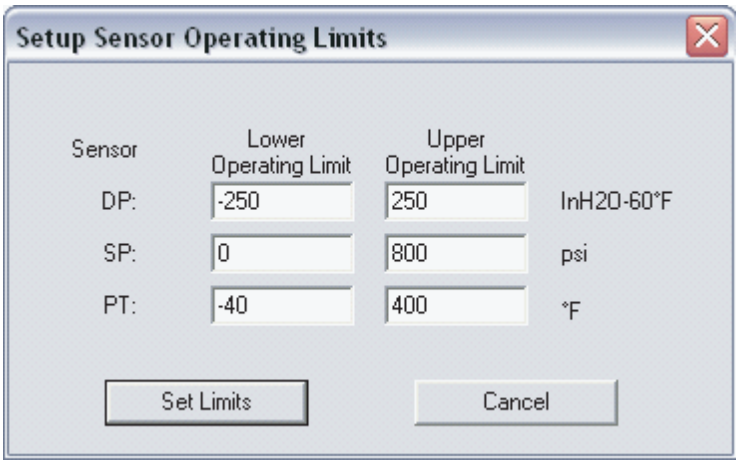
Figure 4-7. Device Info Screen



Setup > Sensor Limits…

This screen determines the normal sensor operating limits for each of the process variables. If a process value is outside of these set limits, the appropriate alarm status bit will be set (registers 407, 408, or 409. See section 8.0 in *Modbus Protocol Guide* in chapter 3).

Figure 4-8. Sensor Limits Screen



Setup > Data Formats…

Floating Point Format:

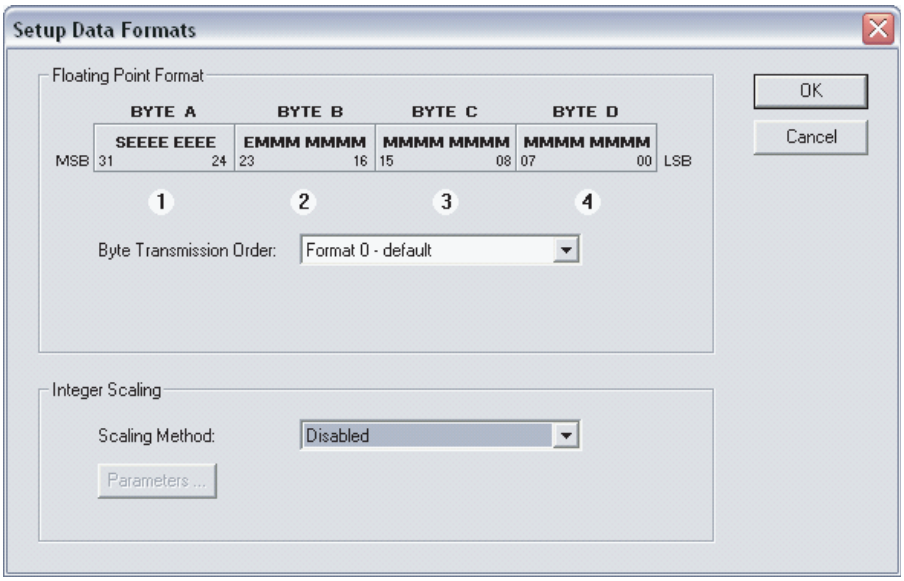
- Byte Transmission Order: Specifies the byte order for the transmission of IEEE 754 floating point numbers. Changing the byte transmission order only affects the transmission of data that is in floating point form, not integer form. Changing the byte order may be necessary to make sure that floating point numbers are compatible between the 3095FB transmitter and the Modbus host system.

  IEEE floating point numbers are made up of 4 bytes (total of 32 bits). The 3095FB can transmit floating point numbers in 4 different byte formats. The default and additional formats are shown in Table 4-3. For more information, refer to section 3.4 in the *Modbus Protocol Guide* in chapter 3.

Table 4-3. Available Floating Point Formats

Floating Point Format Code	Byte Transmission Order	Example Number
Format 0 (default)	A B C D	$42 C8 80 00
Format 1	C D A B	$80 00 42 C8
Format 2	D C B A	$00 80 C8 42
Format 3	B A D C	$C8 42 00 80

Figure 4-9. Data Formats Screen



Integer Scaling:

- ***Scaling Method***: Integer scaling allows the host system to view process variables as integers rather than floating point values. Integer scaling methods are available per Table 4-4.

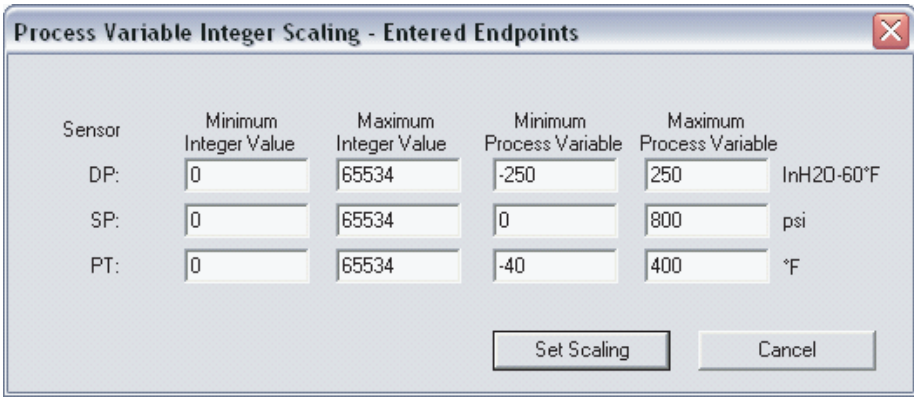
Table 4-4. Integer Scaling Methods

Integer Scaling Method	Description
Disabled	This is the default setting. Only floating point values will be available when integer scaling is disabled.
Entered Endpoints	Allows you to define two endpoints for scaling each process variable.
Entered Scale (slope) Factor & Offset	Allows you to define the scale (slope) factor and offset for scaling each process variable.
Calculated Scare (slope) Factor & Offset	Allows you to have the User Interface Software calculate the scale (slope) and offset for each process variable.

Entered Endpoints

Entered Endpoints assigns a low and high integer that corresponds to a low and high process reading and assumes a linear relation for values in-between. Integer values must be between 0 and 65534. For more information, see section 5.3.1.1 in the *Modbus Protocol Guide* located in chapter 3 of the manual.

Figure 4-10. Integer Scaling - Entered Endpoints Screen



Entered Scale Factor and Offset

Entered Scale Factor and Offset converts floating point numbers into integers through the equation:

$$y = (A)(x) - (B - 32768)$$

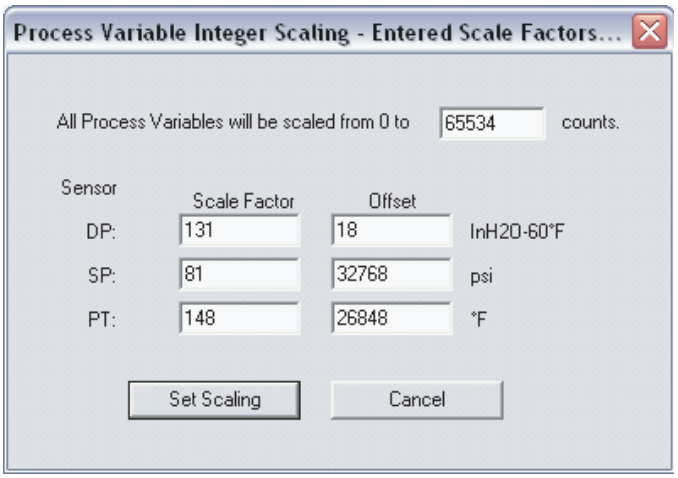
where

y = scaled integer output
x = measured value of PV in current units
A = scale factor
B = offset of scaled integer

For more information, see section 5.3.1.2 in the *Modbus Protocol Guide* located in chapter 3 of the manual.

1. Define the maximum integer count.
2. Calculate the scale factor (“A” in above equation) for each process variable.
3. Calculate the offset (“B” in above equation) for each process variable.
4. Click ***Set Scaling*** to implement changes.

Figure 4-11. Integer Scaling - Entered Scale Factor and Offset Screen

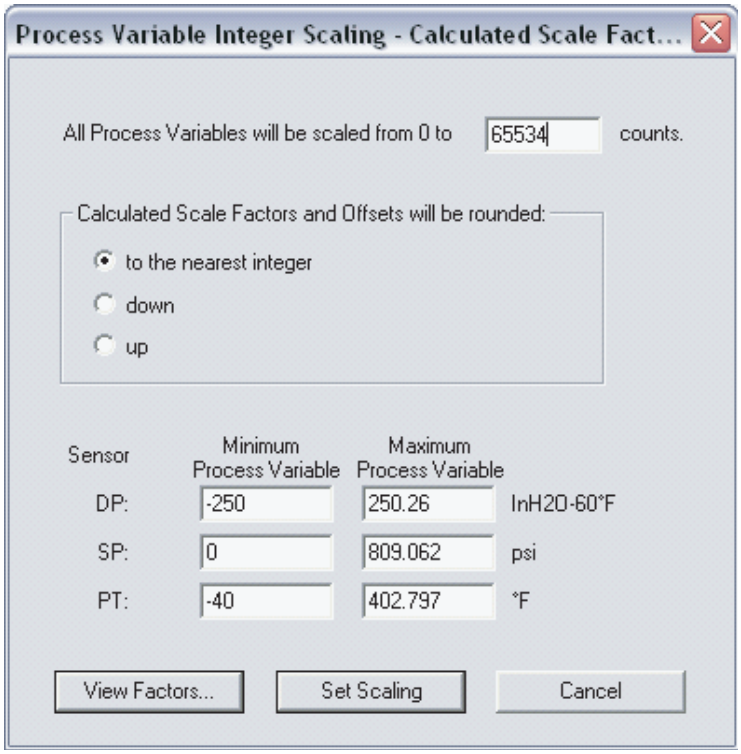


Calculated Scale Factor and Offset

The ***Calculated Scale Factor and Offset*** option works the same way as the ***Entered Scale Factor and Offset*** feature, only the User Interface automatically calculates the values for the scale and offset.

1. Define the maximum integer count.
2. Chose the rounding method (all integers must be whole number values).
3. Enter in the minimum and maximum process variable limits that will correspond to 0 and the maximum integer count.
4. Click ***View Factors…*** to show the calculated scale factor and offset values for the entered information in steps 1 – 3. Click ***OK*** to exit the screen. Modify any of the inputs in steps 1 – 3 if desired.
5. Click ***Set Scaling*** to implement the changes.

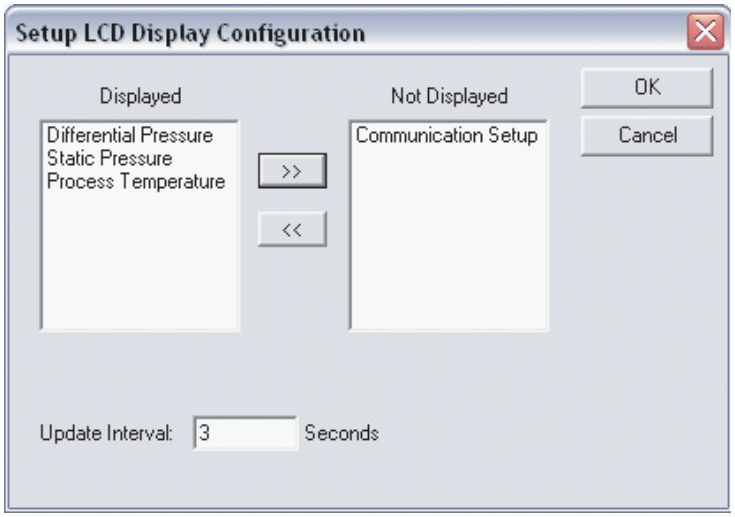
Figure 4-12. Integer Scaling - Calculated Scale Factor and Offset Screen



Setup > LCD Display…

This screen allows for the selection of what process variables are shown on the LCD display. The ***Update Interval*** determines the rate at which the LCD display updates the readings.

Figure 4-13. LCD Display Screen



Setup > Send Config…

Downloads the currently used configuration file to the transmitter.

Setup > Receive Config…

Uploads the configuration file from the transmitter to the User Interface Software.

Transmitter Menu

Connect…

- ***Address***: If you know the address for the transmitter that you want the User Interface Software to talk to, type it in and click OK to connect.
- ***Transmitters Online***: To view all of the transmitters that are currently on the bus, select Transmitters Online and click search. A list of available transmitters will appear. Select the desired transmitter from the list and click OK to connect.
- ***Change Address***: To change the address for a particular transmitter on the RS485 bus, select Change Address. Type in the transmitter's old address, and assign it a new one. Click OK to implement changes.

NOTE
In a multidrop installation, each transmitter must have a different address. These addresses should be set before a transmitter is connected to the bus.

Figure 4-14. Connect Screen

Disconnect

If the ***Setup*** menu selections are grayed out, this indicates that the User Interface Software is currently connected with a 3095FB transmitter. Click ***Transmitter > Disconnect*** to disconnect the software from the transmitter, which will then enable the ***Setup*** menu selections.

Transmitter Comm…
Units…
Damping…
Device Info…
Sensor Limits…
Data Formats…
LCD Display…

These seven links have the same functions and configurations as those found under the ***Setup*** menu. The only difference is the changes made happen immediately to the transmitter, as apposed to working in ***disconnect*** mode with the ***Setup*** menu. For complete information and on configuring these screens, reference the instructions found under the ***Setup*** menu section in this same chapter.

Maintenance Menu

Sensor Trim…

The sensor trim screens are used during bench and field calibration of the 3095FB transmitter.

In addition to the User Interface Software, the following equipment is required for a sensor trim:

- 3095FB transmitter
- Dead-weight tester
- Power supply and load resistor
- Vacuum pump or a barometer that is at least 3 times as accurate as the 3095FB AP sensor. The barometer is preferred. (Only required for transmitters equipped with an AP sensor).
- Ice bath and hot oil bath for trimming the RTD probe.

Table 4-5 identifies the sensor range limits for the 3095FB transmitter.

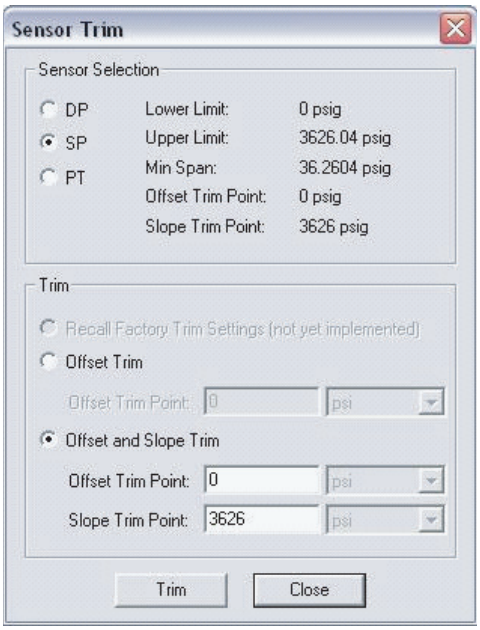
Table 4-5. Sensor Range Limits

Sensor	LRL	URL
DP Range 2	-250 in.H20 (-622,7 mbar)	250 in.H20 (622,7 mbar)
DP Range 3	-1000 in.H20 (-2,49 bar)	1000 in.H20 (2,49 bar)
AP Range 3	0.5 psia (1,245 mbar)	800 psia (55,2 bar)
AP Range 4	0.5 psia (1,245 mbar)	3626 psia (250 bar)
GP Range C	0 psig (0 bar)	800 psig (55,2 bar)
GP Range D	0 psig (0 bar)	3626 psig (250 bar)
PT	-40 °F (-40 °C)	1200 °F (649 °C)

Sensor Trim Procedure (Full Calibration)

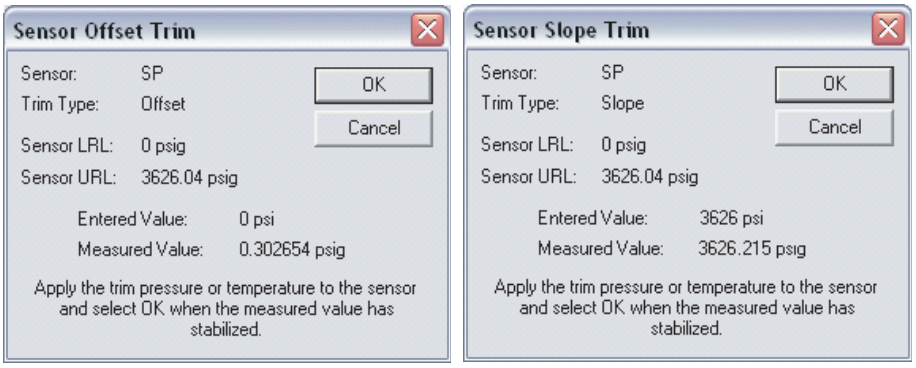
1. Isolate the transmitter from the process by closing the block valves and opening the equalize valve on the manifold.

Figure 4-15. Sensor Selection and Trim Screen



2. SP Offset (zero) and Slope (span) Trim
   a. Select SP from the ***Sensor Selection*** heading, and click ***Offset and Slope Trim***.
   b. Enter the ***Offset Trim Point*** and ***Slope Trim Point*** values that will be applied by a reference device, and click ***Trim***.
   c. Apply the offset trim value.
      - If using a vacuum pump, pull a vacuum to both the high and low sides of the transmitter. Wait for the measured value to stabilize, and click ***OK***.
      - If vented to atmosphere and using a barometer, wait for the measured value to stabilize, and click ***OK***.
   d. Using a deadweight tester, apply the desired slope trim value (high pressure value) to both the low and high sides of the transmitter. Wait for the measured value to stabilize, and click ***OK***.

Figure 4-16. Offset and Slope Trim Screens



3. DP Offset (zero) and Slope (span) Trim
   a. Select DP from the Sensor Selection heading, and click Offset and Slope Trim.
   b. Enter the Offset Trim Point and Slope Trim Point values that will be applied by a reference device, and click Trim.
   c. Using a deadweight tester, apply the desired offset trim value (low pressure value) to only the high side of the transmitter. Wait for the measured value to stabilize, and click OK.
   d. Using a deadweight tester, apply the desired slope trim value (high pressure value) to only the high side of the transmitter. Wait for the measured value to stabilize, and click OK.

4. PT Offset (zero) and Slope (span) Trim
   a. Select PT from the Sensor Selection heading, and click Offset and Slope Trim.
   b. Enter the Offset Trim Point and Slope Trim Point values that will be applied, and click Trim.
   c. Insert the RTD probe into an ice bath. Wait for the measured value to stabilize, and click OK.
   d. Insert the RTD probe into a hot oil bath. Wait for the measured value to stabilize, and click OK.

NOTE
A calibrated decade box can be used instead of the ice bath and the hot oil bath. However, trim results may not be as accurate since the RTD probe is not used in the trim procedure.

5. Return the transmitter to service by closing the equalize valves and opening the block valves.

NOTE
To protect the sensor module, do NOT close the bypass valve on the manifold until after process pressure has been reapplied. This keeps one side of the DP sensor from being subjected to high pressure while the other side has no pressure applied.

Sensor Trim Procedure (Field Calibration)

To correct mounting position effects, field calibrate the 3095FB after installation.

1. Perform a DP Offset (zero)
   a. Select ***DP*** from the ***Sensor Selection*** heading, and click ***Offset Trim***.
   b. Enter the ***Offset Trim Point***, and click ***Trim***.
   c. Wait for the measured value to stabilize, and click ***OK***.
2. (Optional) If a barometer that is at least 3 times as accurate as the 3095FB AP sensor is available, perform an SP Offset (zero).
   a. Select ***SP*** from the Sensor Selection heading, and click Offset Trim.
   b. Enter the ***Offset Trim Point***, and click ***Trim***.
   c. Wait for the measured value to stabilize, and click ***OK***.

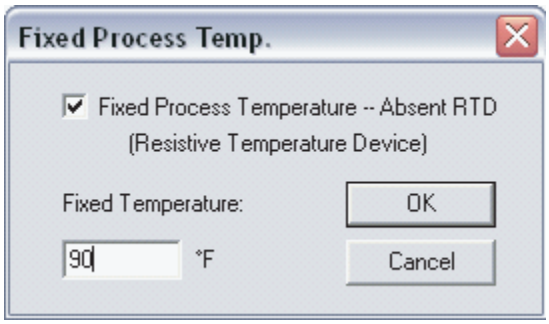
Maintenance > Fixed Process Temp…

This selection allows enabling or disabling the process temperature input from the RTD. To disable the process temperature input:

1. Select ***Fixed Process Temperature*** – ***Absent RTD*** so that an "x" appears in the box.
2. Enter the desired fixed temperature (between -40 and 1200 °F), then click ***OK***.

To enable the process temperature input from the RTD, simply deselect the ***Fixed Process Temperature – Absent RTD*** box.

Figure 4-17. Fixed Process Temperature Screen



The 3095FB can be configured so that a user-selected temperature will be used as the process temperature measurement if an RTD failure occurs.

1. Select ***Fixed Process Temperature – Absent RTD*** so that an "x" appears in the box.
2. Enter the desired fixed temperature, and click ***OK***.
3. Reopen the fixed process temperature screen by selecting ***Maintenance > Fixed Process Temp…***
4. Deselect the ***Fixed Process Temperature*** box so that the box is empty, and click ***OK***.

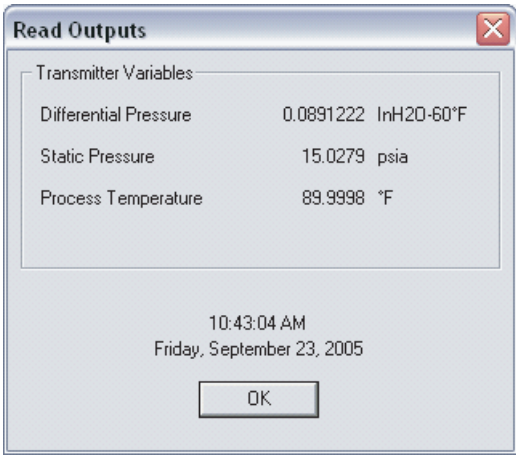
At the end of this procedure, the process temperature input is enabled, and the process temperature register will contain the current measured temperature. If an RTD failure occurs, the temperature entered in step 3 will be stored in the process temperature register. In addition, “RTD is Disconnected” exception handling status bits will be set (Section 8.0 in the *Modbus Protocol Guide* located in chapter 3 of the manual).

Diagnostics Menu

Read Outputs…

This screen displays continuously updated readings for the process variables.

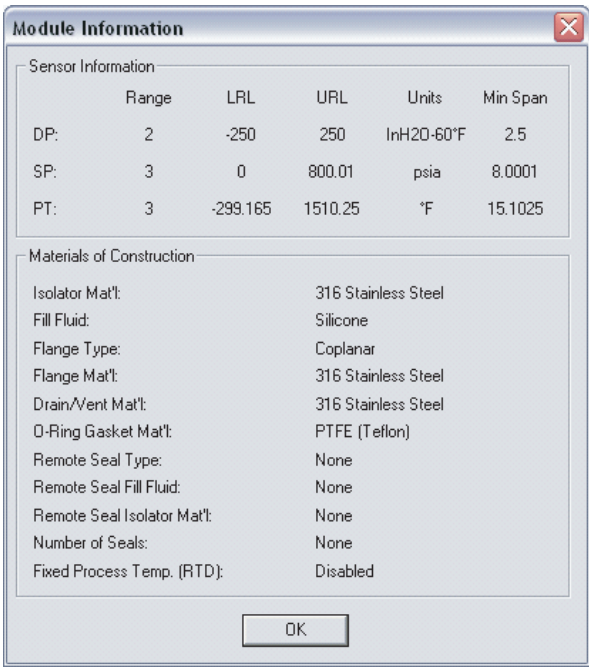
Figure 4-18. Read Outputs Screen



Diagnostics > Device Info > Module Info…

The module information screen displays read-only information about the sensor module.

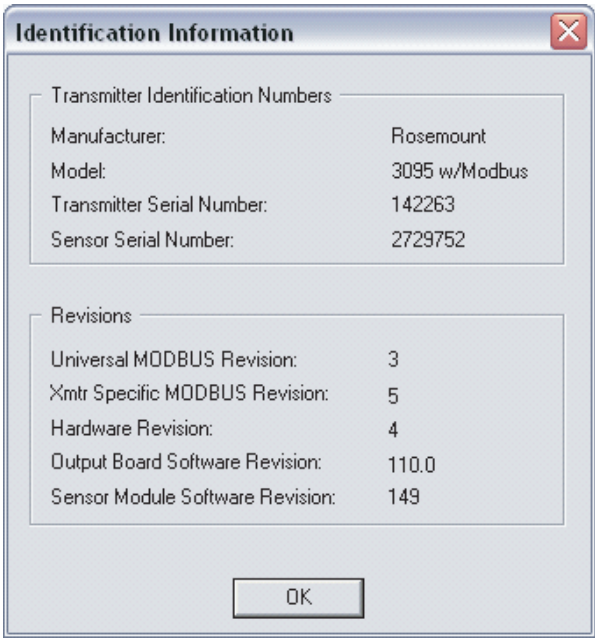
Figure 4-19. Module Information Screen



Diagnostics > Device Info > Identification Info…

This screen displays information about hardware and software revisions, as well as device serial numbers.

Figure 4-20. Identification Information Screen



Diagnostics > Transmitter Master Reset…

The transmitter master reset command reinitializes the transmitter microprocessor. This is the equivalent of removing and then reapplying power to the transmitter.

Diagnostics > Transmitter Self Test…

The transmitter self test performs a series of test to validate the transmitter non-volatile memory. When finished, the ***Diagnostics > Error Info…*** screen is automatically displayed to show the test results.

Diagnostics > Error Info…

This screen identifies the current error status for the 3095FB transmitter. The screen is NOT actively updated. Section 8.0 of the *Modbus Protocol Guide* in Chapter 3 of the manual identifies the possible errors that could be displayed.

Figure 4-21. Error Info Screen

View Menu

Toolbar

This selection toggles the toolbar on and off.

Status Bar

This selection toggles the status bar on and off.

Help Menu

About 3095 Configurator…

This screen displays the version of the 3095 User Interface Software that is in use.

Section 5 Troubleshooting

OVERVIEW

This chapter provides summarized troubleshooting suggestions for the most common operating problems.

If you suspect a malfunction despite the absence of any diagnostic messages on the communicator display, follow the procedures described here to verify that transmitter hardware and process connections are in good working order. Always deal with the most likely and easiest-to-check conditions first.

SAFETY MESSAGES

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

Warnings

⚠WARNING

Explosions could result in death or serious injury.

- Do not remove the transmitter cover in explosive atmospheres when the circuit is live.
- Both transmitter covers must be fully engaged to meet explosion-proof requirements.

⚠CAUTION

Static electricity can damage sensitive components.

- Observe safe handling precautions for static-sensitive components.

COMMUNICATION PROBLEMS

Table 5-1 identifies the most likely causes for communication problems with the 3095FB transmitter.

TABLE 5-1. Communication Troubleshooting

Symptom	Corrective Actions
No communication between the User Interface Software and the transmitter	Check for proper voltage across the power terminals of the transmitter (7.5 – 30 V dc).
	Check for intermittent shorts, open circuits, and multiple grounds.
	Verify the RS-485 bus is terminated with 120 Ohm resistors at each end of the bus.
	Verify the RS-485 bus is NOT terminated at points other than at each end of the bus.
	Verity that the RS-485 converter is connected to the A and B terminals, not the power terminals
	Test the opposite polarity connection to the RS-485 bus.
	Verify identical baud rates for computer and transmitter.
	Verify the correct COMM port is selected.
	Verify the laptop computer is not in low energy mode (some models disable all comm ports in low energy mode).
No communication between the transmitter and the Modbus host	Check for proper voltage across the power terminals of the transmitter (7.5 – 30 V dc).
	Check for intermittent shorts, open circuits, and multiple grounds.
	Verify the RS-485 bus is terminated with 120 Ohm resistors at each end of the bus.
	Verify the RS-485 bus is NOT terminated at points other than at each end of the bus.
	Verify the power wiring and RS-485 bus wiring are not switched.
	Verify identical baud rates for the RTU and transmitter.
	Verify you are talking to the correct transmitter address.
	Possible noise on the bus - switch both "A" and "B" pull-up switches on the comm board of only one transmitter to the "on" position (see Figure 2-5)
	The turnaround time for the transmitter may be too fast for RTU. Try using a longer time (see page 4-7)
	The RTU may be polling too fast and cutting off the transmitter response messages. Try adjusting the polling time on the RTU.
	Verify the software for the RTU is functioning properly.
Transmitter is not sending meaningful data	Verify that the 3095FB is transmitting floating point data in the correct format for the RTU (see page 4-10).
	The RTU may have register addresses referenced to 0 rather than 1. Try subtracting or adding 1 from register addresses when polling.

ALARMS AND CONDITIONS

If an alarm or error condition exists in the 3095FB, it will be displayed in the Modbus registers (Section 3: 8.1.1 in the *Modbus Protocol Guide* located in this manual). Specific alarm conditions can be viewed via the Configurator User Interface software (see the **Diagnostics > Error Info...** selection).

NOTE
Alarms are not logged or archived. The alarms and error conditions displayed on the **Diagnostics > Error Info...** Info screen indicate the alarms present at the time of command invocation.

Table 5-2 identifies corrective actions for 3095FB alarms and events.

TABLE 5-2. Rosemount 3095FB Alarm and Event Summary

Floating Point Reg./ Bit Posit.	Sets Alarm/ Warning Flag?	Alarm Description	Action
20407 15		Calibration flag	Indicates that the host has set the calibration flag. No action required. For more information, see page 31 in the Modbus Master Document.
20407 14		Critical alarm: PVs may not be valid	Summation alarm flag. This register is set if any Alarm (A) register is set.
20407 13		Warning: PVs outside specifications	Summation warning flag. This register is set if any Warning (W) register is set.
20407 12	A	DP signal exceeded Upper Range Limit + 10%	This display means that the transmitter differential pressure reading exceeds its sensor limits by more than 10%. There are two possible causes. Either the transmitter is overpressured, or it has a sensor malfunction. Check the pressure input to the transmitter. If an overpressure condition exists, correct it. If not, replace the sensor module as described on page 5-7.
20407 11	W	DP signal exceeded Upper Range Limit	No action required.
20407 10		DP signal exceeded Upper Operating Limit	No action required.
20407 9		DP signal is less than Lower Operating Limit	No action required.
20407 8	W	DP signal is less than Lower Range Limit	No action required.
20407 7	A	DP signal is less than Lower Range Limit - 10%	This display means that the transmitter differential pressure reading exceeds its sensor limits by more than 10%. There are two possible causes. Either the transmitter is underpressured, or it has a sensor malfunction. Check the pressure input to the transmitter. If an overpressure condition exists, correct it. If not, replace the sensor module as described on page 5-7.
20407 6	A	SP signal exceeded Upper Range Limit + 10%	This display means that the transmitter absolute (or gage) pressure reading exceeds its sensor limits by more than 10%. There are two possible causes. Either the transmitter is overpressured, or it has a sensor malfunction. Check the pressure input to the transmitter. If an overpressure condition exists, correct it. If not, replace the sensor module as described on page 5-7.
20407 5	W	SP signal exceeded Upper Range Limit	No action required.
20407 4		SP signal exceeded Upper Operating Limit	No action required.
20407 3		SP signal is less than Lower Operating Limit	No action required.
20407 2	W	SP signal is less than Lower Range Limit	No action required.
20407 1	A	SP signal is less than Lower Range Limit - 10%	This display means that the transmitter absolute (or gage) pressure reading exceeds its sensor limits by more than 10%. There are two possible causes. Either the transmitter is underpressured, or it has a sensor malfunction. Check the pressure input to the transmitter. If an overpressure condition exists, correct it. If not, replace the sensor module as described on page 5-7.

TABLE 5-2. Rosemount 3095FB Alarm and Event Summary

Floating Point Reg./ Bit Posit.	Sets Alarm/ Warning Flag?	Alarm Description	Action
20407 0	A	SP sensor shorted	The sensor module has undergone a component or software failure. Replace the sensor module as described on page 5-7. Contact your Field Service Center.
20408 15	A	SP signal is unreasonable - open bridge	This display means that the transmitter absolute (or gage) pressure reading exceeds its sensor limits. There are two possible causes. Either the transmitter is overpressured, or it has a sensor malfunction. Check the pressure input to the transmitter. If an overpressure condition exists, correct it. If not, replace the sensor module as described on page 5-7.
20408 14	A	PT signal exceeded Upper Range Limit + 10%	Check the transmitter RTD connector and RTD screw terminals to ensure the RTD cable is properly connected. Verify that the process temperature is between -40F and 400F. If process temperature exceeds these limits, correct the temperature. If process temperature is within these limits, replace the sensor module as described on page 5-7.
20408 13	W	PT signal exceeded Upper Range Limit	No action required.
20408 12	W	PT signal exceeded Upper Operating Limit	No action required.
20408 11		PT signal is less than Lower Operating Limit	No action required.
20408 10	W	PT signal is less than Lower Range Limit	No action required.
20408 9	A	PT signal is less than Lower Range Limit - 10%	Check the transmitter RTD connector and RTD screw terminals to ensure the RTD cable is properly connected. Verify that the process temperature is between -40 °F and 400 °F. If transmitter temperature exceeds these limits, correct the temperature. If transmitter temperature is within these limits, replace the sensor module as described on page 5-7.
20408 8	A	RTD is disconnected	Check the transmitter RTD connector and RTD screw terminals to ensure the RTD cable is properly connected.
20408 7	A	ST signal is greater than high limit	This message indicates that the ambient temperature limit of the transmitter is being exceeded. Verify that the transmitter ambient temperature is between -40 °F and185 °F. If transmitter temperature exceeds these limits, correct the temperature. If transmitter temperature is within these limits, replace the sensor module as described on page 5-7.
20408 6	A	ST signal is less than lower limit	This message indicates that the ambient temperature limit of the transmitter is being exceeded. Verify that the transmitter ambient temperature is between -40F and 185F. If transmitter temperature exceeds these limits, correct the temperature. If transmitter temperature is within these limits, replace the sensor module as described on page 5-7.
20408 5		Reserved	NA.
20408 4		Reserved	NA.
20408 3		Reserved	NA.
20408 2		Reserved	NA.
20408 1		Reserved	NA.
20408 0		Reserved	NA.

TABLE 5-2. Rosemount 3095FB Alarm and Event Summary

Floating Point Reg./ Bit Posit.	Sets Alarm/ Warning Flag?	Alarm Description	Action
20409 15	A	Sensor module is NOT updating	The sensor module has undergone a component or software failure. Replace the sensor module as described on page 5-7. Contact your Field Service Center.
20409 14	A	Sensor board eeprom not initialized, default values used	The sensor electronics has not initialized properly. Replace the sensor module as described on page 5-7. Contact your Field Service Center.
20409 13	A	Sensor microprocessor does not respond	The sensor module has undergone a component or software failure. Replace the sensor module as described on page 5-7. Contact your Field Service Center.
20409 12	A	Sensor board eeprom burn failure	The sensor module has undergone a component or software failure. Replace the sensor module as described on page 5-7. Contact your Field Service Center.
20409 11	A	Sensor hardware incompatible with software	The sensor hardware is incompatible with the software. Replace the sensor module as described on page 5-7. Contact your Field Service Center.
20409 10	A	Sensor CRC error (static region)	Sensor CRC checksum failed indicating corrupted sensor module memory. Replace the sensor module as described on page 5-7.
20409 9	A	Sensor CRC error (dynamic region)	Sensor CRC checksum failed indicating corrupted sensor module memory. Replace the sensor module as described on page 5-7.
20409 8		Reserved	NA.
20409 7		Reserved	NA.
20409 6		Flash output board eeprom soft (recoverable) error	If this is a common error, replace the output electronics board as described on page 5-7.
20409 5	A	Flash output board eeprom hard (non-recoverable) error	The transmitter electronics has undergone a component or software failure. Replace the output electronics board as described on page 5-7.
20409 4		Flash output board eeprom time out	If this is a common error, replace the output electronics board as described on page 5-7.
20409 3		Reserved	NA.
20409 2	A	Non-volatile database CRC error	Non-volatile database checksum failed. Attempt to restore non-volatile database to factory defaults (see page 41 in Modbus Master Document). If unable to restore these factory defaults, replace the output electronics board as described on page 5-7.
20409 1		Write protect status flag	Reflects write protect jumper position. No action required.
20409 0		Bit not used	Bit not used

Disassembly Procedures

Read the following information carefully before disassembling a transmitter. General information concerning the process sensor body and electrical housing is included in the following sections.

⚠WARNING

Explosions can result in death or serious injury. Do not remove the instrument cover in explosive environments.

Remove the transmitter from Service

Once a transmitter is determined to be inoperable, remove it from service.

Be aware of the following:

- Isolate and vent the process from the transmitter before removing the transmitter from service.
- Remove all electrical leads and conduit.
- Detach the process flange by removing the four flange bolts and the two alignment screws that secure it.
- Do not scratch, puncture, or depress the isolating diaphragms.
- Clean isolating diaphragms with a soft rag and a mild cleaning solution, and rinse with clear water.
- Whenever you remove the process flange or flange adapters, visually inspect the Teflon O-rings. Replace the O-rings if they show any signs of damage, such as nicks or cuts. If they are undamaged, you may reuse them.

Remove the Terminal Block

Electrical connections are located on the terminal block in the compartment labeled “FIELD TERMINALS.” Remove the housing cover (see Figure 5-1).

Loosen the two small screws located at the 9 o'clock and 4 o'clock positions, and pull the entire terminal block out to remove it.

Figure 5-1. Removing the Terminal Block Housing Cover

Remove the Electronics Board

The transmitter electronics board is located in the compartment opposite the terminal side. To remove the electronics board, perform the following procedure:

1. Remove the housing cover opposite the field terminal side.
2. Loosen the two captive screws that anchor the board to the housing.
3. The electronics board is electrostatically sensitive; observe handling precautions for static-sensitive components.

⚠CAUTION

The circuit board is electrostatically sensitive. To prevent damage to the circuit board, be sure to observe handling precautions for static-sensitive components.

NOTE
If you are disassembling a transmitter with a LCD display, loosen the two captive screws that are visible on the right and left side of the meter display. The two screws anchor the LCD display to the electronics board and the electronics board to the housing.

4. Slowly pull the electronics board out of the housing. With the two captive screws free of the transmitter housing, only the sensor module ribbon cable holds the board to the housing (see Figure 5-2).
5. Disconnect the sensor module ribbon cable to release the electronics board from the transmitter (See Figure 5-2).

Figure 5-2. Removing the Electronics Board

Removing the Sensor Module from the Electronics Housing

1. Carefully tuck the cable connector completely inside of the internal shroud (see Figure 5-3).

⚠CAUTION

Before removing the sensor module from the electrical housing, disconnect the electronics board power cable from the sensor module. This will prevent damage to the sensor module ribbon cable.

Figure 5-3. Tucking the Cable Connector

2. Loosen the housing rotation set screw with a hex wrench, and back off one full turn (see Figure 5-3).

⚠CAUTION

Before removing the sensor module from the electrical housing, disconnect the electronics board power cable from the sensor module. This will prevent damage to the sensor module ribbon cable.

Figure 5-4. Loosening the Housing Rotation Screws

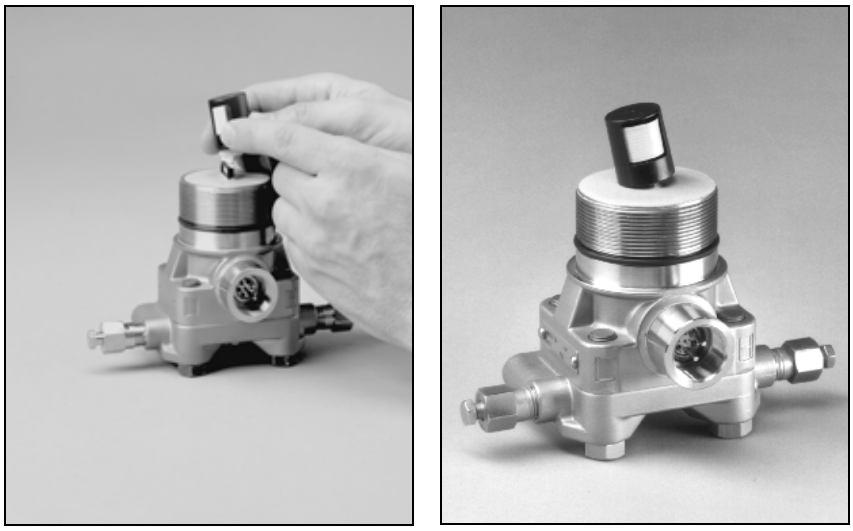
3. Unscrew the housing from the module, making sure the shroud and sensor cable do not catch on the housing. Damage can occur to the cable if the internal shroud and sensor cable rotate with the housing. Carefully pull the shroud and sensor ribbon cable assembly through the housing opening.

REASSEMBLY PROCEDURE

Follow these procedures carefully to ensure proper reassembly:

1. Inspect all cover and housing (non-process-wetted) O-rings and replace if necessary. Lightly grease with silicone lubricant to ensure a good seal.
2. Carefully tuck the cable connector completely inside the internal shroud. To do this, turn the shroud and cable counterclockwise one rotation to tighten the cable.

Figure 5-5. Transmitter Reassembly



3095\016ab,031ab

3. Lower the electronics housing onto the module. Guide the internal shroud and cable through the housing and into the external shroud.
4. Turn the housing clockwise to fasten it to the module.

⚠CAUTION

To prevent damage to the cable connector, watch the cable and shroud as you attach the housing to the module. Make sure the cable connector does not slip out of the internal shroud and begin to rotate with the housing. Reinsert the cable connector into the shroud if it escapes before the housing is fully fastened.

5. Thread the housing completely onto the sensor module. The housing must be no more than one full turn from flush with the sensor module to comply with explosion proof requirements.
6. Tighten the housing rotation set screw using a hex wrench.

Attach the Electronics Board

1. Remove the cable connector from its position inside of the internal shroud and attach it to the electronics board.
2. Insert the electronics board into the housing, making sure that the posts from the electronics housing properly engage the receptacles on the electronics board.
3. Tighten the captive mounting screws.
4. Replace the electronics housing cover. The transmitter covers must be engaged metal-to-metal to ensure a proper seal and to meet Explosion-Proof requirements.

Install the Terminal Block

Gently slide the terminal block into place, making sure the posts from the electronics housing properly engage the receptacles on the terminal block. Tighten the captive screws and replace the electronics housing cover. The transmitter covers must be fully engaged to meet Explosion-Proof requirements.

Reassembling the Process Sensor Body

1. Visually inspect the Teflon sensor module O-rings. If the O-rings are undamaged, you may reuse them. If the O-rings show signs of damage, such as nicks or cuts, or if there is any doubt about their ability to seal properly, replace them with new O-rings.

NOTE
If you are replacing the O-rings, be careful not to scratch the O-ring grooves or the surface of the isolating diaphragm when removing the damaged O-rings.

2. Install the process flange on the sensor module. To hold the process flange in place, install the two hex head alignment screws. While these screws are not pressure retaining, tighten the hex head alignment screws to 33 in-lbs to ensure proper alignment. Do not over-tighten; this will affect the module/flange alignment.
3. Install the appropriate flange bolts:

- For installations requiring a 1/4–18 NPT mounting, install the four 1.75-inch process flange bolts. First, finger-tighten the bolts. Then tighten the bolts incrementally in a cross pattern until they are securely tightened to 650 in-lb (300 in-lb for stainless steel bolts). After tightening, the bolts should protrude through the top of the module housing.
- For installations requiring a 1/2–14 NPT mounting, hold the optional flange adapters and flange adapter O-rings in place while finger-tightening the four 2.88-inch process flange/adapter bolts. Tighten the bolts in a cross pattern following the procedure outlined above. (Use two 2.88-inch bolts and two 1.75-inch bolts for gage pressure configurations.) After tightening, the bolts should protrude through the top of the module housing. If the bolts do not extend all the way through the module housing, you have used a bolt of incorrect length. Replace the bolt with one of the correct length, and repeat the procedure.
- For installations with a three-valve manifold, align the process flange with the three-valve manifold. Install the four 2.25-inch manifold flange bolts following the procedure outlined above. After tightening, the bolts should protrude through the top of the module housing. If the bolts do

not extend all the way through the module housing, you have used a bolt of incorrect length. Replace the bolt with one of the correct length, and repeat the procedure. Optional flange adapters can be installed on the process end of the three-valve manifold using the 1.75-inch flange bolts supplied with the transmitter.

4. **IF** you replaced the Teflon sensor module O-rings, **THEN** re-torque the flange bolts after installation to compensate for cold flow.
5. Install the drain/vent valve.
   a. Apply sealing tape to the threads on the seat. Starting at the base of the valve with the threaded end pointing toward the installer, apply two clockwise turns of the sealing tape.
   b. Take care to place the opening on the valve so that process fluid will drain toward the ground and away from personnel when the valve is opened.
   c. Tighten the drain/vent valve to 250 in-lb.

NOTE
After replacing O-rings on Range 1 (DP) transmitters and re-installing the process flange, expose the transmitter to a temperature of 185 °F (85 °C) for two hours. Then re-tighten the flange bolts in a cross pattern, and again expose the transmitter to a temperature of 185 °F (85 °C) for two hours before calibration.

Appendix A Specifications and Reference Data

FUNCTIONAL SPECIFICATIONS

Service
Gas, Liquid, or Steam

Differential Sensor
Limits
- Code 2: –250 to 250 inH_2O (-0,622 to 0,622 bar)
- Code 3: –1000 to 1000 inH_2O (-2,49 to 2,49 bar)

Absolute Sensor
Limits
- Code 3: 0.5 to 800 psia (3,447 to 5516 kPa)
- Code 4: 0.5 to 3,626 psia (3,447 to 25000 kPa)

Gage Sensor
Limits
- Code C: 0 to 800 psig (0 to 5516 kPa)
- Code D: 0 to 3,626 psig (0 to 25000 kPa)

Over Pressure Limit
0.5 psia to two times the absolute pressure sensor range with a maximum of 3,626 psia.

Static Pressure Limit
Operates within specifications between static line pressures of 0.5 psia and the URL of the absolute pressure sensor.

Power
- Quiescent supply current 10 mA typical. Transmitting supply current not to exceed 100 mA.
- External power supply required
- Transmitter: operates on terminal voltage of 7.5 - 42 Vdc

RS-485 Signal Wiring
2-wire half-duplex RS-485 *MODBUS* with 8 data bits, 1 stop bit, and no parity

Bus Terminations
Standard RS-485 bus terminations required per EIA-485.

Failure Mode Alarm
If self-diagnostics detect a gross transmitter failure, non-latched status bits are set in the transmitter alarm registers.

Humidity Limits
- 0 – 100% relative humidity

Communications
User Interface: EIA-232 (RS-232C) format

Baud Rate: 600 to 19.2 K User selectable

Host: RS-485 / RS-232

User Interface Software and Hardware Requirements:

- IBM-compatible PC
- 10 MB of available hard drive space
- Microsoft® Windows® 98 or higher operating system
- CD-ROM drive
- 32 MB of RAM

Temperature Limits

Process (at transmitter isolator flange for atmospheric pressures and above):

- –40 to 250 °F (–40 to 121 °C)
- Inert fill sensor: 0 to 185 °F (-18 to 85 °C).
- Process temperatures above 185 °F (85 °C) requires derating the ambient limits by a 1.5:1 ratio.

Ambient:

- –40 to 185 °F (–40 to 85 °C)
- with integral meter: -4 to 175 °F (-20 to 75 °C)

Storage:

- –50 to 212 °F (–46 to 100 °C)
- with integral meter: -40 to 185 °F (-40 to 85 °C)

Turn-on Time

Process variables will be within specifications less than 4 seconds after power is applied to transmitter.

Damping (3095FB only)

Response to step input change can be user-selectable from 0.1 to 30 seconds for one time constant. This is in addition to sensor response time of 0.2 seconds.

PERFORMANCE SPECIFICATIONS

(Zero-based spans, reference conditions, silicone oil fill, 316 SST isolating diaphragms, and digital trim values to the span end points)

Specification Conformance

The Rosemount 3095FB maintains a specification conformance of measured variables to at least 3σ.

Differential Pressure

Range 2

- 0–2.5 to 0–250 inH_2O (0–6,2 to 0–622,7 mbar)
  (100:1 rangeability is allowed)

Range 3

- 0–10 to 0–1000 inH_2O(0–0,0249 to 0–2,49 bar)
  (100:1 rangeability is allowed)

Accuracy (including Linearity, Hysteresis, Repeatability)

Range 2-3: 3095FB Ultra for Flow (Option U3)(1)

- ±0.05% DP reading for rangedown from 1:1 to 3:1 of URL
- For rangedown greater than 3:1 of URL
- Accuracy = $\pm\left[0.05 + 0.0145\left(\frac{\text{URL}}{\text{Reading}}\right)\right]$% Reading

Range 2-3:

- ±0.075% of span for spans from 1:1 to 10:1 URL
- For spans less than 10:1 rangedown

$$\text{Accuracy} = \left[0.025 + 0.005\left(\frac{\text{URL}}{\text{Span}}\right)\right]\% \text{ of span}$$

(1) Ultra for Flow (Option U3) applicable for DP ranges 2 and 3 with SST isolator material and silicone fill fluid only.

Ambient Temperature Effect per 50 °F (28 °C)

Range 2-3: 3095FB Ultra for Flow (Option U3)(1)

- ±0.130% reading for rangedown from 1:1 to 3:1 of URL
- ±[0.05 + 0.0345 (URL/Reading)]% Reading > 3:1 to 100:1 of URL

Range 2-3:

- ±(0.025% URL + 0.125% span) spans from 1:1 to 30:1
- ±(0.035% URL + 0.175% span) spans from 30:1 to 100:1

Static Pressure Effects

- Zero error = ±0.05% of URL per 1000 psi (68,9 bar)
- Span error = ±0.20% of reading per 1000 psi (68,9 bar)

Stability

Range 2-3: 3095FB Ultra for Flow (Option U3)(1)

- ±0.25% of URL for 10 years for ±50 °F (28 °C) temperature changes, up to 1000 psi (68,9 bar) line pressure

Range 2-3:

- ±0.125% URL for five years for ±50 °F (28 °C) ambient temperature changes, and up to 1000 psi (68,9 bar) line pressure.

Absolute / Gage Pressure

Absolute (100:1 rangeability allowed)

Range 3

0.5–8 to 0.5–800 psia (3,447–55,16 to 3,447–5516 kPa)

Range 4

0.5–36.26 to 0.5–3,626 psia (3,447–250 to 3,447–25000 kPa)

Gage (100:1 rangeability allowed)

Range C

0–8 to 0–800 psig (0–55,16 to 0–5516 kPa)

Range D

0–36.26 to 0–3,626 psig (0–250 to 0–25000 kPa)

Ambient Temperature Effect per 50 °F (28 °C)

- ±(0.05% URL + 0.125% of span) spans from 1:1 to 30:1
  ±(0.06% URL – 0.175% of span) spans from 30:1 to 100:1

Stability

±0.125% URL for five years for ±50 °F (28 °C) ambient temperature changes.

Accuracy (including Linearity, Hysteresis, Repeatability)

- ±0.075% of span for spans from 1:1 to 10:1 of URL
- For spans less than 10:1 rangedown,

$$\text{Accuracy} = \left[0.03 + 0.0075\left(\frac{\text{URL}}{\text{Span}}\right)\right]\% \text{ of span}$$

Process Temperature (RTD)

Specification for process temperature is for the transmitter portion only. Sensor errors caused by the RTD are not included. The transmitter is compatible with any PT100 RTD conforming to IEC 751 Class B, which has a nominal resistance of 100 ohms at 0 °C and $\propto$ = 0.00385. Examples of compatible RTDs include the Rosemount Series 68 and 78 RTD Temperature Sensors.

Sensing Range

- –40 to 1200 °F (–40 to 649 °C)

Accuracy (including Linearity, Hysteresis, Repeatability)

±1.0 °F (0.56 °C)

Ambient Temperature Effects per 50 °F (28 °C)

- ±0.72 °F (0.40 °C) for process temperatures from –40 to 185 °F (–40 to 85°C)
- (±1.28 °F (0.72 °C) + 0.16% of reading) for process temperatures from 185 to 1200 °F (85 to 649 °C)

Stability

±1.0 °F (0.56 °C) for one year

PHYSICAL SPECIFICATIONS

Electrical Connections

- ½–14 NPT, M20 x 1.5 (CM20), PG-13.5

RTD Process Temperature Input:

100-ohm platinum RTD per IEC-751 Class B

Process Connections

- Transmitter: ¼–18 NPT on $2^{1}/_{8}$-in. centers
- RTD: RTD dependent (see ordering information)

Radiated/Conducted Transmissions

Meets requirements of IEC 61326

Process Wetted Parts

Isolating Diaphragms

- 316L SST or *Hastelloy C*-276®

Drain/Vent Valves

- 316 SST or *Hastelloy C*®

Flanges

- Plated carbon steel, 316 SST, or *Hastelloy C*

Wetted O-rings

- Glass-Filled TFE

Non-Wetted Parts

Electronics Housing

- Low copper aluminum

Bolts

- Plated carbon steel per ASTM A449, Grade 5; or austenitic 316 SST

Fill Fluid

- Silicone oil
- Inert oil (available for gage pressure ranges only)

Paint

- Polyurethane

O-rings

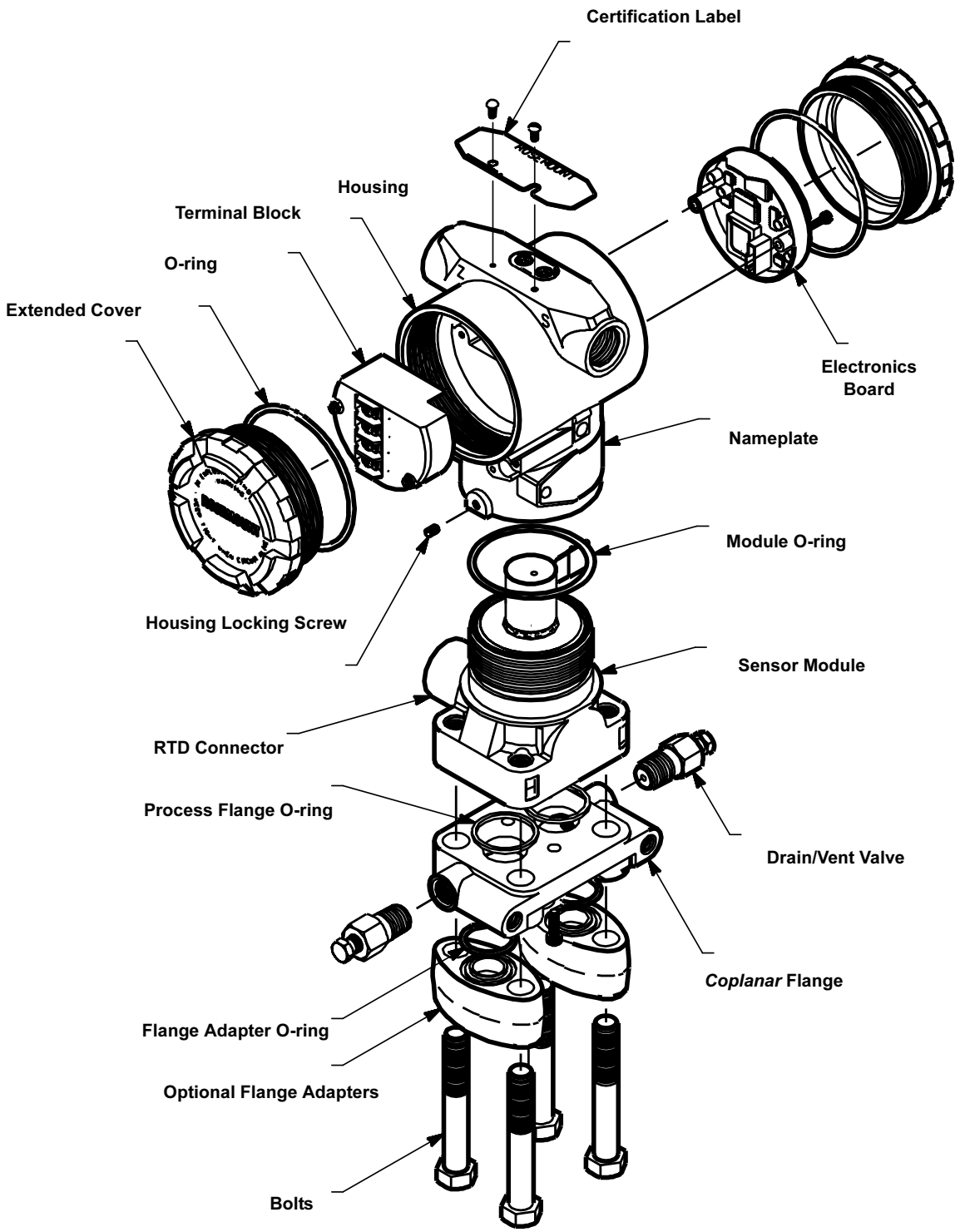
- Buna-N

Weight

Components	Weight in lb. (kg) 3095FB
3095 Transmitter	6.0 (2.7)
LCD Meter	0.5 (0.2)
SST Mounting Bracket	1.0 (0.5)
12 ft. (3.66 m) RTD Shielded Cable	0.5 (0.2)
12 ft. (3.66 m) RTD Armored Cable	1.1 (0.5)
24 ft. (7.32 m) RTD Shielded Cable	1.0 (0.5)
24 ft. (7.32 m) RTD Armored Cable	2.2 (1.0)
Battery / Solar panel	–
Battery Backup	–

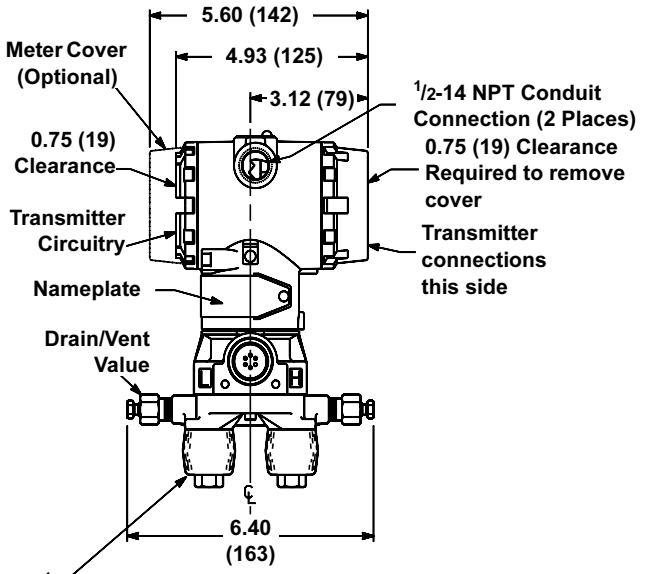
DIMENSIONAL DRAWINGS

Exploded View of 3095FB Transmitter

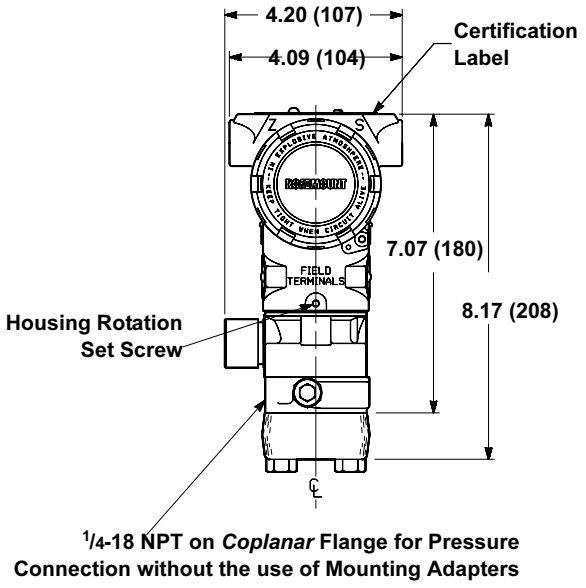


3095FB

Side View



Front View

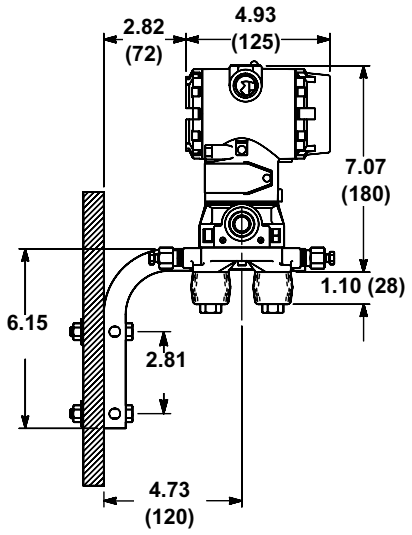


3095/3095H05A, 3095G05A

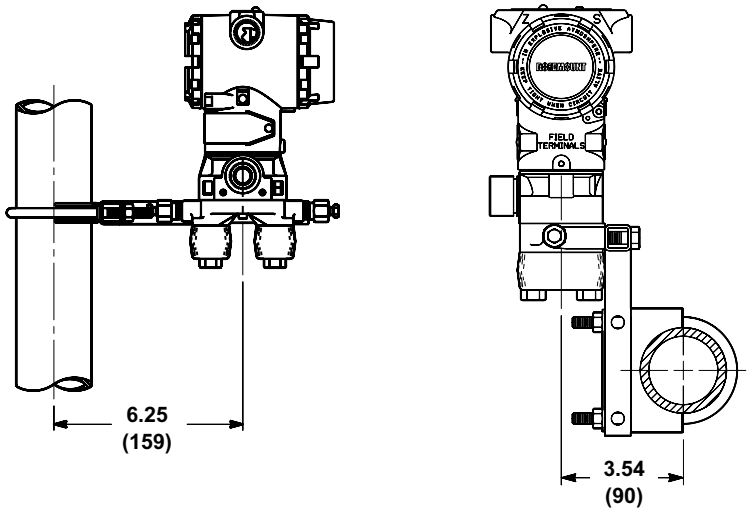
Dimensions are in inches (millimeters)

Mounting Configurations for 3095FB Transmitter

Panel Mount



Pipe Mount



3095/3095K04A, 3095F04A

Dimensions are in inches (millimeters)

ORDERING INFORMATION

• Available
— Not available

Code	Product Description		3095FB	3095FC
3095F	*MultiVariable* Transmitter		•	•
Code	**Output**			
B	Process Variable Measurement: *Modbus* RS-485		•	—
C	Process Variable Measurement: Mass Flow and Data Logging: *Modbus* RS-485		—	•
Code	**Differential Pressure Range**			
2	0 – 2.5 to 0 – 250 inH_2O (0 – 6,22 to 0 – 622,7 mbar)		•	•
3	0 – 10 to 0 – 1000 inH_2O (0 – 0,0249 to 0 – 2,49 bar)		•	•
Code	**Absolute/Gage Pressure Ranges**			
3	0.5–8 to 0.5–800 psia (3,447–55,16 to 3,447–5516 kPa)		•	•
4	0.5–36.26 to 0.5–3,626 psia (3,447-250 to 3,447–25000 kPa)		•	•
C	0–8 to 0–800 psig (0–55,16 to 0–5516 kPa)		•	•
D	0–36.26 to 0–3,626 psig (0-250 to 0–25000 kPa)		•	•
Code	**Isolator Material**	**Fill Fluid**		
A	316L Stainless Steel (SST)	Silicone	•	•
B[1]	Hastelloy C-276	Silicone	•	•
J[2]	316L SST	Inert	•	•
K[1][2]	*Hastelloy C*-276	Inert	•	•
Code	**Flange Style**	**Material**		
A	*Coplanar*	CS	•	•
B	*Coplanar*	SST	•	•
C	*Coplanar*	Hastelloy C[2]	•	•
J	DIN Compliant Traditional Flange	SST, $^{7}/_{16}$ - 20 Bolting	•	•
0	None (Required for Option Codes S3 or S5)		•	•
Code	**Drain/Vent Material**			
A	SST		•	•
C[1]	*Hastelloy* C		•	•
0	None (Required for Option Codes S3 or S5)		•	•
Code	**O-ring**			
1	Glass-filled TFE		•	•
Code	**Process Temperature Input (RTD ordered separately)**			
0	No RTD Cable (required for 3095FC)		•	•
1	RTD Input with 12 ft. (3,66 m) of Shielded Cable (intended for use with conduit)		•	—
2	RTD Input with 24 ft. (7,32 m) of Shielded Cable (intended for use with conduit)		•	—
3	RTD Input with 12 ft. (3,66 m) of Armored, Shielded Cable (intended for use with conduit)		•	—
4	RTD Input with 24 ft. (7,32 m) of Armored, Shielded Cable		•	—
7	RTD Input with 75 ft. (22,86 m) of Shielded Cable (intended for use with conduit)		•	—
8	RTD Input with 75 ft. (22,86 m) of Armored, Shielded Cable		•	—
A	RTD Input with 12 ft. (3,66 m) of ATEX Flameproof Cable (typically ordered with Product Certificate code H)		•	—
B	RTD Input with 24 ft. (7,32 m) of ATEX Flameproof Cable (typically ordered with Product Certificate code H)		•	—
C	RTD Input with 75 ft. (22,86 m) of ATEX Flameproof Cable (typically ordered with Product Certificate code H)		•	—
Code	**Transmitter Housing Material**	**Conduit**		
A	Polyurethane-covered Aluminum	$^{1}/_{2}$–14 NPT	•	Adapter
E	Polyurethane-covered Aluminum	$^{3}/_{4}$–14 NPT	—	•
B	Polyurethane-covered Aluminum	M20 x 1.5 (CM20)	•	Adapter
C	Polyurethane-covered Aluminum	PG 13.5	•	Adapter
J	SST	$^{1}/_{2}$–14 NPT	•	—
K	SST	M20 x 1.5 (CM20)	•	—
L	SST	PG 13.5	•	—

• Available
— Not available

Code	Terminal Block	3095FB	3095FC
A	Standard	•	—
B	With Integral Transient Protection	•	•
C	CE MARK/ Compliant with EMC - Transient Protection Included	•	—
Code	**Display**		
0	None	•	•
1	LCD Display	•	•
Code	**Bracket**		
0	None (required for option code S3 or S5)	•	•
1	*Coplanar* SST Flange Bracket for 2-in. Pipe or Panel Mount, SST Bolts	•	•
2	Traditional Flange Bracket for 2-in. Pipe Mounting, CS Bolts	•	•
3	Traditional Flange Bracket for Panel Mounting, CS Bolts	•	•
4	Traditional Flange Flat Bracket for 2-in. Pipe Mounting, CS Bolts	•	•
5	Traditional Flange Bracket for 2-in. Pipe Mounting, 300 Series, SST Bolts	•	•
6	Traditional Flange Bracket for Panel Mounting, 300 Series, SST Bolts	•	•
7	Traditional Flange Flat Bracket for 2-in. Pipe Mounting, 300 Series, SST Bolts	•	•
8	SST Traditional Flange Bracket for 2-in. Pipe Mounting, 300 Series, SST Bolts	•	•
9	SST Traditional Flange Flat Bracket for 2-in. Pipe Mounting, 300 Series, SST Bolts	•	•
Code	**Bolts**		
0	CS bolts	•	•
1	Austenitic 316 SST bolts	•	•
N	None (required for Options code S5)	•	•
Code	**Product Certifications**		
0	None	•	•
A	FM Approvals Explosion-Proof	•	—
C	Canadian Standards Associate (CSA) Explosion Proof	•	—
H	ATEX Flame-proof	•	—
M	Canadian Standards Association (CSA) US and Canada Explosion-Proof	—	•
P	ATEX Dust	•	—
Code	**Engineered Measurement Solution (EMS)**		
N	Process Variable Measurement: *MODBUS*	•	—
C	Mass Flow with Process Variable Measurement and Data Logging: *MODBUS* (required for 3095FC)	—	•
Code	**Options**		
Performance Class			
U3[2]	Ultra for Flow: ±0.05% DP reading accuracy, up to 100:1 rangedown, 10 year stability, limited 12 year warranty	•	—
S3	Assembly with 405 Compact Orifice (requires compact orifice model number, see 00813-0100-4810)	•	—
S4[3]	Assembly with *Annubar* Averaging Pitot Tubes or 1195 Integral Orifice Plates (requires corresponding model number, see 00813-0100-4809, 00813-0100-4760, or 00813-0100-4686)	•	—
S5	Assemble to 305 Integral Manifold (requires integral manifold model number)	•	•
C1	Custom Flow Configuration (requires completed Configuration Data Sheet)	•	•
A3	Mast with Solar Panel Assembly and 12 Vdc Batteries	—	•
P1	Hydrostatic testing with certificate	•	•
P2	Cleaning for Special Services	•	•
Q4	Calibration Certificate	•	•
Q8	Material Traceability Certification per EN 10204 3.1B	•	•
DF[4]	1/2–14 NPT Flange Adapter, Carbon Steel, Stainless Steel, Hastelloy C	•	•
A1	Additional RS-232 Communication Board	—	•
A2	12 Vdc System with Batteries	—	•

Typical Model Number: 3095F B 2 3 A B A 1 1 A B 0 1 0 A N

(1) Materials of Construction comply with metallurgical requirements highlighted within NACE MR0175/ISO 15156 for sour oil field production environments. Environmental limits apply to certain materials. Consult latest standard for details. Selected materials also conform to NACE MR0103 for sour refining environments.
(2) Ultra for Flow (Option U3) applicable for DP ranges 2 and 3 with SST isolator material and silicone fill fluid only.
(3) With a primary element installed, the maximum operating pressure will be the lesser of either the transmitter or the primary element.
(4) Material determined by Flange Style material selection (Not available with S4 option).

SPARE PARTS

Spares Category[1]	Item No.	Sensor Modules Parts Description		Part Number
B	9	**Silicone Fill Sensor Module**		
		Differential: 0-2.5/250 in H_20, Range 2/ Absolute: 0.5-8/800 psia, Range 3	316L SST	03095-0345-2312
			Hastelloy® C-276	03095-0345-2313
		Differential: 0-2.5/250 in H_20, Range 2/ Absolute: 0.5–36.26/3,626 psia, Range 4	316L SST	03095-0345-2312
			Hastelloy® C-276	03095-0345-2313
		Differential: 0–10/830 in H2O, Range 3 / Absolute: 0.5–8/800 psia, Range 3	316L SST	03095-0345-3312
			Hastelloy® C-276	03095-0345-3313
		Differential: 0–10/830 in H2O, Range 3 / Absolute: 0.5–36.26/3,626 psia, Range 4	316L SST	03095-0345-3412
			Hastelloy® C-276	03095-0345-3413
		Differential: 0–2.5/250 in H2O, Range 2 / Gage: 0–8/800 psig, Range C	316L SST	03095-0345-2812
			Hastelloy® C-276	03095-0345-2813
		Differential: 0–2.5/250 in H2O, Range 2 / Gage: 0–36.26/3,626 psig, Range D	316L SST	03095-0345-2912
			Hastelloy® C-276	03095-0345-2913
		Differential: 0–10/830 in H2O, Range 3 / Gage: 0–8/800 psig, Range C	316L SST	03095-0345-3812
			Hastelloy® C-276	03095-0345-3813
		Differential: 0–10/830 inH2O, Range 3 / Gage: 0–36.26/3,626 psig, Range D	316L SST	03095-0345-3912
			Hastelloy® C-276	03095-0345-3913
		Halocarbon Inert Fill Sensor Module		
		Differential: 0–2.5/250 in H2O, Range 2 / Gage: 0–8/800 psig, Range C	316L SST	03095-0345-2822
			Hastelloy® C-276	03095-0345-2823
		Differential: 0–2.5/250 in H2O, Range 2 / Gage: 0–36.26/3,626 psig, Range D	316L SST	03095-0345-2922
			Hastelloy® C-276	03095-0345-2923
		Differential: 0–10/830 in H2O, Range 3 / Gage: 0–8/800 psig, Range C	316L SST	03095-0345-3822
			Hastelloy® C-276	03095-0345-3823
		Differential: 0–10/830 in H2O, Range 3 / Gage: 0–36.26/3,626 psig, Range D	316L SST	03095-0345-3922
			Hastelloy® C-276	03095-0345-3923

Spares Category[1]	Item No.	Electronics Board Assembly Hardware Parts Description	Part Number
A	5	Output Electronics Board: Modbus	03095-4005-0009
	5	Output Electronics Board: HART	03095-0303-1010
		Real-Time Clock Battery	03095-0378-0001

Spares Category[1]	Item No.	Housing, Covers, Terminal Blocks Parts Description	Part Number
		Standard Aluminum Housing	
	4	Electronics Housing without Terminal Block (½–14 NPT conduit, RFI filters)	03031-0635-0301
B	1	Electronics Cover	03031-0292-0001
A	3	Standard Terminal Block Assembly: Modbus	03095-0302-0021
A	3	Standard Terminal Block Assembly: HART	03095-0946-0001
B	3	Transient Protection Terminal Block Assembly: Modbus	03095-0302-0022
B	3	Transient Protection Terminal Block Assembly: HART	03095-0946-0002
A		External Ground Assembly	03031-0398-0001

(1) Spares Category: "A" - One spare part for every 25 transmitters recommended. "B" - One spare part for every 50 transmitters recommended.

Spares Category[1]	Item No.	Flanges Parts Description		Part Number
A	11	**Process Flanges**		
		Differential Coplanar Flange	SST, 7/16 m	03031-1350-0022
			Nickel-Plated Carbon Steel	03031-0388-0025
			316L SST	03031-0388-0022
			Hastelloy C	03031-0388-0023
		Coplanar™ Flange Alignment Screw (package of 12 screws)		03031-0309-0001
		Differential Traditional Flange		
		DIN compliant Traditional Flange, SST, 7/16 in Adaptor/Manifold Bolting		03031-1350-0012
Spares Category[1]	**Item No.**	**Flange Adapter Union Parts Description**		**Part Number**
B	13	Nickel-plated Carbon Steel		02024-0069-0005
		316L SST		02024-0069-0002
		Hastelloy C		02024-0069-0003
Spares Category[1]	**Item No.**	**Drain/Vent Valve Kits Parts Description**		**Part Number**
A	10	Vent Valve Kits	316L SST Valve Stem and Seat Kit	01151-0028-0022
			Hastelloy C Valve Stem and Seat Kit	01151-0028-0023
		(Each kit contains parts for one transmitter.)		
Spares Category[1]	**Item No.**	**O-Ring Packages Parts Description**		**Part Number**
B	2	Electronic Housing, Cover (Standard and Meter)		03031-0232-0001
B	8	Electronics Housing, Module		03031-0233-0001
B	15	Process Flange, Glass-filled Teflon		03031-0234-0001
B	14	Flange Adapter, Glass-filled Teflon (Each package contains 12 O-rings.)		03031-0242-0001
Spares Category[1]	**Item No.**	**Mounting Brackets Parts Description**		**Part Number**
		Mounting Flange Bracket Kits (Figure 2)		
B		Coplanar Flange Bracket Kit for 2 in. Pipe or Panel Mounting, all SST		03031-0189-0003
B		Traditional flange Bracket Kit for 2 in. Pipe Mounting, CS Bolts		03031-0313-0001
Spares Category[1]	**Item No.**	**Bolt Kits Parts Description**		**Part Number**
B		**Coplanar Flange**		
		Flange Bolt Kit	Carbon Steel (set of 4)	03031-0312-0001
			316 SST (set of 4)	03031-0312-0002
		Flange/Adapter Bolt Kit	Carbon Steel (set of 4)	03031-0306-0001
			316 SST (set of 4)	03031-0306-0002
		Manifold/Flange Kit	Carbon Steel (set of 4)	03031-0311-0001
			316 SST (set of 4) (Each kit contains bolts for one transmitter)	03031-0311-0002
		Manifold		
		Carbon Steel		
		316 SST		

Spares Category[1]	Item No.	LCD Display Option Part Description	Part Number
A		**Aluminum Housing**	
		Meter Kit (Meter Display, 6-pin Interconnection Header, Cover Assembly): Modbus	03031-0193-0101
		Meter Kit (Meter Display, 6-pin Interconnection Header, Cover Assembly): HART	03095-0392-0001
		Meter (Meter Display, 6-pin Interconnection Header): Modbus	03031-0193-0103
		Meter (Meter Display, 6-pin Interconnection Header): HART	03095-0392-0002
		Cover Assembly Kit: Modbus	03031-0193-0002
		Cover Assembly Kit: HART	03095-0392-0003
Spares Category[1]	**Item No.**	**RTD Cables, Adapters and Plugs Part Description**	**Part Number**
B		RTD Input with 12 ft (3.66 m) of Shielded Cable (Intended for use with conduit.)	03095-0320-0011
		RTD Input with 24 ft (7.32 m) of Shielded Cable (Intended for use with conduit.)	03095-0320-0012
		RTD Input with 12 ft (3.66 m) of Armored, Shielded Cable	03095-0320-0001
		RTD Input with 24 ft (7.32 m) of Armored, Shielded Cable	03095-0320-0002
		RTD Input with 21 in. (53 cm) of Armored, Shielded Cable	03095-0320-0003
		RTD input with 4 ft (1.22 m) of Armored, Shielded cable	03095-0320-0004
		RTD Input with 75 ft (22,86 m) of Shielded Cable (Intended for use with conduit)	03095-0320-0013
		RTD Input with 75 ft (22,86 m) of Armored, Shielded Cable	03095-0320-0007
		RTD Input with 12 ft (3,66 m) of CENELEC Flameproof Cable	03095-0320-0021
		RTD Input with 24 ft (7,32 m) of CENELEC Flameproof Cable	03095-0320-0022
		RTD Input with 75 ft (22,86 m) of CENELEC Flameproof Cable	03095-0320-0023
		RTD Input with 21 in. (53 cm) of CENELEC Flameproof Cable	03095-0320-0024
		¾–14 to ½–14 NPT Adapter (conduit adapter for Rosemount RTD Connection Head)	03095-0308-0001
		Armored Cable Compression Seal	03095-0325-0001
		½ in. male to CM20 female Brass Cable Adapter	00444-0282-0001
		NOTE: The following connect to the Rosemount 3095 RTD Connector:	
		RTD Connector Plug (for transmitters without an RTD)	03095-0323-0001
		½–14 NPT RTD Cable Adapter	03095-0322-0001
Spares Category[1]	**Item No.**	**Accessories Part Description**	**Part Number**
		3095FB User Interface Software	
		Windows User Interface Software–Single PC License, Converter, Cables	03095-5130-0003
		Windows User Interface Software–Single PC License	03095-5125-0004
		Windows User Interface Software–Site License	03095-5125-0005
		Converter and Cables	03095-5106-0002

OPTIONS

Standard Configuration

Unless otherwise specified, transmitters are shipped as follows:

Engineering Units	
Differential	in. H_20
Absolute/ Gage	psi
Temperature	°F
Output	Modbus RTU
Baud Rate	9600
Transmitter Address	1
Flange Type	Specified Model Code Option
O-ring Material	Specified Model Code Option
Drain/ Vent	Specified Model Code Option
Software Tag:	Specified Model Code Option

Custom Configuration (Option Code C1)

If option code C1 is ordered, the transmitters are factory configured per user-specified information. Unspecified parameters remain at the factory default settings.

Tagging

Three customer tagging options are available:

- Standard SST tag is wired to the transmitter. Tag character height is 0.125 in. (3.18 mm), 85 characters maximum.
- Tag may be permanently marked on transmitter nameplate upon request. Tag character height is 0.0625 in. (1.59 mm), 65 characters maximum.
- Tag may be stored in transmitter memory. Software tag is left blank unless specified.

Optional Rosemount 305 Integral Manifolds

The Rosemount 3095 Transmitter and 305AC (305BC) Integral Manifold are fully assembled, calibrated, and seal tested by the factory. Refer to the Rosemount product data sheet 00813-0100-4733 for additional information.

Temperature Sensors and Assemblies

Rosemount offers many types of temperature sensors and assemblies.

ACCESSORIES

User Interface Software Package

The User Interface Software package is available with or without the RS232-485 converter and connecting cables. All configurations are packaged separately.

Part Number:

- 03095-5130-0003: Single PC License, Converter, and Cable
- 03095-5125-0004: Single PC License
- 03095-5125-0005: Site License
- 03095-5106-0002: RS232-485 Converter and Cable

Appendix B Product Certifications

APPROVED MANUFACTURING LOCATIONS

Rosemount Inc. — Chanhassen, Minnesota USA

European Directive Information

The EC declaration of conformity for all applicable European directives for this product can be found on the Rosemount website at www.rosemount.com. A hard copy may be obtained by contacting our local sales office.

ATEX Directive (94/9/EC)

Emerson Process Management complies with the ATEX Directive.

European Pressure Equipment Directive (PED) (97/23/EC)

3095F_2/3,4/D Flow Transmitters — QS Certificate of Assessment - EC No. PED-H-20 Module H Conformity Assessment

All other 3095_ Transmitters/Level Controller — Sound Engineering Practice

Transmitter Attachments: Process Flange - Manifold — Sound Engineering Practice

Electro Magnetic Compatibility (EMC) (89/336/EEC)

3095F Flow Transmitters — EN 50081-1: 1992; EN 50082-2:1995; EN 61326-1:1997 – Industrial

Ordinary Location Certification for Factory Mutual

As standard, the Rosemount 3095FB transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by FM, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

HAZARDOUS LOCATIONS CERTIFICATIONS

North American Certifications

FM Approvals

A 3095FB

Explosion Proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof for Class II/III, Division 1, Groups E, F, and G, hazardous locations. Factory Sealed. Provides non-incendive RTD connections for Class I, Division 2, Groups A, B, C, and D. Install per Rosemount drawing 03095-1025. Enclosure Type 4X.

Canadian Standards Association (CSA) - Canada only

C 3095FB

Explosion-Proof for Class I, Division 1, Groups B, C, and D. Dust-Ignition Proof for Class II/III, Division 1, Groups E, F, and G, hazardous locations. CSA enclosure Type 4X. Factory Sealed. Provides a non-incendive RTD Connection for Class I, Division 2, Groups A, B, C, and D. Suitable for use in Class I, Division 2, Groups A, B, C, and D. Install in accordance with Rosemount Drawing 03095-1024.

Canadian Standards Association (CSA) - U.S. and Canada

M 3095FC
Explosion-Proof for Class I, Division 1, Groups C and D including optional solar panel: mast option: Suitable for use in Class I, Division 2, Groups A, B, C, D, and T3. CSA Enclosure Type 4.

European Certifications

H **ATEX Flameproof**
3095FB
Certificate Number: KEMA02ATEX2320X ⟨Ex⟩ II 1/2 G
EEx d IIC T5 (-50°C ≤ T_{amb} ≤ 80°C)
T6 (-50°C ≤ T_{amb} ≤ 65°C)
V_{max} = 55V dc
CE 1180

Special Conditions for Safe Use (x):

The device contains a thin wall diaphragm. Installation, maintenance, and use shall take into account the environmental conditions to which the diaphragm will be subjected. The manufacturer's instructions for installation and maintenance shall be followed in detail to assure safety during its expected lifetime.

3095FC
Certificate Number: LCIE05ATEX6057X ⟨Ex⟩ II 2 G
EEx d IIB T5
V_{max} = 28V dc
IP66
CE 1180

Special Conditions for Safe Use (x):

Operating ambient temperature: -40°C to 75°C

The users have to make sure that the thermal fluid transfer doesn't overheat the equipment to a temperature corresponding to the spontaneous combustion temperature of surrounding gas.

P **ATEX Dust**
3095FB
Certificate Number: KEMA02ATEX2321 ⟨Ex⟩ II 1 D T90°C Ambient Temp (-50°C ≤ T_{amb} ≤ 80°C)
V = 55 Vdc MAX
I = 23 mA MAX
IP66
CE 1180

APPROVAL DRAWINGS

Factory Mutual (FM)

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY

REVISIONS

REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA	ADD 2055	RTC1004207	L.M.E.	5/13/98

12. INSTALLATION TO BE IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE.

9. NON-INCENDIVE FIELD WIRING METHODS MAY BE USED FOR CONNECTING THE TEMPERATURE SENSING ASSEMBLY. WHEN USING NON-INCENDIVE FIELD WIRING, THE CONNECTION HEAD AND TEMPERATURE SENSOR ASSEMBLY NEED NOT BE EXPLOSION PROOF, BUT ALL COMPONENTS CONNECTED TO THE TEMP SENSOR CONNECTOR MUST BE CLASSIFIED "SIMPLE APPARATUS". SIMPLE APPARATUS ARE DEVICES WHICH ARE INCAPABLE OF GENERATING OR STORING MORE THAN 1.2V, Ø.1A, 25mW, OR 20 μJ (RTD's QUALIFY AS SIMPLE APPARATUS).

8. DIVISION 2 WIRING METHOD.

6. CLASS II INSTALLATIONS MUST USE A CSA APPROVED DUST-IGNITIONPROOF SENSOR.

5. IN AMBIENTS GREATER THAN 40°C, SPRING LOADED TEMPERATURE SENSORS USED WITHOUT AN EXPLOSIONPROOF THERMOWELL MUST BE RATED FOR AT LEAST 85°C.

4. COMPONENTS REQUIRED TO BE APPROVED MUST BE APPROVED FOR GAS GROUP APPROPRIATE TO AREA CLASSIFICATION.

3. ALL CONDUIT THREADS TO BE ASSEMBLED WITH FIVE FULL THREADS MINIMUM.

2. TRANSMITTER MUST NOT BE CONNECTED TO EQUIPMENT GENERATING MORE THAN 250VAC.

1. WIRING METHOD SUITABLE FOR CLASS I, DIV 1, ANY LENGTH.

NOTES:

CAD MAINTAINED (MicroStation)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .Ø2 [Ø,5]
.XXX ± .Ø1Ø [Ø,25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

Form Rev AC

CONTRACT NO.

DR. Myles Lee Miller 7/21/93
CHK'D BLL
APP'D. BEN LOUWAGIE 8/17/93
APP'D. GOVT.

EMERSON. Process Management
ROSEMOUNT®
8200 Market Boulevard • Chanhassen, MN 55317 USA

TITLE MODEL 3Ø95/2Ø55 EXPLOSIONPROOF INSTALLATION DRAWING, FACTORY MUTUAL

SIZE A | FSCM NO | DWG NO. Ø3Ø95-1Ø25

SCALE | WT. | SHEET 1 OF 3

REVISIONS				
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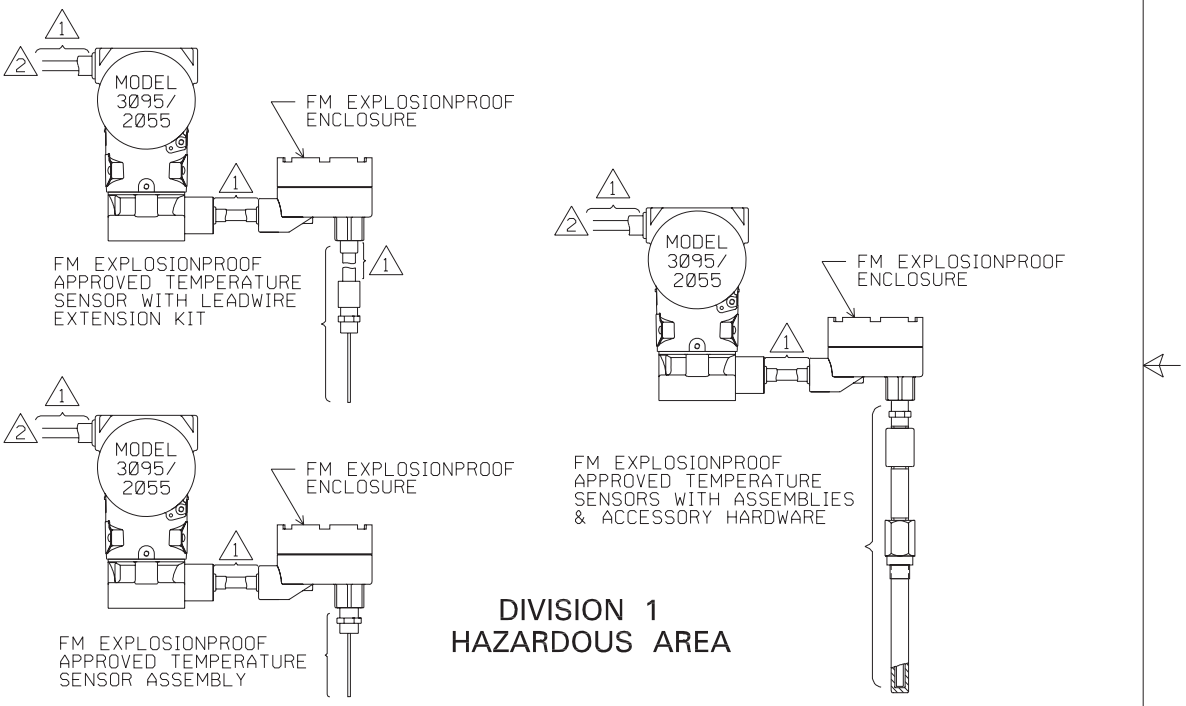
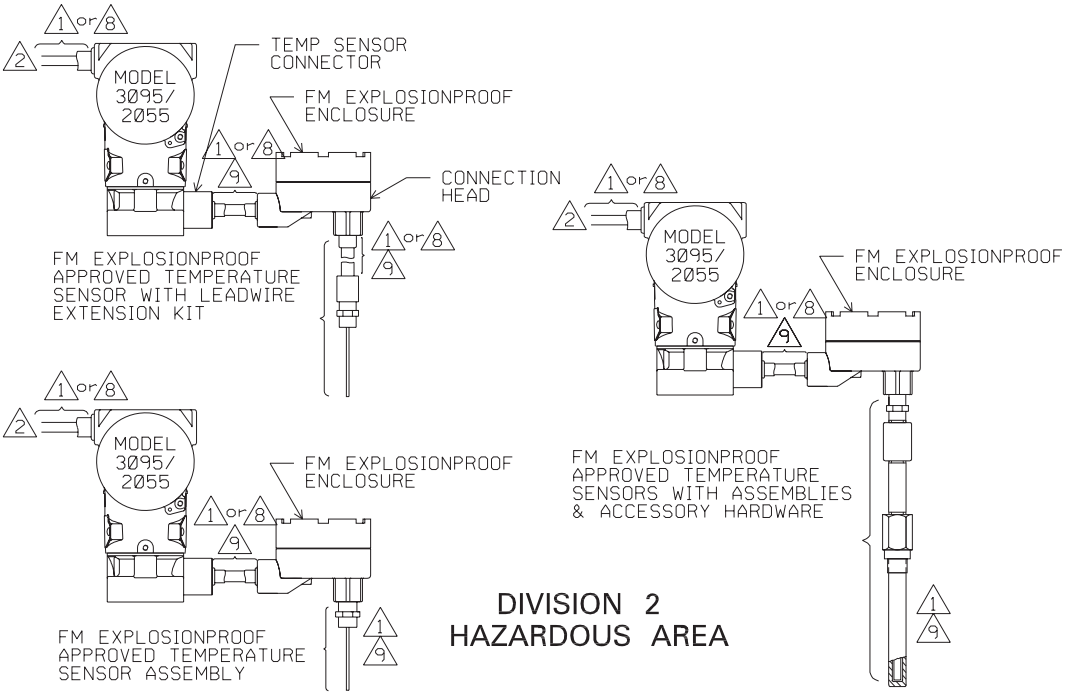
AA		RTC1004207		



Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03095-1025
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 3

Form Rev AC

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004207		



Rosemount Inc. 8200 Market Boulevard Chanhassen, MN 55317 USA			CAD MAINTAINED (MicroStation)	
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03095-1025	
ISSUED	SCALE N/A	WT. ———	SHEET 3 OF 3	

Form Rev AC

Canadian Standards Association (CSA)

CONFIDENTIAL AND PROPRIETARY INFORMATION IS CONTAINED HEREIN AND MUST BE HANDLED ACCORDINGLY	REVISIONS				
	REV	DESCRIPTION	CHG. NO.	APP'D	DATE
	D	ADD DIV 1,2	662265	M.J.Z.	9/6/94
	AA	ADD 2055	RTC1004254	L.M.E.	6/9/98

12. INSTALLATION TO BE IN ACCORDANCE WITH CANADIAN ELECTRICAL CODE.

△9. NON-INCENDIVE FIELD WIRING METHODS MAY BE USED FOR CONNECTING THE TEMPERATURE SENSING ASSEMBLY. WHEN USING NON-INCENDIVE FIELD WIRING, THE CONNECTION HEAD AND TEMPERATURE SENSOR ASSEMBLY NEED NOT BE EXPLOSION PROOF, BUT ALL COMPONENTS CONNECTED TO THE TEMP SENSOR CONNECTOR MUST BE CLASSIFIED "SIMPLE APPARATUS". SIMPLE APPARATUS ARE DEVICES WHICH ARE INCAPABLE OF GENERATING OR STORING MORE THAN 1.2V, 0.1A, 25mW, OR 20 μJ (RTD's QUALIFY AS SIMPLE APPARATUS).

△8. DIVISION 2 WIRING METHOD.

6. CLASS II INSTALLATIONS MUST USE A CSA APPROVED DUST-IGNITIONPROOF SENSOR.

5. IN AMBIENTS GREATER THAN 40°C, SPRING LOADED TEMPERATURE SENSORS USED WITHOUT AN EXPLOSIONPROOF THERMOWELL MUST BE RATED FOR AT LEAST 85°C.

4. COMPONENTS REQUIRED TO BE APPROVED MUST BE APPROVED FOR GAS GROUP APPROPRIATE TO AREA CLASSIFICATION.

3. ALL CONDUIT THREADS TO BE ASSEMBLED WITH FIVE FULL THREADS MINIMUM.

△2. TRANSMITTER MUST NOT BE CONNECTED TO EQUIPMENT GENERATING MORE THAN 250VAC.

△1. WIRING METHOD SUITABLE FOR CLASS I, DIV 1, ANY LENGTH.

NOTES:

CAD Maintained, (MICROSTATION)

UNLESS OTHERWISE SPECIFIED DIMENSIONS IN INCHES [mm]. REMOVE ALL BURRS AND SHARP EDGES. MACHINE SURFACE FINISH 125

-TOLERANCE-
.X ± .1 [2,5]
.XX ± .02 [0,5]
.XXX ± .010 [0,25]
FRACTIONS ± 1/32
ANGLES ± 2°

DO NOT SCALE PRINT

CONTRACT NO.

DR. Myles Lee Miller 10/27/93

CHK'D

APP'D. BEN LOUWAGIE 10/28/93

APP'D. GOVT.

ROSEMOUNT® MEASUREMENT
FISHER-ROSEMOUNT

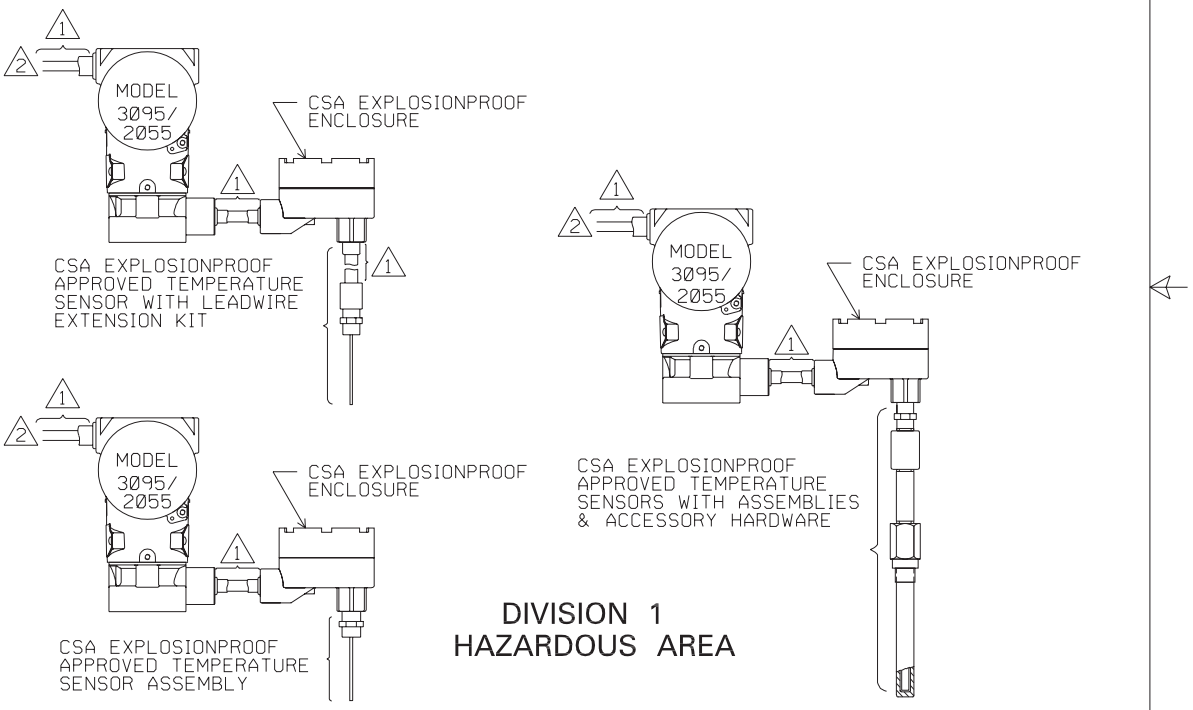
Rosemount Inc.
12001 Technology Drive
Eden Prairie, MN 55344 USA

TITLE MODEL 3095/2055 EXPLOSIONPROOF INSTALLATION DRAWING, CSA

SIZE A | FSCM NO | DWG NO. 03095-1024

SCALE | WT. | SHEET 1 OF 3

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
AA		RTC1004254		



Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA			CAD Maintained, (MICROSTATION)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03095-1024
ISSUED	SCALE N/A	WT. ———	SHEET 2 OF 3

REVISIONS				
REV	DESCRIPTION	CHG. NO.	APP'D	DATE
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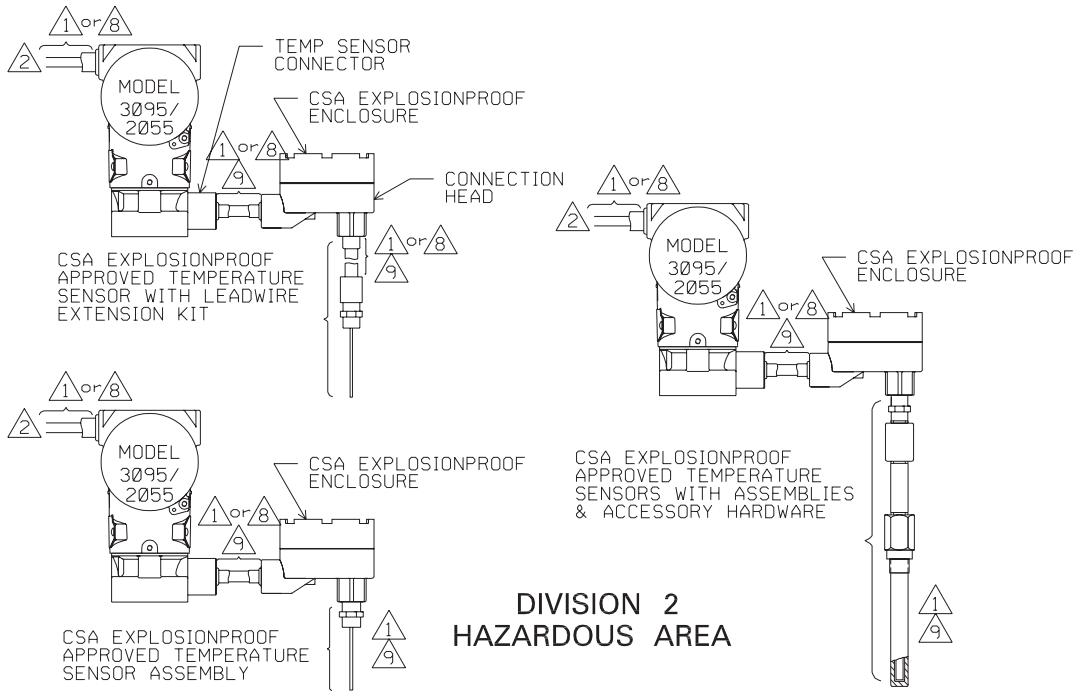

Rosemount Inc. 12001 Technology Drive Eden Prairie, MN 55344 USA			CAD Maintained, (MICROSTATION)
DR. Myles Lee Miller	SIZE A	FSCM NO	DWG NO. 03095-1024
ISSUED	SCALE N/A	WT.	SHEET 3 OF 3

Appendix C 3095FB Modbus Integration Guide

Use this appendix for quick reference to common parameters needed to integrate the 3095FB with various RTUs and other Modbus hosts. For more detailed information, please refer to the *Modbus Protocol Guide* located in chapter 3 of this manual.

GENERAL PROTOCOL INFORMATION

Supported Protocols

The 3095FB supports the following types of Modbus:

- Standard Modbus – RTU

Physical Layer Requirements

- RS485
- 2-Wire (A & B)
- Half-Duplex

Data Format

- Data Bits: 8
- Stop Bits: 1
- Parity: None
- Bit Order: Least Significant Byte (LSB)

Baud Rate

The baud rate is selectable by using the jumper located on the comm. electronics board of the transmitter (see section 2-12 of this manual).

- Default Baud Rate: 9600
- Available Baud Rates: 1200, 2400, 4800, 9600

Supported Modbus Function Codes

Table C-1 lists all of the Modbus functions supported by the 3095FB. For more information, please refer to page 13 of the *Modbus Protocol Guide* in chapter 3 of this manual.

TABLE C-1. Supported Modbus Commands

Function Code	Description
01	Read coil status
02	Read input status
03	Read holding registers
04	Read input registers
05	Force coil
06	Write register
08	Loopback diagnostic
16	Write multiple registers
69	Read multiple floating point registers
70	Write mulitipe floating point registers

NOTE
Function code 04 (read input registers) is the most common command to read the DP, SP, and T process variables measured by the 3095FB.

PROCESS VARIABLE REGISTERS

Floating Point Numbers

The 3 process variables (DP, SP, and T) are saved as 32-bit floating point numbers in three different address locations. In two of the locations, the 32-bit floating point number is saved in two 16-bit registers. In the third location, the number is saved in one 32-bit register.

NOTE
Depending on whether the Modbus host is referenced to a 1 or 0, you may need to add or subtract a 1 from the registers listed below (ex. 0400 instead of 0401) for successful data acquisition between the host and transmitter.

Process Variable	Register Locations		
	16-bit		32-bit
Differential Pressure	0401, 0402	20401, 20402	7401
Static Pressure	0403, 0404	20403, 20404	7402
Temperature	0404, 0405	20404, 20405	7403

Scaled Variables

The 3 process variables can also be read as scaled 16-bit registers in 5 different locations. For example, 0 – 100 in.H20 could correspond to 0 – 65534 (65534 is the maximum value for a 16-bit number).

Process Variable	16-bit Register Locations				
Differential Pressure	0116	3116	30116	40116	50116
Static Pressure	0117	3117	30117	40117	50117
Temperature	0118	3118	30118	40118	50118

OTHER CONSIDERATIONS

For the successful integration of 3095FB transmitters with various installations, it may also be necessary to consider some of the following:

- Make sure the RS-485 network is terminated only twice on the entire bus (once on each end). Termination at multiple points on the bus will hamper communication.
- It may be necessary to alter the way the 3095FB transmits floating point numbers so that Modbus host interprets the data correctly (see page 23 of the *Modbus Protocol Guide* in chapter 3 of this manual).
- If there is noise on the RS-485 bus, try turning on the pull-up and pull-down jumpers (see page 2-12) on only one transmitter.

NOTE
A good practice to assist in troubleshooting is to turn all of the jumpers to the "on" position on the furthest transmitter on the bus while leaving the jumpers on all the other transmitters in the "off" position. This guarantees that the bus is not terminated at more than one point, and that only one transmitter has the pull-up/pull-down jumpers on.

- The transmitter turnaround time may require adjustment (see page 4-7) to make sure the Modbus host receives all transmitted data.

Index

Reference Manual
00809-0100-4738, Rev DA
May 2006

Emerson Process Management

Rosemount Divison
8200 Market Boulevard
Chanhassen, MN 55317 USA
T (U.S.) 1-800-999-9307
T (International) (952) 906-8888
F (952) 949-7001

www.rosemount.com

Emerson Process Management GmbH & Co.
Argelsrieder Feld 3
82234 Wessling
Germany
Tel 49 (8153) 9390
Fax 49 (8153) 939172

Emerson Process Management Asia Pacific Private Limited
1 Pandan Crescent
Singapore 128461
T (65) 6777 8211
F (65) 6777 0947
Enquiries@AP.EmersonProcess.com

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