ROSEMOUNT WARRANTY

CAUTION
The Raman Process Analyzer is designed for industrial applications. Treat with care to avoid physical damage. THE WARRANTY DOES NOT COVER DAMAGE FROM MISHANDLING.

Rosemount warrants that the equipment manufactured and sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after the date of shipment, Rosemount shall, upon prompt written notice from the purchaser, correct such nonconformity by repair or replacement, F.O.B. factory of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Rosemount with respect to the quality of the equipment.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE).

The remedy(ies) provided above shall be purchaser’s sole remedy(ies) for any failure of Rosemount to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).

Rosemount does not warrant equipment against normal deterioration due to environment. Factors such as corrosive gases and solid particulates can be detrimental and can create the need for repair or replacement as part of normal wear and tear during the warranty period.

Equipment supplied by Rosemount Analytical Inc. but not manufactured by it will be subject to the same warranty as is extended to Rosemount by the original manufacturer.

At the time of installation it is important that the required services are supplied to the system. This will ensure, that should there be a delay between installation and full commissioning that the analyzer being supplied with ac power will not be subjected to component deterioration.
PURPOSE

The purpose of this manual is to provide a comprehensive understanding of the Raman Process Analyzer components, functions, installation, and maintenance.

This manual is designed to provide information about the Raman Process Analyzer. We recommend that you thoroughly familiarize yourself with the Description and Installation sections before installing your analyzer.

The description presents the basic principles of the analyzer along with its performance characteristics and components. The remaining sections contain detailed procedures and information necessary to install and service the analyzer.

Before contacting Rosemount concerning any questions, first consult this manual. It describes most situations encountered in your equipment’s operation and details necessary action.

DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this publication.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc. If not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition, or statement.

\(\text{\ding{55}}\): EARTH (GROUND) TERMINAL
\(\text{\ding{56}}\): PROTECTIVE CONDUCTOR TERMINAL
\(\text{\ding{57}}\): RISK OF ELECTRICAL SHOCK
\(\text{\ding{58}}\): WARNING: REFER TO INSTRUCTION BULLETIN

NOTE TO USERS

The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number, and is not related to the illustration in any technical manner.
IMPORTANT

LASER SAFETY INSTRUCTIONS

The Raman Process Analyzer uses a Class IV Diode Laser with a maximum output of 1 Watt at a wavelength of 810 nm (invisible, near-infrared light). The light is transmitted through fiber optic cables to and from the probe. The Raman Process Analyzer contains a Laser Safety Device that detects the return intensity of the laser light. If the return light diminishes below a certain level, the device reduces the laser power to Class I. This safety feature reduces the chance of personnel injury from contact with the laser. Take the following precautions when working around the Raman Process Analyzer:

INVISIBLE LASER LIGHT — AVOID EXPOSURE TO OPERATING LASER. A CLASS IV LASER IS USED IN THIS ANALYZER. THE LASER HAS A MAXIMUM OUTPUT OF 1 WATT AT A WAVELENGTH OF 810 NM.

1. Only service this product if you have completed formal training in laser safety and safe servicing techniques on this unit.
2. Never look at the probe tip when the probe is connected to the analyzer. Disconnect the fiber optic cables before examining the probe.
3. Always clean the probe tip when removed from process. It may be possible for liquid droplets or particles to attach to the tip of the probe, allowing light “reflection” to return to the Laser Safety Device. Use only appropriate material that will not scratch or otherwise damage the probe tip.
4. Do not bring the probe tip in contact with any surfaces when removed from the process. Any “scattered” light returned by the probe may trigger the laser back to Class IV.
5. All personnel working in the area of the laser must wear laser safety goggles (full-goggle type with side shields). Goggles must have a minimum attenuation factor of 100,000 (optical density 5) for an 810 nm wavelength.
IMPORTANT

SAFETY INSTRUCTIONS FOR THE WIRING AND INSTALLATION OF THE LASER

The following safety instructions apply specifically to all EU member states. They should be strictly adhered to in order to assure compliance with the Low Voltage Directive. Non-EU states should also comply with the following unless superseded by local or National Standards.

1. Adequate earth connections should be made to all earthing points, internal and external, where provided.

2. After installation or troubleshooting, all safety covers and safety grounds must be replaced. The integrity of all earth terminals must be maintained at all times.

3. Mains supply cords should comply with the requirements of IEC227 or IEC245.

4. All wiring shall be suitable for use in an ambient temperature of greater than 75°C.

5. All cable glands used should be of such internal dimensions as to provide adequate cable anchorage.

6. To ensure safe operation of this equipment, connection to the mains supply should only be made through a circuit breaker which will disconnect all circuits carrying conductors during a fault situation. The circuit breaker may also include a mechanically operated isolating switch. If not, then another means of disconnecting the equipment from the supply must be provided and clearly marked as such. Circuit breakers or switches must comply with a recognized standard such as IEC947 (properly grounded three wire source of electrical power). All wiring must conform with any local standards.

7. Warning - Electrical Shock Hazard. Where equipment or covers are marked with the symbol to the right, hazardous voltages are likely to be present beneath. These covers should only be removed when power is removed from the equipment — and then only by trained service personnel.

8. Caution - Hot Surface Hazard. Where equipment or covers are marked with the symbol to the right, there is a danger from hot surfaces beneath. These covers should only be removed by trained service personnel when power is removed from the equipment. Certain surfaces may remain hot to the touch.

9. Where equipment or covers are marked with the symbol to the right, refer to the Operator Manual for instructions.

10. Warning - Laser Light Warning. Where equipment or covers are marked with the symbol to the right, high powered laser light is beneath. These covers should only be removed by trained service personnel when power is removed from the equipment.

11. All graphical symbols used in this product are from one or more of the following standards: EN61010-1, IEC417, and ISO3864.
ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures, and tests all its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use, and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. 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 the instrument, and warranty invalidation.

- Read all instructions prior to installing, operating, and servicing the product. If this Instruction Bulletin is not the correct manual, telephone 1-800-654-7768 and the required manual will be provided. Save this instruction manual for future reference.

- If you do not understand any of the instructions, contact your Rosemount representative for clarification.

- Follow all warnings, cautions, and instructions marked on and supplied with the product.

- Inform and educate your personnel in the proper installation, operation, and maintenance of the product.

- Install your equipment as specified in the installation instructions of the appropriate Instruction Bulletin and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.

- To ensure proper performance, use qualified personnel to install, operate, update, program, and maintain this product.

- When replacement parts are required, ensure that the qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product’s performance and place the safe operation of your process at risk. Look alike substitutions may result in fire, electrical hazards, or improper operation.

- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.
WHAT YOU NEED TO KNOW

BEFORE INSTALLING AND WIRING A ROSEMOUNT RAMAN PROCESS ANALYZER

1. What is the line voltage being supplied to the Raman Process Analyzer? Write the line voltage here __________.
2. Is the analyzer being controlled at the analyzer cabinet or by network connection?
3. Is the conduit set-up and all wiring for the analyzer run?

CAN YOU USE THE FOLLOWING QUICK START GUIDE?

Use the Quick Start Guide if....

1. You are familiar with the Raman Process Analyzer installation requirements.
2. All wiring and conduit are in place for installation of the analyzer.
3. A configuration set exists for the process to be analyzed.
4. You are familiar with the SURE calibration procedures.

If you cannot use the Quick Start Guide, turn to Section II, Installation, in this Instruction Bulletin.
Before using the Quick Start Guide, please read “WHAT YOU NEED TO KNOW BEFORE INSTALLING AND WIRING A ROSEMOUNT RAMAN PROCESS ANALYZER” on the preceding page.

1. Mount the analyzer cabinet. Refer to Section II, paragraph 2-3.a.
2. Install the Raman probes. Refer to Section II, paragraph 0.
3. Install the fiber optic cable conduits. Refer to Section II, paragraph 0.
4. Connect the fiber optic cables. Refer to Section II, paragraph 1-1.a.
5. Connect the cooling air supply and filters to the analyzer cabinet. Refer to Section II, paragraph 2-3.e.
6. Connect line voltage to the analyzer cabinet. Refer to Section II, paragraph 2-4.
7. Connect the network cable or computer peripherals to the analyzer cabinet. Refer to Section II, paragraphs 0 and 2-6.
8. Turn power on to the analyzer cabinet.
9. If using a network connection to control the analyzer, use the NetSupport software to enable communication with the analyzer. Refer to Section III, paragraph 3-1.
10. Use MAINCFG to select the desired configuration set. Refer to Section III, paragraph 3-3.a.
11. Perform a dark scan and photometric calibration procedure. Refer to Section III, paragraph 3-3.b.
12. Select the QUIT option to start the MAIN program and monitor the process.
Select a configuration set
1. Close the MAIN program.
2. Start the MAINCFG program.
3. Select SYSTEM CONFIGURATION.
4. Select ENABLE A CONFIGURATION.
5. Select the configuration file to be used.

Calibrate the analyzer
1. Use the MAINCFG program and load the correct configuration set for the process to be monitored.
2. Remove the probe from the process and ensure the probe is clean of any liquid or foreign material.
3. Mount the probe in the SURE calibration kit.
4. Select PHOTOMETRIC CALIBRATION from the MAIN Setup Menu screen.
5. A prompt to verify that the probe is connected to the calibration kit is displayed. Click the CONTINUE button.
6. Select the appropriate channel to be calibrated. Set the number of scans to 1 and click CONTINUE.
7. The system auto-ranges and acquires the dark scan current, then displays the photometric curve. Make sure the curve is not saturated (have a flat region). If flat regions appear in the scan, back out the calibration kit two or three turns and press RE-SAMPLE. Repeat the calibration kit adjustments and re-sampling until a smooth photometric curve is measured.
8. Make sure the appropriate channel is selected and set the number of scans to 10. Press RE-SAMPLE, then press CONTINUE.
9. Press STORE to save this scan for future use. The selected channel photometrics are calibrated.
10. To calibrate the photometrics of another channel, repeat steps 1 through 9.
Technical Support Hotline:

For assistance with technical problems, please call the Customer Support Center (CSC). The CSC is staffed 24 hours a day, 7 days a week.

Phone: 1-800-433-6076

In addition to the CSC, you may also contact Field Watch. Field Watch coordinates Rosemount’s field service throughout the US and abroad.

Phone: 1-800-654-RSMT (1-800-654-7768)

Rosemount may also be reached via the Internet through e-mail and the World Wide Web:

E-mail: GAS.CSC@frco.com
World Wide Web: www.processanalytic.com
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SECTION I. SYSTEM OVERVIEW

1-1. SCOPE OF MANUAL

This instruction bulletin covers installation, setup, operation, troubleshooting, and maintenance of the Raman Process Analyzer manufactured by Rosemount Analytical. The troubleshooting and service procedures in this manual are limited to those that can be performed by most equipment operators.

1-2. COMPONENTS CHECKLIST
(PACKAGE CONTENTS)

The Raman Process Analyzer system includes the items listed in Figure 1-1. The SURE Calibration Kit contains all the necessary components for quickly calibrating the analyzer.

1-3. FUNCTIONAL EQUIPMENT DESCRIPTION

When properly configured, the analyzer detects and measures the concentration of sample components that inelastically scatter light. Access for the detection of the process components is accomplished with one to four analyzer probes installed in or around the process flow.

Functional components of the analyzer are shown in the electronic diagram of Figure 1-2. The important components of the diagram include the process probes, the diode lasers, the laser safety device, spectrograph, vortex cooler, CCD camera, and the industrial computer. Brief descriptions of the analyzer component functions are provided in the following paragraphs.

1. Analyzer
2. Analyzer Test Records
3. Instruction Bulletin
4. Backup Software
5. SURE Calibration Kit
6. Oil Filter
7. Water Filter
8. In Situ Probe (1 per channel)
9. Fiber Optic Cables (3 per probe)

Figure 1-1. Typical Raman Process Analyzer System Package
Figure 1-2. Functional Equipment Diagram
The following are brief descriptions of analyzer component functions. A listing of components in the analyzer cabinet is provided in Figure 1-3.

a. Diode Lasers and Probes. The analyzer uses one or two diode lasers and up to four process probes. Each diode laser generates a light beam. The light beam is split in a 10/90 optic splitter. Fiber optic cables transmit ten percent of the beam to a diamond reference circuit and the remaining ninety percent to a 50/50 optic splitter. A fiber optic cable from the diamond reference transmits the reference beam to the spectrograph.

The ninety percent portion of the beam is evenly split to provide excitation energy for two process probes. Each beam is filtered at the probe to eliminate stray radiation. The probe emits the filtered laser beam into the process flow.

The process components inelastically scatter distinct wavelengths. Two return cables transmit scattered light from the probe to the analyzer. The unfiltered S cable transmits all scattered light to the Laser Safety Device. The filtered R cable transmits only a specific range of near-infrared wavelengths to the spectrograph.

b. Vortex Cooler. The vortex cooler helps control the temperature of the CCD (charge coupled device) camera and the cabinet interior. The main function of the vortex cooler is to maintain the ambient temperature near the camera at 30°C so that the internal CCD chip temperature will remain at –30°C.

Incoming instrument air is dried, filtered, and routed through a temperature-controlled air valve to the vortex cooler. The vortex effect separates the forced air into warm and cold air flows. The chilled air is routed to the CCD camera.

As the cabinet air gets warmer, the air valve opens a larger flow of forced air to the vortex chamber, providing more cooling air to the camera. As the cabinet air cools, a proportional air valve partly closes to slow the flow of cooling air.

c. Spectrograph and CCD Camera. Filtered light from the diamond reference and the R probe is transmitted by fiber optic cable to the spectrograph. The spectrograph separates incoming light into distinct wavelengths. Each wavelength of light is sent to the CCD camera head where the spectral image is decoded and electronically transferred to the CCD camera controller. The controller processes the spectral image into numerical data. The data is sent to the industrial computer for interpretation and display.

d. Industrial Computer. The industrial computer converts data points into light intensity with respect to frequency. The histogram of each predicted component is displayed on the CRT. The spectra are processed by the prediction’s algorithm in accordance with the calibration file. Each application requires its own calibration file. The output data is stored for further analysis.

e. User Interface. An interface device is required to set up and operate the analyzer using the MAIN and MAINCFG software programs. The user interface device can be a remote computer connected through a network modem, Ethernet®, RF antenna and laptop computer, or a monitor, keyboard, and mouse connected at the analyzer cabinet.

f. Analyzer Outputs. The available analyzer outputs are MODBUS and/or analog, 4 to 20 mA.

g. SURE Calibration Kit. The SURE calibration kit is a light proof housing that secures the probe tip above a fluorescent glass. The kit uses no external light source or power source. When the fluorescent glass and probe are properly assembled in the light-proof housing, the analyzer can be calibrated using the MAINCFG software program.
1. Hoffman Enclosure  
2. Computer Power Supply  
3. Computer  
4. Disk Drives  
5. Optics Assembly Tray  
6. CCD Camera  
7. CCD Camera Hood  
8. Termination Board  
9. Peripheral Device Connector  
10. Temperature Controller  
11. Enclosure Backplate  
12. CCD Camera Controller  
13. Spectrograph Assembly  
14. Laser Pedestal Assembly  
15. Laser Safety Device  
16. Proportional Air Valve  
17. Raman Power Supply  
18. Vortex Cooler Assembly

**Figure 1-3. Analyzer Cabinet**
### EQUIPMENT SPECIFICATIONS

Table 1-1. Raman Process Equipment Specifications (Analyzer)*

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral Range</td>
<td>500 cm(^{-1}) to 2000 cm(^{-1}) Raman Shift</td>
</tr>
<tr>
<td>Spectral Resolution</td>
<td>∼2 nm</td>
</tr>
<tr>
<td>Typical Error</td>
<td>Less than 1% of full-scale, application dependent</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>32° to 122°F (0° to 50°C)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>32° to 122°F (0° to 50°C)</td>
</tr>
<tr>
<td>Relative Humidity</td>
<td>20 to 100%</td>
</tr>
<tr>
<td>Warm-up Time</td>
<td>60 minutes</td>
</tr>
<tr>
<td>Input Power</td>
<td>115 or 230 VAC, 50 or 60 Hz</td>
</tr>
<tr>
<td>Power Rating</td>
<td>250 VA (250 W)</td>
</tr>
<tr>
<td>Electrical Classification</td>
<td>General Purpose or Class I, Div II</td>
</tr>
<tr>
<td>Environmental Classification</td>
<td>NEMA-4X</td>
</tr>
<tr>
<td>Dimensions (H x W x D)</td>
<td>48 x 24 x 12 in. (1219 x 610 x 305 mm)</td>
</tr>
<tr>
<td>Weight</td>
<td>165 lbs (75 kg)</td>
</tr>
<tr>
<td>Certification</td>
<td>CE Mark Pending</td>
</tr>
</tbody>
</table>

*Probe specifications may vary from probe to probe. Refer to the material supplied with probe for specifications.
2-1. OVERVIEW

This section covers installation of the Rosemount Raman Process Analyzer. Included are a typical installation, common requirements, what you need to have on hand to start an installation, and the mechanical and electrical installation instructions. An authorized Rosemount service representative must complete the analyzer installation. You must complete the mechanical installation before calling the service representative for final check-out and installation commissioning.

2-2. TYPICAL INSTALLATION

A typical system installation is shown in Figure 2-1. When properly installed, the analyzer cabinet is securely mounted to a wall in the process control area. The cabinet should not be mounted in the path of direct sunlight.

Process probes are installed in the process flow (usually a sampling flow). Up to four process probes may be installed for each analyzer. The installed probes should be adequately shielded from accidental impact, rainfall, and direct sunlight. Ready access for probe removal, cleaning, and replacement is recommended.

Fiber optic cable lengths are per customer specification. Make sure the correct cables are selected for each run. One inch or larger diameter conduits or cable troughs are recommended for shielding the fiber optic cables. Pull boxes are needed when successive cable bend angles exceed 180 degrees. Conduit ends should point down to protect against water accumulation. Sharp conduit edges must be avoided and the cables should be lubricated before pulling.

Figure 2-1. Typical Installation
2-3. **MECHANICAL INSTALLATION**

a. **Analyzer Cabinet.**

**CAUTION**

Never rest the cabinet standing up. Damage to conduit fittings can occur.

The analyzer is housed in a NEMA-4X cabinet. The NEMA-4X cabinet is suitable for wall mounting in a Class I, Division II environment when equipped with an ISA Type Z-Purge.

When lifting, the cabinet door must be closed and latched. Make sure the mounting brackets are installed and tight.

The analyzer cabinet weighs approximately 165 lbs (75 kg). Analyzer cabinet mounting dimensions are provided in Figure 2-2. Mark the position for cabinet hanger mounting on center with wall studs or a securely mounted plywood backplate.

Lift the cabinet with the upper brackets. Avoid contact with the vortex cooler. Position and securely mount the cabinet using appropriate screws and flat washers.

b. **Raman Probe.**

Each analyzer system includes up to four process probes designed for mounting in a flow line or tank. Install each process probe according to the following instructions:

1. Remove the protective covers from the probe tip, Figure 2-3.
2. Install a bored through compression fitting of compatible metallurgy in the process line, tee, or process tank wall.
3. Insert the probe to the desired depth in the compression fitting.
4. If compatible with the process, apply a suitable sealant around the seal diameter of the probe.
5. Tighten the compression fitting to secure the probe. Do not over-tighten the fitting.

![Figure 2-2. Analyzer Cabinet Installation](image)

![Figure 2-3. Raman Probe](image)
c. **Fiber Optic Cable Conduits.**

**CAUTION**

Fiber optic cables are precision optics devices. Careless handling or installation of a fiber optic cable can result in permanent cable damage.

1. Install a 3/4 in. (19 mm) diameter minimum conduit from the analyzer cabinet to each process probe. The minimum radius for all conduit bends is 10 in. (254 mm). For fiber optic cable runs, it is not required to connect the conduit to the analyzer cabinet.

2. Install a cable pull box following a series of conduit bends totaling 180 degrees. A 90 degree turn fitting (Figure 2-4) is recommended for use as a cable pull box.

3. When using pull boxes, coil the fiber optic cable into a figure eight below the pull box. Feed a cable pull tape from one conduit end to the pull box.

4. Overlay 3 ft (91.4 cm) of the fiber optic cable onto the pull tape and wrap with nylon string to hold in place. Wrap and tape the fiber optic cable to the pull tape as shown in Figure 2-5.

5. Carefully pull the cable through the conduit; pull enough cable to allow for cable slack when connecting at the analyzer cabinet or probe.

6. When using cable pull boxes, turn the coiled cable over. Feed the pull tape to the opposite side of the pull box. Wrap and tape the cable to the pull tape and pull the free end through the next section of conduit. Repeat the cable pulling instructions as needed to install all fiber optic cables.

**Figure 2-4.** Cable Pull Box

**Figure 2-5.** Cable to Pull Tape Connection
d. **Connecting Fiber Optic Cables.**

Each process probe has four SMA connectors. The probe connectors are marked “S” for the laser safety, “L” for laser excitation light, and “R” for Raman light collection. The L and R connectors have mating, in-line optic filters. The unmarked connector is a spare S or R connector. Install the Raman probes according to the following instructions:

1. Remove the protective caps from the S, L, and R probe connectors (Figure 2-6).

   **CAUTION**

   Carefully handle fiber optic cables. Avoid bending, pulling, or compressing the cables. Excess stress on the cables or connectors can cause permanent cable damage.

   The Raman probe is a delicate precision optics device. Careless handling or installation can result in permanent probe damage.

Figure 2-6. Probe Connections
2. Remove a protective cap from one probe terminal. Tilt the mating optic filter or cable connector and carefully align the fiber optic filament with the mating filter or connector orifice. Level both connectors, insert the filament, and install the connector finger tight.

**NOTE**

Save the protective caps and use them whenever the fiber optic cables are disconnected. For ready access, Rosemount recommends that you store the protective caps in a plastic bag taped to the inside of the analyzer cabinet door.

3. Repeat step 2 for each probe connector and mating filter and/or cable connector.

4. Using a procedure similar to step 2, carefully connect the fiber optic cables to their mating terminals at the analyzer cabinet.

**e. Air Supply Connection.** The analyzer uses a vortex cooler system to maintain the analyzer cabinet temperature. Connect the supplied water and oil filters to the analyzer cabinet as shown in [Figure 2-7](#).

Rosemount recommends mounting a pressure gage after the filters to monitor filter performance.

Connect the air supply and air pressure regulator to the water filter. The instrument air supply must be dry, filtered air at 60 psi (414 kPa) minimum, developing 15 SCFM, minimum.

---

### 2-4. ELECTRICAL INSTALLATION

Use the following procedures to supply electrical power to the analyzer. Input power to the module can be either 115 or 230 VAC, 50/60 Hz, single phase. A properly rated electrical breaker is required.

Rosemount recommends installing an ON/OFF switch outside the analyzer cabinet.

---

**WARNING**

Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

---

a. **Input Voltage Selector.** The input voltage selection is configured per customer request (115 or 230 VAC). If it becomes necessary to change the input voltage, contact an authorized Rosemount Service Representative.

b. **Electrical Wiring and Conduits.**

**NOTE**

It may be necessary to enlarge conduit ports to install the conduits.

All electrical wiring and conduits must conform to local codes. Refer to [Figure 2-8](#) for the location of the conduit ports.

---

![Figure 2-7. Air Supply Hookup](#)

![Figure 2-8. Conduit Ports](#)
c. **Cabinet Power.**

**WARNING**

Disconnect and lock out power source before working on electrical components. Failure to lock out power may result in severe injury or death.

**NOTE**

All through cables and wiring should be routed through the conduit ports on the bottom of the cabinet.

Lock out the cabinet power source at the main disconnect. Connect cabinet electrical power at the input power terminal (Figure 2-9).

2-5. **COMPUTER NETWORK**

If using the network function of the analyzer, connect an appropriate networking cable to the computer modem terminal shown in Figure 2-10.

2-6. **COMPUTER PERIPHERALS**

A monitor, keyboard, and mouse may be connected to the analyzer computer. Remove the computer terminal cover and connect the peripherals to the terminals shown in Figure 2-10.
2-7. INSTALLATION INSPECTIONS

Perform the following equipment installation checks in the order provided.

**WARNING**
Install all protective equipment covers and safety ground leads after installation. Failure to install covers and ground leads could result in serious injury or death.

a. Mechanical Checks.
   1. Verify that the analyzer cabinet is securely mounted out of the path of direct sunlight.
   2. Verify that all the fiber optic cables are connected to mating terminals on the analyzer termination board. Ensure that all fiber optic cable connections are finger-tight.
   3. Verify the Raman probes are properly installed in the process stream. Verify that all probe shields are in place.
   4. Verify that the fiber optic cables and optic filters are connected to mating terminals on the probe. Ensure that all fiber optic cable connections are finger-tight.

b. Electrical Checks.
   1. Verify that analyzer input power is properly connected per Figure 2-9.
   2. Open the analyzer cabinet and verify that the computer POWER ON/OFF switch is in the ON position.
   3. Verify that the CCD camera controller POWER ON/OFF switch is in the ON position and close the analyzer cabinet.
   4. If using the remote networking, ensure the network cables are attached to the analyzer per Figure 2-10.
SECTION III. SETUP

3-1. COMMUNICATION SOFTWARE

When provided, the NetSupport Local Control program allows remote personal computers to communicate with the analyzer through a RF wireless network. The NetSupport software must be started each time the remote computer is turned on. If needed, refer to the software manual for more information. To initiate network access to the analyzer:

a. Select NETSUPPORT LOCAL CONTROL from the Windows™ START menu. The NETSUPPORT CONTROL screen (Figure 3-1) is displayed.

b. From the NETSUPPORT CONTROL screen, click on the menu CLIENTS and select CONNECT/DISCONNECT from the menu items. The KNOWN CLIENTS screen (Figure 3-2) is displayed.

c. In the KNOWN CLIENTS screen, click the analyzer you wish to control and click the CONNECT button. The program will prompt you when the connection is made.

d. After the program prompts that the connection is made, click the CLOSE button. You will be returned to the NETSUPPORT CONTROL screen. From the NETSUPPORT CONTROL screen, click on the menu SELECTED CLIENTS menu and select CONTROL from the menu items.

e. The program will display a message informing you how to switch from the client computer to the local computer. Click on the OK button.

f. The local computer will now display the RAMAN PROCESS ANALYZER screen of the MAIN program for the analyzer selected above.

Analyzers supplied with an Ethernet connection are equipped with pcANYWHERE™ software. The pcANYWHERE™ software provides TCP/IP protocol and allows a personal computer (PC) to communicate with multiple Raman Analyzers along a network. When provided, pc ANYWHERE™ also supports modem communication.
Figure 3-3. MAINCFG Program Structure
3-2. MAINCFG PROGRAM

This program is used for setting up and calibrating the Analyzer.

a. Starting the MAINCFG Program. Before starting the MAINCFG program, close the MAIN program, if running. Select FILE ⇒ EXIT from the MAIN file menu. To start the MAINCFG program, select MAINCFG from the Windows START menu. Figure 3-3 shows the MAINCFG program structure.

b. SETUP MENUS. The SETUP MENUS screen (Figure 3-4) displays when the program starts.

The selections following are available from the SETUP MENUS screen:

1. SYSTEM CONFIGURATION. Clicking on the SYSTEM CONFIGURATION button displays the SYSTEM CONFIGURATION MENU screen shown in Figure 3-5.

NOTE
When changing a configuration file, keep in mind that the file will be overwritten and the previous configuration will be lost.
The PLS SETUP screen allows you to enable or disable the PLS predictions used to display the histogram on the RAMAN PROCESS ANALYZER screen. Click on the ACCEPT button to accept the new calibration file. Click on the QUIT button to exit without changing the calibration file.

2 CONFIGURE STRIPS. Clicking on this button displays the CCD MAP screen (Figure 3-9). This screen allows you to select the regions of interest (ROI) on the CCD camera array. Use the GRAB AN IMAGE button to acquire an image. Click on and drag the lines on the image map to define the diamond reference channel and sample channel ROIs. Green lines define the ROI for the diamond reference channel. Black lines define the ROI for the sample channel. Click on the APPLY STRIPS button to save the new strip configuration. Click on the QUIT button to exit the CCD MAP screen.
3 FACTORY PARAMETERS.
This screen is for use by authorized Rosemount Service Representatives only.

4 CONFIGURE MODBUS.
Click on this button to display the CONFIGURE MODBUS screen in Figure 3-10. This screen allows you to configure the RS-485 serial port parameters. This screen is typically used by authorized Rosemount Service Representatives only.

The ACCEPT button saves the displayed parameters and returns you to the SYSTEM CONFIGURATION screen.

The QUIT button will ignore parameter changes and return you to the SYSTEM CONFIGURATION screen.

5 ACCEPT. Clicking on the ACCEPT button saves the new system configuration set and returns you to the SYSTEM CONFIGURATION MENU screen.
6 QUIT. Clicking on the QUIT button will discard the configuration changes made and will return you to the SYSTEM CONFIGURATION MENU screen.

(b) CREATE A NEW CONFIGURATION SET. This button [Figure 3-11] allows you to create a new configuration set using the same configuration menus as changing a configuration set. The program will prompt you for the file name before the SYSTEM CONFIGURATION screen displays.

(c) ENABLE A CONFIGURATION. This button allows you to select a configuration file. The program will prompt you for the configuration file to load.

(d) QUIT. Clicking on the QUIT button returns you to the MAIN screen.

---

Figure 3-11. SYSTEM CONFIGURATION MENU Screen

---

Figure 3-12. SETUP MENUS Screen

2. X-AXIS CALIBRATION. The X-AXIS CALIBRATION option [Figure 3-12] should be used by authorized Rosemount Service Representatives only.

3. PHOTOMETRIC CALIBRATION. Clicking this button displays a configuration message [Figure 3-13]. When the probe is mounted in the SURE calibration kit, click the CONTINUE button.

If the probe is not mounted in the SURE calibration kit, click the QUIT button to return to the SETUP MENUS screen.

---

Figure 3-13. Calibration Message
The PHOTOMETRIC CALIBRATION screen (Figure 3-14) is used during the analyzer calibration procedure outlined in paragraph 3-3.b of this section. When the number of scans to average has been entered, click the continue button. The analyzer performs a series of scans and averages the scans to display a calibration spectrum. When the spectrum is displayed, the following buttons appear on the bottom of the screen:

(a) RE-SAMPLE. Clicking the RE-SAMPLE button starts the calibration process over. The new averaged spectrum will display.

(b) STORE. Clicking the STORE button will save the calibration spectrum for use in the configuration set as the photometric calculation spectrum.

(c) QUIT. Clicking the QUIT button will exit without saving the spectrum and return you to the SETUP MENUS screen.

4. DARK CURRENT CALIBRATION. Clicking on the DARK CURRENT CALIBRATION button displays the DARK CURRENT CALIBRATION screen (Figure 3-15). This screen allows you to capture and save a dark scan used to cancel out the dark current background “noise” captured by the camera. To grab a dark scan, click on the RE-SAMPLE button. The scan will display on the CRT. To save the dark scan, click on the STORE button. To exit the DARK CURRENT CALIBRATION screen, click on the QUIT button.

5. ABOUT . Clicking the ABOUT button displays the program information, such as version and date.

6. END. Clicking on the END button exits the MAINCFG program.
3-3. **SETUP**

The following procedures are for setup and calibration of the analyzer. If you are inexperienced, or do not understand the procedures, contact an authorized Rosemount service representative for help.

The analyzer must be calibrated after any of the following occurs:

- Replacement of fiber optic cable(s).
- Replacement of Diode Laser.
- Adjustment of laser power.
- Process or configuration set change.

a. **Select A Configuration Set.** A configuration set must be selected prior to monitoring a process. After selecting a configuration set, the analyzer must be calibrated according to step 3-3.b.

An existing configuration set can be modified using the MAINCFG program. See CHANGE AN EXISTING CONFIGURATION on page 3-3 for more information on modifying an existing configuration set.

A new configuration set may be created using the MAINCFG program. See CREATE A NEW CONFIGURATION SET on page 3-6 for more information on creating a new configuration set.

After modifying or creating a new configuration set, the set must then be enabled. See ENABLE A CONFIGURATION on page 3-6 for more information on enabling a configuration set.

![Dark Current Calibration Screen](image-url)

Figure 3-15. DARK CURRENT CALIBRATION Screen
b. **Calibration.** Calibrate the analyzer according to the following procedure:

1. Verify that the correct configuration set is loaded for the process to be monitored.
   
   (a) Exit the MAIN program and start the screen.
   
   (b) Type the MAINCFG program.
   
   (c) Select the SYSTEM CONFIGURATION button from the SETUP MENUS screen.
   
   (d) Select ENABLE A CONFIGURATION from the SYSTEM CONFIGURATION MENU screen and enter the name of the file you will be using to monitor the process.

2. Remove the probe from the process stream. Clean all liquid and foreign material from the probe.

3. Carefully place the probe into the SURE calibration block and secure the probe.

4. From the SETUP MENUS screen, select PHOTOMETRIC CALIBRATION. The calibration message will display. If the probe is mounted in the SURE calibration kit, click the CONTINUE button. Otherwise click the QUIT button.

5. Using the PHOTOMETRIC CALIBRATION screen as described on page 3-7, set the number of scans to average to 1 and click the CONTINUE button. The analyzer begins the calibration process.

6. The analyzer will display a graph of the dark scan current followed by a display of the photometric curve.

7. Inspect the photometric curve for a quick rise or fall followed by a flat region. A flat region indicates that the detector is saturated; the probe must be backed away from the fluorescent glass. If no signal or a weak signal is shown on the spectrum, the probe must be moved toward the fluorescent glass.

8. If the spectral curve is not adequate, adjust the probe position two or three turns and select the RE-SAMPLE button to repeat the calibration process.

9. Repeat steps 7 and 8 as needed to achieve a smooth spectral curve. When an adequate spectral curve is displayed, set the number of scans to 10, select RE-SAMPLE, then select CONTINUE.

10. Press the STORE button to save the photometric calibration scan for use in the configuration file. The selected channel photometrics are now calibrated.

11. Remove the probe from the SURE calibration assembly and mount the probe in the process stream according to company guidelines.

12. Repeat steps 1 through 11 to calibrate the photometrics of another channel.
SECTION IV. OPERATION

4-1. **OVERVIEW**

This section covers analyzer operation. Before attempting to operate the analyzer, thoroughly read and understand the information provided in this Instruction Bulletin.

4-2. **SOFTWARE USAGE CONVENTIONS**

The following paragraphs describe how to select menu options and change operator-selected equipment parameters.

**NOTE**

“Display” and “window” refer to graphic and text overlays that appear on the CRT.

a. **Selecting a Menu Item.** Use the mouse to move the pointer over the desired menu item, usually a button, and click once with the left mouse button to select the menu item.

b. **Changing a Setup Variable.** To change an equipment setup variable, highlight the existing data block and type in the new value or use the displayed arrow buttons to increase or decrease the value shown.

To toggle an on/off setting, click the on/off switch image once with the left mouse button.

c. **Screen Options.** The following buttons are found on most histogram screens. Their functions are as follows:

1. This button zooms the image to include the extents of the x-axis. The switch displayed beside the button locks and unlocks this zoom selection.

2. This button zooms the image to include the extents of the y-axis. The switch displayed beside the button locks and unlocks this zoom selection.

3. This button allows the operator to change the format and precision of the x-axis values displayed.

4. This button allows the operator to change the format and precision of the y-axis values displayed.

5. This button allows the operator to choose from the following zoom selections:

   (a) This button allows the operator to select any area to zoom.

   (b) This button allows the operator to zoom on a specified x-axis area.

   (c) This button allows the operator to zoom on a specific y-axis area.

   (d) This button allows the operator to zoom in.

   (e) This button allows the operator to zoom out.

6. This button sets the cursor to its default icon. The operator cannot zoom or scroll using this icon.

7. This button allows the operator to scroll the display.
Figure 4-1. MAIN Program Structure
4-3. **MAIN PROGRAM STARTUP**

You can start the software by selecting the MAIN program from the Windows™ START menu. The program structure is illustrated in [Figure 4-1](#).

a. **Main Screen.** The RAMAN PROCESS ANALYZER screen (Figure 4-2) displays process information and a histogram chart for the specified process components. Up to eight process components can be displayed at one time.

Clicking on the OPERATOR MENUS button displays the PASSWORD VERIFICATION screen (Figure 4-3). Enter a valid password and click on the ACCEPT button. Clicking on the QUIT button returns you to the RAMAN PROCESS ANALYZER screen.
When a valid password has been entered, the **OPERATOR MENUS** screen (Figure 4-4) displays with the following menu options:

1. **SETUP.** Clicking on the **SETUP** button displays the **SETUP MENUS** screen (Figure 4-5). From this screen, you can select from the following menu items:

   (a) **ZERO CLIP.** This button displays the screen in Figure 4-6. This screen allows you to configure the display on the **MAIN screen** to either include or exclude negative numbers. When disabled, the **MAIN screen** will display negative numbers. Click on the **OK** button to return to the **SETUP MENUS** screen.

   (b) **DATA LOGGING.** Clicking on this button displays the **RAMAN ANALYZER DATALOG UTILITY** screen (Figure 4-7). This screen allows you to save compositional and spectral data. The concentration log saves the concentration levels of the monitored process as a .DAT file for further analysis. One file will contain all the concentration data.

   The process log saves the process spectra. The analyzer will create a new file containing the process spectrum for each scan requested.

   The Logging Period box indicates how often the analyzer saves a scan. To save every other scan, enter 2.

   (c) **BACK.** Clicking on the **BACK** button returns you to the **OPERATOR MENUS** screen.
2. GRAB SCAN. Clicking the GRAB SCAN button (Figure 4-8) displays the GRAB SCAN MENUS screen in Figure 4-9. The GRAB SCAN MENUS screen provides the following functions:

(a) GRAB SCAN. Clicking on the GRAB SCAN button displays the GRAB SCAN screen shown in Figure 4-10. The GRAB SCAN screen allows you to capture and save scans.
Clicking on the ACQUIRE button displays the SAVE AS screen shown in Figure 4-11. Use the Folders box to select the desired drive and file folder for scan data storage. In the File Name box, enter a name to identify the scan. Use the Save file as type box to select the file delimiter. When the file is properly named, click on the OK button. When OK is selected, the analyzer begins the grab and save process. The analyzer grabs the number of scans entered in the Replicates box. Clicking on the QUIT button returns you to the GRAB SCAN MENUS screen.

**Note**
The program will not allow you to Quit while the analyzer is collecting spectral data.
3. DIAGNOSTICS. Clicking on the DIAGNOSTICS button (Figure 4-12) brings up the DIAGNOSTIC MENUS screen shown in (Figure 4-13). The following menu items are displayed:

(a) VIEW CALCULATIONS. Clicking on the VIEW CALCULATIONS button displays the screen shown in Figure 4-14. The VIEW CALCULATIONS screen displays the calculations performed on the process and diamond data.

The Process spectrum is blue in color and the diamond spectrum is red in color.
The following items are displayed in the VIEW CALCULATIONS screen:

1. Raw Data. Displays the raw Raman spectrum and the raw diamond spectrum.
2. Dark Corrected. Shows the process and diamond spectra after dark current correction.
3. Diamond De-fluoresced. Shows the process and diamond spectra without the fluorescence effects.
4. X-Axis Corrected. Displays the process and diamond spectra after the x-axis calibration correction.
5. Photometrically Compensated. Displays the process and diamond spectra after radiometric calibration corrections.
6. Wavenumbers. Displays the process and diamond spectra after converting the x-axis values from wavelength to wavenumbers.
7. Standardized Spectrum. Shows the convolution-corrected process spectrum. The diamond spectrum is compared to a theoretical diamond spectrum in the Fourier domain to compute a transfer formula. The process spectrum is then convolved with the transfer formula.
8. SNV Standard Spectrum. Shows the process spectrum with a standard normal variant correction.
9. Diamond Ref (nm). Displays the peak of the diamond spectrum.
11. Camera Comms Failures. Shows how many times the analyzer’s computer lost communication with the CCD camera.

Click on the QUIT button (Figure 4-14) to return to the DIAGNOSTIC MENUS screen.

(b) VIEW ANALOG SIGNALS. This button (Figure 4-15) displays the ANALOG INPUT MEASUREMENTS screen in Figure 4-16. This screen displays the following items:

1. Laser Current (Amps). Displays the laser drive current usage.
2. Laser Power (Watts). Displays the output of the laser.
4. Instrument Temperature (°C). Displays the cabinet temperature.
5. QUIT. Returns you to the DIAGNOSTIC MENUS screen.

Figure 4-15. DIAGNOSTIC MENUS Screen
Figure 4-16. ANALOG INPUT MEASUREMENTS Screen

(c) VIEW DIGITAL I/O STATE. Clicking the VIEW DIGITAL I/O STATE button on the DIAGNOSTIC MENUS screen (Figure 4-15) displays the DIGITAL I/O STATE screen (Figure 4-17). This screen displays the current status of the digital I/O ports. You can turn the I/O ports on and off by clicking on the designated port button. Click on the QUIT button to return to the DIAGNOSTICS MENUS screen.

Figure 4-17. DIGITAL I/O STATE Screen
(d) SMART DIAGNOSTICS. Clicking on the SMART DIAGNOSTICS button on the DIAGNOSTIC MENUS screen displays the SMART DIAGNOSTICS MENUS screen (Figure 4-18). The following menu items are displayed:

1. Analyzer Software Status. This button displays the ANALYZER SOFTWARE STATUS screen in (Figure 4-19).

The ANALYZER SOFTWARE STATUS screen displays the software functions and the status of each function.

Clicking on the OK button displays the SMART DIAGNOSTICS MENUS screen.

Figure 4-18. SMART DIAGNOSTICS MENU Screen

Figure 4-19. ANALYZER SOFTWARE STATUS Screen
Analyzer Alarms Status. Clicking on the ANALYZER ALARMS STATUS button (Figure 4-18) displays the status screen shown in Figure 4-20.

The following functions are monitored:

Laser Power (Watt). Monitors the power consumption during laser operation. The upper and lower alarm limits can be set.

Laser Current (Amp). Monitors the laser amperage use during operation. The upper and lower alarm limits can be set.

Laser Thermistor (Ohm). Monitors the laser temperature. The upper and lower limits can be set.

Residual Limit. Monitors the calculated residual distance of the spectrum. The upper alarm limit can be set.

Mahalanobis Distance. Monitors the calculated Mahalanobis distance of the spectrum. The upper alarm limit can be set.

Cabinet Temperature (degrees C). Monitors the temperature in the cabinet. The upper alarm limit can be set.

Alarm Limits / Alarm Status: This screen displays the alarm settings for each monitor function (red is the upper limit and blue is the lower limit). To change a setting, use an authorized password.

![Figure 4-20. ANALYZER ALARMS STATUS Screen](27320040)

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4-11
Clicking on the PASSWORD AUTHORIZATION button displays the screen in Figure 4-21.

Enter a valid password and click the ACCEPT button to enter the password.

Clicking on the QUIT button returns you to the ANALYZER ALARMS STATUS screen.

When a valid password is entered, the ALARM LIMITS SET/FREEZE or ALARM STATUS ENABLED/DISABLED switch can be used. To change a switch position, select the switch image.

The ALARM LIMITS switch must be in the SET position to modify the alarm settings and in the FREEZE position to exit the status screen.

Analyzer alarm monitoring can be disabled by positioning the ALARM STATUS switch to the DISABLED position.

Clicking on the TRENDS button displays the TRENDS screen (Figure 4-22), a graphical history of the monitored functions.

Clicking BACK TO ALARMS PANEL returns you to the ANALYZER ALARMS STATUS screen.
Figure 4-23. SMART DIAGNOSTICS MENU Screen

Analyzer Performance Measures. Clicking ANALYZER PERFORMANCE MEASURES (Figure 4-23) displays the screen shown in Figure 4-24. Predicted averages for the following functions are displayed:

- **Residual.** This display is a calculated difference of the process spectrum and the “reference” spectrum. The calculation is performed and the resulting difference is displayed.

- **Mahalanobis Distance.** This display is a calculated difference of the process spectrum and the “reference” spectrum. The calculation is performed and the resulting difference is displayed.

- **Residual Spectrum.** The display is the residual spectrum after the calculation process is completed.

The hardware performance portion displays the average Laser Wavelength (nm) and the number of comm failures the analyzer has detected.

Clicking on the BACK button will return you to the SMART DIAGNOSTICS MENUS screen.

Figure 4-24. PERFORMANCE MEASURES Screen
Figure 4-25. DARK CURRENT & PHOTOMETRIC CORRECTION Screen

Figure 4-26. CALIBRATION PATH & MODEL Screen
4 Dark Current & Photometric Correction. Clicking on the DARK CURRENT & PHOTOMETRIC CORRECTION button (Figure 4-23) displays the screen in Figure 4-25. The upper screen display shows the dark current reference and process spectrums. The lower screen display shows the photometric response to standard material.

Clicking on the OK button returns you to the SMART DIAGNOSTICS MENU screen.

5 Calibration Path & Model. Clicking this menu button on the SMART DIAGNOSTICS MENU screen displays the CALIBRATION PATH & MODEL screen in Figure 4-26. This screen displays the calibration set in use and the partial least squares (PLS) iteration number being used in the calculations.

Clicking the BACK button on the CALIBRATION PATH & MODEL screen returns you to the SMART DIAGNOSTICS MENU screen (Figure 4-23).

6 Cancel. Clicking the CANCEL button of the SMART DIAGNOSTICS MENUS screen returns you to the DIAGNOSTIC MENUS screen (Figure 4-27).

(e) Back. Clicking the Back button in the DIAGNOSTIC MENUS screen (Figure 4-27) returns you to the OPERATOR MENUS screen (Figure 4-28).

Figure 4-27. DIAGNOSTICS MENUS Screen

Figure 4-28. OPERATOR MENUS Screen
4. **SET SECURITY.** Clicking the **SET SECURITY** button on the OPERATOR MENUS screen (Figure 4-28), displays the **SET SECURITY** screen (Figure 4-29). This screen allows you to set the screen availability for the password levels. If the screen box is checked, the screen is accessible using the current password level.

5. **SET PASSWORDS.** Clicking the **SET PASSWORDS** button on the OPERATOR MENUS screen (Figure 4-28), displays the **SET PASSWORDS** screen (Figure 4-30). This screen allows you to set the passwords for the specific access levels. You must enter the old password prior to entering the new password.

6. **GRAB DARK SCAN.** Clicking on the **GRAB DARK SCAN** button on the OPERATOR MENUS brings up the **GRAB DARK SCAN** Screen (Figure 4-31).

   This screen allows you to grab a new dark scan without having to exit the program and start the MAINCFG program. The analyzer will continuously grab and display a new dark scan every 1 to 2 minutes. To save a dark scan, click on the STORE button. To return to the OPERATOR MENUS screen, click on the QUIT button.

7. **ABOUT.** Clicking on the **ABOUT** button on the OPERATOR MENUS screen displays the program **ABOUT** screen (Figure 4-32). This screen identifies the name, date, and version of the program.

8. **QUIT.** Clicking on the **QUIT** button on the OPERATOR MENUS screen returns you to the RAMAN PROCESS ANALYZER screen.
SECTION V. PREVENTIVE MAINTENANCE

5-1. GENERAL

This section covers the routine preventive maintenance procedures for the Raman Process Analyzer under normal operating conditions. In most applications, the maintenance required for the analyzer is minimal.

5-2. CLEANING

In most applications, cleaning of the analyzer is not required. In facilities where accumulations of dust and/or chemical corrosives may impair equipment life, remove loose particulates with a soft-bristle brush. To remove soil deposits, clean the outer surfaces of the analyzer with a lint-free cleaning cloth dampened with mild soap and warm water.

WARNING
Install all protective equipment covers and safety ground leads after equipment repair or service. Failure to install covers and ground leads could result in serious injury or death.
SECTION VI. TROUBLESHOOTING

![WARNING]

Install all protective equipment covers and ground leads after troubleshooting. Failure to install covers and ground leads could result in serious injury or death.

6-1. GENERAL

This section describes how to identify and isolate equipment failures that may occur during operation of the Raman Process Analyzer. These troubleshooting procedures are designed for use by persons trained to operate the Raman Process Analyzer.

Operator level corrective actions are limited to adjusting the laser amperage and replacement of the items listed below. If equipment repair involves more than replacement of these components or laser current adjustment, notify your Rosemount Service Representative.

- fuses
- fiber optic cables
- CCD camera thermocouple
- 12 VDC cooling fans
- laser

6-2. ALARM MESSAGES

An alarm acknowledgement message is displayed in the control software whenever an alarm condition is detected. The message is only to tell the operator an alarm condition exists, it is the operator’s responsibility to access the ALARM STATUS screen to determine what the cause of the alarm is.

The ALARM SCREEN will indicate the alarm by flashing the specific alarm display with red.

The following is a list of the processes monitored by the Raman Process software. A brief description of the alarm and possible causes for its occurrence is provided for each alarm. For a more descriptive explanation of each alarm, refer to Section 4-3 Main Program Startup.

a. **Laser Power (Watt).** Monitors the watt usage of the laser. This alarm may indicate a problem with the laser or fiber optic cables.

b. **Laser Current (Amp).** Monitors the amp usage of the laser. This alarm may indicate a problem with the laser.

c. **Laser Thermistor (Ohm).** Monitors the temperature of the laser (displayed in ohms). The upper alarm indicates a cooling failure within the system. The lower limit indicates the laser is not up to operating temperature.

d. **Residual Limit.** Monitors the residual calculated spectrum. The displayed number indicates the distance from the “reference” spectrum. The high limit indicates a calculated spectrum outside the set range.

e. **Mahalanobis Distance.** Monitors the Mahalanobis calculated spectrum. The displayed number indicates the distance from the “reference” spectrum. The high limit indicates a calculated spectrum outside the set range.

f. **Cabinet Temperature (deg C).** Monitors the operating temperature of the cabinet enclosure. The upper alarm indicates a cooling failure and overheating of the cabinet. The lower limit indicates the cabinet is not at operating temperature.

6-3. TROUBLESHOOTING

[Figure 6-1] [Figure 6-2] and [Figure 6-3] provide additional troubleshooting guides for detecting the source of equipment faults in the Raman Process Analyzer system. The fault conditions are general. The faults may not be determined by an alarm condition, or reported by an alarm message. If any fault should occur, the condition will be apparent while monitoring or operating the Raman Process Analyzer.
Figure 6-1. Raman Troubleshooting Flowchart #1
Figure 6-2. Raman Troubleshooting Flowchart #2
Figure 6-3. Raman Troubleshooting Flowchart #3
SECTION VII. SERVICE

7-1. GENERAL

This section covers operator level service for the Raman Process Analyzer. Operator level service is limited to the following items:

- adjusting laser amperage
- replacing burned out fuses
- replacing damaged fiber optic cables
- replacing CCD camera thermocouple
- replacing 12 VDC cooling fans
- replacing the laser

If analyzer repair involves more than adjusting the laser amperage or replacing one or more of the listed components, notify an authorized Rosemount Service Representative.

The service instructions included here cover the replacement of the above items with the exception of fiber optic cables. Refer to Section III, Installation, for replacement of a fiber optic cable. Refer to the replacement parts listing in Section VII for applicable part numbers.

7-2. ANALYZER COMPONENT REPLACEMENT

WARNING
Install all protective equipment covers and safety ground leads after equipment repair or service. Failure to install covers and ground leads could result in serious injury or death.

a. Fuse Replacement

1. Turn the analyzer power OFF at the main disconnect box.
2. Verify that the analyzer cabinet is properly grounded.
3. Open the analyzer cabinet door.

CAUTION
Install only properly rated fuses in analyzers. Failure to install properly rated fuses may result in severe equipment damage.

Always wear a static band when working inside the analyzer cabinet. Failure to wear a static band could result in severe equipment damage.
4. See [Figure 7-1] for fuse locations. Remove the “blown” fuse and replace with a new fuse. Fuse specifications can be found on page 8-1. Install only properly rated fuses.

5. Close and secure the cabinet door.

6. Turn the analyzer power ON at the main disconnect box.

b. CCD Camera Thermocouple

1. Turn the analyzer power OFF at the main disconnect box.

2. Verify the cabinet is properly grounded.

3. Open the analyzer cabinet door.

**CAUTION**

Always wear a static band when working inside the analyzer cabinet. Failure to wear a static band could result in severe equipment damage.

4. Remove the screws attaching the CCD camera cooling cover to the CCD camera bracket. See [Figure 7-2].
5. Disconnect the thermocouple wire from the analyzer.

6. Remove the thermocouple retaining screw from the bottom of the CCD camera.

**NOTE**

Use care not to damage the thermocouple wire when installing the thermocouple retaining screw. Damage to the thermocouple wire could result in false thermocouple readings.

7. Replace the new thermocouple in the CCD camera. Use care not to damage the thermocouple wire when installing the new thermocouple in the CCD camera.

8. Reconnect the thermocouple wire to the analyzer.

9. Install the CCD camera cooling cover.

10. Close and secure the cabinet door.

11. Turn the analyzer power ON at the main disconnect box.

c. **Cooling Fans**

The following procedure is for replacing the laser cooling fan. Refer to page 8-1 for fan replacement specifications.

1. Turn the analyzer power OFF at the main disconnect box.

2. Verify the cabinet is properly grounded.

3. Open the analyzer cabinet door.

4. Disconnect the cooling fan power wires from the laser safety device. See Figure 7-3.

5. Remove the cooling fan from the laser heat sink by removing the four retaining screws.

6. Install the new cooling fan to the laser heat sink and secure in place with the four retaining screws.
7. Connect the cooling fan power to the laser safety device.

8. Close and secure the cabinet door.

9. Turn the analyzer power ON at the main disconnect box.

d. Laser Replacement

**WARNING**

Disconnect and lock out power source before working on electrical components. Failure to lock out power source may result in serious injury or death.

Before starting to service this equipment, read the “Safety instructions for the wiring and installation of the laser” and “Laser Safety Instructions” at the front of this Instruction Bulletin. Failure to follow the safety instructions could result in serious injury, death, or substantial property damage.

1. Turn the analyzer power OFF at the main disconnect box and lock out the power source.

2. Verify the cabinet is properly grounded.

3. Open the analyzer cabinet door.

**CAUTION**

Always wear a static band when working inside the analyzer cabinet. Failure to wear a static band could result in severe equipment damage.

4. Disconnect the MPT, MPL, and laser cooling fan leads from the laser safety device. See Figure 7-4.

5. Remove the four retaining nuts securing the laser module assembly to the cabinet.

6. Disconnect the SMA termination at the laser fiber optic connection.

7. Disconnect the SMA connection at the laser.

---

Figure 7-4. Laser Removal
8. Carefully remove the laser module assembly from the analyzer cabinet.

9. Remove the four retaining screws securing the laser to the module assembly.

10. Carefully remove the laser from the module assembly.

11. Apply a thin film of thermal grease to the mounting surface of the new laser.

12. Secure the laser to the module assembly with the four retaining screws.

13. Place the laser module assembly on the laser module mount in the analyzer cabinet.

14. Connect the laser fiber optics to the laser and SMA termination.

15. Secure the laser module assembly to the cabinet with four retaining nuts.

16. Immediately do the Laser Current Adjustment procedure before turning equipment power ON.

e. **Laser Current Adjustment**

The laser current must be adjusted after a fiber optic cable change, laser replacement, or a new process is being analyzed.

1. Adjust VR102 on the laser safety device counterclockwise, closing the current flow from the laser safety device.

2. Turn the Current Limit Adjust screw to the fully negative position (counterclockwise). The screw is located on the MPL.

3. Turn the Output Current Adjust screw to the fully negative position (counterclockwise). The screw is located on the MPL.

4. Turn the analyzer power ON at the main disconnect box.

5. In the Raman control software, display the View Analog Signal screen.

6. Adjust VR102 to the fully open position (clockwise), allowing current to be supplied to the MPL. The screw is located on the Laser Safety Device.

7. Adjust the Laser Current Adjust screw to the fully open position (clockwise).

8. While monitoring the Laser Current (Amps) display on the Analog Input Measurements screen, adjust the Laser Current Limit screw clockwise slowly until the desired Laser Current (Amps) measurement +0.25 Amps is displayed.

9. While monitoring the Laser Current (Amps) display, adjust VR102 screw counterclockwise until the laser current display changes slightly. Try to adjust VR102 to maintain the desired laser current +0.24 Amps displayed on the Laser Current (Amps).

10. While monitoring the Laser Current (Amps) display, turn the Laser Current Adjust screw counterclockwise slowly until the desired laser current is displayed on the Laser Current (Amps).

11. If required, allow the system to operate for at least 15 minutes prior to adjusting the alarm thresholds according to the new laser power settings.

12. Turn the analyzer power OFF at the main disconnect box.

13. Close and secure the cabinet door.

14. Turn the analyzer power ON at the main disconnect box.
7-3. **ANALYZER CALIBRATION**

The analyzer must be calibrated after any of the following events:

- Replacement of a fiber optic cable.
- Replacement of a diode laser.
- Adjustment of laser power.
- Change to the process chemistry or to the configuration set.

To calibrate the analyzer:

a. Verify the correct configuration set is loaded for the process to be monitored.

1. Exit the MAIN program and start the MAINCFG program.
2. Select the SYSTEM CONFIGURATION button from the SETUP MENUS screen.
3. Select ENABLE A CONFIGURATION from the SYSTEM CONFIGURATION screen.
4. Type the name of the configuration file you will be using to monitor the process.

b. Remove the probe from the process stream. Clean all liquid and foreign material from the probe.

c. Carefully insert the process probe into the SURE calibration block. Tighten the nylon nut to secure the probe.

d. From the SETUP MENUS screen, select PHOTOMETRIC CALIBRATION. The calibration message will display.

If the probe is mounted in the SURE calibration block, click the CONTINUE button. Otherwise, click the QUIT button.

e. Using the PHOTOMETRIC CALIBRATION screen (page 3-7), enter the number of scans you wish to average.

f. Click the CONTINUE button. The analyzer begins the calibration process.

g. The analyzer will take and display a dark scan. Inspect the scan for ambient light leaks.

h. The analyzer will then take, average, and display the photometric calculation spectrum.

Inspect the spectrum for quick drops followed by flat spectrum. This indicates the detector is being saturated and the probe must be moved away from the fluorescent glass.

If no signal, or a weak signal is shown on the spectrum, the probe tip must be moved closer to the fluorescent glass.

If the spectrum is inadequate, adjust the probe position as needed.

i. Click the RESAMPLE button. The calibration process will repeat.

j. When an adequate spectrum is displayed, click the STORE button. This saves the photometric calibration spectrum for use in the configuration file.

k. Remove the probe from the calibration block and mount the probe in the process stream. The analyzer is now calibrated.
## SECTION VIII. REPLACEMENT PARTS

Table 8-1. Replacement Parts for the Raman Process Analyzer

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SECTION IX. RETURNING EQUIPMENT TO THE FACTORY

9-1. RETURNING EQUIPMENT

If factory repair of defective equipment is required, proceed as follows:

a. Secure a return authorization number from a Rosemount Analytical Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.

In no event will Rosemount be responsible for equipment returned without proper authorization and identification.

b. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to insure that no additional damage will occur during shipping.

c. In a cover letter, describe completely:

1. The symptoms from which it was determined that the equipment is faulty.

2. The environment in which the equipment has been operating (housing, weather, vibration, dust, etc.).

3. Site from which the equipment was removed.

4. Whether warranty or nonwarranty service is requested.

5. Complete shipping instructions for return of equipment.

6. Reference the return authorization number.

d. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in Rosemount Return Authorization, prepaid, to:

Rosemount Analytical Inc.
RMR Department
1201 N. Main Street
Orrville, Ohio 44667
330/684-4436

If warranty service is requested, the defective unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Rosemount warranty, the defective unit will be replaced at Rosemount’s option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

Contact Rosemount Analytical Customer Service at 1-800-433-6076.
| **GLOSSARY** |
|--------------|--------------------------------------------------|
| **Calibration** | The process of tuning the analyzer to monitor specific process elements. |
| **CCD Camera Thermocouple** | Equipment used to monitor the CCD camera head temperature. |
| **Configuration Set** | The collection of calibration information used to monitor a process for specific substances. |
| **Dark Current Calibration** | The process of calibrating the analyzer to eliminate ambient light from the monitored process spectrum. |
| **Diamond De-fluoresced** | The process of adjusting the diamond reference spectrum to remove ambient light. |
| **Fiber Optic Cable** | Thin transparent fibers of glass or plastic enclosed in light-proof material used to transmit light signals. |
| **Histogram** | A graphical representation of a spectrum frequency. |
| **In Situ** | A method of analyzing process gases without removing them from the process stream. |
| **MPL** | Laser diode driver module which provides the interface, control, and drive for the laser module. |
| **MPT** | Laser temperature controller module which provides the interface and drive for the thermoelectric cooler in the laser module. |
| **Photometric Calibration** | The process of calibrating the analyzer using known parameters to eliminate equipment variables from the photometric calculation. |
| **Raman Spectroscopy** | The analysis of spectral composition of scattered light (process spectrum) as compared to the original incident light (diamond reference). |
| **Spectrograph** | The equipment used to separate the wavelengths of light and direct the desired wavelengths to the CCD camera. |
| **Spectrum** | The image formed from dispersed wavelengths that are focused and arranged in a specific order. |
| **SURE Calibration** | The process of calibrating the analyzer using a photometric response standard (included in the SURE calibration kit) to measure the photometric response of the analyzer and adjust the photometric calculation accordingly. |
| **Wavelength** | The distance of a line from any one point of a wave to the same point on the next corresponding waveform. |
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