Reference Manual
00809-0100-5800 , Rev BC
April 2022

Rosemount™ CT5800 Continuous Gas Analyzer

ROSEMOUNT™

EMERSON™

Preface

Published by Emerson.

If you require additional technical assistance, request help from cascade.support@emerson.com or Emerson distribution partners.

Send general inquiries to cascade.support@emerson.com.

Important information

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

Important
Users must read, understand, and comply with the following information before proceeding.

All users, installers, operators, and maintainers must be familiar with operating the analyzer. To install, start up, operate, maintain, and service the analyzer in a safe manner, it is MANDATORY to read all additional instruction manuals shipped with the analyzer. The following instruction manual(s) are available and/or referenced within this manual:

Rosemount CT5800 Quick Start Guide: 00825-0100-5800

User information

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

Important
All users must read this page before proceeding!

Emerson (Rosemount) designs, manufactures, and tests its products to meet many national and international standards. The Rosemount CT5800 is a sophisticated technical product, and to ensure it continues to operate as designed and within normal specifications, it MUST be installed, used, and maintained correctly. The following instructions MUST be adhered to and integrated into your safety program when installing, using, and maintaining Emerson (Rosemount) products.

- Failure to follow the proper instructions may cause:
  - Loss of life
  - Personal injury
  - Damage to property
  - Damage to this instrument
  - Warranty invalidation
- Read all instructions prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, contact your Emerson (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 manual and in accordance with 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 the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Emerson (Rosemount).
- Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, and VOID YOUR WARRANTY. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- To prevent electrical shock and personal injury, all equipment doors must be closed and protective covers in place, except when maintenance is being performed by qualified personnel.
- The information contained in this document is subject to change without notice.

General safety notice/residual risk

Installation, operation, and maintenance of the analyzer must be in accordance with these instructions.

When operated as intended and all applicable safety instructions are observed, an element of risk will remain, including, but not limited to, the following:

- Explosion protection measures may become ineffective on the occurrence of one failure (for Category 3 instruments).
- The emission of gases hazardous to health may be possible when all gas connections have been correctly made.

To avoid exposure to the dangers of residual risks, take particular care when installing, operating, maintaining, and servicing the analyzer.

Authorized personnel

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

In-depth specialist knowledge is an absolute requirement for working with and on the analyzer. Personnel installing, operating, servicing, and maintaining the analyzer must be instructed, trained, qualified, and authorized for hazardous areas with the operating company and the manufacturer. It is the operating company's responsibility to:

- Train staff
- Observe safety regulations
- Follow the safety instructions and procedures in the product manual

Operators must:

- Be trained
- Read and understand all relevant sections of the product manual before commencing work
- Know the safety mechanisms and regulations

⚠ WARNING

To avoid explosions, loss of life, personal injury, and damage to this equipment and on-site property, do not install, operate, maintain, or service this instrument before reading and understanding this instruction manual and receiving appropriate training.

Regulations and standards

Regulations / Standards	Description
2014/35/EU	The Low Voltage Directive
94/9/EC (until April 19, 2016)(1)	The ATEX Directive
2014/34/EU (from April 20, 2016)(2)	
2014/30/EU	The Electromagnetic Compatibility Directive
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE) Directive
USA 21 CFR 1040.1	Laser products
NEC 505	National Electrical Code (issued by ANSI: American National Standards Institute and NFPA 70: National Fire Protection Association)
EN 6223: 2008	EMC Safety Standard
IEC 60079-10: 2002-06	Electrical apparatus for explosive gas atmospheres. Part 10: Classification of hazardous areas
IEC 60529:1992 + A2 2013	Ingress protection
BS EN 60825-1:2007	Safety of laser products. Equipment classification and requirements (identical to IEC 608250-1 2007).
BS EN 61010-1 2010 IEC 61010-1 2010	Safety requirements for electrical equipment for measurements, control, and laboratory use. General requirements.
IEC 61241-10: 2004-06	Electrical apparatus for use in the presence of combustible dust. Part 10: Classification of areas where combustible dusts are or may be present.
BS EN 61326-1: 2013	Electrical equipment for measurement, control, and laboratory use. EMC requirements. General requirements.
BS EN60079-0: 2012	Explosive atmospheres - Part 0: Equipment - General requirements
BES EN 60079-1: 2014	Explosive atmospheres. Equipment protection by flameproof enclosures *d*
IEC 60079-0:2011 Ed 6	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-1:2014 Ed 7	Explosive atmospheres, Part 1: Equipment protection by flameproof enclosures *d*
UK Statutory Instruments 2016 No. 1101	The Electrical Equipment (Safety) Regulations 2016
UK Statutory Instruments 2016 No. 1107	The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 2016
UK Statutory Instruments 2016 No. 1091	The Electromagnetic Compatibility Regulations 2016
UK Statutory Instruments 2013 No. 3113	The Waste Electrical and Electronic Equipment Regulations 2013

(1) May affect equipment tested prior to April 20, 2016, but shipped at a later date.

(2) All equipment tested from April 20, 2016 will be subject to the directive.

Associated publications

Quick Start Guide

Compliance approvals

This product complies with USA 21 CFR 1040.10.

This product is designed and manufactured under an approved quality management system to ISO 9001: 2015.

Emerson and the Rosemount CT5800 have satisfied the requirements for applying the CE and UKCA marking to the Rosemount CT5800 Gas Analyzer.

This equipment meets all requirements of the EMC and Low Voltage directives.

Explosive / hazardous area protection

This article is in accordance with IEC 60079-0: 2011 Clause 30.

This article must not be changed, amended, or removed.

Emerson has satisfied the requirements of and complies with IEC, ATEX, and North American regulators for operation of electrical/electronic equipment in hazardous locations .

Waste disposal

Do not dispose of measuring tools into household waste.

Only for EC countries:

In accordance with European Directive 2012/19/EU for Waste Electrical and Electronic Equipment and its implementation into national right, measuring tools that are no longer usable must be collected separately and disposed of in an environmentally correct manner.

Safety and information notices

This article is in accordance with IEC 60079-0: 2011 Clause 30. This article must not be changed amended or removed. All authorized users, installation, operation and maintenance personnel, must observe the following safety precautions and warnings.

⚠ DANGER

WILL CAUSE DEATH

Failure to follow this warning will result in death or serious injury to personnel.

⚠ WARNING

DANGER TO PERSONNEL

Failure to follow this warning may result in death or serious injury to personnel.

⚠ CAUTION

MAY CAUSE DAMAGE TO EQUIPMENT

Failure to follow this warning may result in damage to the equipment.

NOTICE

Important or tip messages will appear in this format.

Safety information

All authorized users, including installation, operation, and maintenance personnel, must observe the following safety precautions and warnings.

This article is in accordance with IEC 60079-0: 2011 Clause 30.

This article must not be changed, amended, or removed.

⚠ DANGER

FLAMMABLE SUBSTANCES

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Internal parts of the analyzer may reach temperatures of 140 °F (60 °C) and may present an ignition source. Failure to observe this warning will cause death, personal injury, and/or damage to persons and/or property.

Exercise care when using oil, paint, cleaning rags, and other flammable substances near the analyzer. A fire may result if this precaution is not observed. Always assume that the interior of an analyzer is hot unless it has been switched off and allowed to cool down.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this precaution will cause death, personal injury, and/or damage to persons and/or property.

This analyzer operates using mains voltage that is dangerous to life.

Make sure the circuit breakers are set to OFF and tagged off before opening the front cover.

⚠ DANGER

FAILURE TO LOCK-OUT GAS HANDLING SYSTEM WILL CAUSE DEATH.

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Unauthorized operation of the gas handling system when maintenance is being performed on the analyzer or its associated pipes/hoses may result in highly flammable gas being released, causing fire or explosion.

Always lock out the gas handling system when shutting down the analyzer.

⚠ DANGER

FAILURE TO VENT SAMPLE GAS WILL CAUSE DEATH.

This article is in accordance with IEC 60079-0: 2011 Clause 30.

The sample gas in the system must be vented to prevent fire or explosion during maintenance and to prevent damage to the analyzer during startup.

The sample gas in the pipes leading to the analyzer must be purged to prevent hazards to personnel during maintenance. Purging the sample gas must be done in accordance with the safe working procedures for the site.

Allow the analyzer and system for returning the sample gas to run for five minutes to allow any sample gas in the system to be returned to the exhaust.

⚠ WARNING

EXPLOSION HAZARD

The unit described in this manual may not be used in explosive atmospheres without additional safety measures.

⚠ WARNING

ELECTRICAL SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Installation requires access to live parts which can cause death or serious injury.

Do not operate without covers secure.
Do not open while energized.
For safety and proper performance, this instrument must be connected to a properly grounded three-wire source of power.

⚠ WARNING

TOXIC GASES

The analyzer's exhaust may contain toxic gases, such as (but not limited to) sulfur dioxide. These gases can cause serious injuries.

Avoid inhaling exhaust gases.
Connect the exhaust pipe to a suitable flue and inspect the pipes regularly for leaks.
Make sure all connections are airtight to avoid leaks.

⚠ WARNING

GASES HAZARDOUS TO HEALTH

Follow the safety precautions for all gases (sample and span gases) and gas cylinders.
Before opening the gas lines, purge them with air or neutral gas (N_2) to avoid danger from escaping toxic, flammable, explosive, or hazardous gases.

⚠ WARNING

FLAMMABLE OR EXPLOSIVE GASES

When supplying explosive gases or flammable gases with concentrations of more than 25% of the lower explosion limit, Emerson recommends implementing one or more additional safety measures:

Purging the unit with inert gas
Stainless steel internal pipes
Flame arrestors on gas inlets and outlets
Infallible measuring cells

⚠ WARNING

CONNECTING UNITS FOR PERMANENT INSTALLATION

Failure to complay may cause the risk of injury or death and invalidate the analyzer's warranty. Working on units equipped with screw-type terminals for electrical components may result in the exposure of energized components.

Only qualified personnel familiar with possible risks should install the analyzer.
Wall-mounted units have no power switch and are operational when connected to a power supply. The operating company is therefore required to have a power switch or circuit breaker (as per IEC 60947-1/-3) available on the premises. This switch must be installed near the unit, easily accessible to operators, and labeled as a power cut-off for the analyzer.

⚠ WARNING

EXPLOSION HAZARD

Exhaust gases may contain hydrocarbons and other toxic gases, such as carbon monoxide. Carbon monoxide is toxic. Faulty gas connections may lead to explosion and death.

Ensure that all gas connections are connected as labeled and airtight.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011, Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation, which if not avoided, could result in death or serious injury.

Read all instruction manuals (including versions for auxiliary equipment) before installing this instrument.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

When installing and wiring this equipment, comply with all relevant national legislative requirements and regulations. Consider all safety instructions within this manual and all associated analyzer manuals.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

When the analyzer is out of order, shut off all inputs and outputs connected to external equipment.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

Only properly trained personnel who understand the content of all applicable manuals and related instructions must conduct the startup procedure.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

Do not open in an explosive atmosphere.

AVERTISSEMENT

Ne pas ouvrir si une atmosphère explosive gazeuse est présente.

⚠ WARNING

Do not open when energized.

AVERTISSEMENT

Ne pas ouvrir sous tension

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to comply will void certification and may cause explosions. Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

Use only replacement parts and components authorized by Emerson. All replacement parts and components must be suitable Ex-certified components for use in hazardous areas.

⚠ WARNING

EXPLOSION HAZARD BY BATTERY

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

The Rosemount CT5800 contains a low voltage battery for data backup purposes on the CPU.
Under normal operating conditions, there is no need to replace the battery during the analyzer lifetime. However, if you do replace it, make sure to only use the same type and model.

⚠ WARNING

OPTICAL RADIATION EXPOSURE HAZARD

The analyzer contains lasers. Opening the analyzer and attempting to perform adjustments or procedures other than those specified in this manual may result in hazardous optical radiation exposure.

Failure to follow the correct procedures may cause damage to the eye.

The Rosemount CT5800 is Class 1. The beams are fully enclosed, and there is no access to the laser beams while the product is in operation or during maintenance. Do not look at the lasers with any kind of magnifier or optical measuring device.

The use of control or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

In accordance with USA 21 CFR 1040, the Rosemount CT5800 has warning labels at appropriate positions.
The locations of the safety labels in the analyzer are specified in Safety and system labels and annotation.

Classification

There are three types of lasers that may be included in the Rosemount CT5800: Quantum Cascade Lasers (QCLs), Interband Cascade Lasers (ICLs), and Tunable Diode Lasers (TDLs). The characteristics of the lasers contained within are given in the table below.

Parameter	QCL	ICL	TDL	Comments
Operation mode	Pulsed	Pulsed	Pulsed	
Lasers per system	1 - 6	1 - 6	1 - 6	Maximum of 6 lasers per system
Wavelength	4 -10 µm	2 - 5 µm	760 nm	
Power	< 5 mW	< 5 mW	< 5 mW	
Pulse duration	< 1 µs	1 µs	< 5 µs	

Parameter	QCL	ICL	TDL	Comments
Pulse repetition frequency	< 100 kHz	< 100 kHz	< 100 kHz	
Duty cycle	< 5%	< 5%	< 5%	

⚠ WARNING

HAZARDOUS SUBSTANCES

Gas handling components within the analyzer will contain particulate matter residue from the sample gases. Over the life of the analyzer, the concentration of the particulate matter will become enriched within the gas handling components.

When performing repairs or maintenance on the analyzer:

- Handle used gas handling components with extreme caution.
- Avoid direct skin contact with used gas handling components.
- Do not smoke, drink, or eat in the work area.
- Wear goggles or eye shields.
- Wear a suitable face mask to protect against inhalation of particulate matter.
- Do not wet fingers, eyes, or any exposed skin.
- Pack used gas handling components for disposal in sealed packaging and label them *Contaminated*.
- Dispose of contaminated items as hazardous material according to the applicable local, national, or international health and safety regulations and pollution regulations.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Unauthorized operation of the gas handling system when maintenance is being performed on the analyzer or its associated pipes/hoses may release highly flammable gas, causing fire or explosion.

Always lock-out tag-out the gas handling system when shutting down the analyzer.

⚠ WARNING

HEAVY ITEM

Handle the analyzer with caution during unpacking, installing, maintaining, and transporting to prevent crushing of hands, feet, or other body parts.

The analyzer weighs 176.4 lb. (80 kg). Always use suitable lifting/moving equipment when moving the analyzer.

Wear suitable protective gloves and protective footwear.

When preparing the analyzer for transport by air, road, or rail, safeguard the analyzer against movement or break-away during transport by securely strapping it in place.

⚠ WARNING

HEAVY INSTRUMENT

Failure to observe this warning and/or follow safety instructions could result in death or serious injury.

- The analyzer weighs 176.4 lb. (80 kg) and must be wall or frame mounted.
- Emerson recommends that a minimum of two people move and lift the analyzer using suitable lifting and transportation equipment.
- Use suitable fasteners for weight of the analyzer.
- Make sure the wall or stand the analyzer is mounted on is solid, stable, and of suitable material to hold the analyzer.
- Do not mount the analyzer on stud or partition walls.

⚠ WARNING

HAZARDOUS GAS

This article is in accordance with IEC 60079-0: 2011 Clause 30.

The product stream that the analyzer is examining may be hazardous even at low concentrations.

Therefore, take special care to ensure that the sample gas return port either returns the sample gas to the product stream or discharges the sample gas to a location that will not cause a hazard.

⚠ WARNING

ELECTROSTATIC CHARGING HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

The keypad is non-conducting and may generate an ignition capable level of electrostatic charges under certain extreme conditions.

Ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high pressure steam) which might cause a build-up of electrostatic charges on non-conducting surfaces. Only clean equipment with a damp cloth.

AVERTISSEMENT

Danger potentiel de charges électrostatiques – voir instructions

⚠ WARNING

HIGH PRESSURE GAS AND AIR

This article is in accordance with IEC 60079-0: 2011 Clause 30.

The calibration gas supply and compressed air supply operate at a pressure that can cause injury, e.g., damage to eyes and skin punctures from debris blown by the high pressure gas or compressed air.

Always lock off or tag off the calibration gas supply and compressed air supply when shutting down the analyzer.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

- Do not touch any part of the analyzer.
- Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
- Always wear proper protective equipment when handling the analyzer.
- Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
- The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.

⚠ WARNING

CRUSHING HAZARD

Take care not to crush hands when closing the frront door of analyzer field housings.
Keep out of the closing area between the enclosure cover and base.

⚠ WARNING

EXPLOSION

Danger of explosion if battery is incorrectly replaced.

Replace with only the same or equivalent type of battery.

AVERTISSEMENT

Risque d'explosion si la pile n'est pas remplacée correctement. Remplacer uniquement par une pile de type identique ou équivalent.

⚠ WARNING

Physical access

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

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

⚠ CAUTION

EQUIPMENT DAMAGE

Failure to follow the startup procedure may result in damage to the analyzer.

Always follow the startup procedure.

⚠ CAUTION

EQUIPMENT DAMAGE

Failure to follow the shutdown procedure may result in damage to the analyzer.

Always follow the shutdown procedure.

⚠ CAUTION

UNSERVICEABLE EQUIPMENT

If the pressure and temperature measurements are out of tolerance, refer to Troubleshooting and diagnostics for guidance.

⚠ CAUTION

EMC

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case you may be required to take adequate measures.

⚠ CAUTION

EQUIPMENT DAMAGE

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

⚠ CAUTION

EQUIPMENT DAMAGE

Ensure that the local power voltage where the unit is to be installed corresponds to the unit's nominal voltage as given on the name plate label.

⚠ CAUTION

EQUIPMENT DAMAGE

Do not power up or try to operate the analyzer unless it is physically secure and all electrical and pneumatic connections to the analyzer are in place.

Before commencing the start-up process, it is important to ensure that electrical power, sample gas handling facilities, and any calibration gases that are required are available to the analyzer.

⚠ CAUTION

EQUIPMENT DAMAGE

Additional notes for units with screw-type terminals:

Cables for external data processing must be double-insulated against mains power.

If this is not possible, cables must be laid in such a way as to guarantee a clearance of at least 0.2 in. (5 mm) from power cables. This clearance must be permanently secured (e.g., with cable ties).

Safety and system labels and annotation

The labels and annotation applied to the analyzer are specified in the table below.

Label type	Example	Location
Identification label (including serial number, model number, and USA FDA compliance label	Made in the UK Manufactured XXXX 2017 Rosemount CT5800 Continuous Gas Analyzer Serial number: CT5800-XXXX Model number: CT5800 Emerson Process Management Ltd 2 Hunt Hill Cumbernauld Glasgow G68 9LF Emerson.com/RosemountGasAnalysis 	Bottom right
Laser radiation CAUTION label		Interior on analysis cell
Laser module identification label		On each laser module housing
Earth identification label		Back plate
WARNING statement		Interior adjacent to electric power connections
AC power supply voltage label		Interior adjacent to electric power connections
AC power supply Danger label		External on base adjacent to mains power input conduit

Contents

Chapter 1 Plan 19
1.1 Description 19
1.2 Equipment purpose and role 20
1.3 System overview 21
1.4 Customer information 23
1.5 Safety precautions and conditions for safe use 24
1.6 Qualified personnel 25
1.7 Software version 25
1.8 Gas detection 25
1.9 Detailed system specifications 26
1.10 Unpacking the analyzer 30

Chapter 2 Install 33
2.1 Site requirements 33
2.2 Mounting 35
2.3 Connecting the system 37
2.4 Test connections 49
2.5 Closing the housing 53
2.6 Commissioning 54

Chapter 3 Start-up procedure 55
3.1 Introduction 55
3.2 Preparation for use 55
3.3 Start-up procedure 56

Chapter 4 Operating the analyzer 59
4.1 Introduction 59
4.2 Normal operation 59
4.3 Front panel controls and indicators 60
4.4 Display controller 62
4.5 Gas Sensor Main Screen 63
4.6 Pressure and Temperature screen 64
4.7 Help system 65
4.8 Main menu 66
4.9 BACK button 66

Chapter 5 Verifying gas concentrations 67
5.1 Verification 67

Chapter 6 Gas calibration 77
6.1 Required tools 77

6.2 Gas service menu definitions 77
6.3 Calibration 78

Chapter 7 Troubleshooting and diagnostics 87
7.1 Troubleshooting, repairs, and failure diagnostics 87
7.2 Using the Built-in Self-Test (BIST) fault diagnostics 91
7.3 Faults menu 95
7.4 Diagnostics menu 97
7.5 Visual examination 98
7.6 Failure diagnostics 99
7.7 Repairable items 103
7.8 Tools required for troubleshooting 104
7.9 Opening the enclosure 105
7.10 Replacing the display and control buttons 107
7.11 Replacing the fuses 111
7.12 Replacing the terminal electric cooler (TEC) board 115
7.13 Replacing the peripheral board 118
7.14 Replacing the motherboard 121
7.15 Replacing the DIN rail components 125
7.16 Optical and pneumatic repairs 143
7.17 Closing the enclosure 152

Chapter 8 Shutdown procedure 155
8.1 Safety precautions 155
8.2 Shutdown procedure 156

Chapter 9 Preventative maintenance 161
9.1 Maintaining the analyzer 161
9.2 Scheduled maintenance 161

Appendix A CSA / IECEx Certificates 163
A.1 CSA Certification 164
A.2 IECEx Certification 168

Appendix B Theory of operation 173
B.1 Overview 173
B.2 Laser measurement principle 173
B.3 Gas concentration measurements 173

Appendix C Spare parts list 175

Appendix D Engineering drawings 177
D.1 List of engineering drawings 177

Appendix E Glossary and abbreviations 183

1 Plan

1.1 Description

The Rosemount™ CT5800 Continuous Gas Analyzer, referred to hereafter as Rosemount CT5800 or analyzer, is an electronic sensor that uses laser spectroscopy to perform analysis of process gas streams.

The function of the analyzer is to detect and measure up to twelve different types of gas at concentrations ranging from parts per million (ppm) to percentage levels in the process gas stream.

Built within a flameproof enclosure, the analyzer is designed for operation in potentially explosive environments to measure industrial process applications requiring Ex hazardous area certification.

The analyzer is designed to be wall mounted. However, take care to make sure that the analyzer is not exposed to vibration and/or excess low frequency.

⚠ WARNING

HEAVY ITEM

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to properly handle the analyzer may cause injury to personnel.

- Make sure the wall the unit is mounted on is solid, stable, and of a suitable material to hold the weight of the analzyer.
- Handle the analyzer with caution during unpacking, installing, maintenance, and transporting to prevent crushing of hands, feet, or other body parts.
- The analyzer weighs 176.4 lb. (80 kg).
- Emerson recommends that a minimum of two people move and lift the analyzer.
- Wear suitable protective gloves and protective footwear.

Note
This manual is intended for the personnel who install, operate, and maintain the equipment.

1.1.1 Intended use

The Rosemount CT5800 is intended to be used as an analyzer for industrial purposes. Do not use the analyzer in medical, diagnostic, or life support applications or as a safety device.

⚠ WARNING

An interruption of the protective earth line (e.g. in an extension cable) may result in risk to operators.

⚠ WARNING

Live parts are accessible when operating the analyzer with doors open or covers removed.

⚠ WARNING

The emission of gases hazardous to health may be possible even when all gas connections have been correctly made.

1.1.2 Notes on batteries

This analyzer contains an Li battery (button cell) of type CR 2032. The battery is soldered into position and usually does not need to be replaced during the analyzer's lifetime.

At the end of lifetime, dispose of the analyzer in compliance with the waste regulations.

⚠ WARNING

EXPLOSION

Batteries may leak, overheat, or explode if not handled propery.

Do not open or try to charge a battery.
Do not expose batteries to heat or fire.
Replace batteries only with the same or equivalent type of battery.

AVERTISSEMENT

Risque d'explosion si la pile n'est pas remplacée correctement. Remplacer uniquement par une pile de type identique ou équivalent.

1.1.3 Installing and connecting the unit

The following notices should be followed to ensure compliance with the low voltage directive (Europe) and other applicable regulations.

- Suitably ground all connectors provided for this purpose.
- Properly reinstate all safety covers and grounding connections after maintenance work or troubleshooting.
- Provide a fuse at the installation site which will completely disconnect the analyzer in case of failure. Installing an isolating switch may also be beneficial. In either case, these components must be constructed to conform to recognized norms.

1.2 Equipment purpose and role

The analyzer is a gas sensor system that can be configured to measure the concentrations of multiple small molecules in a gas sample that is provided to the analyzer via a sample line.

The types of molecules that are measured depend on the system configuration.

Figure 1-1: Rosemount CT5800

The analyzer can be configured to detect and measure up to twelve different gases, depending on the combination of laser modules fitted.

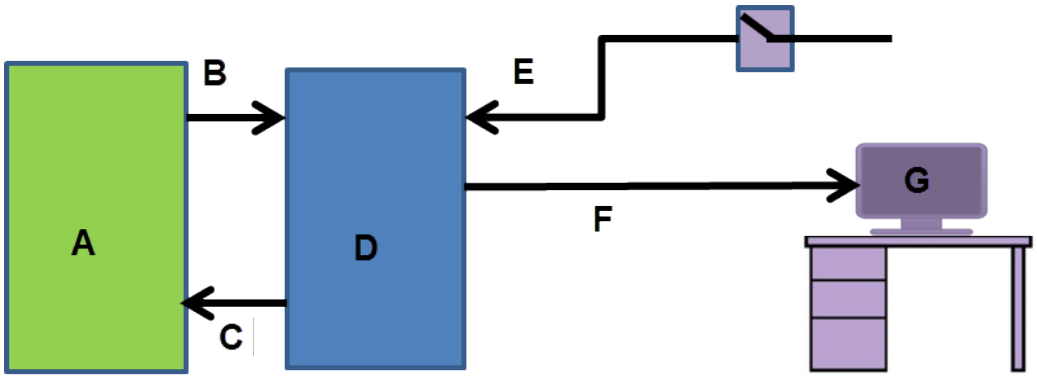
1.3 System overview

A complete Rosemount™ CT5800 system consists of a gas handling system, the analyzer, and the associated interconnecting wiring and gas piping.

Measurement data from the analyzer can be displayed in the process control center.

The Rosemount CT5800 is supplied by Emerson. The gas handling system may be provided by either you or Emerson, depending upon the specific installation. The circuit breakers used to control the application of electrical power to the analyzer, the interconnecting wires, and gas piping are provided by you. In Figure 1-2, the items supplied by Emerson are colored blue, customer-supplied items are colored purple, and items that can be supplied by either Emerson or you are green. Table 1-1 lists the main items of the system.

Figure 1-2: Complete Rosemount CT5800 Gas Analysis System



A. Gas handling system
B. Sample supply line
C. Sample ENTER (exhaust) line
D. Rosemount CT5800 gas analyzer
E. Electrical power
F. Measurement data
G. Control center

Emerson has designed the analyzer for industrial process applications requiring ATEX Zone 1 hazardous area certification; the analyzer has an Ex d flameproof enclosure. It contains an optical system with multiple lasers and a series of optical components that provide an optical path, a heated multi-pass analysis cell, and sample inlet and outlet ports that can be connected to a gas handling system and control and analysis electronics. The number of lasers installed depends upon customer requirements. The complete system operates Vac from a 110/240 Vac 50/60 Hz supply.

The analyzer uses mid-infrared optical absorption spectroscopy to measure gas concentrations. The light sources are lasers, which are operated to produce wavelength sweeps that cover the absorption lines of the gases. The light from each laser is routed through an optical path to the analysis cell, which provides measurement of low concentrations of the subject gases. An external sample handling system conditions the sample gas and draws it through the analysis cell. The light exits the multi-pass analysis cell and is directed to a receiver in the analyzer. The variation in the intensity of light in the vicinity of the absorption lines is measured, and the concentration is determined using a comprehensive spectral fitting routine.

There is no sample conditioning provided within the analyzer; the sampled gas must be brought within the parameters shown in Detailed system specifications before entering the analyzer. Detailed characteristics of the analyzer are also given in Detailed system specifications.

Table 1-1: Main Items of the Rosemount CT5800 System

Item	Name or description	Supplied by	Part number	Quantity	Notes
1	Rosemount CT5800	Emerson		1	N/A

Table 1-1: Main Items of the Rosemount CT5800 System *(continued)*

Item	Name or description	Supplied by	Part number	Quantity	Notes
2	Rosemount CT5800 software package, version 5.x.x	Emerson	N/A	1	Software is embedded in PC board. Version described in manual
3	Gas handling system	Customer (optionally by Emerson)	Customer choice or Emerson	1	Optional supply by Emerson
4	Heated gas sample line hose	Customer/Emerson	Customer choice	1	Optional supply by Emerson
5	Exhaust line hose (for sample gas)	Customer /Emerson	Customer choice	1	Optional supply by Emerson
6	Reference gas cylinders (instrument gas) for calibration purposes	Customer	Customer choice	Dependent upon number of gases being measured	N/A
7	Pressure regulator	Customer	Customer choice	1 per gas cylinder	N/A
8	Pneumatic T-piece	Customer	Customer choice	1	N/A
9	Excess flow line	Customer	Customer choice	1	Required for calibration
10	240 Vac power cable	Customer	Customer choice	1	Connect Rosemount CT5800 to mains power supply
11	Cable from analyzer to control center	Customer	Customer choice	1	N/A
12	Main circuit breaker	Customer	Customer choice	1	N/A

1.4 Customer information

This manual contains all the important information that must be followed to ensure the correct operation and safety of personnel when operating the analyzer.

All personnel must read this manual carefully before commencing any work on the analyzer.

For information regarding installation, consult Install and the Quick Start Guide.

Emerson is committed to continuously improving its products and documentation. Every effort will be made to include in the documentation any modifications by the manufacturer. However, this document reflects the supplied sensor at the revision date on the front cover.

Should you require further information, or should particular problems arise that are not covered in this manual, you can request additional help from Cascade Technical Support

(cascade.support@emerson.com) or Emerson distribution partners. Further contact details for Emerson can be found on the back page of this manual.

1.5 Safety precautions and conditions for safe use

⚠ WARNING

SAFE USE PRECAUTIONS

Before installing or performing any maintenance on the analyzer, read and understand the safety information given in the preliminary information of this manual.

The analyzer described in this document has been quality control tested and left the manufacturer in pristine condition. To achieve the correct and safe operation of this product, it must be transported, installed, operated, and maintained as described by the manufacturer.

All lasers used within the analyzer are Class 1. The emitted laser light is invisible (mid-infrared) and the pulse duration so short that the unprotected eye will not be damaged.

The nature of the laser beam path and beam width further ensures that it should be impossible to cause any eye damage. The analyzer has warning labels at appropriate positions in accordance with USA 21 CFR 1040.10.

IECEx - Specific Condition of Use

- This equipment has flamepaths which differ from those in IEC 60079-1. Cascade Technologies Ltd (cascade.support@emerson.com)shall be contacted for guidance when maintaining the flamepaths.
- The fasteners which secure the cover are non-standard and shall therefore only be replaced by fasteners supplied by the manufacturer for this purpose. The fasteners must always be fitted with the washer supplied by the manufacturer.
- The equipment has non-conductive surfaces which are a potential electrostatic charging hazard – see the instructions for guidance.
- The user shall ensure that the flow of process gas is limited to a maximum flow rate of 6 litres per minute.
- The equipment shallonly be used with process gases which are classified for equipment group IIB + H2 and must not contain oxygen or any other oxidizer in concentrations greater than that found in normal air.

CSA Certificate North American - Conditions of Acceptability

- The equipment has flameproof joints with dimensions which are other than those specified in Table 2 of ANSI/UL 60079-1: 6th Edition and Table 3 of CSA C22.2 60079-1:16. These flameproof joints are not intended to be repaired but where necessary the original manufacturer (cascade.support@emerson.com) shall be contacted for guidance and information on the dimensions of the flameproof joints.
- The fasteners which secure the cover are non-standard and shall therefore only be replaced by fasteners supplied by the manufacturer for this purpose. The fasteners must always be fitted with the washer supplied by the manufacturer.

- The equipment has non-conductive surfaces which are a potential electrostatic charging hazard – see the instructions for guidance.
- The user shall ensure that the flow of process gas is limited to a maximum flow rate of 6 litres per minute.
- The equipment shall only be used with process gases which are in gas groups B, C or D (Divisions) or IIB + H2 (Zones) and must not contain oxygen or any other oxidizer in concentrations greater than that found in normal air.
- This assessment does not cover reliable function, performance, or other properties of the equipment not related to safety.
- The equipment is to be installed using wire no larger than 1mm2 (18 AWG).
- The equipment is only to be installed by manufacturer trained personnel.
- If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.
- The equipment is not to be used with flammable liquids.

1.6 Qualified personnel

This manual provides installation, operation, and maintenance personnel with the level of knowledge required to safely start, operate, and switch off the analyzer.

Only technically qualified personnel in the field of analysis and control who are familiar with this manual and have been specially trained on the analyzer should install, operate, switch off, and service the analyzer. Only qualified and trained persons have the required specific knowledge to correctly interpret the general safety information, warnings, and procedures given in this manual and apply them to this particular application. Emerson or its distribution partners can provide this training on request.

Knowledge of the safety information within this manual and its technically correct implementation are prerequisites for danger-free installation, operation, and maintenance of the analyzer.

1.7 Software version

The analyzer includes software that is used to control the operation of the analyzer. This document describes the software version as: 5.12.7 minimum.

1.8 Gas detection

The analyzer is highly configurable in the gases that can be detected and their range of concentrations.

1.9 Detailed system specifications

Table 1-2 gives the physical characteristics of the analyzer. Figure 1-3 shows schematic diagrams of the sensor and mounting points. Table 1-3 gives the general characteristics of the analyzer.

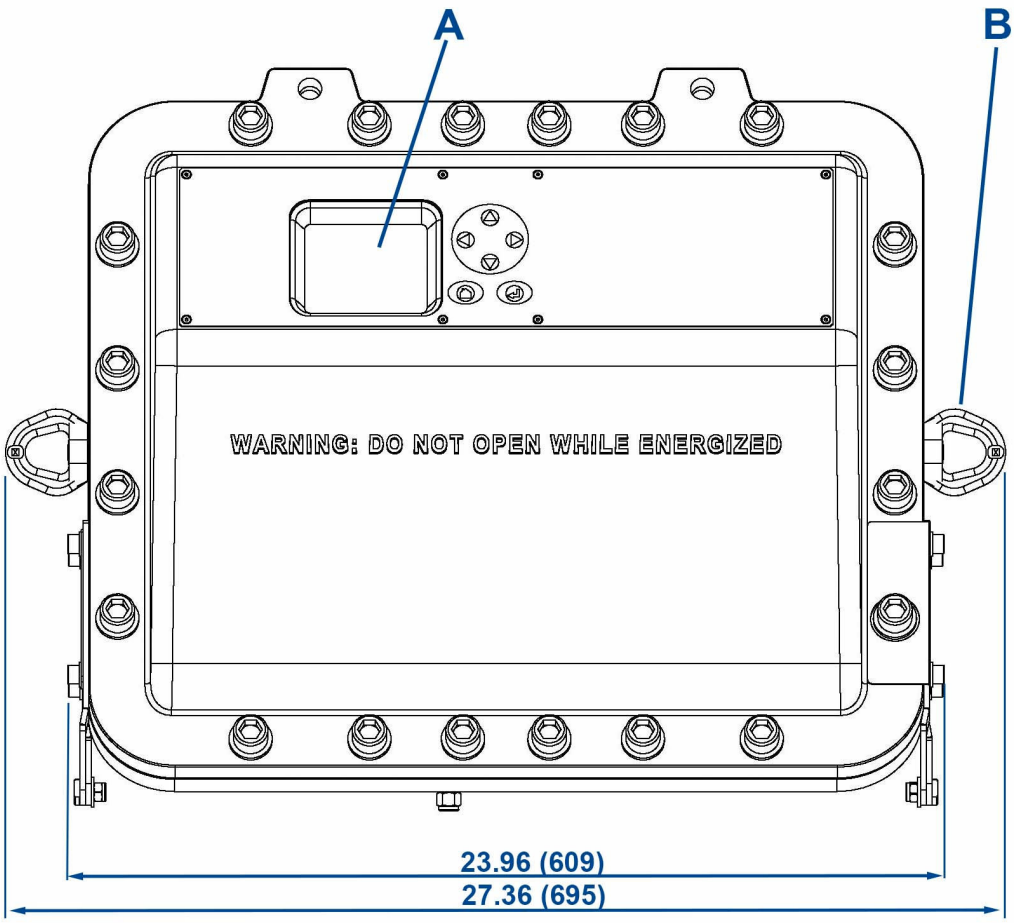
Table 1-2: Physical Characteristics

Rosemount CT5800	Value	Comment
External dimensions (closed)	694.5 x 292 x 515 mm 27.34 x 11.5 x 20.28 in.	Length x width x height Nominal dimensions
External dimensions (open)	27.34 x 11.5 x 41.24 in. 694.5 x 292 x 1047.5 mm	Nominal dimensions, front panel at lowest point To open the enclosure, the minimum height required is 1030 mm (40.55 in.)
Front panel swept radius	21.46 in. 545 mm	Allow sufficient space for the front panel to swing through an arc of 180 ° (see Figure 1-5).
Weight	80 kg 176.37 lb.	Approximate weight The analyzer must be wall mounted. Do not mount it on stud or partitioned walls.

Table 1-3: General Characteristics

Rosemount CT5800	Value	Comment
Voltage	220/240 ± 10% Vac 110/120 ± 10% Vac	50 Hz ± 5% (factory set) 60 Hz ± 5% (factory set)
Peak power consumption	1100 W	Max consumption per gas analyzer
Continuous steady-state power consumption	800 W	N/A
Electrical compartment enclosure	N/A	Aluminum
Optical compartment enclosure	N/A	Aluminum
Measurement technique	N/A	Mid IR absorption spectroscopy
Mid IR source	N/A	Quantum Cascade™ Laser
Near IR source	N/A	Interband Cascade Laser Tunable diode laser
Laser classification	Class 1	BS EN 60825-1: 2007 safety of laser products. Equipment classification and requirements (identical to IEC 60825-1 2007)
Inlet gas port connector	¼ in. 6 mm	Swagelok® type, factory-configured, specify on order
Outlet (exhaust) gas port connector	¼ in. 6 mm	Swagelok type, factory-configured, specify on order
Measurement result signals	4 to 20 mA	4 or 8 channel outputs, specify on order
Warm-up time	90 minutes	N/A

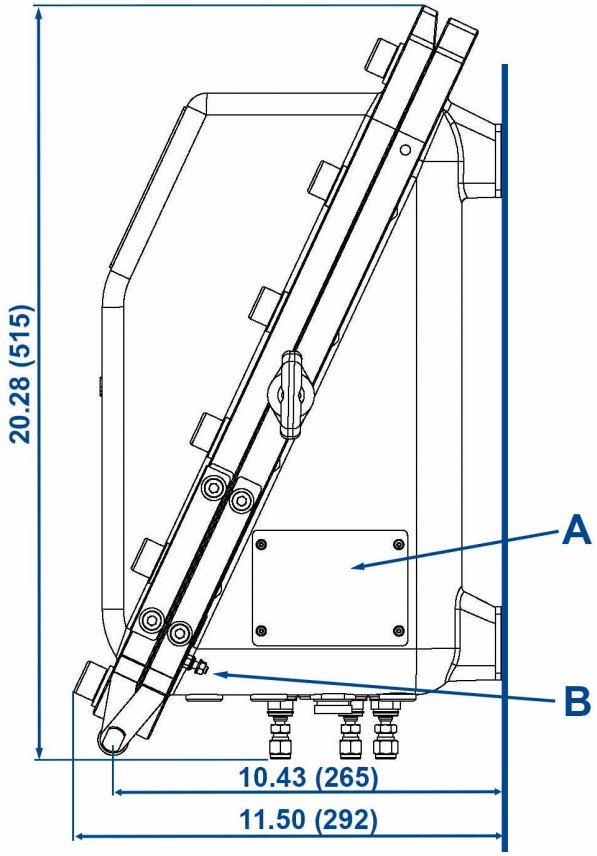
Figure 1-3: Rosemount CT5800 Dimensions: Front View



Dimensions are in inches (mm).

A. *User interface*
B. *2 off lifting eyelets*

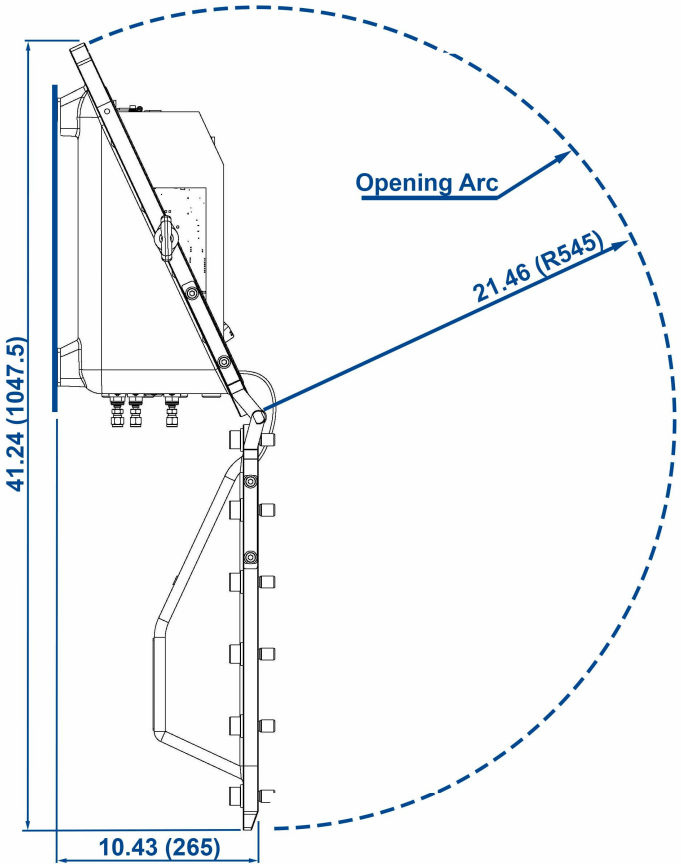
Figure 1-4: Rosemount CT5800 Dimensions: Side View



Dimensions are in inches (mm).

A. *Rating plate*
B. *External earth point*

Figure 1-5: Rosemount CT5800 Radius for Opening



Dimensions are in inches (mm).

A. Opening arc

Table 1-4: Environmental Characteristics

Environmental characteristic	Value	Comment
Operating temperature range	-4 to 131 °F (-20 to 55 °C)	Ambient temperature
Sample gas temperature range	39 to 140 °F (4 to 60 °C)	
Sample gas moisture content	8%	Maximum (dependent on analyser configuration)
Sample gas particulate density	5 mg/m^3	Maximum
Sample gas particulate size	10 µm	Maximum
IP code	66	IP to IEC 60529
Ambient humidity range	10 to 95%	Relative humidity (non-condensing) at 113 °F (45 °C)

1.9.1 Optical description

The laser modules are located in the core of the analyzer. Each laser module produces a separate light beam, and these beams are combined linearly as the modules are aligned in the system. The combined beams are closely coupled, parallel, and coaxial about a virtual line. The laser light beams pass through an optical steering assembly, which directs the laser beam through the sample cell.

The sample cell contains a set of mirrors to create a path through the sample gas that is between 0.7 ft. (0.2 m) and 49.2 ft. (15 m) through multiple reflections along the length of the cell. The laser beams exit the cell at the opposite end from where they entered and are directed using a second optical block to a receiver.

By measuring and analyzing the light detected by the receiver unit, it is possible to accurately determine the concentrations of the target molecules within the gas sample cell.

1.10 Unpacking the analyzer

⚠ WARNING

HEAVY ITEM

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to propery handle the analyzer may cause injury to personnel.

Make sure the wall the analyzer is mounted on is solid, stable, and of suitable material to hold the weight of the analyzer.

Handle the analyzer with caution during unpacking, installing, maintaining, and transporting to prevent crushing of hands, feet, or other body parts.

The analyzer weighs 176.4 lb. (80 kg).

Emerson recommends that a minimum of two people move and lift the analyzer.

Wear suitable protective gloves and protective footwear.

⚠ WARNING

TRANSPORTATION HAZARD

Failure to use proper lifting procedures may cause injury to personnel or damage the analyzer.

Use safety-approved lifting equipment.
Follow safe lifting procedures for the weight and mass of the analyzer.

⚠ WARNING

EXPLOSION HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could result in an explosion or potentially hazardous situaiton which, if not avoided, could result in death or serious injury.

Comply with all relevant national legislative requirements and regulations when installing and wiring this analyzer.

Consider all safety instructions within this manual and all associated instruction manuals.

⚠ WARNING

EXPLOSION HAZARD

Installing the instrument requires opening the enclosure and working at the open instrument. This is permitted only when both no hazardous atmosphere is present and the instrument and connected external circuitry are de-energized.

Depending on the local regulations, this may require a competent hot work supervisor to issue a hot work permit.

⚠ CAUTION

SHOCK AND VIBRATION

Failure to follow this caution may result in damage to the analyzer.

The Rosemount CT5800 contains sensitive electronic equipment.

Do not subject it to any shock or vibration.

Procedure

1. On receipt of goods, look for any visible damage to the analyzer and verify that all items noted to be shipped were received. Record on the goods receipt note any damage or missing items, noting both the item(s) and the quantity missing.
2. Visually inspect the exterior of the analyzer for signs of damage, corrosion, gas leaks, or signs of previously overheating.
3. Report anything found to the maintenance organization.
4. Attach suitably rated and tested lifting slings to the safety engineered lifting eye bolts mounted on the sides of the enclosure.
5. One person carefully guides the equipment from the horizontal to the vertical position while the other person lifts the equipment.
6. Use safety approved and tested lifting equipment to remove the analyzer from the shipping container.
7. Place the analyzer on a solid, level surface and prepare to wall mount the analyzer.
8. Make sure that the analyzer is stored in its protective plastic cover until installation.

2 Install

This section describes the correct installation procedure for the analyzer.

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

2.1 Site requirements

Select an appropriate site for installing the analyzer.

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

⚠ WARNING

INSTALLATION REQUIREMENTS

The place of installation must be clean, dry, and protected against strong vibrations and frost.

Observe the advisable operating temperatures given in Detailed system specifications.

Do not subject analyzer to direct sunlight or heat sources.

For outdoor installation, Emerson recommends installing the analyzer in a cabinet. At a minimum, protect it against rainfall.

⚠ WARNING

FIRE AND EXPLOSION

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to ensure the area is safe or leaving the device powered on can cause an explosion or fire and seriously injure personnel.

Do not open the Ex d enclosure unless the area is known to be free of flammable materials or unless all devices are switched off.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this precaution will cause death, injury, and/or damage to persons and/or property.

The analyzer operates using mains voltage that is dangerous to life.

Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

In accordance with IEC 60079-0:2011 Clause 30, install the analyzer in a suitable position with shading to protect it from the elements. The displays and control panel on the front of the housing must not be exposed to direct UV light sources or direct sunlight.

⚠ WARNING

POTENTIAL ELECTROSTATIC CHARGING HAZARD

This article is in accordance with IEC 60079-0: 2011 Clause 30.

The keypad is non-conducting and may generate an ignition capable of electrostatic charges under certain extreme conditions.

Ensure that the equipment is not installed in a location where it may be subjected to external conditions (such as high pressure steam), which might cause a build-up of electrostatic charges on non-conducting surfaces.

Only clean the analyzer with a damp cloth.

The analyzer has a T4 temperature classification which specifies the maximum surface temperature of the instrument, under a fault condition, is 275 °F (135 °C). You must ensure that no combustible gas concentrations are present, whether on a continual or occasional basis, which have an ignition temperature below the T classification of the unit.

⚠ WARNING

FIRE AND EXPLOSION

Failure to observe this precaution may cause death, personal injury, and/or damage to equipment.

Do not open the Ex d enclosure of the analyzer unless the atmosphere of the area is known to be below the ignitable concentration of combustible gases or materials.

In accordance with IEC 60079-0: 2011 Clause 30, install the analyzer in a suitable position with shading to protect it from the elements. Do not expose the displays and control panel on the front of the housing to direct UV light sources or direct sunlight.

Provide a fuse at the installation site which will completely disconnect the analyzer in case of failure. Installing an isolating switch may also be beneficial. In either case, these components must be constructed to conform to recognized norms.

In accordance with IEC 60664-1, install the analyzer in an area of not more than Pollution Degree 2.

Provide sufficient space around the analyzer to allow maintenance and servicing of this unit.

2.2 Mounting

This procedure requires a minimum of two people to safely move and mount the analyzer.

Detailed system specifications shows outline dimensional drawings of the analyzer.

NOTICE

In accordance with IEC 60079-0: 2011 Clause 30. Figure 2-1 shows the positions of the glands for the three electrical conduits. Do not redesign or reposition these glands without consulting Emerson.

⚠ WARNING

HEAVY ITEM

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to properly handle the analyzer may cause injury to personnel.

Make sure the wall the analyzer is mounted on is solid, stable, and of a suitable material to hold the weight of the analyzer.

Handle the analyzer with caution during unpacking, installing, maintaining, and transporting to prevent crushing of hands, feet, or other body parts.

The analyzer weighs 176.4 lb. (80 kg).

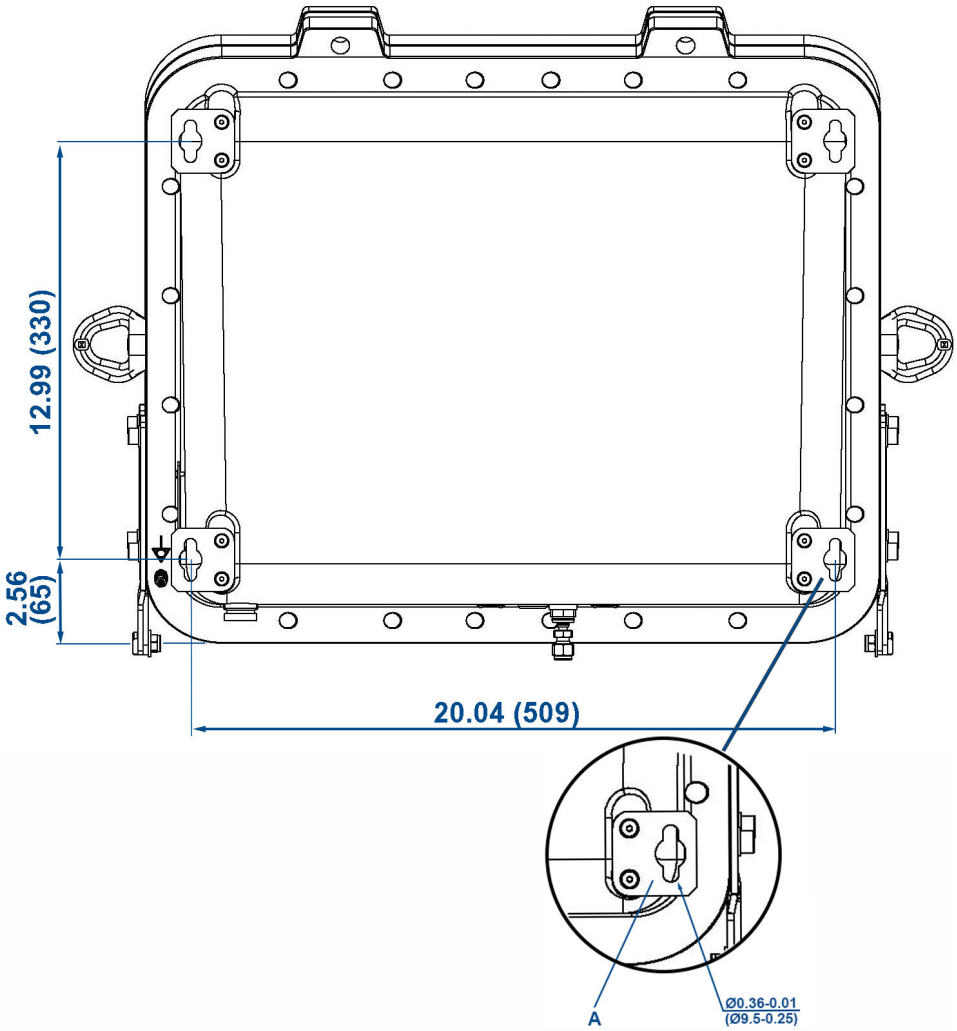
Emerson recommends that a minimum of two people move and lift the analyzer.

Wear suitable protective gloves and protective footwear.

Make sure that the wall fixing points are capable of supporting a load of 176.4 lb. (80 kg) each; this includes a x2 safety factor. All mounting points are 0.6 in. (15 mm) diameter holes.

Procedure

1. Use safety approved equipment to lift the analyzer from the stable platform. One person guides the unit into position as the other person carefully operates the lifting equipment.
2. Mount the analyzer using the factory fitted and pre-drilled wall mounting brackets using four M8 x 1.25 (5/16 - 18 UNC) A2/A4 grade 70 bolts.



Dimensions are in inches (mm).

A. Wall mounting bracket

Mounting brackets are 1/16-in. (4 mm) thick stainless steel. Position the bolts in such a way to allow maximum use of all thread length. Make sure that the fasteners used are suitable for the load and surface the analyzer is mounted on.

Emerson recommends installing the analyzer in an upright (vertical) position; other orientations may affect the measuring results.

3. If you want to increase security on the installation of the analyzer by thread-locking the fittings, only do this with compounds compatible with the hazardous area zone classification of the installation location.
4. Make sure the bolts are secure. Apply maximum torque permissible for the material combination of the supporting structure.
5. Remove the lifting eyes and retain them for future use. Protect the threads with plastic grommets and a suitable grease.

Postrequisites

Do not place any additional load on the analyzer.

2.3 Connecting the system

2.3.1 Opening the enclosure

Use these procedures to make the electrical, power, and gas line connections.

Procedure

1. Make sure that the hinges are securely connected to the enclosure.

⚠ WARNING

HEAVY FRONT HOUSING

Failure to properly support the lid may cause injury to personnel.

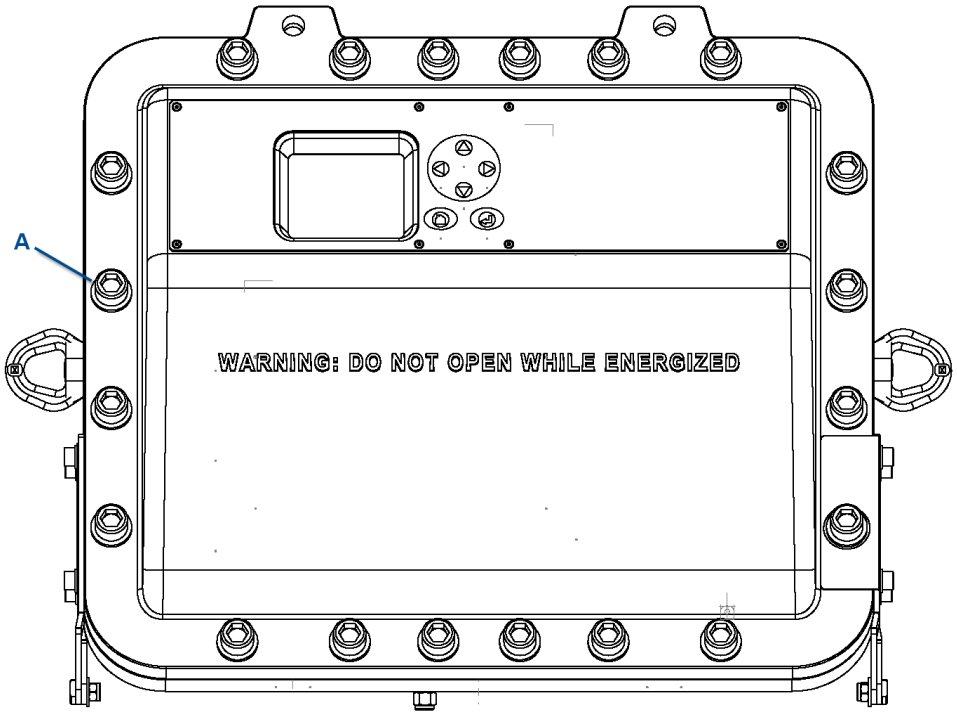
The analyzer's front housing is heavy, 68.1 lb. (30 kg).
After removing the captive bolts, provide support when opening the lid.

⚠ CAUTION

EQUIPMENT HAZARD

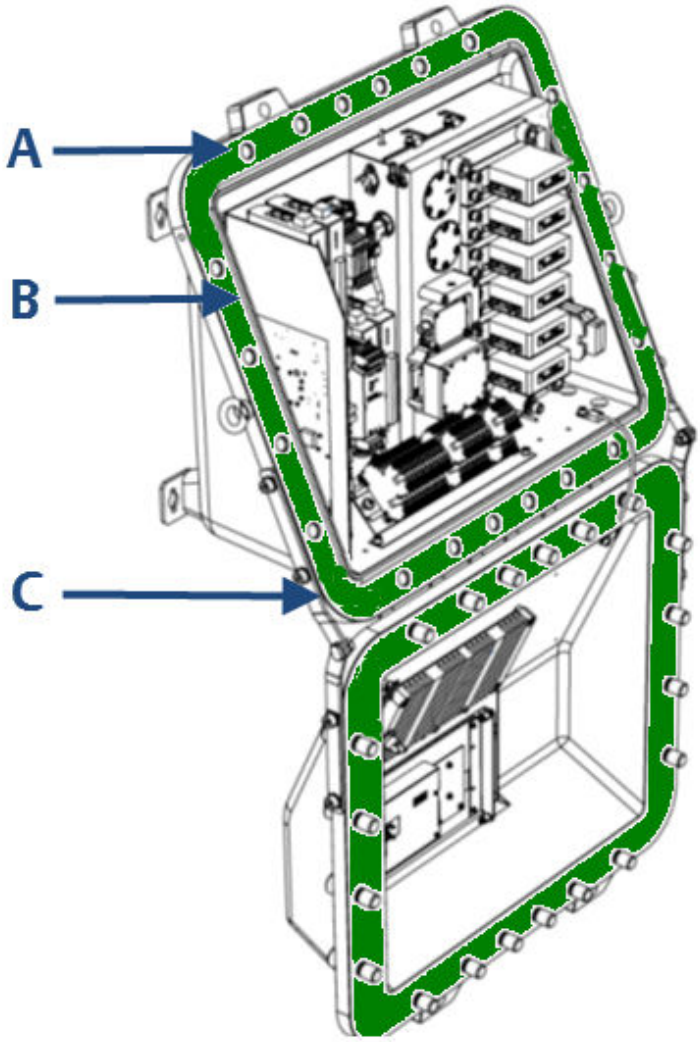
Inspect the hinges for damage before removing the M16 x 45 captive bolts to open the housing.
Make sure no obstructions are in the opening radius when the front housing is opened.
Make sure no obstructions are in the opening radius when the front housing is opened.

2. Unscrew the 20 off M16 x 1.5 inch captive bolts holding the front and rear housings of the enclosure together.



A. 20 off M16 captive bolts

3. Carefully lower the front enclosure to the fully open position.



A. Flamepath (green highlight)
B. Seal
C. Flanges

4. Apply masking tape to the flanges, seal, and flamepath to protect them from scratches, chipping, and other forms of damage of deformation.

⚠ CAUTION

PROTECT FLAMEPATH

Any damage to the flamepath will invalidate certification.

Protect the flamepath with masking tape.

5. Continue the installation with the power and signal cables.
   See AC power safety information.

2.3.2 AC power safety information

NOTICE

This section is in accordance with IEC 60079-0:2011 Clause 30.

This section must not be changed, amended, or removed.

⚠ WARNING

ELECTRIC SHOCK

Failure to follow instructions may cause personal injury or death.

Only qualified personnel, taking into account all applicable standards and legislative requirements, should install the analyzer and connect the power and signal cables.

Instruments providing screw terminals for electrical connections may require working near live parts.

The analyzer does not have power switches and is operable when connected to power.

A customer-supplied power switch or circuit breaker (complying with IEC 60947-1/ -3) must be in the building installation. The switch has to be installed near the analyzer, must be easily accessible, and has to be assigned as a disconnector for the analyzer.

Disconnect instruments with screw terminals from power when working at power terminals (pull power plug or operate power switch / circuit breaker in building installation).

The analyzer provides a protective earth terminal. To prevent electrical shock hazards, connect the instruments to a protective earth. The instruments must be connected to power with a three wire power cable with earth conductor. Any interruption of the earth connector inside or outside the instrument or disconnecting the earth terminal may cause potential electrical shock hazard.

⚠ WARNING

EXPLOSION HAZARD

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning could cause an explosion or potentially hazardous situation which, if not avoided, may cause death or personal injury.

Only enable the purge controller bypass function during setup or maintenance and only when the area is known to be non-hazardous.

The customer supplied circuit breaker must be in accordance with ATEX / IECEx / North American protection concepts. The main power isolator controls the application of electrical power to the analyzer.

Electrical protection for the instrumentation circuitry of the analyzer is provided by fuses F1 and F2 located inside the analyzer.

Table 2-1: Electrical power requirements

Electrical supply	Power consumption	Voltage	Fuse
Instrumentation supply voltage	500 W (peak) 300 W (usual)	110 to 240 Vac, 50/60 Hz ± 10%	3.15 A internal fuses F1 and F2. See Connecting the signal cables.
Purge supply voltage	10 W	110 to 240 Vac, 50/60 Hz ± 10%	1 A (located in secondary circuit breaker)

For the electrical power wiring, use 16 AWG stranded, 3 conductor copper or tin plated copper power wire, rated for at least 250 Vac, of the required length.

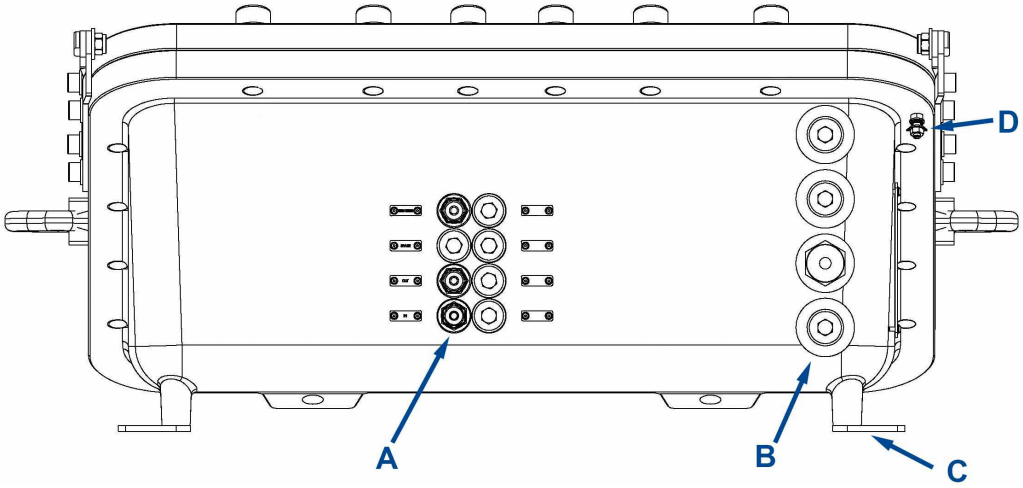
Cables must be rated for operation in ambient temperatures greater than 176 °F (80 °C).

Cables must be terminated in accordance with local electrical codes.

A switching system is not supplied with this equipment. You must supply a suitably rated switch or circuit breaker to be included with this installation. Check the installation of the switch for conformity in accordance with national/local regulations and standards by inspection.

The switch or circuit breaker must be suitably located, easily reached, and identified as the disconnection device for the analyzer.

Figure 2-1: Rosemount CT5800 Bottom View: Gas Connectors and Cable Glands



A. Gas connections (flame arrestor) (M18 x 1.5)
B. Conduit / cable entry apertures (M20 x 1.5)
C. Wall fixing line
D. Earth (ground) bond

The customer supplied circuit breaker must be in accordance with suitably certified hazardous area Ex protection concepts. The main power isolator controls the application of electrical power to the analyzer.

⚠ WARNING

EXPLOSION

Do not open the instrument when it is energized.

Ensure that external circuitry is disconnected or de-energized before opening the instrument.

All cables (power and signal) must end (be connected) in either a safe (nonhazardous) area or in a protecting enclosure (e.g., explosion-proof junction box).

⚠ WARNING

INSTALLATION USING CONDUITS

The analyzer has metric threads for installing cable entries.

Installing conduits requires metric to national pipe thread (NPT) adapters.

To be compliant with North American ordinarly location (Ordloc) and hazardous area (Hazloc) certification, use stainless steel with captive O-ring seals.

Select a type of conduit and seals in accordance with local codes and suitable for the site of installation.

For North American sites, do not fit seals more that 2 in. (50 mm) from the Ex d entry point.

Unused entries are provided with plugs, secured in place with thread locking compound.

AVERTISSEMENT

Un scellement doit être installé à moins de 50 mm du boîtier.

⚠ WARNING

INSTALLATION USING CABLE GLANDS

All cable glands must be suitable certified for use in area of application (Zone/Class/Division).

When installing the analyzer in a hydrogen environment and/or applying hydrogen to the analyzer, do not use the standard compression type cable glands. Use suitable compound barrier cable glands to stay compliant to EN 60079-14.

When selecting cable glands, make sure the correct diameter is selected to ensure correct cable fit.

⚠ CAUTION

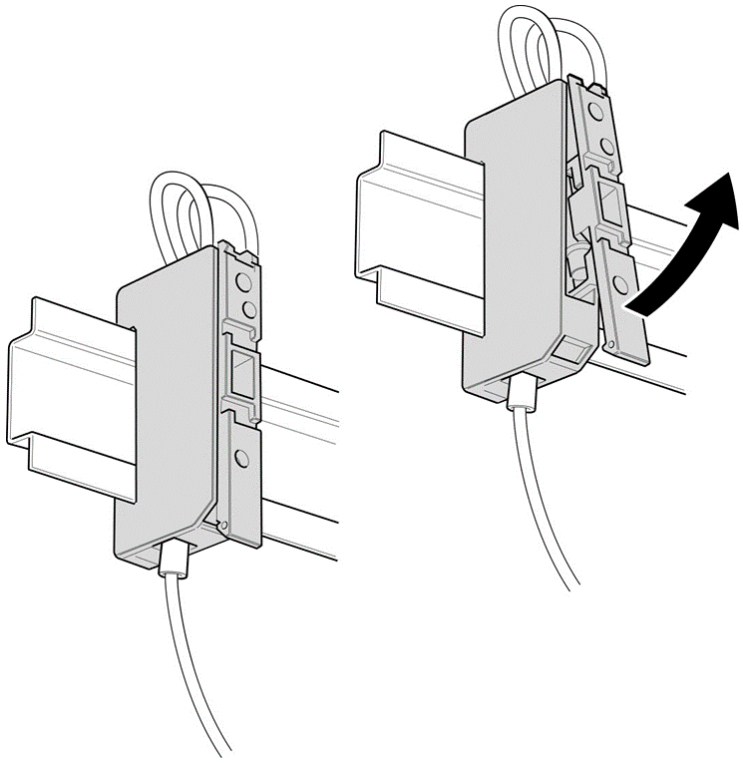
SELECT THE CORRECT TYPE OF CABLE ENTRY.

Before starting to install the analyzer, verify what type of cable entry is required at your site of installation.

Rosemount CT5800 gas analyzers may be equipped with cable glands (e.g., regulated for installations covered by ATEX/IEX/Ex) or may be installed with conduits (e.g., in North America).

Electrical protection for the instrumentation circuitry of the analyzer is provided by fuses F1 and F2 located inside the analyzer.

Figure 2-2: Fuses



Connect power to the system through the power gland on the base of the analyzer (Figure 2-1).

2.3.3 Earthing/grounding the analyzer

The system must be suitably earthed / grounded using the M5 stud bonded to the rear of the system and the connector inside with cable between 1.5 and 4 mm square.

NOTICE

This section is in accordance with IEC 60079: 2011 Clause 30. This article must not be changed, amended, or removed.

⚠ WARNING

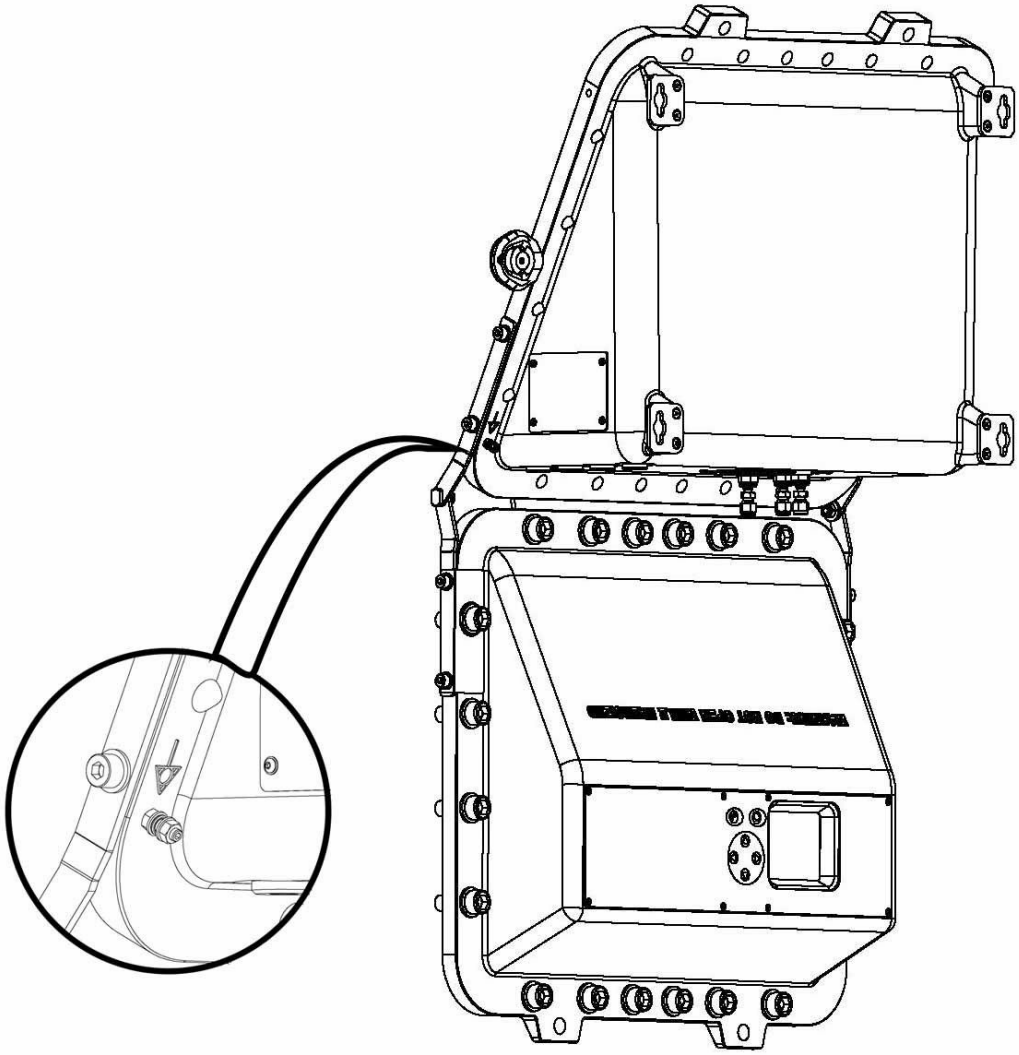
ELECTRIC SHOCK

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning may cause death or personal injury.

The analyzer must be earthed/grounded in accordance with national/local regulations.

Figure 2-3: Earth Bond



2.3.4 Connecting the signal cables

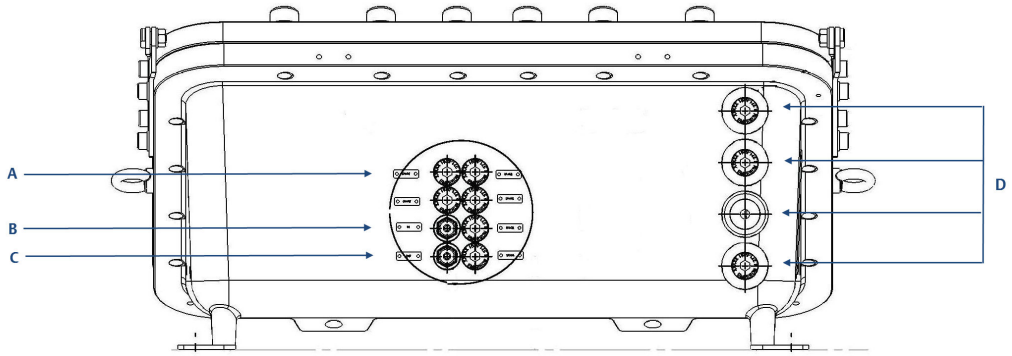
Connect the signal cables through conduit outlets 2 and 3 as shown in the figures below.

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

The signal cables are connected to the system through conduit outlets 2 and 3 as shown in Figure 2-4 and Figure 2-6. All signal cables are to be minimum 20 AWG tri-rated switchgear cables. Customer supplied conduit and cables must be terminated in the conduit outlets in accordance with local electrical codes.

Figure 2-4: Cable Glands, Conduits, and Gas Line Connections



A. Breather
B. Gas connection out (flame arrestor) (M18 x 1.5)
C. Gas connection in (flame arrestor) (M18 x 1.5)
D. Conduit / cable entry apertures (M20 x 1.5)

Figure 2-5: Signal Connections

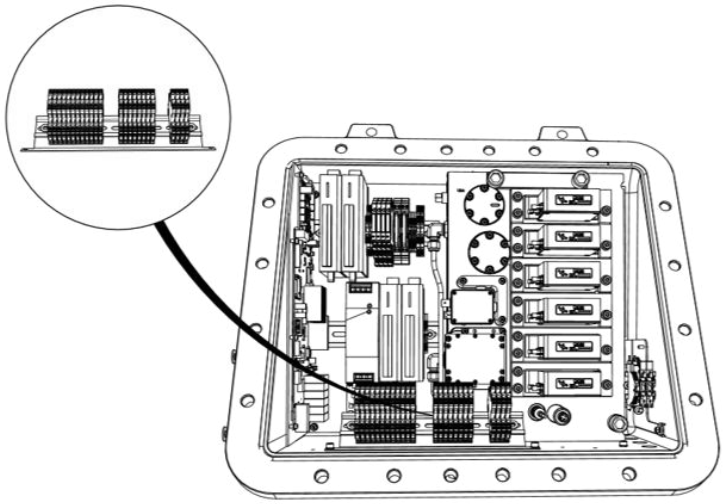


Figure 2-6: Signal Cable Connections

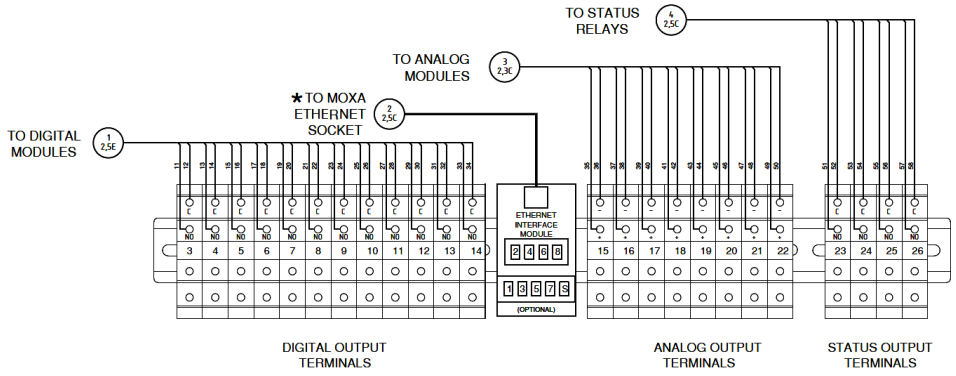


Table 2-2: Power, Digital, and Analog Connections

Terminal	Function
1	System supply (L)
2	System supply (N)
3	Digital output 1
4	Digital output 2
5	Digital output 3
6	Digital output 4
7	Digital output 5
8	Digital output 6
9	Digital output 7

Table 2-2: Power, Digital, and Analog Connections *(continued)*

Terminal	Function
10	Digital output 8
11	Digital output 9
12	Digital output 10
13	Digital output 11
14	Digital output 12
15	Analog output 1
16	Analog output 2
17	Analog output 3
18	Analog output 4
19	Analog output 5
20	Analog output 6
21	Analog output 7
22	Analog output 8
23	Status output 1 (check function)
24	Status output 2 (maintenance required)
25	Status output 3 (out of specification)
26	Status output 4 (failed)

Table 2-3: Ethernet Interface Module wiring to MOXA Ethernet Socket

Terminal	Designation	Color coding
1	Tx+	Orange / White
2	Tx	Orange
3	Rx+	Green / White
4	Not used	Blue
5	Not used	Blue / White
6	Rx-	Green
7	Not used	Brown / White
8	Not used	Brown

2.3.5 Connecting the sample supply and return lines

Sample gas supply and sample return connections are from ¼-in. (6 mm) Swagelok® type fittings.

The analyzer has one gas input and one gas output, which are located on the base of the analyzer (Figure 2-4).

The gas sample that is to be measured for impurities enters the instrument through the sample gas input port.

Once the sample gas has been examined for impurities, it is expelled from the instrument through the sample gas return port.

NOTICE

Remove the breather blanking cap and never connect anything to this port.

To avoid the risk of gas leaks, make sure that these connections are made correctly and tightly. Both the sample gas supply pipe and the sample return pipe should be thermal insulated.

NOTICE

The Swagelok recommendation for pipe fittings of this size is to tighten the nut finger tight and then tighten an additional one and a quarter (1 and ¼) turns with a spanner.

The maximum gas supply pressure is 1 BarG.

The sample supply line must be heated all the way to the sample gas input port on the analyzer to prevent condensation forming at any point in the sample supply line.

⚠ WARNING

HAZARDOUS GAS

This article is in accordance with IEC 60079-0: 2011 Clause 30.

The product stream that the analyzer is examining may be hazardous even at low concentrations.

Take special care to ensure that the sample gas return port either returns the sample gas to the product stream or discharges the sample gas to a location that will not cause a hazard.

⚠ WARNING

MAINS SUPPLY CABLE

Failure to follow this warning may result in personal injury.

Make sure that the mains supply cable used is of a suitable rating for the analyzer's power requirements.

The Ethernet connector provides an Ethernet output from the analyzer that may be used for downloading data for failure diagnostic purposes.

The analyzer outputs the results of the gas analysis through the 4-20 mA analog outputs and sends them to your process control center.

The status outputs provide fault indications to your process control center. Each digital output is connected to a normally closed relay, located inside the analyzer, which will open in response to the detection of a specific fault. The possible causes of a fault indication are:

- The sample gas concentration is outside of specification (i.e., the sample gas concentration has exceeded the measurement range of the instrument).
- The analyzer is out of specification or has developed a fault.

⚠ WARNING

HIGH VOLTAGE

Failure to obey the wiring regulations may result in serious injury to personnel.

Voltages up to 250 Vac, 50 Hz may be present on the digital output terminals. Install external circuits in accordance with national wiring regulations.

⚠ WARNING

ELECTRIC SHOCK

Attaching cables and wiring harnesses longer than 9.8 ft. (3 m) may cause injury to personnel.

The analyzer passed electromagnetic compatibility (EMC) tests based on all electrical cables and harnesses attached to it being 9.8 ft. (3 m) long.

2.4 Test connections

Before sealing the cable glands, it is vital to test the new connections in order that any faults can be remedied before the cables are permanently sealed.

⚠ WARNING

EXPLOSION HAZARD

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning could cause an explosion or potentially hazardous situation which, if not avoided, may cause death or personal injury.

The cable glands used in this analyzer are only suitable for use in areas with a low risk of mechanical damage. Protect the cable glands suitably.

Temporarily seal the cable glands with a suitable sealant to allow testing.

The tests described below are a basic check to prove function, rather than a test of sensor capability.

To start the analyzer, follow the steps in Start-up procedure.

⚠ WARNING

INSTALLER RESPONSIBILITY

In accordance with IEC 60079-0: 2011 Clause 30

Failure to observe this warning could cause a potentially hazardous situation which, if not avoided, may cause death or personal injury.

It is the installer's responsibility to connect the analyzer to a suitable alarm or shutdown facility.

2.4.1 Testing power input cables and circuit breakers

The power input cables and circuit breakers can be tested as follows.

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

Procedure

1. Set the main circuit breaker to *ON*.
2. Check that the display controller lights up.
   The instrument begins to power up.

2.4.2 Testing temperature sensor and cell heater

The sample cell is controlled to operate at a pre-set temperature. This involves a heater and a temperature sensor.

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

Procedure

1. Check that a temperature reading is displayed against ***Temperature*** on the display controller as described in Operating the analyzer.
2. Leave the analyzer operating and confirm that the temperature rises until the analysis cell reaches the pre-set operating temperature around 104 °F (40 °C).
   This takes approximately 90 minutes.

2.4.3 Pressure sensor

The pressure sensor monitors the pressure in the analysis cell.

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

Procedure

1. Check that a pressure reading is displayed under *Pressure* on the display controller.
   The reading is approximately 760 Torr at atmospheric pressure.

   NOTICE

   A Torr is a non SI unit of pressure, defined as 1/760 of standard atmospheric pressure, and is equal to the fluid pressure of 1 mm of mercury.

2. If desired, cap off the gas inlet and use an external pump to evacuate the cell.
   Make sure the pressure drops as expected.

2.4.4 Testing analog output cables

Prerequisites

In order to generate a 4-20 mA output, let the analyzer warm up for 90 minutes and make sure the analysis cell is at the correct pressure.

The 4-20 mA outputs operate when the analysis cell is between 104 and 140 °F (40 and 60 °C) and the pressure is between 180 and 220 Torr. It is not essential to flow sample gas through the system; nitrogen or atmospheric air is adequate for this test.

Procedure

With the analyzer at operating temperature and pressure, ensure that a current between 4 mA and 20 mA is generated on each 4-20 mA output, as listed in Connecting the signal cables.

Use a multimeter to measure the current.

2.4.5 Testing the measurement valid flag

The measurement flag is normally open contact. It is simplest to test this with a multimeter.

With the analyzer closed and compressed air applied as described in the startup procedure (Start-up procedure) when the system is operating correctly, an open contact is created between the two contact wires (white).

Procedure

To test the *Error* state, shut off the sample gas and allow the pump to reduce the cell pressure below 180 Torr.

At this point, the contact should close and there should be no resistance between the two white wires.

⚠ WARNING

FIRE AND EXPLOSION

In accordance with IEC 60079-0: 2011 Clause 30.

Failure to ensure the area is safe or leaving the device powered on can cause an explosion or fire and serious injury to personnel.

Do not open the Ex d enclosure unless the area is known to be free of flammable materials or unless all devices are switched off.

2.5 Closing the housing

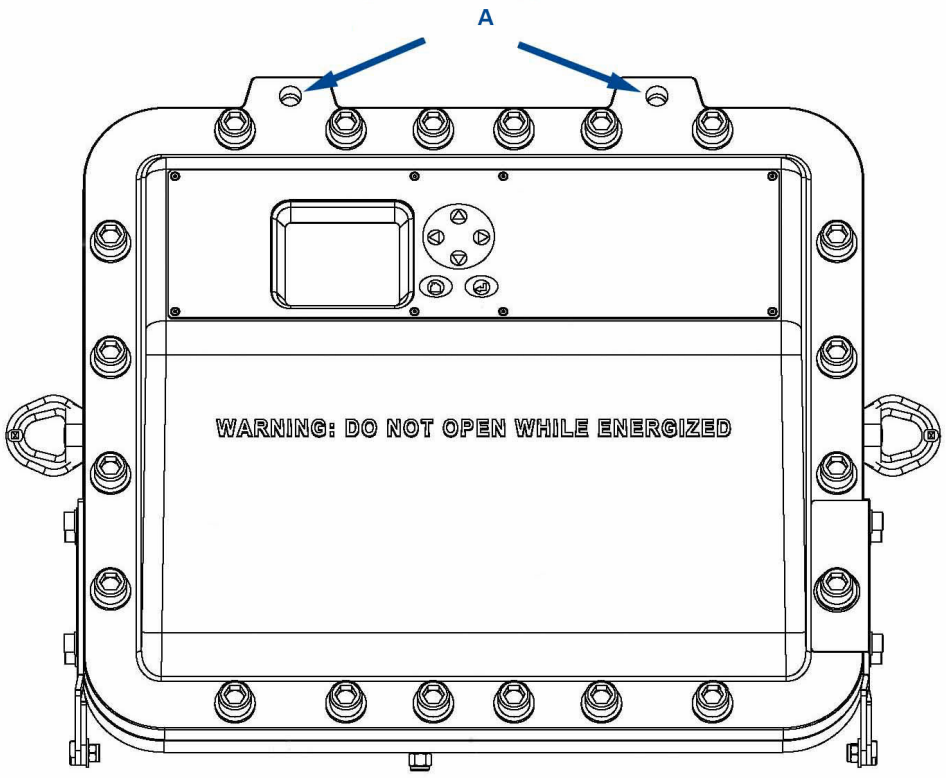
After all internal connections have been made and proved/tested, close the enclosure and secure the 20 off M16 x 45 captive screws and form A washers in accordance with the torque sequence.

Procedure

1. Remove all protective covering from the flamepath and enclosure sealing gasket.
2. Inspect the seal.

   If any damage is detected, stop the process immediately and report to maintenance.
3. Clean the seal to remove any adhesive from the protective cover.
4. Inspect the flanges/flamepath for damage (i.e. scratches, chipping, and/or other form of damage/deformation).

   If any damage is detected, stop the process immediately and report to maintenance.
5. Carefully lift the housing up and align with the rear housing.
6. Make sure that all holes are aligned. If necessary, use the two holes to assist alignment.



A. Alignment holes

7. Insert the captive M16 bolt and engage the threads on the rear housing.

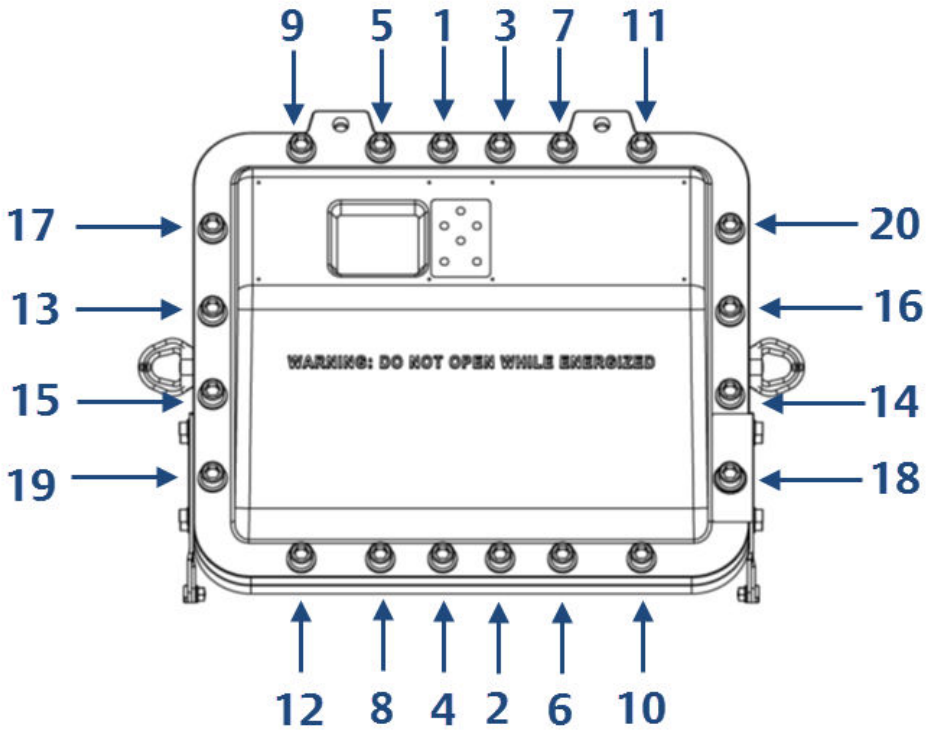
8. Refer to the torque sequence and tighten all bolts.

⚠ WARNING

HAZARDOUS AREA PROTECTION

Failure to follow the warning will invalidate hazardous area Ex d protection.

Always use captive M16 x 45 screws and form A washers to secure the enclosure shut.



Tighten all bolts in sequence to a torque value of 18.44 ft.-lb. (25 Nm).

2.6 Commissioning

Once the sensor is fully installed as described above, commission it according to the commissioning plan agreed on between you and Emerson.

3 Start-up procedure

3.1 Introduction

⚠ CAUTION

EQUIPMENT DAMAGE

Damage to the analyzer may result from a failure to follow this procedure.

Always follow the start-up procedure.

The analyzer normally operates continuously. It should only be necessary to start up the analyzer under the following circumstances:

- When the analyzer is first switched on following installation
- Following repair or maintenance
- When the analyzer has been switched off as part of a plant shutdown or maintenance

3.2 Preparation for use

The analyzer must be installed and fully commissioned prior to startup.

⚠ WARNING

BURNS

Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.

Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.

Some parts of the analyzer may be heated to 140 °F (60 °C).

Always wear proper protective equipment when handling the analyzer.

Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.

The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least twelve hours before performing any maintenance on, or in the vicinity of, the analysis cell.

3.3 Start-up procedure

NOTICE

The gases shown in the screenshots and the measurements may be different from those shown in your particular analyzer. They indicate the functionality of the software, which is the same regardless of the gases being measured.

⚠ CAUTION

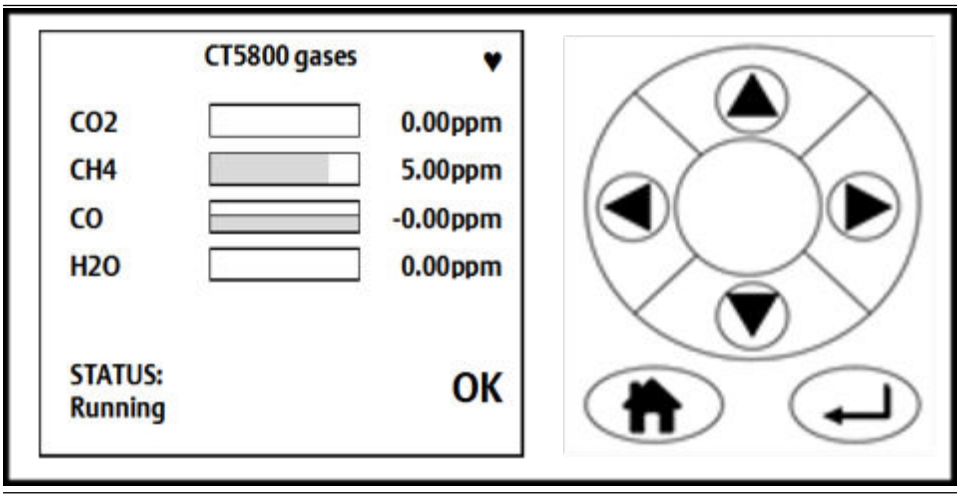
To stop the start-up procedure at any time, set the main circuit breaker to *OFF*.

To start the analyzer, perform the following steps:

Procedure

1. Visually inspect the exterior of the analyzer for signs of damage, corrosion, gas leaks, or overheating. Report anything found to the hazardous area Ex maintenance organization.
2. Ensure that the analyzer has been correctly installed.
   See Install.
3. Ensure that the enclosure is closed and all bolts are correctly torqued.
   If the enclosure cannot be closed and locked, report it to the maintenance organization and do not proceed further until the door has been repaired.
4. Ensure that the gas handling system is turned `OFF`.
5. Ensure that the external circuit breaker is set to `OFF`.
6. Visually examine the gas ports to make sure that the sample supply line and the sample return line are correctly attached to the analyzer.
   If necessary, refer to Replacing the gas input and output lines.
7. Visually check that the electrical connections have been made to the instrument.
8. Set the main circuit breaker to **ON**, which applies main power to the instrument. The analyzer begins its automatic startup. The control PC that forms part of the instrument is configured to automatically load the necessary gas sensor software and configuration files. The startup sequence commences automatically under software control.

   After a few seconds, the **Gas Sensor Main** screen appears on the display controller. If it does not, report the fault to the maintenance organization.



9. Start-up the system for returning the sample gas.
10. Start-up the gas handling system that conditions the sample gas before it is fed into the analyzer. Allow the analyzer to warm up in accordance with the Detailed system specifications before the sample gas supply is turned on.

At the end of the startup procedure, the gas measurements initially appear as `0.00 ppm` until the first readings are taken. After a few seconds, the initial gas concentrations will be displayed.

4 Operating the analyzer

4.1 Introduction

This chapter describes the controls, displays, and indicators on the Rosemount™ CT5800 and how to use the display controller located on the front panel of the analyzer.

NOTICE

The gases shown in the screenshots and the measurements may be different from those shown in your particular analyzer. They indicate the functionality of the software, which is the same regardless of the gases or gas concentrations being measured.

4.2 Normal operation

The analyzer is designed for long term continuous operation, and therefore its normal state is to be switched on and performing gas measurements. The analyzer is usually only switched off for maintenance. The shutdown procedure used to switch off the analyzer is described in Shutdown procedure.

Provided that the Start-up procedure has been followed, the analyzer does not require any human intervention during normal operation other than occasional calibration checks as described in Gas calibration.

During normal operation, either the ***Gas Sensor Main*** screen (Figure 4-1) or the ***Pressure and Temperature*** screen (Figure 4-2) is shown on the display controller. To toggle between these two screens, press ↵.

Figure 4-1: Gas Sensor Main Screen

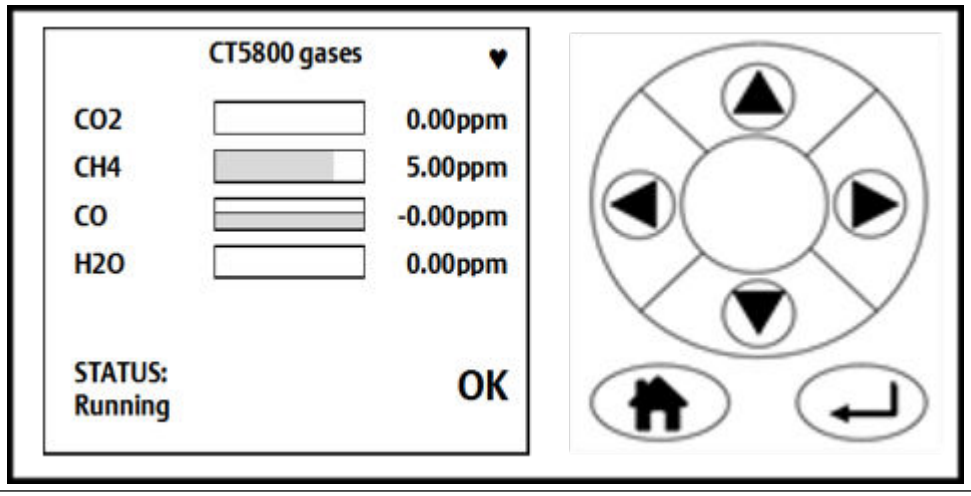
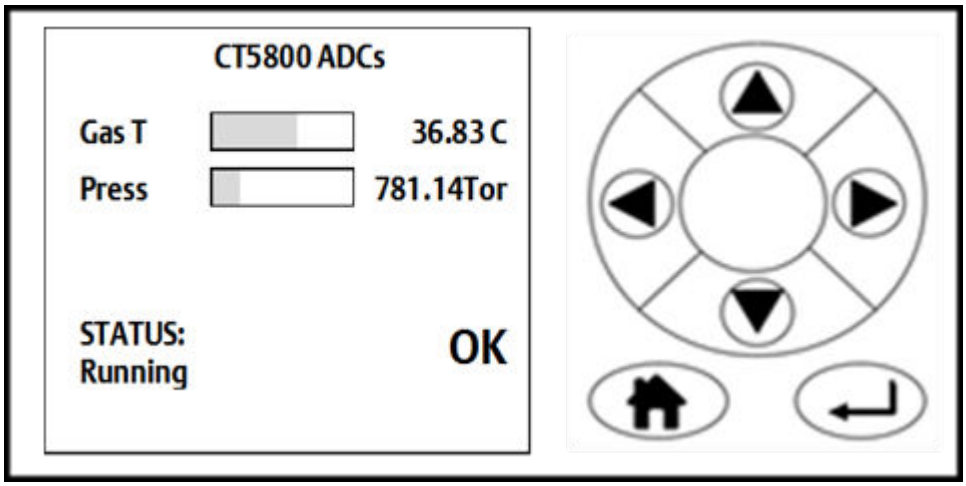


Figure 4-2: Pressure and Temperature Screen



⚠ CAUTION

UNSERVICEABLE EQUIPMENT

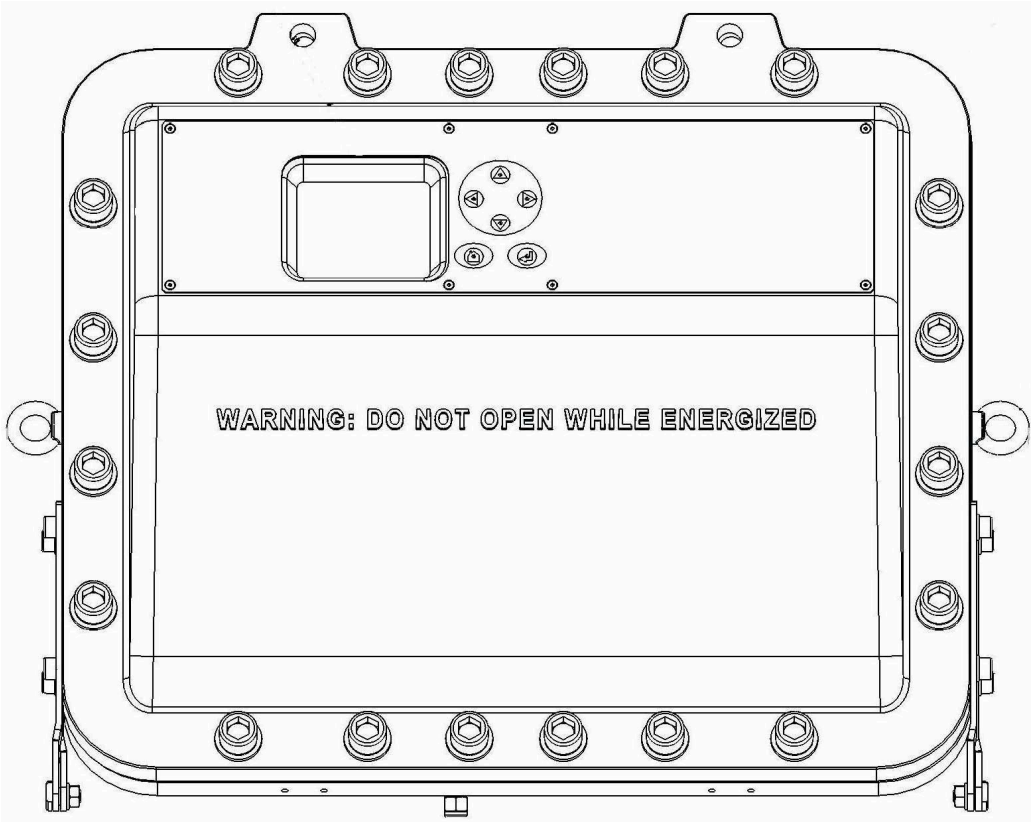
If the pressure and temperature measurements are out of tolerance, refer to Troubleshooting and diagnostics.

On both the **Gas Sensor Main** screen and the **Pressure and Temperature** screen, if the analyzer makes more measurements than can fit on the display, use ▲ and ▼ to scroll down the list.

4.3 Front panel controls and indicators

The analyzer is configured from the display controller located on the front panel.

Figure 4-3: Front Panel Display Controller



NOTICE

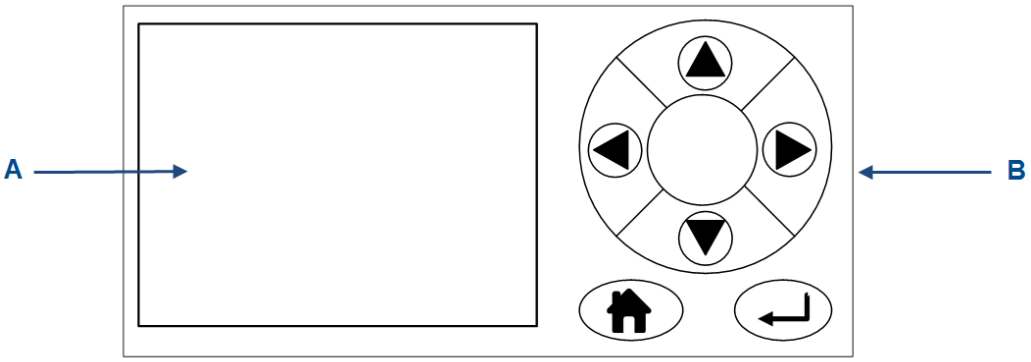
On/Off circuit breakers

There are no **On/Off** switches on the analyzer. The application of electrical power to the analyzer is controlled through an external circuit breaker.

The circuit breaker is a simple two-pole on/off circuit breaker that must be set to On to permit the safe operation of the analyzer.

4.4 Display controller

Figure 4-4: Front Panel Display Controller



A. LCD display
B. Navigation buttons

You can control the analyzer through six navigation buttons (Figure 4-4, on the display controller.

The LCD display can be used to display:

- Gas concentration measurements obtained
- Operating temperature and pressure
- Help screens
- Step-by-step calibration
- Diagnostics

The navigation buttons are configured to perform different functions according to which software screen is shown on the LCD display.

Table 4-1: Display Controller Navigation Button Functions

Button	Description
▲	Normally used to scroll up. Referred to as **UP**.
▼	Normally used to scroll down. Referred to as **DOWN**.
▶	Normally used to select. Also accesses the ***Main Menu*** from the ***Home*** screen. Referred to as **RIGHT**.
◀	Used to go back to the previous screen. No function from the ***Home*** screen. Referred to as **LEFT**.
⌂	Used to return to the **Home** screen.
↵	Generally used to select an alternative function. Also allows you to toggle between gas and physical measurements from the ***Home*** screen. Referred to as **ENTER**.

The analyzer employs Intelligent Device Management, which enables self-monitoring and diagnostics. This ensures that operators are made aware of malfunctions so they can take appropriate action. Table 4-2 defines the symbols that may be displayed.

Table 4-2: Diagnostic symbols

OK	System running
	Maintenance required: still valid output signal
	Out of specification: signal out of the specified range
	Indicates the analyzer is performing a calibration or validation or that the software has been deliberately stopped.
X	Failure: non-valid output signal

4.5 Gas Sensor Main Screen

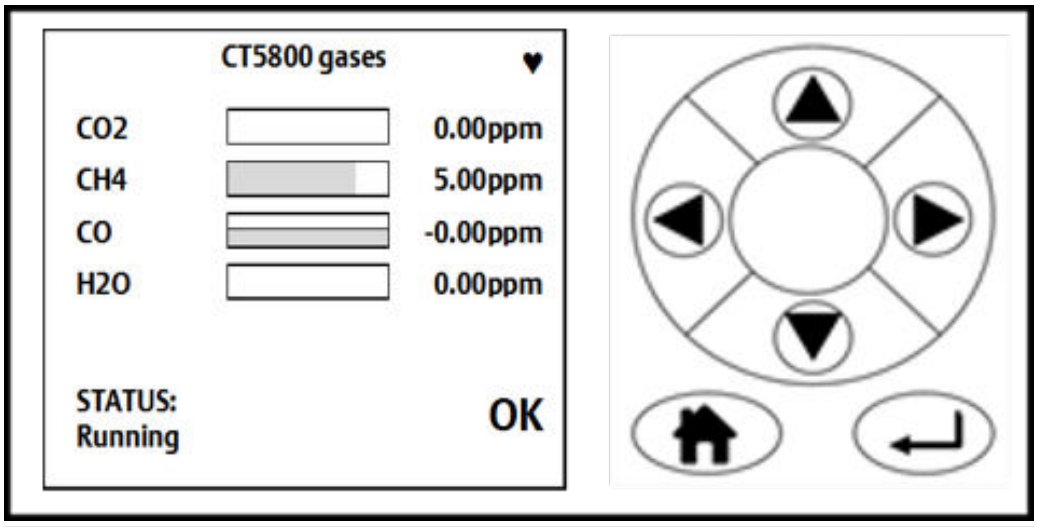
When the analyzer is switched on, at the end of the start-up procedure, the **Gas Sensor Main** screen (Figure 4-5) appears.

The *Gas Sensor Main* screen is the screen that is normally displayed.

NOTICE

The gas concentrations shown in the following screenshots may be different from those shown in your particular analyzer. The screenshots indicate the functionality of the software, which is the same regardless of the gases or gas concentrations being measured.

Figure 4-5: Gas Sensor Main Screen



The **Gas Sensor Main** screen displays the gas concentration measurements obtained by the analyzer. In the example shown in Figure 4-5, the gases carbon dioxide (CO_2), methane

(CH_4), carbon monoxide (CO), and water (H_2O) are being measured; for each gas, the concentration detected is in parts per million (ppm).

At the end of the start-up procedure, the gas measurements initially appear as **0.00 ppm** until the first readings are taken. After a few seconds, the initial gas concentrations are displayed.

The ***Gas Sensor Main*** screen also shows the status of the analyzer. In the example shown in Figure 4-5, the analyzer is **Running** and **OK** (e.g. no faults have been identified).

If a fault is identified, **?** is displayed; if maintenance is required,  is displayed.

To access other screens through the ***Main menu***, press ▶. (Refer to Figure 4-5).

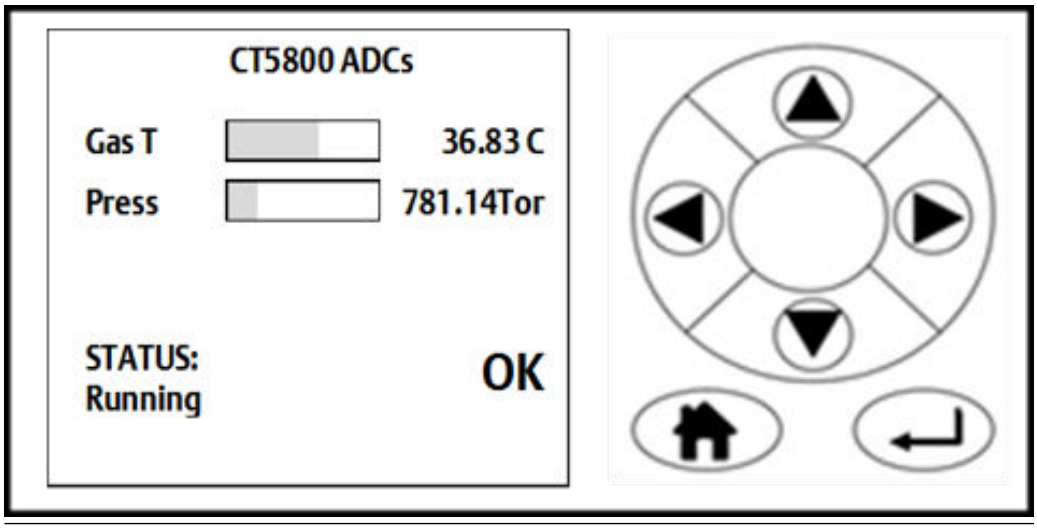
↵ is a link between the **Gas Sensor Main** screen (Figure 4-5) and the **Pressure and Temperature** screen (Figure 4-6). Press ↵ to toggle between the two screens.

On the ***Gas Sensor Main*** screen, ▲ the **STATUS** button has no function when the analyzer is operating correctly. If, however, the software detects a fault, an error message is displayed. Press ▲ to get further information on the error.

4.6 Pressure and Temperature screen

The **Pressure and Temperature** screen (Figure 4-6) shows pressure and temperature measurements taken inside the analyzer.

Figure 4-6: Pressure and Temperature Screen



NOTICE

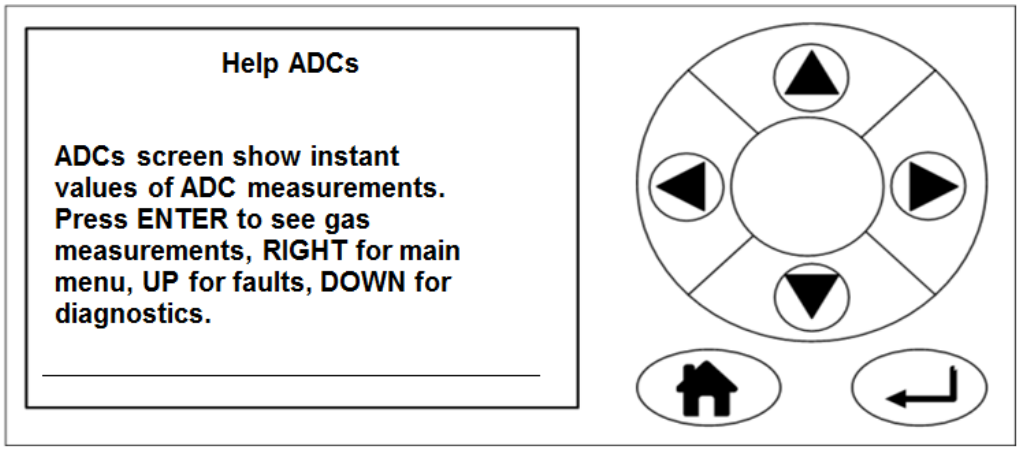
A Torr is a non-SI unit of pressure defined as 1/760 of standard atmospheric pressure and is equal to the fluid pressure of 1 mm of mercury.

4.7 Help system

The analyzer software includes a context-sensitive help system. Press  , which is available on most of the software screens, to open the help system.

The help system contains a number of different ***Help*** screens, each conveying a different message. As the help system is context-sensitive, the ***Help*** screen that appears is the one that is most appropriate to the software function engaged when  was pressed. Figure 4-7 shows an example of a ***Help*** screen.

Figure 4-7: Example of a Help Screen



4.8 Main menu

To access the ***Main menu*** , press ▶ on either the **Gas Sensor Main** screen (Figure 4-5) or the **Pressure and Temperature** screen (Figure 4-6). The ***Main menu*** ( ) options are:

DIAGNOSTICS: Displays various parameters used in the internal calculations and compares desired and actual parameters, for example, the analysis cell pressure and temperature. The diagnostics routines and screens are used to perform fault diagnosis.

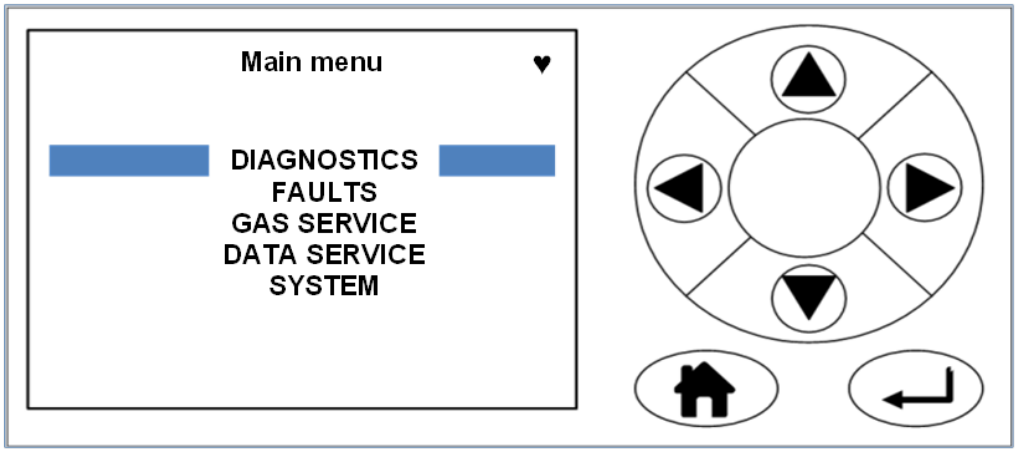
FAULTS: Navigates to a screen that lists any faults affecting the analyzer. This option is used as part of the failure diagnosis procedures.

GAS SERVICE: Allows you to check the sensor readings against a known gas source (verification) or, if necessary, to calibrate the analyzer against that known gas source (calibration).

DATA SERVICE: Navigates to a screen that allows data to be downloaded from the analyzer. The downloaded data is used to diagnose faults.

SYSTEM: Navigates to a screen that allows you to shut down the analyzer or access system information, such as software versions or IP addresses. The main motherboard IP address can also be changed from this menu. Some of these options are not available on older analyzers.

Figure 4-8: Main Menu



4.9 BACK button

On most of the software screens, the top left hand button ◀ is configured as a **BACK** button. Press **BACK** ◀ to return to the previous screen.

5 Verifying gas concentrations

5.1 Verification

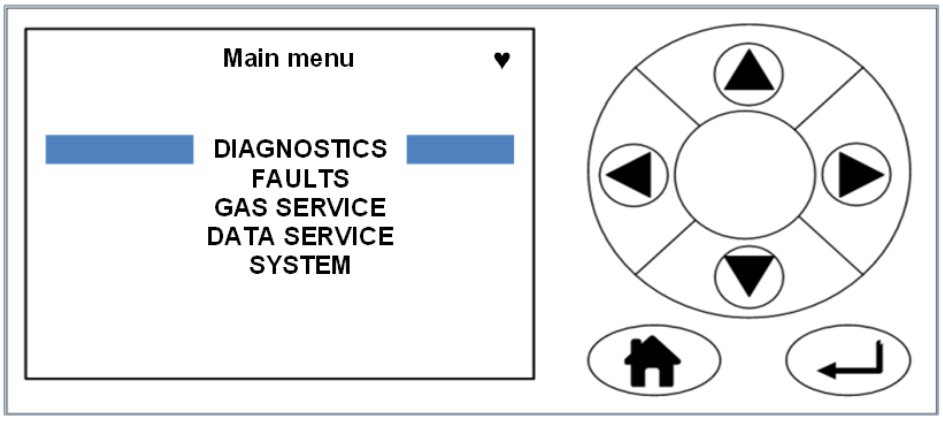
Verification flows the known gas concentration through the analyzer and gives you a display of the measurement, the cylinder value, and the difference between the two. You can use verification to confirm that the analyzer is within tolerance. If it is out of tolerance, perform a calibration (see Calibration).

5.1.1 Zero verification

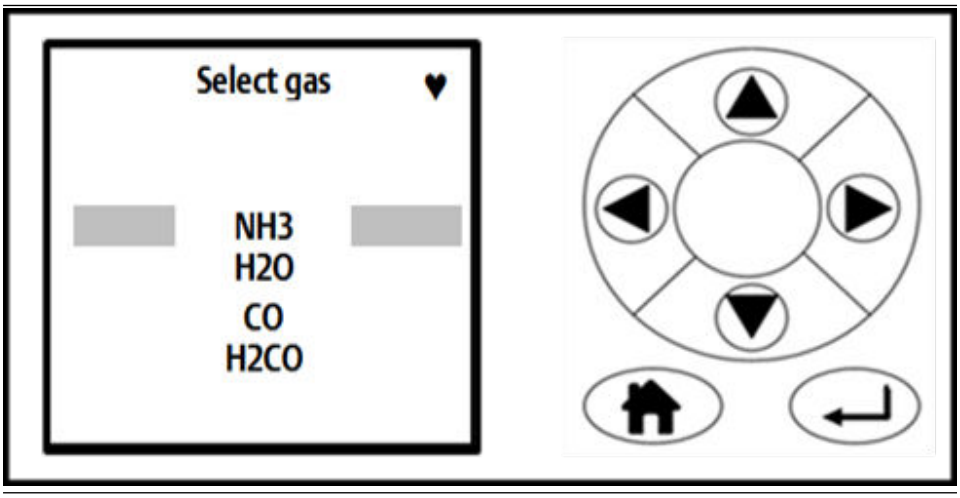
Zero verification confirms that when no sample gas is flowing through the analyzer, the gas concentrations measured by the analyzer are zero. To zero verify, compare the analyzer measurements to a known sample gas using the following procedure:

Procedure

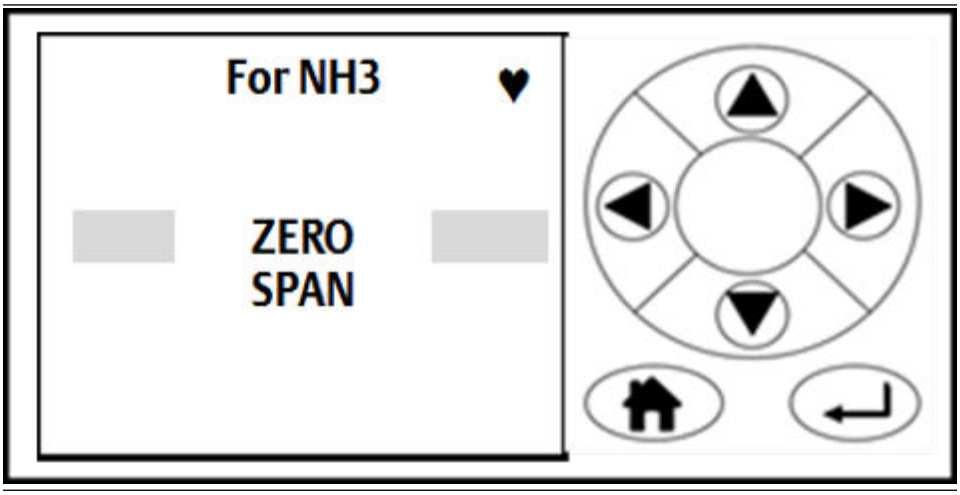
1. Using ▲ and ▼, select *GAS SERVICE*.



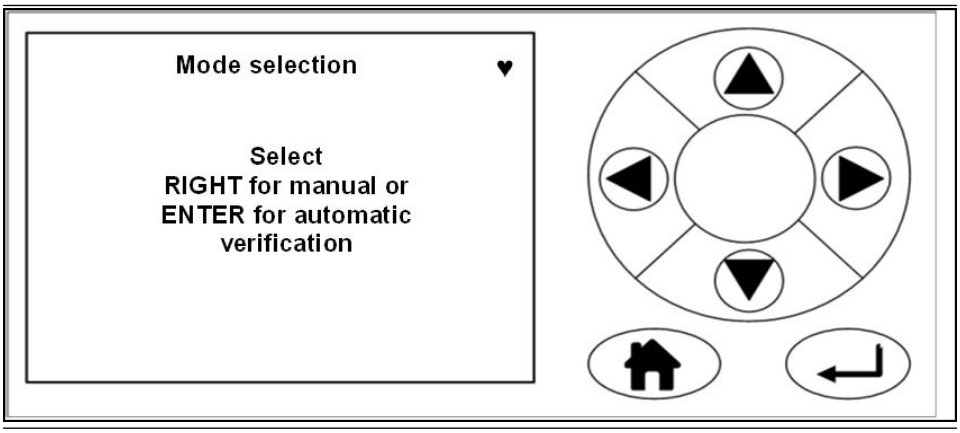
2. Press ▼.
   The *Select gas* screen opens.



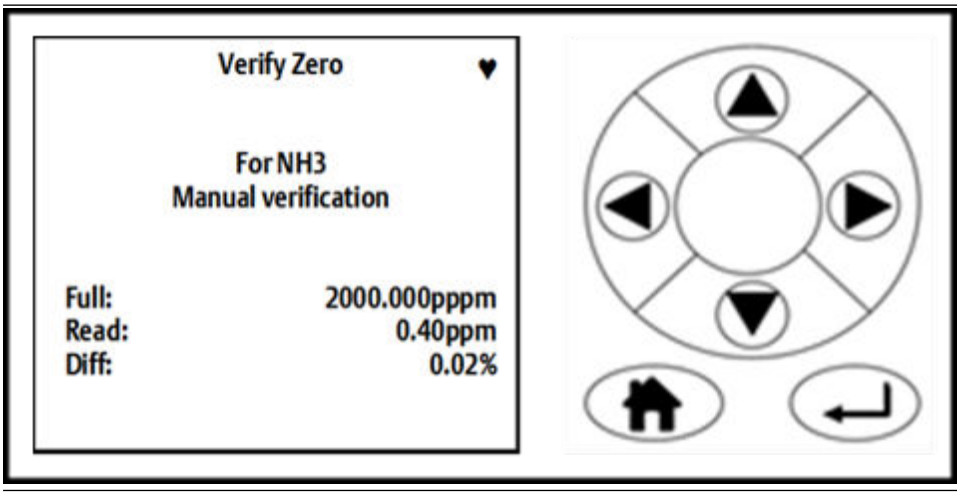
3. Use ▲ and ▼ to move the cursor until the gas that you wish to zero verify is selected. Press ▶.
   The ***Select Type*** screen opens.



4. Use ▲ and ▼ to move the cursor until the ***ZERO*** verification option is selected.
5. To perform a verification, press ▶.
   The ***Manual/Automatic*** screen opens.

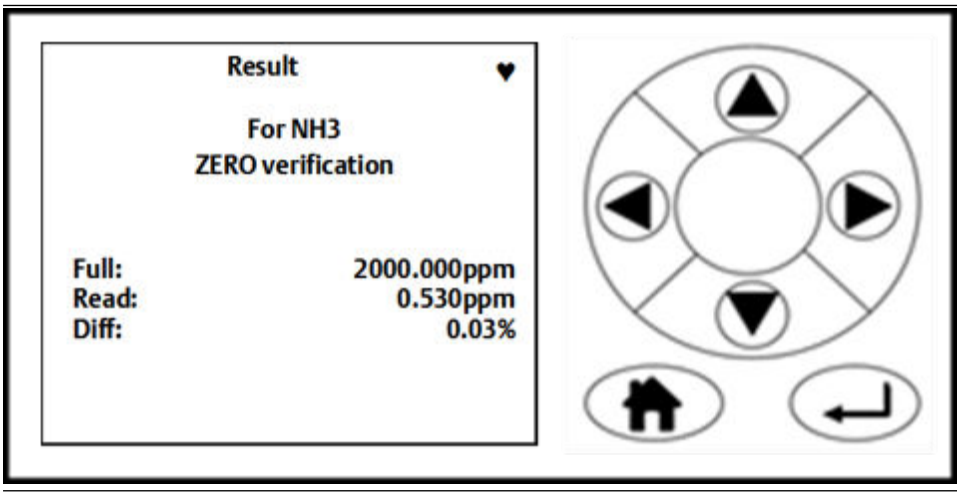


6. Press ▶ for manual verification. Press ↵ for automatic verification.
   The ***Verify Zero*** screen opens.

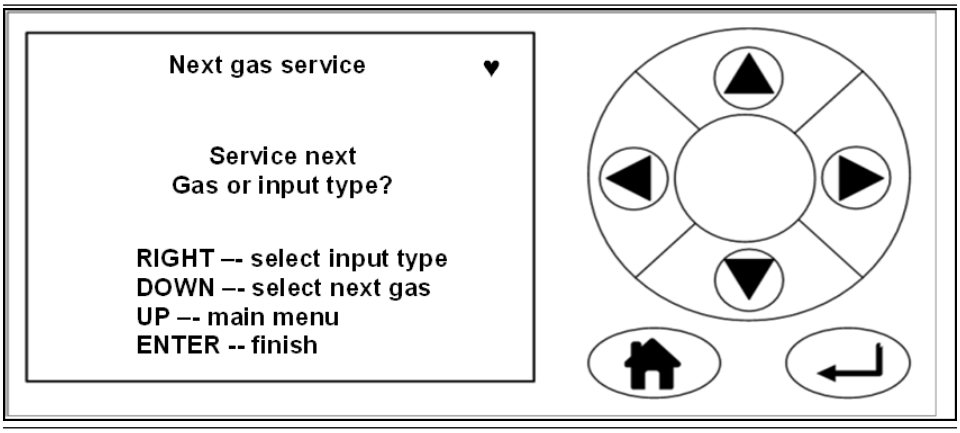


7. Allow the concentrations to stabilize and wait for two minutes after stabilization. This screen gives a reading of the concentration of the selected gas that is present as an impurity in the nitrogen calibration gas, as measured by the instrument. In the example the gas being measured is NH_3 (ammonia), and the instrument has detected a concentration of `0.40 ppm`.

8. If the reading is within tolerance, no further action is required. Press ▶ to end the zero verification process.
   The display controller proceeds to the ***Result*** screen.



9. If the reading is outside tolerance, you need to zero calibrate the analyzer.
   Refer to Zero calibration.
10. In either case, press ▶ to return to the *Calibration / Verification Complete* screen.



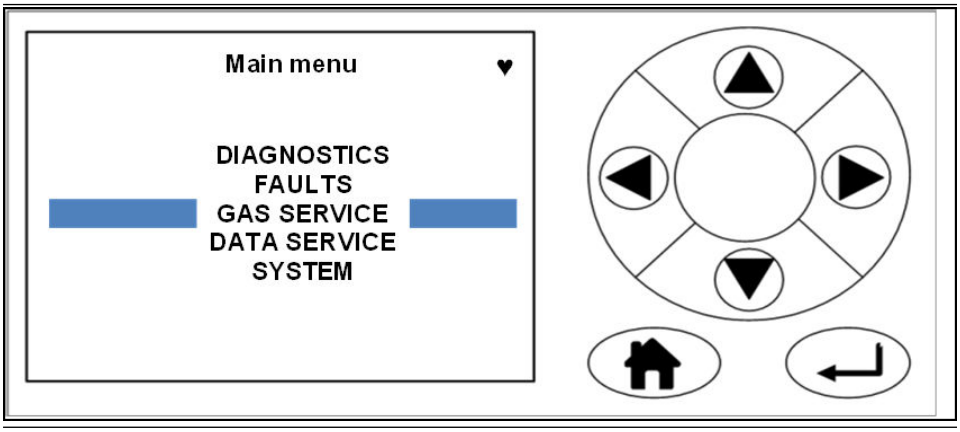
11. To perform a zero verification for another gas, press ▼.
    The software returns to the *Select gas* screen.
12. Repeat the actions in steps Step 3 through Step 10 for the next gas.
13. To perform a span verification, press ▼. Then follow the span verification procedure in Span verification.
14. If you are finished verifying the analyzer, press ↵.
    The software returns to the *Gas Sensor Main* screen.

5.1.2 Span verification

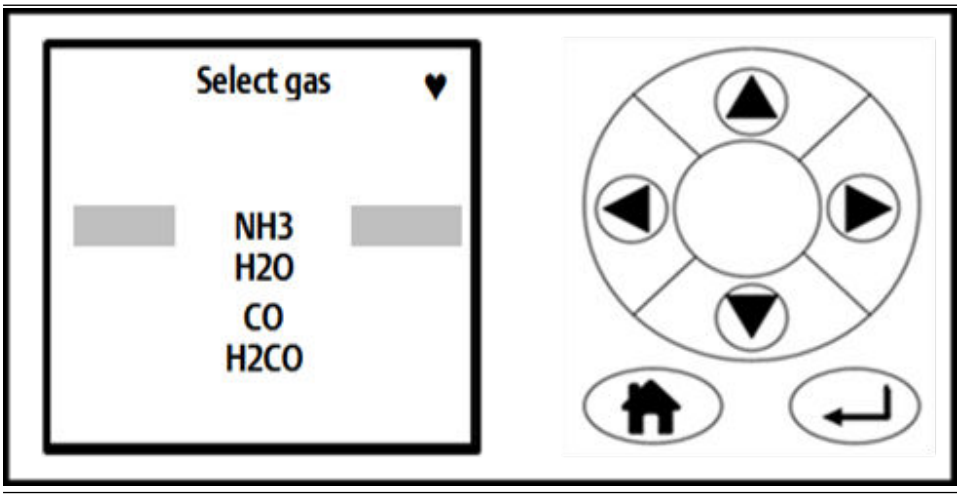
To verify the span gas concentrations measured by the analyzer when reference gas is flowing:

Procedure

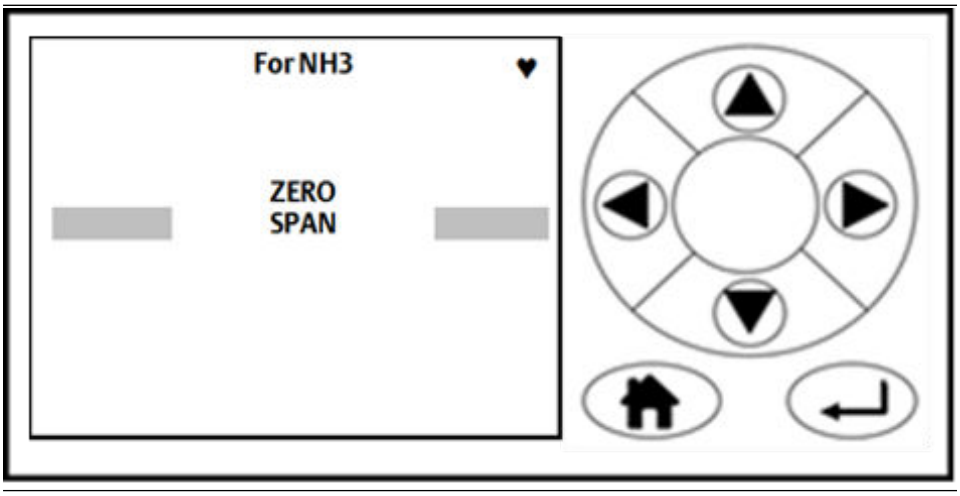
1. Use a certified reference gas cylinder as the source of the span verification gas.
2. Ensure that a pressure regulator is connected to the reference gas bottle.
3. Connect a hose from the reference gas bottle, through a T-piece, to the sample supply port on the rear panel of the analyzer.
4. Connect an excess flow line to the unused port on the T-piece and route the excess flow line to a suitable extractor.
5. On the display controller, browse to the ***Main menu***.
6. Press ▲ or ▼, select ***Gas Service***.



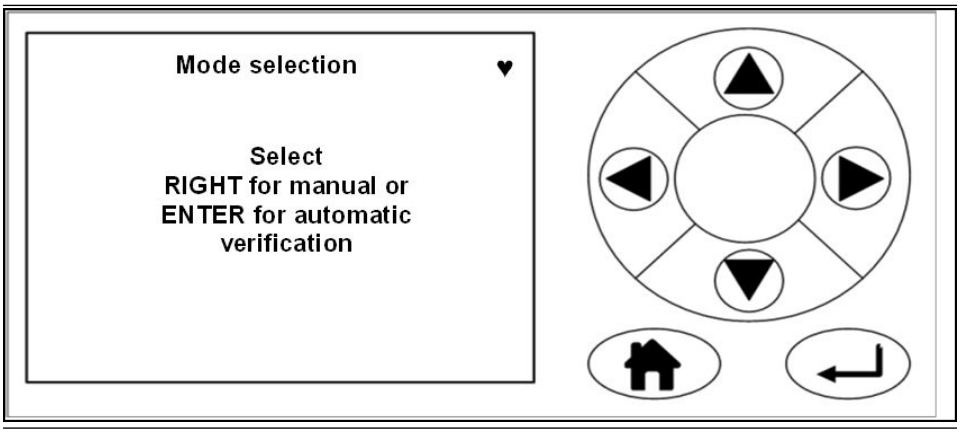
7. Press ▶. The ***Select Gas Screen*** opens.



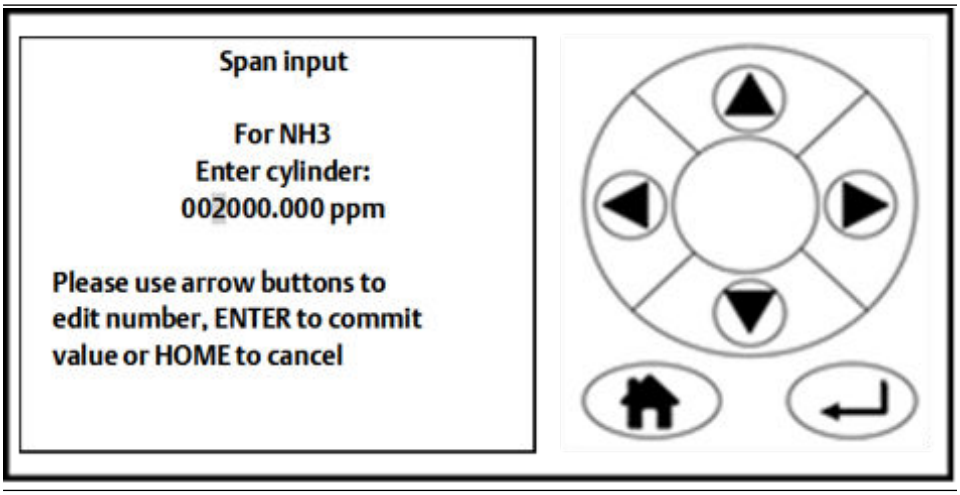
8. Use ▲ and ▼ to move the cursor until the gas that you wish to span verify is selected. Press ▶.
   The ***Select Type*** screen opens.



9. Use ▲ and ▼ until the SPAN verification option is selected. To perform a verification, press ▶.
   The ***Mode selection*** screen opens for manual or automatic verification.



10. Press ▶ for manual verification.
The ***Span input*** screen opens.

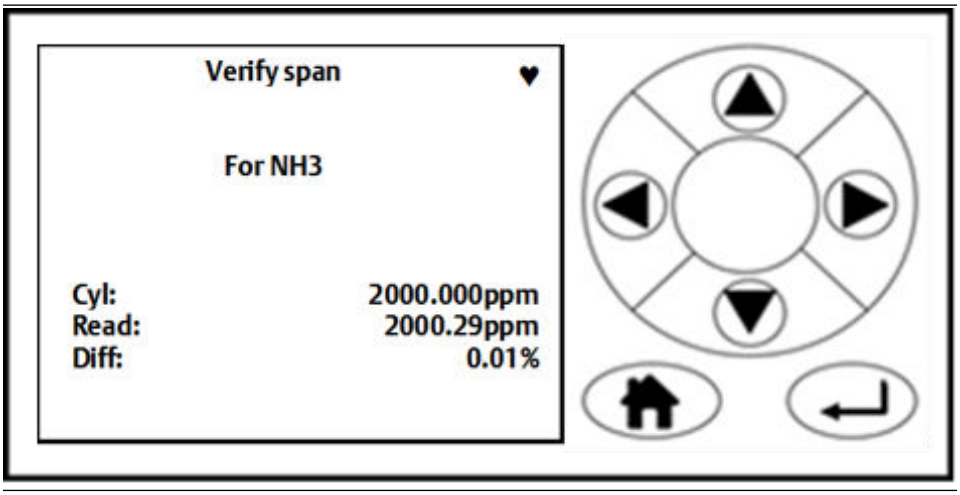


11. Use ◀ and ▶ to highlight each digit in turn; then use ▲ and ▼ to increase or decrease the value until the concentration displayed matches the cylinder you are using.

NOTICE

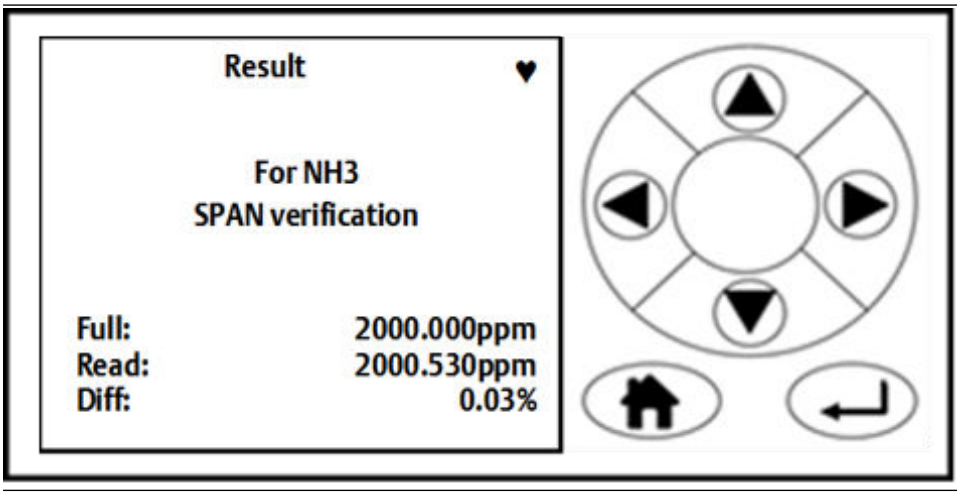
The cylinder concentration must be entered in ppm.

12. Press ↵ to proceed to the next step.
The ***Verify span*** screen opens.

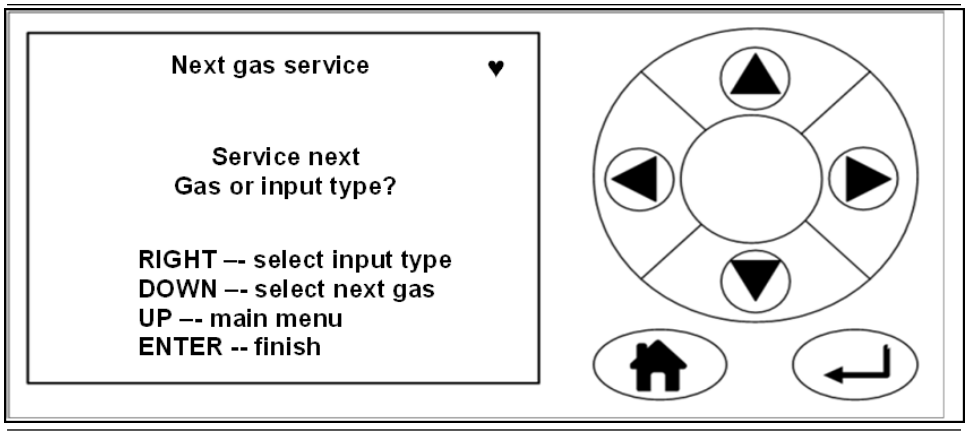


13. Press ▲ to cancel the manual verification.
14. Press ↵ to finish.
15. Repeat steps Step 5 through Step 9.

16. Press ↵ for automatic verification.
    This opens the valve (where applicable) and flows the span gas.
17. Allow the concentrations to stabilize and wait for two minutes after stabilization.
    This screen gives a reading of the concentration of the selected gas that is present, as measured by the instrument. In the example, the gas being measured is NH_3 (ammonia), and the instrument has detected a concentration of `2000.00 ppm`.
18. If the reading is within tolerance, no further action is required. Press ▶ to end the span verification process.
    The display controller proceeds to the ***Result*** screen.



19. If the reading is outside tolerance, the span calibrate the analyzer.
    Refer to Span calibration.
20. Press ▶ to return to the screen.



21. If you wish to perform a span for another gas, press ▼.
    The software returns to the ***Select gas*** screen.
22. Repeat steps Step 8 through Step 16 for the next gas.

23. If you wish to zero verify, press ▶. Then follow the zero verification procedure in Zero verification.
24. If you are finished verifying the analyzer, press ↵.
    The software returns to the ***Gas Sensor Main*** screen (Figure 4-5).

6 Gas calibration

6.1 Required tools

The gas concentrations measured by the analyzer can be validated against a known sample gas or calibrated to match it by using the following gas calibration procedure.

To calibrate the analyzer, you need the following items:

- Nitrogen gas of instrument gas purity for use as a zero calibration gas
- Suitable span calibration gases for each gas measured
- Gas bottle pressure regulators
- Interconnecting hoses to connect the gas bottles to the analyzer
- A T-piece and excess flow line

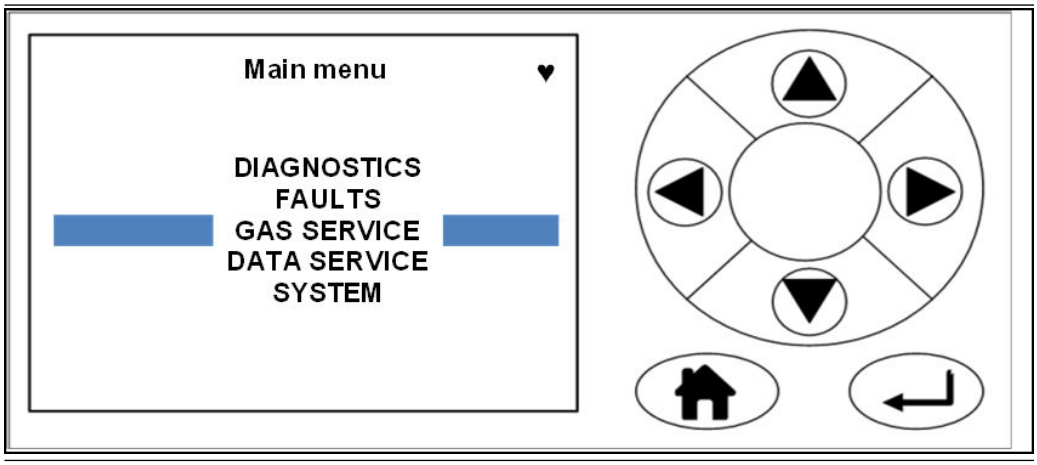
NOTICE

In the case of gases, such as H_2O, for which it is not normally possible to obtain calibrated gas cylinders, it will usually be measured by the same laser as some other gas. Validating the other gases measured by the analyzer (particularly any which are measured by the same laser as H_2O) can demonstrate that the system is functioning correctly, meaning there is no need to calibrate the water measurement directly.

If you need to calibrate (e.g. for legal requirements), you can use a water vapor generator to supply a known concentration of water vapor.

6.2 Gas service menu definitions

Access the calibration functions through the ***Main menu***. To get to the ***Main menu***, press **MENU** on either the ***Gas Sensor Main*** screen or the ***Pressure and Temperature*** screen, as described in Main menu.



Use the ***Main menu*** to access the software routines and screens that are used for calibration and maintenance. Five options are presented . For more information about the options on the ***Main menu***.

On the ***Main menu***, use ▲ and ▼ to scroll between the menu options.

When the option you want is highlighted (***GAS SERVICE*** is the example shown, press ▶ to go to the first screen of that software routine.

6.3 Calibration

Calibration flows the known cylinder gas through the analyzer and then adjusts the readout until the measurement matches the cylinder. The analyzer then applies this adjustment to all measurements until the next calibration. There are two circumstances in which you may want to calibrate:

1. After you verify gas concentrations (see Verifying gas concentrations) and find that the analyzer readings are outside of tolerance.
2. At regular intervals, such as once a month.

6.3.1 Zero calibration

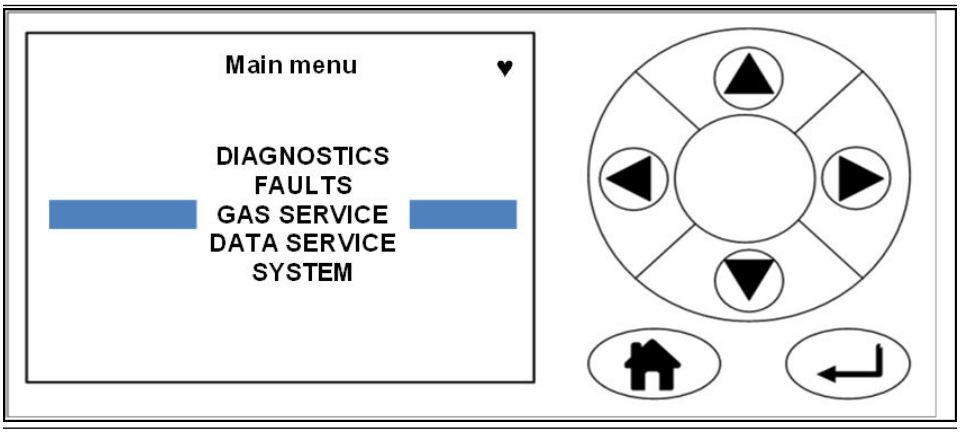
The zero calibration procedure adjusts for any zero offset in the measurement. Zero calibration is done by calibrating the analyzer measurements against a known sample gas using the following procedure.

Prerequisites

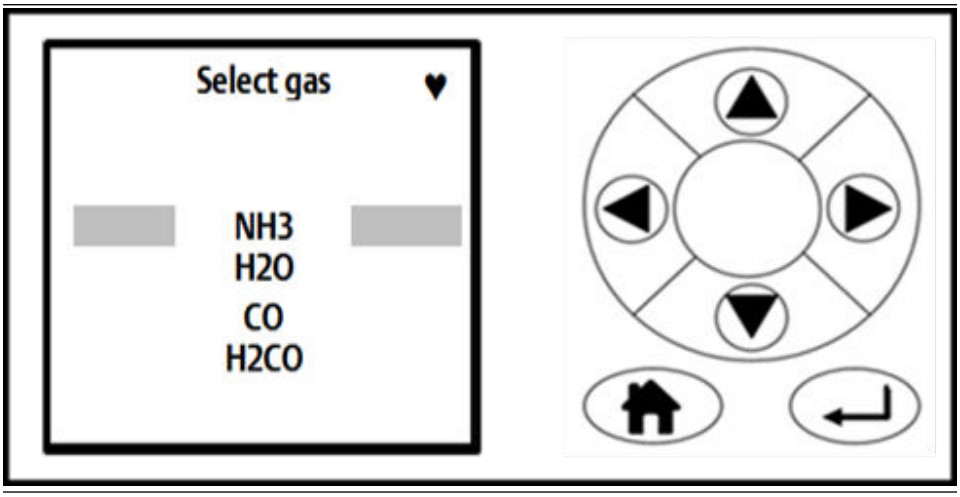
Run the analyzer at a stable temperature for at least thirty minutes prior to commencing this procedure.

Procedure

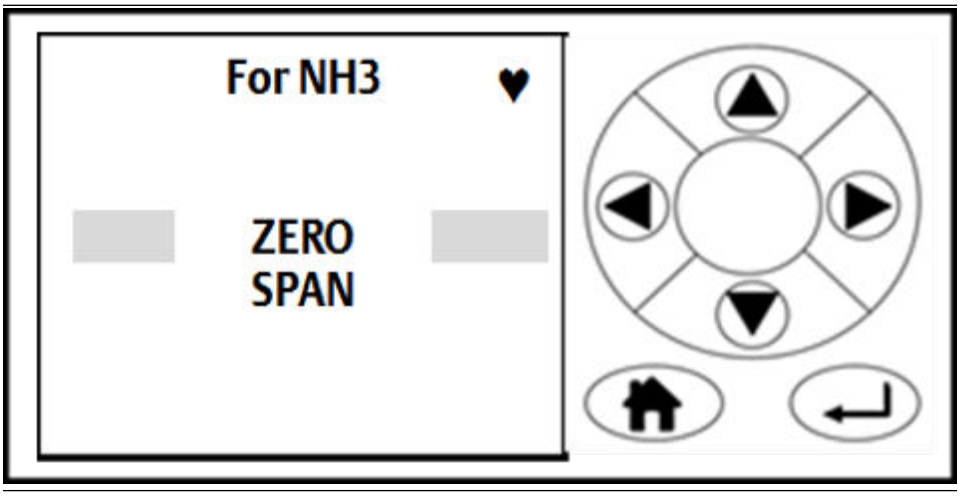
1. Use nitrogen gas of "instrument gas" purity as the zero calibration gas.
2. Ensure that a pressure regulator is connected to the nitrogen gas bottle.
3. Connect a hose from the nitrogen gas bottle through a T-piece to the sample supply port on the rear of the analyzer.
4. Connect an excess flow line to the unused port on the T-piece and route the excess flow line to a suitable extractor.
5. On the display controller of the analyzer, browse to the ***Main menu*** as described in Gas service menu definitions.



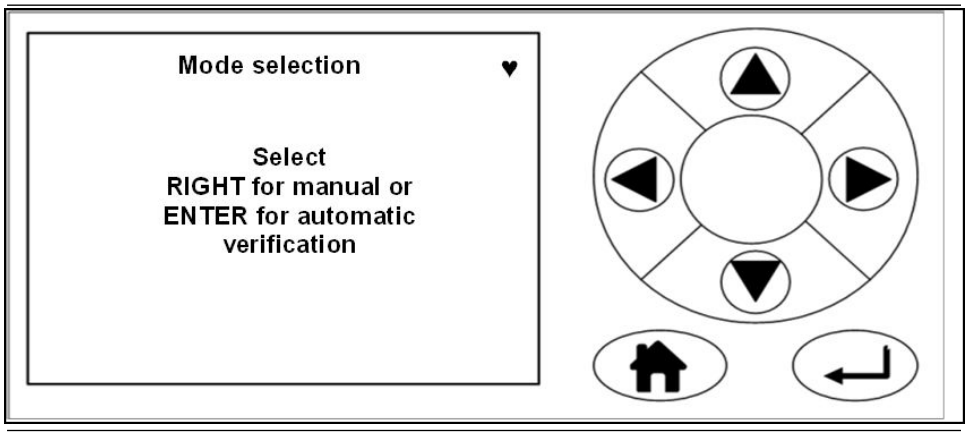
6. Using ▲ and ▼, select *GAS SERVICE*. Press ▶. The *Select gas screen* opens.



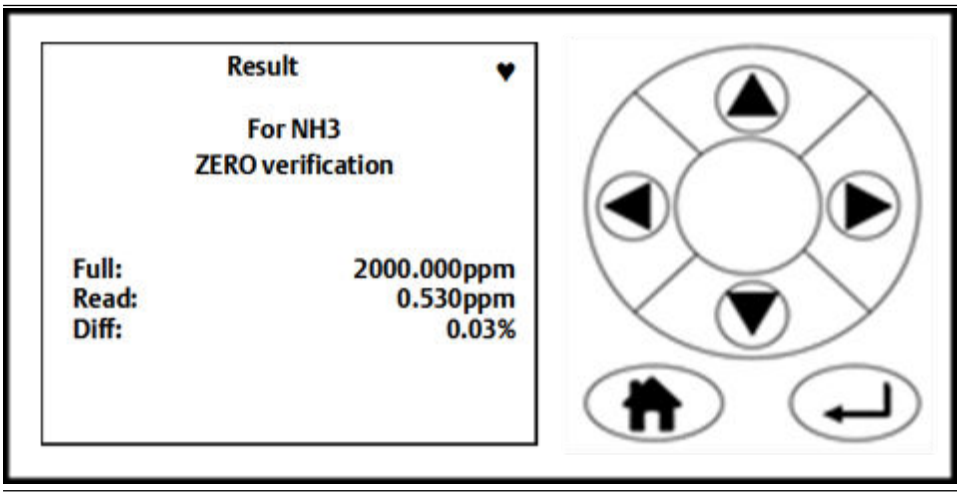
7. Use ▲ and ▼ to move the cursor until the gas that you wish to zero calibrate is selected. Press ▶.
   The ***Select Type*** screen opens.



8. Use ▲ and ▼ to move the cursor until the ***ZERO*** calibration option is selected .
9. To calibrate, press ↵.
   The ***Mode selection*** screen opens.



10. Press ▶ for manual calibration. Press ↵ for automatic calibration.
11. Press ▶ to confirm.
    The ***Result*** screen displays.



12. After the required flush time (dependent on analyzer configuration), the top line on the screen changes from `Calibrate zero` to `Result`.
    This shows the zero calibration is complete.
13. Press ↵ to finish the process.
14. Press ▶ to display the ***Calibrate gas*** screen and perform a span calibration on the same gas (see Span calibration).

6.3.2 Span calibration

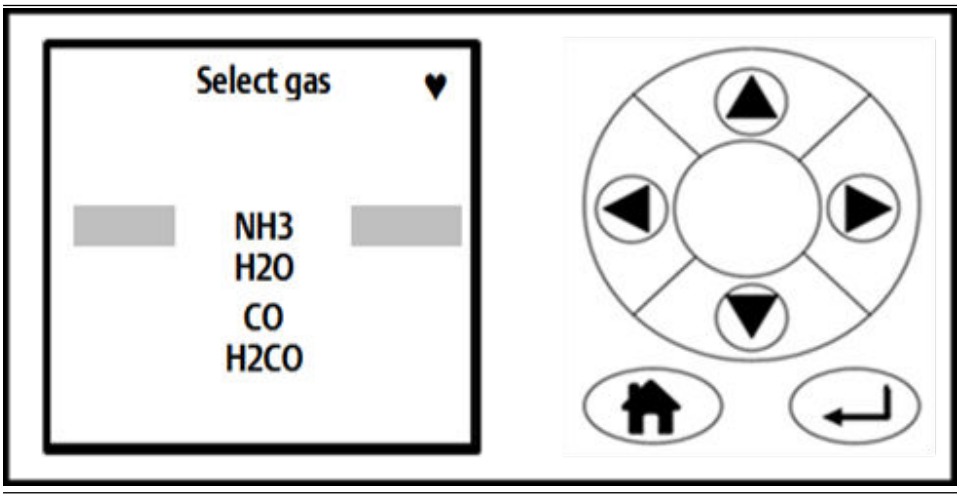
Span calibrate to verify the span gas concentrations measured by the analyzer when reference gas is flowing and, if necessary, calibrate them against the known reference gas.

Prerequisites

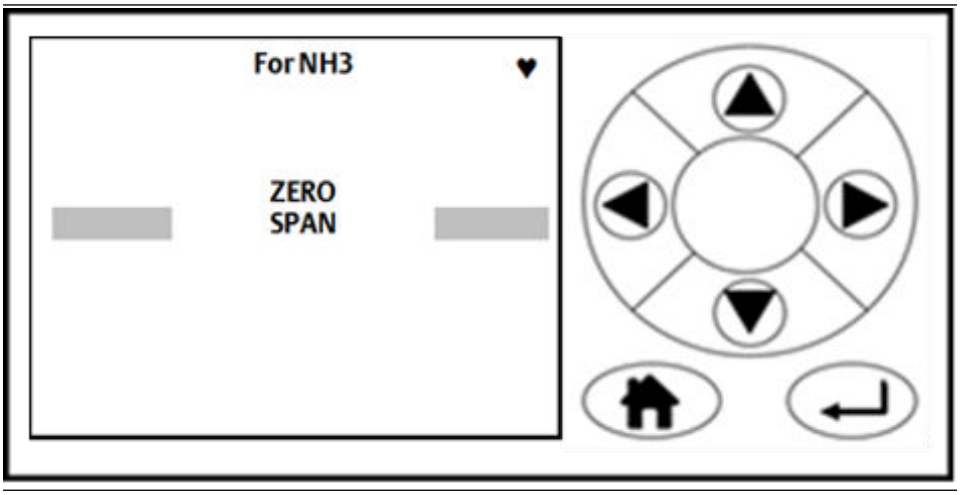
Run the analyzer at a stable temperature for at least 30 minutes prior to commencing this procedure. Startup takes 90 minutes to achieve the required temperature.

Procedure

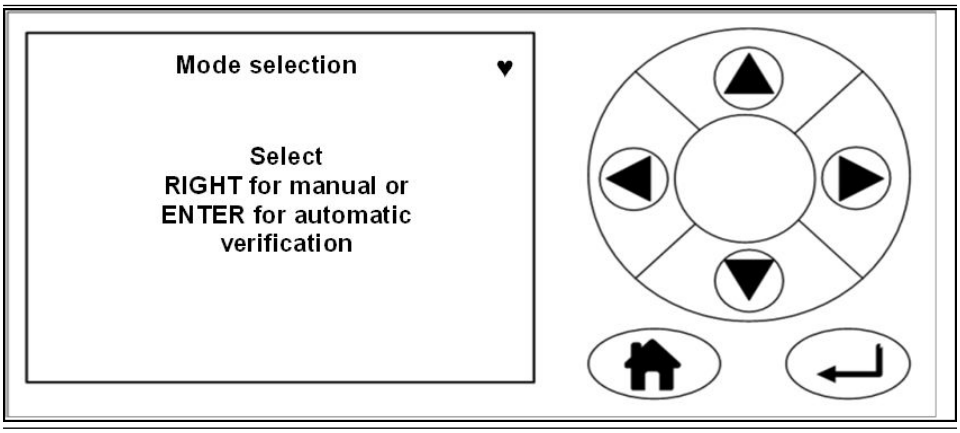
1. Use a certified reference gas cylinder as the source of the span calibration gas.
2. Make sure that a pressure regulator is connected to the reference gas bottle.
3. Connect a hose from the reference gas bottle, through a T-piece, to the sample supply port on the rear panel of the analyzer. Connect an excess flow line to the unused port on the T-piece and route the excess flow line to a suitable extractor.
4. On the display controller of the analyzer, browse to the ***Main menu*** as described in Main menu.
5. Using ▲ and ▼, select **GAS SERVICE**.
6. Press ▶.
   The ***Select gas*** screen opens.



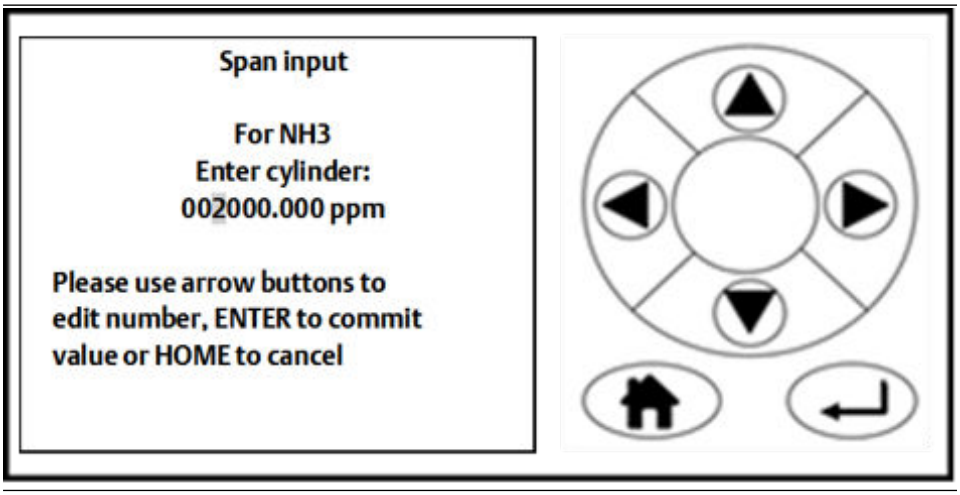
7. Use ▲ and ▼ to move the cursor until the gas that you wish to span calibrate is highlighted by the cursor. Press ▶.
The ***Select type*** screen opens.



8. Use ▲ and ▼ to move the cursor until ***SPAN*** is selected. To calibrate, press ↵.
The ***Mode selection*** screen opens.



9. Press ▶ to perform a manual calibration.
The ***Span input*** screen opens.

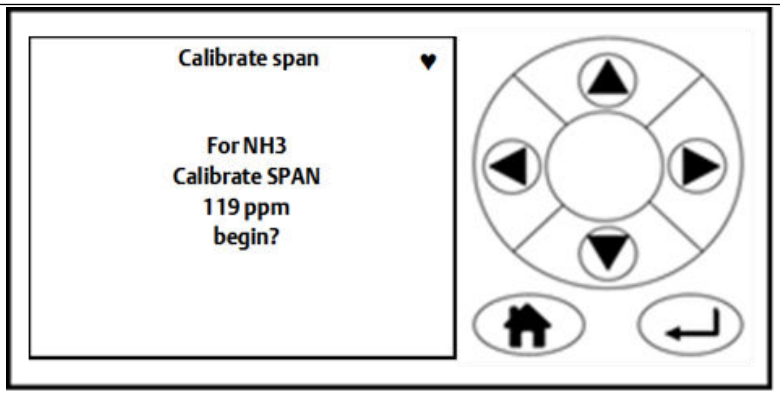


10. Use ◀ and ▶ to highlight each digit in turn; then use ▲ and ▼ to increase or decrease the value until the concentration displayed matches the cylinder you are using. Press ↵ to proceed to the next step.

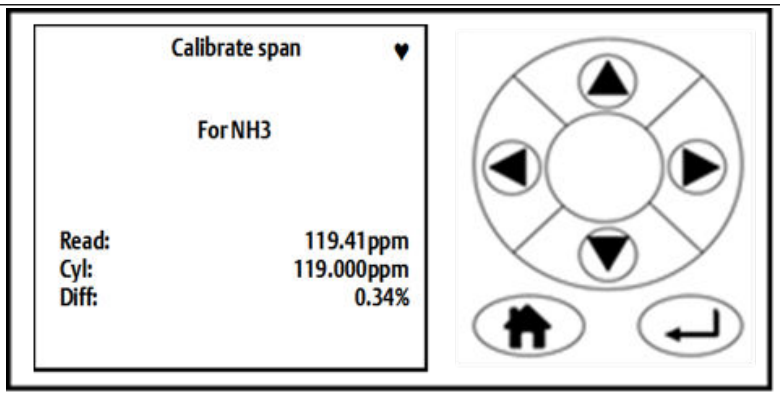
NOTICE

Enter the cylinder concentration in ppm.

The ***Begin Calibrate span*** screen opens.

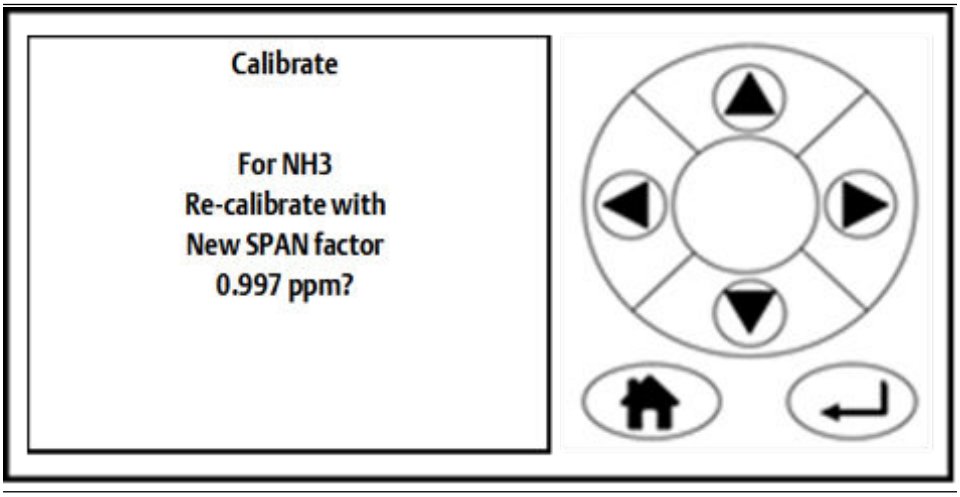


11. Press ▶ to confirm. The ***Calibrate span*** screen opens.



12. Allow the concentrations to stabilize and wait for two minutes after stabilization. This screen gives a reading of the concentration of the selected gas that is present, as measured by the instrument. The gas being measured is NH_3 (ammonia), and the instrument has detected a concentration of `119.41 ppm` (vol).
13. If the reading is now within tolerance, no further action is required. Press ▲ or ▼ to abort the span calibration process.
14. If the reading is outside tolerance, press **ENTER**.
    The analyzer returns to its factory-set calibration. Allow a minute to ensure the readings are stable.
15. If the reading is now within tolerance, no further action is required. Press ▲ or ▼ to abort the calibration process.
16. If the calibration of the analyzer remains outside of tolerance, you can adjust the calibration by pressing ▶.
    This brings up a ***Calibrate*** screen.
17. To proceed with the automatic re-calibration, press ▶.
    The automatic re-calibration of the instrument's span calibration starts, and the offset shown on the screen is `(0.997)` applied to the instrument. Press ▲ or ▼ to abort the calibration process.

When the calibration or verification is complete, the screen is displayed.



18. If you wish to perform a span calibration for another gas, press ▼.
The software returns to the ***Select gas*** screen. Repeat steps Step 7 through Step 17 for the next gas.
19. If you are finished calibrating the analyzer, press ↵.
The software returns to the ***Main menu***.

7 Troubleshooting and diagnostics

7.1 Troubleshooting, repairs, and failure diagnostics

To diagnose failures in the analyzer, you must interpret system fault messages shown on the LCD display, visually examine the data, perform failure diagnostic tests, and download performance data and send that data to Emerson for analysis.

In the failure diagnosis procedures, all controls and indicators are on the analyzer unless otherwise indicated.

Observe and obey all safety precautions when performing preventative maintenance on the analyzer.

Important
The troubleshooting and failure diagnosis procedures described in this chapter assume that any host equipment provided by you is fully functional. Always make sure that the host equipment is fully serviceable before performing failure diagnosis on the analyzer.

Failure diagnosis, repair, and maintenance must only be performed by:

- Maintenance engineers who have the necessary skills, training, and hazardous area Ex training where applicable and who have been authorized to perform maintenance on the analyzer.
- Emerson customer care engineers.

In all the cases described in this chapter, maintenance personnel must perform the repairs by directly replacing the faulty item with a known serviceable spare part supplied by Emerson. All other items must be repaired or replaced by the manufacturer.

NOTICE

As a general principle, if any optical component other than the cell assembly and the laser module is unserviceable, the analyzer must be repaired by Emerson. Repair, replacement, and alignment of the optical components require the use of special optical test/calibration equipment and procedures.

⚠ DANGER

FLAMMABLE SUBSTANCES

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Some parts of the analyzer may reach temperatures of 140 °F (60 °C) and may present an igintion source. A fire may result if this precaution is not observed.

Exercise care when using oil, paint, cleaning rags, and other flammable substances near the analyzer.

Always assume that the interior of an analyzer is hot unless it has been switched off and allowed to cool down.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

TRANSPORTATION HAZARD

Failure to secure the equipment may cause a break-away and injure personnel.

When preparing the analyzer for transport by air, road, or rail, safeguard it against movement or break-away during transport by securely strapping it in place. Use suitable fasteners for the weight of the analyzer.

⚠ WARNING

INSTALLATION HAZARD

Failure to properly install the equipment may cause serious injury to personnel.

Make sure that the wall unit the analyzer is mounted on is solid, stable, and of a suitable material to hold the weight of the analyzer.

Do not mount the analyzer on stud or partition walls.

⚠ WARNING

FIRE AND EXPLOSION

Failure to observe this precaution may cause death, personal injury, and/or damage to property.

Do not open the Ex d enclosure of the analyzer unless the atmosphere in the area is known to be below the ignitable concentration of combustible gases or materials.

⚠ WARNING

OPTICAL RADIATION EXPOSURE HAZARD

The analyzer contains lasers. Opening the analyzer and attempting to perform adjustments or procedures other than those specified in this manual may result in hazardous optical radiation exposure.

Failure to follow the correct procedures may cause damage to the eye.

The Rosemount CT5800 is Class 1. The beams are fully enclosed, and there is no access to the laser beams while the product is in operation or during maintenance. Do not look at the lasers with any kind of magnifier or optical measuring device.

The use of control or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

In accordance with USA 21 CFR 1040, the Rosemount CT5800 has warning labels at appropriate positions.

The locations of the safety labels in the analyzer are specified in Safety and system labels and annotation.

There are three types of lasers that may be included in the Rosemount CT5800: Quantum Cascade Lasers (QCLs), Interband Cascade Lasers (ICLs), and Tunable Diode Lasers (TDLs). The characteristics of the lasers contained within are given in the table below.

Parameter	QCL	ICL	TDL	Comments
Operation mode	Pulsed	Pulsed	Pulsed	
Lasers per system	1 - 6	1 - 6	1 - 6	Maximum of 6 lasers per system
Wavelength	4 -10 µm	2 - 5 µm	760 nm	

Parameter	QCL	ICL	TDL	Comments
Power	< 5 mW	< 5 mW	< 5 mW	
Pulse duration	< 1 µs	1 µs	< 5 µs	
Pulse repetition frequency	< 100 kHz	< 100 kHz	< 100 kHz	
Duty cycle	< 5%	< 5%	< 5%	

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.

Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.

Always wear proper protective equipment when handling the analyzer.

Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.

The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.

If burns occur, seek immediate medical treatment.

⚠ WARNING

HAZARDOUS SUBSTANCES

Gas handling components within the analyzer will contain particulate matter residue from the sample gases. Over the life of the analyzer, the concentration of the particulate matter will become enriched within the gas handling components.

When performing repairs or maintenance on the analyzer:

- Handle used gas handling components with extreme caution.
- Avoid direct skin contact with used gas handling components.
- Do not smoke, drink, or eat in the work area.
- Wear goggles or eye shields.
- Wear a suitable face mask to protect against inhalation of particulate matter.
- Do not wet fingers, eyes, or any exposed skin.
- Pack used gas handling components for disposal in sealed packaging and label them *Contaminated*.
- Dispose of contaminated items as hazardous material according to the applicable local, national, or international health and safety regulations and pollution regulations.

7.2 Using the Built-in Self-Test (BIST) fault diagnostics

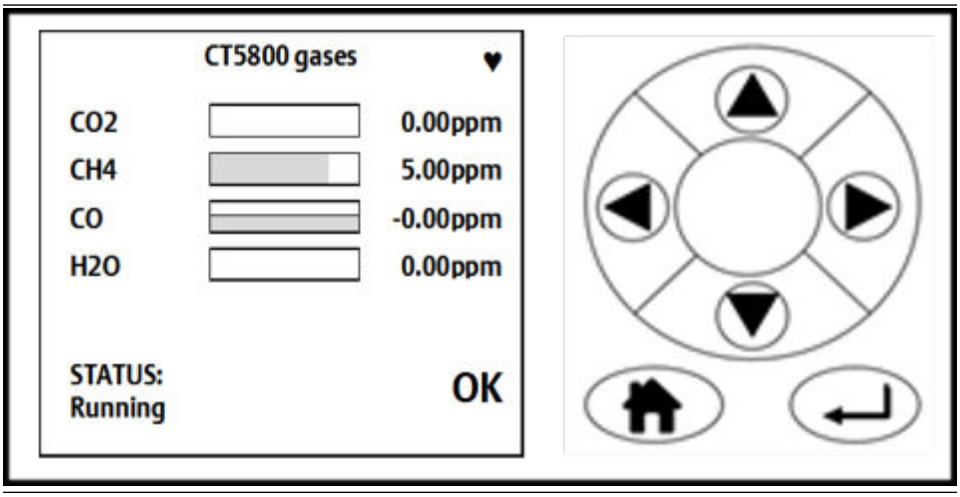
The analyzer has a limited BIST diagnostics function.

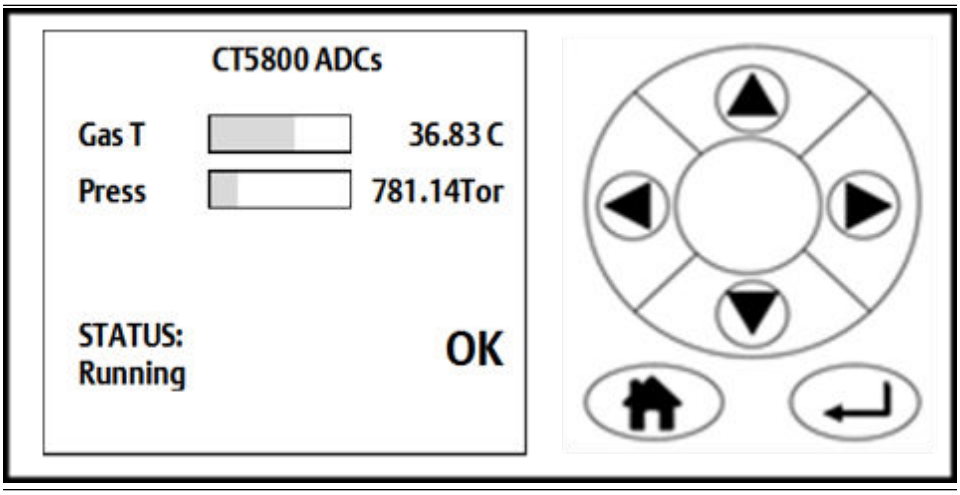
Prerequisites

The BIST function can be used to perform failure diagnosis of some functions in situations where there is a fault other than a complete failure of the equipment. Use the display controller mounted on the front panel to access and control the BIST.

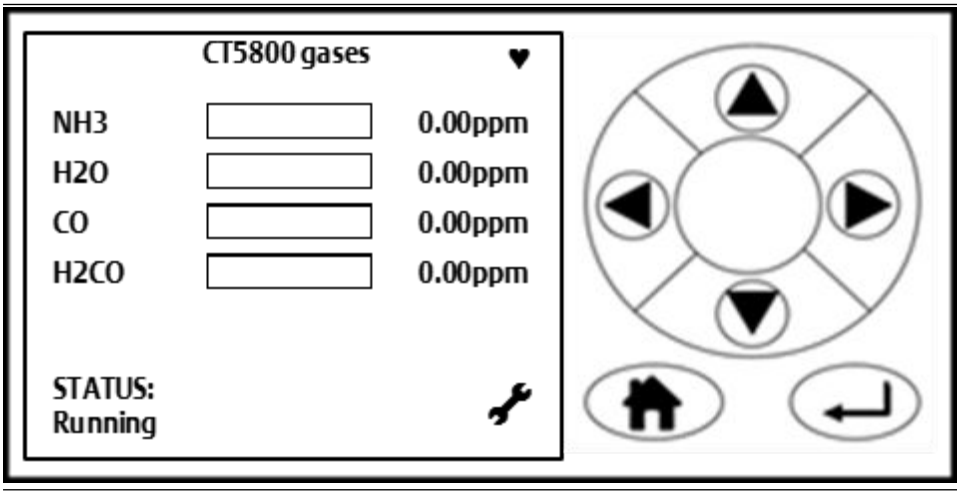
Procedure

1. You can see the STATUS information from either the ***Gas Sensor Main*** screen or the ***Pressure and Temperature*** screen.

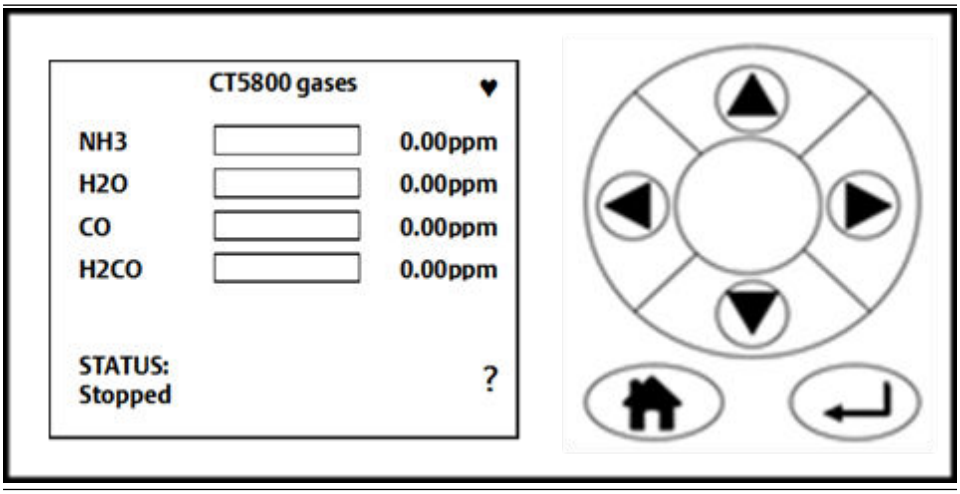




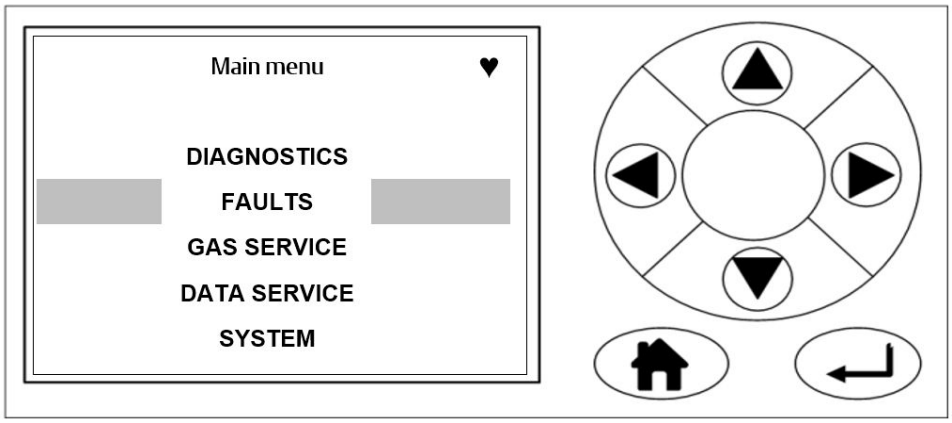
2. When the analyzer is running correctly, the ***STATUS*** displays ***Running*** and ***OK***.
3. If a fault is detected the ***STATUS*** display in the bottom left-hand corner of the screen changes from ***OK*** to a flashing .



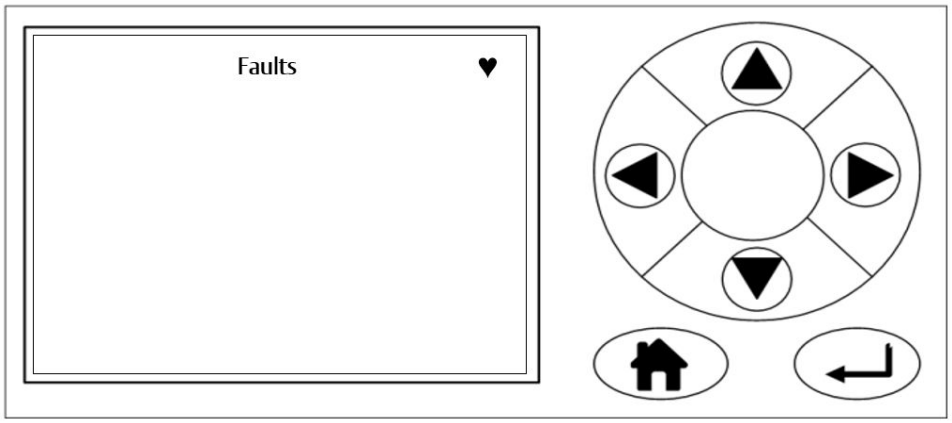
If the analyzer stops, the *STATUS* changes to *Stopped*, and *OK* changes to a **?**.



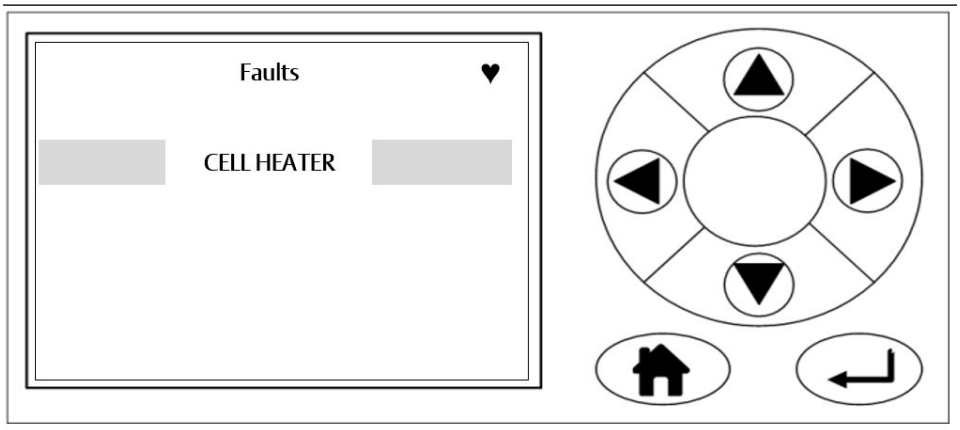
4. From either the *Gas sensor main* screen or the *Pressure and Temperature* screen, press ▶ to go to the *Main menu*.
5. Press ▲ and ▼ to scroll to the *Faults* screen.



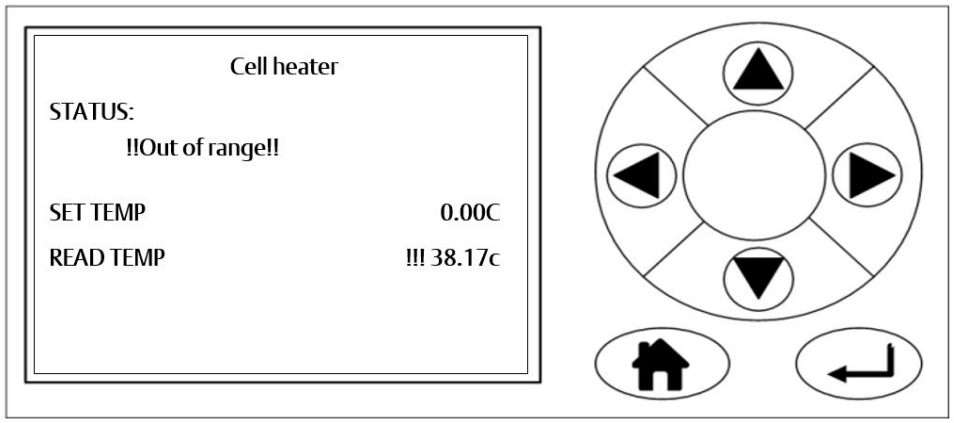
If the BIST has not identified any faults, the central area of the ***Faults*** screen is blank.



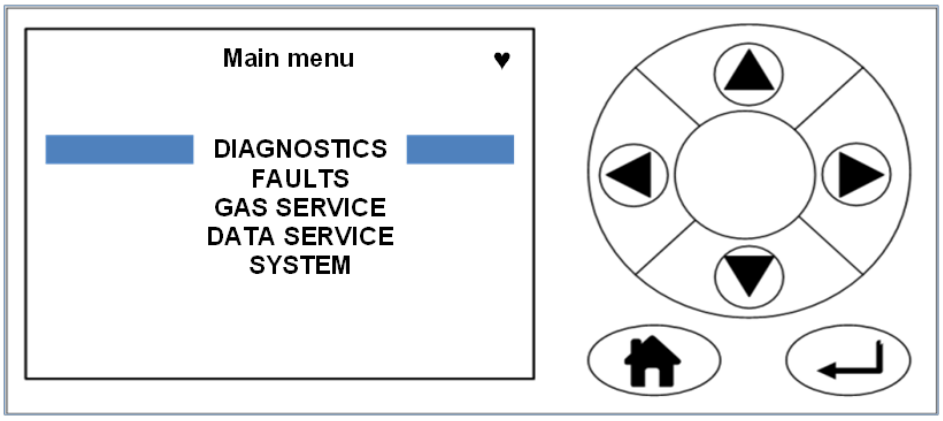
If the BIST has identified faults, the display controller indicates the fault. The precise data displayed varies depending upon where the fault has occurred in the analyzer.



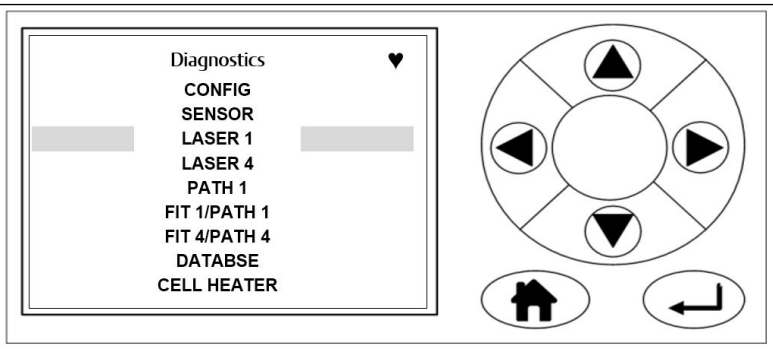
6. Press ▲ and ▼ to list the fault listed.
7. Press ▶ to display the ***Fault diagnostic information*** screen.



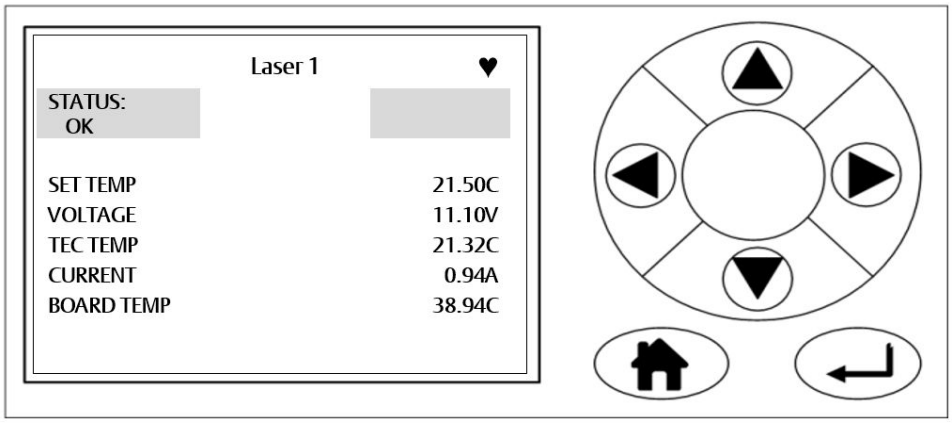
8. Examine the data shown on the ***Fault*** screen to determine if the suspect component has failed or is operating outside of its correct parameters. If you do not have the necessary information to determine if the suspect component is faulty, contact your local Customer Care representative.
9. From the ***Main menu***, press ▲ and ▼ to scroll to ***DIAGNOSTICS***.



The ***Diagnostics*** screen lists those main components of the analyzer where problems can be diagnosed using the BIST system. The ***Diagnostics*** screen also enables you to check on the status and, where appropriate, the values of any of the listed components.



10. Press ▲ and ▼ to scroll to the component for further troubleshooting.
11. Press ▶ to display the component's diagnostic information. (e.g. a diagnostics example for Laser 1)

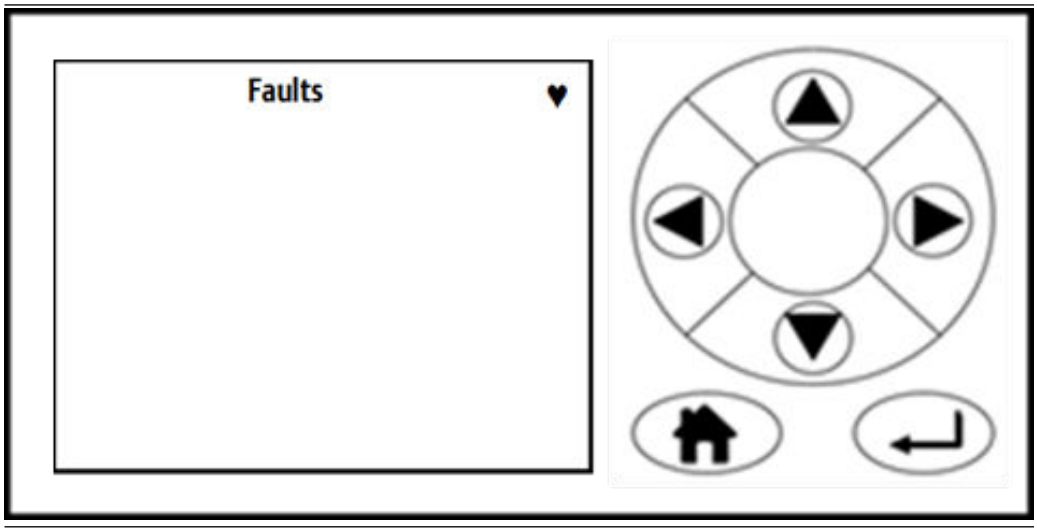


The parameters data displayed varies depending upon which component was selected for diagnosis.

12. Examine the data shown on the ***Component Diagnostic*** screen to determine if the suspect component has failed or is operating outside of its correct parameters. If you do not have the necessary information to determine if the suspect component is faulty, contact your local Customer Care representative.

7.3 Faults menu

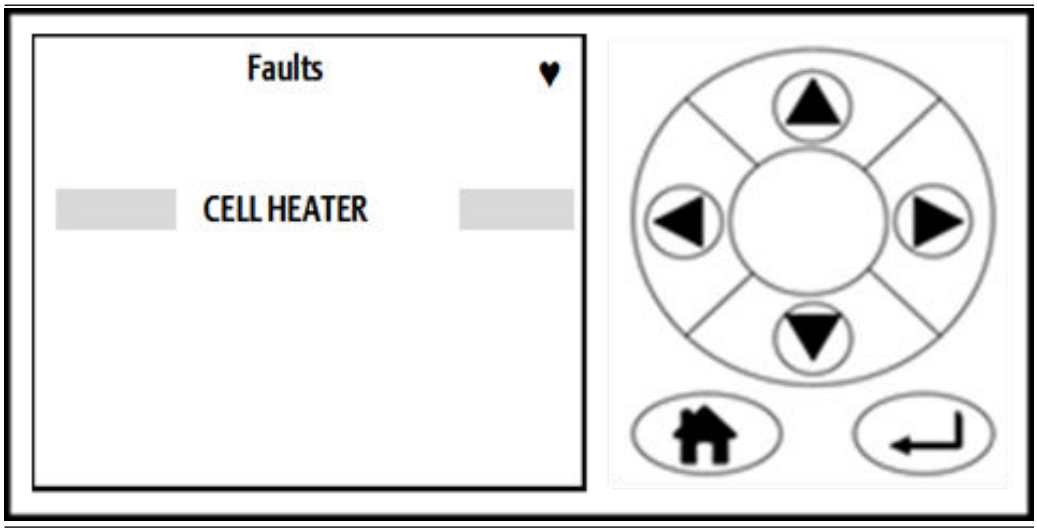
The ***Faults*** menu displays an example list of faults affecting the analyzer that have been identified by the BIST. If no faults have been identified by the BIST, the central area of the Faults menu is blank.



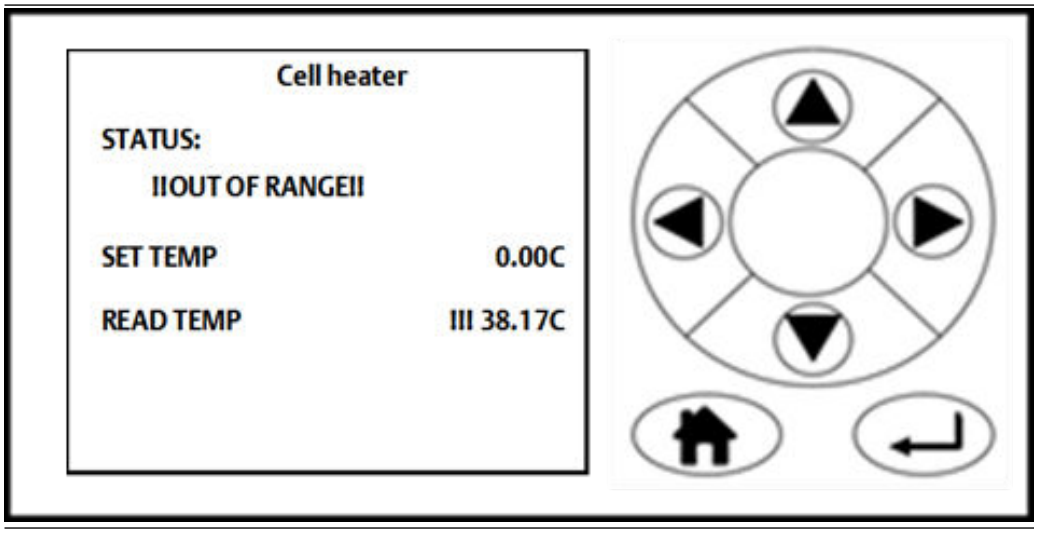
However, if the BIST identifies a fault, the display shows what the fault is.

NOTICE

The precise data displayed varies depending upon where the fault has occurred.



Using ▲ and ▼, select the fault; then press ▶. This opens a screen advising what the actual fault is.

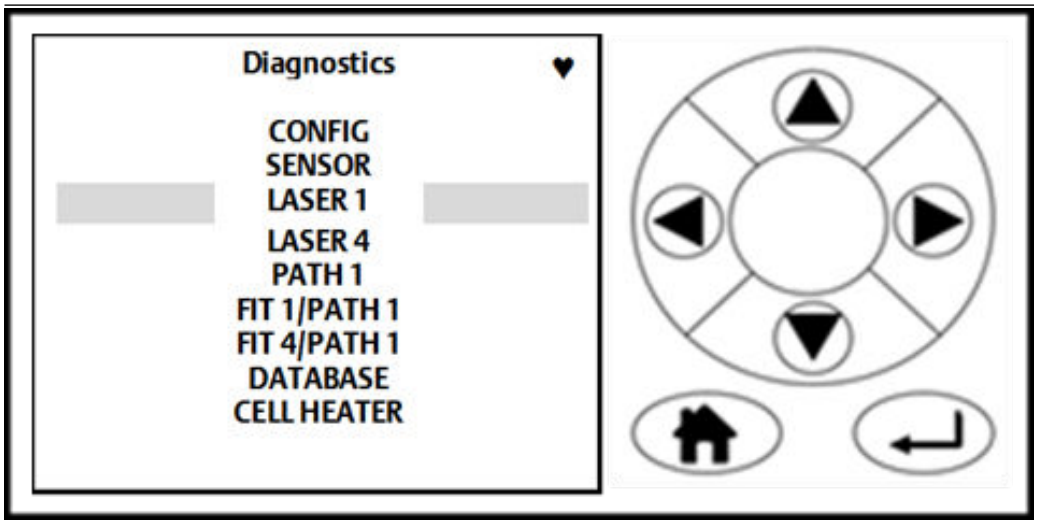


By examining the data shown on the ***Faults*** display, it is possible to determine if the suspect component has failed or is operating outside of its correct parameters. If you do not have the necessary information to determine if the suspect component is faulty, contact Cascade Technologies Ltd for advice and assistance.

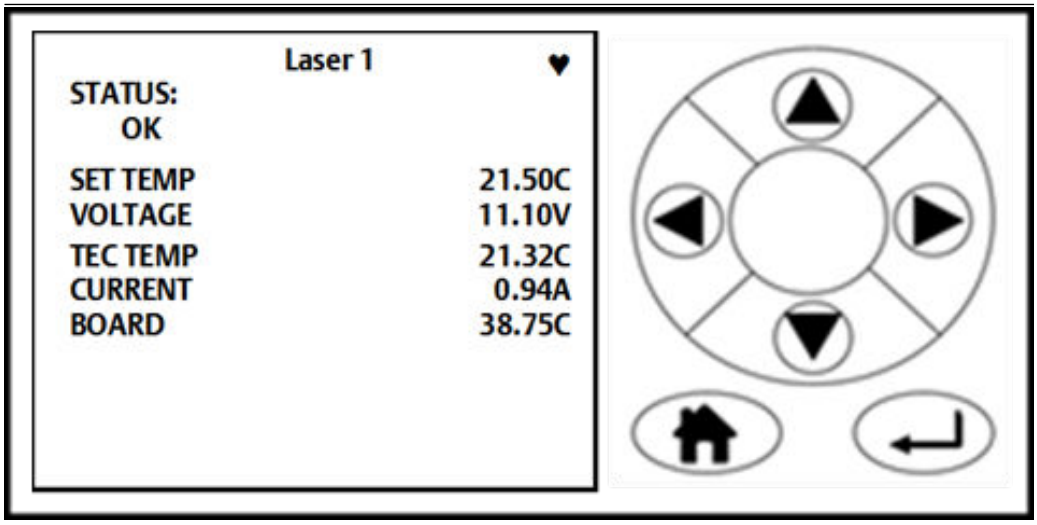
7.4 Diagnostics menu

The ***Diagnostics*** menu lists those main components of the analyzer where problems can be diagnosed using the BIST system. The ***Diagnostics*** menu also enables you to check on the status and, where appropriate, the values of any of the listed components.

Select ***Diagnostics*** on the ***Main menu*** screen and press ► to open the ***Diagnostics*** menu.



Use ▲ and ▼ buttons to highlight a component for further investigation by the BIST system. Once the component that you wish to diagnose has been highlighted, press ▶ to select it. The ***Diagnostics*** screen for that component opens. In the example, ***LASER 1*** is highlighted. Press ▶ to select ***LASER 1***. The ***Laser 1*** component diagnostics screen opens.



The component diagnostic screen shows the parameters of the component that was selected on the ***Diagnostics*** menu. In the example, the parameters of Laser 1 are shown.

The parameters data displayed varies depending upon which component was selected for diagnosis.

Examine the parameters shown to determine if the suspect component has failed or is outside of its correct parameters. If you do not have the necessary information to determine if the suspect component is faulty, refer to Cascade Technologies Ltd for advice and assistance.

7.5 Visual examination

A visual examination of the analyzer is recommended as the next step in failure diagnosis if the BIST fails to identify the problem.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

TRANSPORTATION HAZARD

Failure to secure the equipment may cause a break-away and injure personnel.

When preparing the analyzer for transport by air, road, or rail, safeguard it against movement or break-away during transport by securely strapping it in place. Use suitable fasteners for the weight of the analyzer.

⚠ WARNING

INSTALLATION HAZARD

Failure to properly install the equipment may cause serious injury to personnel.

Make sure that the wall unit the analyzer is mounted on is solid, stable, and of a suitable material to hold the weight of the analyzer.

Do not mount the analyzer on stud or partition walls.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

Procedure

1. Power down the analyzer and allow it to cool.
2. Open the front enclosure as described in Opening the enclosure.
3. Visually examine the exterior of the analyzer for signs of damage.
4. Perform a visual inspection of the optical and electrical components inside the analyzer.
5. If any loose connections are found in the electrical compartment, refer to the wiring diagrams (see Engineering drawings) to identify and repair the connection.
6. Refit the front housing (see Closing the enclosure).

7.6 Failure diagnostics

If the BIST and the visual examination fail to identify the fault, perform the failure diagnostics and recommended actions.

7.6.1 Gas reading abnormal

Check measurement validity flag. If the reading is invalid, refer to Measurement invalid flag. If the reading is valid:

Potential cause

Sensor required calibration.

Recommended action

Perform a new Zero and Span calibration to ensure calibration factors are correct. Readings return to normal.

Potential cause

Unknown

Recommended action

Contact Cascade (cascade.support@emerson.com).

Related information

Measurement invalid flag

7.6.2 Calibration/validation drift

Check measurement validity flag. If the reading is invalid, refer to Measurement invalid flag. If the reading is valid:

Potential cause

Sensor required calibration.

Recommended action

Perform a new Zero and Span calibration to ensure calibration factors are correct.
Readings return to normal.

Potential cause

Cylinder was empty.

Recommended action

Replace cylinder.
Readings return to normal.

Potential cause

Pipework was damaged.

Recommended action

Replace pipework.
Readings return to normal.

Potential cause

Unknown

Recommended action

Contact Cascade (cascade.support@emerson.com).

Related information

Measurement invalid flag

7.6.3 Measurement invalid flag

Check display controller to assess which measurements are invalid. If one gas readout was invalid, refer to Single gas reading invalid. If all gas readouts are invalid:

Potential cause

Hardware failure

Recommended actions

1. Use the display controller to check pressure and cell temperature.
2. If pressure and temperature are both within range, contact Cascade (cascade.support@emerson.com).

Potential cause

Pressure or temperature is out of range.

Recommended action

Refer to Analysis cell pressure out of range or Analysis cell temperature out of range.

Related information

Gas reading abnormal
Calibration/validation drift
Single gas reading invalid
Analysis cell pressure out of range
Analysis cell temperature out of range

7.6.4 Single gas reading invalid

Check which gas. Then check fault reading.

If Fault reading is active:

Recommended actions

1. Use ***Fault*** to access further diagnostic information.
2. Contact Cascade (cascade.support@emerson.com).

If Fault reading is not displayed:

Unknown cause

Recommended action

Contact Cascade (cascade.support@emerson.com).

Related information

Measurement invalid flag

7.6.5 Analysis cell pressure out of range

Potential cause

Pressure was out of range.

Recommended action

Adjust inlet valve to change pressure.
Pressure returns to normal.

If pressure is unstable or impossible to adjust:

Recommended action

Contact Cascade (cascade.support@emerson.com).

Related information

Measurement invalid flag

7.6.6 Analysis cell temperature out of range

Read cell temperature from display controller.

If temperature is too low:

System was recently started from cold.

Recommended action

Allow system to heat up.
System heats up with time.

Potential cause

Heater failure: temperature is too high or too low.

Recommended action

Contact Cascade (cascade.support@emerson.com).

Related information

Measurement invalid flag

7.6.7 Sensor frozen or unresponsive

Potential cause

Computer freeze-up or connection failure.

Recommended actions

1. Attempt a reboot.
   System reboots successfully.
2. Contact Cascade (cascade.support@emerson.com).

Potential cause

PC or HMI failure.

Recommended actions

1. Attempt a reboot.

System does not reboot.

2. Contact Cascade (cascade.support@emerson.com).

7.6.8 Other error

Not covered in other sections.

Potential cause

Unknown

Recommended action

Contact Cascade (cascade.support@emerson.com).

7.7 Repairable items

This chapter describes the repair procedures for all items that are repairable by maintenance personnel who have been trained, are hazardous area Ex version compliant, and are authorized to carry out repairs on the analyzer.

The major items that are repairable without Emerson's assistance are listed in Spare parts list. In all cases, the repair is by direct replacement of the faulty item with a known serviceable item purchased from Emerson that is hazardous area Ex compliant. If any items other than those listed require service, Emerson must perform the repair.

Before starting to repair the analyzer, allow it to cool down as detailed in the safety precautions below.

⚠ DANGER

FLAMMABLE SUBSTANCES

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Some parts of the analyzer may reach temperatures of 140 °F (60 °C) and may present an igintion source. A fire may result if this precaution is not observed.

Exercise care when using oil, paint, cleaning rags, and other flammable substances near the analyzer.

Always assume that the interior of an analyzer is hot unless it has been switched off and allowed to cool down.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

NOTICE

As a general principle, if any optical component other than the cell assembly and the laser modules is unserviceable, then the manufacturer must repair the analyzer. This is because the repair, replacement, and alignment of the optical components requires the use of special optical test/calibration equipment and procedures.

7.8 Tools required for troubleshooting

The following tools are required to remove and replace components

Table 7-1: Required Tools

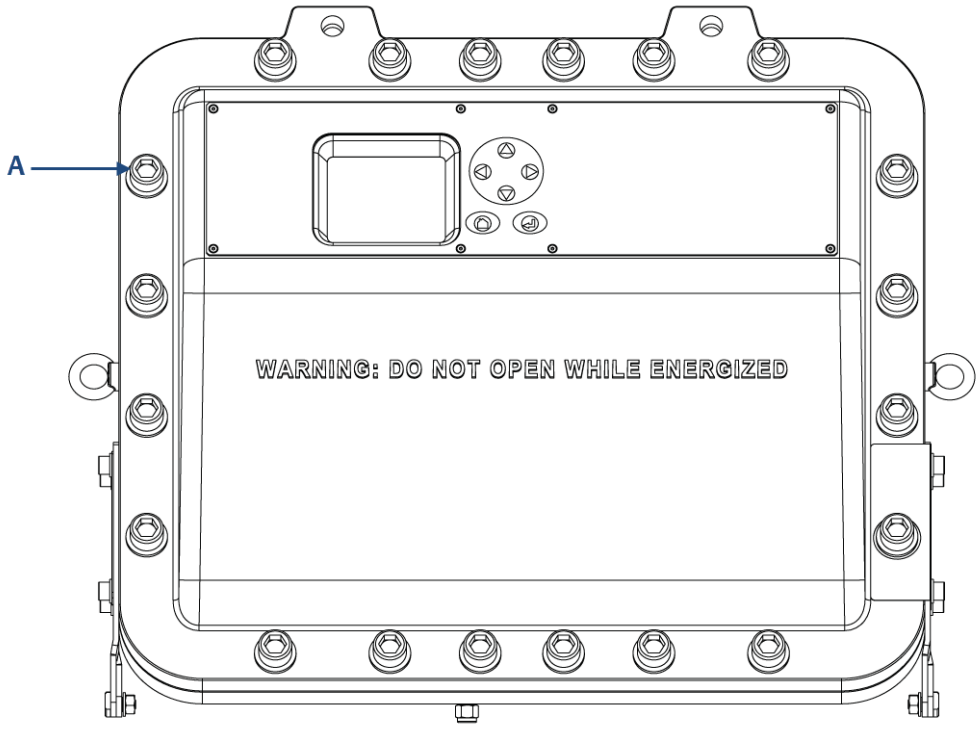
14 mm	Hex key needed to open the box
2.5 mm	Hex Socket (Allan key)
4.0 mm	Hex Socket (Allan key)
5.0 mm	Hex Socket (Allan key)
7.0 mm	Spanner
8.0 mm	Spanner
14 mm	Spanner
16 mm	Spanner

Table 7-1: Required Tools *(continued)*

Small snap-on ratchet
Small flat blade screwdriver (used for wiring terminals)
Multimeter - used to perform continuity checks on electrical wiring during an inspection
Control drawing
Wiring diagrams - Engineering drawings

7.9 Opening the enclosure

To gain access to the electrical and optical components, it is necessary to open the front enclosure.



A. M16 captive bolts

Procedure

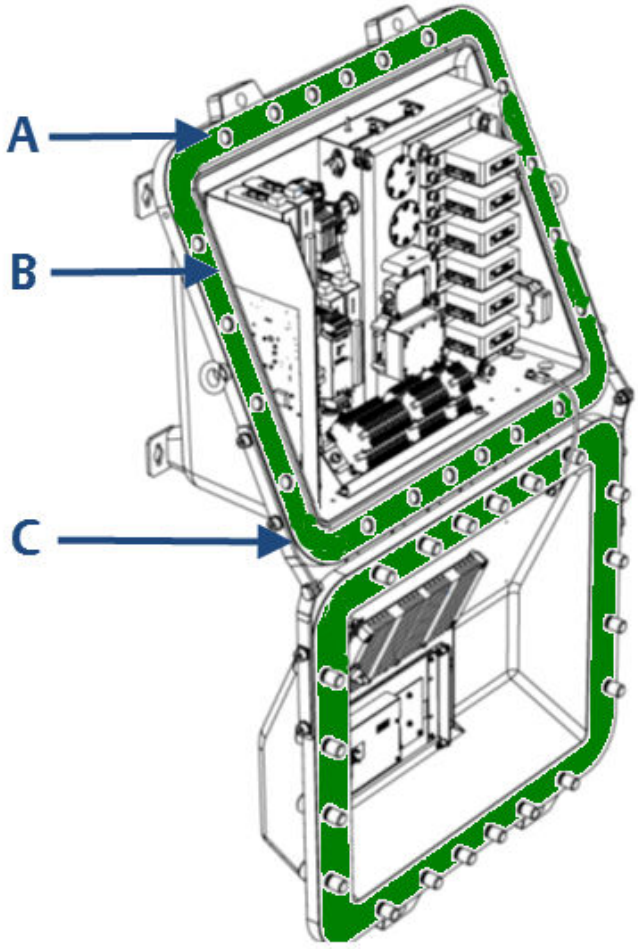
1. Make sure that the hinges are securely connected to the enclosure.

⚠ WARNING

HEAVY LID

Inspect the hinges for damage before removing the M16 x 45 captive screws. Ensure no obstructions are in the opening radius when the front housing is opened.

2. Undo the 20 off M16 x 1.5 captive bolts holding the front and rear housings of the enclosure together.
3. Carefully lower the front enclosure to the fully open position.



A. Flamepath (green highlight)
B. Seal
C. Flanges

4. Apply masking tape to the flanges, seal,and flamepath to protect them from scratches, chipping, and other forms of damage or deformation.

⚠ CAUTION

PROTECT FLAMEPATH

Any damage to the flamepath will invalidate certification.

Protect the flamepath.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

5. Set the external breaker **ON/OFF** switch to OFF. Tag out.
6. Check that the hinges are in good condition.
7. Undo the 20 m16 x 45 cap screws around the housing.
8. Lift the front housing carefully away from the rear housing and downwards.
9. Examine the front housing for signs of physical damage.

   If it is undamaged, retain the front housing. You can retouch minor damage to the paintwork on the front housing.
10. Make sure that the faces of the flamepath on both the front and back housings are protected.

7.10 Replacing the display and control buttons

The display and button controls are supplied and fitted as one assembly. To replace the display, complete the following instructions.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

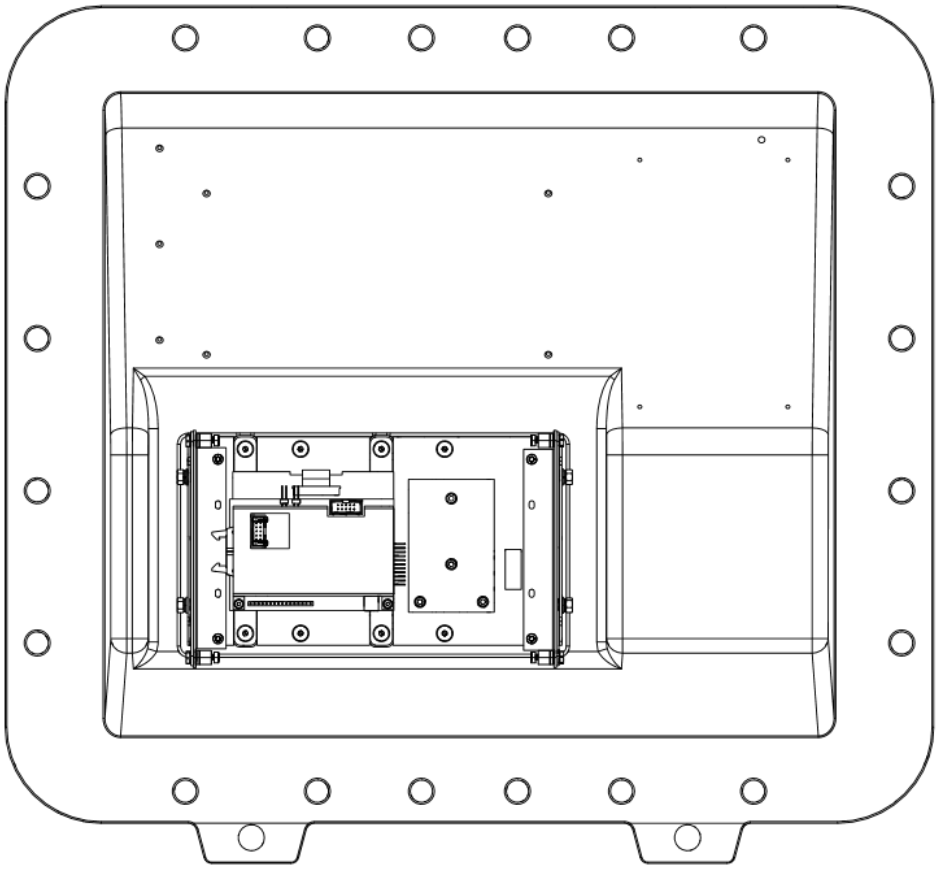
BURNS

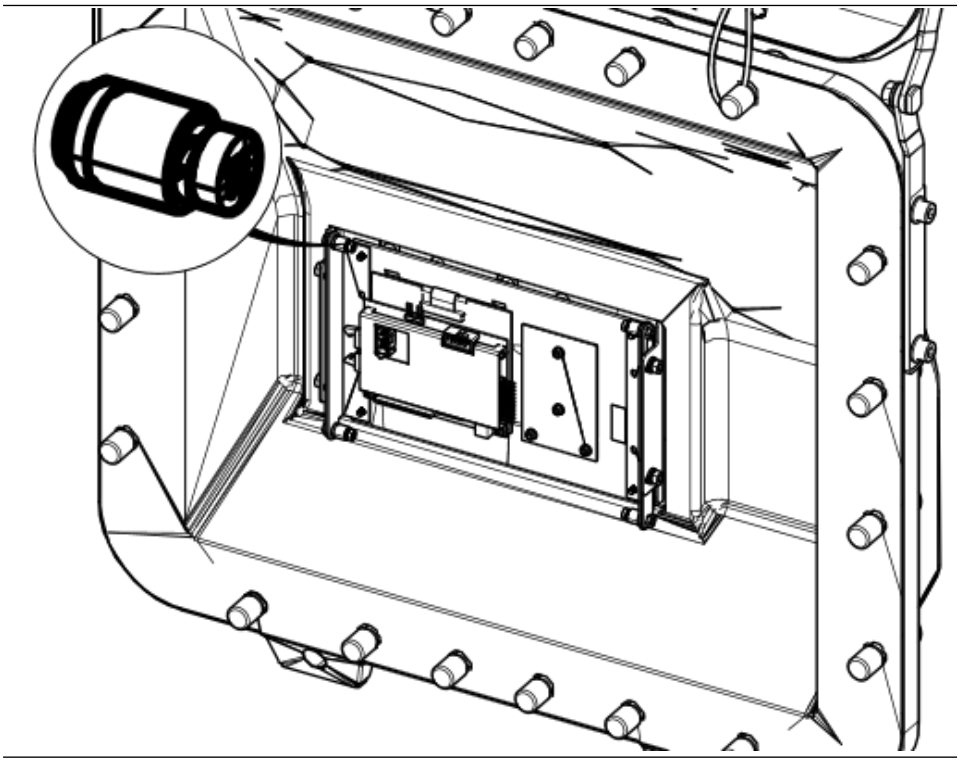
Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

Procedure

1. Shut down the analyzer
   See Shutdown procedure.
2. Tag or otherwise identify all wiring harnesses before disconnecting.
3. Open the front enclosure as described in Opening the enclosure.
   The LCD display will then be accessible.
4. Release the four off captive screws that secure the display to the chassis assembly.





5. Using a small spanner, remove and retain the four M5 hex nuts and plain washers from the display and the four M5 hex nuts and plain washers from the display controller PCB.

   Retain the nuts and washers for future use.
6. Remove the display and controller by pulling it from the front of the chassis assembly.
7. Unpack and visually inspect the replacement LCD display for damage. If damage has occurred, contact your local Emerson Customer Care Representative.
8. Insert the display into the front panel of the chassis assembly through the front of the chassis assembly.
9. Tighten all the captive screws until the display is held securely against the front panel of the chassis assembly.
10. Make sure that the bolts operate; if necessary, adjust the display position by loosening M5 Hex nuts and align accordingly.
11. Plug the connector and attached wiring harness into the vacant connector location on the display.
12. Close the front enclosure as described in Closing the enclosure.
13. Remove the Lock-out Tag-out labels from the circuit breaker.
14. Apply power to restart the analyzer.

7.11 Replacing the fuses

Use this procedure to replace the two Rosemount™ CT5800 fuses.

Prerequisites

NOTICE

This section is in accordance with IEC 60079-0: 2011 Clause 30. This section must not be changed, amended, or removed.

NOTICE

Make sure that the fuses are in place and of the correct rating.

⚠ DANGER

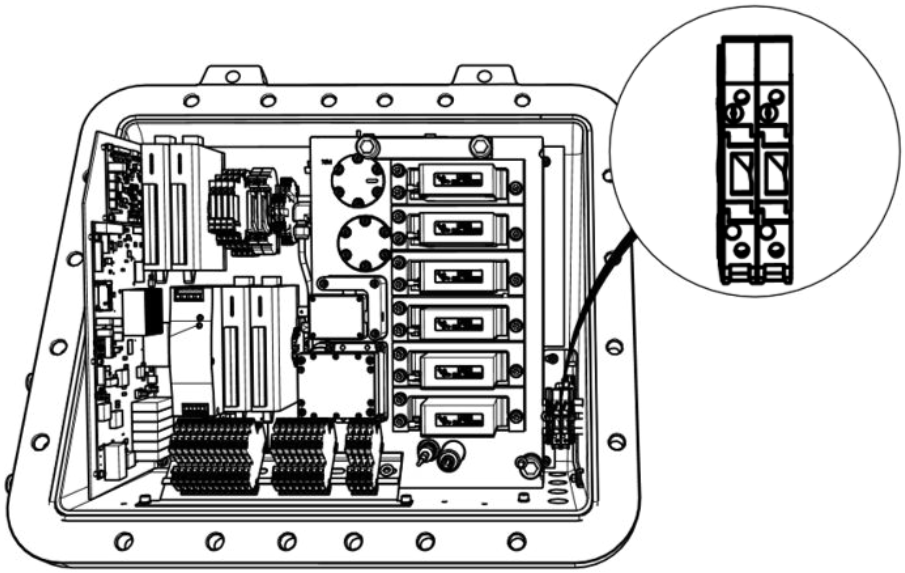
ELECTRIC SHOCK

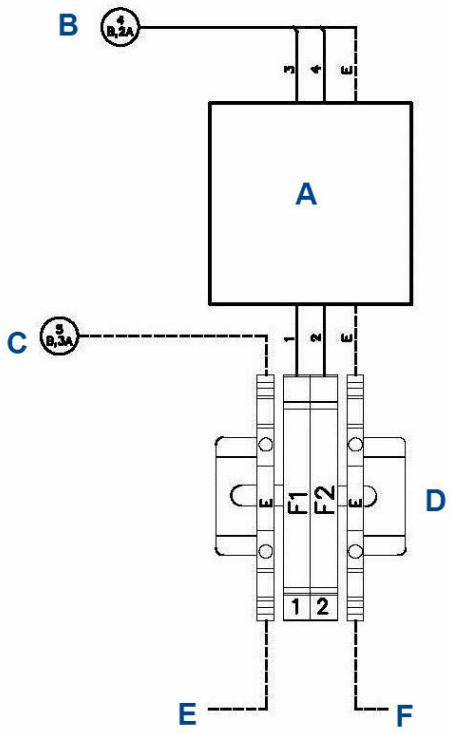
This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.





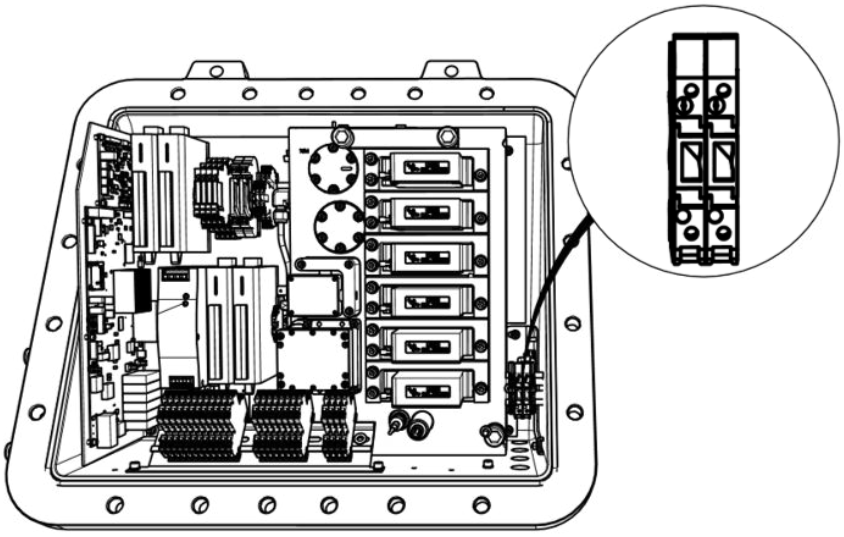
A. Mains filter unit
B. To PSU modules
C. To DIN rail earth terminals
D. Mains input terminals
E. To backplate earth connection
F. To casing earth connection

Table 7-2: Fuses

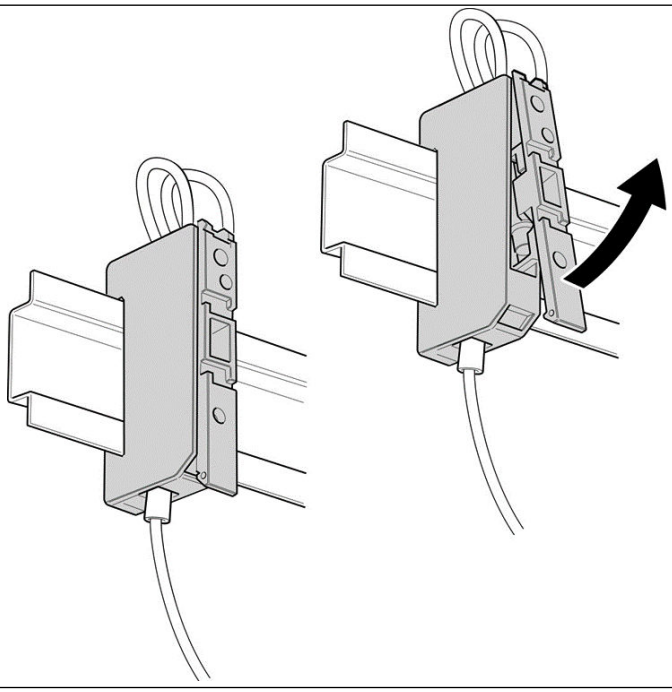
Fuse	Function	Rating
1	Live line 110/240 Vac (following mains filter)	3.15 A, 240 V, fast acting ceramic
2	Neutral line 110/240 Vac (following mains filter)	3.15 A, 240 V, fast acting ceramic

Procedure

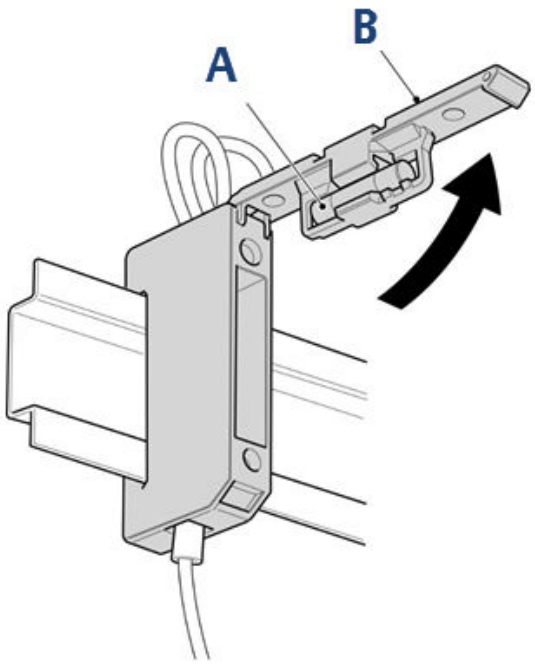
1. Shut down the analyzer as described in Shutdown procedure and allow it to cool.
2. Follow the procedure for opening the enclosure described in Opening the enclosure.
   The fuses are located inside a fuse holder that is mounted on the DIN Rail of the Power Supply Unit.



For clarity, the fuse holder is shown in both the closed and partially open positions.



3. No tools are required to remove the fuse. Place a finger on the catch on the upper part of the fuse holder and lift the upper part of the fuse holder to open.
4. Fully raise the upper part of the fuse holder and then push out the old fuse.



A. Fuse
B. Fuse holder

5. Fit the replacement fuse into the fuse holder.

   Refer to Table 7-2 and make sure that the fuse is of the correct type and rating. When lowering the upper part of the fuse holder, ensure that it clicks into place when fully lowered.

6. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
7. Remove Lock-Out Tag-Out labels.
8. Apply power to restart the analyzer.

7.12 Replacing the terminal electric cooler (TEC) board

Observe all safety precautions before starting this procedure.

⚠ WARNING

EXPLOSION

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

Read all manuals (including those for auxiliary equipment) before installing this instrument.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

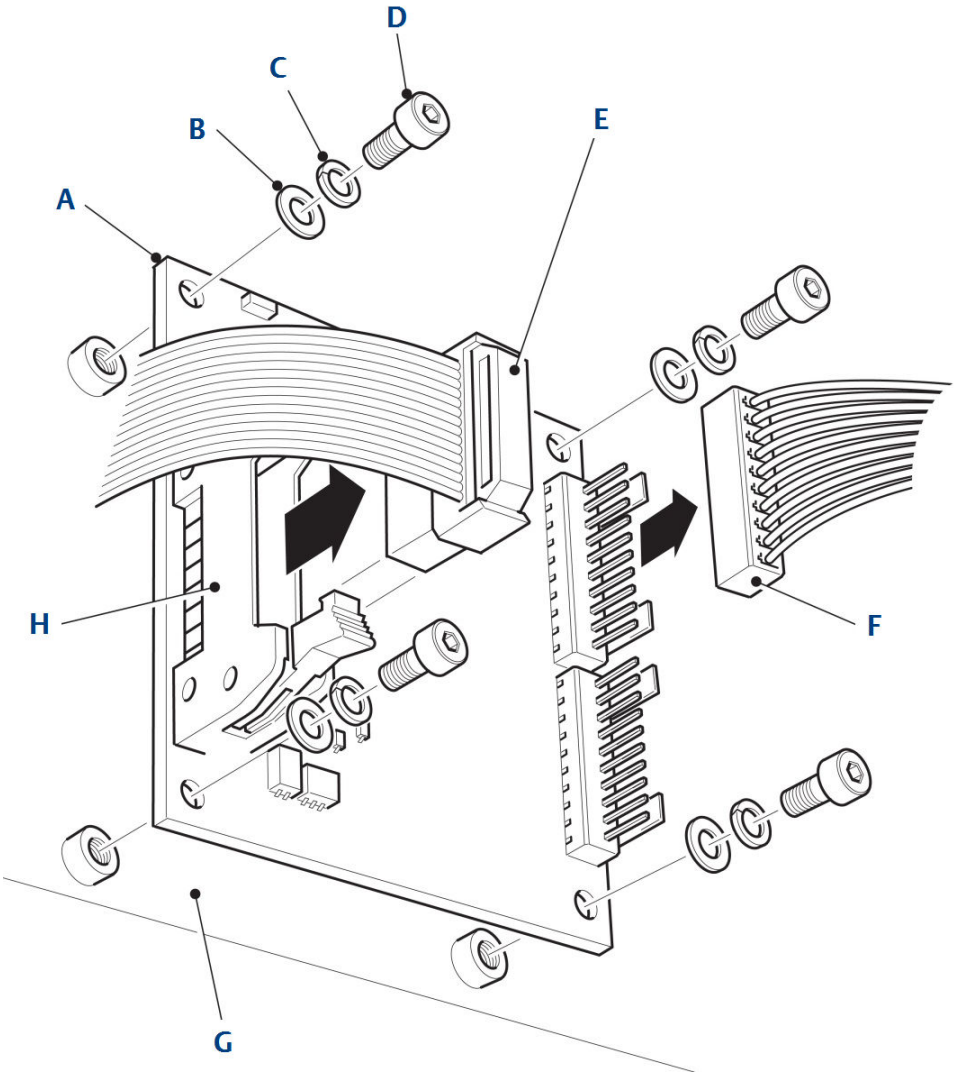
Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

.

Procedure

1. Shut down the analyzer as described in Shutdown procedure and allow it to cool.
2. Follow the procedure for opening the enclosure described in Opening the enclosure.
3. Tag or otherwise identify all wiring harnesses before disconnecting.

4. Remove and retain the four off M3 x 6 mm hex cap screws and associated spring washers and flat washers that secure the TEC board to the back plate.



A. TEC board
B. M3 flat washer
C. M3 spring washer
D. M3 x 5 mm socket head cap screw
E. Ribbon cable (to motherboard)
F. Wiring harness (to detector module)
G. Backplate
H. Connector for ribbon cable

5. Remove the TEC Board from the backplate.
6. Discard the unserviceable TEC board observing all local and federal laws regarding disposal of electronics.

⚠ CAUTION

ELECTROSTATIC DISCHARGE 

Wear an ESD wrist strap or ground yourself to prevent damage to the USB PCB electronics.

7. Examine the replacement TEC Board for damage or delamination. If damaged, contact your local Customer Care representative.
8. Fit the TEC Board in position on the backplate. Secure the TEC Board by fitting the four screws and associated spring washers and flat washers that were retained during the removal procedure. Apply Loctite® 222 to the four off M3 screws and torque tighten the screws to 0.75 Nm.
9. Connect the wiring harness to the TEC board.
10. Connect the ribbon cable to the ribbon cable connector on the TEC board. Make sure that the ribbon cable securely clicks into place in the ribbon cable connector.
11. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
12. Remove Lock-Out Tag-Out labels.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

13. Apply power to restart the analyzer.

7.13 Replacing the peripheral board

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

EXPLOSION

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

Read all manuals (including those for auxiliary equipment) before installing this instrument.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.

Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.

Always wear proper protective equipment when handling the analyzer.

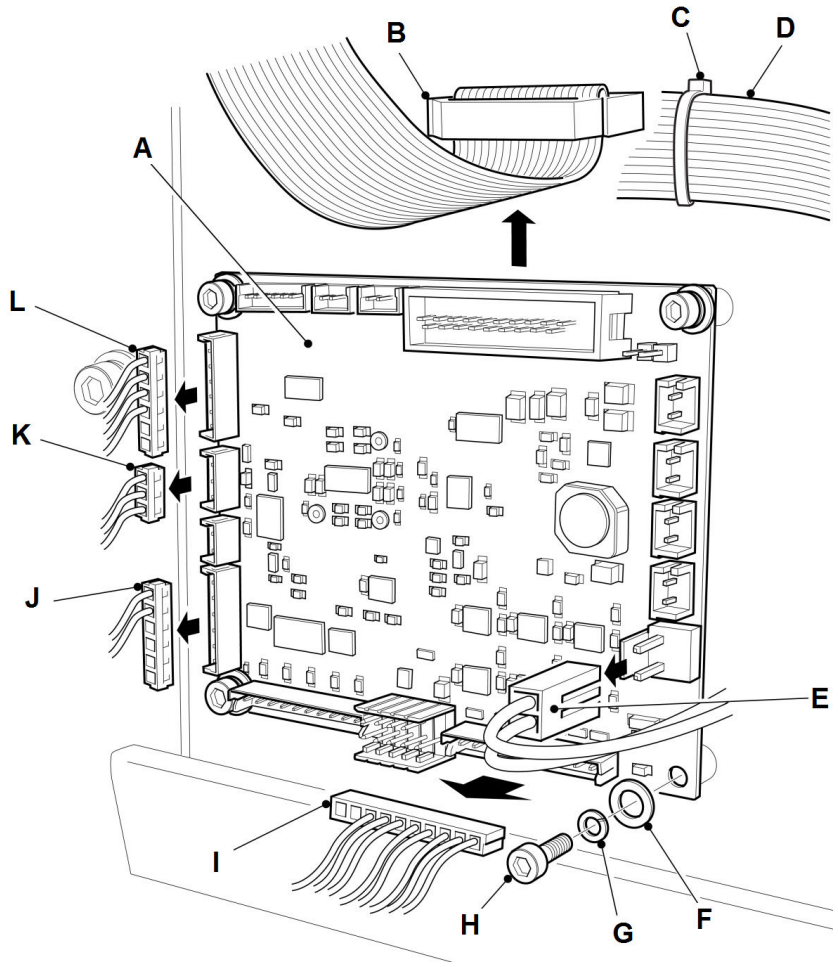
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.

The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.

If burns occur, seek immediate medical treatment.

Procedure

1. Shut down the analyzer as described in Shutdown procedure and allow it to cool.
2. Tag or otherwise identify all wiring harnesses before disconnecting.
3. Disconnect the 12 V power wiring harness from the peripheral board.



A. Peripheral board
B. Ribbon cable (to motherboard)
C. Cable tie
D. TEC board ribbon cable harness
E. 12 V power wiring harness
F. M3 flat washer harness
G. M3 spring washer
H. M3 x 6 mm socket head cap screw
I. Relay wiring harness
J. Gas/cell temp monitoring
K. Gas/cell temp monitoring
L. Gas/cell temp monitoring

4. Cut the cable tie that secures the TEC board ribbon cable to the connector of the peripheral board ribbon cable. Carefully move the TEC board ribbon cable clear of the peripheral board.
5. Disconnect the ribbon cable from the peripheral board.
6. Disconnect the relay wiring harness from the peripheral board.

7. Disconnect the three connectors of the gas/cell temperature monitoring harness from the peripheral board.
8. Remove the four screws, spring washers, and flat washers.
9. Remove the peripheral board from the analyzer.

⚠ CAUTION

ELECTROSTATIC DISCHARGE 

Wear an ESD wrist strap or ground yourself to prevent damage to the replacement peripheral PCA board.

10. Discard the unserviceable peripheral board observing all local and federal laws regarding disposal of electronics.
11. Remove the replacement peripheral board from the shipping package and inspect for damage. If damaged, contact your local Customer Care representative.
12. Secure the peripheral board by fitting the four screws, spring washers, and flat washers retained during the removal procedure.
13. Torque tighten the screws to 0.6 Nm.
14. Connect the three connectors of the gas/cell temperature monitoring harness respectively to connectors J9, J24, and J37 on the peripheral printed circuit card (PCA).
15. Connect the relay wiring harness to the peripheral board.
16. Connect the peripheral board ribbon cable to the peripheral board.
17. Secure the TEC board ribbon cable to the connector of the peripheral board ribbon cable with a cable tie.
18. Connect the 12 V power wiring harness to the peripheral board.
19. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
20. Remove Lock-Out Tag-Out labels.
21. Apply power to restart the analyzer.

7.14 Replacing the motherboard

Observe all safety precautions before starting this procedure.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

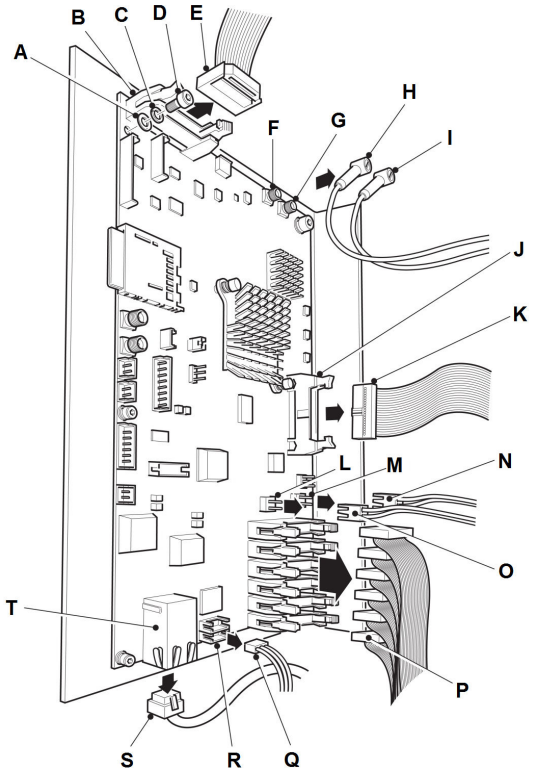
Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

Procedure

1. Shut down the analyzer as described in Shutdown procedure and allow it to cool.
2. Follow the procedure for opening the enclosure described in Opening the enclosure.
3. Tag or otherwise identify all wiring harnesses before disconnecting.



A. *M3 flat washer*
B. *Ribbon cable connector*
C. *M3 spring washer*
D. *M3 x 6 mm socket head cap screw*
E. *TEC board ribbon cable*
F. *TRIGGER OUT connector J32*
G. *TRIGGER OUT connector J31*
H. *TRIGGER OUT wiring harness*
I. *TRIGGER OUT wiring harness*
J. *Ribbon cable connector J7*
K. *Ribbon cable (to peripheral PCB)*
L. *12 V power out connector J17*
M. *12 V power in connector J16*
N. *12 V power output wiring harness*
O. *12 V power input wiring harness*
P. *Laser module ribbon cable*
Q. *HMI display wiring harness*
R. *Connector J22*
S. *Ethernet cable*
T. *Ethernet connector*

4. Disconnect the TRIGGER OUT wiring harness from connector J32.
5. Disconnect the laser module ribbon cables from the motherboard.

The number of laser module ribbon cables to be disconnected will vary depending upon the application for which the analyzer has been configured.

6. Disconnect the 12 V power input wiring harness from connector J16.
7. Disconnect the 12 V power output wiring harness from connector J17.
8. Disconnect the peripheral PCB ribbon cable from connector J7.
9. Disconnect the Ethernet cable from the Ethernet connector.
10. Disconnect the HMI display wiring harness from connector J22.
11. Remove the SD card and retain for future use.
12. Remove and retain the six screws, spring washers, and flat washers.
13. Remove the motherboard.
14. Discard the unserviceable motherboard observing all local and federal laws regarding disposal of electronics.

⚠ CAUTION

ELECTROSTATIC DISCHARGE 

Wear an ESD wrist strap or ground yourself to prevent damage to the motherboard electronics.

15. Inspect the replacement motherboard for signs of damage or delamination.
16. Place the motherboard in position on the backplate and secure it by fitting the six screws and the associated spring washers and flat washers retained during the removal procedure. Torque tighten the screws to 0.6 Nm.
17. Insert the SD card removed from the old motherboard.
18. Connect the HMI display wiring harness to connector J22.
19. Connect the Ethernet cable to the Ethernet connector.
20. Connect the peripheral PCB ribbon cable to connector J7.
21. Connect the 12 V power output wiring harness to connector J17.
22. Connect the 12 V power input wiring harness to connector J16.
23. Connect the laser module ribbon cables to the motherboard. Make sure that the laser module ribbon cables are connected to the correct laser module connectors on the motherboard, as tagged or noted down during the removal procedure.
24. Connect the TRIGGER OUT wiring harness to connector J32.
25. Connect the detector module 1 TRIGGER OUT wiring harness to connector J31.
26. If applicable, connect the detector module 2 TRIGGER OUT wiring harness to connector J31.
27. Connect the TEC board ribbon cable to connector J12.
28. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
29. Remove Lock-Out Tag-Out labels.
30. Apply power to the analyzer.

7.15 Replacing the DIN rail components

7.15.1 Removing the DIN rails

To access most components and remove or replace the analysis cell assembly and the core, the lower DIN rail must be removed.

Prerequisites

Refer to the following section to remove active components from the DIN rails.

Refer to Replacing the fuses for the fuse replacement.

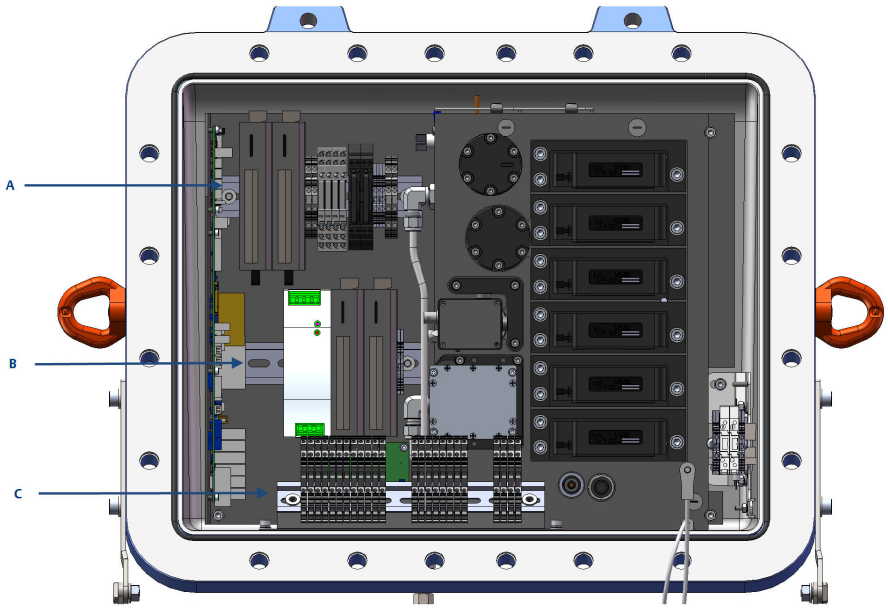
Refer to Replacing the DC power supply for replacing the DC power supply.

Refer to Replacing the temperature controller for replacing the temperature controller.

Before removing any of the active components from the DIN rails, perform the following steps:

Procedure

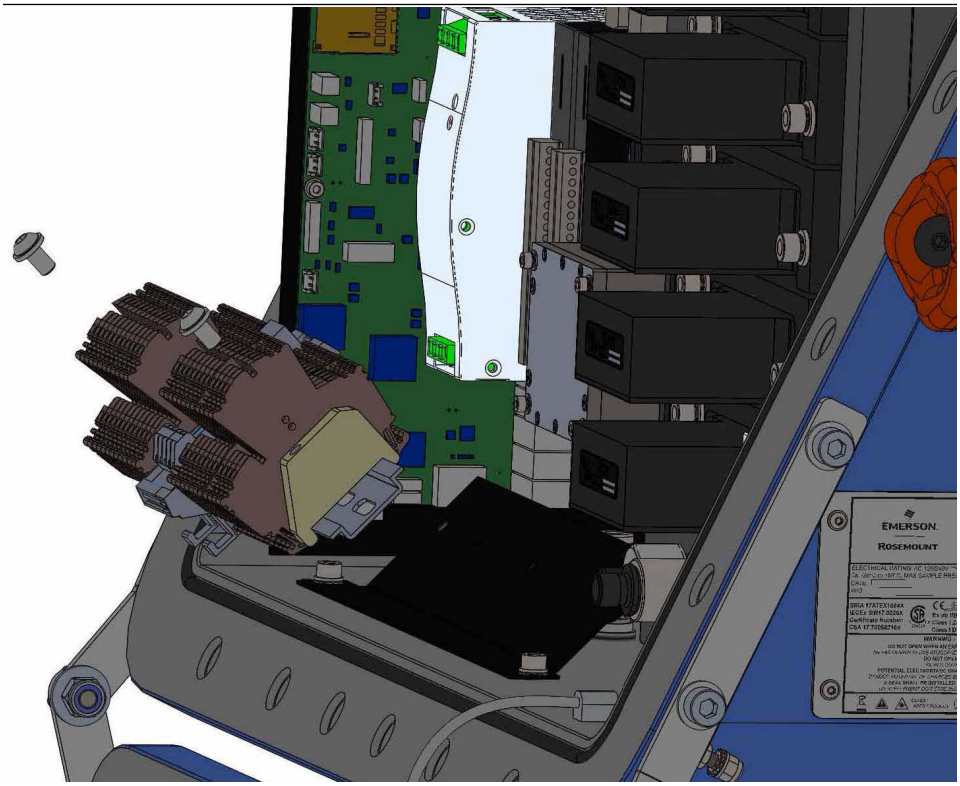
1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Tag and disconnect all cables and connections as appropriate.



A. Upper DIN rail
B. Middle DIN rail
C. Lower DIN rail

4. Disconnect the two 14 mm gas input and output line connectors at the flame arrestor. Refer to Replacing the gas input and output lines.

5. Remove the two M5 socket head cap screws, two M5 Spring washers and two M5 plain washers securing the lower DIN rail support bracket to the base of the enclosure. Retain the screws and washers for future use.



7.15.2 Removing the core

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

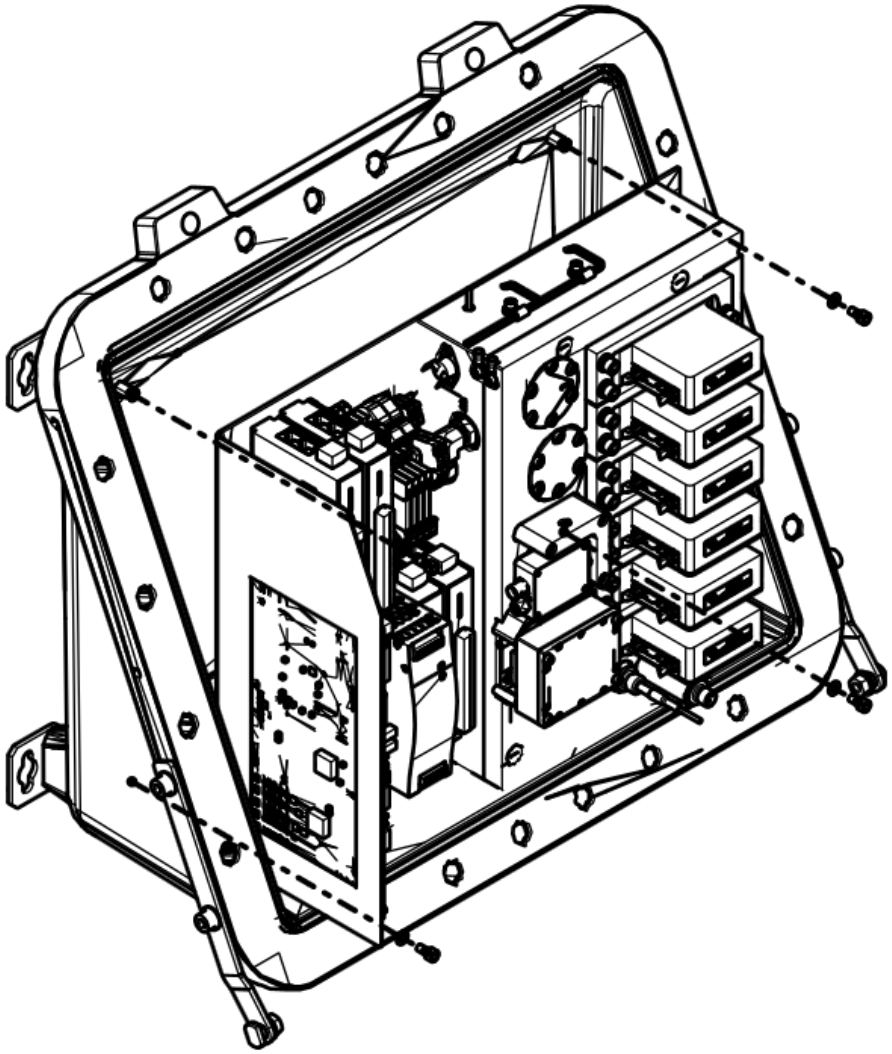
⚠ CAUTION

The core can weigh approximately 44.1 lb. (20 kg) and does not have dedicated lifting/handling points.

Two people must handle the core when removing it from the housing.
Take care not to damage any of the components.

Procedure

1. Shutdown the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Tag and disconnect all cables and connections as appropriate.
4. Unscrew the two 14 mm connections to the gas input and output lines.
5. Remove the lower DIN rail as described in Removing the DIN rails.
6. Undo the four M5 Socket head cap screws, four M5 spring washers and four M5 plain washers and retain for future use.



7. Carefully lift the core from the enclosure and place on a suitable table or bench.

7.15.3 Replacing the Moxa analog input unit

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

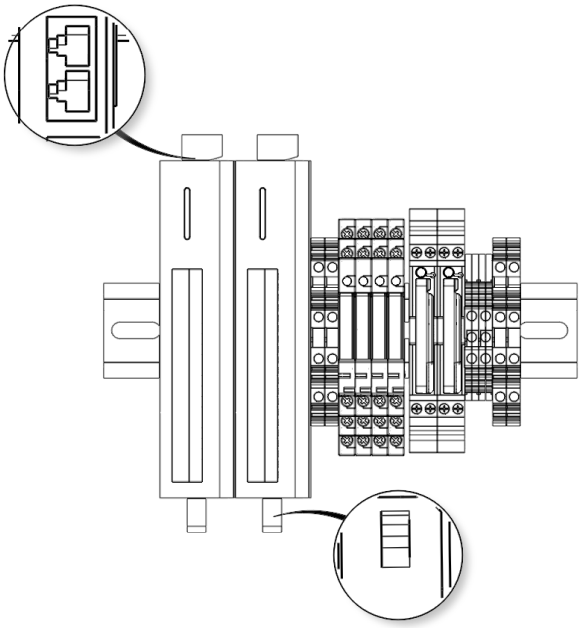
BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Disconnect the Moxa analog I/O connector from the top of the Moxa analog IN/OUT unit.



4. Disconnect the connectors from the bottom of the Moxa analog input unit.
5. Release the Moxa analog input unit from the DIN rail by pressing a small lever on the underside of the unit. While continuing to press the lever, remove the Moxa analog input unit from the DIN rail.
6. Discard the unserviceable Moxa analog input unit.
7. Inspect the replacement unit for damage. If damage has occurred, contact your local Emerson Customer Care Representative.
8. Insert the replacement Moxa analog input unit in its correct location on the DIN rail. Press the small lever on the underside of the unit and push the unit onto the DIN rail. Release the small lever and check that the unit is secure.
9. Connect Ethernet cable to the Moxa.
10. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
11. Remove Lock-Out Tag-Out labels.
12. Apply power to the analyzer.

7.15.4 Replacing the temperature controller

The two temperature controllers are identical; therefore, the replacement procedure for only one is described. Each temperature controller plugs into a base unit that is mounted

on the DIN rail. The base unit has no active components and should not require replacement.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

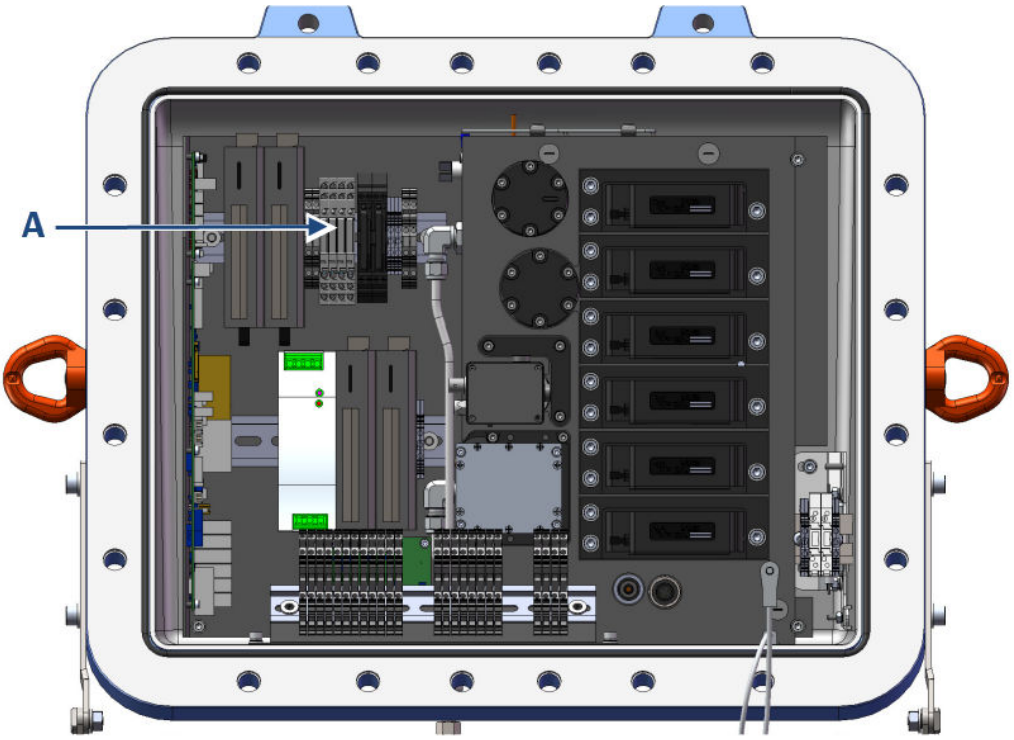
Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.



A. Temperature controller

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Press the small lever. While holding the lever in the down position, unplug the temperature controller from the upper DIN rail.

NOTICE

When replacing a temperature controller, the interconnecting wiring does not have to be disconnected from the base unit.

4. Discard the unserviceable temperature controller.
5. Inspect the replacement temperature controller for damage. If damage has occurred, contact your local Customer Care Representative.
6. Fit the replacement temperature controller onto the upper DIN rail. Make sure the orientation of the temperature controller is correct. Press the small lever on the base unit and, while holding the lever in the down position, push the temperature controller home into the base unit. Release the lever and check that the temperature controller is secure.
7. Attach the cables and wiring connections to the temperature controller.
8. Remove the protective masking tape from the flanges, seal, and flamepath.

⚠ CAUTION

Any damage to the flamepath will invalidate certification.

Use care not to damage the flamepath.

9. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
10. Apply power to the analyzer.

7.15.5 Replacing the Ethernet connector

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

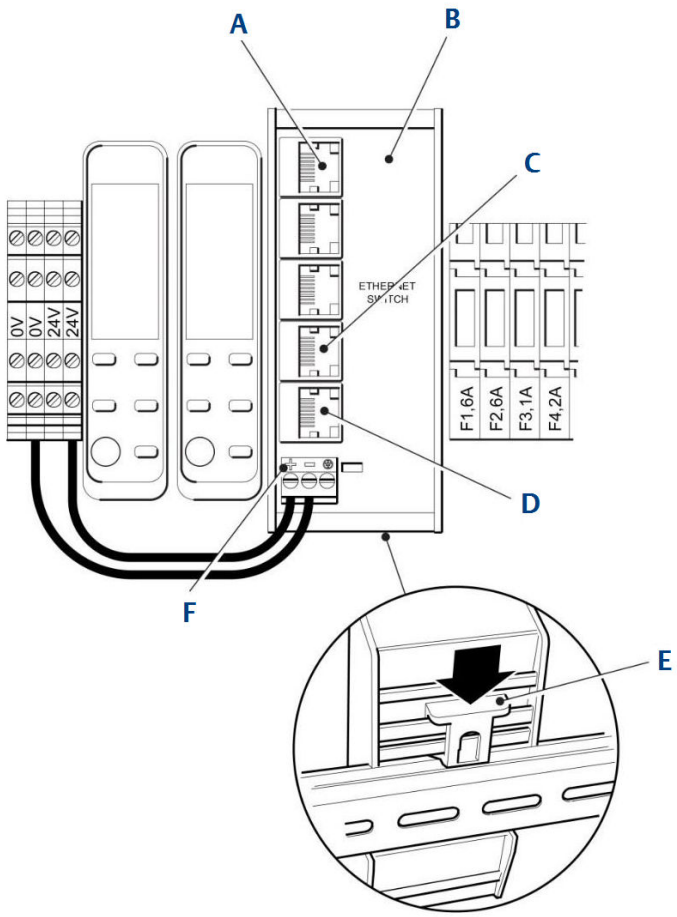
Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.



A. Ethernet connector
B. Ethernet switch
C. Ethernet connector (to Ethernet port)
D. Ethernet connector (to motherboard)
E. Lever
F. Wiring harness

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Disconnect the wiring harness from the Ethernet switch.
4. Press the small lever on the underside of the Ethernet switch to release it from the DIN rail. While pressing the lever, remove the Ethernet switch from the DIN rail.
5. Inspect the replacement Ethernet connector for damage. If damaged, contact your local Customer Care Representative.
6. Discard the unserviceable Ethernet switch.

7. Clip the replacement Ethernet switch onto the correct location on the DIN Rail. Check the DC power supply is secure.
8. Connect the wiring harness to the Ethernet switch.
9. Close the enclosure as described in Closing the enclosure and secure with captive M16 bolts and engage the threads on the rear housing.
10. Apply power to restart the analyzer.

7.15.6 Replacing the laser modules

The analyzer contains multiple laser modules; the precise number of laser modules is determined by the configuration of the analyzer.

Prerequisites

All the laser modules are physically identical, but are NOT interchangeable as they differ in internal settings. Each laser module is a sealed unit and can only be repaired by Emerson. Repair therefore consists of removing the unserviceable laser module and returning it to Emerson for repair.

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

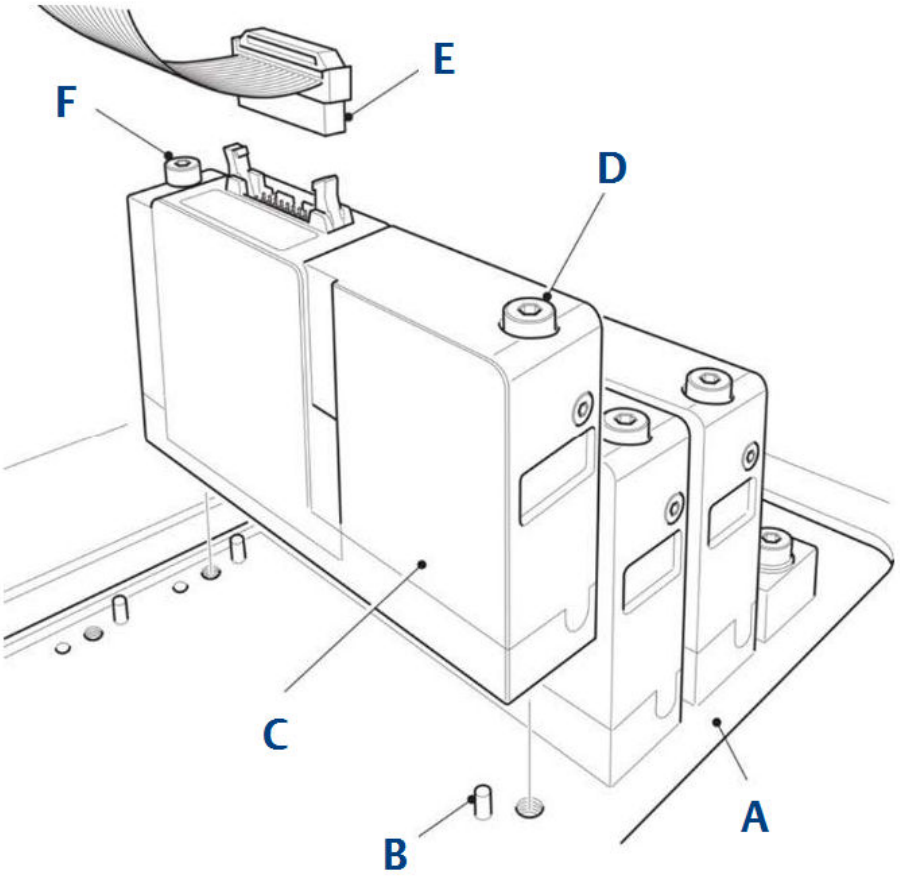
Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Disconnect the ribbon cable and the captive screws.



A. Base plate
B. Pin
C. Laser module
D. Captive screw
E. Ribbon cable
F. Captive screw

4. Inspect the replacement laser module for damage.
5. Fit the replacement laser module in position on the base plate. The laser module must mate with the two locating pins on the Base Plate.
6. Secure the laser module by tightening the two captive screws.
7. Connect the ribbon cable to the laser module.
8. Remove the protective masking tape from the flanges, seal, and flamepath.

⚠ CAUTION

Any damage to the flamepath will invalidate certification.

Use care not to damage the flamepath.

9. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
10. Apply power to the analyzer.

7.15.7 Installing the DIN rails

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

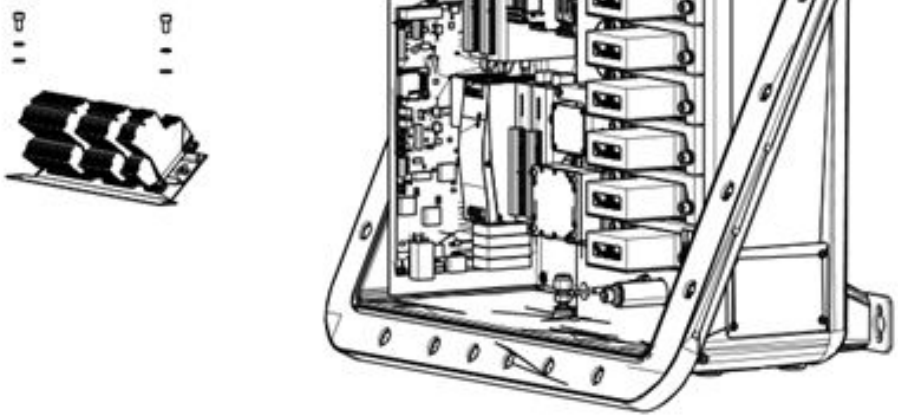
The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

Prerequisites

Remove the DIN rails and gas inlet and outlet lines to access the analyzer electronics.

Procedure

1. Insert the lower DIN rail in the enclosure.
2. Install the two M5 socket head cap screws, two M5 Spring washers, and two M5 plain washers securing the lower DIN rail support bracket to the base of the enclosure.



3. Connect the two 14 mm gas input and output line connectors at the flame arrestor. Refer to Replacing the gas input and output lines.
4. Connect all cables and wiring connections as appropriate.
5. Remove the protective masking tape from the flanges, seal, and flamepath.

⚠ CAUTION

PROTECT FLAMEPATH

Any damage to the flamepath will invalidate certification.

Use care not to damage the flamepath.

6. Close the enclosure as described in Closing the enclosure and secure with the captive M16 bolts and engage the threads on the rear housing.
7. Apply power to the analyzer.

7.15.8 Replacing the DC power supply

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

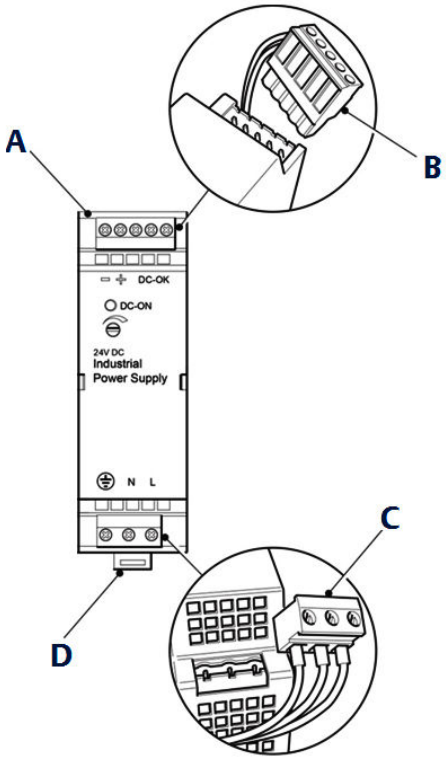
Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

Procedure

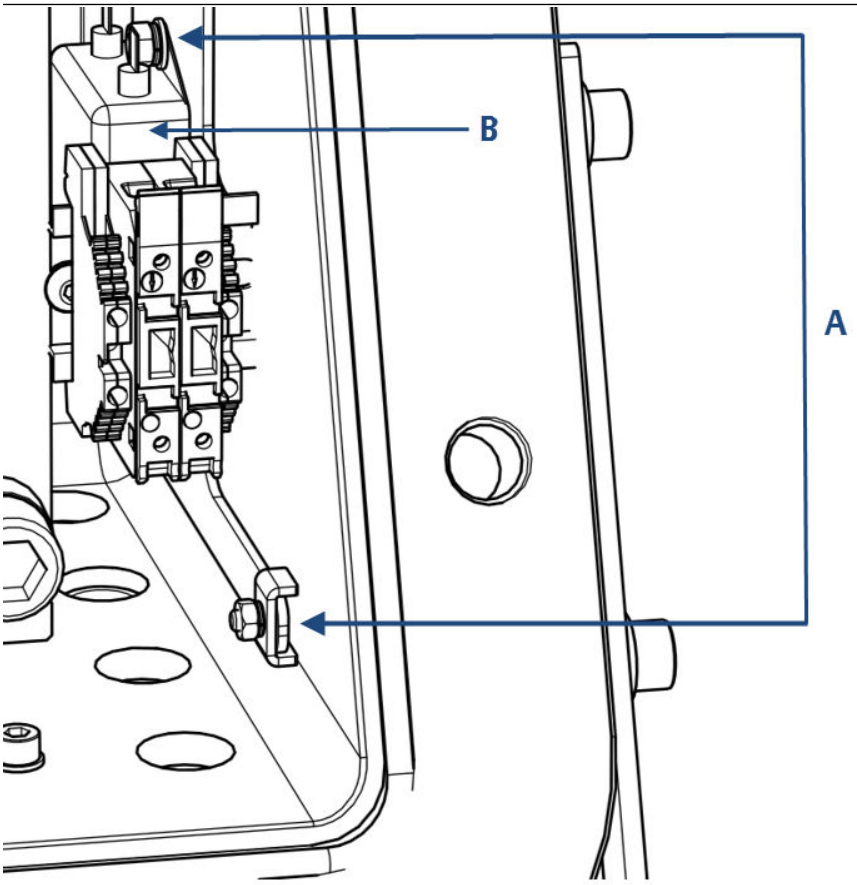
1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.

3. Disconnect the wiring harness connector from the top of the DC Power Supply.

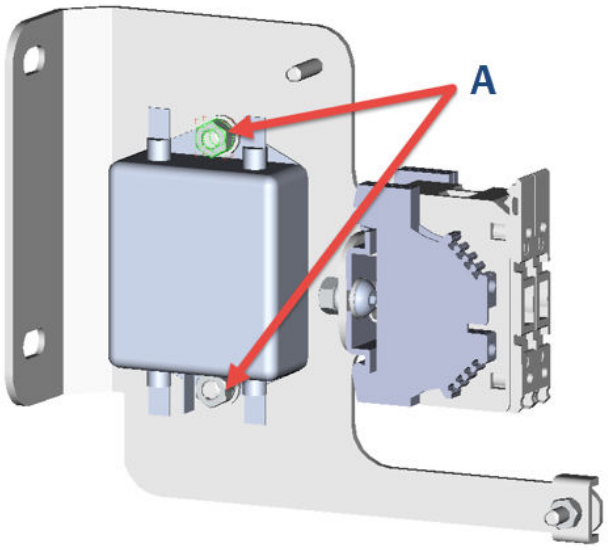


A. DC power supply
B. Wiring harness connector (top)
C. Wiring harness connector (bottom)
D. Lever

4. Disconnect the wiring harness connector from the bottom of the DC power supply.
5. Tag and disconnect all cables and connections as appropriate.



A. Fuse DIN rail bolts
B. Power supply unit



A. Two off M5 Hex nuts/spring washers and plain washers

6. Remove the two DIN rail M5 screws, spring washers and flat washers and retain for future use.
7. Discard the unserviceable DC power supply.
8. Inspect the replacement DC power supply for damage. If damaged, contact your local Customer Care Representative.
9. Install the replacement DC power supply on the bracket assembly.
10. Secure the bracket assembly to the enclosure housing with the two M5 screws, spring washers and flat washers.
11. Reinstall the fuse assembly to the power supply DIN rail.
12. Connect the wiring harness connector to the bottom of the DC power supply.
13. Connect the wiring harness connector to the top of the DC power supply.
14. Close the enclosure as described in Closing the enclosure and secure with captive M16 bolts and engage the threads on the rear housing.
15. Apply power to the analyzer.

7.16 Optical and pneumatic repairs

7.16.1 Replacing the temperature sensor

Prerequisites

⚠ WARNING

EXPLOSION

Failure to observe this warning and/or follow safety instructions could cause an explosion or potentially hazardous situation which, if not avoided, could result in death or serious injury.

When the analyzer is out of order, shut off all inputs and outputs connected to external equipment.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.

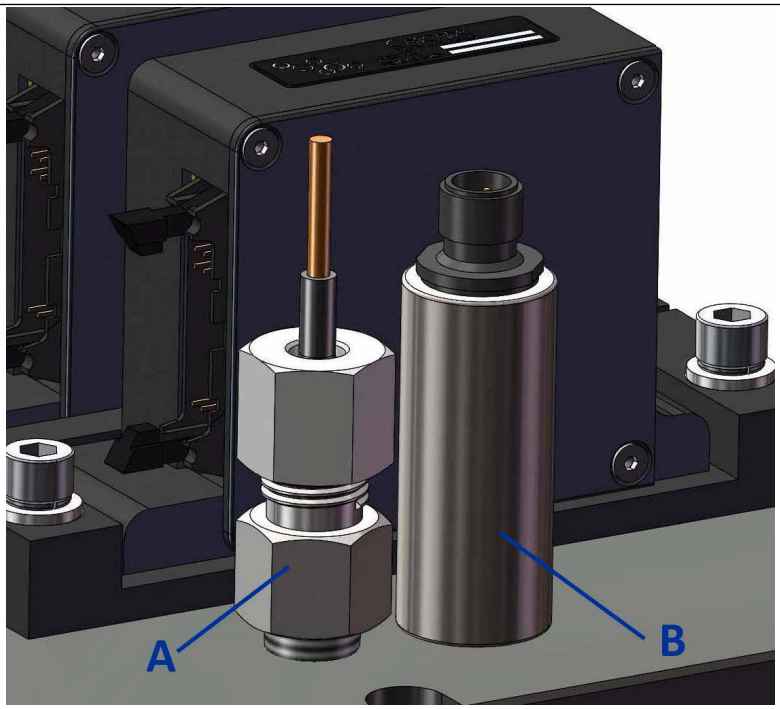
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.

Always wear proper protective equipment when handling the analyzer.

Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.

The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.

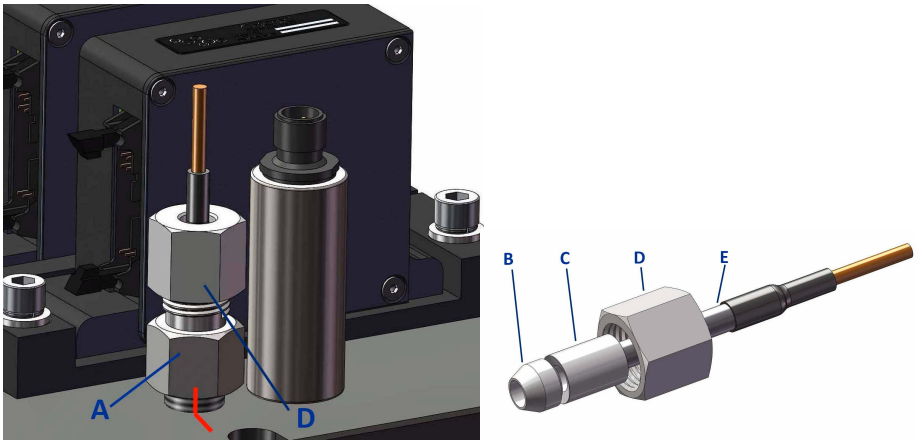
If burns occur, seek immediate medical treatment.



A. Temperature sensor
B. Pressure sensor

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Carefully cut and remove any cable ties used to secure the temperature sensor wiring harness.
4. Disconnect the temperature sensor wiring harness from the connector block on the DIN rail.



A. Main body
B. Seal
C. Follower
D. Cap
E. Temperature sensor

5. Apply a witness mark from the main body onto the baseplate to show the rotational alignment.
6. Using one spanner hold the main body of the temperature sensor to prevent it turning while using the second spanner to loosen cap. Remove the temperature sensor assembly.

Note
The torque applied when installing the temperature sensor in the factory was 30 Nm.

7. Discard the faulty temperatures sensor, retaining the cap, follower and seal.
8. Inspect the replacement temperature sensor for damage. If damaged contact your local customer care representative.
9. Slide in order the cap, follower and seal onto the temperature sensor and insert the assembly into the main body. Adjust the height of the temperature sensor in the main body and tighten the cap by hand to lock in position.

10. Use one spanner to hold the main body to prevent it turning while using a torque wrench with crow foot attachment to tighten cap.

    The required torque is 30 Nm.

11. Reconnect the wiring harness fitting cable ties as required.
12. Close the housing and secure in accordance with Closing the enclosure.
13. Restart the analyzer in accordance with Start-up procedure.

7.16.2 Replace the pressure sensor

⚠ WARNING

HEAVY ITEM

The analyzer weighs 176.4 lb. (80 kg). Failure to properly handle the analyzer may cause injury to personnel.

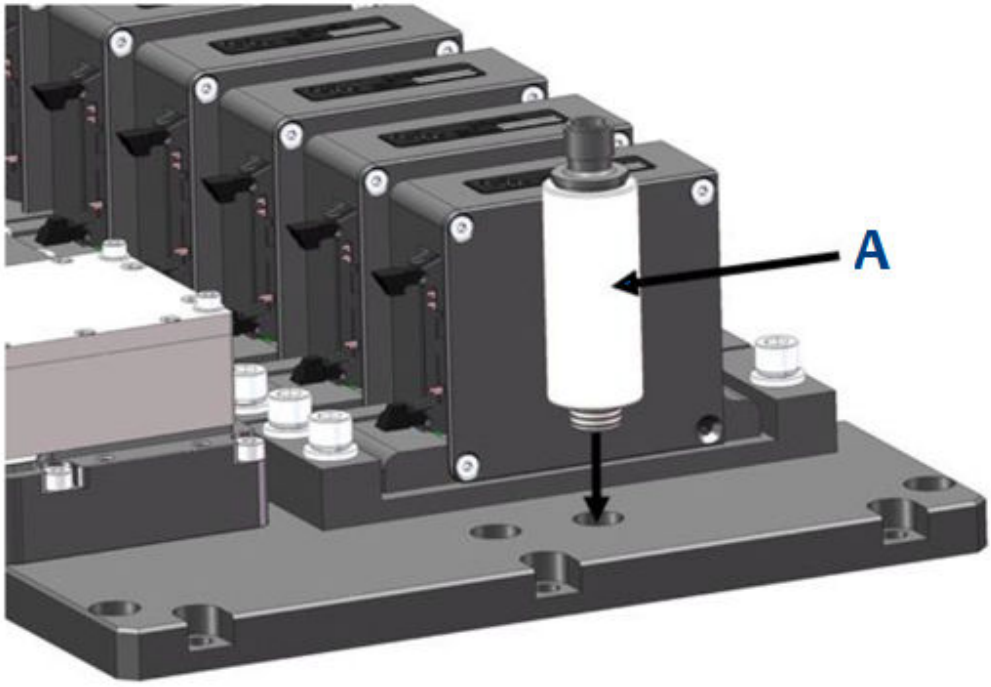
Use a minimum of two people when lifting and transporting the equipment.
Wear suitable protective gloves and protective footwear.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.



A. Pressure sensor

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Carefully cut and remove any cable ties that secure the gas sensor wiring harness.
4. Disconnect the gas sensor wiring harness from connector block on the DIN rail.
5. Use a spanner on the sensor's 6¼ mm hex fitting and remove the sensor from the baseplate.
6. Discard the faulty sensor and Dowty washer.
7. Inspect the replacement sensor and washer for damage. If, damaged, contact your local customer care representative.
8. Insert the replacement Dowty washer on the base of the temperature sensor and insert into the baseplate.
9. Use a spanner to tighten the sensor fitting.

NOTICE

The Swagelok® recommendation for pipe fittings of this size is to tighten the nut finger tight and then tighten an additional one and a quarter (1¼) turns with a spanner.

10. Reconnect the wiring harness and fit with cable ties.
11. Close the enclosure as described in Closing the enclosure and secure with captive M16 bolts and engage the threads on the rear housing.

12. Apply power to the analyzer.

7.16.3 Replacing the gas input and output lines

Prerequisites

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

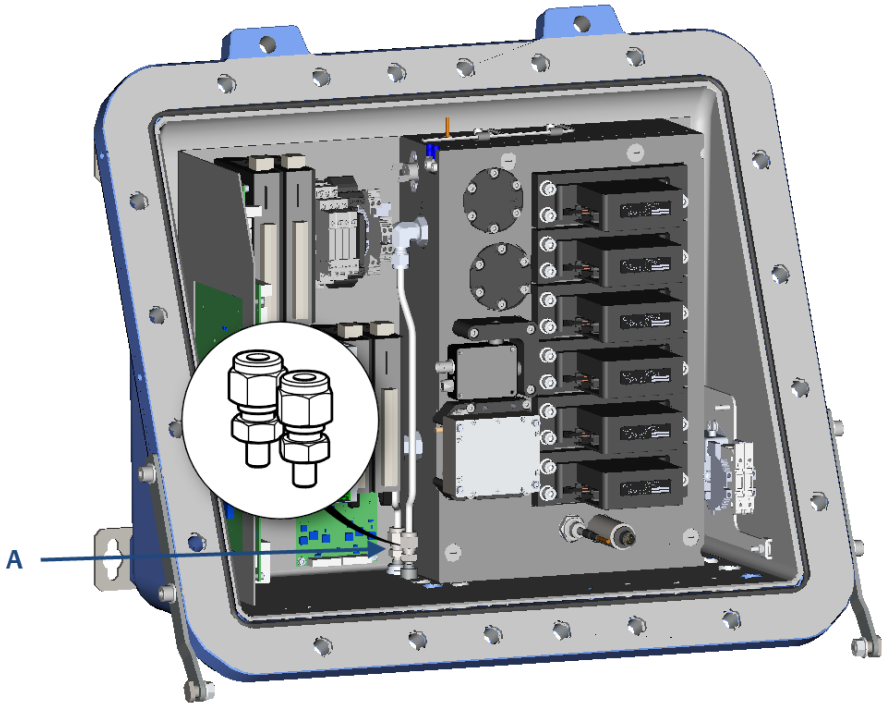
Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Tag and disconnect all cables and connectors.



A. Gas input and output lines

4. Remove the two M5 socket head cap screws, M5 Spring washers, and M5 plain washers securing the DIN rail support bracket to the base of the enclosure.
   Retain the screws and washers for future use.
5. Pull the DIN rail away from the enclosure.
6. Unscrew the two 14 mm connections to the gas input and output lines.
7. Replace the gas input and output lines as required.

7.16.4 Replacing the analysis cell

⚠ DANGER

ELECTRIC SHOCK

This article is in accordance with IEC 60079-0: 2011 Clause 30.

Death or personal injury may result if this is not observed.

The analyzer uses mains voltage that is dangerous to life. Make sure that the circuit breakers are set to OFF and tagged off before opening the front cover.

The analyzer **MUST** be earthed using a grounded three core cable suitable for the rating defined in the General characteristics Table 1-3.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

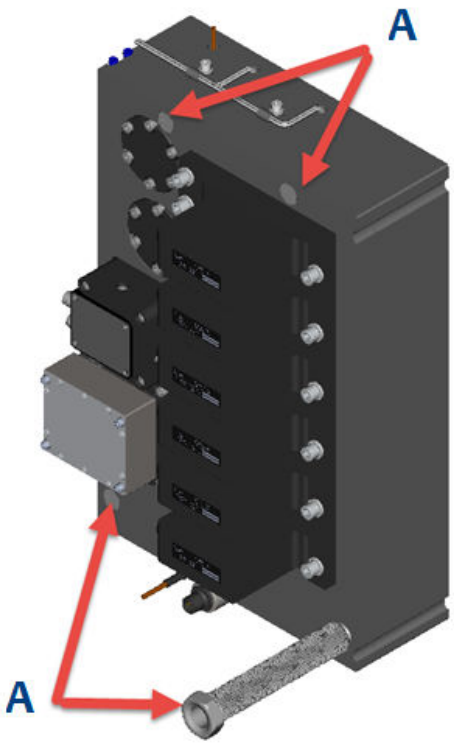
Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

To gain access to the electrical, pneumatic, and optical components, it is necessary to open the front enclosure.

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. Open the enclosure as described in Opening the enclosure.
3. Tag and disconnect all cables and connections as appropriate.
4. Remove the lower DIN rail.
   See Removing the DIN rails.

5. Disconnect the two 14 mm gas input and output line connectors at the flame arrestor.
   Refer to Replacing the gas input and output lines.



⚠ CAUTION

Take care not to put any pressure on or cause damage to the TEC board.

6. Use a flat head screwdriver to remove the four protective caps.
7. Remove the four socket head cap screws.
8. Carefully lift the cell assembly out of the enclosure.
9. Inspect the replacement analysis cell for damage. If the parts are damaged, contact your local Customer Care representative.
10. Insert the replacement analysis cell into the enclosure.
11. Secure the four socket head screws and spring washers.
12. Attach the four protective caps.
13. Attach the DIN rail with two M5 socket head cap screws, M5 Spring washers, and M5 plain washers securing the DIN rail support bracket to the base of the enclosure.
14. Connect all the component cables and connections on the lower DIN rail.
15. Connect the two 14 mm gas input and output line connectors at the flame arrestor.
    Refer to Replacing the gas input and output lines.

16. Close the enclosure as described in Closing the enclosure and secure with captive M16 bolts and engage the threads on the rear housing.
17. Remove the lock-out tag-out tag labels.
18. Apply power to the analyzer.

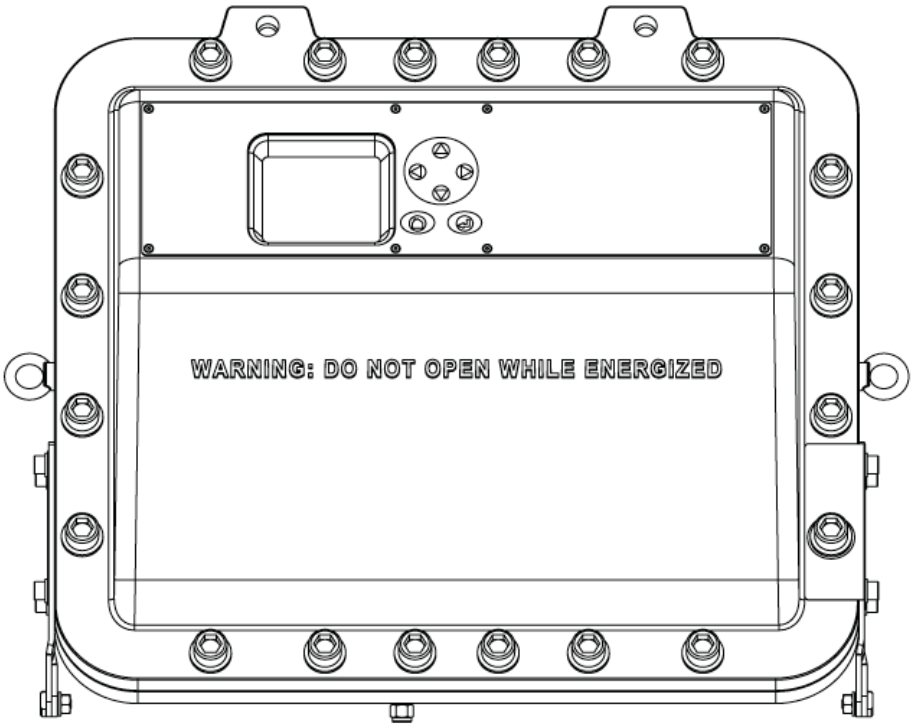
7.17 Closing the enclosure

After all internal connections have been made and proved/tested, close the enclosure and secure the 20 off M16 x 45 captive screws in accordance with the torque sequence shown below.

Procedure

1. Remove all protective masking tape covering the flamepath and enclosure sealing gaskets.
2. Inspect the seal. If any damage is detected, stop the process immediately and report to maintenance.
3. Clean the seal to remove any adhesive from the protective cover.
4. Inspect the flanges/flamepath for damage, i.e., scratches, chipping, or other forms of damage/deformation. If any damage is detected, stop the process immediately and report to maintenance.
5. Carefully lift up the housing and align with the rear housing.
6. Make sure that all holes are aligned.

   If necessary, use the two holes to assist alignment.



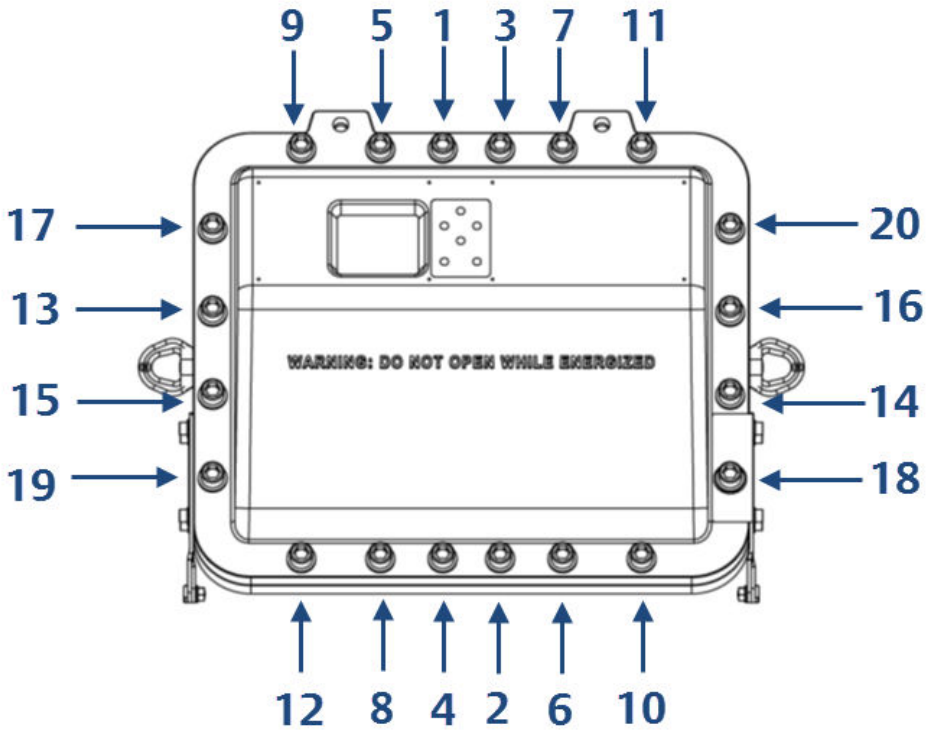
7. Insert the captive M16 bolts and engage the threads on the rear housing.
8. Refer to the torque sequence and tighten all bolts.

⚠ WARNING

SECURE ENCLOSURE

Failure to follow this warning will invalidate hazardous area (Ex d) explosion-proof protection.

Always use captive M16 x 45 screws and form A washers to secure the enclosure.



Important
Tighten all bolts in sequence to a torque value of 20 Nm (14.75 ft-lb).

8 Shutdown procedure

8.1 Safety precautions

⚠ CAUTION

EQUIPMENT DAMAGE

Damage to the analyzer may result from a failure to follow this procedure.

Always follow the shutdown procedure.

The analyzer normally operates continuously. It should only be necessary to shut down the analyzer in the following circumstances:

- In order to perform repairs or maintenance on the analyzer
- When the analyzer has to be switched off as part of a plant shutdown or plant maintenance

Use the display controller to perform the shutdown procedure. Refer to Display controller for the display controller navigation instructions.

NOTICE

The gas concentrations shown in the following screenshots may be different from those shown in your particular analyzer. The screenshots indicate the functionality of the software, which is the same regardless of the gases or gas concentrations being measured.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

8.2 Shutdown procedure

To shut down the analyzer.

⚠ WARNING

EXPLOSION HAZARD

Unauthorized operation of the gas handling system when maintenance is being performed on the analyzer or on its associated pipes/hoses may result in gas being released, causing fire or explosion. Failure to lock out the gas handling system may cause death.

Always lock out the gas handling system when shutting down the analyzer.

Procedure

1. Shut down the gas handling system that conditions the sample gas and feeds it to the analyzer. Always lock-out the gas handling system to prevent its unauthorized operation during maintenance, which may cause an escape of gas.

   ⚠ WARNING

   EXPLOSION HAZARD

   Failure to vent sample gas may cause death.

   Vent the sample gas in the system to prevent fire or explosion during maintenance and to prevent damage to the analyzer during shutdown.
   Purge the sample gas in the pipes leading to the analyzer to prevent hazards to personnel during maintenance.
   Purge the sample gas in accordance with safe working procedures for the site.
   Allow the analyzer and system for returning the sample gas to run for five minutes to allow any sample gas in the analyzer to be returned to the exhaust.

2. Purge any sample gas in the pipe/hose from the gas handling system to the analyzer using factory air or nitrogen supply.

3. Allow the analyzer to run for five minutes with the purge gas connected, so that any sample gas in the analyzer is vented to the exhaust. On the display controller, check that the gas concentrations read **0 ppm** before stopping the purge flow.

   ⚠ WARNING

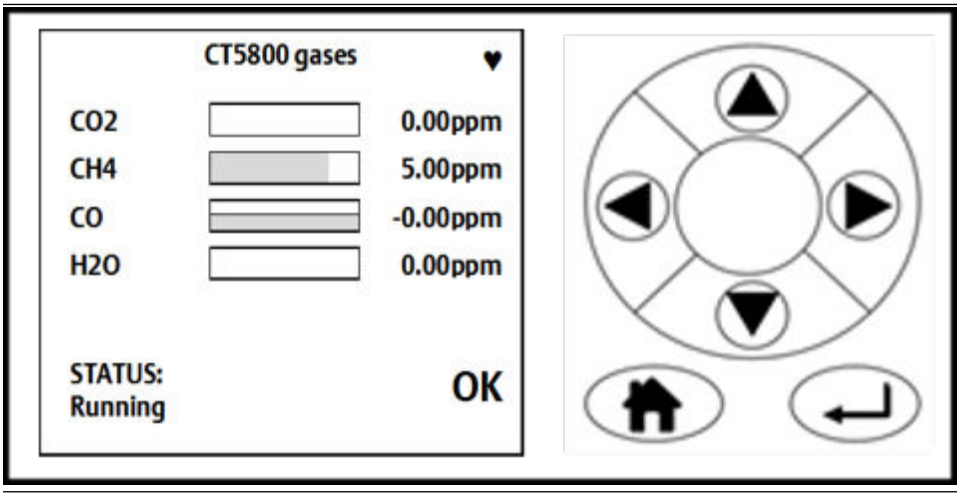
   HIGH PRESSURE GAS AND AIR

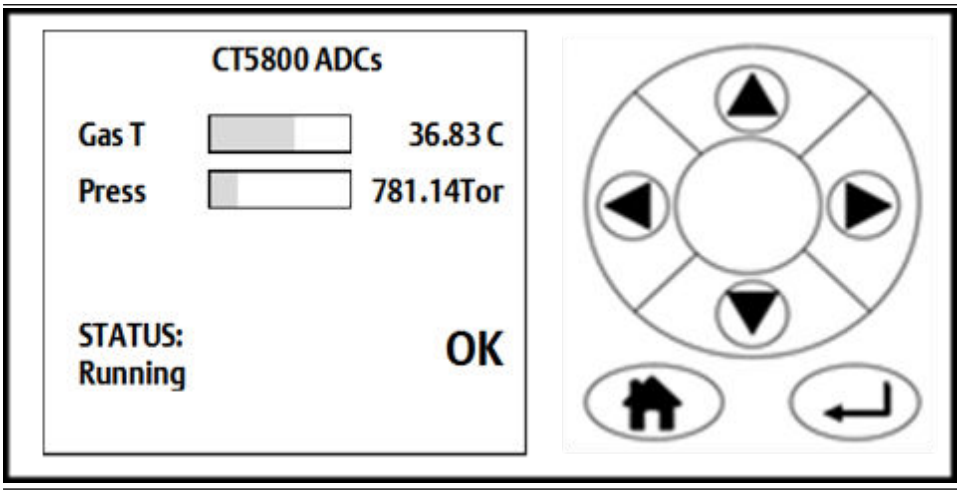
   This article is in accordance with IEC 60079-0: 2011 Clause 30.

   The calibration gas supply and compressed air operate at a pressure that can cause injury (e.g. damage to eyes and skin punctures from debris blown by the high pressure has or compressed air).

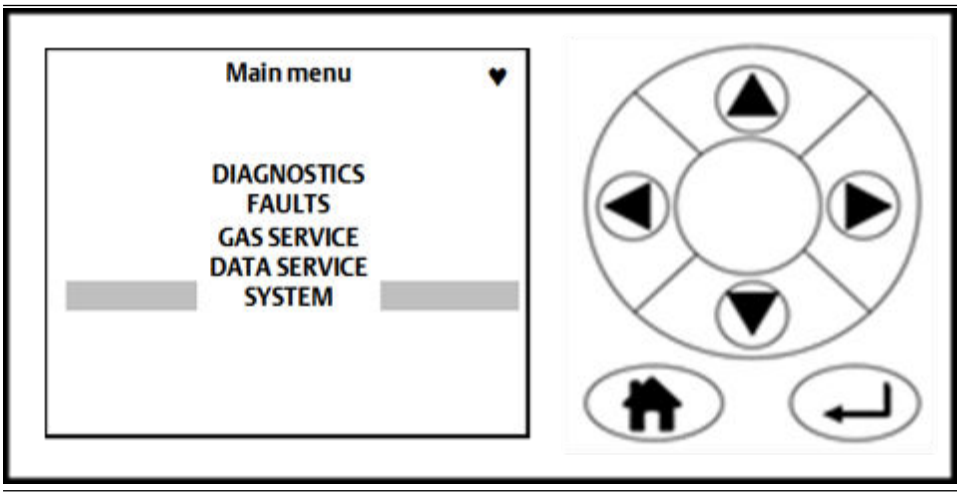
   Always lock off or tag off the calibration gas supply and compressed air supply when shutting down the analyzer.

4. Turn off the calibration gas supply to the analyzer. Lock out and tag out the compressed air supply.
5. Press ▶ on the display controller in either the ***Gas Sensor Main*** screen or the ***Pressure and Temperature*** screen.

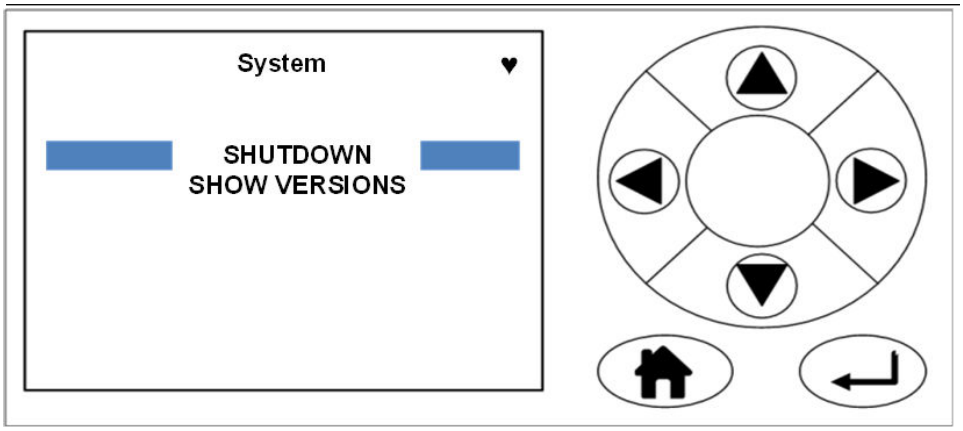




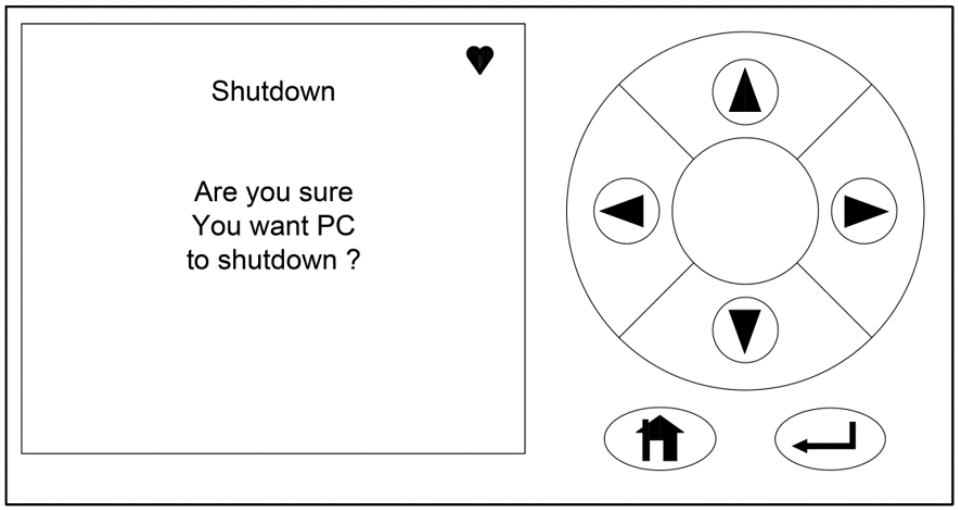
The ***Main menu*** opens.



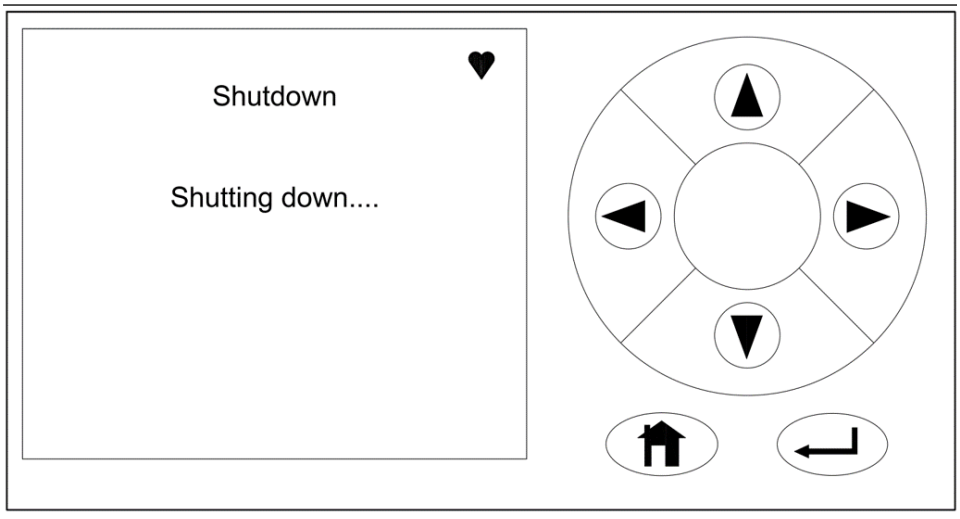
6. On the display controller, use the ▲ to select `SYSTEM`.
7. Press ▶.
   The ***System*** screen opens.



8. Use ▲ and to select **SHUTDOWN** . Then press ▶.
   The ***Shutdown*** screen opens.



9. Press ▶ to confirm.
   The analyzer displays the ***Shutdown*** screen and then stops running.



10. Wait until the heart icon at the top right of the screen stops flashing.
    You can now isolate the analyzer by turning off the power supply.

9 Preventative maintenance

9.1 Maintaining the analyzer

Preventative maintenance (PM) is also sometimes known as scheduled maintenance or planned maintenance.

Observe and obey the all safety precautions when performing preventative maintenance on the analyzer.

⚠ WARNING

BURNS

Some parts of the analyzer may be heated to 140 °F (60 °C). Failure to allow sufficient cooling may cause serious burn injury to personnel.

Do not touch any part of the analyzer.
Assume all parts of the analyzer are hot unless it has been switched off and allowed to cool down.
Always wear proper protective equipment when handling the analyzer.
Switch off the analyzer and allow it to cool for at least two hours before fitting, removing, or performing any maintenance.
The analysis cell is insulated against heat loss. Allow the analyzer to cool for at least 12 hours before performing any maintenance on, or in the vicinity of, the analysis cell.
If burns occur, seek immediate medical treatment.

⚠ WARNING

MAINTENANCE / MODIFICATIONS

On completion of any maintenance and/or modifications, verify:

- All tools and equipment are removed.
- No contamination (water or dust) is in the compartments.
- The analyzer is wiped clean.
- Vents are clear and not obstructed.
- The system is in a safe state for operation.

9.2 Scheduled maintenance

This schedule lists the tasks required by the analyzer and the recommended frequency. Variation in customer sites may require these activities to be performed more or less often than indicated. Details of the tasks to be performed are contained in Table 9-1.

Table 9-1: Scheduled Checks

Frequency	Action
Monthly	1. Check the zero and span calibration. Perform the calibration more or less frequently if necessary to meet quality control or plant operation requirements.
Annually	1. Perform the monthly check detailed in the previous row. 2. Perform a laser wavelength calibration. Contact your local service representative for guidance.

A ATEX / IECEx Assessment Report Summary

This appendix must not be changed, amended, or removed.

A.1 Certification Overview

This report covers the assessment of the Rosemount™ CT5800 Continuous Gas Analyzer to the standards listed in Section 1, in order to support the issue of prime ATEX and IECEx certification.

A.2 Applicant's Name & Address

Emerson Process Management Limited

2 Hunt Hill

Cumbernauld

Glasgow

G68 9LF

A.3 Manufacturer's Name & Address

As applicant.

A.4 Trademark

EMERSON™

A.5 Product Name/Model Number

Rosemount CT5800 Continuous Gas Analyzer

A.6 Rating

110V to 120V, 60Hz, single phase, 1100W

220V to 240V, 50Hz, single phase, 1100W

A.7 Assessment Standards

Table A-1: Europe

IECEx	ATEX/UKEx
IEC 60079-0:2011 Ed 6	EN 60079-0: 2018
IEC 60079-1:2014 Ed7	EN 60079-1:2014

(The requirements of the equivalent ATEX and IECEx standards are similar; therefore, any references in the following report can be regarded as referring to either format unless stated otherwise.)

This report may be issued against standards that do not appear on the UKAS Scope of Accreditation, but have been added through Sira's flexible scope of accreditation. Sira's flexible scope is available on request.

Table A-2: CSA Certificate North America

CAN/CSA-C22.2 No. 61010-1-12	Safety requirement for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
UL Std. No. 61010-1 (3rd Edition)	Safety requirement for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements
CAN/CSA - C22.2 No.0-10 (R2015)	Canadian Electrical Code, Part II - General Requirements
CAN/CSA - C22.2 No. 60079-0:15	Electrical Apparatus for Explosive Gas Atmospheres - Part 0: General Requirements
CAN/CSA - C22.2 No. 60079-1:16	Explosive Atmospheres - Part 1: Equipment Protection by Flameproof Enclosures "d"
ANSI/UL 60079-0 6th Edition	Electrical Apparatus for Explosive Gas Atmospheres - Part 0: Equipment - General Requirements
ANSI/UL 60079-1: 6th Edition	Explosive Atmospheres - Part 1: Equipment Protection by Flameproof Enclosures "d"
CSA C22.2 No. 94.1-15 / UL50	Enclosures for Electrical equipment, Non-environmental Considerations
CSA C22.2 No. 94.2-15 UL50E	Enclosures for Electrical Equipment, Environmental Considerations

A.8 Marking

Table A-3: Europe

Detail	IECEx	ATEX/UKEx
Certificate number	IECEx SIR 17.0026X	Sira 17ATEX1094X / CSAE 22UKEX1084X
Certification code	Ex db IIB+H2 T4 Gb	Ex db IIB+H2 T4 Gb
Other marking		
IP rating	IP66	
Model number	Rosemount CT5800 Continuous Gas Analyzer	
Manufacturer's name	Emerson Process Management Ltd	
Manufacturer's address	2 Hunt Hill Cumbernauld Glasgow G68 9LF	
Ambient range	-20 to 55 °C -4 to 131 °F	
Serial number	As applicable	
Year of manufacture	As applicable	
Warnings	WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT. WARNING - POTENTIAL ELECTROSTATICAL CHARGING HAZARD - SEE INSTRUCTIONS WARNING – DO NOT OPEN WHEN ENERGISED	
Maximum supply pressure	1 Bar	

Table A-4: North America

Detail	CSA North American Marking
Certificate number	CSA 70068210
Marking Class	Class 2258-02
Certification code	Class I Division 2 Groups B, C, D, T4
	Ex db IIB + H2 T4 Gb
Marking Class	Class 2258-82
	Class I Division 2 Groups B, C, D, T4
	Class I, Zone 1 AEx db IIB + H2 T4 Gb
Model number	Rosemount CT5800 Continuous Gas Analyzer

Table A-4: North America *(continued)*

Detail	CSA North American Marking
Manufacturer's name	Emerson Process Management Ltd
Manufacturer's address	2 Hunt Hill Cumbernauld Glasgow G68 9LF
Ambient range	-20 to 55 °C -4 to 131 °F
IP Rating	Type 3RX IP66
Serial number	As applicable
Year of manufacture	As applicable
Warnings	WARNING - DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT. WARNING - POTENTIAL ELECTROSTATIC CHARGING HAZARD - SEE INSTRUCTIONS. WARNING – DO NOT OPEN WHEN ENERGISED. WARNING – A SEAL SHALL BE INSTALLED WITHIN 50 mm OF THE ENCLOSURE.
Maximum supply pressure	1 Bar

A.9 Conditions of certification / special conditions for safe use

- This equipment has flamepaths which differ from those in IEC60079-1/EN 60079-1. Cascade Technologies Ltd shall be contacted for guidance when maintaining the flamepaths.
- The fasteners which secure the cover are non-standard and shall therefore only be replaced by fasteners supplied by the manufacturer for this purpose. The fasteners must always be fitted with the washer supplied by the manufacturer.
- The equipment has non-conductive surfaces which are a potential electrostatic charging hazard - see instructions for guidance.
- The user shall ensure that the flow process gas is limited to a maximum flow rate of 6 liters per minute.
- The equipment shall only be uses with process gases which are classified for equipment group IIB + H2 and must not contain oxygen or any other oxidizer in concentrations greater than those found in normal air.

North American conditions

- The equipment has flameproof joints with dimensions which are other than those specified in Table 2 of ANSI/UL 60079-1: 6th edition and Table 3 of CSA C22.2 60079-1:16. These flameproof joints are not intended to be repaired but where necessary the original manufacturer shall be contacted for guidance and information on the dimensions of the flameproof joints.
- The fasteners which secure the cover are non-standard and shall therefore only be replaced by fasteners supplied by the manufacturer for this purpose. The fasteners must always be fitted with the washer supplied by the manufacturer.
- The equipment has non-conductive surfaces which are a potential electrostatic charging hazard - see the instructions for guidance.
- The user shall ensure that the flow of process gas is limited to a maximum flow rate of 6 liters per minute.
- The equipment shall only be used with process gases which are in gas groups B, C, or D (Divisions) or IIB + H_2 (Zones) and must not contain oxygen or any other oxidizer in concentrations greater than those found in normal air.
- This assessment does not cover reliable function, performance, or other properties of the equipment not related to safety.
- The equipment is to be installed using wire no larger than 1 mm^2 (18 AWG).
- The equipment is only to be installed by manufacturer trained personnel.
- If at any time there is a conflict between the system safety provisions and any relevant local (national or regional) requirements, the local requirements always take precedence.
- The equipment is not to be used with flammable liquids.

B Theory of operation

B.1 Overview

The Rosemount™ CT5800 is a gas sensor system that can be configured to measure the concentrations of multiple small molecules carried in the gas sample. The types of molecules that are measured depend on the system configuration.

The analyzer can be configured to detect and measure up to twelve gases, with ranges varying from parts per billion to percent (%) volume levels. A detailed description of the system is given in Detailed system specifications .

B.2 Laser measurement principle

The analyzer uses up to six lasers to detect and measure the gases. Each laser measures between one and three gases. The lasers used in the system may be QCL or Tunable Diode Laser (TDL) laser types.

This cascade of electrons can produce between 20 and 100 photons per electron, giving the layers a higher output power than traditional semi-conductor lasers.

The lasing wavelength of a laser is determined by adjusting the physical thickness of the semiconductor layers, giving access to high power lasers covering the mid-infrared spectral region. The lasers have no need for cryogenic cooling and have excellent spectral quality in chirped mode and good tuneability.

B.3 Gas concentration measurements

In the analyzer, gas concentrations are measured using mid-infrared optical absorption spectroscopy. The laser light sources are operated to produce wavelength sweeps that cover the absorption lines of the gases to be measured.

Sample gas, which may contain impurity gases that are to be detected and measured, is conditioned and drawn into the analyzer. Inside the analyzer, the sample gas is fed into an analysis cell, where the laser beams are passed through the gas. The analysis cell contains a set of mirrors that bounce the light back and forth many times, which lengthens the path of the lasers through the gas.

On exiting the analysis cell, the light is detected by a receiver unit. The variation in the intensity of light in the vicinity of absorption lines for the gases being detected is measured, and the concentration is determined using a comprehensive spectral fitting routine.

C Spare parts list

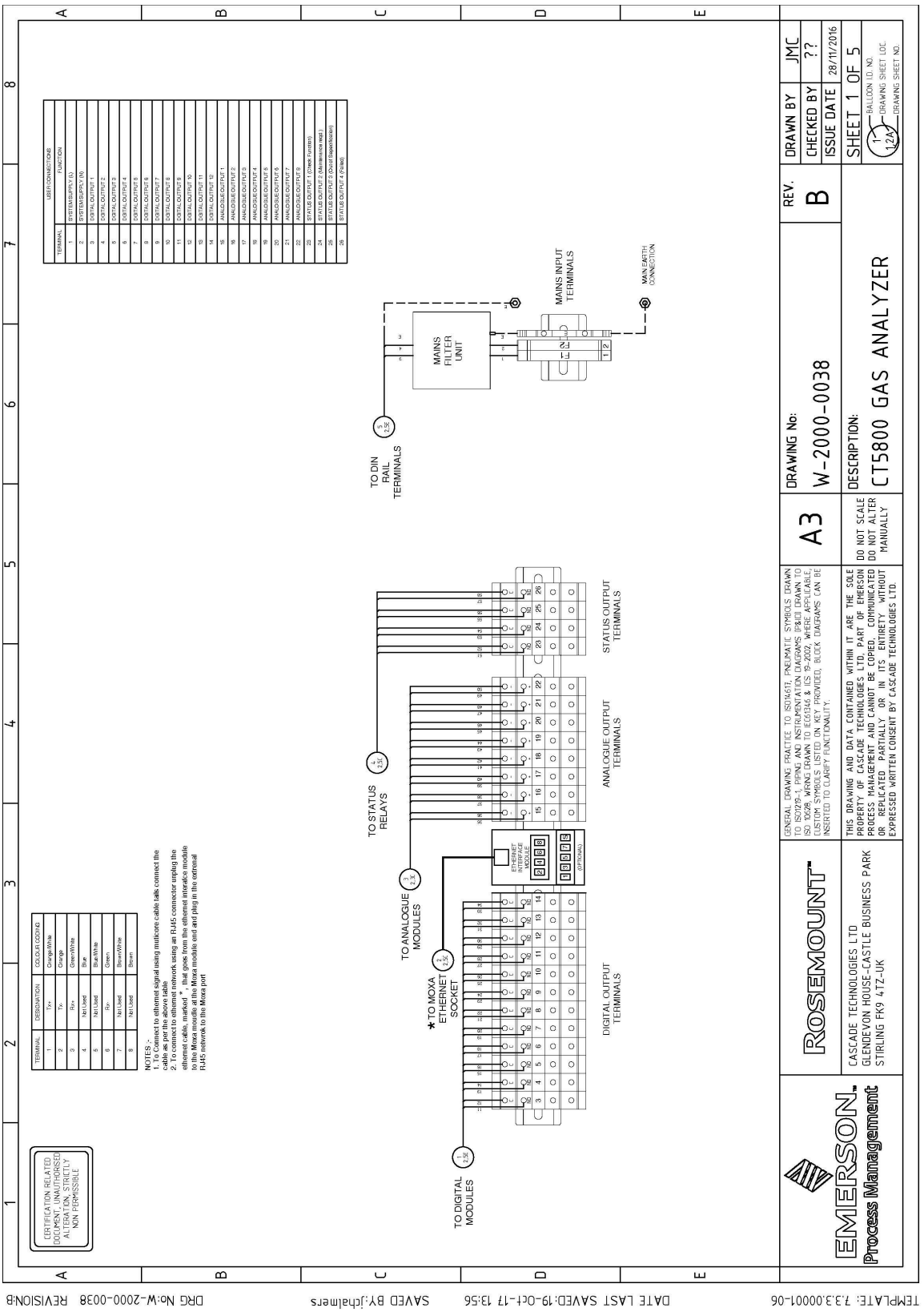
Rosemount part number	Description
P-6001-00012	Remote Ethernet I/O 2-port Etnet switch, 6 DIs and 6 relay
P-6001-00013	ioLogik remote Ethernet I/O 4AO, 2-port Switch
E-4004-6303	Tested TEC 3 board
E-4004-8001	Tested TC5000 motherboard
E-4004-6201	Tested peripheral board with XStream display interface
P-6001-00027	Cartridge fuse, F, 5A
P-6001-00032	CTE8000 series 0-2 bar A, 0-5 V output, G⅛ in. BSP male
P-6001-00036	Crydom SPST-NO solid state relay DIN rail mount, zero cross, 5 A rms, 15 V
P-6001-00030	1 output switch mode DIN rail panel mount power supply, 12 Vdc, 10 A
P-6001-00037	PT100 lead assembly, 6 mm dia x 50 long
P-6001-00040	O_2 detector
P-6001-00052	Detector
P-6001-00038	110 V Watlow cartridge ¼-in. (6.4 mm) OD x 7.5-in. (190.5 mm) x 200 W
P-6001-00031	Hasselroth XSTREAM display screen
P-6000-00034	Enclosure sealing gasket (cut to length)
P-6000-00112	Hasselroth enclosure flame arrestor

D Engineering drawings

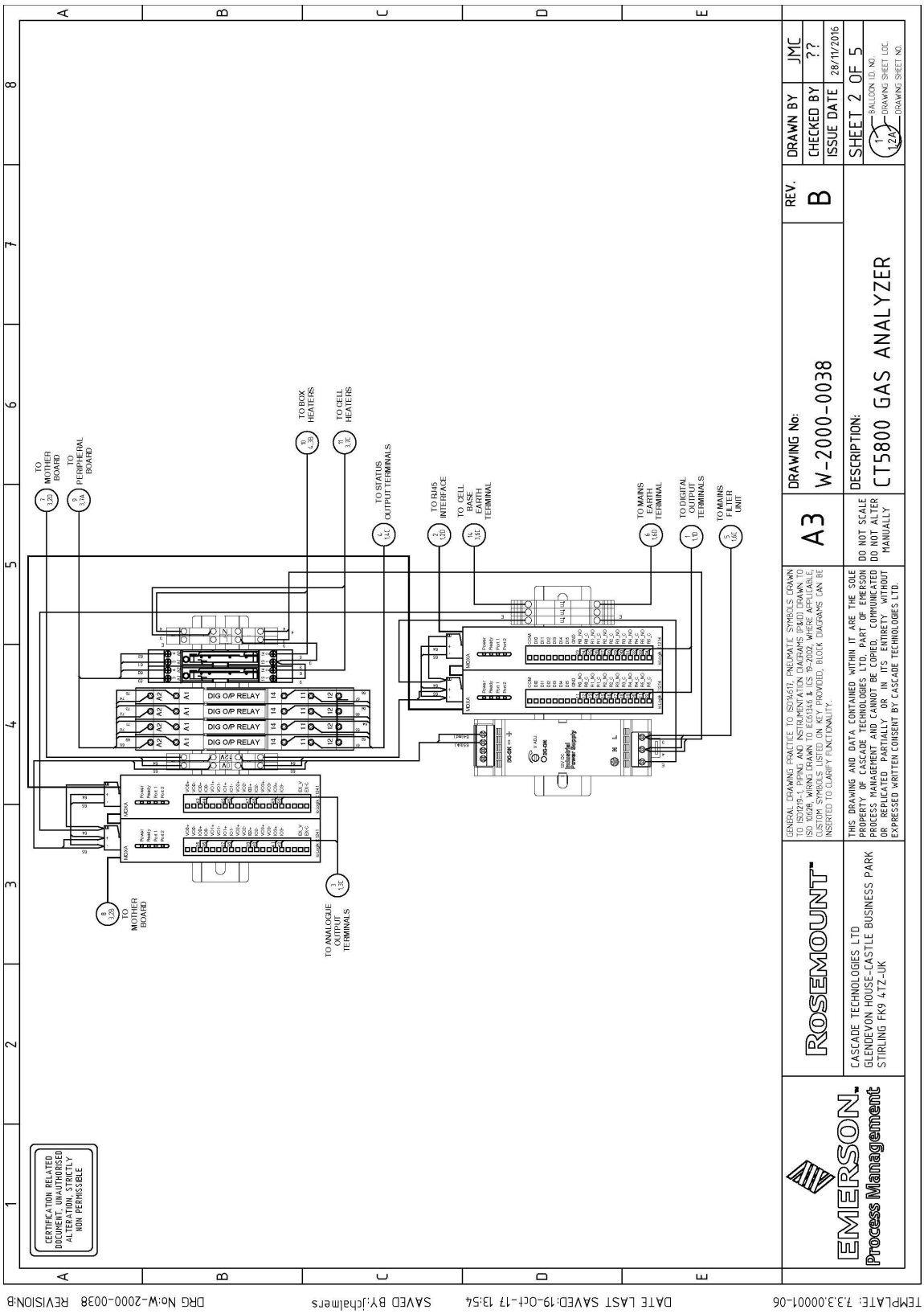
D.1 List of engineering drawings

Drawing number	Description
W-2000-0038 (Sheets 1-5)	Rosemount™ CT5800 Gas Analyzer

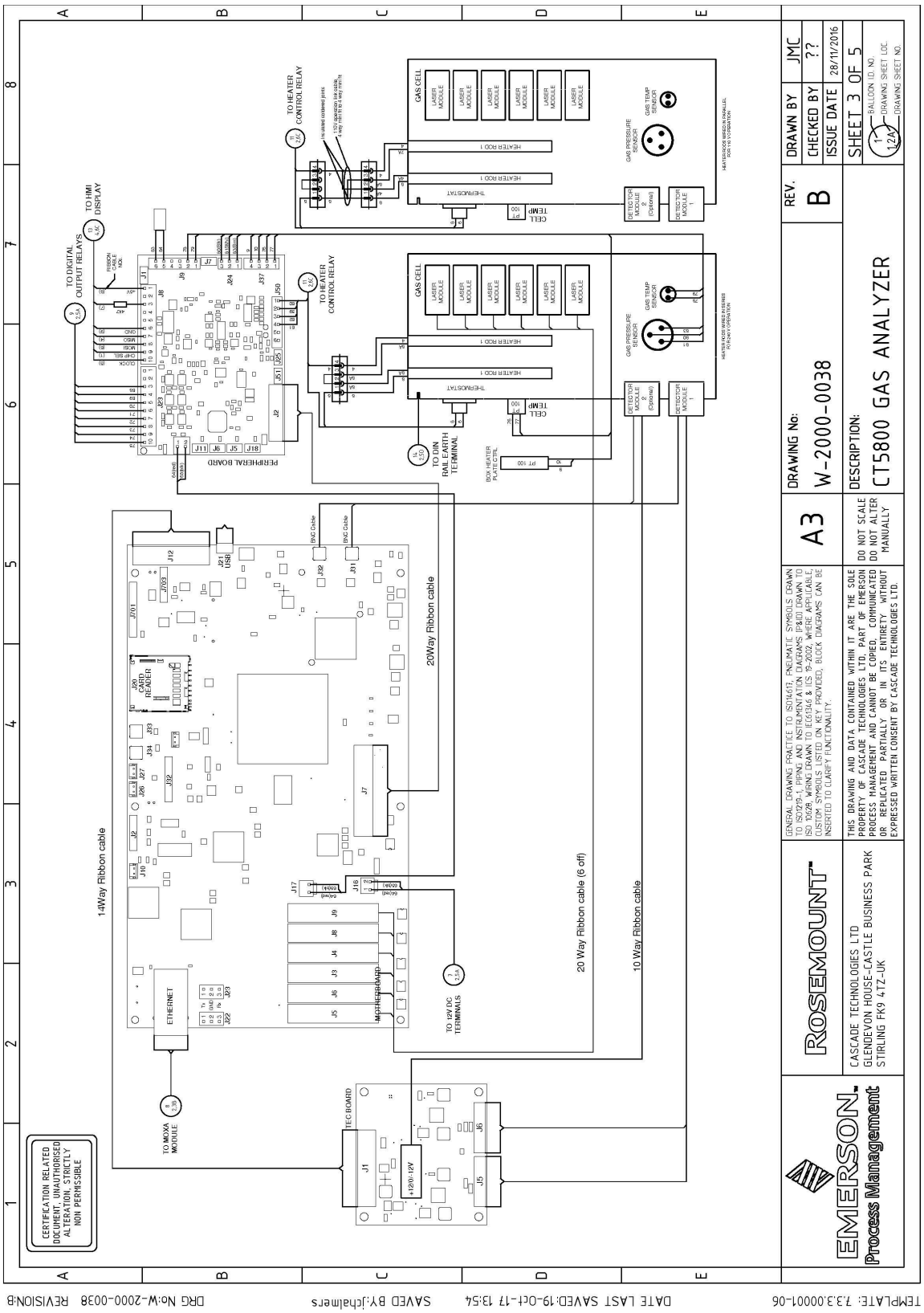
D.1.1 Wiring diagram W-2000-0038 (page 1)



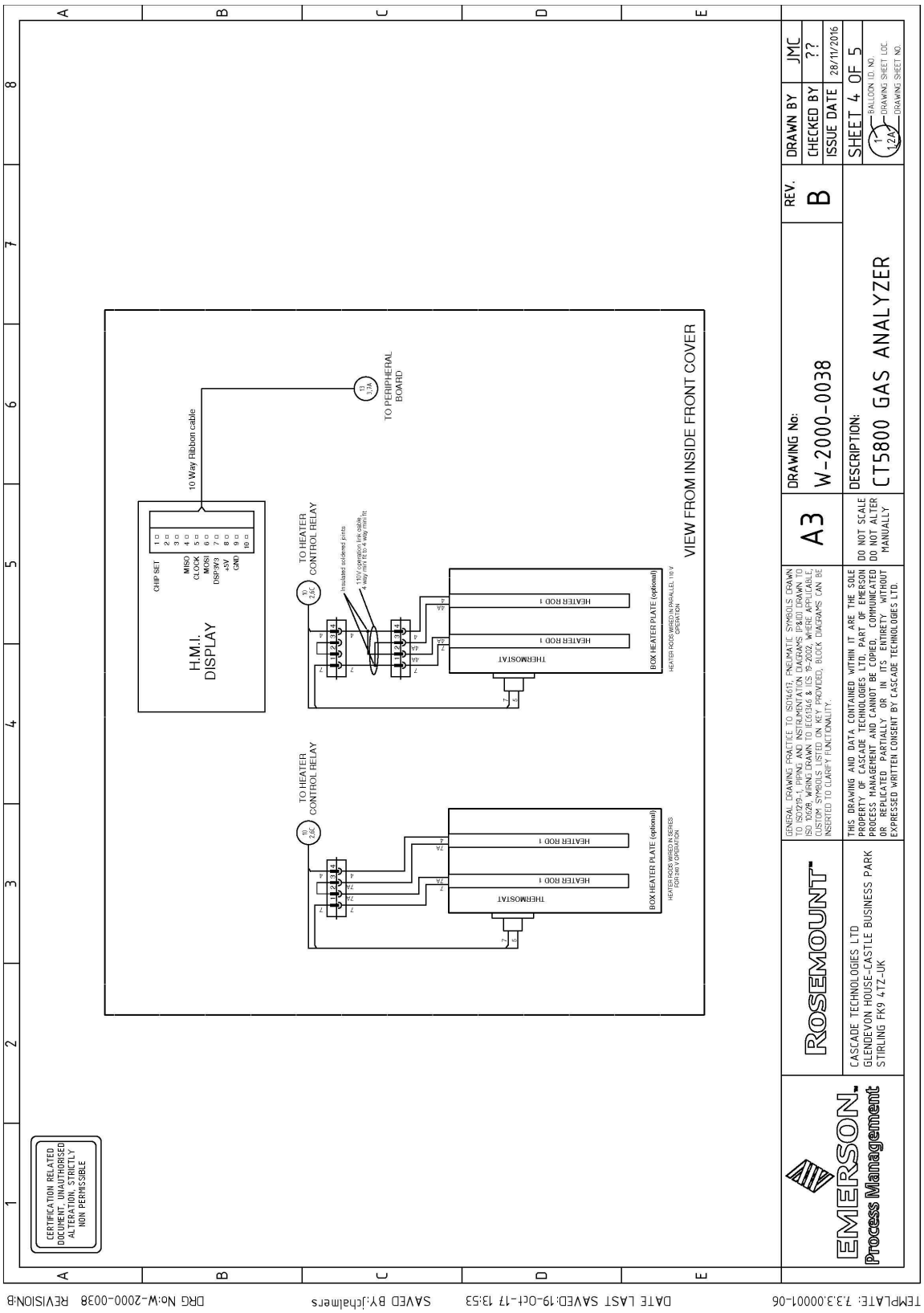
D.1.2 Wiring diagram W-2000-0038 (page 2)



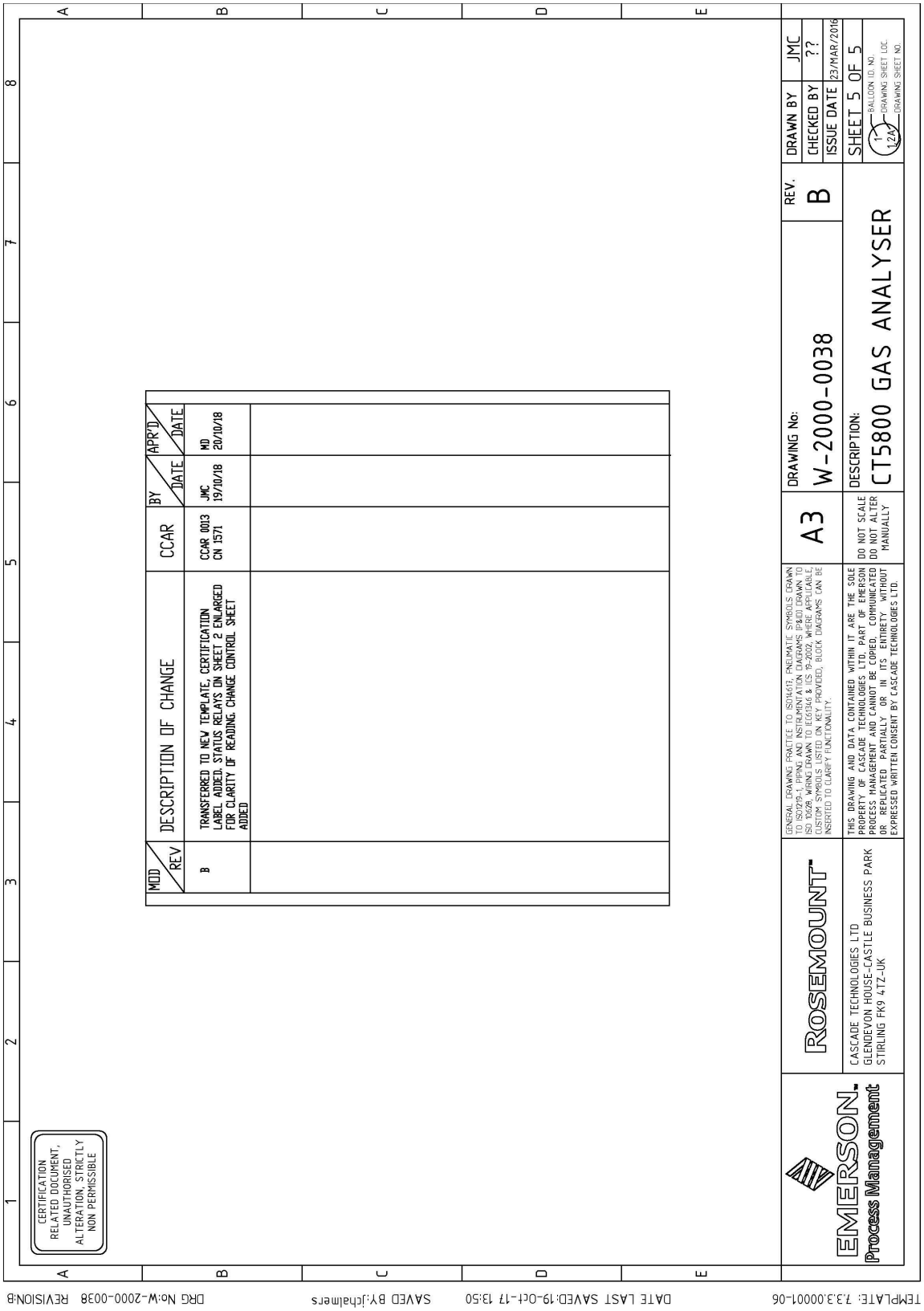
D.1.3 Wiring diagram W-2000-0038 (page 3)



D.1.4 Wiring diagram W-2000-0038 (page 4)



D.1.5 Wiring diagram W-2000-0038 (page 5)



E Glossary and abbreviations

The following terms are used in this manual.

Term	Description
Caution	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in equipment damage.
Danger	Signal word used to indicate an imminently hazardous situation which, if not avoided, will result in death or serious injury.
Detection limit	Although the gas detection range is given from zero, this is the lowest possible level of gas that the Rosemount CT5800 Gas Analyzer can detect.
Explosive gas(es)	Flammable gases and gas mixtures in a mixture with air within the explosive limits.
Flammable gas(es)	Gases and gas mixtures are assigned to be flammable if they might become ignitable when in a mixture with air.
Infallible containment	This term is derived from the standards of explosion protection especially from the requirements for pressurized housings; thus an infallible containment can be characterized by no intended leakage into the gas paths enabling gas to enter the inner compartment of the analyzer housing.
Intrinsically safe cell (IS cell)	Cells supplied with an intrinsically safe power signal, approved by a test institute, to operate with explosive gases. The design ensures the IS cells remain safe even in case of failure, and explosive gases are not ignited.
Laser beam path length	The optical distance traveled by the laser through the gas being measured.
Lower explosion limit (LEL)	Volume ratio of flammable gas in air below which an explosive gas atmosphere will not be formed; the mixture of gas and air lacks sufficient fuel (gas) to burn.
Measurement frequency	The frequency at which all gas concentrations are updated.
NAMUR	NAMUR is an international user association of automation technology in process industries. This organization has issued experience reports and working documents, called recommendations (NE) and worksheets (NA).
NEMA®	National Electrical Manufacturers Association. 4X specifies a degree of protection to personnel against incidental contact with the enclosed equipment, to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, and hose-directed water, and that will be undamaged by the external formation of ice on the enclosure.
Protection Class IP66	Both terms are used to specify conditions for equipment to be installed outdoors. IP stands for ingress protection; the first number specifies protection against solid objects (6 = dust tight) while the second number specifies the degree of protection against liquids (6 = heavy seas).
Purge	A purge is the use of high pressure gas to remove particulates that may have built up on the cell mirror surfaces.
Replace	In the repair procedure, replace means to remove and discard an unserviceable item and then fit a serviceable replacement item.
Sample flow rate	The rate at which sample gas flows through the cell

Term	Description
Upper explosion limit (UEL)	Volume ratio of flammable gas in air above which an explosive gas atmosphere will not be formed; the mixture of gas and air is too rich in fuel (deficient in oxygen) to burn.
Warning	Signal word used to indicate a potentially hazardous situation which, if not avoided, could result in death or serious injury.

Abbreviation	Description
©	Copyright
%	Percent
<	Less than
°	Degree
AC	Alternating current
Barg	Pressure, in units of bars, above or below atmospheric pressure
BS	British Standard
C	Celsius
CDA	Compressed dry air
CE	European Conformity
CH_4	Methane
CO_2	Carbon dioxide
DC	Direct current
Deg	Degree (temperature)
e.g.	For example
EC	European Community
EMC	Electromagnetic compatibility
EU	European Union
Hrs	Hours
Hz	Hertz
H_2O	Water
ICL	Interband Cascade Laser
IEC	International Electro-technical Commission
in.	Inches
IP	Ingress protection
IPxx	Ingress protection (xx are numbers that define the protection level)
IS	Intrinsically safe
ISO	International Organization for Standardization
k	Thousand

Abbreviation	Description
kg	Kilogram
kHz	Kilo hertz
L	Liter
lb.	Pound
LCD	Liquid crystal display
LED	Light emitting diode
LEL	Lower explosion limit
L/min	Liters per minute
m	Meter
m^3	Cubic meter
mA	Milliamp
Max	Maximum
mBar	milli-Bar
mbps	Megabits per second
mg	Milligram
mg/m^3	Milligram/cubic meter
Mid IR	Mid Infrared
min	Minute
mm	Millimeter
NEC®	National Electrical Code
NFPA	National Fire Protection Association
nm	Nanometer
No.	Number
PC	Personal computer
PM	Preventative maintenance
ppm	Parts per million
psi	Pounds per square inch
QCL	Quantum Cascade Laser
TDL	Tunable Diode Laser
Torr	Unit of pressure defined as exactly 1/760 of a standard atmosphere
USA	United States of America
USB	Universal serial bus
V	Volt
Vac	Volt alternating current

Abbreviation	Description
Vdc	Volt direct current
W	Watt
WEEE	Waste electrical and electronic equipment
µm	Micro-meter

00809-0100-5800
Rev BC
2020

For more information: Emerson.com

ROSEMOUNT™

EMERSON™