Reference Manual
00809-0100-3560, Rev AB
July 2020

Rosemount™ Clarity II T1056 Turbidmeter

Turbidity Measurement System

ROSEMOUNT™

EMERSON™

Essential instructions

Read this page before proceeding!

Your instrument purchase from Emerson is one of the finest available for your particular application. These instruments have been designed and tested to meet many national and international standards. Experience indicates that its performance is directly related to the quailty of the installation and knowledge of the user in operating and maintaining the instrument. To ensure continued operation to the design specifications, read this Manual thoroughly before proceeding with installation, commissioning, operation, and maintenance of this instrument.

- Failure to follow the proper instructions may cause any one of the following situations to occur: loss of life, personal injury, property damage, damage to this instrument, and warranty invalidation.
- For clarification of instructions, contact your Rosemount representative.
- Follow all warnings, cautions, and instructions marked on and supplied with the product.
- Use only qualified personnel to install, operate, program, and maintain the product.
- Educate your personnel on the proper installation, operation, and maintenance of this product.
- Install equipment as specified in the installation instructions of the appropriate Reference Manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- Use only factory documented components for repair. Tampering or unauthorized substitution of parts and procedures can affect the performance and cause unsafe operation of your process.
- All equipment doors must be closed, and protective covers must be in place unless qualified personnel are performing maintenance.

⚠ WARNING

Risk of electrical shock

Installation and servicing of this product may expose personnel to dangerous voltages.

Equipment protected throughout by double insulation.
Disconnect main power wired to separate power source before servicing.
Do not operate or energize instrument with case open.
Signal wiring within this box must be rated at least 240 V.
Non-metallic cable strain reliefs do not provide grounding between conduit connections. Use grounding type bushings and jumper wires.
Unused cable conduit entries must be securely sealed by non-flammable closures to provide exposure integrity in compliance with personal safety and environmental protection requirements. Unused conduit openings must be sealed with NEMA 4X or IP65 conduit plugs to maintain the ingress protection rating (IP65).
Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other national or local codes.
Operate only with front panel fastened and in place.
Proper use and configuration is the operator's responsibility.

⚠ WARNING

This product is not intended for use in the light industrial, residential, or commercial environments per the instrument's certification to EN50081-2.

⚠ CAUTION

Radio interference

This product generates, uses, and can radiate radio frequency energy and thus can cause radio communication interference. Improper installation or operation may increase such interference. As temporarily permitted by regulation, this unit has not been tested for compliance within the limits of Class A computing devices, pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference.

Operation of this equipment in a residential area may cause interference, in which case the operator, at his own expense, will be required to take whatever measures may be required to correct the interference.

⚠ WARNING

Physical access

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

Warranty

Seller warrants that the firmware will execute the programming instructiosn provided by Seller, and that the Goods manufactured or services provided by Seller will be free from defects in materials or workmanship under normal use and care until the expiration of the applicable warranty period. Goods are warranted for twelve (12) months from the date of intial installation or eighteen (18) months from the date of shipment by Seller, whichever period expires first. Consumables, such as glass electrodes, membranes, liquid junctions, electrolyte, O-rings, catalytic beads, etc. and services are warranted for a period of 90 days from the date of shipment or provision.

Products purchased by Seller for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer. Buyer agrees that Seller has no liability for Resale Products beyond making a reasonable commercial effeort to arrange for procurement and shipping of the Resale Products.

If Buyer discovers any warranty defects and notifies Seller thereof in writing during the applicable warranty period, Seller shall, at its option, promptly correct any errors that are found by Seller in the firmware or Services, or repair or replace F.O.B. point of manufacture that portion of Goods or firmware found by Seller to be defective, or refund the purchase price of the defective portion of the Goods/Services.

All replacements or repairs necessitated by inadequate maintenance, normal wear and usage, unsuitable power sources, unsuitable environmental conditions, accident, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense. Seller shall not be obligated to pay any costs or charges incurred by Buyer or by any other party except as may be agreed upon in writing in advance by an authorized Seller representative. All costs of dismantling, reinstallation and freight and the time and expenses of Seller's personnel for site travel and diagnosis under this warranty clause shall be borne by Buyer unless accepted in writing by Seller.

Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller. Except as otherwise expressly provided in the Agreement, THERE ARE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

Contents

1 Quick start guide

Complete the following steps to start the Rosemount T1056.

Prerequisites

Refer to Install for installation instructions.

The sensor cable is pre-wired to a plug that inserts into a recieving socket in the analyzer. The cable also presses through a strain relief fitting.

Procedure

1. To install the cable:
    a) Remove the wrenching nut from the strain relief fitting.
    b) Insert the plug through the hole in the bottom of the enclosure nearest the sensor socket. Seat the fitting in the hole.
    c) Slide the wrenching nut over the plug and screw it onto the fitting.
    d) Loosen the cable nut so the cable slides easily.
    e) Insert the plug into the appropriate receptacle on the circuit board.
    f) Adjust the cable slack in the enclosure and tighten the cable nut. For wall/pipe mounting, be sure to leave sufficient cable in the enclosure to avoid stress on the cable and connections.
    g) Plug the cable into the back of the sensor.
    h) Place the sensor in either the measuring chamber or the calibration cup.

    Important
    The sensor must be in a dark place when power is first applied to the analyzer.

2. Make power, alarm, and output connections as shown in Wire.
3. Once connections are secured and verified, apply power to the transmitter.

    When the transmitter is powered up for the first time, the ***Quick Start*** screens appear.
4. Follow the Quick Start Guide to enable live readings.
    a) A blinking field shows the position of the cursor.
    b) Use ◀ or ▶ to move the cursor left or right. Use ▲ or ▼ to increase or decrease the value of a digit. Use ◀ or ▶ to move the decimal point.
    c) Press **ENTER** to store a setting. Press **EXIT** to leave without storing changes. Pressing **EXIT** also returns the display to the language selection screen.

Important
When using EPA/incandescent sensors (PN 8-0108-0002-EPA):

- Do not power up the instrument without the sensor connected.
- Do not disconnect and reconnect a sensor while a transmitter is powered.

If this is inconvenient or cannot be avoided:

1. Cycle power to the instrument after connecting the sensor or
2. Perform a slope calibration or standard calibration routine after connecting the sensor. Following these guidelines will extend the life of the incandescent lamp and avoid premature warnings and faults due to reduced lamp life.

1.1 Rosemount T1056 screens

Figure 1-1: Quick Start Guide, Rosemount 1056

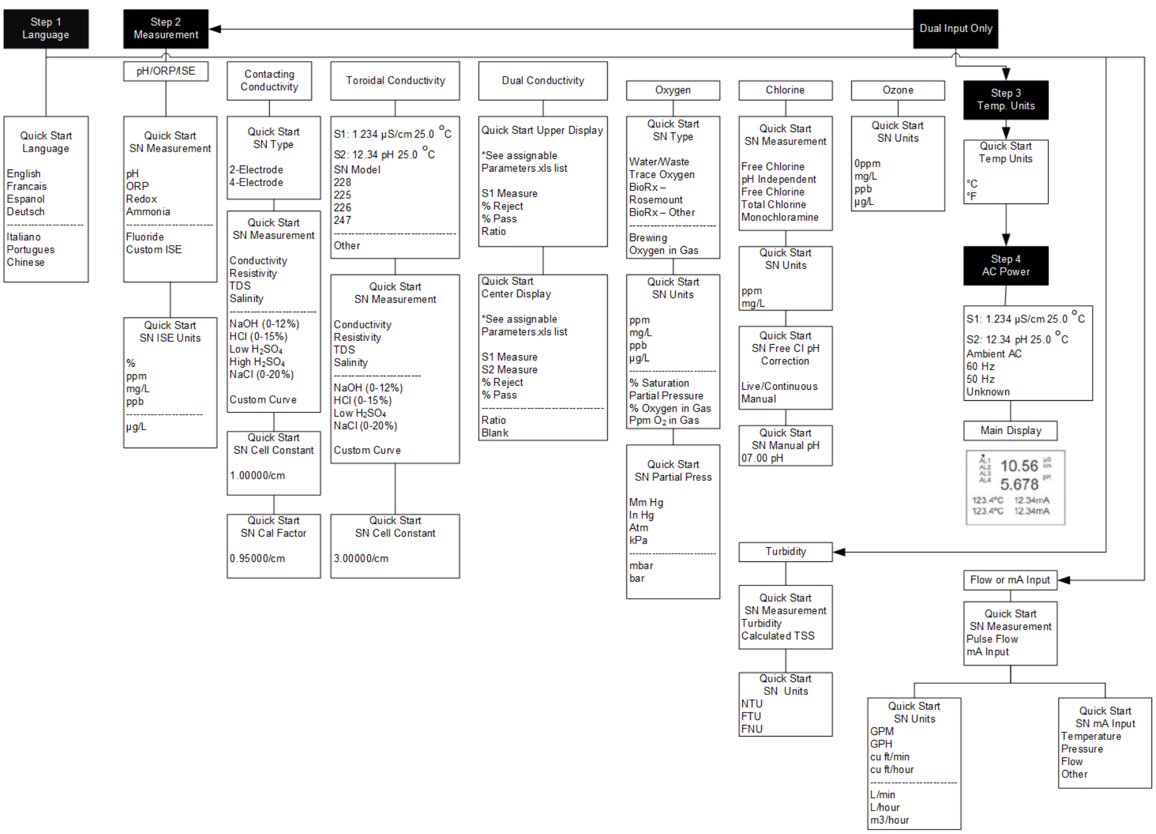
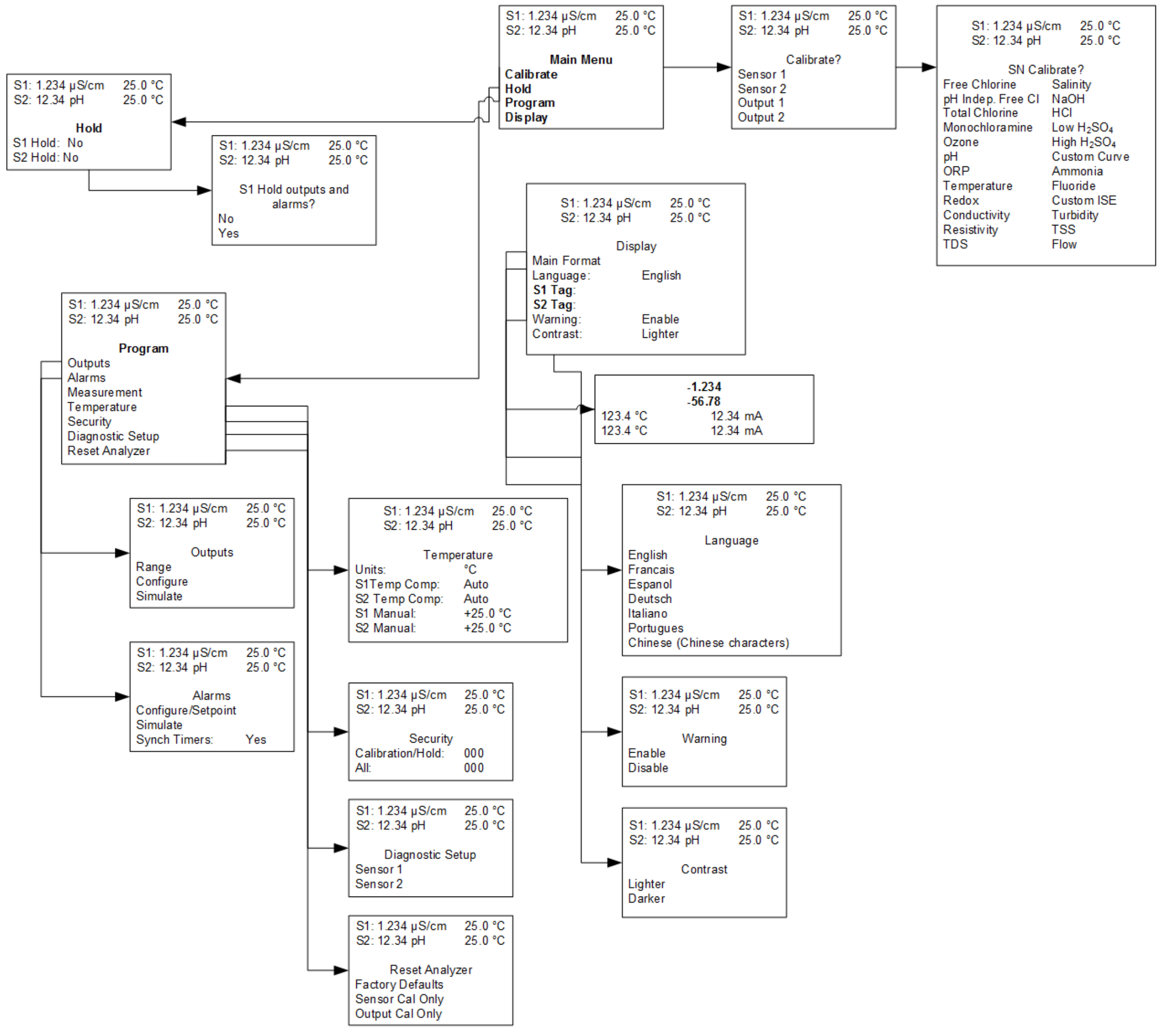


Figure 1-2: Rosemount 1056 Menu Tree



2 Description and specifications

- Complete system includes single or dual input analyzer, sensor(s), and debubbler assembly.(1)
- Choose US EPA Method 180.1 or ISO Method 7027 compliant sensors.
- Resolution 0.001 NTU
- Full featured analyzer with fully scalable analog outputs and fully programmable alarms with interval timers.
- Intuitive, user-friendly menu in seven languages makes setup and calibration easy.

2.1 Features and applications

The Rosemount T1056 turbidmeter is intended for the determination of turbidity in water. Low stray light, high stability, efficient bubble rejection, and a display resolution of 0.001 NTU make the turbidmeter ideal for monitoring the turbidity of filtered drinking water. You can also use the turbidmeter in applications other than drinking water treatment. Examples are monitoring wastewater discharges, condensate returns, and clarifiers.

Currently, new ISO 7027 systems are available, with replacement EPA 180.1 sensors available for current install base. USEPA 180.1 sensors use a visible light source. ISO 7027 sensors use a near infrared light emitting diode (LED). For regulatory monitoring in the United States, you must use USEPA 180.1 sensors. Regulatory agencies in other countries may have different requirements.

The turbidmeter consists of a transmitter, which accepts either one or two sensors, the sensors themselves, and a debubbler/measuring chamber and cable for each sensor. The cable plugs into the sensor and the transmitter, making setup fast and easy. Sensors can be located as far as 50 ft. (15.2 m) away from the transmitter.

The turbidmeter incorporates the popular and easy to use Rosemount 1056 transmitter. Menu flows and prompts are so intuitive that you practically do not need a manual. Analog outputs are fully scalable. Alarms are fully programmable for high/low logic and dead band. To simplify programming, the transmitter automatically detects whether an EPA 180.1 or ISO 7027 sensor is being used.

The turbidmeter is available in an optional configuration in which the transmitter, sensor(s), and debubbling flow cell(s) are mounted on a single back plate. The sensor cables are pre-wired to the transmitter, so setup is exceptionally fast and easy. Simply mount the unit on a wall, bring in power and sample, and provide a drain. To order this option, consult the factory.

2.2 Specifications

Note
Specifications subject to change without notice.

(1) Clarity II is a trademark of Emerson.

2.2.1 General specifications

Enclosure	Polycarbonate. Type 4X/CSA 4 (IP65).
Dimensions	Overall: 6.10 x 6.10 x 5.5-in. (155 x 155 x 131 mm). Cutout: ½ DIN 5.45 x 5.45-in. (139 mm x 139 mm)
Conduit openings	Accepts ½-in. or PG 13.5 conduit fittings.
Display	Monochromatic graphic liquid crystal display. 128 x 96 pixel display resolution. Backlit. Active display area: 2.3 x 3.0-in. (58 x 78 mm)
Security code	3-digit code prevents accidental or unauthorized changes in instrument settings and calibration.
Languages	• English • French • German • Italian • Spanish • Portuguese • Chinese
Units	Turbidity • NTU • FTU • FNU Total suspended solids • mg/L • ppm • No units
Display resolution-turbidity	Four digits; decimal point moves from `x.xxx` to `xxx.x`
Display resolution-TSS	Four digits; decimal point moves from `x.xxx` to `xxx.x`
Calibration methods	User-prepared standard, commercially prepared standard, or grab sample. For total suspended solids, you must provide a linear calibration equation.
Ambient temperature and humidity	32 to 131 °F (0 to 55 °C). Turbidity only: 32 to 122 °F (0 to 50 °C), relative humidity 5 to 95 percent (non-condensing)
Altitude	For use up to 6562 ft. (2000 m).

Storage temperature effect
-4 to 140 °F (-20 to 60 °C)

Power
Ordering code -02: 20 to 30 Vdc. 15 W min. input power

Ordering code -03: 85 to 265 Vac, 47.5 to 65.0 Hz, switching. 15 W min. input power

Equipment protected by double insulation.

Inputs
One or two isolated sensor inputs

Outputs
Two 4-20 mA or 0-20 mA isolated current outputs. Fully scalable. Max load: 550 Ohm. Output 1 has supermiposed HART® signal (configurations 1056-0X-2X-3X-HT only)

Current output accuracy
±0.05 mA at 25 °C

Terminal connections rating
Power connector (3-leads): 24-12 AWG wire size. Signal board terminal blocks: 26-16 AWG wire size. Current output connectors (2-leads): 24-16 AWG wire size. Alarm relay terminal blocks: 24-12 AWG wire size (-02 24 Vdc power supply and -03 85-265 Vac power supply)

RFI/EMI
EN 61326 CE

LVD
EN-61010-1 CE

Hazardous location approvals
Options for CSA: 02, 03, 20, 21, 22, 24, 25, 26, 27, 30, 31, 32, 34, 35, 36, 37, 38, AN, and HT.

-LR 34186

Class I, Division 2, Groups A, B, C, & D

Class II, Division 2, Groups E, F, & G

Class III T4A Tamb = 50 °C

Evaluated to the ANSI/UL Standards. The "C" and "US" indicators adjacent to the CSA mark signify that the product has been evaluated to the applicable CSA and ANSI/UL Standards, for use in Canada and the US respectively.

Relays
Form C, SPDT, epoxy sealed

Table 2-1: Maximum Relay Current

Supply voltage	Resistive
28 Vdc	5.0 A
115 Vac	5.0 A
230 Vac	5.0 A

Inductive load
⅛ HP motor (max.), 40 Vac

⚠ WARNING

Risk of electrical shock

Field wiring terminals	Removable terminal blocks for power, analog outputs, and sensors

2.2.2 Sensor

Method	ISO 7027 (using 860 nm LED source).
Incandescent lamp life	One year (EPA 180.1)
LED life	Three years (ISO 7027)
Wetted materials	Delrin®(2), glass, EPDM
Accuracy after calibration at 20.0 NTU	0-1 NTU: ±2% of reading or ±0.015 NTU, whichever is greater. 0-20 NTU: ±2% of reading.

Note
Turbidity values of 2-200 NTU can be measured, but frequent cleaning may be required to maintain turbidity measurements.

Cable	20 ft. (6.1 m) or 50 ft. (15.2 m). Maximum 50 ft. (15.2 m). Connector is IP65.
Maximum pressure	30 psig (308 kPa abs)
Temperature	40 to 95 °F (5 to 35 °C)
Sensor body rating	IP65 when cable is connected

2.2.3 Debubbler and flow chamber

Dimensions	18.1 x 4.1-in. (460 mm x 104 mm) diagram (approximately)
Wetted materials	ABS, EPDM, Delrin®, polypropylene, nylon
Inlet	Compression fitting accepts ¼-in. OD tubing; fitting can be removed to provide ¼-in. FNPT.
Drain	Barbed fitting accepts ⅜-in. ID tubing; fitting can be removed to provide ¼-in. female national pipe thread (FNPT). Must drain to atmosphere.
Sample temperature	40 to 95 °F (5 to 35 °C)
Minimum inlet pressure	3.5 psig (308 kPa abs).

(2) Delrin is a registered trademark of DuPont Performance Elastomers.

	3.5 psig will provide about 0.01 oz./min (250 mL/min) sample flow.
Maximum inlet pressure	30 psig (308 kPa abs). Do not block drain tube.
Recommended sample flow	0.01 to 0.03 oz./min (250 to 750 mL/min)

2.2.4 Miscellaneous

Weight/shipping weight

Sensor	1 lb./2 lb. (0.5 kg/1.0 kg)
Transmitter	2 lb./3 lb. (1.0 kg/1.5 kg)
Debubbler	3 lb./4 lb. (1.5 kg/2.0 kg) (rounded to the nearest lb. or 0.5 kg)

3 Install

3.1 Unpack and inspect

The Rosemount T1056 Turbidmeter is a complete system for the determination of turbidity in drinking water. The system consists of the transmitter, sensor(s), cable(s), and flow chamber/debubbler(s). Consult the table to verify that you have received the parts for the option you ordered.

Table 3-1: Rosemount T1056 Turbidmeter Parts

Item	Model/part number
Single input turbidity transmitter	1056-03-27-38-AN
Dual input turbidity transmitter	1056-03-27-37-AN
Single input turbidity transmitter with HART®	1056-03-27-38-HT
Dual input turbidity transmitter with HART	1056-03-27-37-HT
Sensor - EPA standards	8-0108-0002-EPA
Sensor - ISO standard	8-0108-0003-ISO
Cable - 3 ft. (0.9 m)	2413800
Cable - 20 ft. (6.1 m)	2409700
Cable - 50 ft. (15.2 m)	2409800
Calibration cup	2410100
Molded chamber/debubbler	24170-00

Note
The transmitter model number is printed on a label attached to the side of the instrument.

3.2 Install

3.2.1 General installation information

1. Although the transmitter is suitable for outdoor use, do not install it in direct sunlight or in areas of extreme temperatures.
2. Install the transmitter in an area where vibration and electromagnetic and radio frequency interference are minimized or absent.
3. Keep the transmitter and sensor wiring at least one foot (0.3 m) from high voltage conductors. Be sure there is easy access to the transmitter.
4. The transmitter is suitable for panel, pipe, or surface mounting. Refer to the figures below.

⚠ WARNING

Electrical shock

Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other applicable national or local codes.

Do not operate or energize instrument with case open.

Note
Dimensions are in inches (millimeters).

Note
Panel mounting seal integrity (4/4X) for outdoor applications is the customer's responsibility.

Figure 3-1: Panel Mount Front View

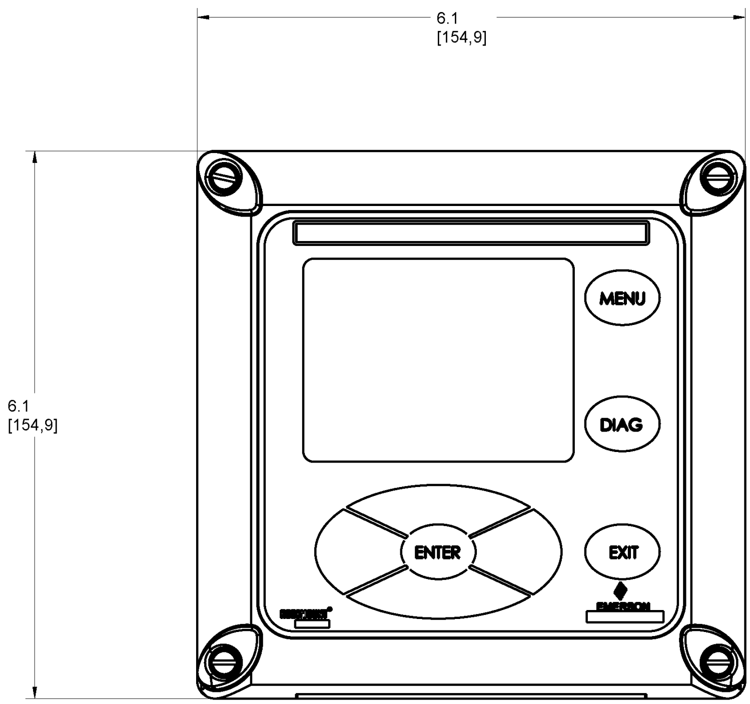
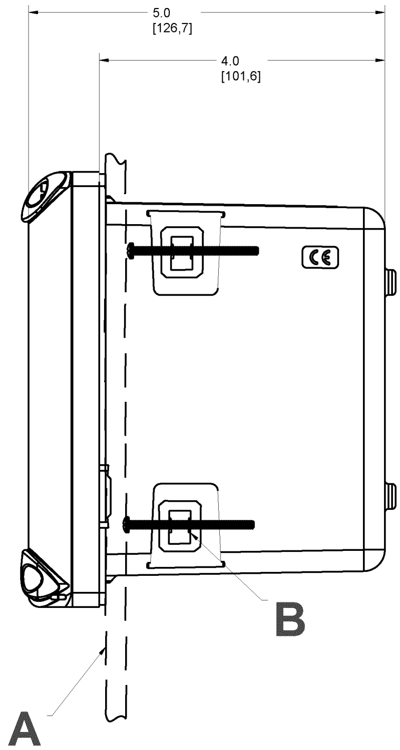
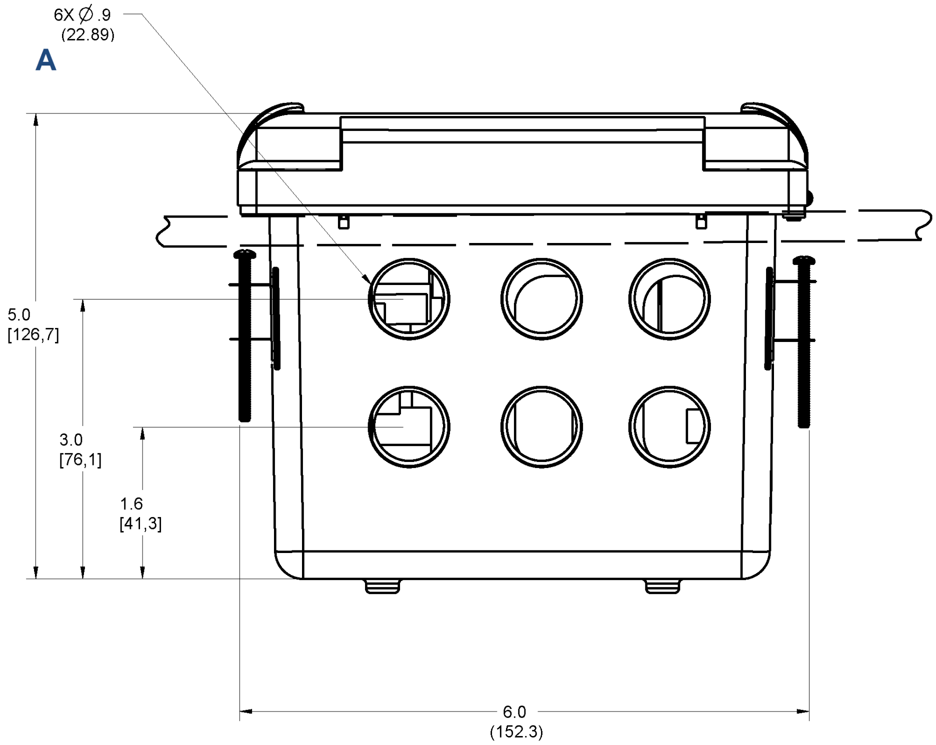


Figure 3-2: Panel Mount Side View



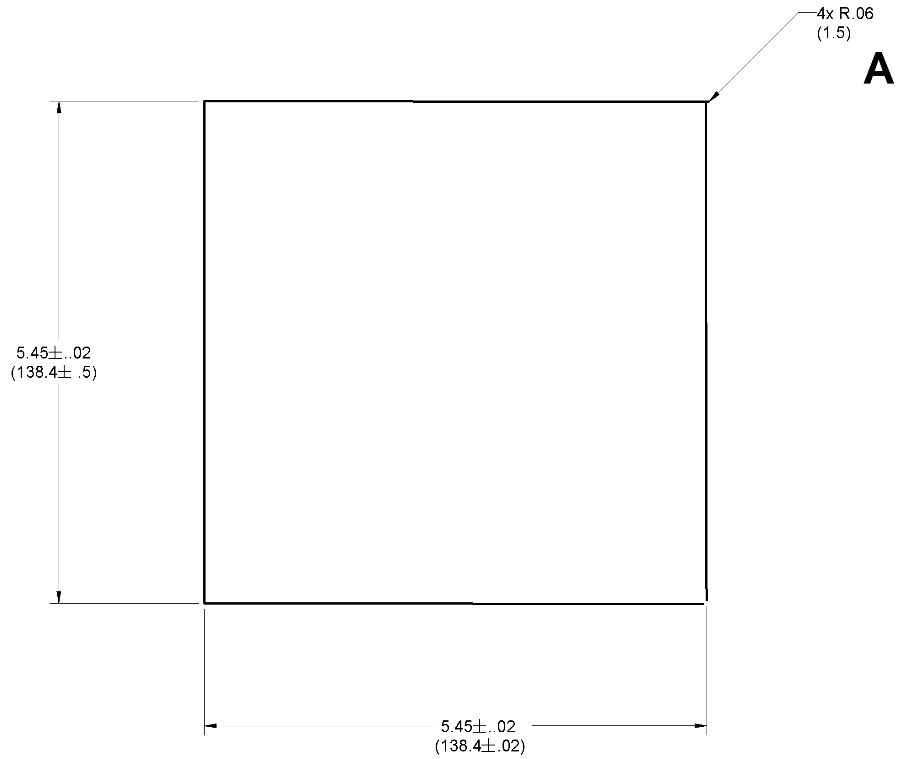
1. Panel supplied by others. Maximum thickness: 3.75 in. (9.52 mm)
2. 4X mounting brackets and screws provided with instrument

Figure 3-3: Panel Mount Bottom View



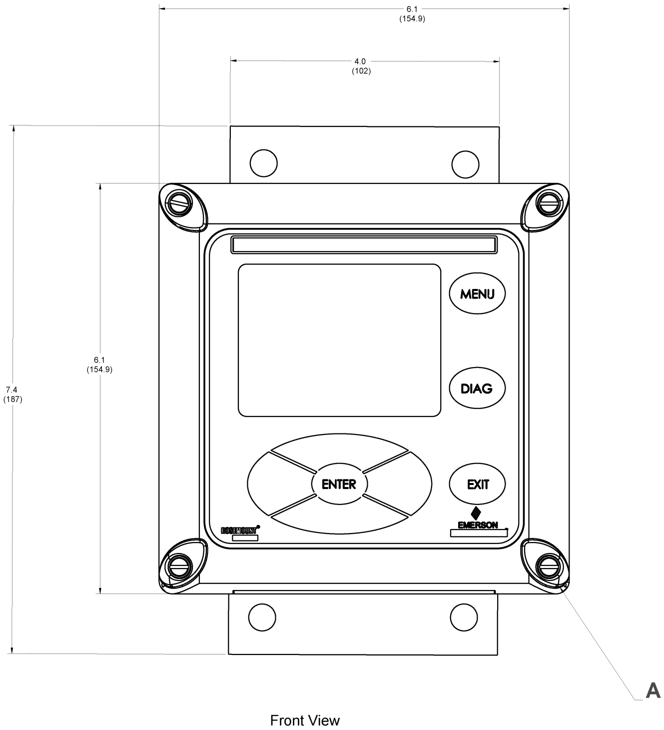
A. Conduit openings

Figure 3-4: Panel Cut-out



A. Maximum radius

Figure 3-5: Wall Mount Front View



A. Four cover screws

Figure 3-6: Wall Mount Side View

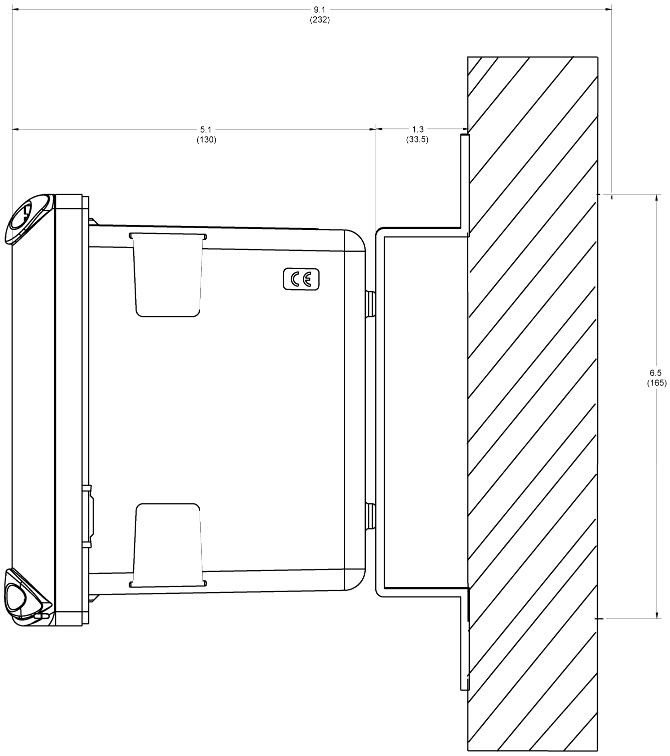
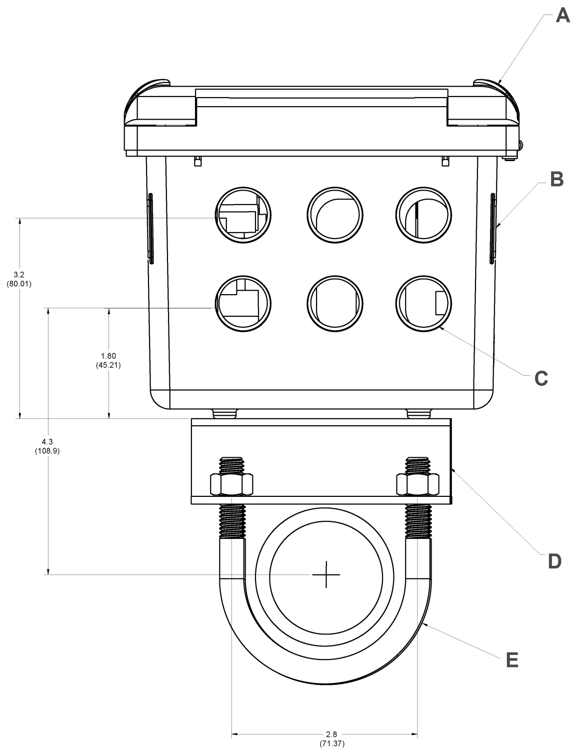


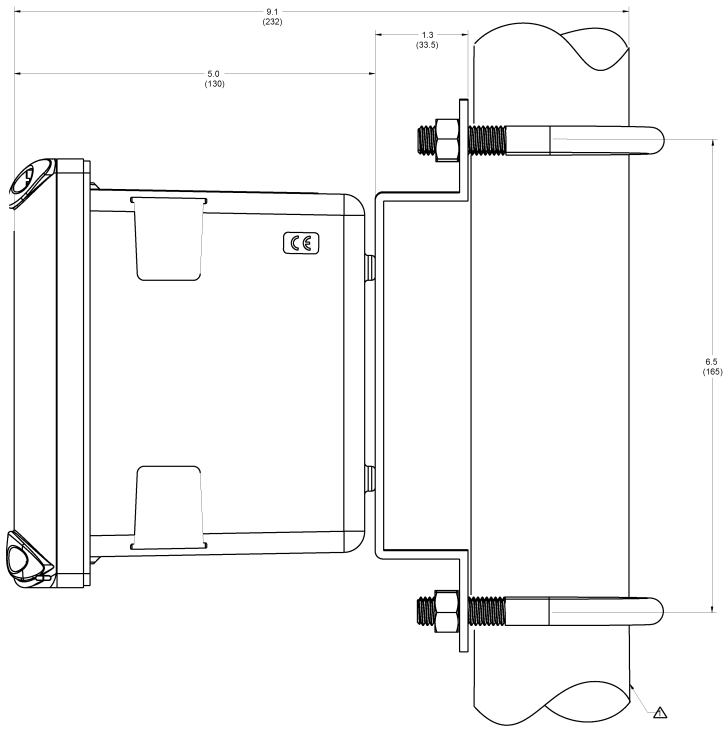
Figure 3-7: Pipe Mount Bottom View



A. *Front panel*
B. *Panel & pipe mount enclosure*
C. *6x Ø conduit openings*
D. *2-in. (50.8 mm) pipe mount bracket*
E. *2X set U-bolts for 2-in. (50.8 mm) pipe in kit PN 23280-00*

The front panel is hinged at the bottom. The panel swings down for easy access to the wiring locations.

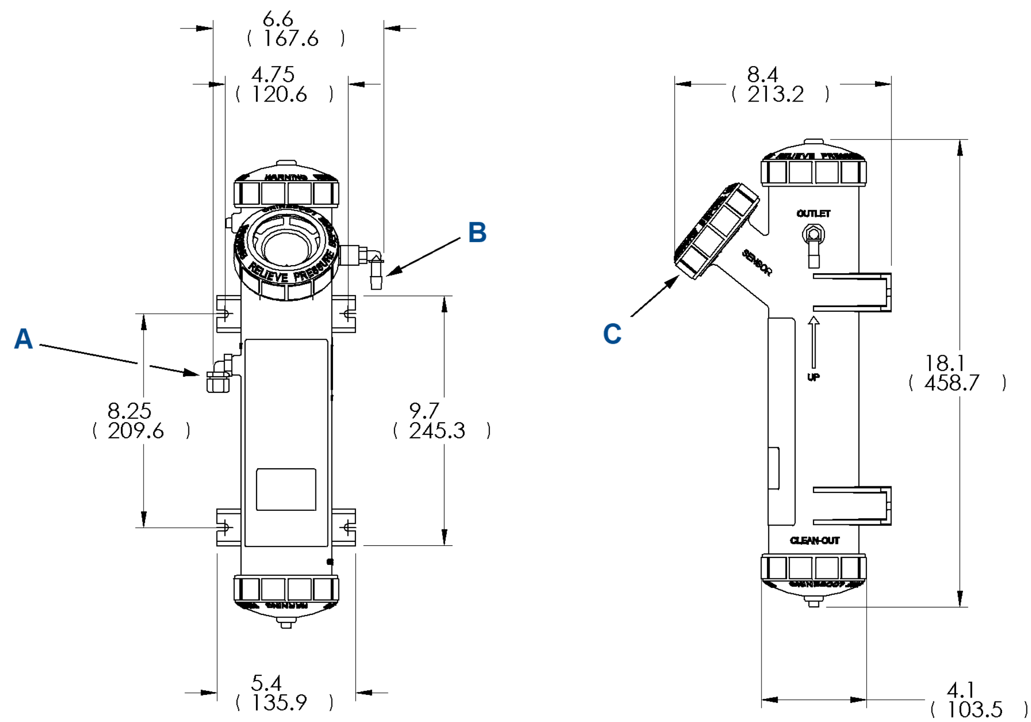
Figure 3-8: Pipe Mount Side View



3.3 Install debubbler assembly

See Figure 3-9 for installation.

Figure 3-9: Debubbler and Flow Chamber



A. Inlet
B. Outlet
C. Sensor port

Procedure

1. Connect the sample line to the inlet fitting.

   The fitting accepts ¼-in. OD tubing. See Sample point for recommended installation of the sample port.

2. Attach a piece of ⅜-in. ID soft tubing to the drain fitting.

   The debubbler must drain to atmosphere.

   ⚠ WARNING

   High pressure and temperature

   Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig and the process temperature is lowered to a safe level!

⚠ CAUTION

Reading errors

During operation, the debubbler is under pressure. A 0.040 in. (1 mm) orifice in the outlet provides the pressure. Back pressure helps prevent outgassing, which can lead to bubbles accumulating on the sensor face, resulting in erroneous readings.

Do not exceed 30 psig (308 kPa abs) inlet pressure.

The amount of pressure in the debubbler can be estimated from the flow rate. See Table 3-2.

Table 3-2: Approximate Debubbler Pressure as a Function of Flow (0.040 Inch Outlet Orifice)

gph	psig	mL/min	kPa abs
2	1	100	110
4	3	200	120
6	8	300	140
8	14	400	160
10	21	500	190
11	26	600	240
12	31	700	280
--	--	800	340

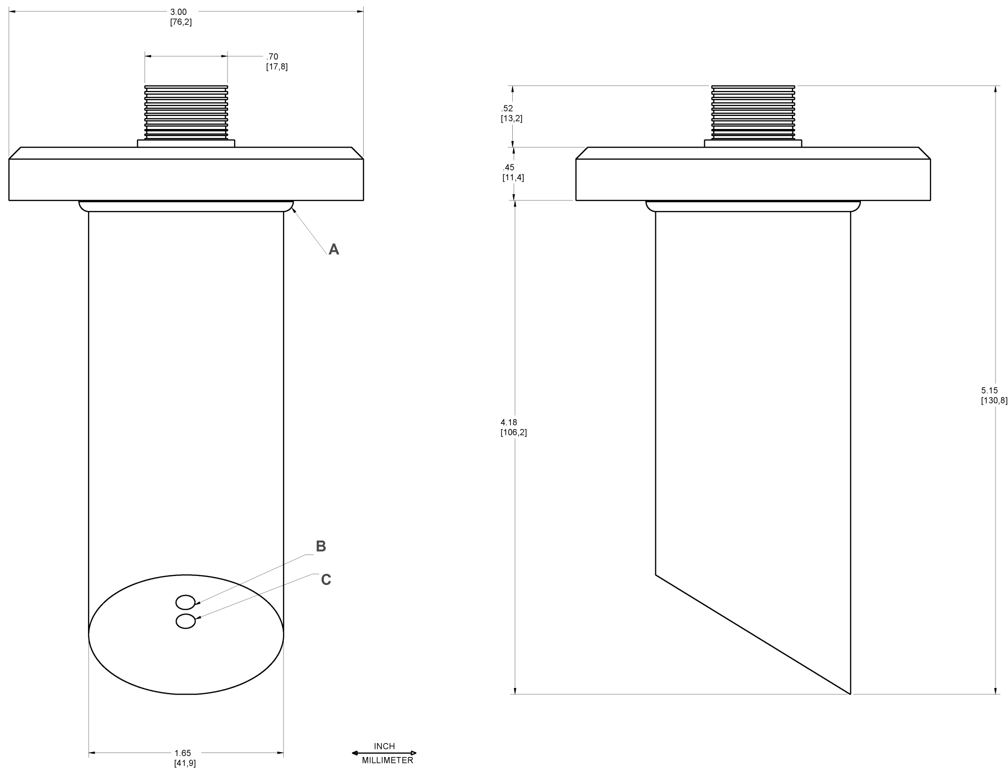
To control and monitor sample flow, a valved rotameter with fittings is available (PN 24103-00).

3. Attach the rotameter to the debubbler outlet.

   You can also use the rotameter to increase back pressure on the debubbler if additional pressure is needed to prevent outgassing.

3.4 Install sensor

Figure 3-10: Sensor



A. O-ring PN 9550145
B. Light source
C. Detector

Procedure

1. Unscrew the nut on the side of the debubbler.
2. Insert the sensor in the mouth of the measuring chamber.
   Be sure the pin on the debubbler lines up with the hole in the sensor.
3. Replace the nut.
4. Remove the protective cap from the sensor.
5. Screw the cable onto the receptacle.
   The plug and receptacle are keyed for proper alignment.

The sensor is rated to IP65 when properly connected to the cable.

Postrequisites

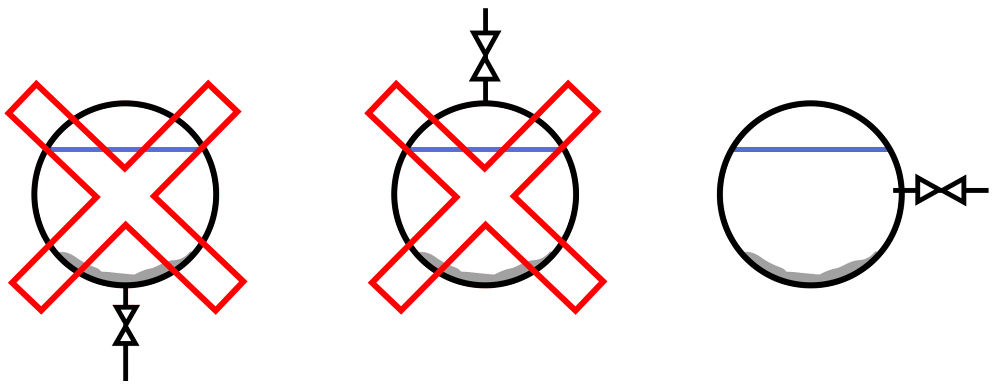
To prevent possible water damage to the connector contacts, be sure the cable receptacle and the connector on the back of the sensor are dry when connecting or disconnecting the cable.

3.5 Sample point

Locate the sample tap to minimize pickup of sediment or air.

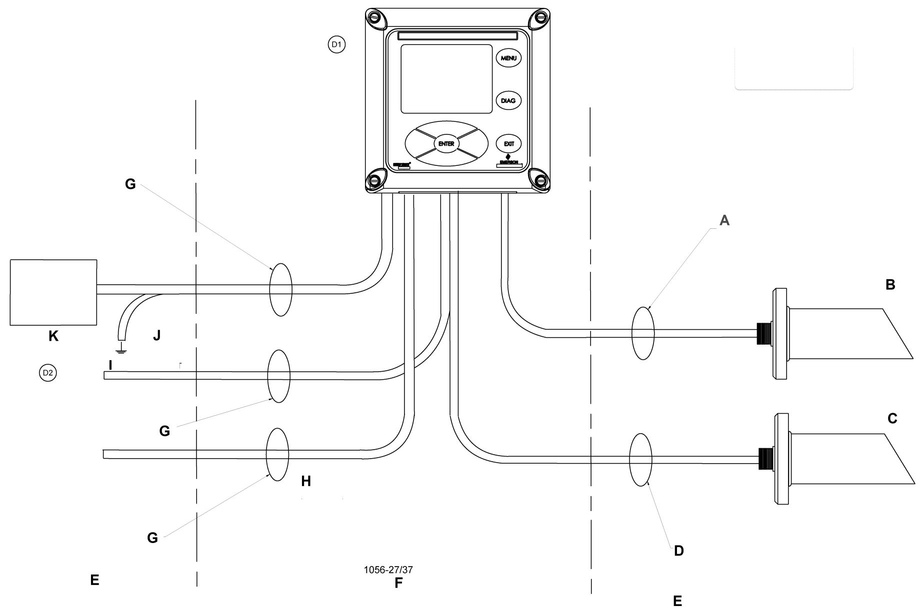
See Figure 3-11.

Figure 3-11: Sampling for Turbidity



If possible, install a sampling port that extends one or two inches (25-50 mm) into the pipe. Use ¼-in. OD rigid plastic tubing. Avoid soft plastic tubing if possible. To reduce sample lag time, install the debubbler and flow chamber as close to the sample tap as possible.

Figure 3-12: Non Incendive Field Wiring Installation (CSA) 1056-27/37



A. *Sensor cable is shielded. Max cable length is 50 ft. (15.2 m).*
B. *Rosemount Clarity II Turbidity Sensor #2 (optional)*
C. *Rosemount Clarity II Turbidity Sensor #1 (optional)*
D. *Sensor cable is shielded. Max cable length is 50 ft. (15.2 m).*
E. *Unclassified area*
F. *Hazardous area*
   Class I, Div. 2 GPS A-D, 0 to 50 °C
   Class II, III, Div. 2 GPS E-G
G. *Metal conduit*
H. *Alarm wiring (Vac) optional*
I. *Analog output*
J. *Ground connection may be made in hazardous area.*
K. *Power supply*

- For FM installation, refer to installation drawing number 1400324.
- For CSA installation, refer to installation drawing number 1400325.

⚠ WARNING

Flammable

Use with non-flammable process media only.

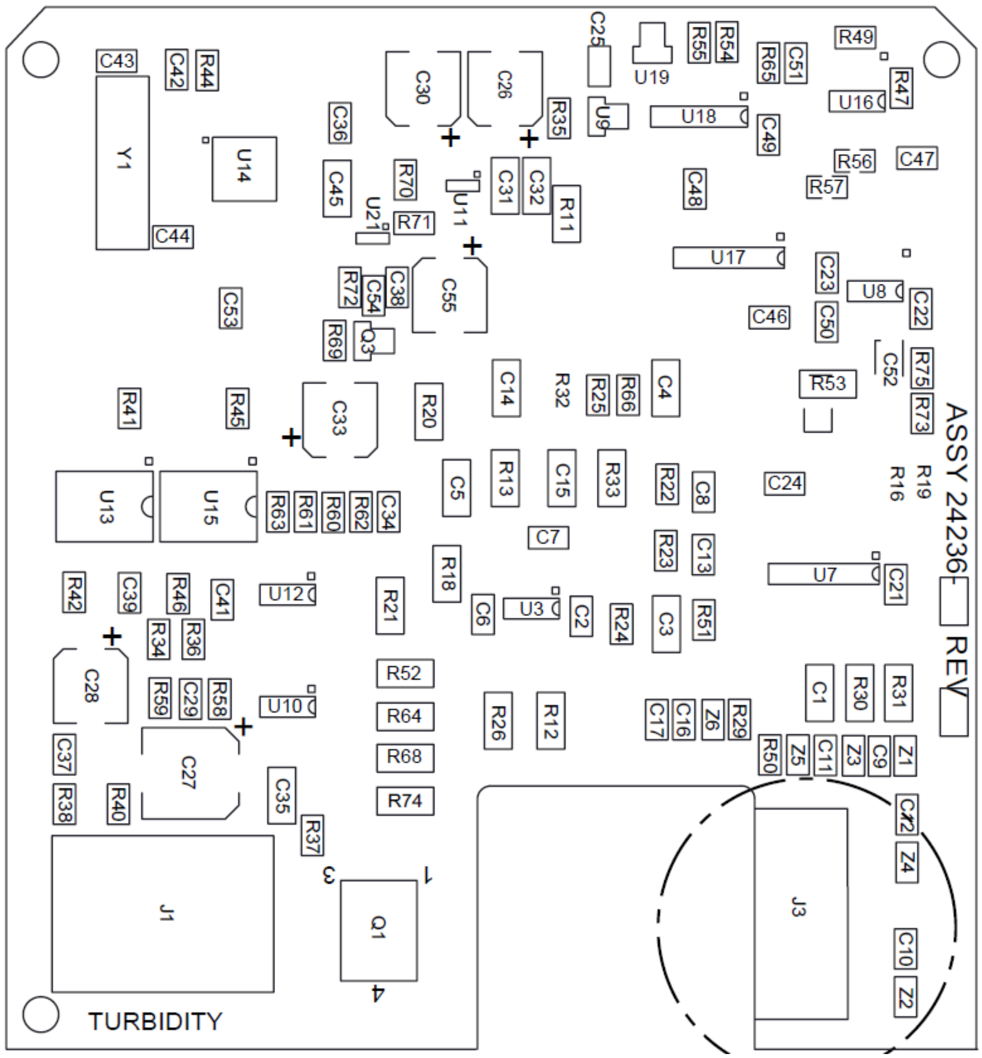
Note

- Installation must conform to the CEC.
- Seal required at each conduit entrance.

- During installation, leave maximum amount of jacket insulation possible on N.I. field wiring within instrument enclosure. After termination, wrap N.I. field wiring within enclosure with mylar tape to ensure adequate double insulation remains.

Unless otherwise specified.

Figure 3-13: Non-Incendive Field Wiring Connection for Class 1, Division 1, Group D



Turbidity sensor board

Option -27/-37: turbidity

May only be used with a Rosemount Clarity II Turbidity Sensor.

4 Wire

4.1 General wiring information

The transmitter is easy to wire.

It includes removable connectors and slide-out signal input boards.

4.1.1 Removable connectors and signal input boards

The transmitter uses removable signal input boards and communication boards for ease of wiring and installation.

You can remove each of the signal boards either partially or completely from the enclosure for wiring. The transmitter has three slots for placement of up to two signal input boards and one communication board.

Slot 1 - left	Slot 2 - center	Slot 3 - right
Communication board	Input board 1	Input board 2

4.1.2 Signal input boards

Slots 2 and 3 are for signal input measurement boards.

Procedure

1. Wire the sensor leads to the measurement board following the lead locations marked on the board.
2. Carefully slide the wired board fully into the enclosure slot and take up the excess sensor cable through the cable gland.
3. Tighten the cable gland nut to secure the cable and ensure a sealed enclosure.

4.1.3 Alarm relays

Emerson supplies four alarm relays with the switching power supply (85 to 264 Vac, 03 order code) and the 24 Vdc power supply (20 - 30 Vdc, 02 order code). You can use all relays for process measurement(s) or temperature. You can also configure any relay as a fault alarm instead of a process alarm. In addition, you may configure any relay independently and program it to activate pumps or control valves.

All process alarms, alarm logic (high or low activation or USP*), and deadband are user-programmable. Customer-defined failsafe operation is supported as a programmable menu function to allow all relays to be energized or not energized as a default condition upon powering the transmitter. You may program the USP* alarm to activate when the conductivity is within a user-selectable percentage of the limit. USP* alarming is available only when a contacting conductivity measurement board is installed.

4.2 Prepare conduit openings

The transmitter enclosure has six conduit openings. Four conduit openings are fitted with conduit plugs.

Conduit openings accept ½-in. conduit fittings or PG 13.5 cable glands. To keep the case watertight, block unused openings with NEMA® 4X or IP65 conduit plugs.

Note
Use watertight fittings and hubs that comply with the requirements of UL514B. Connect the conduit hub to the conduit before attaching the fitting to the transmitter (UL508-26 16).

4.3 Prepare sensor cable

The Rosemount T1056 is intended for use with all Rosemount sensors. Refer to the sensor installation instructions for details on preparing sensor cables.

4.4 Power, output, and sensor connections

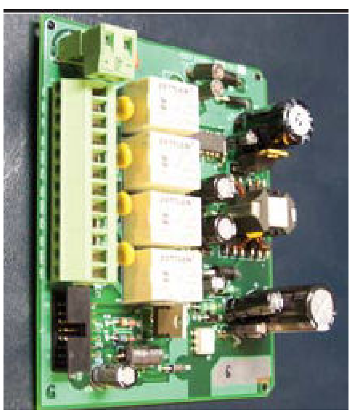
4.4.1 Power wiring

Emerson offers two power supplies for the Rosemount T1056:

1. 24 Vdc (20-30 V) power supply (02 ordering code)
2. 85-265 Vac switching power supply (03 ordering code)

AC mains (115 or 230 V) leads and 24 Vdc leads are wired to the power supply board which is mounted vertically on the left side of the main enclosure cavity. Each lead location is marked clearly on the power supply board. Wire the power leads to the power supply board using the lead markings on the board.

Figure 4-1: 24 Vdc Power Supply (02 Ordering Code)



4.4.2 Current output wiring

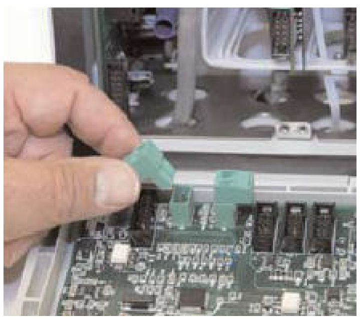
Emerson ships all instruments with two 4-20 mA current outputs. Wiring locations for the outputs are on the main board which is mounted on the hinged door of the instrument.

Wire the output leads to the correct position on the main board using the lead markings (+/positive, -/negative) on the board. Emerson provides male mating connectors with each unit.

For best electromagnetic interference/radio freqency interference (EMI/RFI) protection use shielded output signal cable enclosed in an earth-grounded metal conduit. Connect the shield to earth ground. AC wiring should be 14 gauge or greater. Provide a switch or breaker to disconnect the analyzer from the main power supply. Install the switch or breaker near the analyzer and label it as the disconnecting device for the analyzer.

Keep sensor and output signal wiring separate from power wiring. Do not run sensor and power wiring in the same conduit or together in a cable tray.

Figure 4-2: Current Output Wiring



4.4.3 Alarm relay wiring

Emerson supplies four alarm relays with the switching power supply (85 to 265 Vac, 03 order code) and the 24 Vdc power supply (20-30 Vdc, 02 order code).

Wire the relay leads on each of the independent relays to the correct position on the power supply board using the printed lead markings (NO/Normally open, NC/Normally closed, or Com/Common) on the board. See Figure 4-3.

Figure 4-3: Alarm Relay Wiring for Rosemount 1056 Switching Power Supply (03 Order Code)

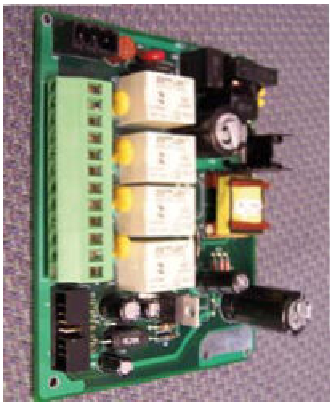


Table 4-1: Performance Specifications

NO1	Relay 1
COM1	
NC1	
NO2	Relay 2
COM2	
NC2	
NO3	Relay 3
COM3	
NC3	
NO4	Relay 4
COM4	
NC4	

4.4.4 Sensor wiring to signal boards

Plug the pre-terminated sensor cable connector directly into the turbidity signal board mating connector.

⚠ WARNING

Electrical shock

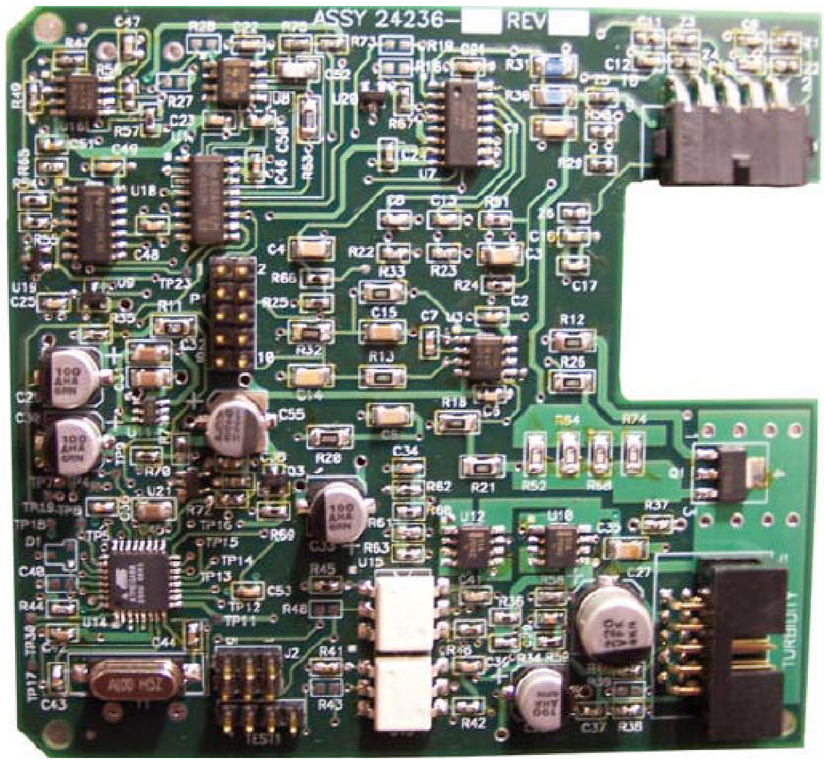
Electrical installation must be in accordance with the National Electrical Code (ANSI/ NFPA-70) and/or any other applicable national or local codes.

4.4.5 Wire sensor cable

The sensor cable is pre-wired to a plug that inserts into a receiving socket on the signal board.

See Figure 4-4.

Figure 4-4: Turbidity Signal Board with Plug-in Sensor Connection



The cable also passes through a strain relief fitting. To install the cable:

Procedure

1. Remove the wrenching nut from the strain relief fitting.
2. Insert the plug through the hole in the bottom of the enclosure nearest the sensor socket. Seat the fitting in the hole.
3. Slide the wrenching nut over the cable plug and screw it onto the fitting.
4. Loosen the cable nut so the cable slides easily.
5. Insert the plug into the appropriate receptacle. To remove the plug, squeeze the release clip and pull straight out.
6. Adjust the cable slack in the enclosure and tighten the cable nut.

   Be sure to allow sufficient slack to avoid placing stress on the cable and connections.
7. Plug the cable into the back of the sensor.

   The sensor is rated to IP65 when properly connected to the cable. To prevent possible water damage to the connector contacts, be sure the cable receptacle and the connector on the back of the sensor are dry when connecting or disconnecting the cable.

8. Place the sensor in either the measuring chamber or the calibration cup.

Important
The sensor must be in a dark place when power is first applied to transmitter.

Note
If `S1 Warning` appears, check sensor cable connection and confirm sample water flow at debubbler drain outlet.

Important
When using EPA/incandescent sensors (P 8-0108-0002-EPA):

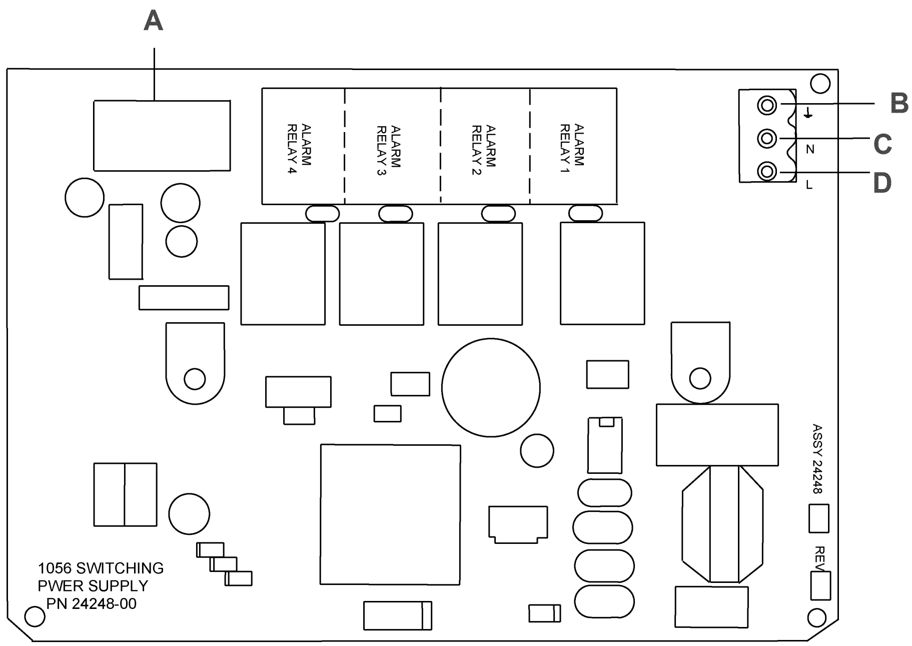
- Do not power up the instrument without the sensor connected.
- Do not disconnect and reconnect a sensor while a transmitter is powered.

If this is inconvenient or cannot be avoided:

- Cycle power to the instrument after connecting to the sensor or
- Perform a slope calibration or standard calibration routine after connecting the sensor.

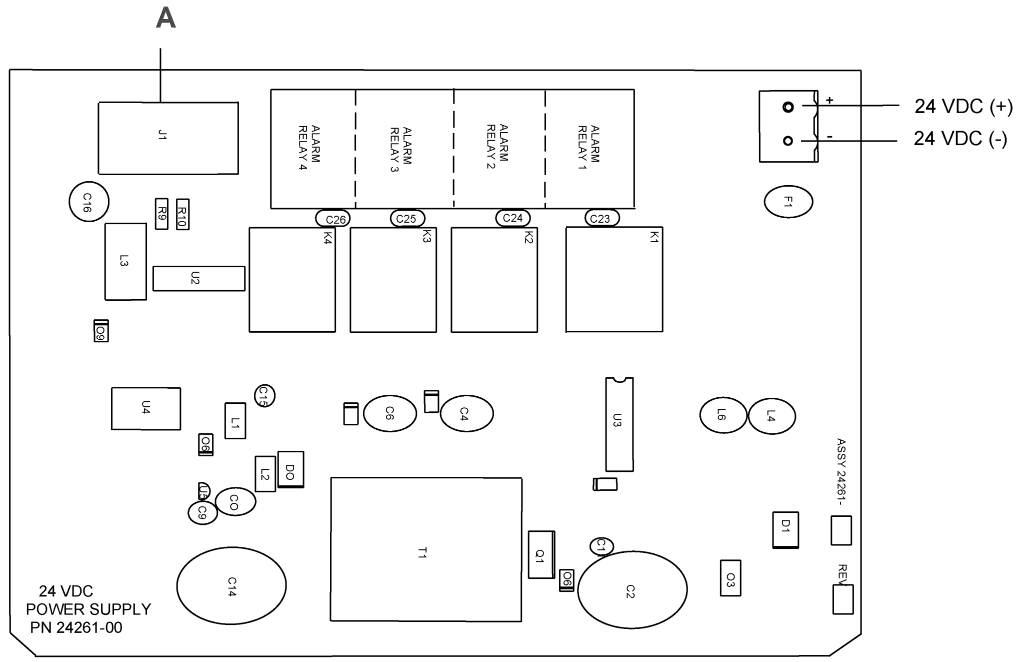
Following these guidelines will extend the life of the incandescent lamp and avoid premature warnings and faults due to reduced lamp life.

Figure 4-5: Power Wiring for Rosemount 1056 85-265 Vac Power Supply (03 Ordering Code)



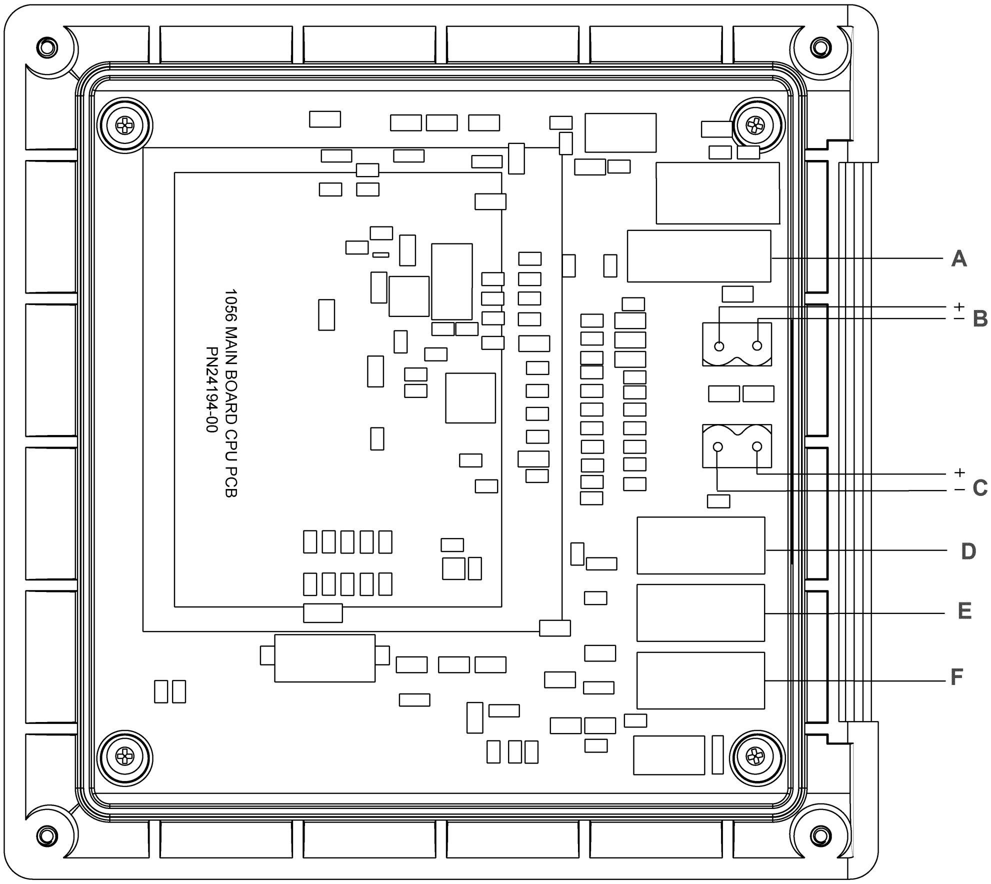
A. To main board
B. Earth ground
C. Neutral
D. Line

Figure 4-6: Power Wiring for Rosemount 1056 254 Vdc Power supply (02 Ordering Code)



A. To main PCB

Figure 4-7: Output Wiring for Rosemount 1056 Main PCB



A. *To power supply PCB*
B. *Analog output 1*
C. *Analog output 2*
D. *To digital I/O PCB*
E. *To sensor 1 PCB*
F. *To sensor 2 PCB*

5 Display and operation

5.1 User interface

The Rosemount 1056 has a large display which shows two live measurement readouts in large digits and up to four additional process variables or diagnostic parameters concurrently. The display is back-lit, and the you can customize the format to meet your requirements. The intuitive menu system allows access to Calibration, Hold (of current outputs), Programming, and Display functions by pressing **MENU**. In addition, a dedicated **DIAGNOSTIC** button is available to provide access to useful operational information on installed sensor(s) and any problematic conditions that might occur. The display flashes **Fault** and/or **Warning** when these conditions occur. Help screens are displayed for most fault and warning conditions to guide you in troubleshooting. During calibration and programming, key presses cause different displays to appear.

5.2 Instrument keypad

There are four function keys and four selection keys on the instrument keypad.

Function keys

Four top-level menu items appear when you press **MENU**.

- *Calibrate*: Calibrate the attached sensor(s) and analog output(s).
- *Hold*: Suspend analog output(s).
- *Program*: Program outputs, measurement, temperature, security, and reset.
- *Display*: Program display format, language, warnings, and contrast.

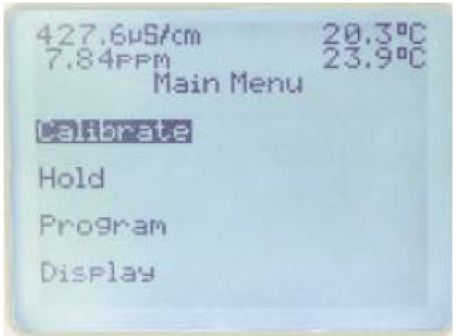
Press **MENU** to display the *Main Menu* screen. Press **MENU** followed by **EXIT** to display the main display.

Press the **DIAG** key to display active Faults and Warnings and detailed instrument information and sensor diagnostics, including: faults, warnings, Sensor 1 and 2 information, Out 1 and Out 2 live current values, instrument software version, and AC frequency used.

Press **ENTER** on Sensor 1 or Sensor 2 to display useful diagnostics and information (as applicable): Measurement, Sensor type, Raw signal value, Cell constant, Zero offset, Temperature, Temperature offset, Selected measurement range, Cable resistance, Temperature sensor resistance, and Signal board software version.

Press **ENTER** to store numbers and settings and move the display to the next screen.

Press **EXIT** to return to the previous screen without storing changes.



Selection keys

Surrounding the **ENTER** key, four selection keys **- Up**, **Down**, **Right**, and **Left -** move the cursor to all areas of the screen while using the menus.

Selection keys are used to:

1. Select items on the menu screens.
2. Scroll up and down the menu lists.
3. Enter or edit numeric values.
4. Move the cursor to the right or left.
5. Select measurement units during operation.

5.3 Main display

The Rosemount 1056 displays one or two primary measurement values, up to four secondary measurement values, a fault and warning banner, alarm relay flags, and a digital communications icon.

Process measurements

Two process variables are displayed if two signal boards are installed. One process variable and process temperature is displayed if one signal board is installed with one sensor. The Upper display area shows the Sensor 1 process reading. The Center display area shows the Sensor 2 process reading.

For single input configurations, the Upper display area shows the live process variable.

Secondary values

Up to four secondary values are shown in four display quadrants at the bottom half of the screen. You can program all four secondary value positions to any display parameter available. Possible secondary values include:

- Slope 1
- Ref Off 1
- Gl Imp 1
- Ref Imp 1
- Raw
- mV Input
- Temp 1
- Man Temp 1

- Man Temp 2
- Output 1 mA
- Output 2 mA
- Output 1%
- Output 2%
- Measure 1
- Blank

Fault and Warning banner

If the transmitter detects a problem with itself or the sensor, the word **Fault** or **Warning** appears at the bottom of the display. A fault requires immediate attention. A warning indicates a problematic condition or impending failure. For troubleshooting assistance, press **DIAG**.

Formatting the main display

You can program the main display screen to show primary process variables, secondary process variables, and diagnostics.

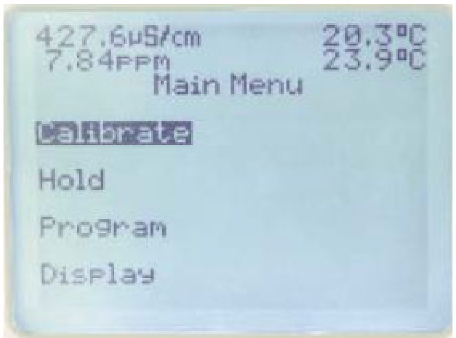
1. Press **MENU**.
2. Scroll down to Display. Press **ENTER**.
3. **Main Format** is highlighted. Press **ENTER**.
4. The sensor 1 process value is highlighted in reverse video. Press the selection keys to navigate down to the screen sections you wish to program. Press **ENTER**.
5. Choose the desired display parameter or diagnostic for each of the four display sections in the lower screen.
6. Continue to navigate and program all desired screen sections. Press **MENU** and **EXIT**. The screen returns to the main display.

For single sensor configurations, the default display shows the live process measurement in the upper display area and temperature in the lower display area. You can elect to disable the display of temperature in the center display area using the Main Format function. See Figure 5-1 to guide you through programming the main display to select process parameters and diagnostics of your choice.

For dual sensor configurations, the default display shows Sensor 1 live process measurement in the upper display area and Sensor 2 live process measurement temperature in the center display area. See Figure 5-1 to guide you through programming the main display to select process parameters and diagnostics of your choice.

5.4 Menu system

The Rosemount 1056 uses a scroll and select menu system. Press the **MENU** key at any time to open the top-level menu, including Calibrate, Hold, Program, and Display functions.



To find a menu item, scroll with the **Up** and **Down** keys until the item is highlighted. Continue to scroll and select menu items until the desired function is chosen. To select the menu item, press **ENTER**. To return to a previous menu level or to enable the main live display, press **EXIT** repeatedly. To return immediately to the main display from any menu level, simply press **MENU** and then **EXIT**.

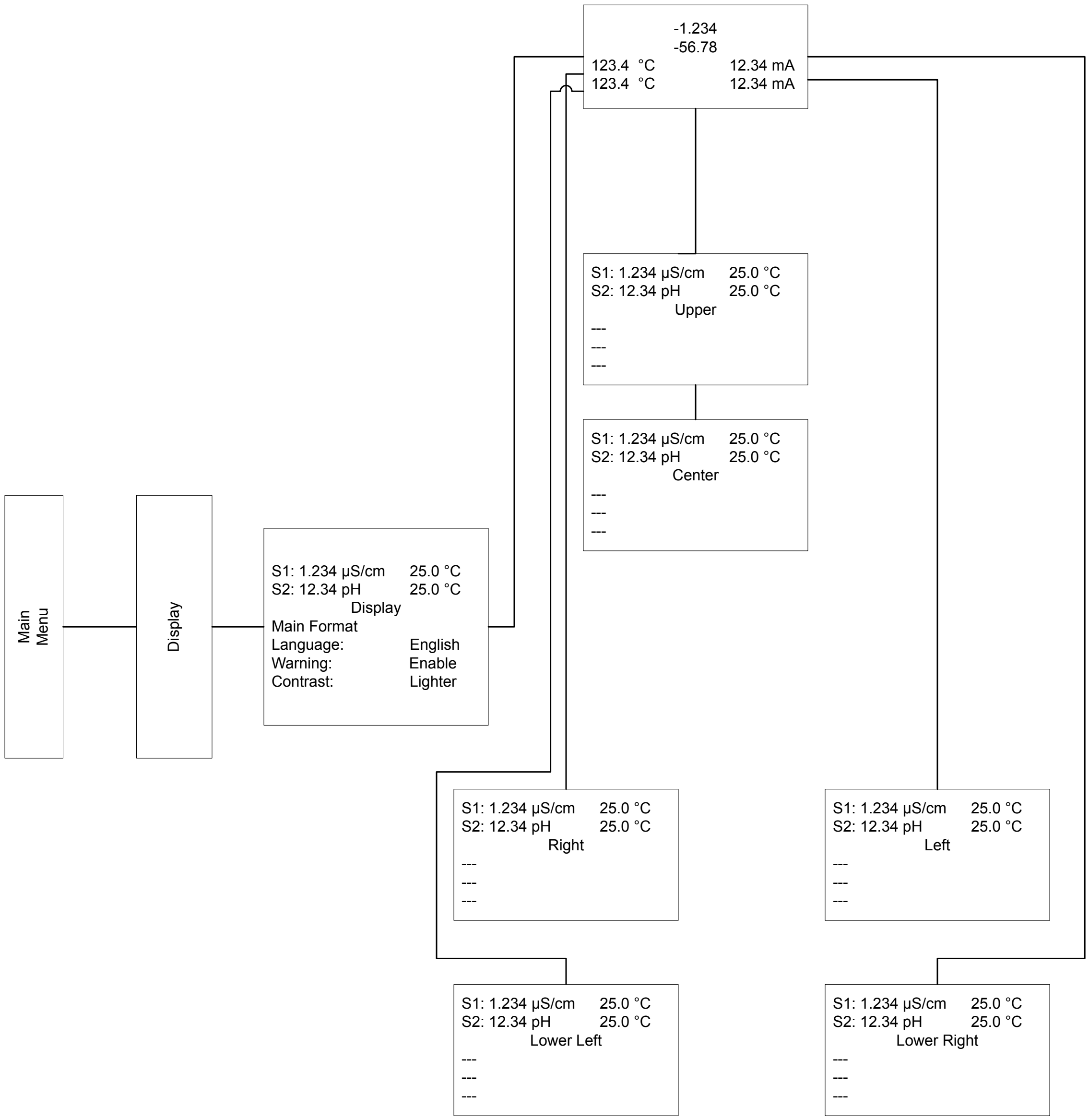
The selection keys have the following functions:

- The **Up** key (above **ENTER**) increments numerical values, moves the decimal point one place to the right, or selects units of measurement.
- The **Down** key (below **ENTER**) decrements numerical values, moves the decimal point one place to the left, or selects units of measurement.
- The **Left** key (left of **ENTER**) moves the cursor to the left.
- The **Right** key (right of **ENTER**) moves the cursor to the right.

To access desired menu functions, use Figure 1-2. During all menu displays (except main display format and *Quick Start*), the live process measurements and secondary measurement values are displayed in the top two lines of the upper display area. This conveniently allows display of the live values during important calibration and programming operations.

Menu screens time out after two minutes and return to the main display.

Figure 5-1: Formatting the Main Display



5.5 Using hold

5.5.1 Putting sensor in hold

To prevent unwanted alarms and improper operation of control systems or dosing pumps, place the alarms and outputs assigned to the sensor in hold before removing it for maintenance.

During hold, outputs assigned to the sensor remain at the last value, and alarms assigned to the sensor remain in their present state.

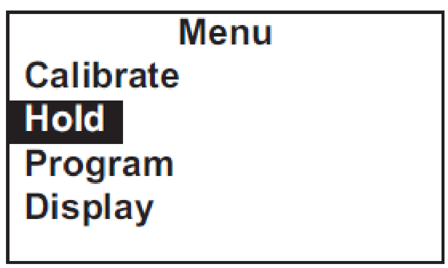
Once in hold, the sensor remains in hold until hold is turned off. However, if power is loss than restored, hold is automatically turned off.

5.5.2 Using the hold function

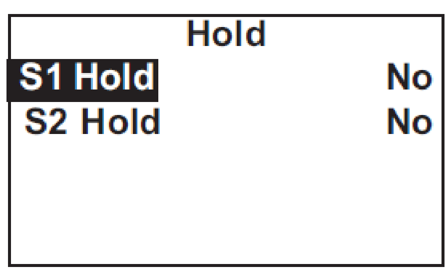
To put the transmitter in hold, complete the following steps.

Procedure

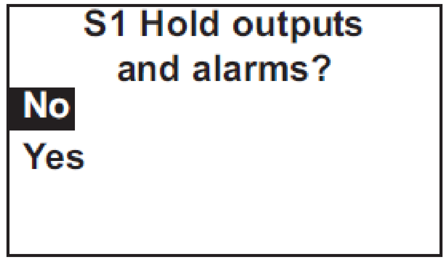
1. Press **MENU**.
   The main *Menu* screen appears.



2. Select **Hold**.
   The screen shows the current hold status for each sensor.



3. Select the sensor to be put in hold. Press **ENTER**.



4. To put the sensor in hold, select **Yes**. To take the sensor out of hold, select **No**.

6 Programming the transmitter

6.1 General programming information

This chapter describes the following programming functions

- Change the measurement type, measurement units, and temperature units.
- Choose temperature units and manual or automatic temperature compensation mode.
- Configure and assign values to the current outputs.
- Set a security code for two levels of security access.
- Access menu functions using a security code.
- Enable and disable Hold mode for current outputs.
- Choose the frequency of the AC power (needed for optimum noise rejection).
- Reset all factory defaults, calibration data only, or current output settings only.

6.2 Changing start-up settings

6.2.1 Purpose of changing start-up settings

To change the measurement type, measurement units, or temperature units that were initially entered in *Quick Start*, choose the **Reset analyzer** function (Resetting factory default settings) or access the *Program* menus for sensor 1 or sensor 2 (Programming turbidity). The following choices for specific measurement type and measurement units are available for each sensor measurement board.

6.2.2 Change start-up settings

Follow the Reset Analyzer procedure (Reset factory default setting) to reconfigure the transmitter to display new measurements or measurement units. To change the specific measurement or measurement units for each signal board type, refer to the *Program* menu for the appropriate measurement (Programming turbidity).

6.3 Configuring and ranging the current outputs

6.3.1 Purpose of configuration

The Rosemount 1056 accepts inputs from two sensors and has two analog current outputs. Ranging the outputs means assigning values to the low (0 or 4 mA) and high (20 mA) outputs. This section provides a guide for configuring and ranging the outputs.

Important
Always configure the outputs first.

6.3.2 Definitions for outputs

Current outputs	The transmitter provides a continuous output current (4-20 mA or 0-20 mA) directly proportional to the process variable or temperature. The low and high current outputs can be set to any value.
Assigning outputs	Assign a measurement to Output 1 or Output 2.
Dampen	Output dampening smooths out noisy readings. It also increases the response time of the output. Output dampening does not affect the response time of the display.
Mode	You can make the current output directly proportional to the displayed value (linear mode) or directly proportional to the common logarithm of the displayed value (log mode).

6.3.3 Configure outputs

Under the ***Program/Outputs*** menu, the screen below appears to allow configuration of the outputs. Follow the menu screens in Figure 6-1 to configure the outputs.

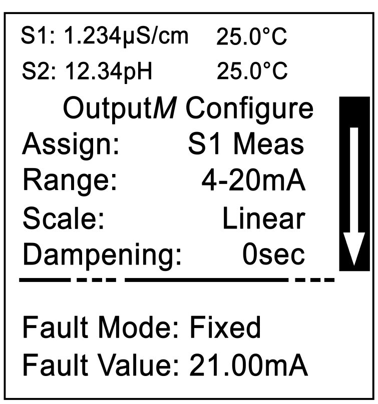
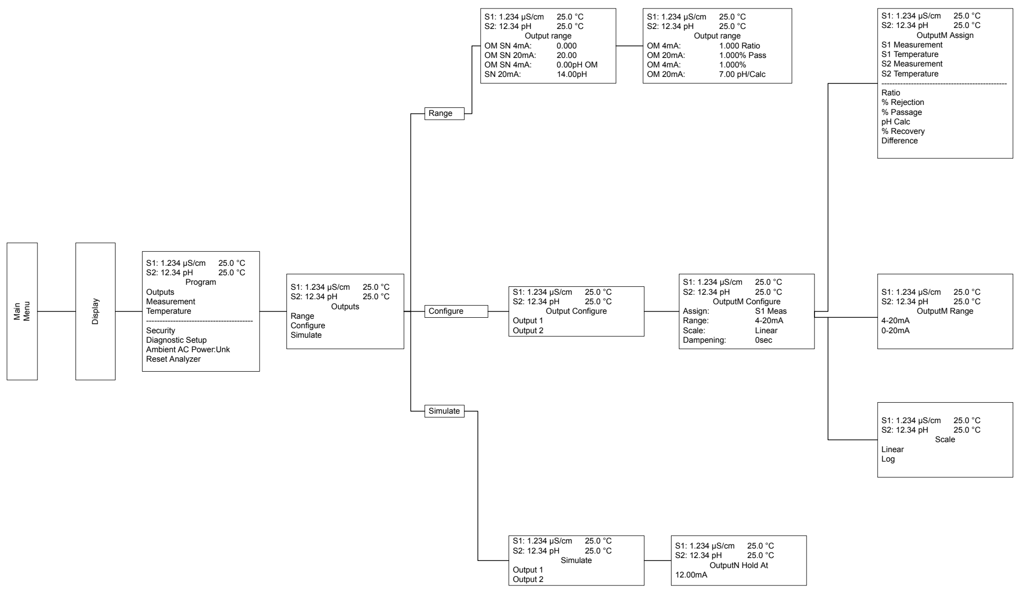
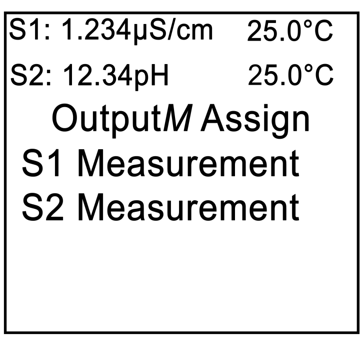


Figure 6-1: Configure and Range the Current Outputs



6.3.4 Assign the low and high current output measurements

The screen below appears when entering the **Assign** function under **Program** → **Output** → **Configure**. These screens allow you to assign a measurement, process value, or temperature input to each output. Follow the menu screens in Figure 6-1 to assign measurements to the outputs.



6.3.5 Range current outputs

The screen below appears under **Program** → **Output** → **Range**. Enter a value for 4 mA and 20 mA (or 0 mA and 20 mA) for each output. Follow the menu screens in Figure 6-1 to assign values to the outputs.

```
S1: 1.234µS/cm   25.0°C
S2: 12.34pH      25.0°C
      Output Range
OM SN 4mA:    0.000µS/cm
OM SN 20mA:   00.00µS/cm
OM SN 4mA:    00.00pH
OM SN 20mA:   00.00pH
```

6.4 Setting a security code

6.4.1 Security codes

The security codes prevent accidental or unwanted changes to program settings, displays, and calibration. The Rosemount 1056 has two levels of security code to control access and use of the instrument to different types of users. The two levels of security are:

- All: This is the supervisory security level. It allows access to all menu functions, including Programming, Calibration, Hold, and Display.
- Calibration/Hold: This is the operator or technician level. It allows access to only calibration and hold of the current outputs.

6.4.2 Set security code

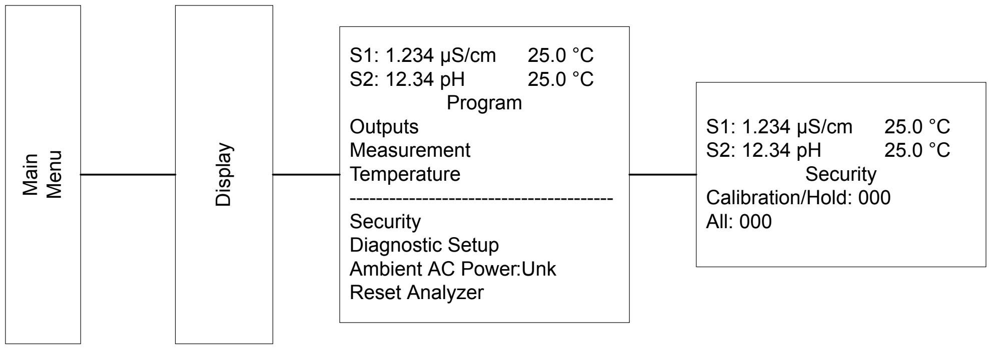
Procedure

1. Press **MENU**.
   The *Main menu* screen appears.
2. Select **Program**.
3. Select **Security**.
   The *Security* entry screen appears.
4. Enter a three digit security code for each of the desired security levels.
   The security code takes effect two minutes after the last key stroke.
5. Record the security codes for future access and communication to operators or technicians as needed.

The display returns to the *Security* menu screen. Press **EXIT** to return to the previous screen. To return to the main display, press **MENU** followed by **EXIT**.

Figure 6-2 displays the security code screens.

Figure 6-2: Setting a Security Code



6.5 Security access

6.5.1 How the security code works

To access the *Calibration* and *Hold* menus, enter the correct access code for the Calibration/Hold security level. This allows operators or technicians to perform routine maintenance. This does not allow access to the *Program* or *Display* menus.

To access all menu functions, including programming, calibration, hold, and display, enter the correct access code for the All security level.

6.5.2 Enter security code

Procedure

1. If a security code has been programmed, select the **Calibrate**, **Hold**, **Program**, or **Display** top menu item to display the *Security* access screen.
2. Enter the three-digit security code for the appropriate security level:

```
S1: 1.234 µS/cm     25.0 °C
S2: 12.34 pH        25.0 °C
        Security Code
000
```

If the entry is correct, the appropriate menu screen appears. If the entry is incorrrect, the *Invalid Code* screen appears. The *Enter Security Code* screen reappears after two seconds.

6.6 Using hold

6.6.1 Putting sensor in hold

To prevent unwanted alarms and improper operation of control systems or dosing pumps, place the alarms and outputs assigned to the sensor in hold before removing it for maintenance.

During hold, outputs assigned to the sensor remain at the last value, and alarms assigned to the sensor remain in their present state.

Once in hold, the sensor remains in hold until hold is turned off. However, if power is loss than restored, hold is automatically turned off.

6.6.2 Use the Hold function

To hold the outputs:

Procedure

1. Press **MENU**.
   The *Main menu* screen appears.
2. Select **Hold**.
   The Hold Outputs and Alarms? screen appears.
3. Select **Yes** to place the transmitter in hold. Select **No** to take the transmitter out of hold.

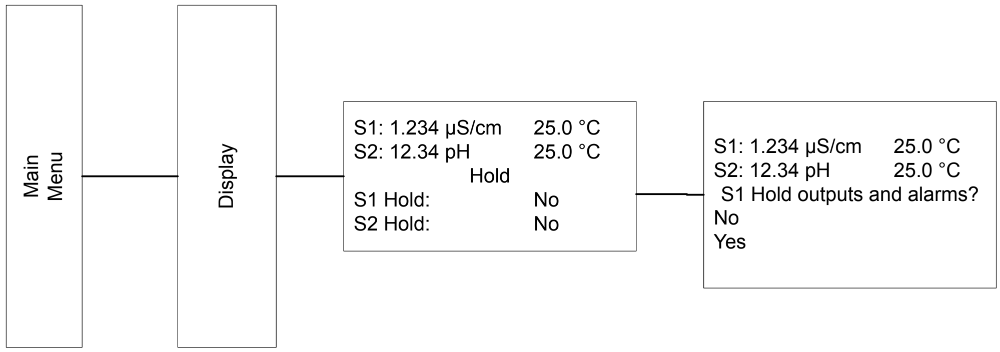
   Note
   There are no alarm relays with this configuration. Current outputs are included with all configurations.

The *Hold* screen appears.

Important
Hold remains on indefinitely until Hold is disabled.

See Figure 6-3 below.

Figure 6-3: Using Hold



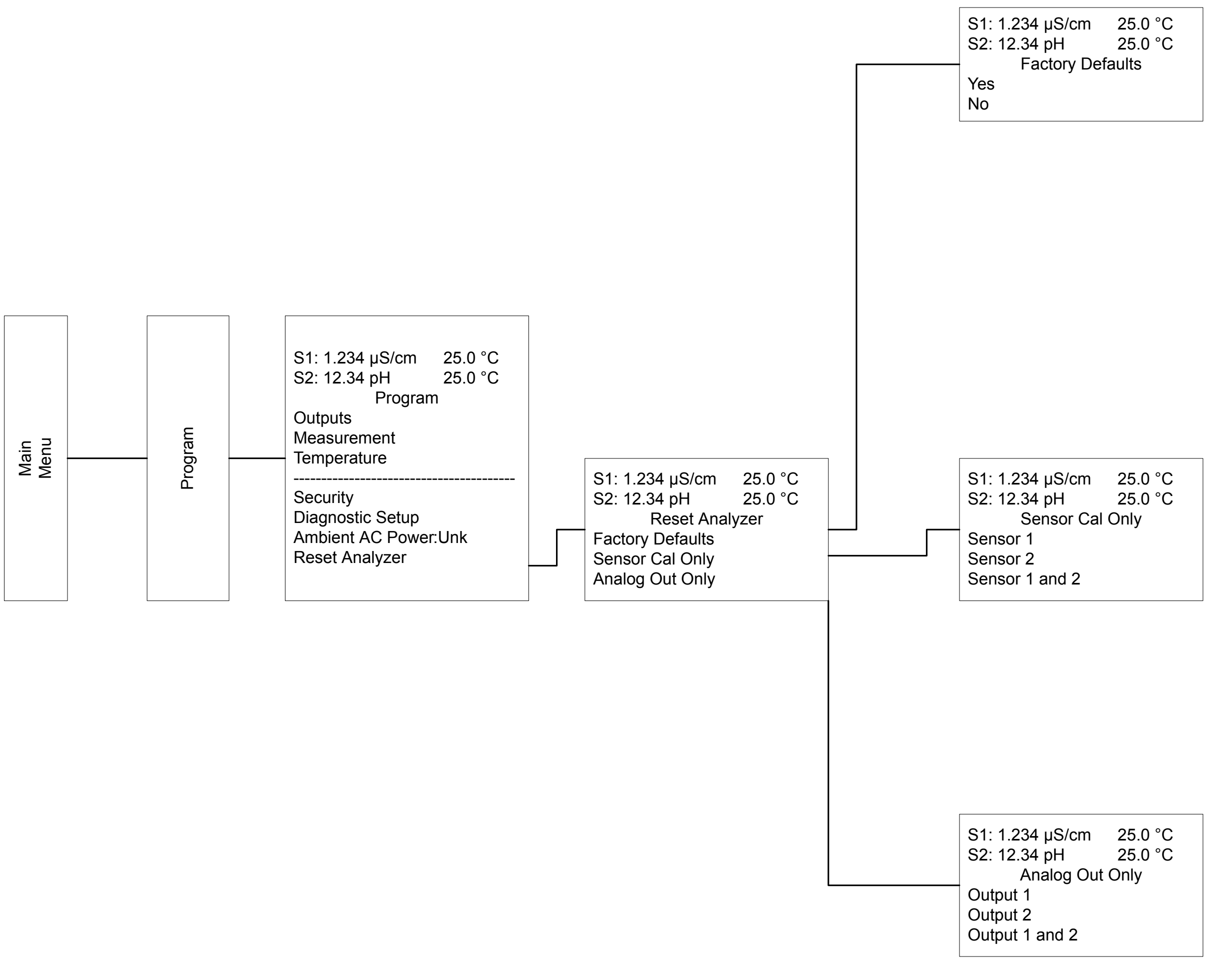
6.7 Reset factory default setting

This section describes how to restore factory calibration and default values. The process also clears all fault messages and returns the display to the first *Quick Start* screen. The Rosemount 1056 offers three options for resetting factory defaults.

1. Reset all settings to factory defaults.
2. Reset sensor calibration data only.
3. Reset analog output settings only.

To reset to factory defaults, reset calibration data only, or reset analog outputs only, follow the flow diagram below.

Figure 6-4: Resetting Factory Default Settings



6.8 Programming alarm relays

6.8.1 Purpose of programming relays

The Rosemount 1056 24 Vdc (-02 order code) and the AC switching power supply (-03 order code) provide four alarm relays for process measurement or temperature. Each alarm can be configured as a fault alarm instead of a process alarm. Also, each relay can be programmed independently, and each can be programmed as an interval timer. This section desribes how to configure alarm relays, simulate relay activation, and synchronize timers for the four alarm relays. This section provides details on programming the following alarm features:

Section	Alarm relay feature	Default	Description
Enter setpoints	Enter setpoint	100.00 µS/cm	Enter alarm trigger value.
Assign alarm relays	Assign measurement	S1 Measure	Select alarm assignment.
Set relay logic	Set relay logic	High	Program relay to activate at High or Low reading.
Program the deadband	Deadband	0.00 µS/cm	Program the change in process value after the relay deactivates.
Define failsafe conditions	Normal state	Open	Program relay default condition as open or closed for failsafe operation.
Set interval time	Interval time	24.0 hr	Time in hours between relay activations
Set relay on-time	On-time	10 min	Enter the time in seconds that the relay is activated.
Set recovery time	Recover time	60 sec	Enter time after the relay deactivation for process recovery.
Program Hold while active feature	Hold while active	S1	Holds current outputs during relay activation.
Select alarms to simulate	Simulate	N/A	Manually simulate alarms to confirm relay operation.
Synchronize timers	Synchronize timers	Yes	Control the timing of two or more relay timers set as Interval timers.

Under the **Programs/Alarms** menu, this screen appears to allow configuration of the alarm relays.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
          Alarms
Configure/Setpoint
Simulate
Synchronize Timers:  Yes
```

Follow the menu screens in Figure 6-1 to configure the outputs.

The screen below appears to allow you to select a specific alarm relay. Select the desired alarm and press **ENTER**.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
    Configure/Setpoint
Alarm 1
Alarm 2
Alarm 3
Alarm 4
```

The screen below appears next to allow you to completely program each alarm. Factory defaults are displayed as they would appear for an installed contacting conductivity board. **USP Safety** only appears if alarm logic is set to **USP**. **Interval time**, **On Time**, **Recover Time**, and **Hold while active** only appear if the alarm is configured as an interval timer.

```
S1: 1.234µS/cm   25.0°C
S2: 12.34pH      25.0°C
     AlarmM Settings
Setpoint:      100.0uS/cm
Assign:        S1 Measure
Logic:               High
Deadband:      0.00uS/cm
USP Safety:           0%↓
------------------------
Interval time:    24.0 hr
On Time:          120 sec
Recover time:      60 sec
Hold while active:  Sens1
```

6.8.2 Enter setpoints

Under the *Program/Alarms* menu, the screen below appears to allow you to configure the alarm relays.

Enter the desired value for the process measurement or temperature at which to activate an alarm event.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
 Alarm1  S2 Setpoint
+100.0uS/cm
```

6.8.3 Assign alarm relays

Under the *Alarms Settings* menu, the screen below appears to allow you to assign the alarm relays.

Select an alarm assignment.

```
S1: 1.234μS/cm    25.0°C
S2: 12.34pH       25.0°C
      AlarmM Assign:
S1 Measurement
S2 Measurement
Interval Timer
Fault
Off
```

6.8.4 Set relay logic

Under the *Alarms Settings* menu, the screen below appears to set the alarm logic. Select the desired relay logic to activate alarms at a high reading or a low reading. **USP** only appears if a contacting conductivity board is installed.

```
S1: 1.234μS/cm    25.0°C
S2: 12.34pH       25.0°C
      AlarmM Logic:
High
Low
USP
```

6.8.5 Program the deadband

Under the *Alarms Settings* menu, the screen below appears to allow you to program the deadband as a measurement value.

Enter the change in the process value needed after the relay deactivates to return to normal (thereby preventing repeated alarm activation).

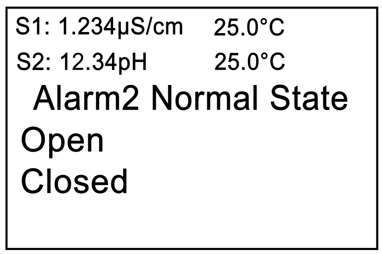
```
S1: 1.234μS/cm    25.0°C
S2: 12.34pH       25.0°C
   Alarm1 Deadband
+000.5uS/cm
```

6.8.6 Define failsafe conditions

You can define failsafe conditions in software by programming the alarm default state to normally open or normally closed upon power up.

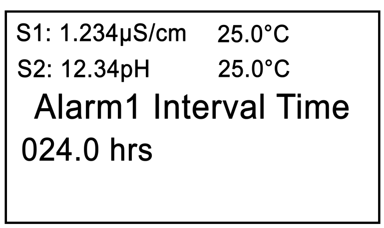
To display this alarm configuration item, enter the *Expert* menus by holding down **EXIT** for six seconds while in the main display mode. When the screen displays **Enable Expert Menu?** select **Yes**.

Under the *Alarms Settings* menu, the screen below appears to set the normal state of the alarms. Select the alarm condition you want each time the transmitter powers up.



6.8.7 Set interval time

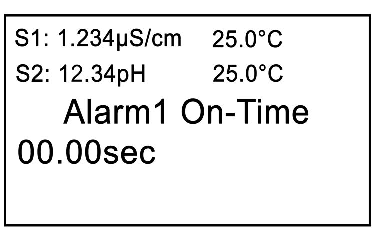
Under the *Alarms Settings* menu, the screen below appears to allow you to set the interval time.



Enter the fixed time in hours between relay activations.

6.8.8 Set relay on-time

Under the *Alarm Settings* menu, the screen below appears to allow you to set the relay on-time.



Enter the time in seconds that you want the relay to be activated for.

6.8.9 Set recovery time

Under the *Alarms Settings* menu, the screen below appears to allow you to set the relay recovery time.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
Alarm1 Recovery
060sec

Enter time for process recovery after the relay deactivation.

6.8.10 Program Hold while active feature

Under the *Alarms Settings* menu, the screen below appears to allow you to program the feature that holds the current outputs while alarms are active.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
Alarm1 Hold while active
Sensor 1
Sensor 2
Both
None

Select whether or not to hold the current outputs for Sensor 1, Sensor 2, or both sensors while the relay is activated.

6.8.11 Select alarms to simulate

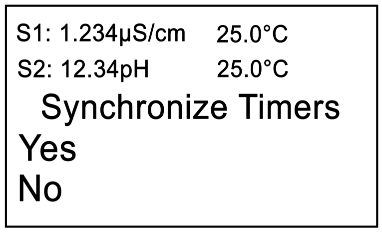
You can manually set alarm relays to check devices, such as valves or pumps.

Under the *Alarms Settings* menu, the screen below appears to allow you to set manual forced activation of the alarm relays. Select the desired alarm condition to simulate.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
Simulate Alarm *M*
Don't simulate
De-energize
Energize

6.8.12 Synchronize timers

Under the *Alarms Settings* menu, the screen below appears to allow you to synchronize alarms that are set to interval timers.



Select **Yes** or **No** to synchronize two or more timers.

7 Programming turbidity

7.1 Introduction to programming measurements

The Rosemount 1056 automatically recognizes each installed measurement board upon first power-up and each time the transmitter is powered. Completing *Quick Start* screens upon first power-up enables measurements, but you may have to take additional steps to program the transmitter for the desired measurement application. This section covers the following programming and configuration functions:

1. Select measurement type or sensor type (all sections).
2. Define measurement display units (all sections).
3. Adjust the input filter to control display and output reading variability or noise (all sections).
4. Enter TSS data.
5. Information on bubble rejection algorithm.

To fully configure the transmitter for each installed measurement board, you may use the following:

1. Reset Analyzer function to reset factory defaults and configure the measurement board to the desired measurement. Follow the *Reset Analyzer* menu to reconfigure the transmitter to display new measurements or measurement units.
2. Program menus to adust any of the programmable configuration items. Use the following configuration and programming guidelines for the applicable measurement.

7.2 Programming turbidity measurements

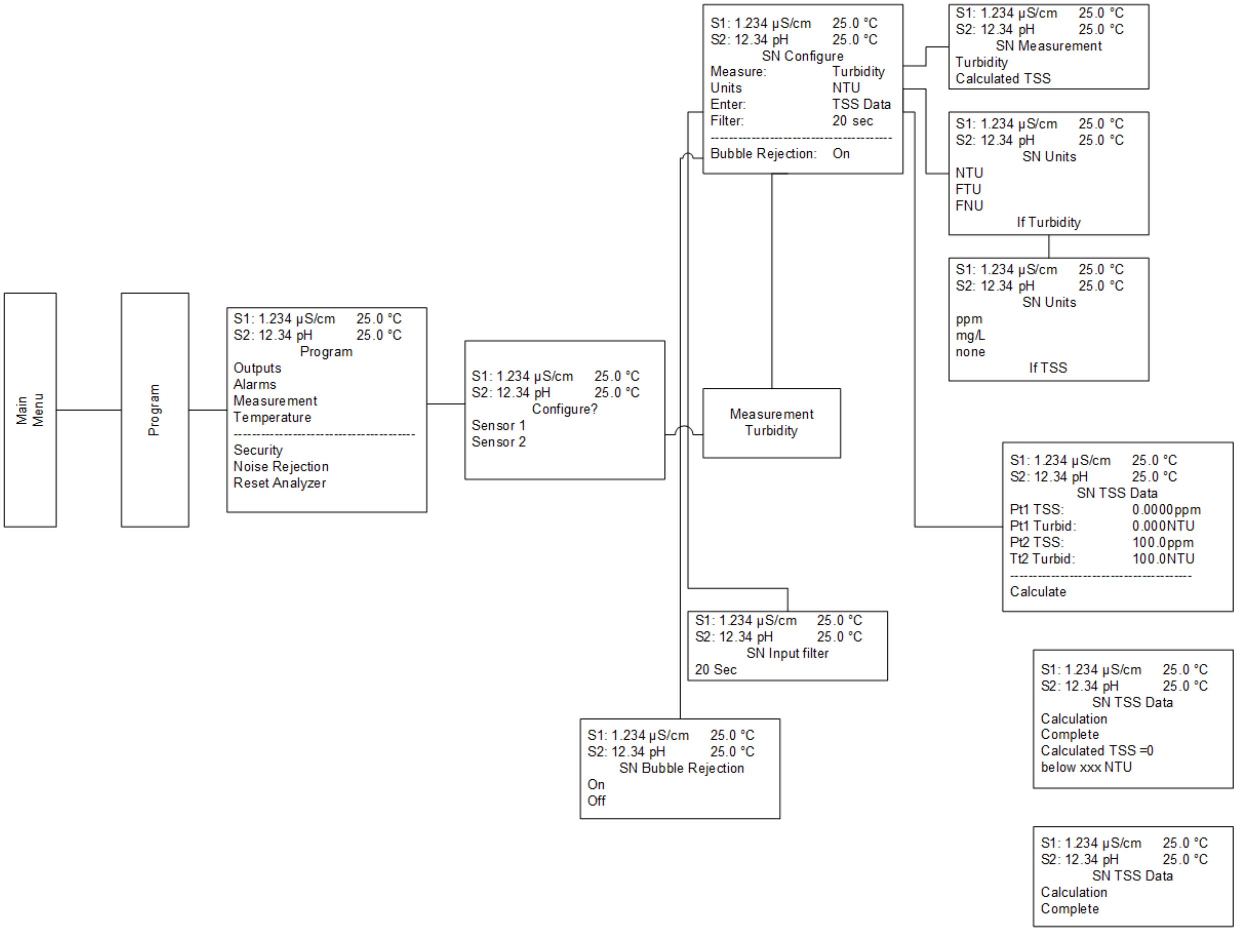
The following programming and configuration functions are covered.

Table 7-1: Turbidity Measurement Programming

Measure	Section	Menu function	Default	Description
Turbidity	Measurement	Measurement type	Turbidity	Select Turbidity or TSS calculation (estimated TSS).
	Units	Measurement units	NTU	NTU, FTU, FNU.
	Enter total suspended solids (TSS) data	Enter total suspended solids (TSS) data		Enter TSS and NTU data to calculate TSS based on turbidity.
	Filter	Filter	20 sec	Override the default input filter; enter 0-999 seconds.
	Bubble rejection	Bubble rejection	On	Intelligent software algorithm to eliminate erroneous readings caused by bubble accumulation in the sample.

A detailed flow diagram for turbidity programming is provided below to guide you through all basic programming and configuration functions.

Figure 7-1: Configure Turbidity Measurement



To configure the turbidity measurement board:

1. Press **MENU**.
2. Scroll down to **Program**. Press **ENTER**.
3. Scroll down to **Measurement**. Press **ENTER**.
4. Select **Sensor 1** or **Sensor 2** corresponding to turbidity. Press **ENTER**.
   The following screen format appears (factory defaults are shown).

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
      SN Configure
Measure:      Turbidity
Units:        NTU
Enter TSS Data
Filter:       20sec
-------------------------
Bubble Rejection:  On
```

5. To program turbidity, scroll to the desired item and press **ENTER**.

Measurement through Bubble rejection provide you with the initial display screen that appears for each programming routine. Use Figure 7-1 for turbidity programming and the live screen prompts to complete programming.

7.2.1 Measurement

The display screen for selecting the measurement is shown below. The default measurement is displayed in bold type.

Refer to Figure 7-1 to complete this function.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
    SN Measurement
Turbidity
Calculated TSS
```

7.2.2 Units

The display screen for selecting the measurement units is shown below. The default value is displayed in bold type.

Refer to Figure 7-1 to complete this function. If TSS (total suspended solids) calculation is selected, the following screen is displayed.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
        SN Units
NTU
FTU
FNU
```

7.2.3 Enter total suspended solids (TSS) data

The display screen for entering TSS data is shown below. The default values are displayed.

Refer to Figure 7-1 to complete this function.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
      SN TSS Data
Pt1 TSS:       0.000ppm
Pt1 Turbid:    0.000NTU
Pt2 TSS:       100.0ppm
Pt2 Turbid:    100.0NTU
------------------------
Calculate
```

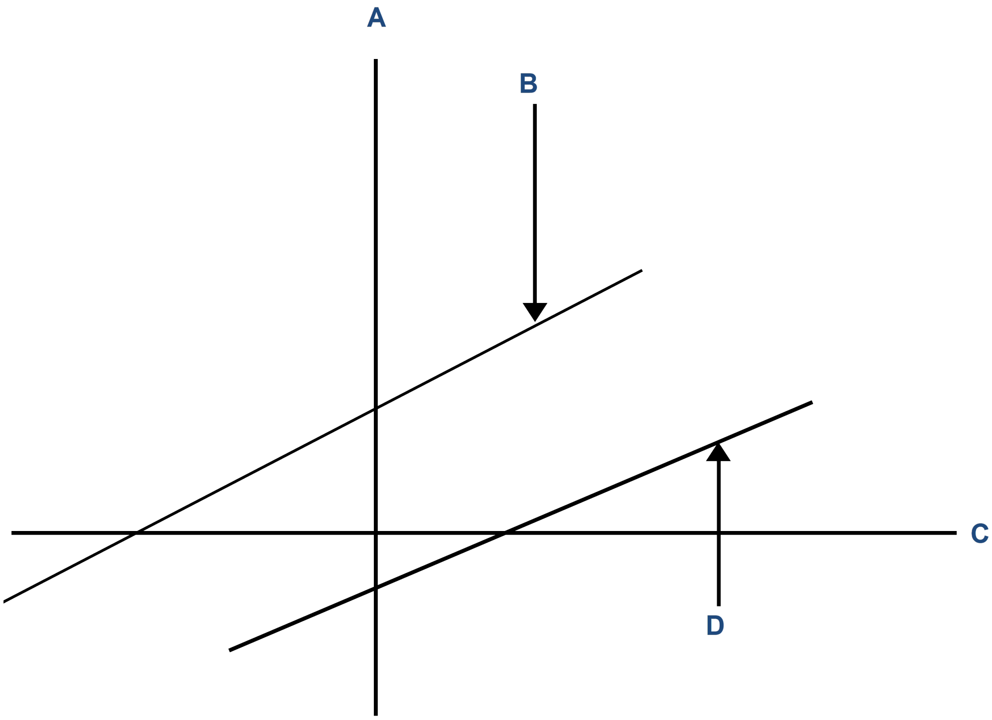
Note

Based on user-entered NTU data, calculating TSS as a straight line curve could cause TSS to go below zero. The following screen lets you know that TSS becomes zero below a certain NTU value.

```
S1: 1.234µS/cm   25.0°C
S2: 12.34pH      25.0°C
      SN TSS Data
Calculation Complete
Calculated TSS = 0 below
xxxx NTU
```

The following illustration shows the potential for calculated TSS to go below zero.

Figure 7-2: Potential for TSS to go below Zero



A. *TSS*
B. *Normal case: TSS is always a positive number when turbidity is a positive number.*
C. *Turbidity*
D. *Abnormal case: TSS can be a negative number when turbidity is a positive number.*

When the TSS data entry is complete, press **ENTER**. The display confirms the determination of a TSS straight line curve fit to the entered NTU/turbidity data by displaying the following screen:

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
      SN TSS Data
Calculation
Complete
```

The following screen may appear if TSS calculation is unsuccessful. You must re-enter NTU and TSS data.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
SN TSS Data
Data Entry Error

Press EXIT S1 Meas

7.2.4 Filter

The display screen for entering the input filter value in seconds is shown below. The default value is displayed in bold type.

Refer to Figure 7-1 to complete this function.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
SN Input Filter
020sec

7.2.5 Bubble rejection

Bubble rejection is an internal software algorithm that characterizes turbidity readings as bubbles as opposed to true turbidity of the sample. With bubble rejection enabled, these erroneous readings are eliminated from the live measurements shown on the display and transmitted via the current outputs.

The default setting is displayed in bold type. Refer to Figure 7-1 to complete this function.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
SN Bubble Rejection
On
Off

7.3 Choosing turbidity or total suspended solids

7.3.1 Configuring the transmitter

This section describes how to do the following:

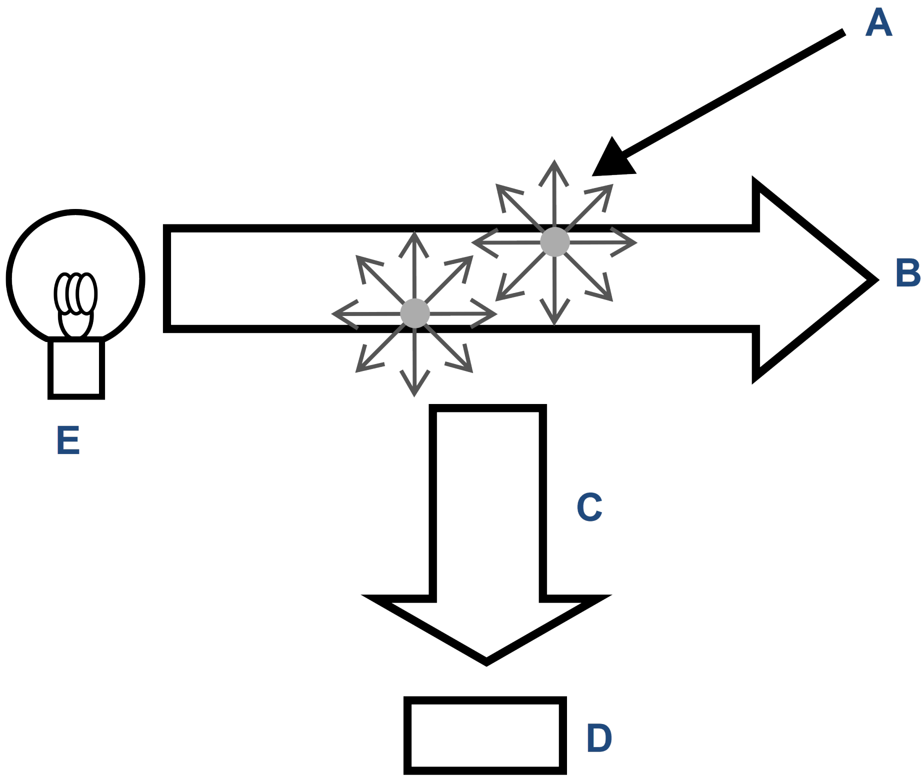
1. Configure the transmitter to display results as turbidity or total suspended solids (TSS).
2. Choose units in which results are to be displayed.
3. Select a time period for signal averaging.
4. Enable or disable bubble rejection software.

7.3.2 Definitions

Turbidity

Turbidity is a measure of the amount of light scattered by particles in a sample. Figure 7-3 illustrates how turbidity is measured. A beam of light passes through a sample containing suspended particles. The particles interact with the light and scatter it in all directions. Although the drawing implies scattering is equal in all directions, this is generally not the case. For particles bigger than about 1/10 the wavelength of light, scattering is highly directional. A detector measures the intensity of scattered light.

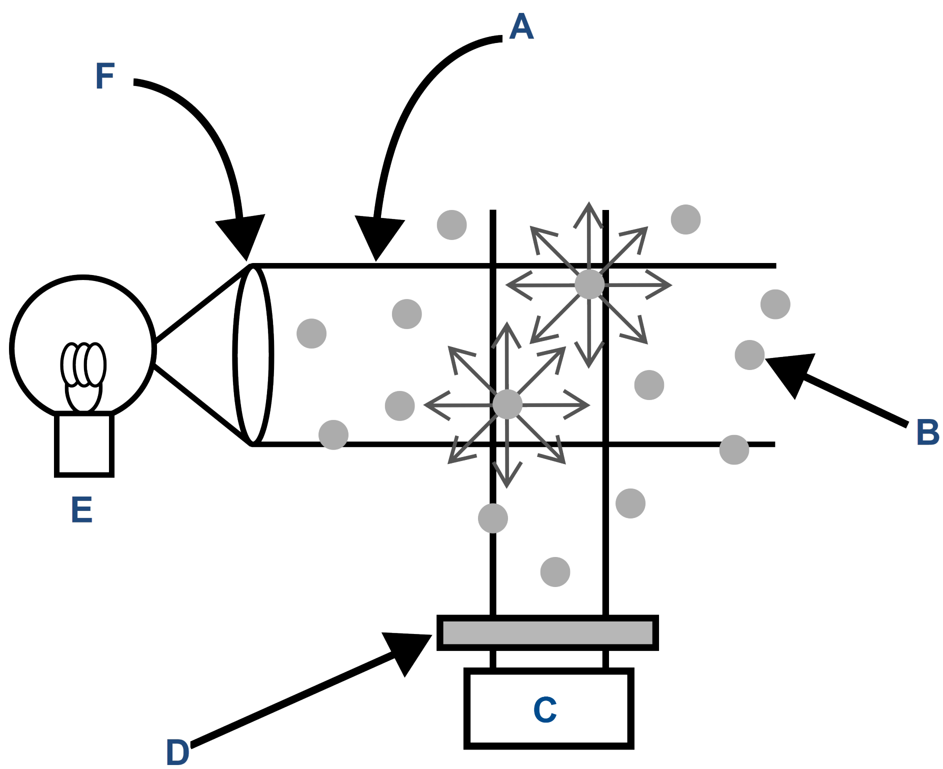
Figure 7-3: Turbidity Sensor - General



A. *Light scattered in all directions by particle*
B. *Interrogating beam*
C. *Scattered light at 90 °*
D. *Detector*
E. *Light source*

Measured turbidity is dependent on instrumental conditions. In an attempt to allow turbidities measured by different instruments to be compared, two standards for turbidity measurements have evolved. USEPA established Method 180.1, and the International Standards Organization established ISO 7027. EPA Method 180.1 must be used for reporting purposes in the United States. Figure 7-4 shows an EPA 180.1 turbidmeter.

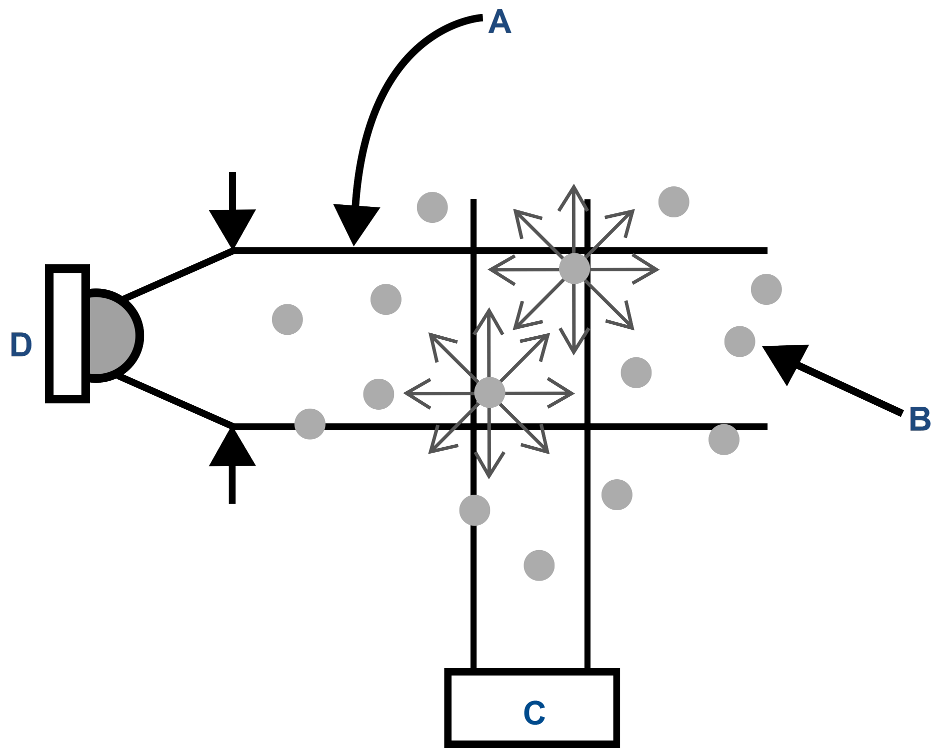
Figure 7-4: Turbidity Sensor - EPA 180.1



A. *Interrogating beam*
B. *Particle*
C. *Detector*
D. *Optical filter*
E. *Light source*
F. *Collimator*

Figure 7-5 shows an ISO 7027 turbidmeter.

Figure 7-5: Turbidity Sensor - ISO 7027



A. *Interrogating beam*
B. *Particle*
C. *Detector*
D. *Light source*

EPA Method 180.1 requires that:

1. The light source must be a tungsten lamp operated with a filament temperature between 2200 and 2700 K.
2. The detector must have an optimum response between 400 and 600 nm (approximates the human eye).
3. The scattered light must be measured at 90 ° ± 30 ° with respect to the incident beam.
4. The total path length of the light through the sample must be less than 3.9 in. (10 cm).

Requirements 1 and 2 essentially restrict the measurement to visible light. Although most of the energy radiated by an incandescent lamp is in the near infrared, keeping the filament temperature between 2200 and 2700 K ensures that at least some energy is available in the visible range. Further specifying that the detector and filter combination have maximum sensitivity between 400 nm (violet light) and 600 nm (orange light) cements the measurement in a visible range. Wavelength is important because particles scatter light most efficiently if their size is approximately equal to the wavelength of light used in the measurement. The longer the wavelength, the more sensitive the measurement is to larger diameter particles and the less sensitive it is to smaller particles.

Requirement 3 is arbitrary. The light scattered by a particle depends on the shape and size of the particle, the wavelength used for the measurement, and the angle of observation. Choosing 90 ° avoids the difficulties of having to integrate the scattered light over all the scattering angles. An arbitrary observation angle works so long as the sample turbidity is referred to the turbidity of a standard solution measured at the same angle. A turbidmeter that measures light at 90 ° is called a nephelometer.

Requirement 4 has a lot to do with the linearity of the sensor. As Figure 7-4 and Figure 7-5 show, particles lying between the measurement zone and the detector can scatter the scattered radiation. This secondary scattering reduces the amount of light striking the detector. The result is a decrease in the expected turbidity value and a decrease in linearity. The greater the amount of secondary scattering, the greater the non-linearity. Particles in the area between the source and measurement zone also reduce linearity.

ISO 7027 requirements are somewhat different from EPA requirements. ISO 7027 requires that:

1. The wavelength of the interrogating light must be between 860 ± 60 nm or for colorless samples, 550 ± 30 nm.
2. The measuring angle must be 90 ° ± 2.5 °.

ISO 7027 does not restrict the maximum light path length through the sample. ISO 7027 calls out beam geometry and aperture requirements that EPa 180.1 does not address.

Although ISO 7027 allows a laser, light emitting diode (LED), or tungsten filament lamp fitted with an interference filter as the light source, most instruments, including the Rosemount Clarity II, use an 860 nm LED. Because ISO 7027 turbidmeters use a longer wavelength for measurement, they tend to be more sensitive to larger particles than EPA 180.1 turbidmeters. Turbidities measured using the EPA and ISO methods will be different.

Total suspended solids (TSS)

TSS is a measure of the total mass of particles in a sample. It is determined by filtering a volume of the sample and weighing the mass of dried residue retained in the filter. Because turbidity arises from suspended particles in water, turbidity can be used as an alternative way of measuring total suspended solids (TSS). The relationship between turbidity and TSS is wholly empirical and must be determined by the user.

Turbidity units

Turbidity is measured in nephelometric turbidity units (NTU), formazin turbidity units (FTU), or formazin nephelometric units (FNU). Nephelometry means the scattered light is measured at 90 ° to the interrogating beam. Formazin refers to the polymer suspension typically used to calibrate turbidity sensors. The units - NTU, FTU, and FNU - are equivalent.

TSS units

The TSS value calculated from the turbidity measurement can be displayed in units of ppm or mg/L. You can also choose to have no units displayed.

Signal averaging

Signal averaging is a way of filtering noisy signals. Signal averaging reduces random fluctuation in the signal but increases the response time to step changes. Recommended signal averaging is 20 seconds. The reading takes 20 seconds to reach 63 percent of its final value following a step change greater than the filter threshold.

Bubble rejection

When a bubble passes through a light beam, it reflects light onto the measuring photodiode, causing a spike in turbidity. The Rosemount 1056 transmitter has proprietary software that rejects the turbidity spikes caused by bubbles.

7.3.3 Select turbidity or total suspended solids (TSS)

To choose a menu item, move the cursor to the item and press **ENTER**. To store a number or setting, press **ENTER**.

Procedure

1. Press **MENU**.
   The *Main menu* screen appears.
2. Select **Program**.
3. Select **Measurement**.
4. Select **Sensor 1** or **Sensor 2**.

   For a single input configuration, the *Sensor 1 Sensor 2* screen does not appear.
5. Select **Turbidity** or **TSS**.
6. Select the desired units.

   For turbidity, select **NTU** (nephelometric turbidity units), **FTU** (formazin turbidity units), or **FNU** (formazin nephelometric units)..

   For TSS, select **ppm**, **mg/L**, or **none**.
7. Select **Bubble Rejection**.
8. Select **On** to enable bubble rejection software. Select **Off** to disable the software.
9. Press **EXIT** to return to the previous screen. To return to the main display, press **MENU** and then **EXIT**.

7.4 Entering a turbidity to total suspended solids (TSS) conversion equation

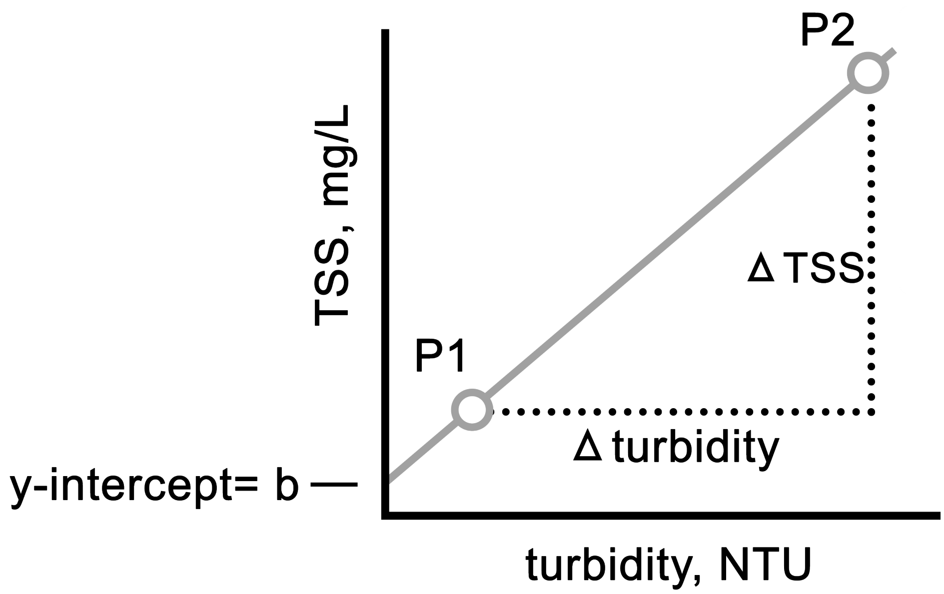
7.4.1 Converting turbidity to total suspended solids (TSS)

You can program the transmitter to convert turbidity to a TSS reading. There is no fundamental relationship between turbidity and TSS. Every process stream is unique. You must determine the relationship between turbidity and TSS for your process. The transmitter accepts only a linear calibration curve.

To convert turbidity to TSS, enter two points, P1 and P2, and the transmitter calculates the equation of a straight line between the points. The transmitter then converts all subsequent measurements to TSS using the equation.

Important
If the cause or the source of the turbidity changes, you must determine new points, P1 and P2, and the calibration must be repeated.

Figure 7-6: Converting Turbidity to TSS



$$\text{slope} = m = \frac{\Delta\,\text{TSS}}{\Delta\,\text{Turbidity}}$$

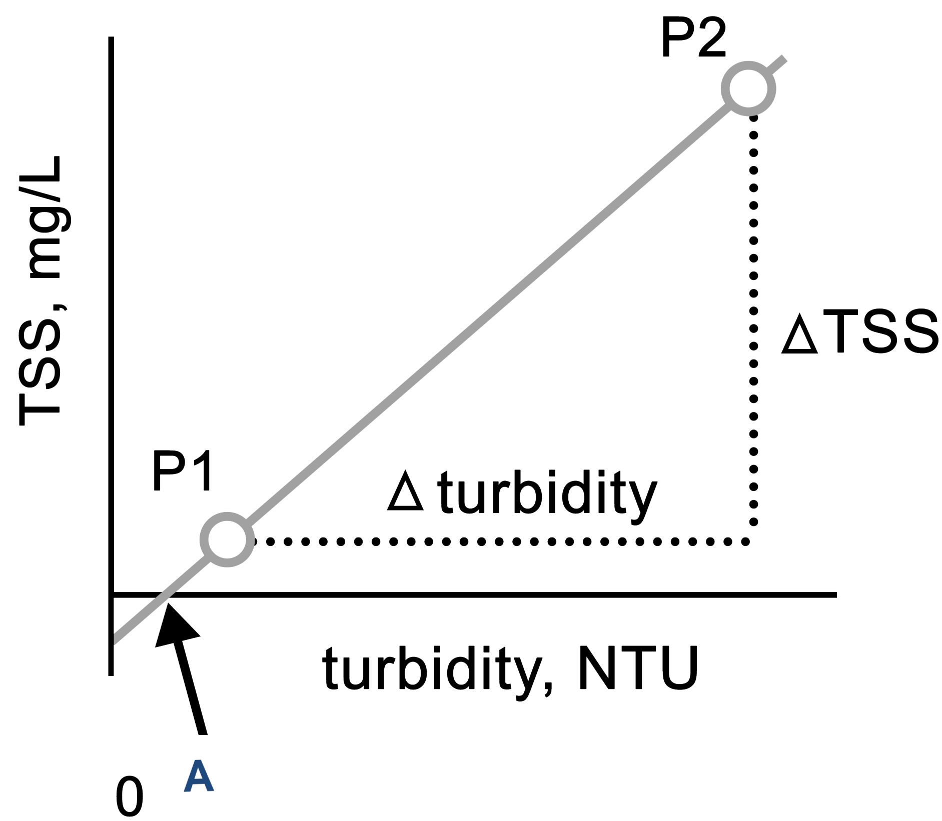
P2 must be less than 200 nephelometric turbidity units (NTU).

TSS = m(NTU) = b

The accuracy of the measurement depends on how linear the actual relationship between TSS and turbidity is. At a minimum, confirm linearity by diluting the most turbid sample (P2) and verifying that the new turbidity and TSS points lie reasonably close to the line. Ideally, do the dilutions with filtered sample, not deionized water. Deionized water can change the index of refraction of the liquid and can increase or decrease the solubility of particles. Therfore, the diluted sample will not be representative of the process liquid.

After the transmitter has calculated the turbidity to TSS conversion equation, it also calculates the X-intercept (NTU). If the X-intercept is greater than zero, the transmitter displays that value as the lowest turbidity reading it will accept. A lower turbidity reading produces a negative TSS value. If the X-intercept is less than zero, the screen does not appear.

Figure 7-7: Lowest Turbidity (TSS)



A. *Lowest turbidity*

7.4.2 Create conversion equation

Complete the following steps to enter the total suspended soldis (TSS) and turbidity points so that transmitter can create the conversion equation.

Prerequisites

First, calibrate the sensor. See Turbidity measurement programming, Choosing turbidity or total suspended solids, or Converting turbidity to total suspended solids (TSS).

Procedure

1. Press **MENU**.
   The *Main menu* appears.
2. Select **Program**.
3. Select **Measurement**.
4. Select **Sen1** (sensor 1) or **Sen2** (sensor 2).
5. Select **Enter TSS Data**.
6. Enter TSS for **Pt1** (point 1). Press **ENTER**.

7. Enter the turbidity for **Pt1** (point 1). Press **ENTER**.
8. Enter the TSS for **Pt2** (point 2). Press **ENTER**.
9. Enter the turbidity for **Pt2** (point 2). Press **ENTER**.
10. If the calibration was unsuccessful, repeat Step 6 through Step 9, checking for data entry errors.

    If the intercept on the nephelometric turbidity units (NTU) axis is negative, the transmitter displays the low turbidity limit.

Postrequisites

To return to the main display, press **MENU** and then **EXIT**.

8 Calibrate

8.1 Introduction to calibration

Calibration is the process of adjusting or standardizing the transmitter to a lab test or a calibrated laboratory instrument or standardizing to some known reference.

The transmitter's auto-recognition feature enables the appropriate calibration screens to allow calibration for any single sensor configuration or dual sensor configuration of the transmitter. Completing Quick Start upon first power-up enables live measurements but does not ensure accurate readings in the lab or in process. Calibrate each attached sensor to ensure accurate, repeatable readings.

8.2 Calibrating turbidity

8.2.1 Calibrate turbidity

This section describes how to calibrate the turbidity sensor against a user-prepared standard as a 2-point calibration with deionized water, against a 20 nephelometric turbidity unit (NTU) user-prepared standard as a single point calibration, and against a grab sample using a reference turbidmeter.

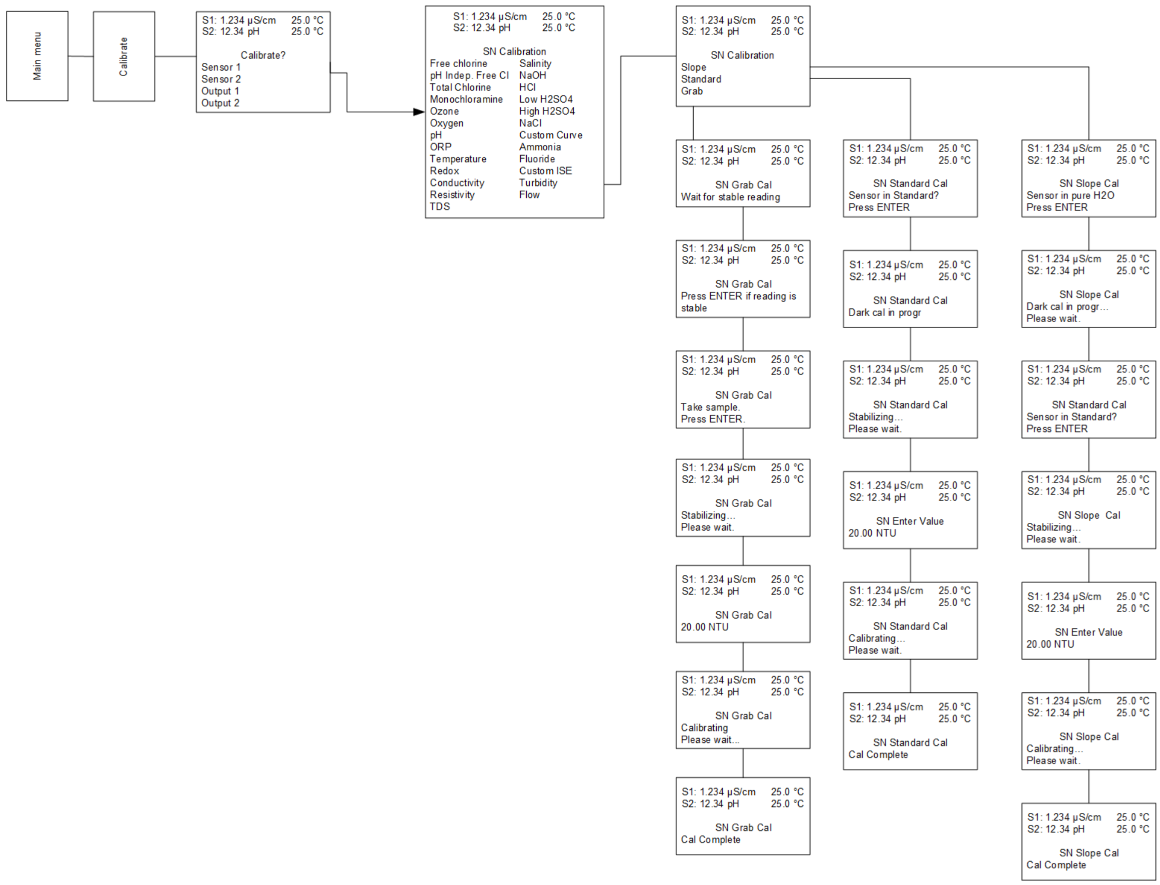
The following calibration routines are covered.

Table 8-1: Turbidity Calibration Routines

Section	Calibration function	Description
Calibrate slope	Slope calibration	Slope calibration with pure water and a standard of known turbidity.
Calibrate against a standard	Standardize calibration	Standardize the sensor to known turbidity.
Calibrate against a grab sample	Grab calibration	Standardize the sensor to a known turbidity based on a reference turbidmeter.

A detailed flow diagram is provided below to guide you through the calibration routines.

Figure 8-1: Calibrate Turbidity



To calibrate turbidity:

Procedure

1. Press **MENU**.
2. Select **Calibrate**. Press **ENTER**.
3. Select **Sensor 1** or **Sensor 2** corresponding to turbidity. Press **ENTER**.
4. Select **Turbidity**. Press **ENTER**.
   The following screen appears.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
     SN Calibrate?
Turbidity
```

Postrequisites

The following sections show the intial display screen that appears for each calibration routine. Use Figure 8-1 and the live screen prompts to complete calibration.

8.2.2 Calibrate slope

Conduct a two-point calibration of the turbidity sensor against a user-prepared nephelometric turbidity unit (NTU) standard.

Procedure

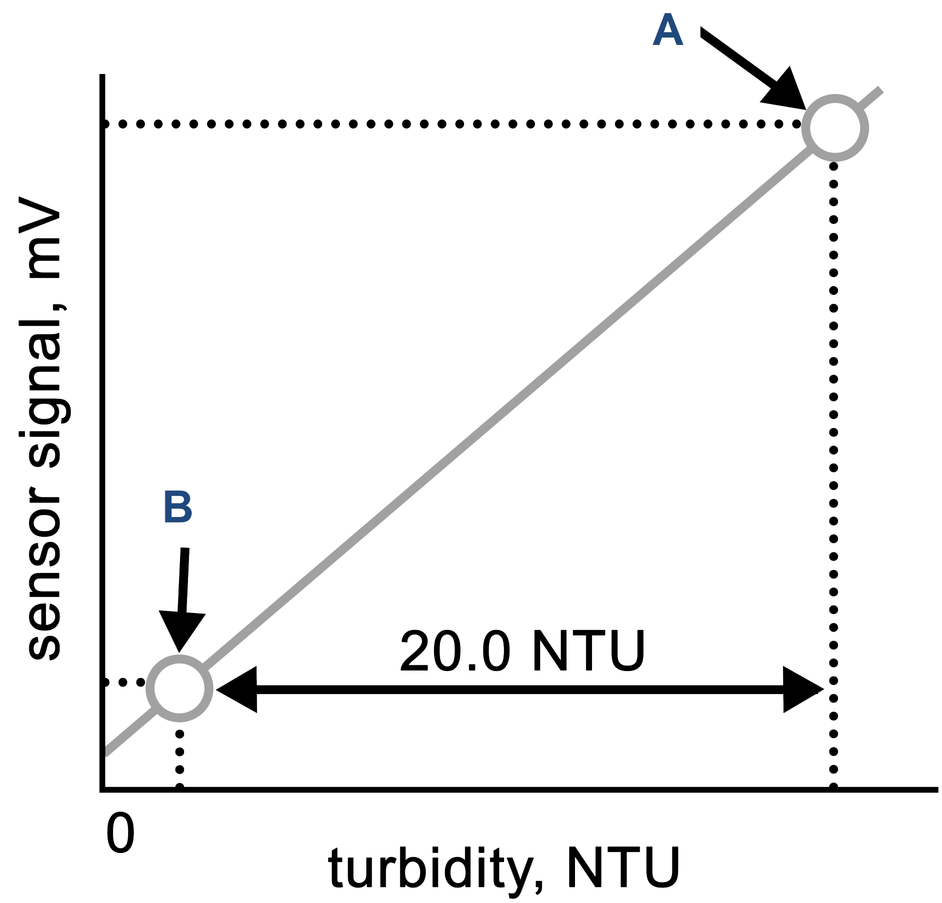
1. Immerse the sensor in filtered water having very low turbidity and measure the sensor output.
2. On the Rosemount 1056 transmitter, select **Slope Calibration**.
   This screen appears.

   ```
   S1: 1.234µS/cm    25.0°C
   S2: 12.34pH       25.0°C
         SN Slope Cal
   Sensor in pure H2O?
   Press ENTER
   ```

3. Enter the sensor output. Press **ENTER**.
4. Increase the turbidity of the filtered water by a known amount, typically 20 NTU, and measure the sensor output again.
   The transmitter takes the two measurements, applies a linear correction (if necessary), and calculates the sensitivity.

Sensitivity is the sensor output (in mV) divided by turbidity. A typical new sensor has a turbidity of about 10 mV/NTU. As the sensor ages, the sensitivity decreases. Dark current is the signal generated by the detector when no light is falling on it. The transmitter substracts the dark current from the raw scattered light signal and converts the result to turbidity. In highly filtered samples, which scatter little light, the dark current can be a substantial amount of the signal generated by the detector.

Figure 8-2: Turbidity in Filtered Water



A. *Filtered water + 20.0 NTU*
B. *Filtered water*

Example

The following screen appears if the slope calibration is successful.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
        SN Slope Cal
Cal Complete
```

The screen returns to the ***Turbidity Cal*** menu.

Example

The following screen may appear if slope calibration is unsuccessful.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
      SN Slope Cal
Calibration
Error

Press EXIT
```

8.2.3 Calibrate against a standard

You can calibrate the turbidity sensor against a commercial standard.

Stable 20.0 nephelometric turbidity unit (NTU) standards are available from a number of sources. Calibration using a commercial standard is simple. Filtered deionized water is not required.

Prerequisites

Before beginning the calibration, the transmitter does a dark current measurement. Dark current is the signal generated by the detector even when no light is falling on it.

Procedure

1. Select **Standard Calibration**.
   The following screen appears.

   ```
   S1: 1.234µS/cm    25.0°C
   S2: 12.34pH       25.0°C
       SN Standard Cal
   Sensor in Standard?
   Press ENTER
   ```

2. Press **ENTER**.
   The transmitter subtracts the dark current from the raw scattered light signal and converts the result to turbidity. In highly filtered samples, which scatter little light, the dark current can be a substantial amount of the signal generated by the sensor.

Example

The following screen appears if standard calibration is successful.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
    SN Standard Cal
Cal Complete
```

The screen returns to the **Turbidity Cal** menu.

Example

The following screen may appear if standard calibration is unsuccessful.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
      SN Standard Cal
Calibration
Error

Press EXIT
```

8.2.4 Calibrate against a grab sample

If you want, you can calibrate the turbidity sensor against the turbidity reading from another instrument.

The transmitter treats the value you entered as though it were the true turbidity of the sample. Therefore, grab sample calibration changes the sensitivity; it does not apply an offset to the reading.

This screen appears after you select **Grab calibration**

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
        SN Grab Cal
Wait for stable
reading
```

.

The following screen appears if grab calibration is successful.

```
S1: 1.234µS/cm    25.0°C
S2: 12.34pH       25.0°C
        SN Grab Cal
Cal Complete
```

The screen returns to the *Turbidity Cal* menu.

The following screen may appear if grab calibration is unsuccessful.

S1: 1.234µS/cm 25.0°C
S2: 12.34pH 25.0°C
S*N* Grab Cal
Calibration
Error

Press EXIT

9 Maintenance

9.1 Maintaining the transmitter

The Rosemount 1056 transmitter used with the Rosemount T1056 Turbidmeter requires little routine maintenance.

Clean the transmitter case and front panel by wiping with a clean soft cloth dampened with water only. Do not use solvents, like alcohol, that might cause a buildup of static charge.

⚠ WARNING

Explosion

Do not disconnect equipment when a flammable or combustible atmosphere is present.

Table 9-1: Replacement Parts for Rosemount 1056

PN	Description	Shipping weight
23823-00	Panel mounting kit, includes four brackets and four set screws	2 lb. / 1.0 kg
34059-00	Gasket, for panel mounting	1 lb. / 0.5 kg
34062-00	Gasket, internal for enclosure	1 lb. / 0.5 kg
24230-00	Hole plug and gland fittings	2 lb. / 1.0 kg

Note
Shipping weights are rounded up to the nearest whole lb. or 0.5 kg.

9.2 Clean the sensor

Clean the sensor by rinsing it thoroughly with water and then wiping it with a soft tissue. If water is inadequate, wash with a mild detergent solution and then thoroughly rinse it with water.

⚠ CAUTION

Equipment damage

Do not scratch the lamp or photodiode windows.
Do not use abrasive cleaners or solvents.

If mineral scale is present, apply a dilute acid solution with a cotton swab to clean away the deposit. Rinse thoroughly with water.

9.3 Replace the lamp/light-emitting diode (LED) board

The US EPA-compliant sensor uses a tungsten filament lamp (PN 1-0901-0004-EPA) as the light source. The lamp has an expected life of about one year. The ISO-compliant version uses an infrared LED (PN 1-0901-0005-ISO). Its expected life is five years. The transmitter continuously monitors the source intensity and corrects for changes in source intensity caused by age. When the source intensity becomes too low, the transmitter warns you. Replace the lamp as soon as possible.

To replace the lamp/LED board:

Procedure

1. Turn off power to the transmitter.

   ⚠ WARNING

   Explosion

   Do not disconnect equipment when a flammable or combustible atmosphere is present.

2. Remove the sensor from the measuring chamber and disconnect the cable.

   ⚠ WARNING

   High pressure and temperature

   Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig and the process temperature is at a safe level.

   Note
   If you have a dual input transmitter, you can reapply power at this point. The initial reading from the other sensor will momentarily be zero. After about 60 seconds, the reading will reach its final value.

3. Using a small Phillips screwdriver, remove the two screws holding the top flange of the sensor to the body.

4. Using a slight back and forth twisting motion, carefully pull the flange from the sensor body.

⚠ CAUTION

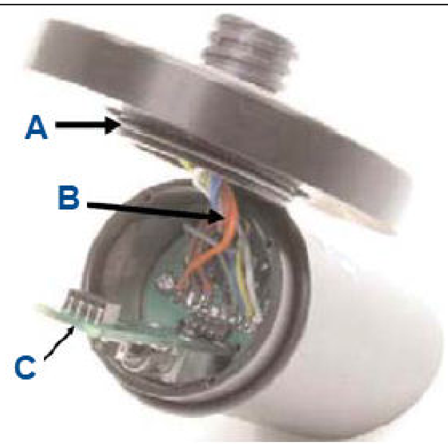
Equipment damage

Wires are short. Pulling too hard will damage connections.

Don't pull too hard.

   a. Don't pull too hard.
   b. O-ring

5. Using your thumb and forefinger, remove the lamp/LED circuit board from the sensor.



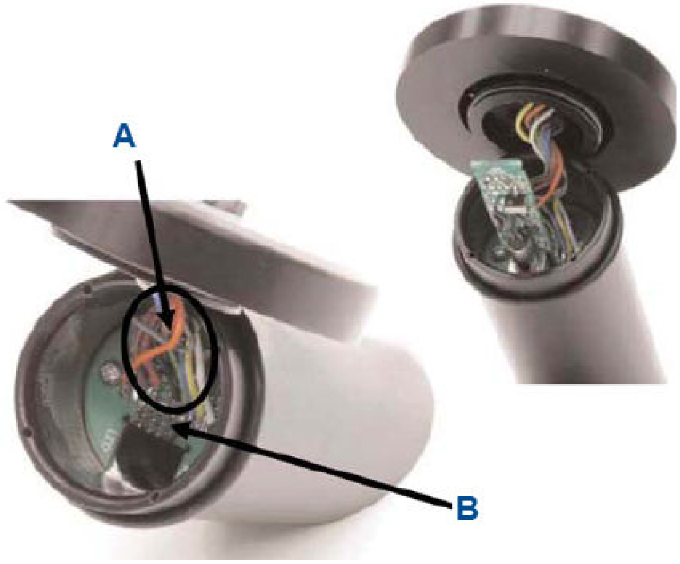
A. O-ring
B. Connecting wires
C. Lamp board

6. Insert the replacement board in the sensor and push the socket on the replacement board into the mating pins in the sensor.

⚠ CAUTION

Equipment damage

Keep wires pushed away from lamp board when replacing the flange.



A. Wires and flange
B. Mating pins

7. Place the dessicant package in the sensor body.
8. Orient the flange so that the screw holes line up with the holes in the sensor body. Push the flange back on the sensor body and replace the screws.

   Don't let wires push on lamp board. You may need to turn the flange a small amount until the holes line up.
9. Place the sensor in the calibration cup and reconnect the cable.
10. Calibrate the sensor using either slope or standard calibration.

    See Calibrate slope or Calibrate against a standard. Do not use grab calibration. Failure to calibrate the sensor may reduce the life of the sensor.

9.4 Maintaining the debubbler and measuring chamber

9.4.1 Clean the debubbler and measuring chamber

Procedure

1. Turn off the sample supply to the debubbler.

   ⚠ WARNING

   High pressure and temperature

   Before disconnecting the sample and drain lines or removing the sensor, be absolutely certain the process pressure is reduced to 0 psig and the process temperature is at a safe level.

2. Remove the sensor and put it in a safe place.

   The calibration cup is a good place to store the sensor.
3. Loosen the small drain plug in the base plug and allow the sample in the debubbler to drain out.

   See Figure 9-1.
4. Replace the drain plug.
5. Unscrew the upper and lower caps.

   Be careful not to lose the O-rings.
6. Use a stream of water, a brush, or a rag to flush and clean out the inside of the debubbler and measuring chamber.
7. Inspect the O-rings for signs of damage and replace if necessary.

   The part number for the O-ring (one each) is 9550316.
8. Replace the upper and lower caps.
9. Replace the sensor.

9.4.2 Clean the debubbler orifice

Procedure

1. Turn off the sample to the debubbler.
2. Disconnect the drain line. Unscrew the drain fitting from the orifice; then unscrew the orifice from the debubbler body.

   See Figure 9-1.
3. Use a stream of water to flush out any residue accumulated in the orifice. Direct the stream of water counter to the normal flow through the orifice.

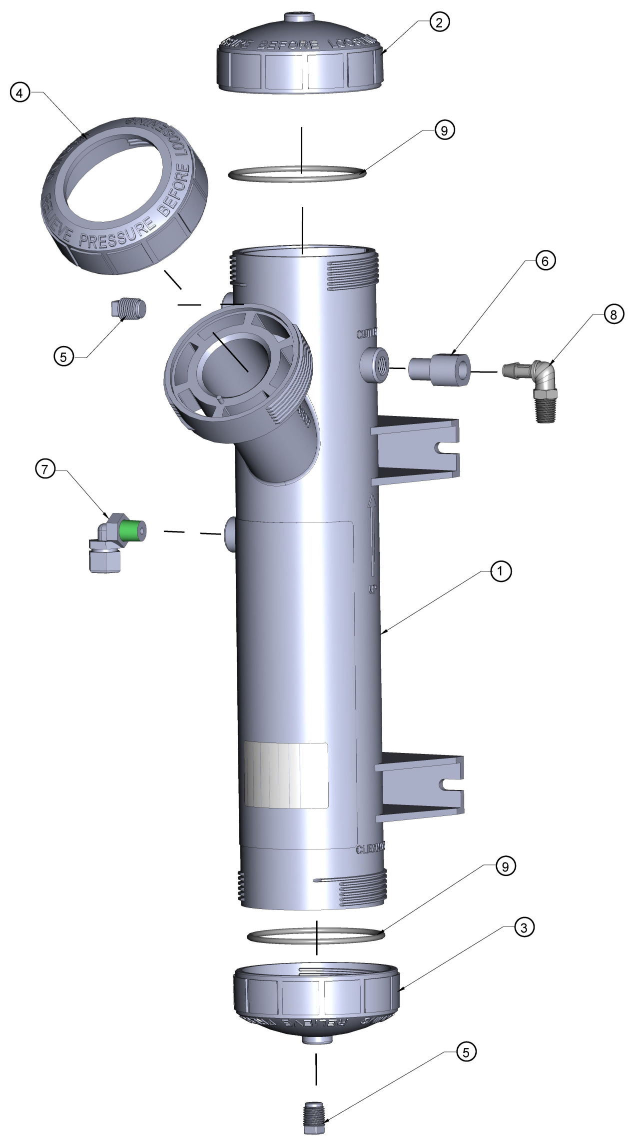
4. If the material plugging the orifice cannot be removed with flushing, use a toothpick or stiff wire to push out the obstruction. Push counter to the normal flow through the orifice.
5. Reinstall the orifice and reconnect the drain line. Turn on the sample flow.

Postrequisites

If the blockage cannot be removed or the orifice is damaged during cleaning, replace the orifice (PN 33947-00).

9.5 Replacement parts

Figure 9-1: Molded Debubbler Assembly



Location in Figure 9-1	Description	Part number
---	Replacement lamp board assembly, ISO-compliant sensor	109010010ISO
---	Replacement sensor, USEPA-complaint	801080002EPA
---	Replacement sensor, ISO-compliant	801080003ISO
1	Debubbler housing	3401500
2	Upper cap for debubbler	3401400
3	Lower cap for debubbler	3401401
4	Sensor nut	3401402
5	Pipe plug, ¼-in. male national pipe thread (MNPT), 2 places	3000854
6	Orifice assembly	3394700
7	Sample inlet elbow, ¼-in. compression fitting x ¼-in. MNPT	9321010
8	Sample drain elbow, ⅜-in. barb x ¼-in. MNPT	9322036
9	O-ring, one each, for upper and lower caps	9550322
not shown	O-ring, one each, for sensor	9550145

10 Troubleshoot

10.1 Troubleshooting overview

The Rosemount 1056 transmitter used in the Rosemount T1056 Turbidmeter continuously monitors itself and the sensor for problems. When the transmitter identifies a problem, the word **warning** or **fault** followed by **s** appears in the display alternately with the measurement.

If alarm 3 was configured as a fault alarm and a fault has occurred, the relay will energize. The outputs do not change during a fault or warning condition. They continue to reflect the measured turbidity or total suspended solids (TSS) value.

To read fault and warning messages, go to the main display and press **s**. The analyzer automatically scrolls through the messages and continues to scroll through the messages for two minutes. After two minutes, the display returns to the default screen.

To stop the automatic scrolling and return to the main display, press **EXIT**.

Error messages are prefaced by the word **fault** or **warning**.

Faults are conditions requiring immediate attention. If the transmitter displays a fault, regard its measurements as being in error.

Warnings are less serious than faults. A warning signifies the existence of a condition requiring attention. The transmitter remains usable.

⚠ WARNING

Explosion

Do not disconnect equipment when a flammable or combustible atmosphere is present.

10.2 Troubleshooting using fault codes

Fault message	Explanation	Section
SN Lamp / LED Failure	Lamp or light-emitting diode (LED) is burned out.	Lamp/LED Failure
EEPROM Failure	Cannot save data to non-volatile memory.	EEPROM Failure
Factory Failure	Needs factory calibration.	Factory Failure

Warning message	Explanation	Section
SN Need Cal	Lamp intensity is weak, but can be improved by calibrating.	Need Cal
SN Weak Lamp	Weak lamp; replace as soon as possible.	Weak Lamp

Warning message	Explanation	Section
SN Warning	Poor sensor cable connection or unusual ambient light condition affecting sensor or sensor not immersed.	SN Warning

SN identifies the sensor affected. S1 is sensor 1; S2 is sensor 2.

10.2.1 Lamp/LED Failure

The light source in a Rosemount T1056 Turbidmeter can be either a tungsten filament lamp or a light-emitting diode (LED). US Environmental Protection Agency (EPA)-compliant sensors use a tungsten lamp. International Standards Organization (ISO)-compliant sensors use an LED. A photodiode inside the sensor continuously monitors the intensity of the light source. The source intensity measurement is used to correct for source drift, which allows the sensor to operate for longer periods without calibration. If the signal from the photodiode drops below a certain value, the transmitter assumes the light source has either failed completely or the intensity is too low to be useful. At this point, the transmitter displays the **Lamp Failure** message.

Recommended actions

1. Replace the lamp or LED board.
2. After replacing the board, recalibrate the sensor using either slope or standard calibration.

   See Calibrate slope or Calibrate against a standard. Recalibration is necessary to reset the lamp power supply. Grab calibration will not reset the power supply and may result in significantly reduced lamp life.

10.2.2 EEPROM Failure

EEPROM failure means the transmitter is unable to store data in the non-volatile memory. If this happens and power is lost and then restored, all configurations and calibrations will be lost.

Recommended action

Call the factory for assistance.

You will probably need to replace the transmitter.

10.2.3 Factory Failure

The factory calibrations have been corrupted.

Recommended action

Call the factory for assistance.

You will probably need to replace the transmitter.

10.2.4 Need Cal

The Rosemount T1056 contains two photodiodes. One measures the intensity of the light scattered by the sample. The other measures the intensity of the lamp. Because turbidity is proportional to the intensity of light falling on the sample photodiode, any reduction of the lamp intensity will be measured as a decrease in turbidity, even though the true turbidity remains constant. The transmitter uses the lamp intensity measurement to correct for changes in apparent turbidity caused by reduction of lamp intensity. However, if the lamp intensity gets too low, the correction may not be valid. At this point, the transmitter displays the **Need Cal** warning. Calibrating will cause the transmitter to increase the current supplied to the lamp, thus increasing the lamp intensity.

Recommended action

Calibrate the sensor using slope (Calibrate slope), standard (Calibrate against a standard), or a grab sample (Calibrate against a grab sample).

Use grab calibration only if a turbidity standard is not available.

10.2.5 Weak Lamp

The `Weak Lamp` warning appears when lamp intensity is low and the current being supplied to the lamp has been increased above a level likely to significantly reduce lamp life.

Replace the lamp board as soon as possible. After you replace the lamp, recalibrate the sensor using either slope or standard calibration. See Calibrate slope or Calibrate against a standard. Recalibration is necessary to reset the lamp power supply. Grab calibration will not resent the power supply. Failure to recalibrate using slope or standard calibration may signficantly reduce lamp life.

10.2.6 SN Warning

`SN Warning` will be displayed on the instrument to communicate an unusual but non-fatal condition that may require checking and adjustments. Check three things.

1. Check the sensor/cable connection. Confirm that the swivel nut on the cable is in the locked position on the sensor.

   Note
   Once the plastic threaded swivel nut is engaged with the sensor threads, rotate the swivel ¾ turn to lock the cable to the sensor.

2. Confirm that sample water is flowing out of the debubbler drain outlet. This ensures that the sensor is immersed in sample water.

3. Ensure that the sensor is not exposed to high ambient light sources (such as direct sunlight).

Important
When using EPA/incandescent sensors (PN 8-0108-0002-EPA):

- Do not power up the instrument without the sensor connected.
- Do not disconnect and reconnect a sensor when a transmitter is powered.

If this is inconvenient or cannot be avoided:

1. Cycle power to the instrument after connecting the sensor or
2. Perform a slope calibration or standard calibration routine after connecting the sensor.

Following these guidelines will extend the life of the incandescent lamp and avoid premature warnings and faults due to reduced lamp life.

10.3 Troubleshooting calibration problems

Once you have completed the calibration sequence, the transmitter verifies that the calibration meets certain requirements. If the calibration is valid, the transmitter displays the *Calibration complete* screen and updates the calibration. If the calibration does not meet requirements, the *Calibration error* screen appears. The transmitter retains the original calibration.

Calbration method	Section
User-prepared standard (Calibrate slope)	Calibration error - user-prepared standard
Commerical standard (Calibrate against a standard)	Calibration error - commercial standard
Grab sample (Calibrate against a grab sample)	Calibration error - grab sample

10.3.1 Calibration error - user-prepared standard

1. For best results, calibrate using freshly prepared 20.0 NTU standard. Use the procedure in Calibrate slope.
2. Has the stock 4000 NTU standard exceeded its expiration date?
3. Is the turbidity of the dilution water less than 0.5 NTU? If you are using bottled distilled or deionized water, open a fresh bottle and repeat the calibration.
4. Are the lamp and detector windows clean? See Clean the sensor.
5. Is the sensor securely sealed in the calibration cup with no light leaking in? Putting a dark cloth over the sensor and calibration cup and removing it should have no effect on the reading. Are both the lamp and photodiode windows completely submerged in the standard?
6. Was the correct turbidity value entered in the transmitter?

10.3.2 Calibration error - commercial standard

1. For best results, calibrate using 20.0 NTU standard.
2. Has the calibration standard exceeded its expiration date?
3. Are the lamp and detector windows clean? See Clean the sensor.
4. Is the sensor securely sealed in the calibration cup with no light leaking in? Putting a dark cloth over the sensor and calibration cup and removing it should have no effect

on the reading. Are both the lamp and photodiode windows completely submerged in the standard?

5. Was the correct turbidity value entered in the transmitter?

10.3.3 Calibration error - grab sample

1. Was the referee instrument used to measure the grab sample properly calibrated?
2. Was the process turbidity reading stable when the grab sample was taken? Do not attempt a grab sample calibration when turbidity readings are rapidly changing.
3. Is the sensor securely sealed in the measuring chamber with no light leaking in? Putting a dark cloth over the sensor and measuring chamber and removing it should have no effect on the reading.
4. Is the sensor clean? See Clean the sensor.
5. Was the correct turbidity value entered in the transmitter?

10.4 Troubleshooting other problems

Problem	Section
Readings are erratic.	Readings are erratic.
Readings drift.	Readings drift.
Transmitter responds too slowly to changes in turbidity.	Transmitter responds too slowly to changes in turbidity.
Flow is too low.	Flow is too low.
Readings are lower or higher than expected.	Readings are lower or higher than expected.
Current output is too low.	Analog current is too low.
Alarm relays do not operate when setpoint is exceeded.	Alarm relays do not operate when setpoint is exceeded.
Display is unreadable - too faint or all pixels dark.	Display is unreadable - too faint or all pixels dark.

10.4.1 Readings are erratic.

Erratic readings are usually caused by air bubbles drifting through the measurement zone of the sensor. Air bubbles reflect light onto the detector and cause spikes in the turbidity reading. A debubbling chamber helps remove large bubbles. An orifice in the outlet of the debubbler helps eliminate outgassing by putting back pressure on the debubbler. Outgassing can occur when the pressure of the sample is reduced or when a cold sample warms up. A bubble rejection filter in the transmitter software also helps reduce the effect of bubbles.

1. Be sure the bubble rejection filter is on and increase the signal averaging time. See Bubble rejection.
2. If the inlet pressure is high enough, increase the back pressure on the debubbler using a valve or a valved rotameter (PN 24103-00) installed in the outlet of the

debubbler. Do not exceed 30 psig (303 kPa abs). Increasing the back pressure reduces the sample flow and increases the system response time. If the inlet pressure is too low, increasing the back pressure might not be feasible.

3. If bubbles persist, increase the back pressure and use a sample pump to increase the inlet pressure.

10.4.2 Readings drift.

Gradual downward drift in readings is caused by dirt accumulating on the lamp or detector windows. The dirt reduces the amount of light entering the measuring zone in the sample and blocks scattered light from reaching the detector. Upward drift is usually caused by bubbles adhering to the lamp or detector windows. The bubbles, which act like lenses, direct light onto the detector and increase the apparent turbidity reading. Once the bubbles get large enough, they break away from the surface of the detector and the turbidity reading drops.

1. If downward drift is occuring, inspect the sensor windows for cleanliness. See Clean the sensor for cleaning instructions.
2. If upward drift is occurring, remove the sensor completely from the debubbler and then replace it. If readings drop back to normal or expected values, then the upward drift was probably caused by bubbles accumulating on the sensor. (Removing the sensor from the debubbler causes the air bubbles to break). To reduce bubble accumulation, increase the back pressure on the debubbler using a valve or valved rotameter (PN 24103-00) installed in the outlet of the debubbler. Do not exceed 30 psig (308 kPa abs). Increasing the back pressure reduces the sample flow and increases the system response time. If the inlet pressure is too low, increasing the back pressure might not be feasible.
3. If bubbles persist, increase the back pressure and use a sample pump to increase the inlet pressure.

10.4.3 Transmitter responds too slowly to changes in turbidity.

Response time is primarily a function of sample flow rate, distance between the sample point and transmitter, and the diameter of the sample tubing. Because the debubbler has a flow restrictor on the outlet to increase back pressure, sample flow rate is primarily determined by the inlet pressure.

1. If possible, increase the inlet pressure.
2. If increasing the inlet pressure is not feasible, move the sensor closer to the sample port.

10.4.4 Flow is too low.

The debubbler is fitted with a 0.040 in. (1 mm) diameter orifice in the outlet. The orifice puts back pressure on the debubbler, which helps reduce outgassing. If the inlet pressure is about 3.5 psig (125 kPa abs), the flow through the debubbler will be about 250 mL/min. The response time to a step change at 250 mL/min is about 4.5 minutes. If the flow is too low, the response time may become excessive. The only way to improve the response time is to reduce the back pressure or increase the inlet pressure.

1. To eliminate back pressure, remove the orifice from the debubbler. See Clean the debubbler orifice.
2. If removing the orifice causes outgassing - the symptom of outgassing is an upward drift in apparent turbidity - increase the back pressure by a small amount. Use the valve or a valved rotameter (PN 24103-00) in the debubbler outlet. Do not exceed 30 psig (308 kPa abs).
3. If outgassing continues to persist, increase the back pressure. To maintain flow, use a pump to increase the inlet pressure.

10.4.5 Readings are lower or higher than expected.

1. Is the instrument to which readings are being compared properly calibrated?
2. Are samples being tested immediately after sampling? If samples are allowed to sit too long before testing, the turbidity may change.
3. Are the measurement chamber and debubbler clean? Sample flow may be stirring up solids that have previously settled out in the debubbler and measurement chamber, increasing the apparent turbidity. See Clean the debubbler and measuring chamber for cleaning procedure.

10.4.6 Analog current is too low.

Load resistance is too high. Maximum load is 600 Ω.

10.4.7 Alarm relays do not operate when setpoint is exceeded.

1. Is the alarm board in place and properly sealed?
2. Is the alarm logic (high/low) and dead band correct?
3. Has the setpoint been properly entered?

10.4.8 Display is unreadable - too faint or all pixels dark.

While holding down the **MENU** key, press `s` or `t` until the display has the correct contrast.

11 Return of material

11.1 General return information

To expedite the repair and return of instruments, proper communication between the customer and factory is important. Before returning a product for repair, call +1-855-724-2638 for a Return Materials Authorization (RMA) number.

11.2 Warranty repair

The following is the procedure for returning instruments still under warranty.

1. Call Rosemount™ for authorization.
2. To verify warranty, supply the factory sales order number of the original purchase order number. In the case of individual parts or sub-assemblies, you must supply the serial number on the unit.
3. Carefully package the materials and enclose your *Letter of Transmittal*. If possible, pack the materials in the same manner as they were received.
   See Warranty.
4. Send the package prepaid to:
   Emerson Automation Solutions
   8200 Market Boulevard
   Chanhassen, MN 55317, USA
   Attn: Factory Repair
   RMA No.________________
   Mark the package: `Returned for Repair`
   Model No.________________

11.3 Non-warranty repair

The following is the procedure for returning instruments that are no longer under warranty for repair.

1. Call Rosemount™ for authorization.
2. Supply the purchase order number and make sure to provide the name and telephone number of the individual to be contacted should additional information be needed.
3. Do steps 3 and 4 in Warranty repair.

Note
Consult the factory for additional information regarding service or repair.

A Verify linearity

This procedure describes how to verify linearity between turbidity and TSS.

Procedure

1. Collect a sample of the process liquid.

   You may need 10 L or more if you use the Rosemount™ Clarity II for measuring turbidity. If you uses a laboratory turbidmeter, you will need less volume. The Rosemount Clarity II requires about 500 mL for the measurement; laboratory turbidmeters require 50 mL or less. Verify that the turbidity of the sample is less than 200 NTU. Store in a clean bottle.

2. Filter a portion of the sample to obtain at least 5 L of dilution liquid.

   The filtrate is needed to dilute the sample in subsequent steps. Verify that the turbidity of the dilution water is low. If filtering the sample is impractical, use deionized water for dilution.

3. Measure the total suspended solids (TSS) in the sample obtained in Step 1. Thoroughly mix the sample before withdrawing liquid.

   A magnetic stirrer is best, but inverting the sample repeatedly for about a minute works too. Avoid violent shaking or mixing. Refer to any standard reference work on water and wastewater testing for the procedure for determining TSS.

4. Dilute the sample from Step 1 by a factor of 0.9, 0.7, 0.5, 0.3, and 0.1.

   See the table for recommended volumes. Measure TSS and turbidity for each dilution. For lower TSS values, use a larger volume of sample.

Dilution factor	Volume of stock, mL	Final volume, mL	Volume for Rosemount Clarity II, mL	Volume for TSS, mL
1.00	--	--	500	50 - 250
0.9	900	1000	500	50 - 250
0.7	700	1000	500	50 - 250
0.5	500	1000	500	50 - 250
0.3	300	1000	500	50 - 250
0.1	100	1000	500	50 - 250

5. Plot the data obtained in Step 4, with turbidity on the Y-axis and TSS on the X-axis. Fit the best straight line to the data.
6. Locate two points (P1 and P2) on the line separated as much as possible. Read the ppm and NTU value for each point and enter these into the transmitter.

   See Enter total suspended solids (TSS) data.

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