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Instruction Manual
PN 51-T1055/rev.L
October 2008

Clarity II™ Turbidimeter

Turbidity Measurement System



ROSEMOUNT® Analytical

EMERSON™ Process Management

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ESSENTIAL INSTRUCTIONS

READ THIS PAGE BEFORE PROCEEDING!

Your purchase from Rosemount Analytical, Inc. has resulted in one of the finest instruments 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 quality of the installation and knowledge of the user in operating and maintaining the instrument. To ensure their continued operation to the design specifications, personnel should read this manual thoroughly before proceeding with installation, commissioning, operation, and maintenance of this instrument. If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.

- 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.
- Ensure that you have received the correct model and options from your purchase order. Verify that this manual covers your model and options. If not, call 1-800-854-8257 or 949-757-8500 to request correct manual.
- 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, update, program and maintain the product.
- Educate your personnel in the proper installation, operation, and maintenance of the product.
- Install equipment as specified in the Installation section of this manual. Follow appropriate local and national codes. Only connect the product to electrical and pressure sources specified in this manual.
- 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.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by it against hazards may be impaired.



⚠WARNING

RISK OF ELECTRICAL SHOCK

⧈ Equipment protected throughout by double insulation.

- Installation of cable connections and servicing of this product require access to shock hazard voltage levels.
- Main power and relay contacts wired to separate power source must be disconnected before servicing.
- Do not operate or energize instrument with case open!
- Signal wiring connected in 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 enclosure 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 (NEMA 4X).
- Electrical installation must be in accordance with the National Electrical Code (ANSI/NFPA-70) and/or any other applicable national or local codes.
- Operate only with front and rear panels fastened and in place over terminal area.
- Safety and performance require that this instrument be connected and properly grounded through a three-wire power source.
- Proper relay use and configuration is the responsibility of the user.

⚠CAUTION

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 user at his own expense, will be required to take whatever measures may be required to correct the interference.

⚠WARNING

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

Emerson Process Management

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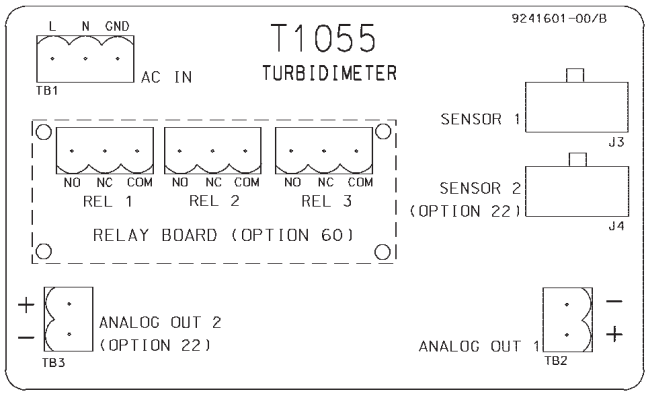
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QUICK START GUIDE

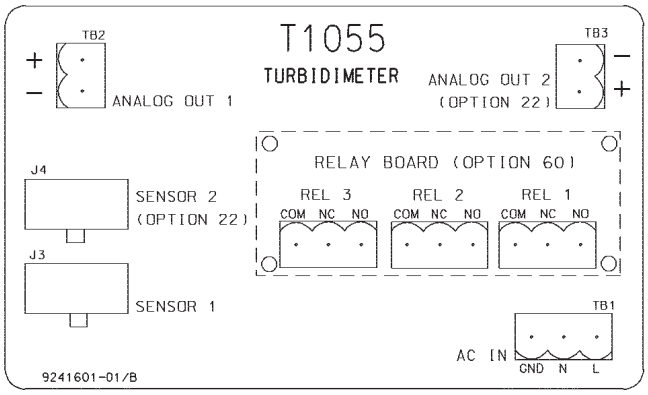
FOR CLARITY II TURBIDIMETER

1. Refer to Section 2.0 for installation instructions.
2. The sensor cable is pre-wired to a plug that inserts into a receiving socket in the analyzer. The cable also passes through a strain relief fitting. 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 the wall/pipe mount version, 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. **The sensor must be in a dark place when power is first applied to the analyzer.**
3. Make power, alarm, and output connections as shown in the drawing below.



Panel Mount version

The release clip on the sensor plug faces the top of the analyzer enclosure.



Wall/Pipe Mount version

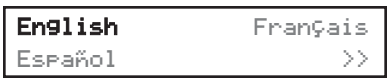
The release clip on the sensor plug faces the user.

Power, Alarm, and Output Connections

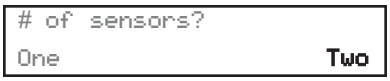
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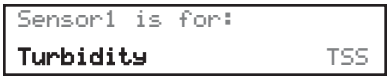
4. Once connections are secured and verified, apply power to the analyzer.
5. When the analyzer is powered up for the first time **Quick Start** screens appear. Using **Quick Start** is easy.
   a. A blinking field shows the position of the cursor.
   b. Use the ◀ or ▶ key to move the cursor left or right. Use the ▲ or ▼ key to increase or decrease the value of a digit. Use the ▲ or ▼ key 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.



6. Choose the desired language. Move the cursor to **>>** and press ENTER to show more choices.



7. Choose the number of sensors. This screen will be displayed only for dual input analyzers.

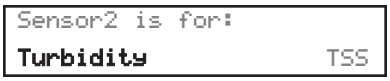


8. Choose **Turbidity** or **TSS** (total suspended solids). If you choose **TSS** you must enter a calibration curve. Refer to Section 6.5.





9. Choose units for turbidity (**NTU**, **FTU**, **FNU**) or TSS (**ppm**, **mg/L**, **none**).



10. If you have a dual input analyzer the screen at left appears. Repeat steps 8 and 9 for the second sensor.

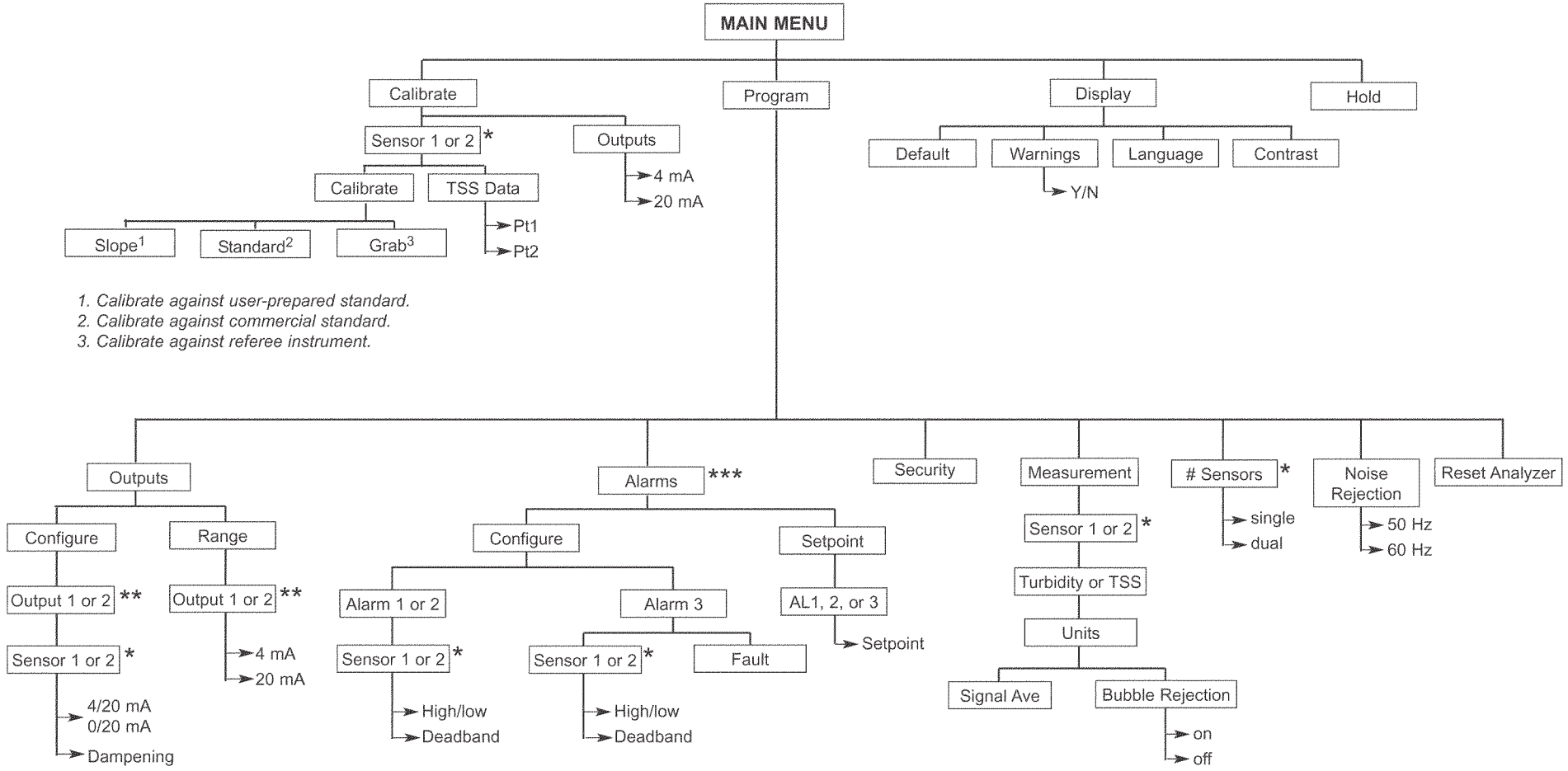
11. The main display appears. The initial turbidity reading will be 0.000 NTU. Over the next 60 seconds the reading will gradually reach a final value. The error in the displayed value may be as great as 20%. For best results, the sensor must be calibrated. See Section 6.0.

    The outputs and alarms are assigned to default values. To change settings, refer to Section 5.0, Programming the Analyzer. To reinstall factory settings and return to Quick Start, see Section 5.9.

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QUICK REFERENCE GUIDE

MENU TREE FOR TURBIDITY/TSS MEASUREMENTS



1. *Calibrate against user-prepared standard.*
2. *Calibrate against commercial standard.*
3. *Calibrate against referee instrument.*

*Sensor 1 or Sensor 2 screens appear only in the dual input analyzer.

**Output 1 or Output 2 screens appear only in the dual input analyzer.

***Alarm screen appear only if the optional alarm board is installed.

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About This Document

This manual contains instructions for installation and operation of the Clarity II Model T1055 Turbidimeter.

The following list provides notes concerning all revisions of this document.

Rev. Level	Date	Notes
A	5/04	This is the CD-launch version containing only installation information.
B	6/04	This is the electronic launch version, which added more detail instructions for programming and troubleshooting.
C	11/04	This is the initial full release of the product manual. The manual has been reformatted to reflect the Emerson documentation style and updated to reflect any changes in the product offering.
D	1/05	Updated ordering matrix, added lamp calibration section, revised information screens section.
E	3/05	Revised panel mount drawing.
F	7/05	Revised text on pp. 32 & 34; revised text & figure on page 46.
G	10/05	Revised text on pp 9 & 47 and drawings on pp. 10 & 48 to show new molded debubbler; revised debubbler specifications. Addition of agency-required warnings to pp. 12, 43, 45, & 48.
H	1/06	Revised Analyzer Enclosure Specifications - page 2.
I	5/06	Added FM and CSA Non-Incendive approval ratings to Specifications - Analyzer, page 2. Added FM and CSA Non-Incendive installation control drawings to section 3.0 - Wiring, pp. 12-15. Added wetted materials to debubbler specifications, page 2. Changed part numbers for replacement lamp boards, page 50.
J	7/06	Added troubleshooting advice for “SN Warning”, pp. 11, 36, 38, 40, 51, 52.
K	4/07	
L	10/08	PN number changed on page 50 for #9 on replacement parts.

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MODEL CLARITY II TURBIDIMETER

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APPENDIX

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SECTION 1.0.
DESCRIPTION AND SPECIFICATIONS

- COMPLETE SYSTEM includes single or dual input analyzer, sensor(s), and debubbler assembly
- CHOOSE U.S. EPA METHOD 180.1 or ISO METHOD 7027 compliant sensors
- RANGE 0-200 NTU
- RESOLUTION 0.001 NTU
- FULL FEATURED ANALYZER with fully scalable analog outputs and optional fully programmable alarms
- INTUITIVE, USER-FRIENDLY MENU in six languages makes setup and calibration easy

Clarity II is a trademark of Emerson Process Management.

FEATURES AND APPLICATIONS

The Clarity II turbidimeter 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 Clarity II ideal for monitoring the turbidity of filtered drinking water. Because it measures turbidity as high as 200 NTU, Clarity II is also suitable for most raw waters. The Clarity II turbidimeter can be used in applications other than drinking water treatment. Examples are monitoring wastewater discharges, condensate returns, and clarifiers.

Both USEPA 180.1 and ISO 7027-compliant sensors are available. USEPA 180.1 sensors use a visible light source. ISO 7027 sensors use a near infrared LED. For regulatory monitoring in the United States, USEPA 180.1 sensors must be used. Regulatory agencies in other countries may have different requirements.

The Clarity II turbidimeter consists of an analyzer, 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 analyzer, making setup fast and easy. Sensors can be located as far as 50 ft (15.2 m) away from the analyzer.

The Clarity II turbidimeter incorporates the popular and easy to use Solu Comp II analyzer. Menu flows and prompts are so intuitive that a manual is practically not needed. Analog outputs are fully scalable. An optional alarm board with three relays is also available. Alarms are fully programmable for high/low logic and dead band. To simplify programming, the analyzer automatically detects whether an EPA 180.1 or ISO 7027 sensor is being used.

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

A dry check is also available to periodically confirm Clarity II operation.

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1.2 SPECIFICATIONS — ANALYZER

Enclosure: ABS (panel mount), polycarbonate (pipe/wall mount); NEMA 4X/CSA 4 (IP65)

Dimensions:

Panel mount version: 6.10 X 6.10 X 3.72 in (155 X 155 X 94.5 mm)

Pipe/ Wall mount version: 6.23 X 6.23 X 3.23 in (158 X 158 X 82 mm)

Conduit openings: Accepts PG 13.5 or ½-in fittings.

Display: Two line, 16-character back lit display. Character height 4.8 mm. Display can be customized to meet individual requirements.

Security Code: 3-digit code prevents accidental or unauthorized changes in instrument settings and calibration.

Languages: English, German, Spanish, Italian, French, Portuguese

Units: Turbidity (NTU, FTU, or FNU); total suspended solids (mg/L, ppm, or no units)

Display resolution-turbidity: 4 digits; decimal point moves from x.xxx to xxx.x

Display resolution-TSS: 4 digits; decimal point moves from x.xxx to xxxx

Calibration methods: user-prepared standard, commercially prepared standard, or grab sample. For total suspended solids user must provide a linear calibration equation.

Ambient temperature and humidity: 0 to 50°C, (32 to 122°F); RH 10 to 90% (non-condensing)

Power: 85 to 265 Vac, 47.5 to 65.0 Hz. Maximum current without option -60 alarm board: 1.0 amp, with option -60 alarm board: 1.3 amp.

⧈ Equipment protected by double insulation.

Hazardous Location:

Class I, Div. 2, Groups A, B, C, & D: T3C Tamb 0°-50°C Suitable for use in Class II and III, Division 2, Groups E, F and G. Enclosure Type 4/4X

FM APPROVED — Install in accordance with control drawing no. 1400311 or 1400312 (FM).

SP® –LR 34186 — Install in accordance with control drawing no. 1400313 or 1400314 (CSA).

SP® –LR 34186 C US (Ordinary Location only)

Inputs: Choice of single or dual input

RFI/EMI: EN-61326

LVD: EN-61010-1 CE

Outputs: Single input analyzer has single output. Dual input analyzer has dual outputs. Outputs are 0-20 mA or 4-20 mA isolated. Maximum load is 600 ohms. Output dampening with 5 sec time constant is user-selectable.

Output Accuracy: 0.05 mA

Alarms: Optional alarm relay board includes three alarms. Alarm 3 can be configured as a fault alarm in-stead of a process alarm. Each relay can be configured independently. Alarm logic (low or high) and dead band are user-programmable.

Relays: Form C, single pole, double throw, epoxy sealed.

Alarm Board Ratings:

	Resistive	Inductive
115 Vac	5.0 A	3.0 A
230 Vac	5.0 A	1.5 A

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

SPECIFICATIONS — SENSOR

Method: EPA 180.1 or ISO 7027 (using 860 nm LED source). Must be specified when ordering.

Incandescent lamp life: two years

LED life: five years

Wetted materials: Delrin®[1], 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

Cable: 20 ft (6.1 m) or 50 ft (15.2 m). Maximum 50 ft (15.2 m).

Maximum Pressure: 30 psig (308 kPa abs)

Temperature: 40 - 95°F (5 - 35°C)

Sensor Body: IP65 when cable is connected.

[1]*Delrin is a registered trademark of DuPont Performance Elastomers.*

SPECIFICATIONS — DEBUBBLER AND FLOW CHAMBER

Dimensions: 18.1 in. x 4.1 in. diam. (460 mm x 104 mm diam.) (approx.)

Wetted materials: ABS, EPDM, polypropylene, nylon, Kynar®[2], Delrin

Inlet: compression fitting accepts 1/4 in. OD tubing; fitting can be removed to provide 1/4 in. FNPT

Drain: barbed fitting accepts 3/8 in. ID tubing; fitting can be removed to provide 1/4 in. FNPT. Must drain to atmosphere.

Sample temperature: 40 - 95°F (5 - 35°C)

Minimum inlet pressure : 3.5 psig (125 kPa abs). 3.5 psig will provide about 250 mL/min sample flow.

Maximum inlet pressure: 30 psig (308 kPa abs). Do not block drain tube.

Recommended sample flow: 250 - 750 mL/min

Response Time: The table shows the time in minutes to percent of final value following a step change in turbidity.

% response following step change	response time (minutes)	
	4 gph (250 mL/min)	12 gph (750 mL/min)
10	2.0	0.5
50	2.5	1.0
90	4.5	2.5
99	7.0	4.0

SPECIFICATIONS — MISCELLANEOUS

Weight/shipping weight:

Sensor: 1 lb/2 lb (0.5 kg/1.0 kg)

Analyzer: 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)

[2]*Kynar is a registerd trademark of Elf Atochem North America, Inc.*

Specifications subject to change without notice.

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SECTION 2.0. INSTALLATION

2.1 UNPACKING AND INSPECTION

The Clarity II Turbidimeter is a complete system for the determination of turbidity in drinking water. The system consists of the analyzer, 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.

Item	Model/part number (1)
Analyzer-panel mount (1)	T1055-[10]-[ ]
Analyzer-pipe/wall mount	T1055-[11]-[ ]
Analyzer-single input	T1055-[ ]-[21]
Analyzer-dual input	T1055-[ ]-[22]
Analyzer- alarm board input	T1055-[ ]-[ ]-[60]
Sensor-EPA standard	8-0108-0002-EPA
Sensor-ISO standard	8-0108-0003-ISO
Cable-3 ft (0.9 m)	24138-00
Cable-20 ft (6.1 m)	24097-00
Cable-50 ft (15.2 m)	24098-00
Calibration cup	24101-00
Molded chamber/debubbler	24170-00

(1) The analyzer model number is printed on a label attached to the side of the instrument. For example, if you ordered a panel mount, dual input analyzer, with alarm board, the label should read: T1055-10-22-60.

2.2 INSTALLATION — ANALYZER

2.2.1 General Information

1. Although the analyzer is suitable for outdoor use, do not install it in direct sunlight or in areas of extreme temperatures.
2. Install the analyzer in an area where vibrations and electromagnetic and radio frequency interference are minimized or absent.
3. Keep the analyzer and sensor wiring at least one foot from high voltage conductors. Be sure there is easy access to the analyzer.
4. **Do not run AC power and relay wiring through the top conduit openings. Keep AC power and relay wiring separate from other wiring in the analyzer after installation.**
5. The analyzer is suitable for panel, pipe, or surface mounting. Refer to the table below.

Type of Mounting	Section
Panel	2.2.2
Pipe	2.2.3
Surface	2.2.4

6. See Section 3.1 for removal of conduit knockouts.
7. To reduce the likelihood of stress on wiring connections, remove the hinged front panel (-11 models) from the base during wiring installation. Allow sufficient wire length to avoid stress on conductors.

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2.2.2 Panel Mounting.

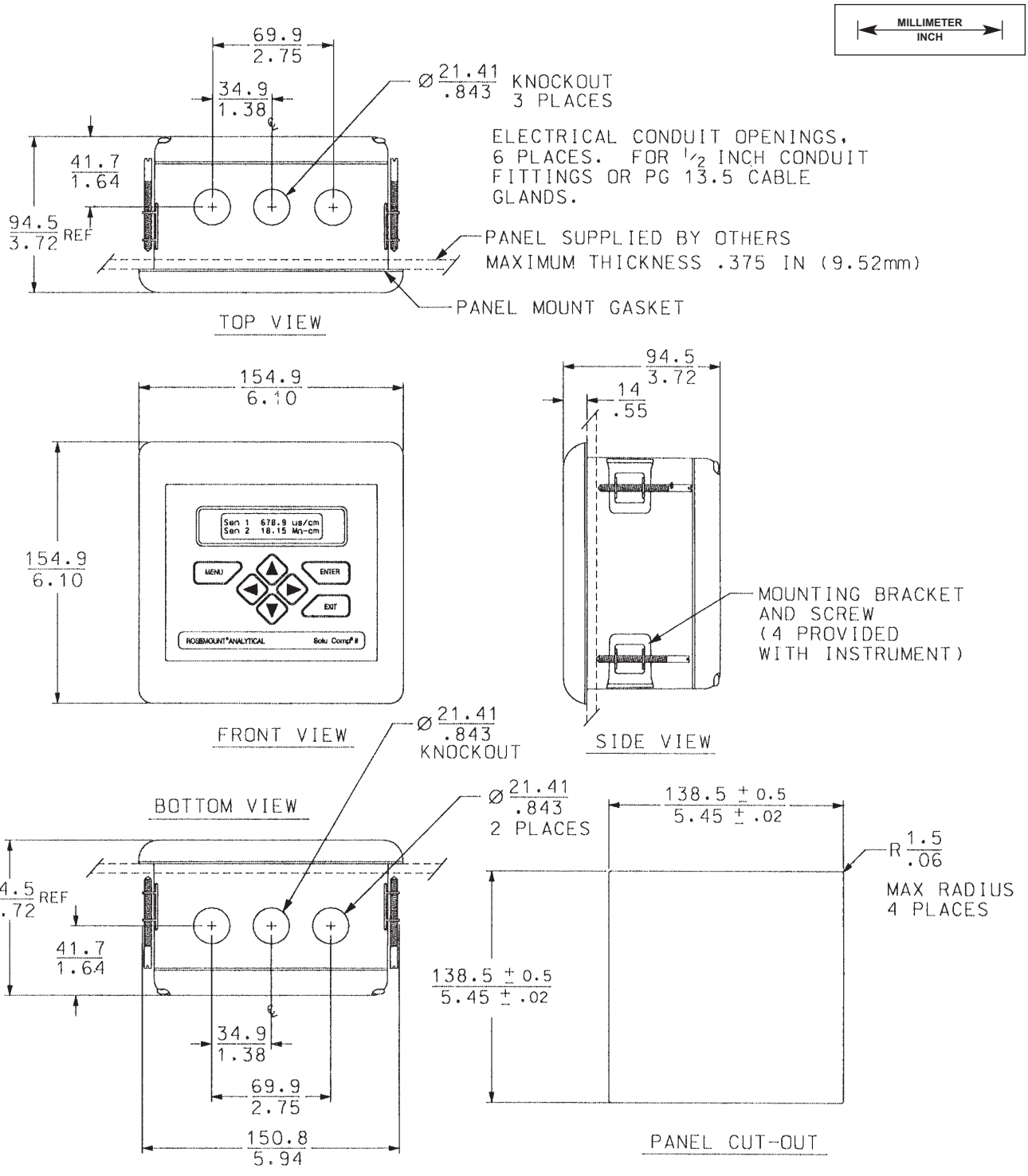


FIGURE 2-1. Panel Mount Installation

Access to the wiring terminals is through the rear cover. Four screws hold the cover in place.

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2.2.3 Pipe Mounting.

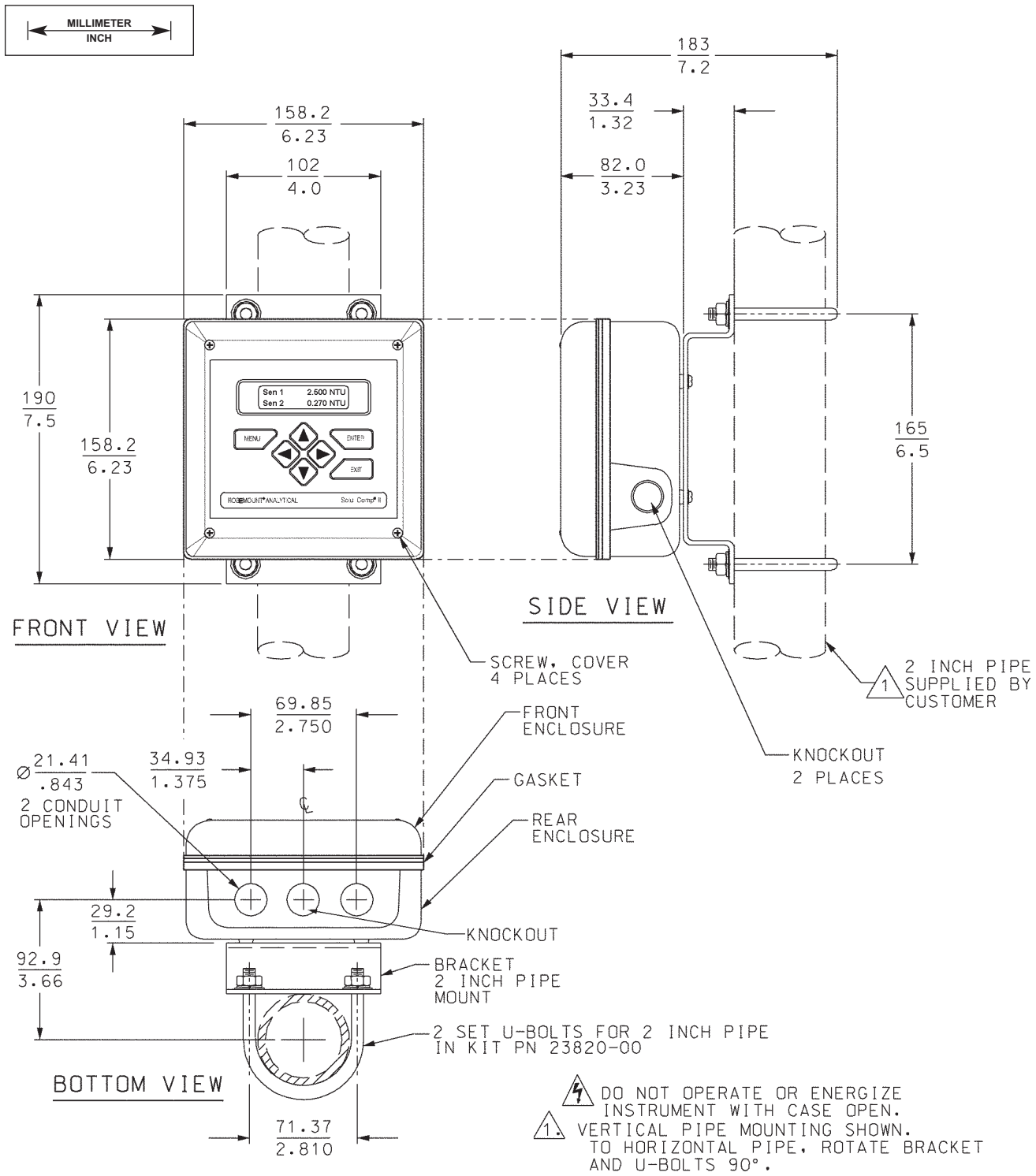


FIGURE 2-2. Pipe Mount Installation

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

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2.2.4 Surface Mounting.

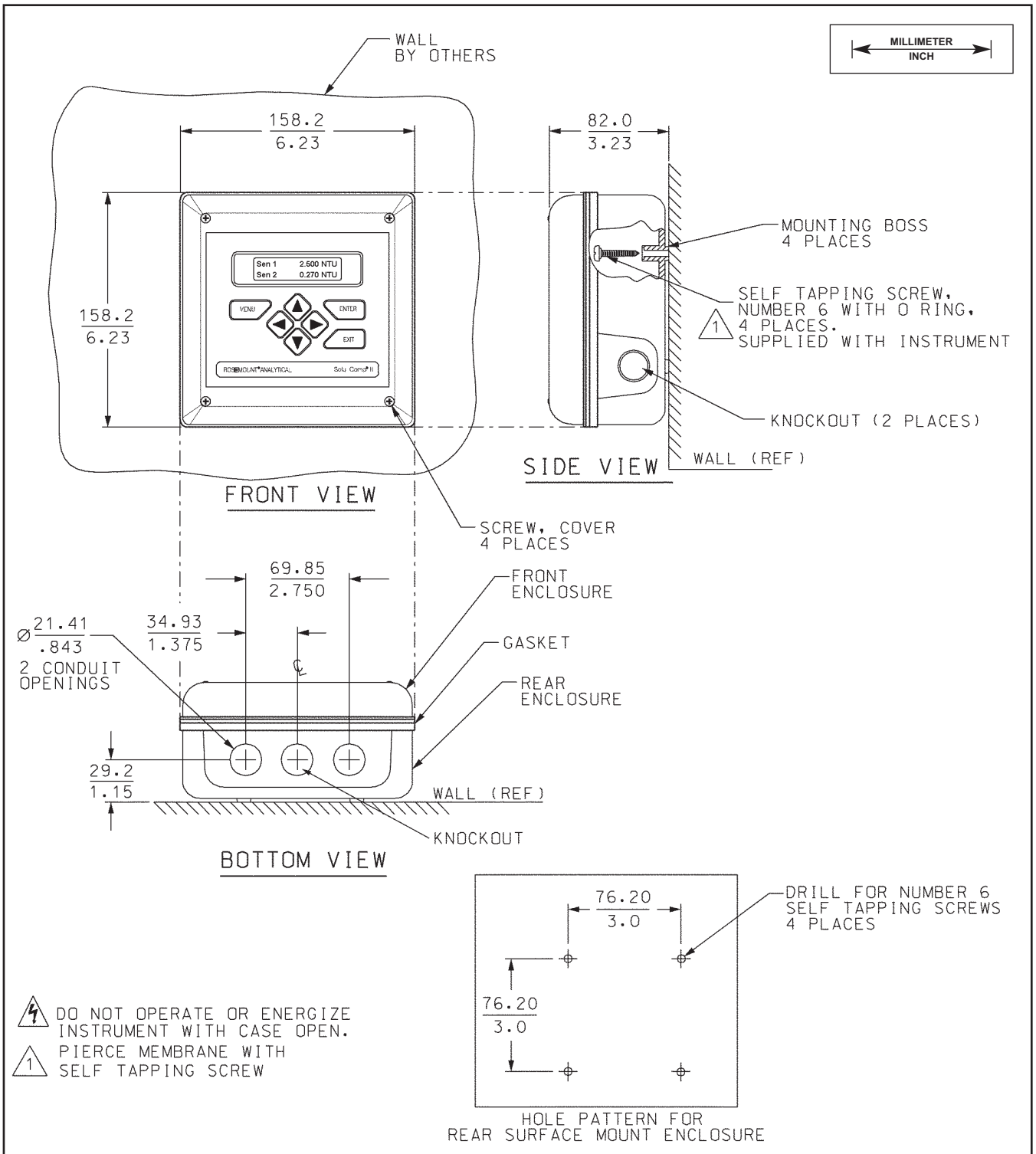


FIGURE 2-3. Surface Mount Installation

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

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2.3 INSTALLATION — DEBUBBLER ASSEMBLY

See Figure 2-4 for installation.

Connect the sample line to the inlet fitting. The fitting accepts 1/4-inch OD tubing. See Section 2.6 for recommended installation of the sample port.

Attach a piece of 3/8 inch ID soft tubing to the drain fitting. The debubbler **must** drain to atmosphere.

NOTE

During operation, the debubbler is under pressure. A 0.040 inch (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.

⚠ CAUTION



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

The amount of pressure in the debubbler can be estimated from the flow rate. See Table 2-1.

To control and monitor sample flow, a valved rotameter with fittings is available (PN 24103-00). Attach the rotameter to the debubbler outlet. The rotameter can also be used to increase back pressure on the debubbler if additional pressure is needed to prevent outgassing.

TABLE 2-1. 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

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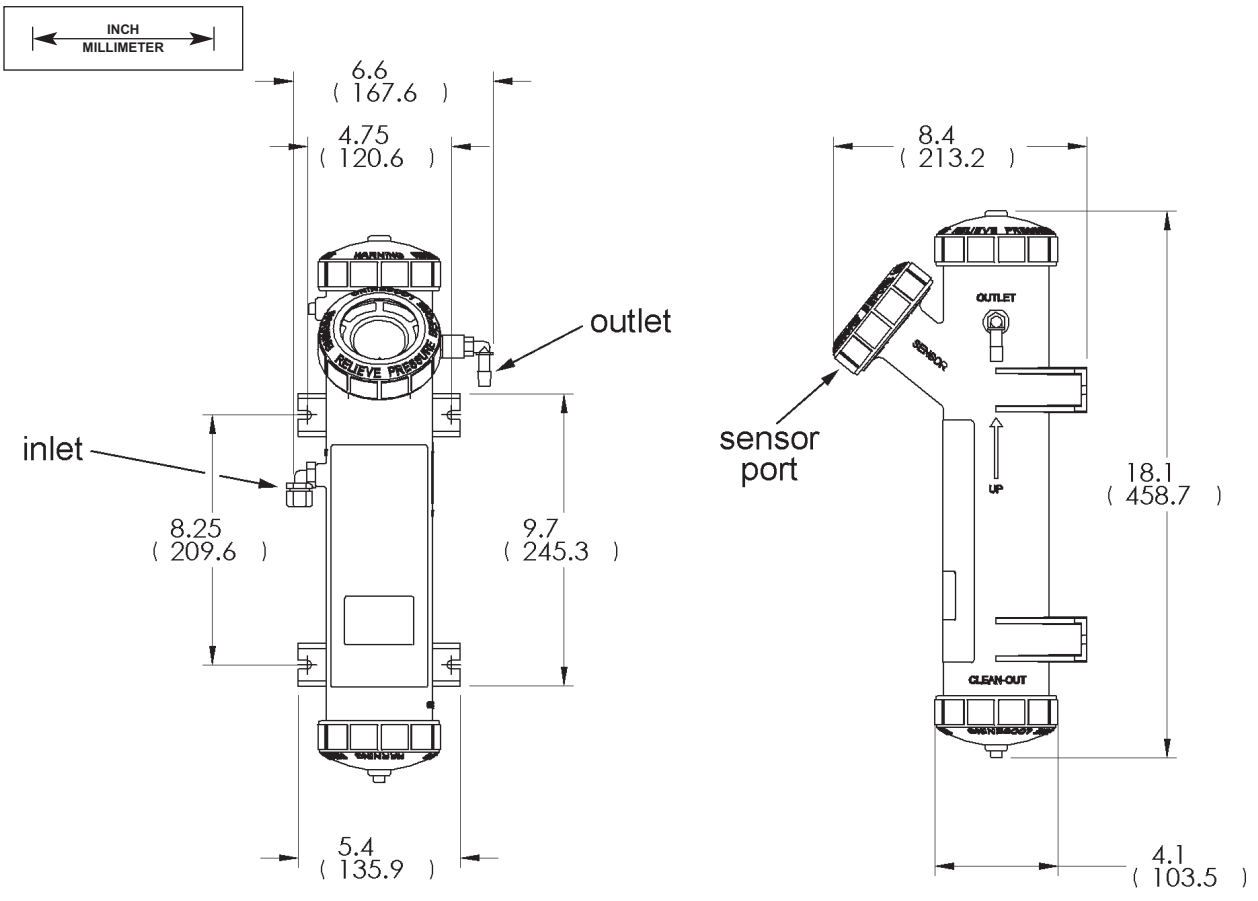


FIGURE 2-4. Debubbler and Flow Chamber

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2.4 INSTALLATION — SENSOR

Unscrew the nut on the side of the debubbler. 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. Replace the nut. Remove the protective cap from the sensor and 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. 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.

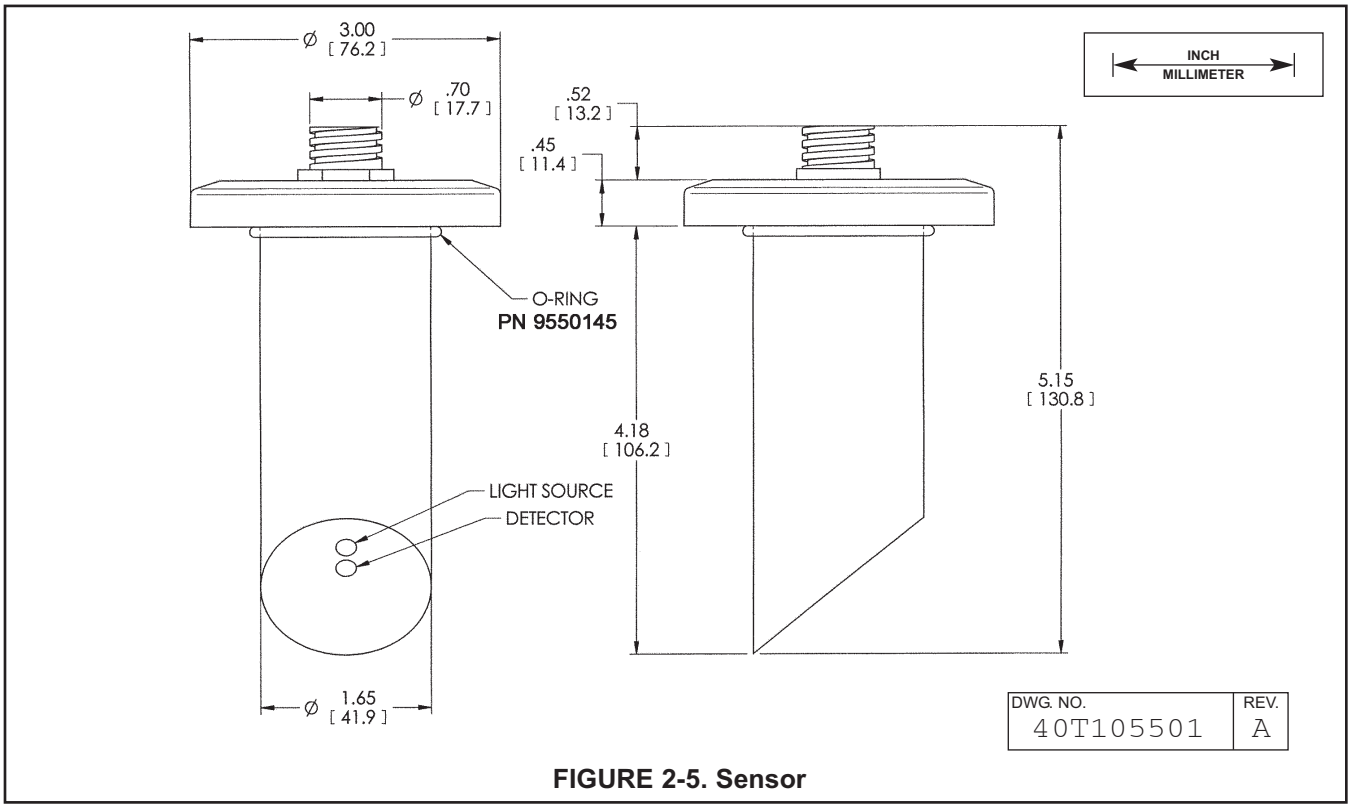


FIGURE 2-5. Sensor

2.5 SAMPLE POINT

Locate the sample tap to minimize pickup of sediment or air. See Figure 2-6. If possible, install a sampling port that extends one or two inches (25 - 50 mm) into the pipe. Use ¼ inch 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.

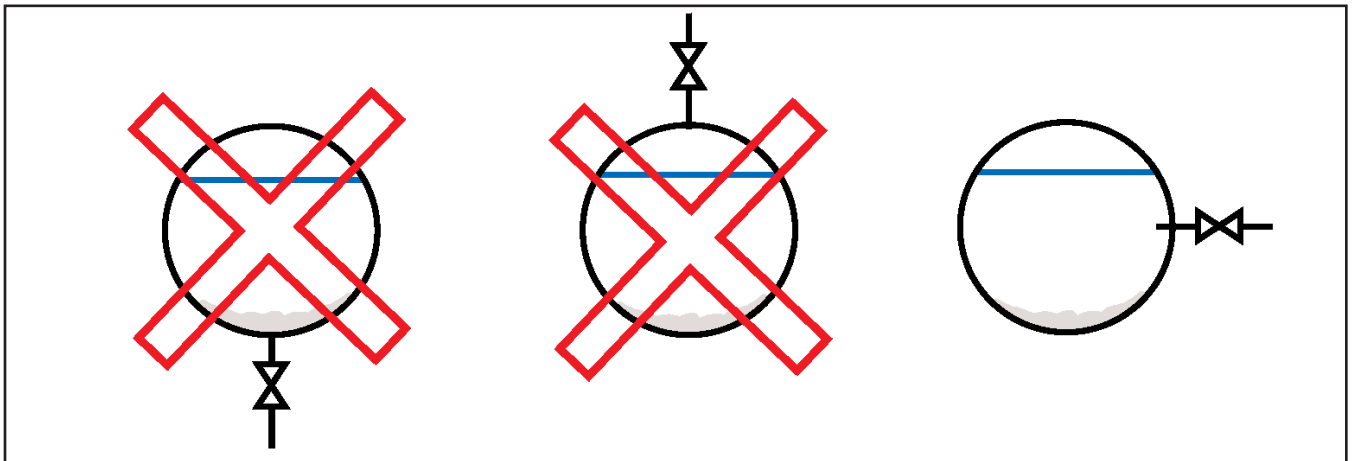


FIGURE 2-6. Sampling for Turbidity

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SECTION 3.0.
WIRING

3.1 PREPARING CONDUIT OPENINGS

The analyzer enclosure has five conduit openings. Two are open and three are knockouts.

Conduit openings accept 1/2-inch 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 analyzer (UL508-26.16).

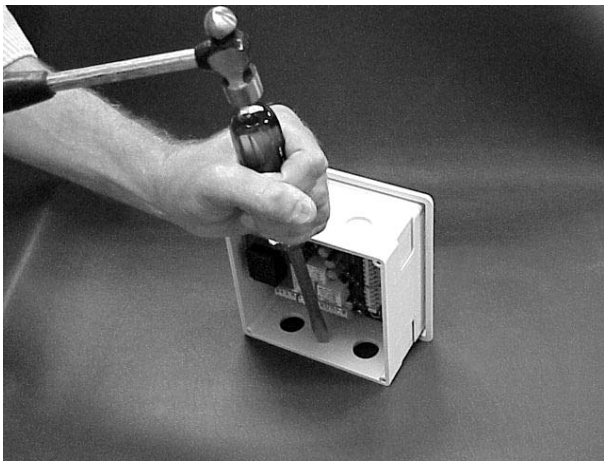


FIGURE 3-1. Removing the Knockouts

Figure 3-1 shows how to remove the knockouts. The knockout grooves are on the outside of the case. Place the screwdriver blade on the inside of the case and align it approximately along the groove. Rap the screwdriver sharply with a hammer until the groove cracks. Move the screwdriver to an uncracked portion of the groove and continue the process until the knockout falls out. Use a small knife blade to remove the flash from the inside of the hole.

3.2 POWER, ALARM, OUTPUT, AND SENSOR CONNECTIONS

3.2.1 General Information

The analyzer is available in two mounting configurations.The positions of the power, alarm, output, and sensor terminal blocks are different in each. See Figure 3-2 (panel mount) or Figure 3-3 (pipe/wall mount).

To reduce the likelihood of stress on wiring connections, keep the hinged front panel (-11 option only) attached to the back cover while installing wiring. Be sure there is sufficient cable within the analyzer enclosure to avoid stress on conductors and connections.

For ease of wiring, connections for power, outputs, and alarms are removable.

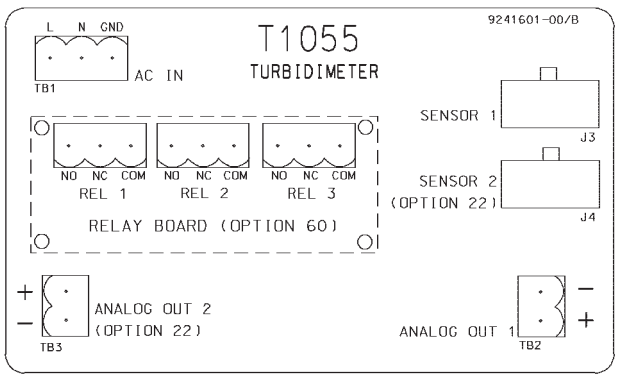


FIGURE 3-2. Wiring Diagram for Model T1055-10 analyzer (panel mount version)

The release clip on the sensor plug faces the top of the analyzer enclosure.

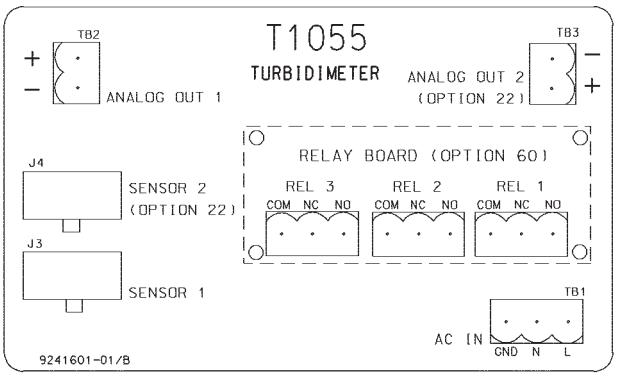


FIGURE 3-3. Wiring Diagram for Model T1055-11 analyzer (wall/pipe mount version)

The release clip on the sensor plug faces the user.

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3.2.2 Sensor

The sensor cable is pre-wired to a plug that inserts into a receiving socket in the analyzer. See Figures 3-2 and 3-3 for the locations of the sockets. If you are using a single input analyzer, be sure to plug the sensor into the SENSOR 1 receptacle. The cable also passes through a strain relief fitting. To install the cable…

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

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

3.2.3 Power, Alarm, and Ouput

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.

⚠WARNING

RISK OF ELECTRICAL SHOCK

AC connections and grounding must be in compliance with UL 508 or local electrical code. DO NOT apply power to the analyzer until all electrical connections are verified and secure.

⚠ WARNING

Exposure to some chemicals may degrade the sealing properties of materials used in the following device: PN AZ8-1CH-6DSEA (Zettler Inc.)

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

For best EMI/RFI protection use shielded output signal cable enclosed in an earth-grounded metal conduit. Connect the shield to earth ground.

Do not apply power to the analyzer until all connections are secured and verified.

⚠ WARNING

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

3.2.4 Non-Incendive Installation

The sensor cable is rated as Non-Incendive field wiring by FM and CSA.

The AC power wiring, analog output wiring, and alarm wiring (optional configuration) is not rated as Non-Incendive and must be installed in metal conduit. Refer to the FM and CSA control drawings herein, Figures 3-4 through 3-7, for proper installation in hazardous areas.

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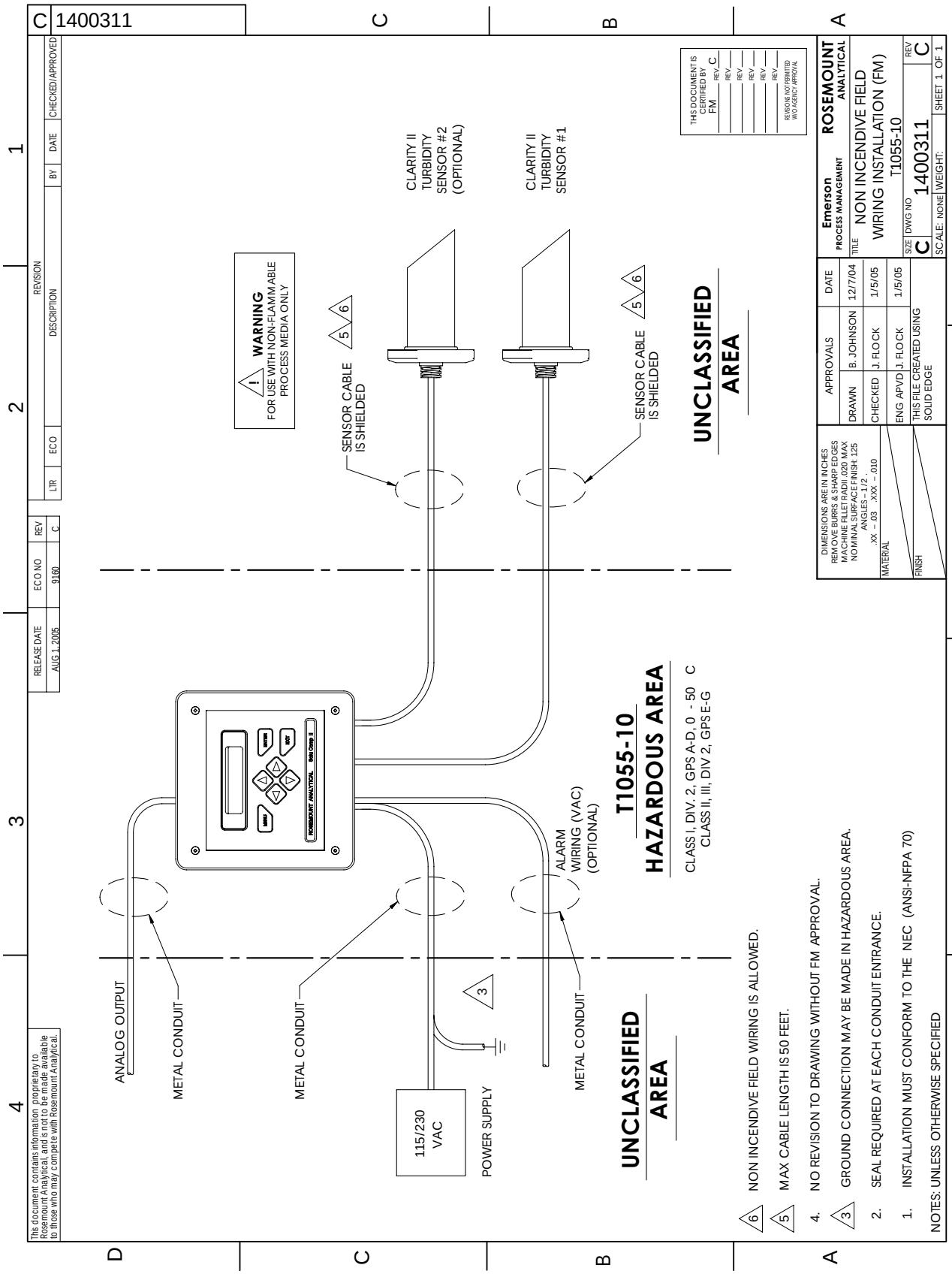


FIGURE 3-4. Non-Incendive Field Wiring (FM) T1055-10

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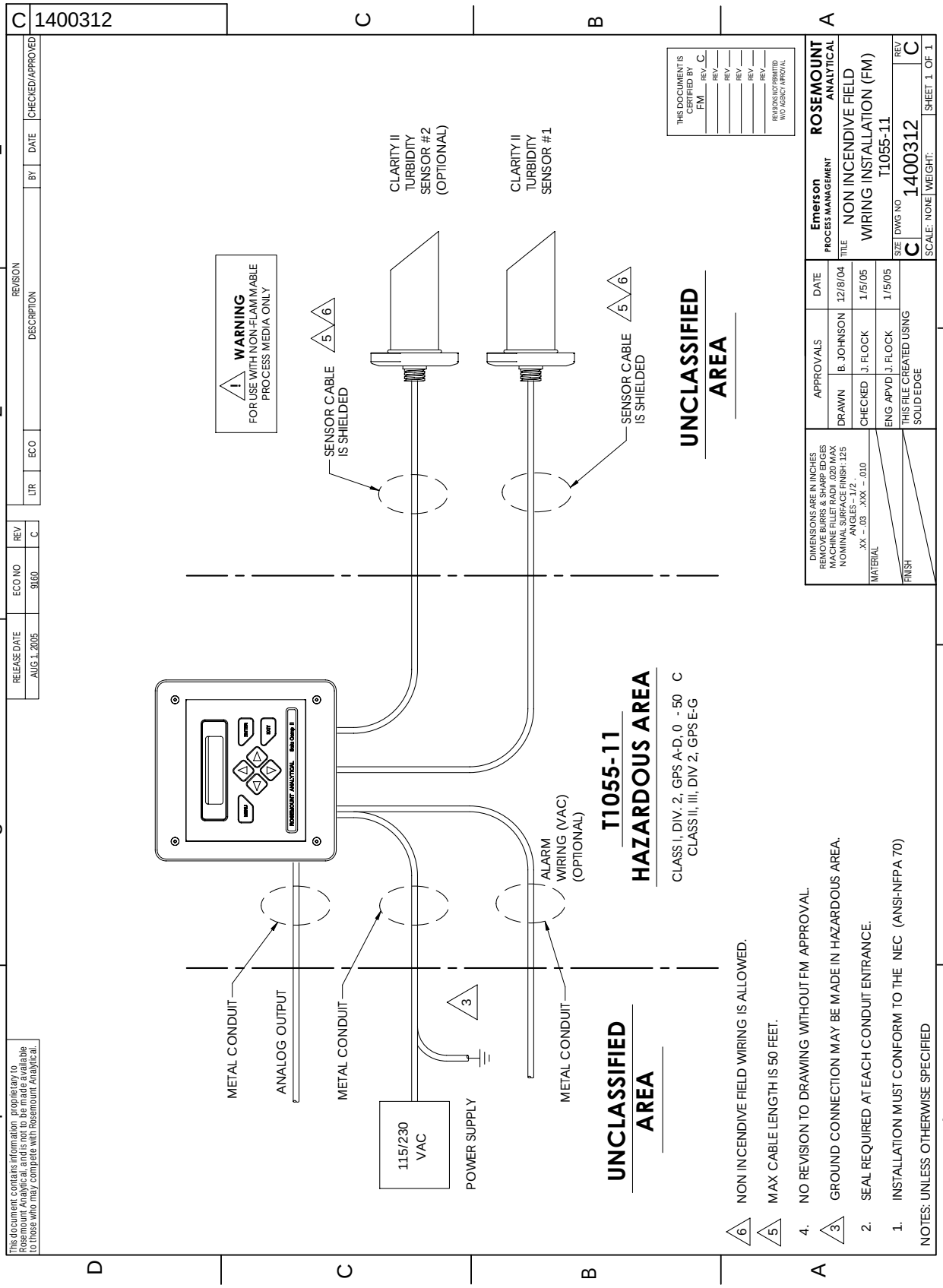


FIGURE 3-5. Non-Incendive Field Wiring (FM) T1055-11

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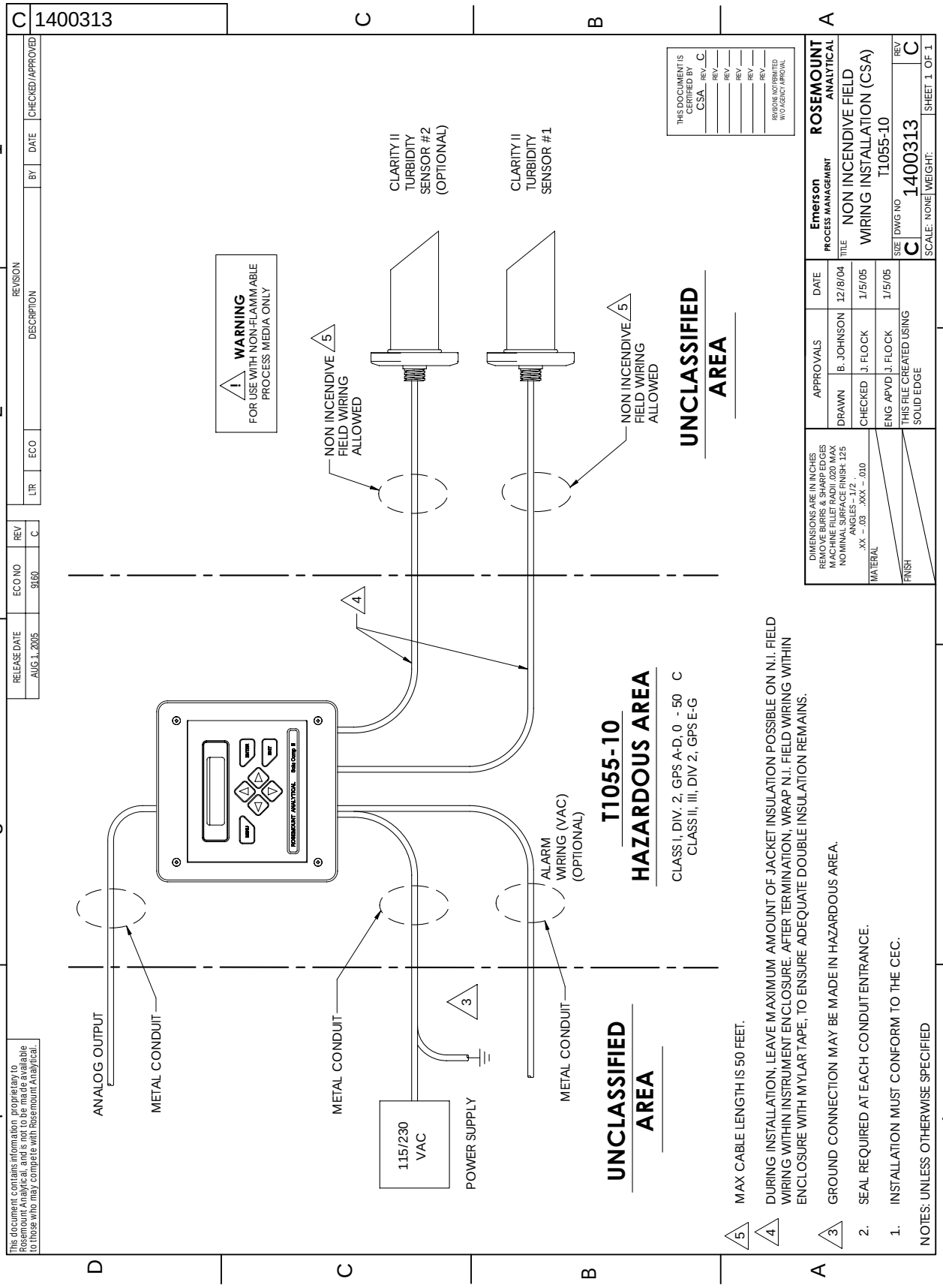


FIGURE 3-6. Non-Incendive Field Wiring (CSA) T1055-10

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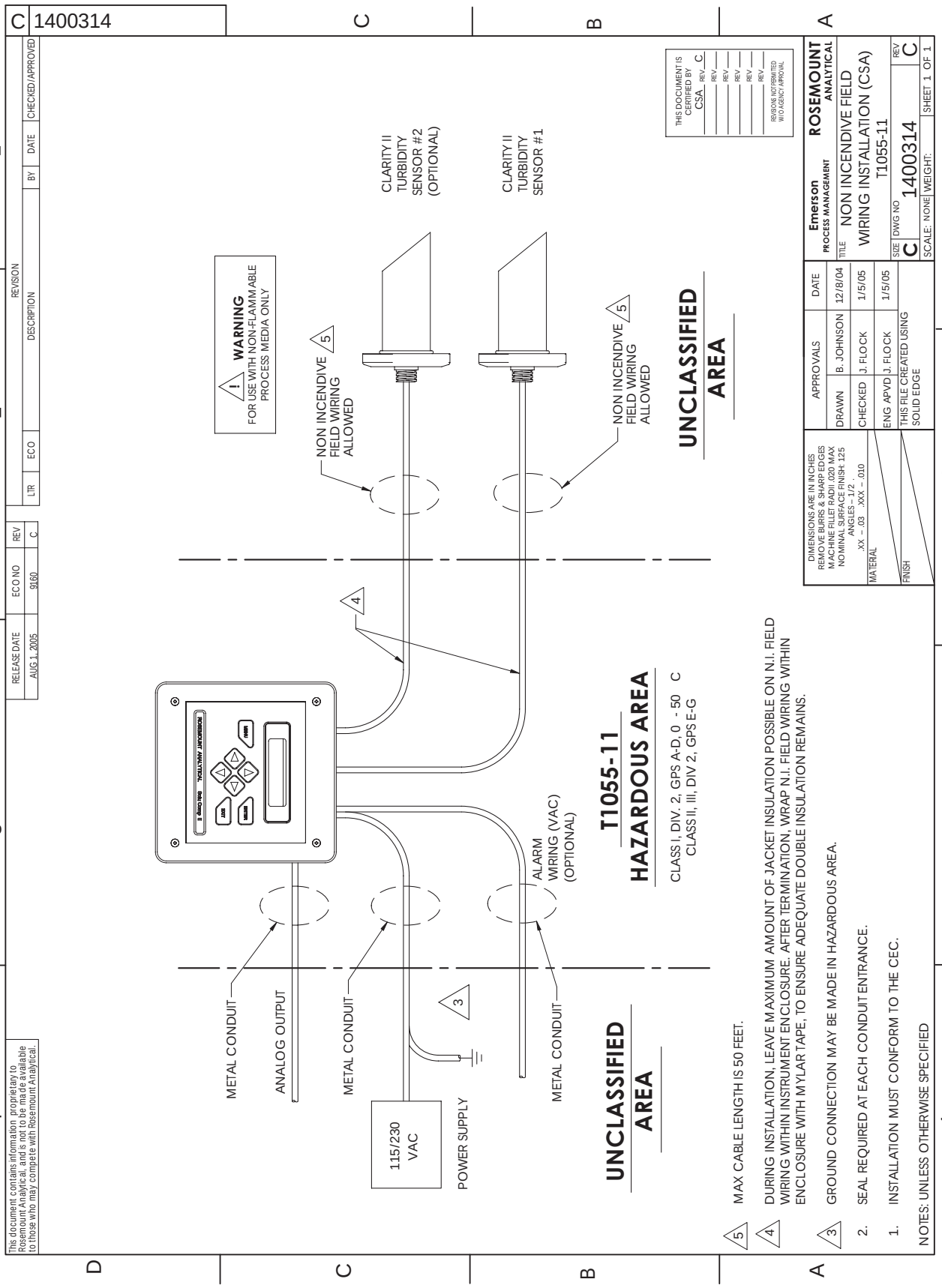


FIGURE 3-7. Non-Incendive Field Wiring (CSA) T1055-11

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SECTION 4.0
DISPLAY AND OPERATION

4.1. DISPLAY

The Solu Comp II analyzer provided with the Clarity II has a two-line display. The display can be customized to meet user requirements (see Section 5.10). Figure 4-1 shows some of the displays available during normal operation. View A is the default screen for a single sensor. View B is the default screen for dual sensors.

The Solu Comp II has information screens that supplement the data in the main display. Press ▲ or ▼ to view the information screens. **The last information screen is the software version.**

During calibration and programming, key presses cause different displays to appear. The displays are self-explanatory and guide the user step-by-step through the procedure.

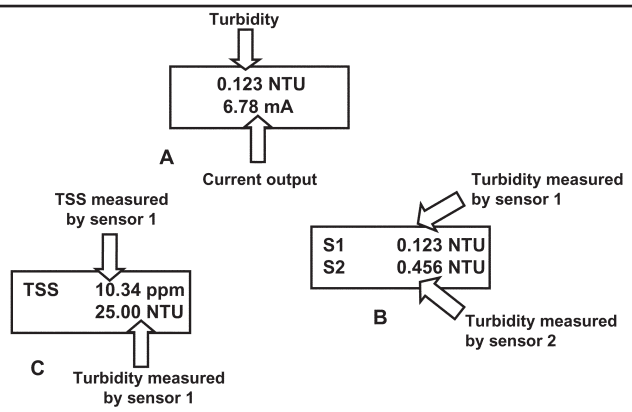


FIGURE 4-1. Displays During Normal Operation

Screen A shows the turbidity and current output for sensor 1. If the analyzer had been configured to measure total suspended solids (TSS), the units displayed would be ppm or mg/L. TSS units are user-selectable. Screen B shows the turbidity measured by sensor 1 (S1) in the first line and the turbidity measured by sensor 2 (S2) in the second line. Although screens A and B are probably the most useful, other displays are available. For example, Screen C shows the TSS value on the first line and the measured turbidity from which it was calculated on the second line.

4.2 KEYPAD

Figure 4-2 shows the Solu Comp II keypad.

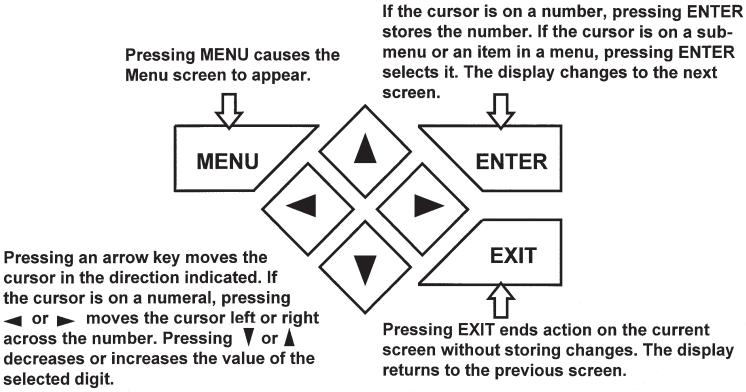


FIGURE 4-2. Solu Comp II Keypad

Four arrow keys move the cursor around the screen. A blinking word or numeral show the position of the cursor. The arrow keys are also used to change the value of a numeral. Pressing ENTER stores numbers and settings and moves the display to the next screen. Pressing EXIT returns to the previous screen without storing changes. Pressing MENU always causes the main menu screen to appear. Pressing MENU followed by EXIT causes the main display to appear.

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4.3 PROGRAMMING AND CALIBRATING THE SOLU COMP II — TUTORIAL

Setting up and calibrating the Solu Comp II analyzer is easy. The following tutorial describes how to move around in the programming menus. For practice, the tutorial also describes how to assign turbidity values to the 4 and 20 mA outputs for sensor 1.



1. If the MENU screen (shown at the left) is not already showing, press MENU. **Calibrate** is blinking, which means the cursor is on **Calibrate**.



2. To assign tubidity values to current outputs, the **Program** sub-menu must be open. Press ▼. The cursor moves to **Program** (**Program** blinking). Press ENTER. Pressing ENTER opens the **Program** sub-menu.



OR



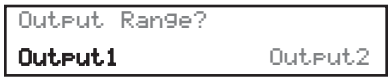
option -60 only

3. The **Program** sub-menu permits the user to set outputs, alarms (option -60 only), and a security code, as well as choose between turbidity or TSS. When the sub-menu opens, **Outputs** is blinking, which means the cursor is on Outputs. Press ▼ or ▶ (or any arrow key) to move the cursor around the display. Move the cursor to **>>** and press ENTER to cause a second screen with more program items to appear. There are three screens in the **Program** menu. Pressing **>>** and ENTER in the third screen causes the display to return to the first screen (**Outputs**, **Alarms**, **Measurement**).

4. For practice, assign turbidity values to the 4 and 20 mA outputs for sensor 1. Move the cursor to **Outputs** and press ENTER.

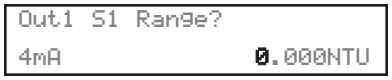


5. The screen shown at left appears. The cursor is on **Output Range** (blinking). Output range is used to assign values to the low and high current outputs. Press ENTER.



6. For a dual input analyzer, the screen shown at left appears. The dual input analyzer has two outputs, one for each sensor. Move the cursor to the desired output and press ENTER. For this example, choose **Output 1**.

   For a single input analyzer, this screen does not appear. Instead, the screen in step 7 appears.

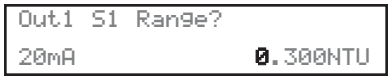


7. The screen shown at left appears. **Out1 S1** in the top line means output 1 (**Out1**) is assigned to sensor 1 (**S1**). For a dual input analyzer, either output can be assigned to either sensor (sensor and output assignments are made under the **Output Configure** menu shown in step 5). Use the **Out1 S1 Range?** screen to assign a turbidity value to the **4 mA** output.

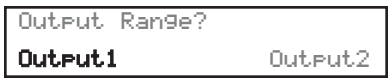
   a. Use the arrow keys to change the pH to the desired value. Press ◀ or ▶ to move the cursor from digit to digit. Press ▲ or ▼ to increase or decrease the value of the digit. Holding ▲ or ▼ down causes the numeral to continuously scroll up or down.

   b. To move the decimal point, press ◀ or ▶ until the cursor is on the decimal point. Press ▲ to move the decimal point to the right. Press ▼ to move the decimal point to the left.

   c. Press ENTER to store the setting.



8. The screen shown at left appears. Use this screen to assign a full scale pH value to the **20 mA** output. Use the arrow keys to change the turbidity to the desired value. Press ENTER to store the setting.



9. The screen shown at left appears. To assign turbidity values to the low and high currents for output 2, select **Output 2** and follow the prompts.

10. To return to the main menu, press MENU. To return to the main display press MENU then EXIT, or press EXIT repeatedly until the main display appears. To return to the previous display press EXIT.

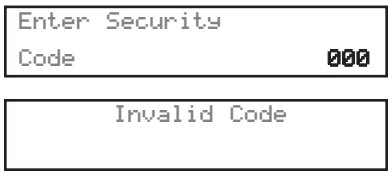
NOTE
To store values or settings, press ENTER before pressing EXIT.

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4.4 SECURITY

4.4.1 How the Security Code Works

Use the security code to prevent accidental or unwanted changes to program settings, displays, and calibration.



1. If a security code has been programmed, pressing MENU causes the security screen to appear.
2. Enter the three-digit security code.
3. If the entry is correct, the main menu screen appears. If the entry is incorrect, the **Invalid Code** screen appears. The **Enter Security Code** screen reappears after 2 seconds.

4.4.2 Bypassing the Security Code

Enter 555. The main menu will open.

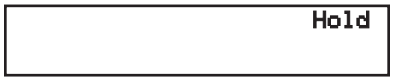
4.4.3 Setting a Security Code

See Section 5.7.

4.5 USING HOLD

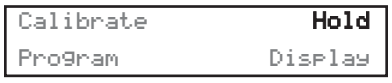
4.5.1 Purpose

The analyzer output is always proportional to measured turbidity. To prevent unwanted alarms and improper operation of control systems, place the analyzer in hold before removing the sensor for calibration and maintenance. Be sure to remove the analyzer from hold once calibration is complete. During hold, both outputs remain at the last value. **Once in hold, the analyzer remains there indefinitely until the user disables hold or the power to the analyzer is turned off then on again.** While in hold, the screen shown to the left appears periodically.

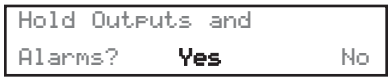


4.5.2 Using the Hold Function

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



1. Press MENU. The main menu screen appears. Choose **Hold**.



2. The **Hold Outputs and Alarms ?** screen appears. Choose **Yes** to place the analyzer in hold. Choose **No** to take the analyzer out of hold.
3. The main display screen will appear.

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SECTION 5.0
PROGRAMMING THE ANALYZER

5.1 GENERAL

This section describes how to do the following:

1. configure and assign values to the current outputs
2. configure and assign setpoints to the alarm relays
3. choose turbidity or total suspended solids (TSS)
4. set a security code
5. tell the analyzer the frequency of the ac power (needed for optimum noise rejection)
6. tell the analyzer the number of sensors being used
7. reset the analyzer to factory calibration and default settings
8. select a default display screen

Default settings are shown in Table 5-1 on the following page. To change a default setting, refer to the section listed in the table. To reset default settings, see Section 5.9.

5.2 CHANGING STARTUP SETTINGS

When the Solu Comp II is powered up for the first time, startup screens appear. The screens prompt the user to identify the number of sensors being used, the measurement (turbidity or TSS), and the units. If incorrect settings were entered at startup, enter the correct settings now. To change the number of sensors refer to Section 5.6. To change the measurement, refer to Section 5.5.

FOR BEST RESULTS, ENTER THE NUMBER OF SENSORS BEING USED (SECTION 5.6) AND WHETHER TURBIDITY OR TSS IS BEING MEASURED (SECTION 5.5) BEFORE MAKING OTHER PROGRAM SETTINGS.

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TABLE 5-1. DEFAULT SETTINGS

1. OUTPUT CONFIGURATION

	assigned to	dampening	mA range	section
output 1	sensor 1	off	4 - 20	5.3
output 2*	sensor 2	off	4 - 20	5.3

**Output 2 is available only with the dual input option.*

2. OUTPUT RANGES

measurement	range and units	section
turbidity	0 - 2 NTU	5.3
TSS	0 - 100 ppm	5.3

3. ALARM CONFIGURATION AND SETPOINTS

	alarm			
	1	2	3	section
assigned to	sensor 1	sensor 2*	fault	5.4
high or low	high	high	--	5.4
deadband	0	0	--	5.4
setpoint (turbidity)**	high 2.0; low 0.0	high 2.0; low 0.0	--	5.4
setpoint (TSS)**	high 100; low 0	high 100; low 0	--	5.4

**For a single input configuration, alarm 2 is assigned to sensor 1.*
***Number assigned to setpoint is unaffected by units selected.*

4. MEASUREMENT RELATED SETTINGS

		section
measurement	turbidity	5.5
turbidity units	NTU	5.5
TSS units	ppm	5.5
signal averaging	20 sec	5.5
bubble rejection	on	5.5

5. MISCELLANEOUS SETTINGS

		section
language	English	5.10
hold	off	4.5
security code	000 (none)	5.7
noise rejection	60 Hz	5.8
disable warnings	no	5.10

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5.3 CONFIGURING AND RANGING THE OUTPUTS.

5.3.1 Purpose

The analyzer is available in single or dual input versions. The single input analyzer has one current output. The dual input analyzer has two current outputs. This section describes how to configure and range the outputs. **CONFIGURE THE OUTPUTS FIRST.**

1. Configuring an output means
   a. Selecting either a 4-20 mA or 0-20 mA output,
   b. Assigning a sensor and a measurement (turbidity or TSS) to output 1 and output 2,
   c. Turning on or turning off output current dampening.
2. Ranging the outputs means assigning values to the low (0 or 4 mA) and high (20 mA) outputs.

5.3.2 Definitions

1. CURRENT OUTPUTS. The analyzer provides either a continuous 4-20 mA or 0-20 mA output current directly proportional to turbidity or TSS.
2. ASSIGNING OUTPUTS. Figure 5-1 shows the ways in which the outputs can be assigned in a dual input analyzer. The single input analyzer has only one output.

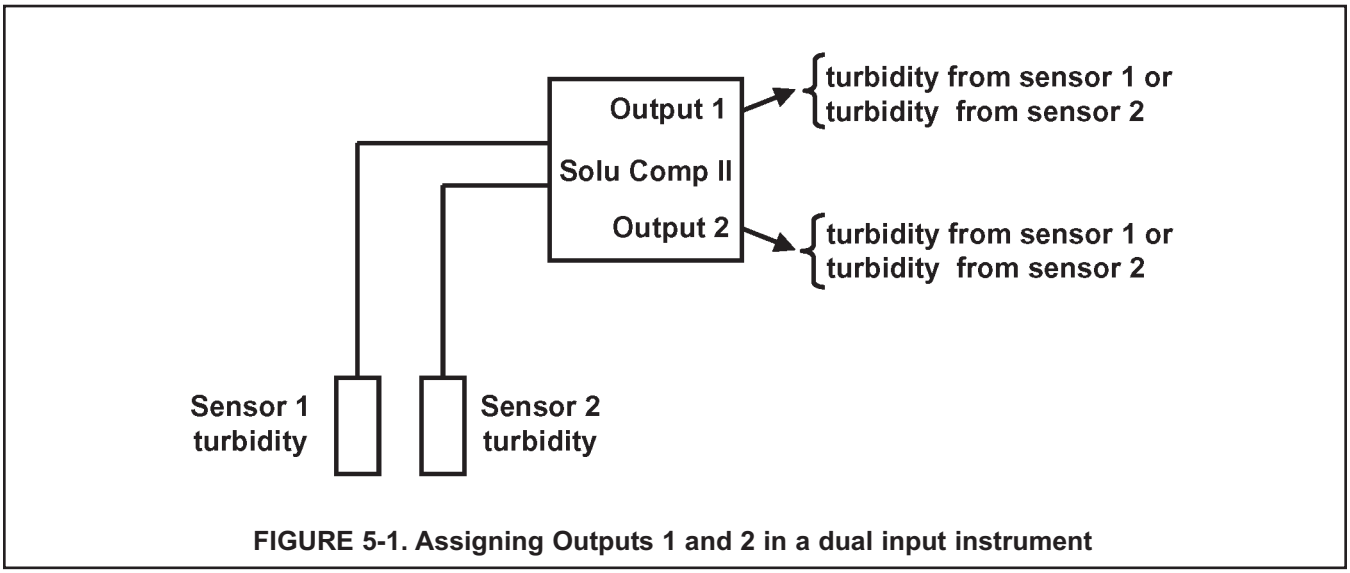


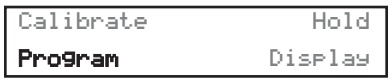
FIGURE 5-1. Assigning Outputs 1 and 2 in a dual input instrument

3. DAMPEN. Output dampening smooths out noisy readings. It also increases the response time of the output. With output dampening the time to reach 63% of final reading following a step change is 5 sec. Output dampening does not affect the response time of the display.

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5.3.3. Procedure: Configure Outputs.

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



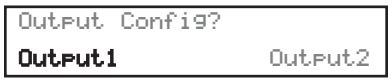
1. Press MENU. The main menu screen appears. Choose **Program**.



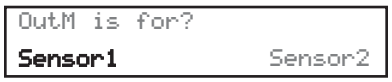
2. Choose **Outputs**.



3. Choose **Output Configure**.



4. Choose **Output1** or **Output2**. This screen appears only in instruments having dual input.



5. Choose **Sensor1** or **Sensor2**. Either sensor can be assigned to either output.

6. Make the appropriate settings:
   a. Choose **4-20 mA** or **0-20 mA**.
   b. Choose **Yes** or **No** for output dampening.
7. The display returns to the screen in step 3. Select the other output or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

5.3.4. Procedure: Assigning Values to the Low and High Current Outputs (Output Ranging)

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



1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **Outputs**.



3. Choose **Output Range**.



4. Choose **Output1** or **Output2**. This screen appears only in instruments having dual input.

5. Make the appropriate settings.
   a. Assign a value to the low current (**0 mA** or **4 mA**) output.
   b. Assign a value to the high current (**20 mA**) output.

6. The display returns to the screen in step 4. Select the other output or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

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5.4 CONFIGURING ALARMS AND ASSIGNING SETPOINTS

5.4.1 Purpose

This section describes how to do the following:

1. disable all alarms,
2. assign an alarm relay to a sensor,
3. set the alarm logic to high or low,
4. assign values to the alarm setpoints,
5. set the alarm deadbands.

ALARM RELAYS MUST BE CONFIGURED BEFORE ASSIGNING SETPOINTS.

5.4.2 Definitions

1. The Solu Comp II analyzer provided with the Model T1055 can be ordered with an optional alarm relay board. If the alarm board is installed, the analyzer leaves the factory with default setpoints, which may bring in nuisance alarms when the analyzer is put in service. Users who do not intend to use the alarms and do not want to be troubled changing alarm setpoints can disable alarms in a single step.
2. ASSIGNING ALARMS. There are three alarms (**AL1**, **AL2**, and **AL3**). Alarms 1 and 2 can be assigned to any sensor. For example, **AL1** and **AL2** can be assigned to sensor 1 with, perhaps, one alarm configured as a high alarm and the other as a low alarm, and **AL3** can be assigned to sensor 2. Alarm 3 can be assigned to either sensor or used as a fault alarm. The fault alarm activates when a fault exists in a sensor or the analyzer.
3. FAULT ALARM. A fault condition exists when the Solu Comp II detects a problem with a sensor or with the analyzer that is likely to cause seriously erroneous readings. If Alarm 3 was programmed as a fault alarm, the alarm 3 relay will activate. The word **Fault** will appear alternately in the display with the reading.
4. ALARM LOGIC, SETPOINTS, AND DEADBANDS. See Figures 5-2 and 5-3.

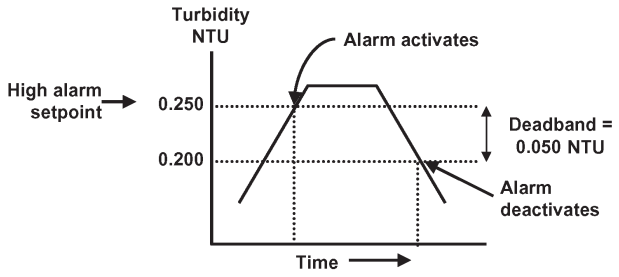


FIGURE 5-2. High Alarm Logic

The alarm activates when the turbidity exceeds the high setpoint. The alarm remains activated until the reading drops below the value determined by the deadband.

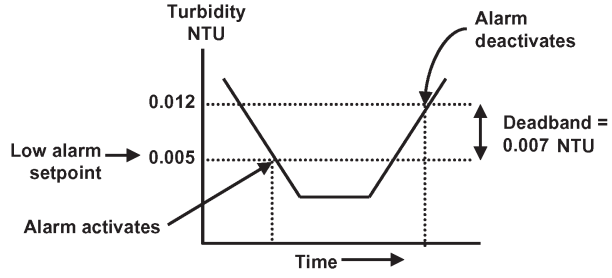


FIGURE 5-3. Low Alarm Logic

The alarm activates when the turbidity drops below the low setpoint. The alarm remains activated until the reading increases above the value determined by the deadband.

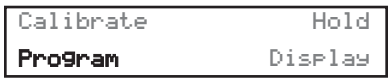
Alarm relays are single pole-double throw (SPDT). When an alarm is activated, the coil is energized.

When an alarm activates, **AL1**, **AL2**, or **AL3** (as appropriate) appears periodically in the display.

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5.4.3 Procedure: Configuring Alarms

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



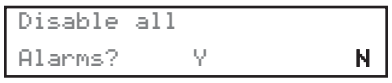
1. Press MENU. The main menu screen appears. Choose **Program**.



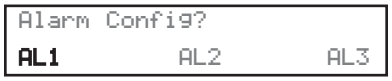
2. Choose **Alarms**.



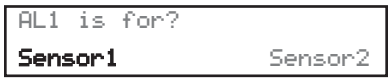
3. Choose **Alarm Configure**.



4. To disable all alarms, choose **Y** (yes). The display returns to the screen shown in step 2. If you want to use the alarm relays, choose **N**. Go to step 5.

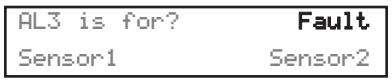


5. Choose Alarm 1 (**AL1**), Alarm 2 (**AL2**), or Alarm 3 (**AL3**).



6. For **AL1** or **AL2**
   a. Choose **Sensor 1** or **Sensor 2**. For a single input configuration, the **Sensor 1 Sensor 2** screen does not appear.
   b. Choose **High** or **Low**.
   c. Set the alarm **Deadband**.

7. The display returns to the **Alarm Configure?** screen. Select another alarm or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.



8. For **AL3**
   a. Choose **Sensor1**, **Sensor2**, or **Fault**.
   b. For **Sensor1**, select **High** or **Low** and set the deadband.
   c. Choosing **Fault** means **AL3** will activate when a sensor or analyzer fault exists. There is no user setting to make.

9. The display returns to the **Alarm Configure?** screen. Select another alarm or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

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5.4.4 Procedure: Programming Alarm Setpoints

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



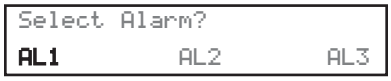
1. Press MENU. The main menu screen appears. Choose **Program**.



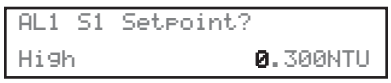
2. Choose **Alarms**.



3. Choose **Alarm Setpoints**.



4. Choose Alarm 1 **(AL1**), Alarm 2 (**AL2**), or Alarm 3 (**AL3**).



5. The display shows the alarm selected (**AL1**) and the configuration. The alarm is for Sensor 1 (**S1**), and the logic is high. Use the arrow keys to change the alarm setpoint.

6. The display returns to the **Select Alarm?** screen. Select another alarm or press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

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5.5 CHOOSING TURBIDITY OR TOTAL SUSPENDED SOLIDS

5.5.1 Purpose

This section describes how to do the following:

1. Configure the analyzer 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.

5.5.2 Definitions

1. TURBIDITY. Turbidity is a measure of the amount of light scattered by particles in a sample. Figure 5-4 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 of the wavelength of light, scattering is highly directional. A detector measures the intensity of scattered light.

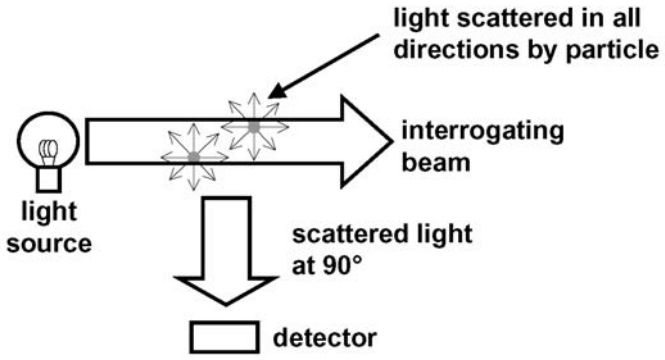


FIGURE 5-4. Turbidity Sensor — General

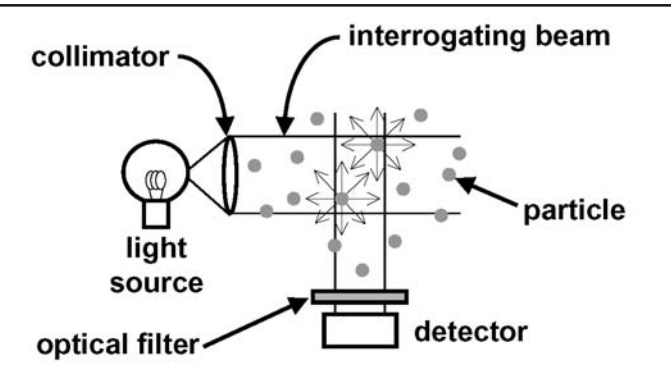


FIGURE 5-5. Turbidity Sensor — EPA 180.1

Measured turbidity is dependent on instrumental conditions. In an attempt to allow turbidities measured by different instruments to be compared, two standards for turbidity instruments 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 5-5 shows an EPA 180.1 turbidimeter. Figure 5-6 shows an ISO 7027 turbidimeter.

EPA Method 180.1 requires that:

A. The light source be a tungsten lamp operated with a filament temperature between 2200 and 2700 K.

B. The detector have optimum response between 400 and 600 nm (approximates the human eye).

C. The scattered light be measured at 90º±30º with respect to the incident beam.

D. The total path length of the light through the sample be less than 10 cm.

Requirements A and B essentially restrict the measurement to visible light. Although the 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 the visible range. Wavelength is important because particles scatter light most efficiently if their size is approximately equal to the wavelength of light used for the measurement. The longer the wavelength, the more sensitive the measurement is to larger diameter particles and the less sensitive it is to smaller diameter particles.

continued on following page

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Requirement C 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 90º 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 turbidimeter that measures scattered light at 90º is called a nephelometer.

Requirement D has a lot to do with the linearity of the sensor. As Figures 5-5 and 5-6 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.

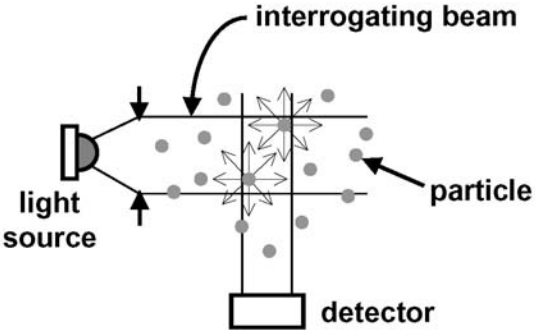


FIGURE 5-6. Turbidity Sensor — ISO 7027

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

A. The wavelength of the interrogating light be 860±60nm, or for colorless samples, 550±30nm.

B. The measuring angle be 90±2.5º.

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

2. TOTAL SUSPENDED SOLIDS. Total suspended solids (TSS) is a measure of the total mass of particles in a sample. It is determined by filtering a volume of sample and weighing the mass of dried residue retained on 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 relation between turbidity and TSS is wholly empirical and must be determined by the user.

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

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

5. 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 sec. The reading will take 20 seconds to reach 63% of its final value following a step change greater than the filter threshold.

6. BUBBLE REJECTION. When a bubble passes through the light beam, it reflects light onto the measuring photodiode, causing a spike in the measured turbidity. The Solu Comp II analyzer has proprietary software that rejects the turbidity spikes caused by bubbles.

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5.5.3 Procedure: Selecting Turbidity or TSS

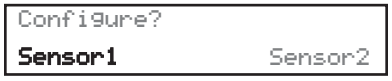
To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.



1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **Measurement**.



3. Choose **Sensor 1** or **Sensor 2**. For a single input configuration, the **Sensor 1 Sensor 2** screen does not appear.



4. Choose **Turbidity** or **TSS**.





5. Choose the desired units:
   a. For turbidity choose **NTU**, **FTU**, or **FNU**.
   b. For TSS choose **ppm**, **mg/L**, or **none**.



6. Choose **Signal Averaging**.



7. Choose the desired signal averaging. For most applications, 20 sec is suitable.



8. The display returns to the screen in step 6. Choose **Bubble Rejection**.



9. Choose **On** to enable bubble rejection software. Choose **Off** to disable.

10. Press EXIT to return to the previous screen. To return to the main display, press MENU followed by EXIT.

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5.6 CHOOSING SINGLE SENSOR OR DUAL SENSOR INPUT

5.6.1 Purpose

The Solu Comp II accepts input from a single sensor or from two sensors. **The screens in this section appear only if you purchased a dual input analyzer.** This section gives you the opportunity to configure a dual sensor analyzer to accept a single sensor input. Because changing from a dual input to a single input configuration might cause some previously made settings to change, **COMPLETE THIS SECTION BEFORE DOING OTHER PROGRAMMING.**

5.6.2 Procedure.

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



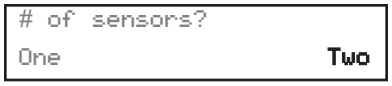
1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **>>**.



3. Choose **#Sensors**.



4. Choose **One** or **Two**. Changing from **Two** to **One** will cause some settings to change.

NOTE

If **One** sensor is selected, only **S1** will be available.

5. The display returns to the screen in step 3. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

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5.7 SETTING A SECURITY CODE

5.7.1 Purpose.

This section describes how to set a security code. The security code prevents program and calibration settings from accidentally being changed. Refer to Section 4.4 for additional information.

5.7.2 Procedure.

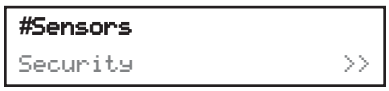
To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.



1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **>>**, then **Security**.



3. Enter a three digit security code. The security code takes effect two minutes after the last key stroke.

4. 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.

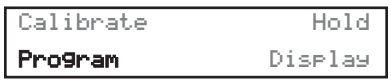
5.8 NOISE REJECTION

5.8.1 Purpose.

For maximum noise rejection, the frequency of the ac power must be entered in the analyzer.

5.8.2. Procedure.

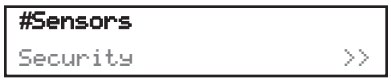
To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.



1. Press MENU. The main menu screen appears. Choose **Program**.



2. Choose **>>**.



3. Choose **>>**.



4. Choose **Noise Rejection**.

5. Enter the mains frequency, 50 Hz or 60 Hz.

6. The display returns to the **Noise Rejection** screen. To return to the main menu, press EXIT. To return to the main display, press MENU followed by EXIT.

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5.9 RESETTING FACTORY DEFAULT SETTINGS

5.9.1 Purpose.

This section describes how to re-install factory default values. The process also clears all fault messages and returns the display to the first quick start screen.

5.9.2. Procedure.

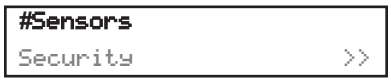
To choose a menu item, move the cursor to the item and press ENTER.
To store a number or setting, press ENTER.



1. Press MENU. The main menu screen appears. Choose **Program**.



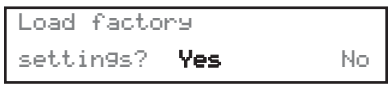
2. Choose **>>**.



3. Choose **>>**.



4. Choose **ResetAnalyzer**.



5. Choose **Yes** or No. If **Yes** is selected, previous settings are cleared and the **Quick Start Menu** appears.

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5.10 SELECTING A DEFAULT SCREEN, LANGUAGE, AND SCREEN CONTRAST

5.10.1 Purpose

This section describes how to do the following:

1. set a default display screen

   The default display screen is the screen shown during normal operation. The Solu Comp II allows the user to customize the default display. Which screens are available depends on how the analyzer was configured. In some instances, for example, a single input analyzer measuring turbidity, only one screen is available. A few abbreviations are used in the main display. **S1** is sensor 1, and **S2** is sensor 2. If neither **S1** nor **S2** appears, the analyzer has been configured for a single sensor input.

2. disable warning messages

   The analyzer displays fault and warning messages. Faults are conditions requiring immediate attention from the user. Measurements made while a fault warning is showing should be regarded as being seriously in error. Warnings are conditions requiring attention. However, the instrument remains usable until the problem can be corrected.

   Fault messages will always be shown. Fault messages cannot be disabled.

3. select a language
4. change the screen contrast

5.10.2 Procedure: Selecting a Display Screen

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



1. Press MENU. The main menu screen appears. Choose **Display**.



2. Choose **Default Display**.
3. Press ▲ or ▼ until the desired display appears. Press ENTER. For an explanation of abbreviations, see Section 5.10.1.
4. The display returns to the screen in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

5.10.3 Procedure: Disabling Warning Messages



1. Press MENU. The main menu screen appears. Choose **Display**.



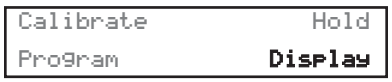
2. Choose **Disable Warn**.



3. To disable warning messages, choose **Y**. To permit warning messages to be displayed, choose **N**.
4. The display returns to the screen in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

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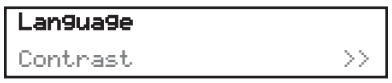
5.10.4 Procedure: Choosing a Language



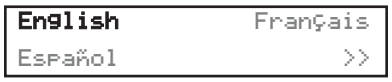
1. Press MENU. The main menu screen appears. Choose **Display**.



2. Choose **>>**.



3. Choose **Language**.



4. Choose **English**, **Français**, **Español**, **Deutsch**, **Italiano**, or **Portugues**.

5. The display returns to the screen in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

5.10.5 Procedure: Changing Screen Contrast



1. Press MENU. The main menu screen appears. Choose **Display**.



2. Choose **>>**.



3. Choose **Contrast**.



4. Press ▲ or ▼ to increase or decrease the screen contrast. As contrast increases, the number increases. When the contrast reaches 90, pressing ▲ again will cause the display to disappear. Continue pressing ▲ and the display will reappear.

5. The display returns to the screen shown in step 2. To return to the main menu, press MENU. To return to the main display, press MENU followed by EXIT.

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SECTION 6.0
CALIBRATION

6.1 INTRODUCTION

The calibrate menu allows the user to calibrate the turbidity sensor, to enter the equation the analyzer will use to convert turbidity to a TSS reading, and to calibrate the outputs.

The turbidity sensor can be calibrated in one of three ways:

1. against a user-prepared solution
2. against a standard solution obtained from a commercial source
3. against the results of a turbidity measurement made with a referee instrument.

6.2 CALIBRATING AGAINST A USER-PREPARED STANDARD

6.2.1 Definitions

This section describes how to calibrate the turbidity sensor against a user-prepared standard. The calibration requires two steps. First, immerse the sensor in filtered water having very low turbidity and measure the sensor output. Next, **increase** the turbidity of the filtered water by a known amount, typically 20 NTU, and measure the sensor output again. The analyzer takes the two measurements, applies a linearization correction (if necessary), and calculates the sensitivity. Sensitivity is the sensor output (in mV) divided by turbidity. A typical new sensor has a sensitivity of about 10 mV/NTU. As the sensor ages, the sensitivity decreases. Figure 6-1 illustrates how the calibration works.

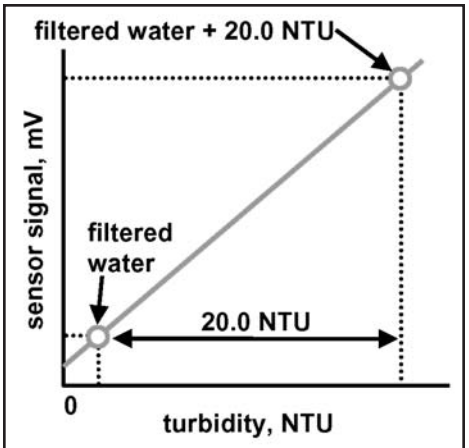


FIGURE 6-1. Calibration against a user-prepared standard.

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

6.2.2 Procedure

1. Obtain a quantity of filtered deionized water. Filtered deionized water can be prepared by using pressure or vacuum to force deionized water through a 0.2 µm membrane filter. Collect the filtrate in a clean glass container that has been rinsed at least three times with the filtrate. The turbidity of the water should be less than 0.5 NTU. Store the water in a clean container and keep it tightly capped when not in use. A freshly opened bottle of commercially available distilled or deionized water is usually suitable for calibration.
2. Prepare a 20.0 NTU standard by diluting 4000 NTU of formazin suspension (PN 905-761854) with the filtered water obtained in step 1.

NOTE

The standard does not actually have a turbidity of 20.0 NTU. Its turbidity is 20.0 NTU greater than the turbidity of the filtered water from which it was prepared.

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Refer to the table to select the appropriate size volumetric flask and pipet. A single calibration requires about 300 mL of standard. Be sure to thoroughly mix the 4000 NTU standard before withdrawing liquid from the bottle. DO NOT SHAKE VIGOROUSLY.

4000 NTU stnd	Final volume
5.00 mL	1.00 L
10.00 mL	2.00 L

For example, to prepare 1.00 L of a 20.0 NTU standard, pipet 5.00 mL of 4000 NTU standard into a 1.00 L volumetric flask and dilute to volume with the filtered deionized water obtained in step 1. Gently invert the flask several times to mix. DO NOT SHAKE VIGOROUSLY. Use the 20.0 NTU standard within four hours after preparing it. Before removing a portion of standard, mix well by gently inverting the flask repeatedly for at least one minute.

NOTE

Turbidity standards other than 20.0 NTU can be used to calibrate the sensor. However, for greatest accuracy, particularly when measuring water having low turbidity, 20.0 NTU standard is recommended. If the measured turbidity is at the upper end of the scale (>100 NTU), calibrate at 200 NTU.

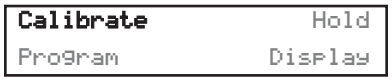
For users who do not have the appropriate volumetric glassware, a kit containing 4000 NTU standard, a volumetric flask, and a pipet is available (PN 060-761855).

3. Rinse the calibration cup several times with filtered deionized water. Fill the calibration cup with filtered deionized water to the level of the groove cut inside the cup.
4. Remove the sensor from the flow chamber. If the sensor is dirty, clean it by wiping with a soft, damp cloth. Rinse the sensor with filtered deionized water and place it in the calibration cup. Swirl the sensor to remove air bubbles. It is not necessary to completely screw the gray coupling nut onto the calibration cup.

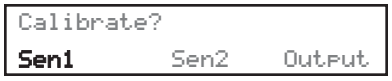
⚠ CAUTION



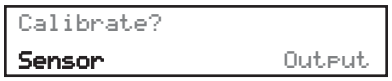
Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig and the process temperature is lowered to a safe level!



5. Press MENU. The main menu screen appears. Choose Calibrate.



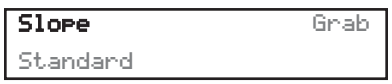
6. If the sensor has dual input, choose **Sen1** (sensor 1) or **Sen2** (sensor 2).



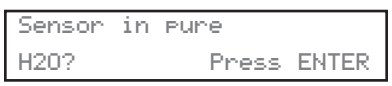
If the analyzer has single input, choose **Sensor**.



7. Choose **Calibrate**.



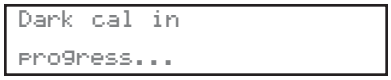
8. Choose **Slope**. If **Lamp** appears in this screen, refer to Section 6.5.



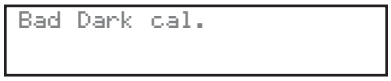
9. The analyzer prompts the user to put the sensor in filtered water. Press ENTER.

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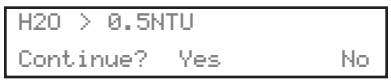
10. The screen at left appears showing that the sensor dark current is being measured. This step takes 30 seconds. If the reading does not stabilize after about 2 minutes, press ENTER. The analyzer will use the current dark reading.



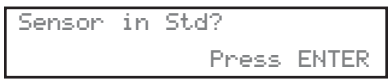
If the dark current is too high, the screen at left appears. Be sure the sensor is squarely and securely seated in the calibration cup. Press EXIT and repeat the calibration. If the dark current measurement is acceptable, the screen in step 11 appears.



11. The turbidity value in the first line is the turbidity of the water based on the previous calibration. **Stabilizing** flashes until the reading is stable.



12. This screen appears if the turbidity of the water is too high (>0.5 NTU). To continue with the calibration, choose **Yes**. To start over again, choose **No**. If you choose to repeat the step, obtain a fresh portion of filtered deionized water. Rinse the calibration cup and sensor thoroughly with the filtered water.



13. Once the reading in filtered water is stable, the screen at left appears. Remove the sensor from the calibration cup and place it in a clean area. Discard the filtered water. Rinse the calibration cup several times with small amounts of 20.0 NTU standard. Fill the calibration cup with standard to the level of the groove cut inside the cup. Place the sensor in the cup. Swirl the sensor to remove air bubbles. Press ENTER.



14. The screen at left appears. The turbidity value in the first line is the turbidity of the 20.0 NTU standard based on the previous calibration. **Stabilizing** flashes until the reading is stable.



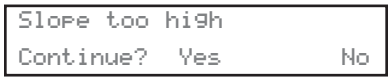
15. Once the reading is stable, the screen at left appears. The turbidity value in the first line is the apparent turbidity based on the previous calibration. The turbidity value in the second line is the measured turbidity at the time the reading became stable. Use the arrow keys to change the turbidity to match the amount by which you increased the turbidity of the filtered water. For example, if you added sufficient formazin to increase the turbidity by 20.0 NTU, enter 20.00. See Section 6.2.1. Press ENTER.

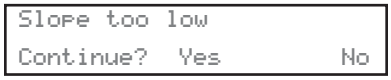


16. The screen at left shows the calibration was successful. Press ENTER. The display returns to one of the screens in step 6. To return to the main display, press MENU then EXIT.

Note: If “S1 Warning” appears after reinstalling the sensor into the debubbler, check the sensor cable connection and confirm sample water flow at debubbler drain outlet.







17. If a calibration error occurred, one of the screens at left appears. **Calibration error** means that zero was entered in step 16 — the analyzer attempted to divide by zero. **Slope too high** or **slope too low** implies the standard was improperly prepared or the wrong value was entered in step 15. For additional troubleshooting information, see Section 8.3.1.

If **calibration error** is showing, the analyzer retains the existing calibration. To attempt a recalibration, press ENTER. The display returns to step 8. If **Slope too high** or **Slope too low** is showing, choose **Yes** to update the calibration or choose **No** to repeat the calibration.

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6.3 CALIBRATING AGAINST A COMMERCIAL STANDARD

6.3.1 Purpose

The turbidity sensor can also be calibrated against a commercial standard. Stable 20.0 NTU standards are available from a number of sources. Calibration using a commercial standard is simple. Filtered deionized water is not required.

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

6.3.2 Procedure

1. Rinse the calibration cup several times with clean water, then several times with 20.0 NTU standard. Fill the calibration cup to the level of the groove cut inside the cup.

NOTE

Turbidity standards other 20.0 NTU can be used to calibrate the sensor. However, for greatest accuracy, particularly when measuring water having low turbidity, 20.0 NTU standard is recommended.

2. Remove the sensor from the flow chamber. If the sensor is dirty, clean it with a soft, damp cloth. Rinse the sensor with several portions of 20.0 NTU standard and place it in the calibration cup. Swirl the sensor to remove air bubbles. It is not necessary to completely screw the gray coupling nut onto the calibration cup.

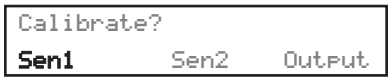
⚠ CAUTION



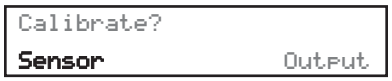
Before removing the sensor, be absolutely certain that the process pressure is reduced to 0 psig and the process temperature is lowered to a safe level!



3. Press MENU. The main menu screen appears. Choose **Calibrate**.



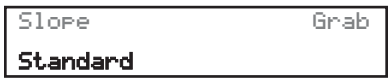
4. If the sensor has dual input, choose **Sen1** (sensor 1) or **Sen2** (sensor 2).



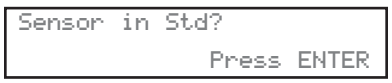
If the analyzer has single input, choose **Sensor**.



5. Choose **Calibrate**.



6. Choose **Standard**. If **Lamp** appears in this screen, refer to Section 6.5.



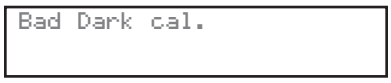
7. The analyzer prompts the user to put the sensor in the standard solution. Press ENTER.



8. The screen at left appears showing that the sensor dark current is being measured. This step takes 30 seconds. If the reading is not stable after about 60 seconds, press ENTER. The analyzer will use the current reading.

procedure continued on following page

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If the dark current is too high, the screen at left appears. Be sure the sensor is squarely and securely seated in the calibration cup. Press EXIT and repeat the calibration. If the dark current measurement is acceptable, the screen in step 9 appears.



9. The turbidity value in the first line is turbidity of the 20.0 NTU standard based on the previous calibration. **Stabilizing** flashes until the reading is stable.



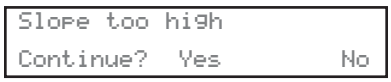
10. Once the reading is stable, the screen at left appears. The turbidity value in the first line is the apparent turbidity based on the previous calibration. The turbidity value in the second line is the measured turbidity at the time the reading became stable. Use the arrow keys to change the value to match the turbidity of the standard being used. Press ENTER.

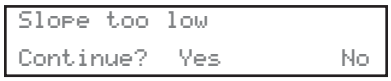


11. The screen at left shows the calibration was successful. Press ENTER. The display returns to one of the screens in step 4. To return to the main display, press MENU then EXIT.

    Note: If “S1 Warning” appears after reinstalling the sensor into the debubbler, check the sensor cable connection and confirm sample water flow at debubbler drain outlet.







12. If a calibration error occurred, one of the screens at left appears. **Calibration error** means that zero was entered in step 10 — the analyzer attempted to divide by zero. **Slope too high** or **Slope too low** implies the wrong value was entered in step 10 or the standard solution has deteriorated and does not have the expected value. For additional troubleshooting information, see Section 8.3.2.

    If **Calibration error** is showing, the analyzer retains the existing calibration. To attempt a recalibration, press ENTER. The display returns to step 6. If **Slope too high** or **Slope too low** is showing, choose **Yes** to update the calibration or choose **No** to repeat the calibration.

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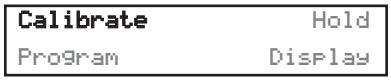
6.4 CALIBRATING THE TURBIDITY SENSOR AGAINST A GRAB SAMPLE

6.4.1 Purpose

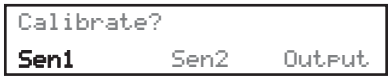
If desired, the turbidity sensor can be calibrated against the turbidity reading from another instrument. The analyzer treats the value entered by the user as though it were the true turbidity of the sample. Therefore, grab sample calibration changes the sensitivity, it does not apply an offset to the reading.

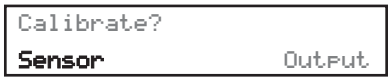
6.4.2 Procedure

1. Place the sensor in the flow chamber and allow the turbidity reading to stabilize.



2. Press the MENU key. The main menu appears. Choose **Calibrate**.





3. If the analyzer has dual input choose **Sen1** (sensor 1) or **Sen2** (sensor 2).

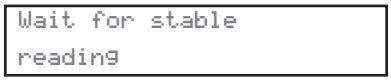
   If the analyzer has single input, choose **Sensor**.



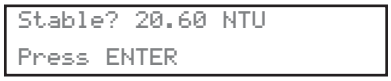
4. Choose **Calibrate**.



5. Choose **Grab**. If **Lamp** appears in this screen, refer to Section 6.5.



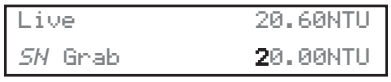
6. The screen at left appears for two seconds.



7. The first line shows the sample turbidity based on the current calibration. If the reading is stable, press ENTER.



8. Take a grab sample of the liquid and press ENTER. The analyzer saves the sensor reading. Measure the turbidity using the referee instrument. If the grab sample test results are more than about 20% different from the displayed value, consult Section 8.3.3.

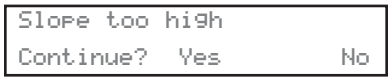


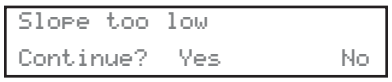
9. The screen at left appears. The value in the top line is the current turbidity reading based on the previous calibration. The reading may be different from the value at the time the grab sample was taken. The analyzer will calculate the correction factor based on the turbidity reading when you pressed ENTER in step 8. Use the arrow keys to change the turbidity reading in the second line to the value measured by the referee instrument.

procedure continued on following page

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10. If a calibration error occurred, one of the screens at left appears. **Calibration error** means that zero was entered in step 9 — the analyzer attempted to divide by zero. **Slope too high** or **Slope too low** implies the turbidity measured using the referee instrument (entered in step 9) is substantially different from the turbidity measured by the Clarity II. For additional troubleshooting information, see Section 8.3.3.

    If **Calibration error** is showing, the analyzer retains the existing calibration. To attempt a recalibration, press ENTER. The display returns to step 5. If **Slope too high** or **Slope too low** is showing, choose **Yes** to update the calibration or choose **No** to repeat the calibration.

11. This screen appears when the calibration is complete. Press ENTER. The display returns to one of the screens in step 3. To return to the main display, press MENU then EXIT.

    Note: If “S1 Warning” appears after reinstalling the sensor into the debubbler, check the sensor cable connection and confirm sample water flow at debubbler drain outlet.

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6.5 LAMP CALIBRATION

6.5.1 Purpose

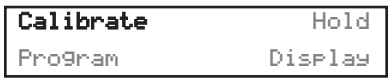
Turbidity is a measure of the amount of light scattered by small particles suspended in a liquid. Turbidity depends on both the quantity of particles in the sample and the intensity of the light used to make the measurement. In USEPA-compliant turbidity sensors the light source is a tungsten filament lamp. As the lamp ages, the intensity gradually drops. This means that the measured turbidity will decrease even though the amount of suspended particles remained constant. To correct for source drift, a photodiode in the sensor continuously monitors the intensity of the light source. However, if the lamp intensity gets too low, the correction is no longer valid. When this happens, the analyzer displays a **NeedCal** warning message. Calibrating at this point will cause the analyzer to increase the current supplied to the lamp, thus bringing the intensity into the range where the correction is valid.

For best results and to ensure the measurement meets specifications, the sensor should be calibrated using either slope or standard calibration. However, if turbidity standards are not available and **if an error as much as 5% can be tolerated**, the sensor can be calibrated using lamp calibration.

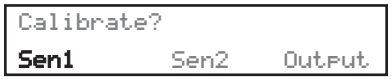
Lamp calibration is not available and is not needed with ISO-compliant sensors.

6.5.2 Procedure

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



2. Press the MENU key. The main menu appears. Choose **Calibrate**.



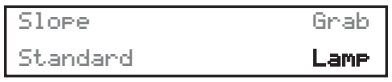


3. If the analyzer has dual input choose **Sen1** (sensor 1) or **Sen2** (sensor 2).

   If the analyzer has single input, choose **Sensor**.



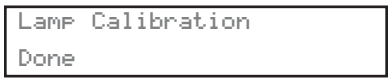
4. Choose **Calibrate**.



5. Choose **Lamp**.



6. This screen appears while the analyzer adjusts the lamp current.



7. If the calibration is successful, the screen at left appears.



8. If the analyzer is unable to adjust the lamp current sufficiently to bring the lamp intensity into the normal range, the Calibration Error screen appears. The lamp should be replaced as soon as possible.

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

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6.6 USING THE DRY CHECK CUP

A dry check cup is available for checking the operation of the Clarity II turbidimeter. To use the dry check…

1. Calibrate the turbidimeter using one of the methods described in Section 6.2, 6.3, or 6.4. For regulatory reporting purposes, the turbidimeter must be calibrated against user-prepared formazin standard or against a commercial standard acceptable to the regulatory agency.
2. After the calibration is complete, remove the sensor from the calibration solution, rinse it with water, and dry thoroughly with a soft cloth.
3. Place the sensor in the dry check cup. Line up the pin on the check cup with the hole in the sensor and firmly seat the sensor in the cup. Record the turbidity reading.

NOTE

Different sensors in the same dry check will give slightly different readings. Similarly, a single sensor tested in different dry checks will give slightly different readings. If you are using different sensors and different dry checks, be sure to keep track of which sensor was tested in which dry standard.

4. Periodically, check the operation by putting the sensor — be sure it is completely dry — in the dry check cup. If the reading is acceptably close to the value when the sensor was last calibrated, the sensor does not need recalibration. If the reading has drifted too far from the calibration value, recalibrate the sensor using formazin or an acceptable alternative standard.

NOTE

Do not use the dry check for recalibrating the sensor. The dry check is intended ONLY for checking the operation of the loop.

5. After recalibrating the sensor, record the new turbidity reading in the dry check.
6. Keep the dry check covered and stored in a safe place when not in use.

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6.7 ENTERING A TURBIDITY TO TSS CONVERSION EQUATION

6.7.1 Purpose

The analyzer can be programmed to convert turbidity to a total suspended solids (TSS) reading. There is no fundamental relationship between turbidity and TSS. Every process stream is unique. The user must determine the relationship between turbidity and TSS for his process. The analyzer accepts only a linear calibration curve.

Figure 6-2 shows how the turbidity to TSS conversion works. The user enters two points P1 and P2, and the analyzer calculates the equation of a straight line between the points. The analyzer then converts all subsequent turbidity measurements to TSS using the equation. It is important to note that if the cause or the source of the turbidity changes, new points P1 and P2 will need to be determined and the calibration repeated.

The accuracy of the measurement depends on how linear the actual relationship between TSS and turbidity is. At a minimum, the user should confirm linearity by diluting the most turbid sample (P2) and verifying that the new turbidity and TSS point lies reasonably close to the line. Ideally, the dilution should be done 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 the particles. Therefore, the diluted sample will not be representative of the process liquid. For a more rigorous procedure for checking linearity and developing values to enter for points P1 and P2, refer to the Appendix.

After the analyzer has calculated the turbidity to TSS conversion equation, it also calculates the x-intercept (NTU). See Figure 6-3. If the x-intercept is greater than zero, the analyzer will display that value as the lowest turbidity reading it will accept. A lower turbidity reading will produce a negative TSS value. If the x-intercept in less than zero, the screen does not appear.

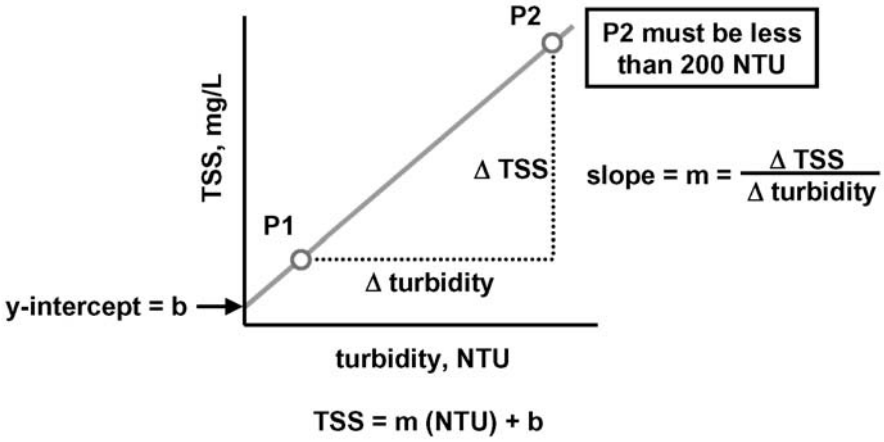


FIGURE 6-2. Converting Turbidity to TSS

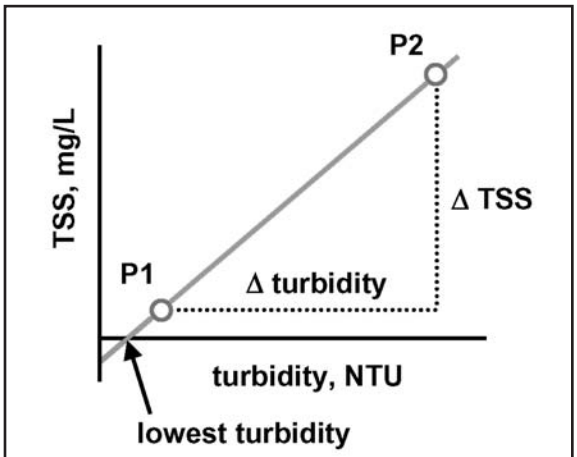


FIGURE 6-3. Lowest Turbidity (TSS)

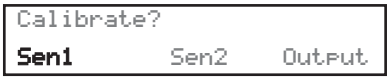
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6.7.2 Procedure

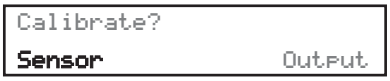
1. First, calibrate the sensor. See Section Section 6.2, 6.3, or 6.4.



2. Press the MENU key. The main menu appears. Choose **Calibrate**.



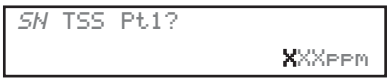
3. If the analyzer has dual input choose **Sen1** (sensor 1) or **Sen2** (sensor 2).



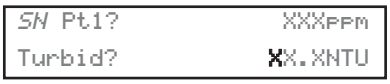
If the analyzer has single input, choose **Sensor**.



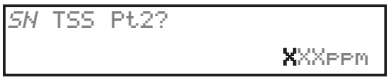
4. Choose **Enter TSS Data**.



5. The display prompts the user to enter TSS for point 1 (**Pt1**). The units shown in the second line will be the units selected in Section 5.5.3. Press ENTER.



6. The display prompts the user to enter the turbidity for point 1. Press ENTER.



7. The display prompts the user to enter TSS for point 2 (**Pt2**). Press ENTER.



8. The display prompts the user to enter the turbidity for point 2. Press ENTER.



9. The screen at left appears if the calibration was successful. Press ENTER.



10. If the calibration was unsuccessful, the screen at left appears. Repeat steps 6 through 9, checking for data entry errors.



11. If the intercept on the NTU axis is negative, the analyzer will display the low turbidity limit. See Section 6.6.1 for more information.

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

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6.8 CALIBRATING CURRENT OUTPUTS

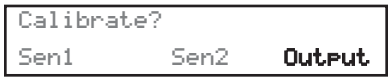
6.8.1 Purpose

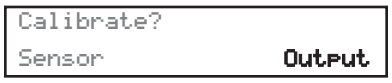
Although the analyzer outputs are calibrated at the factory, they can be trimmed in the field to match the reading from a standard current meter. Both the low (0 or 4 mA) and the high (20 mA) outputs can be trimmed.

6.8.2 Procedure

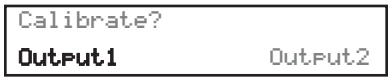


1. Press the MENU key. The main menu appears. Choose **Calibrate**.

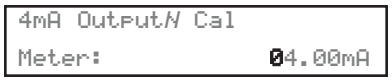




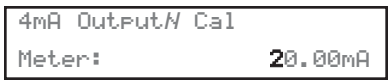
2. Choose **Output**.



3. Choose **Output1** or **Output2**. For a single input analyzer, this screen does not appear.



4. Connect a calibrated milliammeter across the out put terminals. Use the arrow keys to change the reading in the second line to match the current measured by the ammeter.



5. Connect a calibrated milli-ammeter across the out put terminals. Use the arrow keys to change the reading in the second line to match the current measured by the ammeter.

6. The display returns to the screen in step 2. To return to the main display, press MENU then EXIT.

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SECTION 7.0
MAINTENANCE

7.1 SOLU COMP II ANALYZER

The Solu Comp II analyzer used in the Clarity II turbidimeter needs little routine maintenance.

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

A few of the components of the analyzer are replaceable. See Tables 7-1 and 7-2.

⚠ WARNING

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

TABLE 7-1. Replacement Parts for Solu Comp II (Panel Mount Version)

Location in Figure 7-1	PN	Description	Shipping Weight
not shown	23823-00	Panel mounting kit, includes four brackets and four set screws	2 lb/1.0 kg
1	33654-00	Gasket, front, for panel mount version	2 lb/1.0 kg
2	33658-00	Gasket, rear cover, for panel mount version	2 lb/1.0 kg
3	note	Self-tapping screws, four, #6 x 1.25 in.	—

Note: Information about the size of screws is for information only. Screws cannot be purchased from Rosemount Analytical. Shipping weights are rounded up to the nearest whole lb or 0.5 kg.

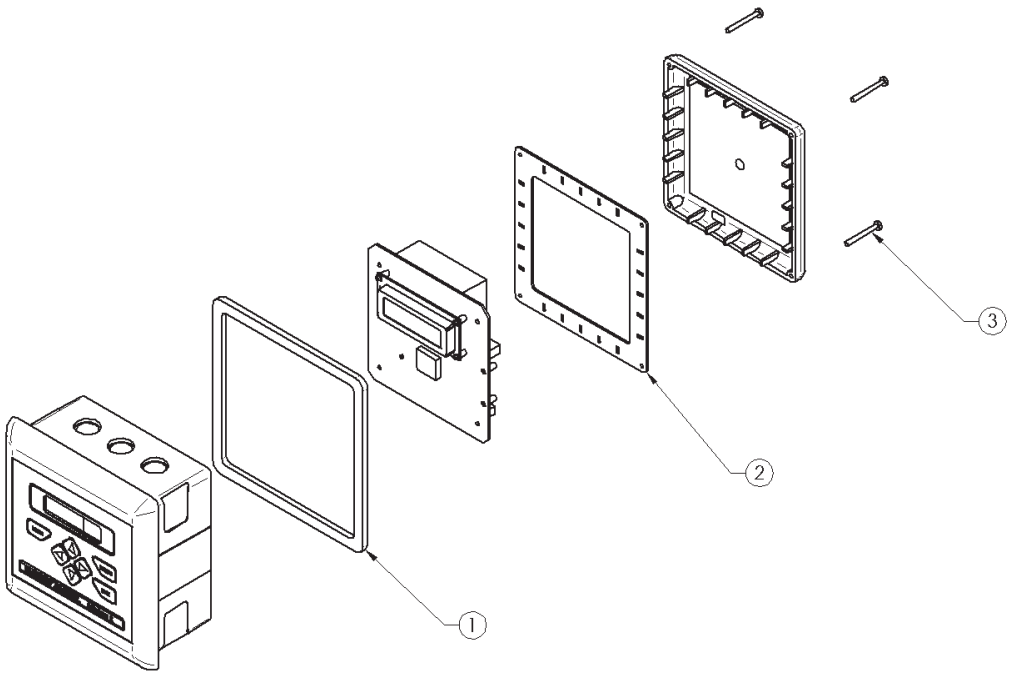


FIGURE 7-1. Exploded View of Solu Comp II (Panel Mount Version)

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TABLE 7-2. Replacement Parts for Solu Comp II (Pipe/Surface Mount Version)

Location in Figure 7-2	PN	Description	Shipping Weight
1	note	Screw, 6-32 x 1.38 in.	—
2	note	O-ring 2-007	—
3	33655-00	Gasket for pipe/surface mount version	2 lb/1.0 kg
not shown	23833-00	Surface mount kit; consists of four self-tapping screws #6 x 1.75 in. and four O-rings	1 lb/0.5 kg

Note: Information about the size of screws and O-rings is for information only. Screws and O-rings cannot be purchased from Rosemount Analytical.

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

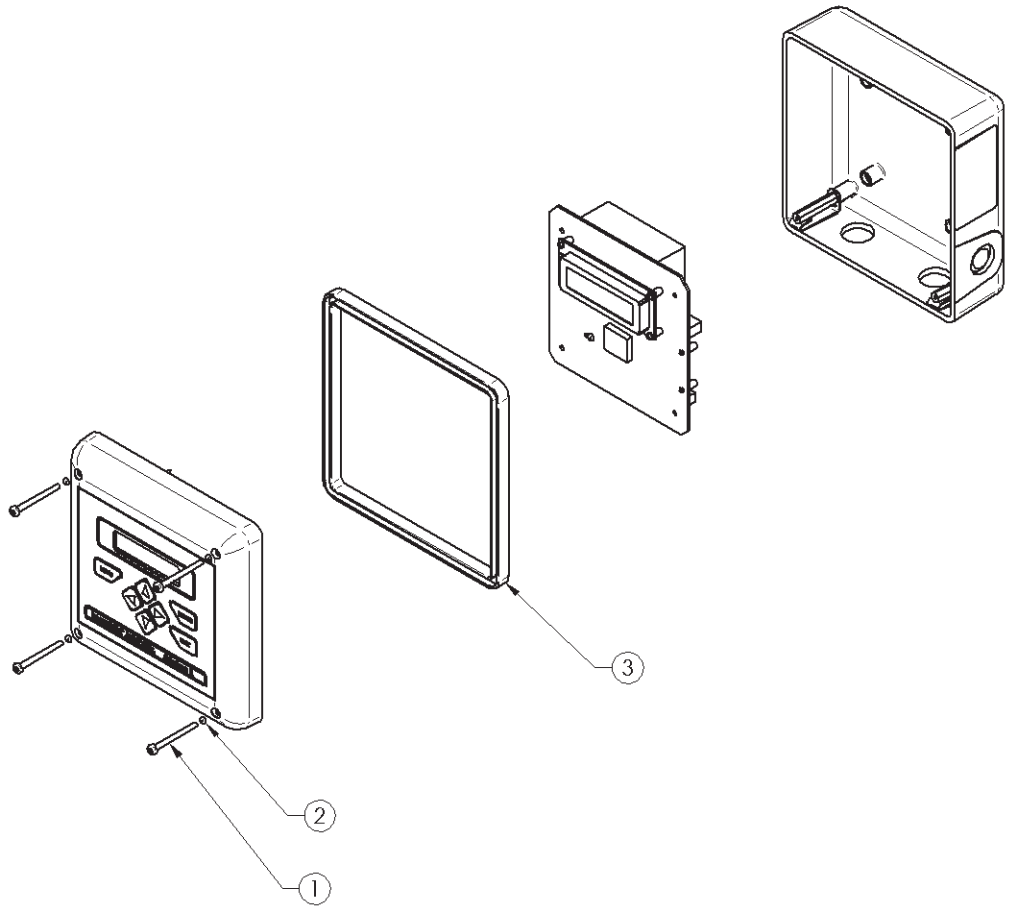


FIGURE 7-2. Exploded View of Solu Comp II (Pipe/Surface Mount Version)

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7.2 SENSOR

7.2.1 Cleaning the sensor

Clean the sensor by rinsing it with water followed by wiping with a soft tissue. If water is inadequate, wash with a mild detergent solution followed by thorough rinsing with water. **Do not scratch the lamp or photodiode windows.**

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

Do not use abrasive cleaners or solvents.

7.2.2 Replacing the lamp/LED board

The USEPA-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 Solu Comp II analyzer continuously monitors the source intensity and corrects for changes in source intensity caused by age. When the source intensity becomes too low, the analyzer warns the user. The user should replace the lamp as soon as possible.

To replace the lamp/LED board…

1. Turn off power to the analyzer.

⚠ WARNING

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

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

⚠ CAUTION



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

NOTE

If you have a dual input analyzer, you can reapply power at this point. The initial reading from the other sensor will be momentarily 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. You are pulling against a single O-ring seal. Don't pull too hard.
5. Using your thumb and forefinger, remove the lamp/LED circuit board from the sensor.
6. Insert the replacement board in the sensor and push the socket on the replacement board into the mating pins in the sensor.
7. Place the desiccant 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. It may be necessary to turn the flange a small amount until the holes line up.

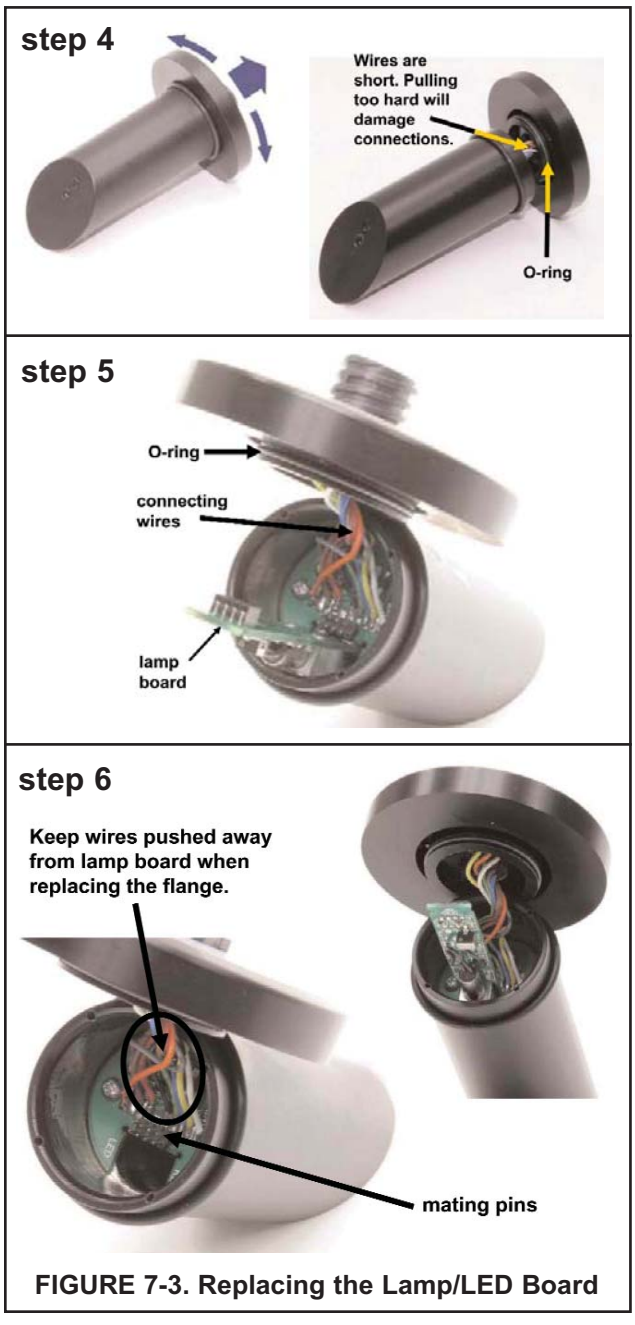


FIGURE 7-3. Replacing the Lamp/LED Board

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9. Place the sensor in the calibration cup and reconnect the cable.
10. Calibrate the sensor using either slope or standard calibration (Section 6.2 or 6.3). Do not use grab calibration. Failure to calibrate the sensor may reduce the life of the sensor. See Sections 8.2.5 and 8.2.6.

7.3 DEBUBBLER AND MEASURING CHAMBER

7.3.1 Cleaning the debubbler and measuring chamber

1. Turn off the sample supply to the debubbler.

⚠ CAUTION



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 7-4. Replace the drain plug.
4. Unscrew the upper and lower caps. Be careful not to lose the O-rings.
5. Use a stream of water, a brush, or a rag to flush and clean out the inside of the debubbler and measuring chamber.
6. Inspect the O-rings for signs of damage and replace if necessary. The part number for the O-ring (one each) is 9550316.
7. Replace the upper and lower caps.
8. Replace the sensor.

7.3.2 Cleaning the orifice

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 7-4.
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 a 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.
6. If the blockage cannot be removed or the orifice is damaged during cleaning, replace the orifice (PN 33947-00).

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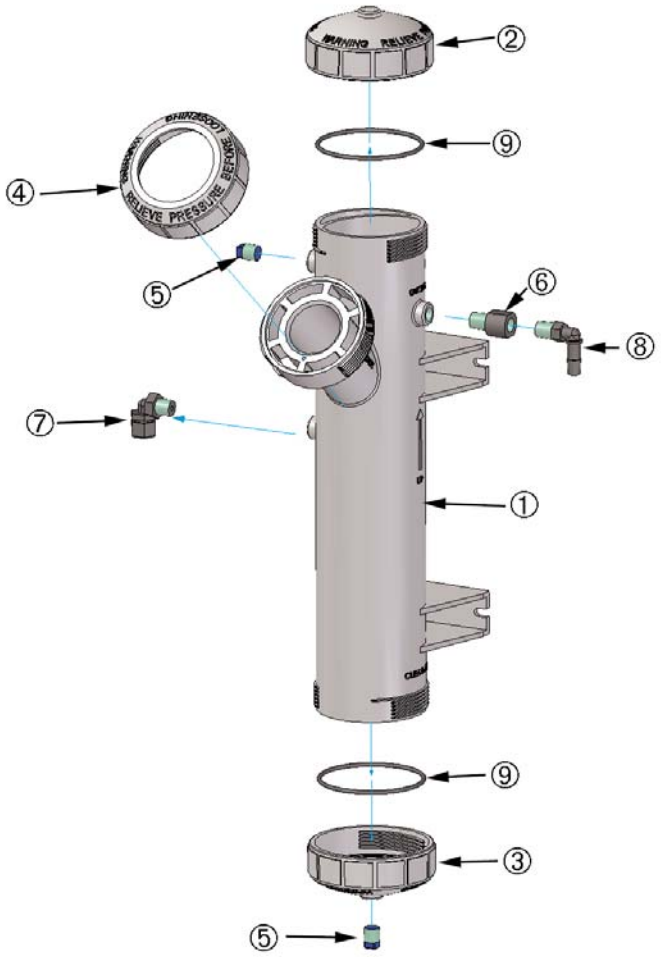


FIGURE 7-4. Molded Debubbler Assembly

7.4 LIST OF REPLACEMENT PARTS

LOCATION IN FIGURE 7-4	DESCRIPTION	PART NUMBER
—	Replacement lamp board assembly, USEPA-compliant sensor	1-0901-0009-EPA
—	Replacement lamp board assembly, ISO-compliant sensor	1-0901-0010-ISO
—	Replacement sensor, USEPA-compliant	8-0108-0002-EPA
—	Replacement sensor, ISO-compliant	8-0108-0003-ISO
1	Debubbler housing	34015-00
2	Upper cap for debubbler	34014-00
3	Lower cap for debubbler	34014-01
4	Sensor nut	34014-02
5	Pipe plug, 1/4 inch MNPT (2 places)	3000854
6	Orifice assembly	33947-00
7	Sample inlet elbow, 1/4 in compression fitting x 1/4 in MNPT	9321010
8	Sample drain elbow, 3/8 in barb x 1/4 in MNPT	9322036
9	O-ring, one each, for upper and lower caps	9550322
not shown	O-ring, one each, for sensor	9550145

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SECTION 8.0
TROUBLESHOOTING

8.1 OVERVIEW

The Solu Comp II analyzer used in the Clarity II turbidimeter continuously monitors itself and the sensor for problems. When the analyzer detects a problem, the word fault or warning followed by ▲ 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 TSS value.

To read fault and warning messages, go to the main display and press ▲. The analyzer will automatically scroll through the messages and will continue to scroll through the messages for two minutes. After two minutes the display will return 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 from the user. Measurements made by the analyzer should be regarded as being in error.

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

⚠ WARNING

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

8.2 TROUBLESHOOTING USING FAULT CODES

Fault message	Explanation	Section
SN Lamp/LED Failure	Lamp or LED is burned out	8.2.1
SN Sensor Fail	Photodiode circuit measuring scattered light has failed	8.2.2
EEPROM Failure	Cannot save data to non-volatile memory	8.2.3
Factory Failure	Needs factory calibration	8.2.4

Warning message	Explanation	Section
SN Need Cal	Lamp intensity is weak but can be improved by calibrating	8.2.5
SN Weak Lamp	Weak lamp, replace as soon as possible	8.2.6
SN Warning	Poor sensor cable connection or unusual ambient light condition affecting sensor or sensor not immersed.	8.2.7

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

8.2.1 Lamp/LED Failure

The light source in a Clarity II turbidity sensor can be either a tungsten filament lamp or an LED. USEPA-compliant sensors use a tungsten lamp. 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 analyzer assumes the light source has either failed completely or the intensity is too low to be useful. At this point the analyzer displays the *Lamp Failure* message.

Replace the lamp or LED board. See Section 7.2.2.

After replacing the lamp board, be sure to recalibrate the sensor using either slope or standard calibration. See Section 6.2 or 6.3. 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.

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8.2.2 Sensor Fail

Sensor Fail means the photodiode measuring the scattered light from the sample has probably failed. The analyzer calculates turbidity from the difference between the scattered light signal and the dark current. Dark current is the signal generated by the photodiode when no light is falling on it. If the difference between the scattered light signal and the dark current is equivalent to less than 0.005 NTU, the analyzer displays the *Sensor Fail* fault. The 0.005 NTU limit was selected because the intrinsic turbidity of perfectly filtered water is 0.010 - 0.015 NTU.

A. Are the lamp and detector windows clean? A dirty lamp or detector window can reduce the intensity of light reaching the sample photodiode leading to low results. Clean the sensor (see Section 7.2.1) and check the turbidity.

B. Repeat sensor calibration. See Sections 6.2, 6.3, or 6.4.

C. If after cleaning and recalibrating, the *Sensor Fail* fault persists, replace the sensor.

8.2.3 EEPROM Failure

EEPROM failure means the analyzer is unable to store data in the non-volatile memory. Thus, if power is lost then restored, all configurations and calibrations will be lost. Call the factory for assistance. The analyzer will probably need to be replaced.

8.2.4 Factory Failure

Factory failure means the factory calibrations have been corrupted. Call the factory for assistance. The analyzer will probably need to be replaced.

8.2.5 Need Cal

The Clarity II sensor 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 remained constant. The analyzer 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 analyzer displays the ***Need Cal*** warning. Calibrating will cause the analyzer to increase the current supplied to the lamp, thus increasing the lamp intensity.

A. Calibrate the sensor using slope (Section 6.2), standard (Section 6.3), or lamp calibration (Section 6.5). Using slope or standard calibration is strongly recommended. Use lamp calibration ONLY if a turbidity standard is not available.

B. If a replacement lamp board is not available, order one as soon as possible.

8.2.6 Weak Lamp

The Weak Lamp warning appears when lamp intensity is low and the current being supplied to the lamp (see Section 8.2.5) 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 Section 6.2 or 6.3. 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 significantly reduce lamp life.

8.2.7 SN Warning

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

A. 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 3/4 turn to lock the cable to the sensor.

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

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

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8.3 TROUBLESHOOTING CALIBRATION PROBLEMS

Once the user has completed the calibration sequence, the analyzer verifies that the calibration meets certain requirements. If the calibration is valid, the analyzer displays the calibration complete screen and updates the calibration. If the calibration does not meet requirements, the calibration error screen appears. The analyzer retains the original calibration.

Calibration method	Section
User-prepared standard (Section 6.2)	8.3.1
Commercial standard (Section 6.3)	8.3.2
Grab sample (Section 6.4)	8.3.3

8.3.1 Calibration Error-User-Prepared Standard (Section 6.2)

A. For best results calibrate using freshly prepared 20.0 NTU standard. Use the procedure in Section 6.3.2.

B. Has the stock 4000 NTU standard exceeded its expiration date?

C. 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.

D. Are the lamp and detector windows clean? See Section 7.2.1.

E. Is the sensor securely seated in 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?

F. Was the correct turbidity value entered in the analyzer?

8.3.2 Calibration Error-Commercial Standard (Section 6.3)

A. For best results calibrate using 20.0 NTU standard.

B. Has the calibration standard exceeded its expiration date?

C. Are the lamp and detector windows clean? See Section 7.2.1.

D. Is the sensor is securely seated in 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?

E. Was the correct turbidity value entered in the analyzer?

8.3.3 Calibration Error-Grab Sample (Section 6.4)

A. Was the referee instrument used to measure the grab sample properly calibrated?

B. 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.

C. Is the sensor securely seated 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.

D. Is the sensor clean? See Section 7.2.1.

E. Was the correct turbidity value entered in the analyzer?

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8.4 TROUBLESHOOTING OTHER PROBLEMS

Problem	Section
Readings are erratic	8.4.1
Readings drift	8.4.2
Analyzer responds too slowly to changes in turbidity	8.4.3
Flow is too low	8.4.4
Readings are lower or higher than expected	8.4.5
Current output is too low	8.4.6
Alarm relays do not operate when setpoint is exceeded	8.4.7
Display is unreadable-too faint or all pixels dark	8.4.8

8.4.1 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 analyzer software also helps reduce the effect of bubbles.

A. Be sure the bubble rejection filter is on and increase the signal averaging time. See Section 5.5.

B. 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 (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.

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

8.4.2 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.

A. If downward drift is occurring, inspect the sensor windows for cleanliness. See Section 7.2.1 for cleaning instructions.

B. 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.

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

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8.4.3 Analyzer responds too slowly to changes in turbidity

Response time is primarily a function of sample flow rate, distance between the sample point and analyzer, 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.

A. If possible, increase the inlet pressure.

B. If increasing the inlet pressure is not feasible, move the sensor closer to the sample point.

8.4.4 Flow is too low

The debubbler is fitted with a 0.040 inch (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 ***sss*** 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 to increase the inlet pressure.

A. To eliminate back pressure, remove the orifice from the debubbler. See Section 7.3.

B. 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 a valve or a valved rotameter (PN 24103-00) in the debubbler outlet. Do not exceed 30 psig (308 kPa abs).

C. If outgassing continues to persist, increase the back pressure. To maintain flow, use a pump to increase the inlet pressure.

8.4.5 Readings are lower or higher than expected

A. Is the instrument to which readings are being compared properly calibrated?

B. Are samples being tested immediately after sampling? If samples are allowed to sit too long before testing, the turbidity may change.

C. 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 Section 7.3.1 for cleaning procedure.

8.4.6 Analog current is too low

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

8.4.7 Alarm relays do not operate when setpoint is exceeded

A. Is the alarm board is in place and properly seated?

B. Is the alarm logic (high/low) and dead band correct?

C. Has the setpoint has been properly entered?

8.4.8 Display is unreadable — too faint or all pixels dark.

While holding down the MENU key, press ▲ or ▼ until the display has the correct contrast.

8.5 INFORMATION SCREENS

8.5.1 Overview

Information screens provide data that can be helpful in diagnosing measurement problems. To read the information screens, go to the main display and press ▼. Each press will display a new information screen. Once all the information screens have been displayed, the analyzer will show warning and fault screens. In the information screens, **S1** means sensor 1 and **S2** means sensor 2.

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8.5.2 Explanation of information screens



1. The first line shows the sensor dark current. The dark current is the sensor output in mV when the lamp or LED is turned off. For a more detailed explanation of the importance of dark current, see Section 8.2.7. Typical dark current signal is less than 20 mV.

   The second line is the sensor slope. **Slp** means the sensor was calibrated with a user-prepared standard (Section 6.2). **Stnd** means the sensor was calibrated using a commercial standard (Section 6.3). **Grab** means the sensor was calibrated against turbidity measured using a referee instrument (Section 6.4). Typical sensor slope is about 10mV/NTU. As the sensor ages the slope will decrease.



2. For USEPA-compliant sensors the screen at left appears. The first line is the output from the detector monitoring the intensity of the tungsten lamp. As the lamp ages, the detector output drops.

   The second line has two pieces of data: lamp current and detector temperature.

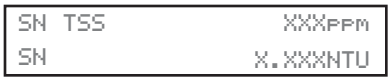
   a. The lamp current is typically either 228 mA or 257 mA. Older lamps (rev A) operate at 228 mA. Newer lamps (rev B) operate at 257 mA. As a lamp ages and intensity becomes too low for the lamp drift correction to work properly, recalibrating the sensor causes the lamp current to increase. The maximum current is 360 mA.

   b. The detector temperature is the internal temperature of the sensor. The internal temperature is **NOT** the process temperature.



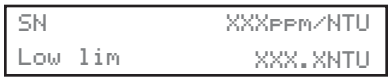
3. For ISO-compliant sensors the screen at left appears. The first line is the output from the detector monitoring the intensity of the LED. As the LED ages, the detector output will drop.

   The second line is the internal temperature of the sensor. The internal temperature is **NOT** the process temperature.



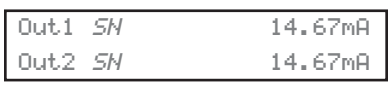
4. This screen appears only if the analyzer was configured to convert the turbidity reading to TSS. The first line is the calculated TSS of the sample. See Section 6.6 for more information.

   The second line is the turbidity of the sample.

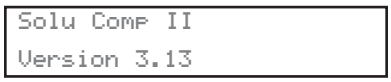


5. This screen appears only if the analyzer was configured to convert the turbidity reading to TSS. The first line is the slope of the calibration curve.

   The second line is the lower limit for the turbidity measurement. A measured turbidity below this value will return a negative TSS value.



6. This screen shows the value of the analog output corresponding to the displayed value and the scaling programmed in Section 5.3.4.



7. This screen shows the software version.

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SECTION 9.0
RETURN OF MATERIAL

9.1 GENERAL.

To expedite the repair and return of instruments, proper communication between the customer and the factory is important. Before returning a product for repair, call 1-949-757-8500 for a Return Materials Authorization (RMA) number.

9.2 WARRANTY REPAIR.

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

1. Call Rosemount Analytical for authorization.
2. To verify warranty, supply the factory sales order number or the original purchase order number. In the case of individual parts or sub-assemblies, the serial number on the unit must be supplied.
3. Carefully package the materials and enclose your “Letter of Transmittal” (see Warranty). If possible, pack the materials in the same manner as they were received.
4. Send the package prepaid to:

   Emerson Process Management
   Liquid Division
   2400 Barranca Parkway
   Irvine, CA 92606

   Attn: Factory Repair

   RMA No. _____

   Mark the package: Returned for Repair

   Model No. ____

9.3 NON-WARRANTY REPAIR.

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

1. Call Rosemount Analytical 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 of Section 9.2.

NOTE

Consult the factory for additional information regarding service or repair.

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APPENDIX

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

1. Collect a sample of the process liquid-you may need 10 L or more if you use the Clarity II for measuring turbidity. If you use a laboratory turbidimeter, you will need less volume. The Clarity II requires about 500 mL for the measurement; laboratory turbidimeters require 50 mL or less. Verify that the turbidity of the sample is less than 200 NTU. Store the 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 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 analyzer. See Section 6.5.2.

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WARRANTY

Seller warrants that the firmware will execute the programming instructions 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 initial 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 from a third party 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 effort 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 the 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 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, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO ANY OF THE GOODS OR SERVICES.

RETURN OF MATERIAL

Material returned for repair, whether in or out of warranty, should be shipped prepaid to:

Emerson Process Management
Liquid Division
2400 Barranca Parkway
Irvine, CA 92606

The shipping container should be marked:

Return for Repair
Model _____

The returned material should be accompanied by a letter of transmittal which should include the following information (make a copy of the "Return of Materials Request" found on the last page of the Manual and provide the following thereon):

1. Location type of service, and length of time of service of the device.
2. Description of the faulty operation of the device and the circumstances of the failure.
3. Name and telephone number of the person to contact if there are questions about the returned material.
4. Statement as to whether warranty or non-warranty service is requested.
5. Complete shipping instructions for return of the material.

Adherence to these procedures will expedite handling of the returned material and will prevent unnecessary additional charges for inspection and testing to determine the problem with the device.

If the material is returned for out-of-warranty repairs, a purchase order for repairs should be enclosed.

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