Reference Manual
00809-0100-4511, Rev AA
May 2020

Rosemount™ CT5100

Continuous Gas Analyzer

ROSEMOUNT™

EMERSON™

Preface

Published by Emerson.

All possible care has been taken in the preparation of this publication, but Emerson and its agents and distributors accept no liability for any inaccuracies that may be found. This manual reflects the state of the product at the issue date below, but further enhancements while in service may mean that the manual does not reflect your particular system.

Emerson reserves the right to make changes without notice both to this publication and the products which it describes.

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Preliminary information

This section details important user information for the Rosemount CT5100 Continuous Gas Analyzer.

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 documents shipped with the analyzer. The following information is also available and/or referenced in the Rosemount CT5100 Quick Start Guide: 00825-0100-4511.

Save all instructions for future use. Contact your local service center or sales office when missing documents.

Authorized personnel

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 personnel of the operating company for hazardous areas and the manufacturer. It is the responsibility of the operating company to:

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

Operators must:

- Have been trained
- Have 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 analyzer before reading and understanding this document and receiving appropriate training.

Important instructions

Important

All users must read this page before proceeding!

Emerson designs, manufactures and tests its products to meet many national and international standards. The Rosemount CT5100 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 products.

- Failure to follow the proper instructions may cause:
  - Loss of life
  - Personal injury
  - Damage to property
  - Damage to this analyzer
  - 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 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 Reference 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.
- 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.

Regulations and standards

Regulations/standards	Description
2014/35/EU	The Low Voltage Directive
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)
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
BS EN 61326-1: 2013	Electrical equipment for measurement, control, and laboratory use. EMC requirements. General requirements

Associated publications

Rosemount CT5100 Quick Start Guide

Compliance approvals

Important
The Rosemount CT5100 analyzer is designed for use in Non Hazardous areas ONLY.

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 CT5100 have satisfied the requirements for applying the CE marking to the Rosemount CT5100 Gas Analyzer.

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

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

⚠ 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 precautions

Important

The precautions in this manual MUST NOT be changed amended or removed. All authorized users, installation, operation and maintenance personnel, must observe the following safety precautions and warnings.
The Rosemount CT5100 analyzer is designed for use in Non Hazardous areas ONLY.

⚠ WARNING

ELECTRIC SHOCK

The analyzer operates using mains voltage, which may cause death or serious injury to personnel. Death, personal injury, and/or damage to persons and/or property may result if this is not observed.

Confirm that the circuit breakers are set to **OFF** and locked out and tagged out before removing the top cover or opening the front cover. The analyzer must be earthed.

Only trained, qualified personnel may install and connect power and signal cables. The installation/connection must be in accordance with all legislative requirements and applicable standards.

Only qualified personnel, familiar with potential risks, should install the analyzer.

⚠ DANGER

EXPLOSION HAZARD

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

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

The sample gas in the pipes leading to the analyzer must be purged for a minimum of 2 minutes and 30 seconds at a minimum flow rate of 280 L/m at 1.5 ± 0.5 bar to prevent hazards to personnel during maintenance.

Purge the sample gas in accordance with the safe working procedures for this site.

⚠ WARNING

FLAMMABLE SUBSTANCES

Some parts of the analyzer may reach temperatures of 374 °F (190 °C) and may present an ignition source. The interior of a analyzer is always hot unless it has been switched off and allowed to cool down. A fire may result if this precaution is not observed.

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

⚠ WARNING

TRANSPORTATION HAZARD

The analyzer weighs 117 lb. (53 kg) and should always be lifted and moved using suitable lifting/moving equipment.

Handle the analyzer with caution during unpacking, installation, maintenance, and transport to prevent crushing of hands, feet, or other body parts.

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.

Use safety approved lifting equipment. Ensure that the equipment is tested, meets the lifting ratings for the weight of the equipment, and is in good operational condition.

⚠ WARNING

FIRE AND EXPLOSION

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

Do not open the analyzer's electrical compartment unless the atmosphere in the area is known to be below the ignitable concentration of combustible gases or materials, or unless all equipment within the protected enclosure is de-energized .

The protective gas supply valve must be kept open unless the atmosphere in the area is known to be below the ignitable concentration of combustible gases or materials or unless all equipment within the protected enclosure is de-energized.

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

After opening the enclosure, do not restore power until the enclosure has been purged for a minimum of 2 minutes and 30 seconds at a minimum flow rate of 280 L/m at 1.5 ± 0.5 bar.

DO NOT operate the analyzer with doors or covers open.

Refer to local regulations as this may require a competent hot work supervisor to issue a hot work permit.

When the analyzer is out of order or if the pressurization unit shuts off due to a failure, all inputs and outputs connected to external equipment MUST be shut off.

This will ensure that no hazardous voltages are present within the analyzer enclosure when not pressurized.

Only properly trained personnel who understand the contents of all applicable manuals and related instructions should start up the analyzer.

Do not keep operating the analyzer if the enclosure shows permanent deformations after performing the overpressure test.

Use only replacement parts and components authorized by Emerson.

All replacement parts and components must be certified and approved for use in hazardous areas.

The analyzer contains a battery for data backup purposes.

Under normal operating conditions, there is no need to replace the battery during the analyzer life time. Battery replacement **MUST** only be conducted by Rosemount Customer Care personnel. It is NOT a customer serviceable item.

⚠ WARNING

FIRE, BURN, AND OPTICAL RADIATION EXPOSURE HAZARD

Electrical shock, thermal burns, or loss of vision may occur. Failure to observe this warning could cause an explosion or potentially hazardous situation, which if not avoided, may cause death, personal injury, and/or damage to persons and/or property.

Operators and service personnel do not have access to the laser/electrics or upper cell compartments for general maintenance or service.

⚠ WARNING

BURNS

Personal injury and/or damage to property may result if these precautions are not observed. These precautions are particularly important when working at heights.

Some parts of the analyzer may be heated to 374 °F (190°C). To prevent burns, do not touch any of the hot parts. All parts of a analyzer are always hot unless it has been switched off and allowed to cool down.

Before fitting, removing, or performing any maintenance on the analyzer, ensure that it has been switched off and allowed to cool for at least two hours. Before performing any maintenance on, or in the vicinity of, the analysis cell, allow the analyzer to cool for at least 12 hours as the analysis cell is insulated against heat loss.

When handling the analyzer, always wear suitable protective gloves.

If you receive a burn, seek medical treatment immediately.

⚠ WARNING

HAZARDOUS SUBSTANCES

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

The analyzer may contain hazardous substances. Always handle the analyzer assemblies and components with extreme caution. Wear personal protective equipment (PPE) when handling the equipment.

Gas handling components within the analyzer contain particulate matter residue from the sample gases. Over the life of the the analyzer, the concentration of particulate matter will become enriched within the gas handling components. When performing repairs and maintenance on the 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 in accordance with applicable local, national, or international health and safety regulations and pollution regulations.

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

OPTICAL RADIATION EXPOSURE HAZARD

There are three types of laser that may be included in the Rosemount CT5100: Quantum Cascade Lasers (QCLs), Interband Cascade Lasers (ICLs), and diode lasers. The lasers within the analyzer are Class 1. The characteristics of the lasers contained within the analyzer are given in the table below.

The emitted laser light is invisible (mid-infrared), and the combined laser powers are sufficiently low at the first accessible aperture that the unprotected eye will not be damaged. This class is eye safe under all operating conditions.

It is, however, possible to cause damage to the eye through not following correct procedures. Do not look at the laser with any kind of magnifier or optical measuring device.

Parameter	QCL	ICL	Diode	Comment
Operation mode	Pulsed	Pulsed	Pulsed	N/A
Lasers per system	1 - 6	1- 6	1- 6	Maximum of 6 lasers per system
Wavelength	4 - 10 µm	2 - 5 µm	Approximately 760 nm	N/A
Power	< 5 mW	< 5 mW	< 5 mW	Combined power of QCL at first accessible aperture: < 9.62 mW
Pulse duration	< 1 µs	< 1 µs	< 5 µs	N/A
Pulse repetition frequency	< 100 kHz	< 100 kHz	< 100 kHz	N/A
Duty cycle	< 5 %	< 5 %	< 25 %	N/A

The combined power of the QCL, ICL, and diode lasers at the first accessible aperture is < 9.62 mW.

The analyzer has warning labels in appropriate positions according to USA 21 CFR 1040.10. The location of laser safety labels on the analyzer is specified in Safety and system labels and annotation.

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

⚠ WARNING

HIGH PRESSURE GAS AND AIR

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 out the calibration gas supply and compressed air supply when shutting down the analyzer.

The maximum gas pressure valve must not exceed 100 psig (690 kPa).

⚠ WARNING

EXPLOSIONS HAZARD DUE TO ELECTROSTATIC DISCHARGE

In the event of a sudden discharge from electrostatically charged devices or individuals, there is a risk of an 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.

Take suitable measures to ensure that no electrostatic discharge can build up in the explosions risk area.

Clean the device surface by gently wiping it with a damp or antistatic cloth only.

⚠ WARNING

HAZARD BY WRONG INPUT VOLTAGE

Applying a rated voltage other than specified on the analyzer´s nameplate label may cause an explosion, injury, or damage to the installation. Failure to observe this warning could cause an explosion or potentially hazardous situation, which if not avoided, may cause death, personal injury, and/or damage to persons and/or property.

This type of analyzer is always setup for a specific rated input voltage; see nameplate label.

Ensure the voltage at site of installation meets the rated analyzer input voltage.

⚠ WARNING

LOOSE ITEMS

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

Do not place any loose items on top of the system or inside the compartments when doors / covers are open.

Confirm that all loose items, tools, and equipment are removed from compartments before closing doors and covers.

⚠ WARNING

MAINTENANCE/MODIFICATIONS

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

On completion of any maintenance and or modifications verify:

- All tools and equipment are removed.
- No contamination (water/dust) is in the compartments.
- Analyzer is wiped clean.
- Vents are clear and not obstructed.
- Verify that system is in a safe state for operation.

⚠ 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 perform pre-system start-up checks may cause damage to equipment.

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 starting up the analyzer, ensure that electrical power, sample gas handling facilities, and any calibration gases that are required are available to the analyzer.

Always follow the Start-up procedure.

Always follow the Shutdown procedure.

⚠ CAUTION

UNSERVICEABLE EQUIPMENT

If the pressure and temperature screen does not display measurements similar to those shown in Figure 8-1 and Figure 8-2, refer to Troubleshooting and diagnostics.

⚠ CAUTION

EMC

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

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

Some faults can only be repaired by Emerson. Where an item is unserviceable, and no replacement procedure is given in this manual, then the fault must be repaired by Emerson.

Contents

1 Introduction

1.1 Description

The Rosemount CT5100 Continuous Gas Analyzer, referred to hereafter as the Rosemount CT5100, 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 10 different types of gas at concentrations ranging from parts per million (ppm) to percentage levels in the process gas stream.

Important
The Rosemount CT5100 is designed for use in Non Hazardous areas ONLY.

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

1.2 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.

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 analyzer 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.

1.3 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 guide 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.

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:

- 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.

1.4 Qualified personnel

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 personnel of the operating company for hazardous areas 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 analyzer before reading and understanding this reference manual and receiving appropriate training.

1.5 Software version

The analyzer includes software that is used to control the operation of the analyzer. This manual describes the software version as: 5.7.13.

1.6 Glossary and abbreviations

Abbreviation	Description
©	Copyright
%	Percent
<	Less than
°	Degree
AC	Alternating current
ATEX	Explosive atmospheres
Barg	Pressure, in units of bars, above or below atmospheric pressure
BS	British Standard
C	Celsius
CDA	Compressed dry air
CE	European Conformity
CFR	Code of Federal Regulations
CGA	Continuous Gas Analyzer
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
kg	Kilogram

Abbreviation	Description
kHz	Kilo hertz
L	Liter
lb.	Pound
LCD	Liquid crystal display
LED	Light emitting diode
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
N_2	Nitrogen
NEC®	National Electrical Code
NFPA	National Fire Protection Association
nm	Nanometer
NH_3	Ammonia
NO	Nitric oxide
NO_2	Nitrogen dioxide
N_2O	Nitrous oxide
No.	Number
O_2	Oxygen
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

Abbreviation	Description
UKAS	United Kingdom Accreditation Service
USA	United States of America
USB	Universal serial bus
V	Volt
VA	Volt-ampere
Vac	Volt alternating current
Vdc	Volt direct current
W	Watt
WEEE	Waste electrical and electronic equipment
µm	Micro-meter

2 Theory of operation

2.1 Overview

The Rosemount CT5100 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 10 gases, with ranges varying from volume to percent (%) volume levels. A detailed description of the system is given in Detailed system specifications .

2.2 Laser measurement principle

The analyzer can use up to six lasers to detect and measure gases. Each laser can measure between one and three gases. Inside the laser, which is about the size of a pin head, electrons cascade down a series of quantum wells, producing a photon at each step.

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.

2.3 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 beams from the Quantum Cascade Lasers (QCLs) 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.

3 Description

3.1 Equipment purpose and role

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

Figure 3-1: Rosemount CT5100 Continuous Gas Analyzer

The analyzer can be configured to detect and measure up to 10 different gases, depending on the combination of laser modules fitted.

3.2 System overview

A complete Rosemount CT5100 system consists of a gas handling system, the analyzer, and the associated interconnecting wiring and gas piping.

The customer MUST provide the gas handling system and interconnecting wiring and gas piping.

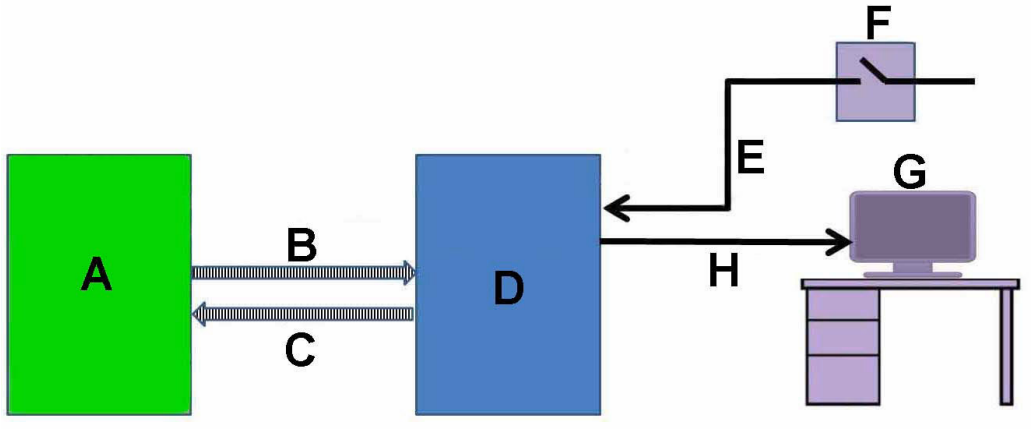
The Rosemount CT5100 is supplied by Emerson. The gas handling system may be provided by either the customer or Emerson, depending upon the specific installation. The

circuit breaker used to control the application of electrical power to the analyzer, the interconnecting wires, and gas piping are provided by the customer.

In Figure 3-2, the items supplied by Emerson are colored blue; the items supplied by the customer are colored purple. The green gas handling system may be provided by Emerson or the customer.

Table 3-1 lists the main items of the system.

Figure 3-2: Rosemount CT5100 Installation



A. Gas handling system
B. Sample supply line
C. Sample return (exhaust) line
D. Rosemount CT5100
E. Electrical power
F. Two pole main isolator complete with RCD
G. Control center
H. Measurement data

The analyzer 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 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 at either 110 or 240 Vac 50/60 Hz supply.

The analyzer uses mid-infrared optical absorption spectroscopy to measure gas concentrations. The light sources are Quantum Cascade Lasers (QCLs), 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 in Table 4-1.

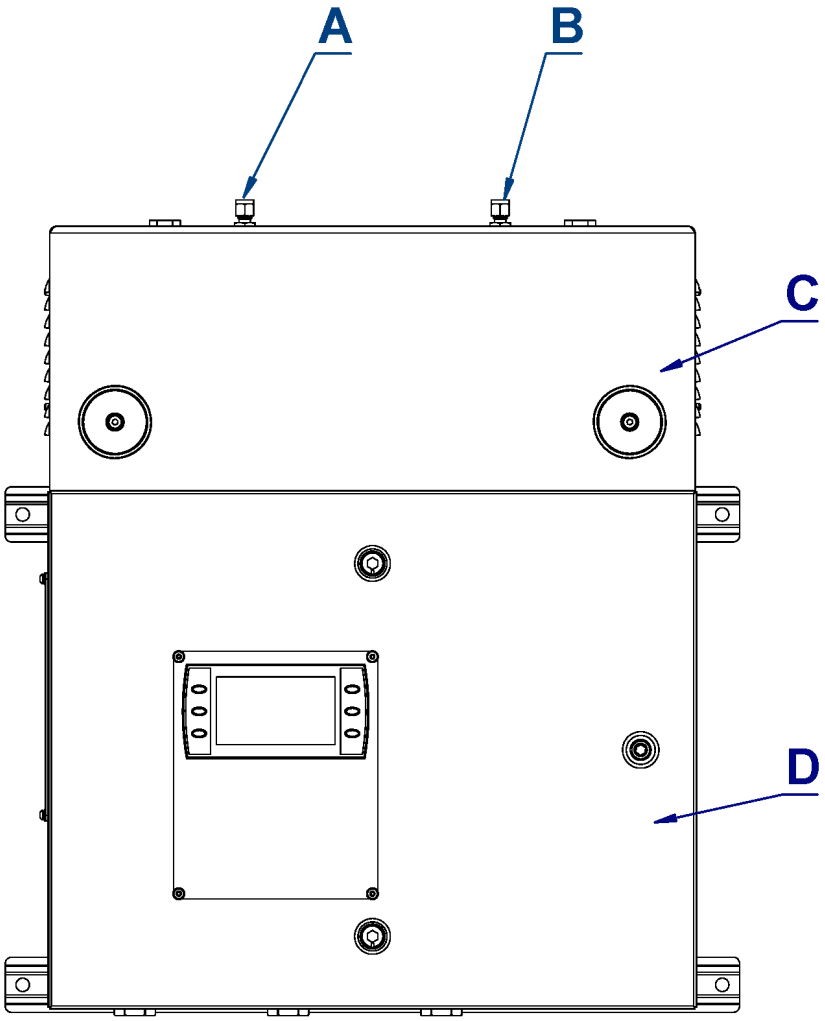
Table 3-1: Main Items of the Rosemount CT5100 Installation

Item	Name or description	Supplied by	Part number	Quantity	Notes
1	Rosemount CT5100	Emerson	Rosemount CT5100	1	N/A
2	Rosemount CT5100 software package, version 5.x.x.	Emerson	N/A. Software is embedded in the system.	1	Version described in manual
3	Gas handling system	Customer (optionally by Emerson)	Customer choice or Emerson	1	N/A
4	Heated gas sample line hose	Customer	Customer choice	1	N/A
5	Exhaust line hose (for sample gas)	Customer	Customer choice	1	N/A
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	Required for calibration
8	Pneumatic T-piece	Customer	Customer choice	1	Required for calibration
9	Excess flow line	Customer	Customer choice	1	Required for calibration
10	Power cables to Rosemount CT5100	Customer	Customer choice	1	N/A
11	Cables from Rosemount CT5100 to control center	Customer	Customer choice	1	N/A
12	Main circuit breaker complete with RCD	Customer	Customer choice	N/A	N/A

3.3 Gas inputs and outputs

The analyzer has one gas input and one gas output. See Figure 3-3.

Figure 3-3: Gas Inlet and Outlet Connectors



A. Sample gas return port
B. Sample gas input port
C. Top cover of Rosemount CT5100 (cell compartment)
D. Laser/electrical compartment

Procedure

1. The gas sample that is to be measured for impurities enters the analyzer through the sample gas input port located on top of the analyzer (see Figure 3-3.).
2. Once the gas sample has been examined for impurities, it is expelled from the analyzer through the sample gas return port.
3. The sample gas supply line must be heated all the way to the sample gas input port on the analyzer to prevent condensation forming in the line.

⚠ WARNING

HAZARDOUS GASES

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

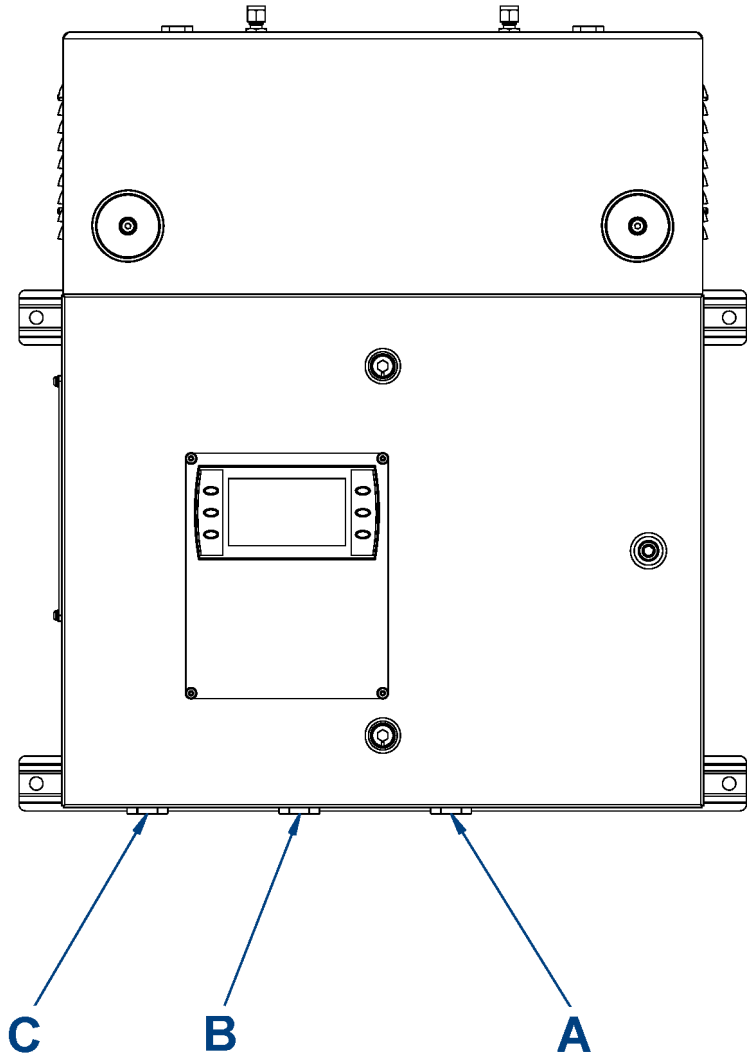
Therefore, take special care to ensure that the sample gas return port either returns the sample gas to the product stream or discharges the sample gas to a location that will not cause a hazard.

3.4 Connecting the electrical/electronic inputs and outputs

⚠ CAUTION

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

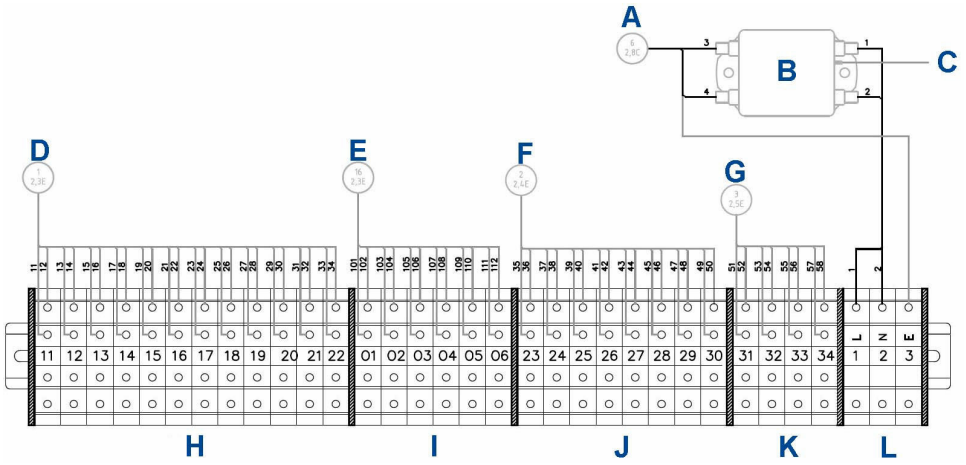
Figure 3-4: Electrical/Electronic Connectors



A. Power entry point
B. Analog/digital entry point
C. Analog/digital entry point

Electrical/electronic signal connections to the analyzer are made through three electrical entry points located on the underside of the analyzer, as shown in Figure 3-4. Use the wiring diagram to make the electrical connections as shown in Engineering drawings and Figure 3-5.

Figure 3-5: Signal Cable Outputs



A. To mains input fuses
B. Mains input filter
C. To enclosure earth stud
D. To digital modules
E. To digital modules
F. To analog modules
G. To status relays
H. Digital output terminals
I. Analog or digital output terminals
J. Analog output terminals
K. Status outpput terminals
L. Mains input terminals

Table 3-2: Rosemount CT5100 System Wiring User Connections

Terminal	Function
1	Sensor system supply (L)
2	Sensor system supply (N)
3	Earth
11	Digital output 1
12	Digital output 2
13	Digital output 3
14	Digital output 4
15	Digital output 5
16	Digital output 6
17	Digital output 7
18	Digital output 8
19	Digital output 9

Table 3-2: Rosemount CT5100 System Wiring User Connections *(continued)*

Terminal	Function
20	Digital output 10
21	Digital output 11
22	Digital output 12
23	Analog output 1
24	Analog output 2
25	Analog output 3
26	Analog output 4
27	Analog output 5
28	Analog output 6
29	Analog output 7
30	Analog output 8
31	Status output 1 (Check function)
32	Status output 2 (Maintenance required)
33	Status output 3 (Out of specification)
34	Status output 4 (Failed)
01	Analog or digital input/output
02	Analog or digital input/output
03	Analog or digital input/output
04	Analog or digital input/output
05	Analog or digital input/output
06	Analog or digital input/output

Electrical power is applied to the analyzer through the power entry point, Figure 3-4.

The power supply is 110 or 230 Vac, 50/60 Hz ± 10%. AC to DC. Power converters inside the analyzer automatically adjust in response to the input voltage level and ensure that the correct DC voltage is available inside the unit. The analyzer is electrically protected by an internal 5 A, 250 VA fast acting fuse on the instrumentation electrical supply line and an internal 2 A, 250 VA fuse on the purge electrical supply line.

⚠ WARNING

Failure to follow this warning may result in personal injury and/or damage to persons and/or property.

Make sure that the mains supply cable used is of a suitable rating for the unit power requirements and is of a three core earthed construction.

The digital outputs conduit (B and C) provides an Ethernet output from the instrument that may be used for downloading data for failure diagnosis purposes or for downloading data to the process control center.

The results of the gas analysis are output from the instrument through the 4-20 mA analog or Modbus® outputs and sent to the process control center.

The optional digital 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:

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

NOTICE

The installation of the gas analyzer shall be in accordance with all local and national standards.

3.5 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 a baseplate onto 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 0.66 ft. (0.2 m), 6.56 ft. (2 m), 16.4 ft. (5 m), and 19.2 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.

4 Specifications

4.1 Gas detection

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

4.2 Detailed system specifications

Table 4-1 gives the physical characteristics of the analyzer. Schematic diagrams of the sensor and mounting points are shown in Figure 4-1 and Figure 4-2. Table 4-2 gives the general characteristics of the analyzer.

Table 4-1: Physical Characteristics

Rosemount CT5100	Value	Comment
External dimensions	22.64 x 11.73 x 28.11 in. 575 x 298 x 714 mm	Length x width x height Nominal dimensions
Weight	117 lb. 53 kg	Approximate weight

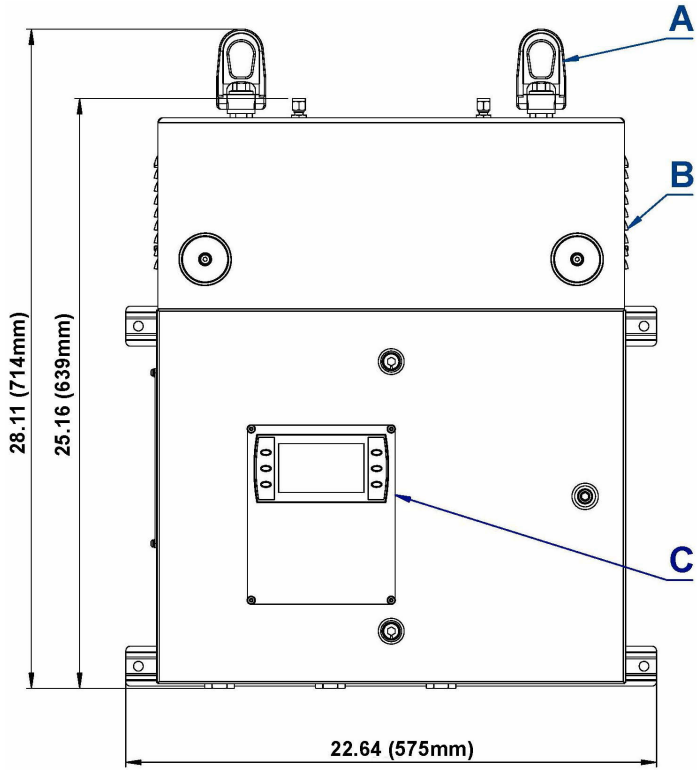
Table 4-2: General Characteristics

Rosemount CT5100	Value	Units	Comment
Instrument supply voltage	110 to 240	Vac	50/60 HZ ±10%
Peak power consumption	500	W	Max consumption per gas analyzer
Continuous steady-state power consumption	300	W	Once the gas analyzer has stabilized and the analysis cell has reached the temperature set point
Electrical compartment enclosure	N/A	N/A	304 stainless steel
Optical compartment enclosure	N/A	N/A	Polyester TGIC free powder coated 304 stainless steel
Wetted materials	N/A	N/A	AISI 316 (EN 1.4401 grade) stainless steel tubing and fittings including thermowell and pressure diaphragm, PFA coated aluminum cell body, PTFE seals, protected gold coated mirrors, CaF2 windows, and FKM (typically Viton™) or FFKM (typically Kalrez™) O-rings
Measurement technique	N/A	N/A	Mid infrared (IR) absorption spectroscopy
Mid IR source	N/A	N/A	Quantum Cascade Laser

Table 4-2: General Characteristics *(continued)*

Rosemount CT5100	Value	Units	Comment
Near IR source			Interband Cascade Laser 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 6	in. mm	Swagelok® type, factory-configured, specify on order
Outlet (exhaust) gas port connector	¼ 6	in. mm	Swagelok type, factory-configured, specify on order
Measurement result signals	4 to 20	mA	4 or 8 channel outputs, specify on order
Communication	10/100	Mbps	Ethernet
Warm-up time	90	minutes	N/A

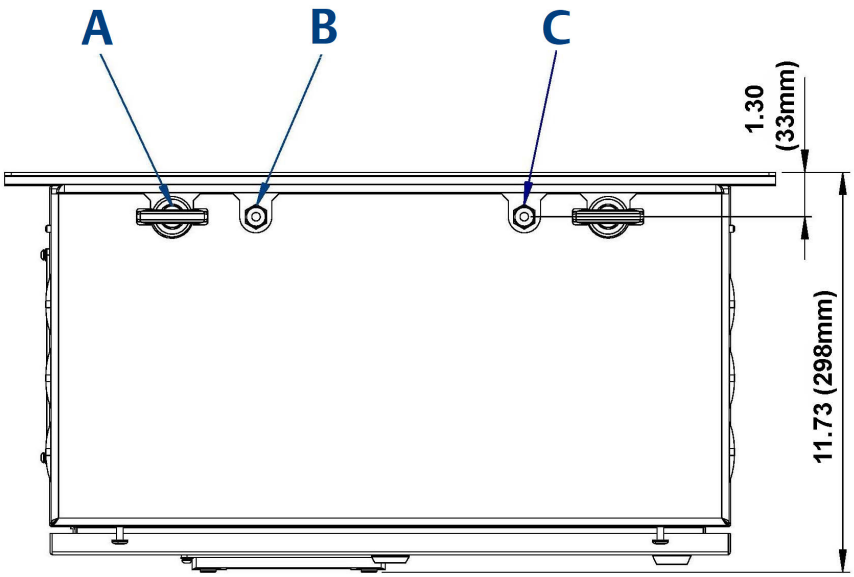
Figure 4-1: Rosemount CT5100 Dimensions - Front View



Dimensions are in inches (mm).

A. *Lifting eyelet*
B. *Ventilation*
C. *User interface*

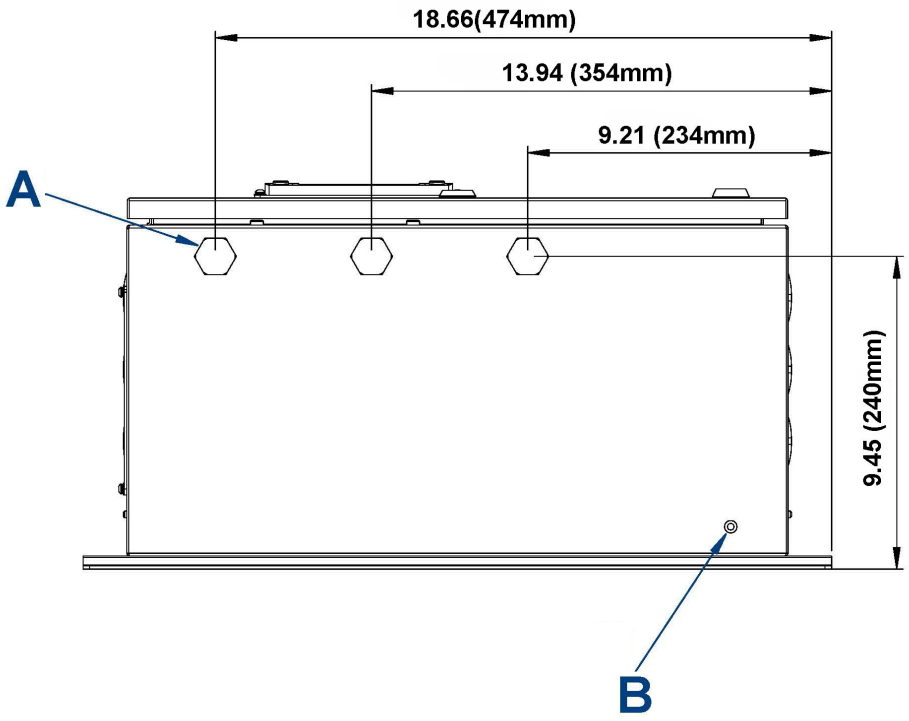
Figure 4-2: Rosemount CT5100 Dimensions - Top View



Dimensions are in inches (mm).

A. *Lifting eyelet*
B. *Sample return*
C. *Sample inlet*

Figure 4-3: Rosemount CT5100 Dimensions - Bottom View



Dimensions are in inches (mm).

A. *Cable glands*
B. *Earth point*

Table 4-3: Environmental Characteristics

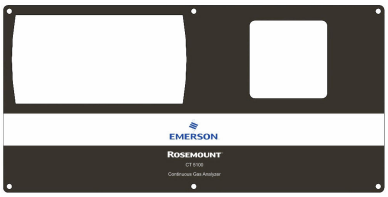
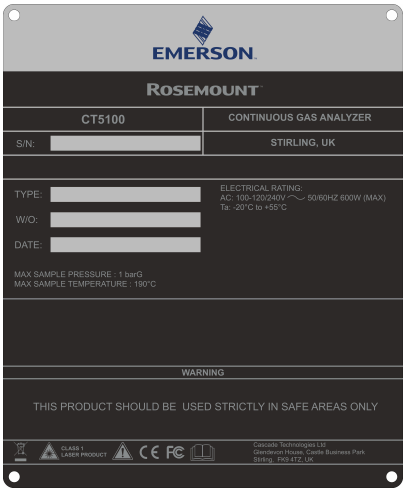
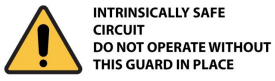
Environmental characteristic	Value	Units	Comment
Operating temperature range	-4 to 131 -20 to 55	°F °C	Ambient temperature
Sample gas temperature range	131 to 374 50 to 190	°F °C	Factory set, specify on order
Sample gas moisture content	30 (dependent on gas type. Customer must confirm.)	%	Maximum
Sample gas particulate density	5	mg/m^3	Maximum
Sample gas particulate size	10	µm	Maximum
IP code	IP66 (electrical compartment enclosure) IP20 (optical compartment enclosure)	N/A	IP to IEC 60529

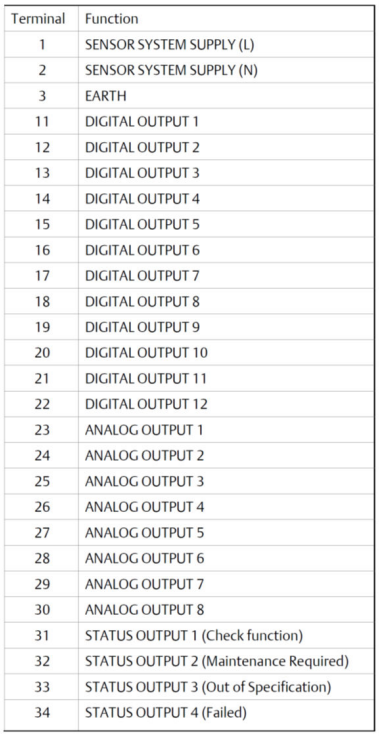
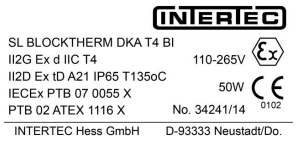
Table 4-3: Environmental Characteristics *(continued)*

Environmental characteristic	Value	Units	Comment
Sensor humidity range	10 to 95	%	Relative humidity (non-condensing) at 113 °F (45 °C)

4.3 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 and model number)	Emerson.com/RosemountGasAnalysis 	Front panel
Fuse identification label		1. Back plate 2. Top right inside of door
Ratings label		Enclosure side panel
Laser radiation CAUTION label		Baseplate
Laser module identification label		On each laser module housing
Intrinsically safe label		1. HMI 2. Intrinsically safe sensor barrier

Label type	Example	Location
Terminal label		Top left inside of door
Earth identification label		Back plate
Manufacturer's label		On analysis cell heater block
Electrical safety label		On inside of electrical compartment door
AC Power Supply Danger label		1. On outside of electrical compartment door 2. On manifold block of air overpressure system

5 Install

5.1 Site selection

The Rosemount CT5100 has a T3 temperature classification which specifies the maximum surface temperature of the analyzer. Ensure that no combustible gas concentrations will be present, whether on a continual or occasional basis, which have an ignition temperature below the T-rating of the analyzer.

⚠ WARNING

FIRE AND EXPLOSION

Death, personal injury, and/or damage to persons and/or property may result if this is not observed.

The analyzer's electrical compartment must not be opened unless the atmosphere in the area is known to be below the ignitable concentration of combustible gases or materials, or unless all equipment within the protected enclosure is de-energized.

⚠ WARNING

ELECTRIC SHOCK

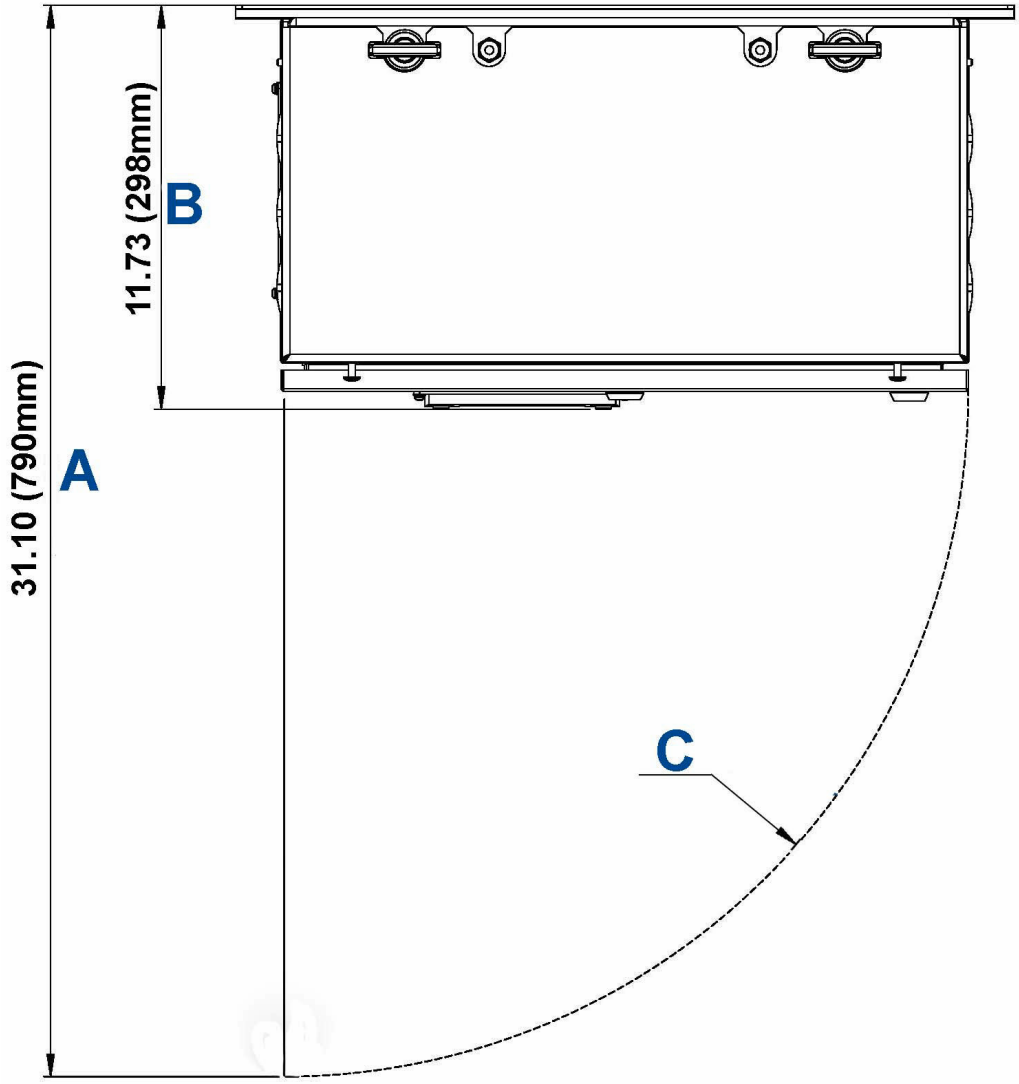
The analyzer operates using mains voltage, which may cause death or serious injury to personnel. Failure to observe this precaution will cause death, personal injury, and/or damage to persons and/or property.

Ensure that the circuit breakers are set to Off and locked out and tagged out off before removing the top cover or opening the front cover.

The analyzer is intended to be installed in a suitable Division 2 shelter to protect it from the elements.

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

Figure 5-1: Clearance with Door Open



Dimensions are in inches (mm).

A. *Door open*
B. *Door closed*
C. *Door opening arc*

5.2 Unpacking

This procedure requires a minimum of two people to safely remove the equipment from the shipping container.

⚠ WARNING

HEAVY INSTRUMENT - LIFTING HAZARD

Handle the analyzer with caution during unpacking, installation, maintenance, and transport to prevent crushing of hands, feet, or other body parts.

The analyzer weighs 117 lb. (53 kg) and should always be lifted and moved using suitable lifting/moving equipment. Emerson recommends that a minimum of two people using suitable tools for transportation and lifting are employed.

Wear suitable protective gloves and protective footwear.

⚠ CAUTION

EQUIPMENT DAMAGE

Failure to observe this caution may cause damage to the equipment.

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

EXPLOSION HAZARD

Installing and wiring the analyzer must comply with all relevant national legislative requirements and regulations.

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

⚠ WARNING

EXPLOSION HAZARD

Installing the analyzer requires opening the enclosure and working at the open unit. This is permitted only when both the analyzer and connected external circuitry are de-energized.

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

⚠ WARNING

HEAVY ITEM

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

Ensure 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 117 lb. (53 kg).

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

Wear suitable protective gloves and protective footwear.

⚠ CAUTION

SHOCK AND VIBRATION

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

The analyzer contains sensitive electronic equipment. It MUST NOT be subjected to any shock and 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 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 top of the analyzer.
5. One person should carefully guide the equipment from the horizontal to 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 and place it on a solid, level surface.
7. Ensure that the analyzer is stored in its protective plastic cover until installation.

5.3 Mounting the analyzer

This procedure requires two people to safely move and mount the Rosemount CT5100.

Procedure

1. Ensure that there is free space around the analyzer to allow ventilation of the upper part of the analyzer.

⚠ WARNING

HEAVY ITEM

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

Ensure 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.

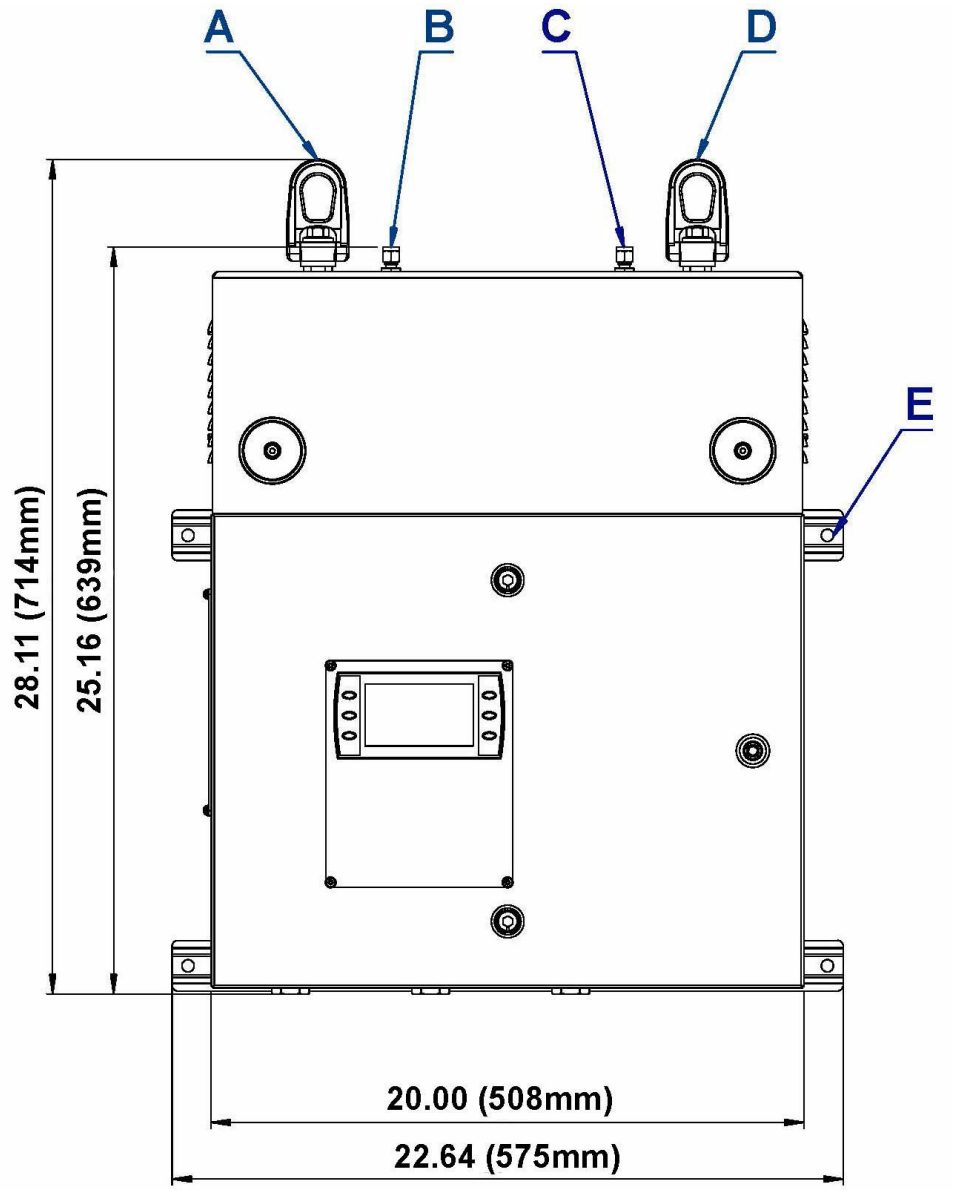
The analyzer weighs 117 lb. (53 kg).

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

Wear suitable protective gloves and protective footwear.

2. Attach suitably rated and testing lifting slings to the safety engineered lifting eye bolts mounted on top of the analyzer.

Figure 5-2: Front View Dimensions



A. Lifting eye bolt
B. Sample gas input port
C. Sample gas return port
D. Lifting eye bolt
E. 0.413-in. (10.5 mm) diameter mounting bolts

3. One person should carefully guide the equipment while the other person operates the lifting equipment.

4. Use safety approved and tested lifting equipment to lift the analyzer from the stable platform.
5. Mount the analyzer using four M8 (⅜-in.) fasteners to attach the wall mount brackets.

   The bolts must be positioned in such a way to allow maximum use of all the thread length.

   The installer must ensure that the fasteners used are suitable for the load and surface that the analyzer is mounted on.

   In case you need to thread lock the fittings for extra security, only do this with compounds compatible with the zone classification of the installation location.

   The four wall fixing points must be 0.413-in. (10.5 mm) diameter mounting holes.

   Ensure that the wall fixing points are capable of supporting a load of 242 lb (110 kg) each; this includes a x 2 factor of safety. Figure 5-3 shows the locations of the mounting points on the analyzer. All mounting points are 0.413-in. (10.5 mm) diameter holes.

   Confirm the bolts are secure. Do not overtighten the fasteners.

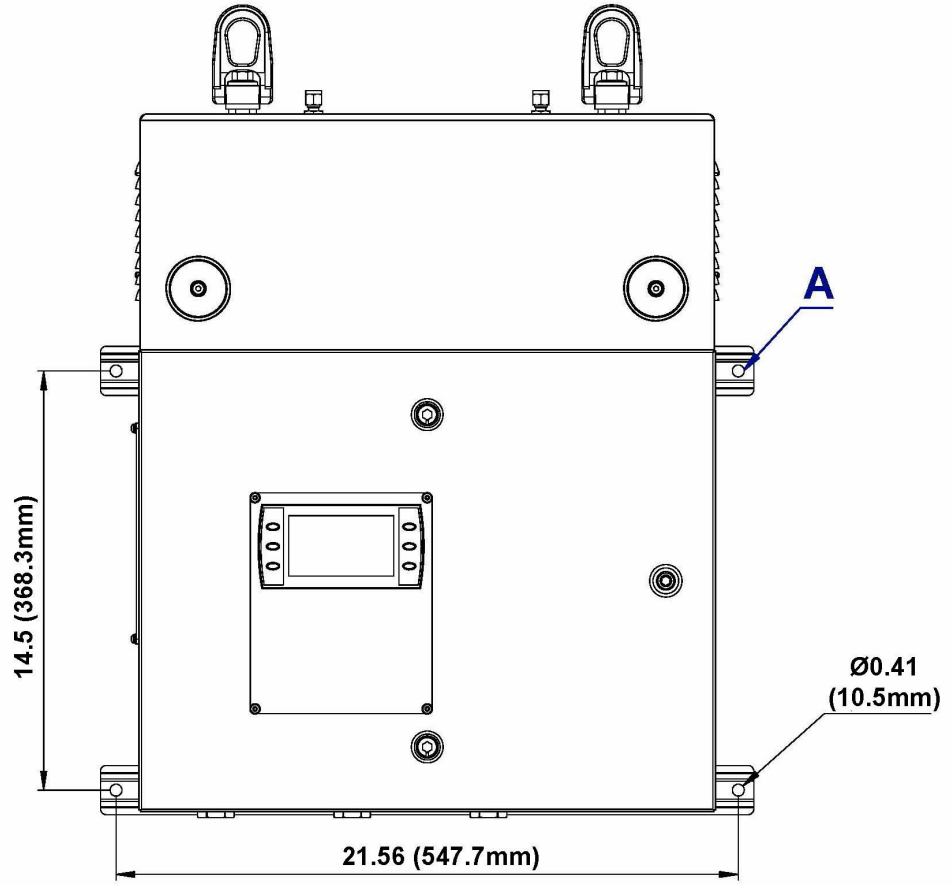
   The analyzer must be mounted using the four off factory fitted and predrilled holes on the brace bars. Refer to Figure 5-2.
6. Remove the lifting eyes and retain them for future use.

   Threads must be protected with a suitable grease and plastic grommets.

   After mounting, do not place any additional load on the analyzer.

   Do not place or leave loose items on flat surfaces.

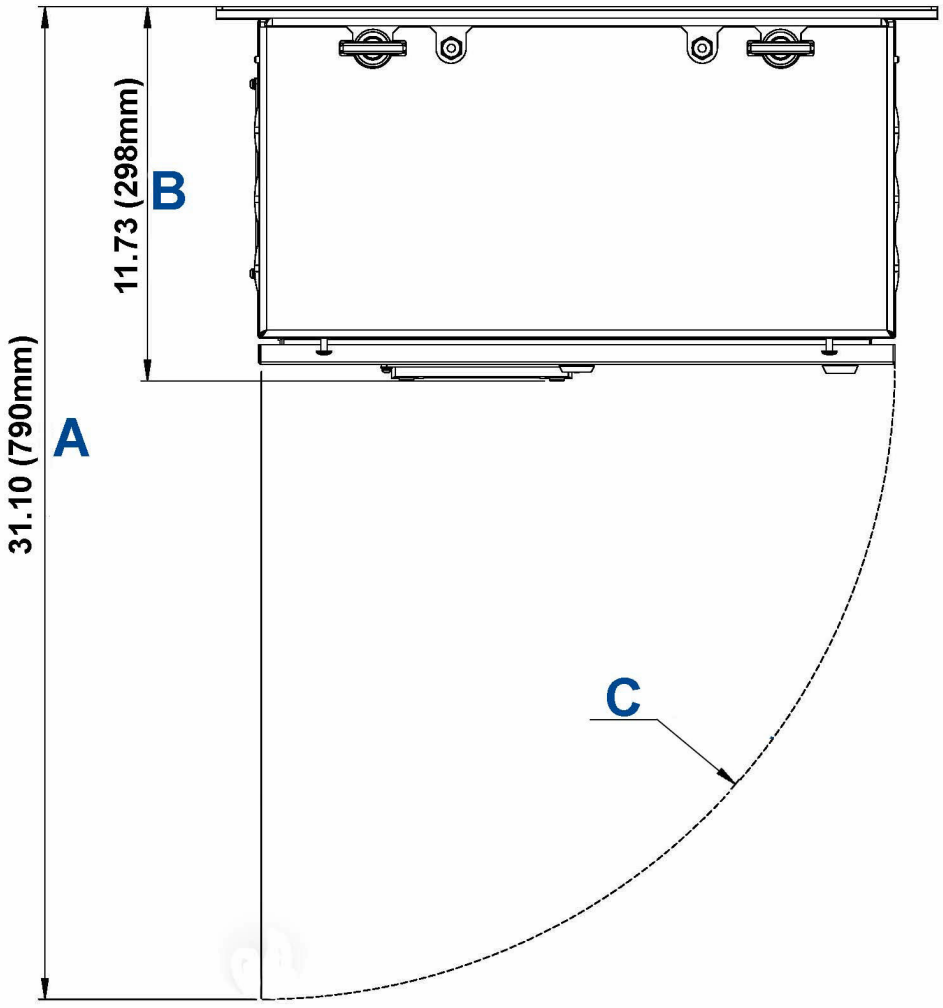
Figure 5-3: Mounting Details



Dimensions are in inches (mm).

A. Mounting points

Figure 5-4: Clearance with Door Open



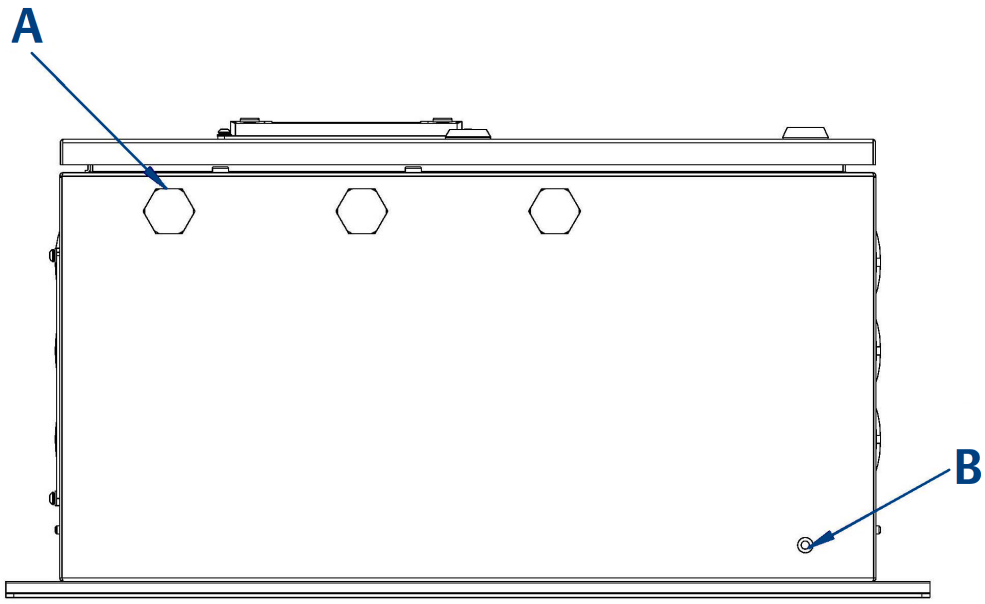
A. Door open
B. Door closed
C. Door opening arc

5.4 Connecting the electrical/electronic inputs and outputs

5.4.1 AC power

Power is connected to the analyzer instrumentation through the power entry point (A) fitted to the base of the analyzer. Refer to Figure 5-5.

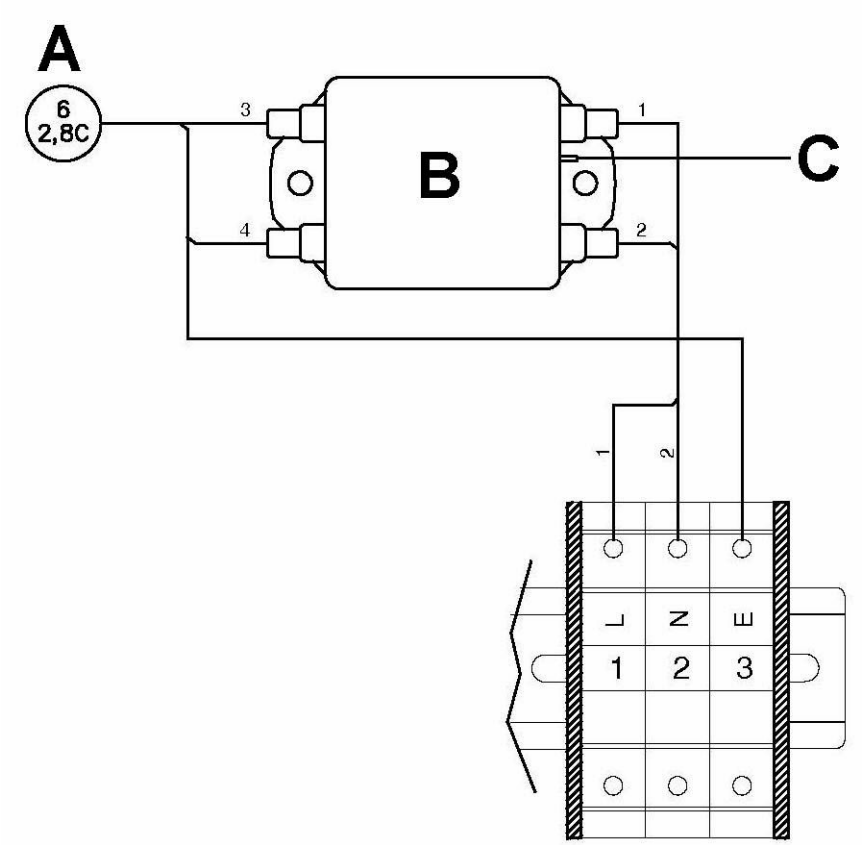
Figure 5-5: Power Gland



A. Power and signal/exit points
B. M6 earth stud

The customer supplied circuit breaker, complete with RCD, **must** be in accordance with local and national standards.

Figure 5-6: Power Entry Point Connections



A. To mains input fuses
B. Mains input filter
C. To enclosure earth stud

Table 5-1: Mains Input Terminals User Connections

Terminal	Function
1	Sensor system supply (L)
2	Sensor system supply (N)
3	Earth (E)

Electrical protection for the instrumentation circuitry of the analyzer is provided by fuses F1 and F2 located inside the analyzer. Refer to Figure 5-7.

The customer supplied power cable for the analyzer instrumentation will be connected to terminals 1 - 3.

Table 5-2: Electrical Power Requirements

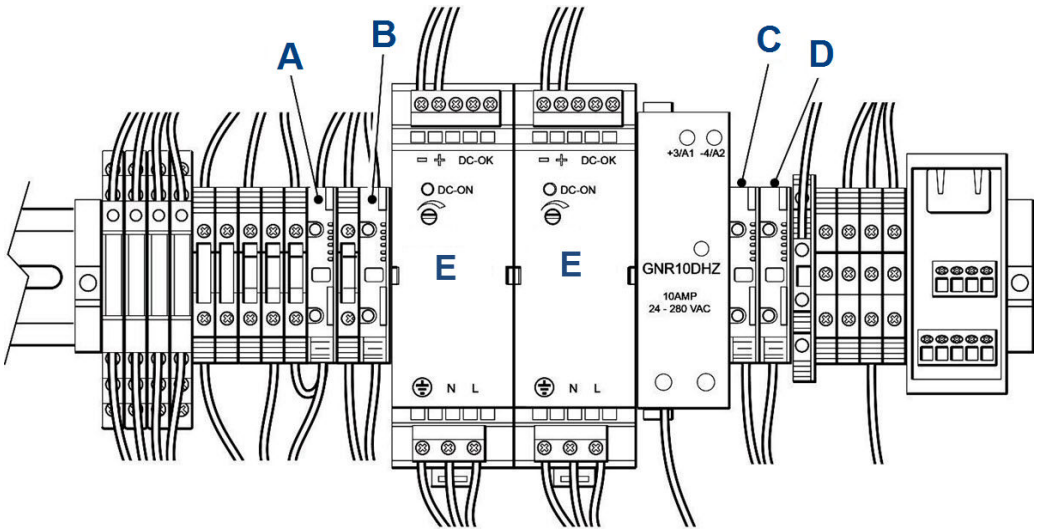
Electrical supply	Power consumption	Voltage	Fuse
Instrumentation supply voltage	500 W	100 to 230 Vac, 50/60 Hz ±10%	3.15 A internal fuses F1 and F2

For the electrical power wiring use 16 AWG stranded, three conductor copper or tin-plated copper power wire, rated for at least 250 Vac, of the required length. Cables must be terminated in the power entry points in accordance with local and national electrical codes. The full electrical wiring diagram is provided in Engineering drawings.

5.4.2 Fuses

Figure 5-7 shows the location of the fuses.

Figure 5-7: Fuses



A. *Fuse F4 (24 Vdc supply)*
B. *Fuse F3 (12 Vdc supply)*
C. *Fuse F1 (mains supply – live)*
D. *Fuse F2 (mains supply – neutral)*
E. *Industrial power supply*

Table 5-3: Fuse Requirements

Fuse	Function	Rating	Schurter part number
1	Live line 110/240 Vac (following mains filter)	3.15 A, 240 V, fast acting ceramic	0001.1009
2	Neutral line 110/240 Vac (following mains filter)	3.15 A, 240 V, fast acting ceramic	0001.1009

Table 5-3: Fuse Requirements *(continued)*

Fuse	Function	Rating	Schurter part number
3	Analyzer 12 Vdc supply rail	3.15 A, 240 V, fast acting ceramic	0001.1009
4	Analyzer 24 Vdc supply rail	3.15 A, 240 V, fast acting ceramic	0001.1009

5.4.3 Connecting the sample supply and return line

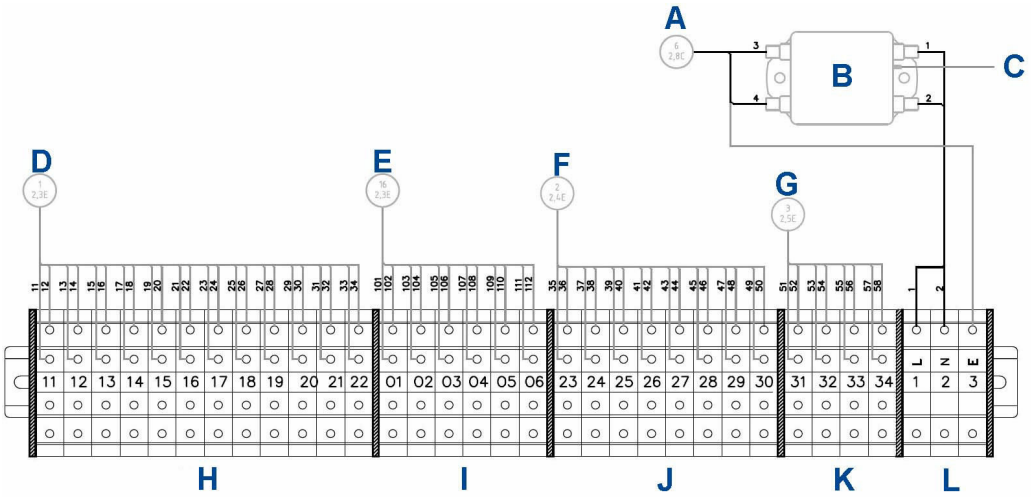
Sample gas supply and sample return connections are ¼-in. (6 mm) ”Hamlet” compression tube fittings. To avoid the risk of gas leaks, confirm that these connections are made correctly and tightly. Both the sample gas supply pipe and the sample return pipe should be thermal insulated.

The maximum sample gas supply pressure is 2 BarG.

5.4.4 Connecting the signal cables

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

Figure 5-8: Signal Cable Outputs



A. To mains input fuses
B. Mains input filter
C. To enclosure earth stud
D. To digital modules
E. To digital modules
F. To analog modules
G. To status relays
H. Digital output terminals
I. Analog or digital output terminals
J. Analog output terminals
K. Status output terminals
L. Mains input terminals

Table 5-4: System Wiring

Terminal	Function
1	Sensor system supply (L)
2	Sensor system supply (N)
3	Earth
11	Digital output 1
12	Digital output 2
13	Digital output 3
14	Digital output 4
15	Digital output 5
16	Digital output 6
17	Digital output 7
18	Digital output 8

Table 5-4: System Wiring *(continued)*

Terminal	Function
19	Digital output 9
20	Digital output 10
21	Digital output 11
22	Digital output 12
23	Analog output 1
24	Analog output 2
25	Analog output 3
26	Analog output 4
27	Analog output 5
28	Analog output 6
29	Analog output 7
30	Analog output 8
31	Status output 1 (Check function)
32	Status output 2 (Maintenance required)
33	Status output 3 (Out of specification)
34	Status output 4 (Failed)
01	Analog or digital input/output
02	Analog or digital input/output
03	Analog or digital input/output
04	Analog or digital input/output
05	Analog or digital input/output
06	Analog or digital input/output

5.4.5 Power input cables and circuit breaker

The power input cable circuit breaker can be tested as follows:

- Set the main power circuit breaker to **ON**.
- Check that the display controller lights up. The analyzer will then begin to power-up.

5.4.6 Temperature sensor and cell heater

The sample cell is controlled to operate at a pre-set temperature when it leaves the factory.

With the analyzer on, the cell will reach the pre-set operating temperature in approximately 90 minutes.

5.4.7 Pressure sensor

The pressure sensor monitors the pressure in the analysis cell.

To test that it is functioning, check that a pressure reading is displayed under pressure on the Display Controller as described in Pressure and Temperature screen.

The reading will be approximately 760 Torr at atmospheric pressure. If desired, cap off the gas inlet and use an external pump to evacuate the cell. Verify that the pressure drops as expected.

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.

5.4.8 Analog output cable

In order to generate a 4-20 mA output, the analyzer must be left for 90 minutes to warm up, and the analysis cell must be at the correct pressure.

The 4-20 mA outputs will operate when the analysis cell temperature and pressure are within the required test range. It is not essential to flow sample gas through the system; nitrogen or atmospheric air will be adequate for this test.

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. This can either be measured as a current with a multimeter, or as a gas concentration through the control station.

5.4.9 Seal glands

Where poured seal glands are a local industry requirement for cable termination, they should be made in accordance with the manufacturer's instructions once acceptance tests have been made on the system to ensure that the analyzer does not need to be removed.

5.4.10 Commissioning

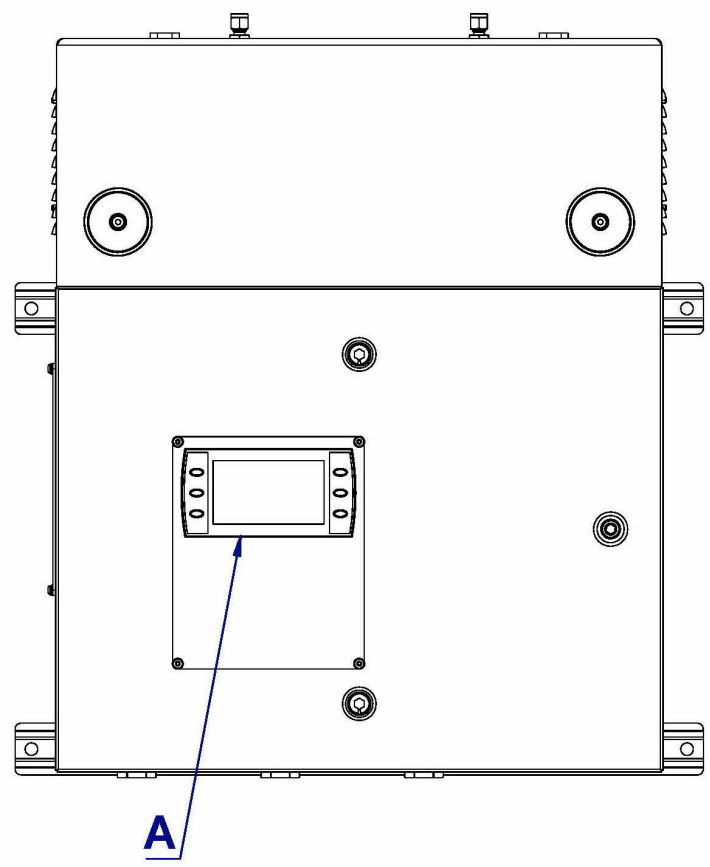
Once the sensor is fully installed as described above, it should be commissioned in accordance with the commissioning plan agreed between Emerson and the customer.

6 Controls and display controller

6.1 Front panel controls and indicators

The Rosemount CT5100 is configured from the control display located on the front panel. Refer to Figure 6-1.

Figure 6-1: Front Panel



A. Display controller

NOTICE

ON/OFF circuit breaker

There is no **ON/OFF** switch on the analyzer. The external circuit breaker controls the application of electrical power to the analyzer.

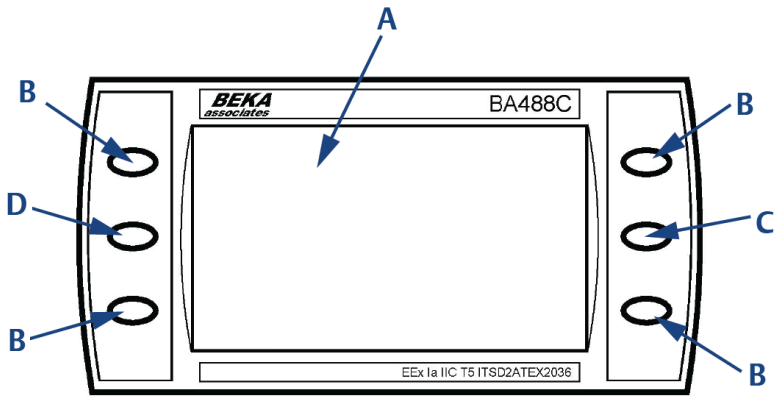
The external circuit breaker is a simple two-pole **ON/OFF** circuit breaker that must to set to **ON** to permit the safe operation of the analyzer.

The display controller controls operation of the analyzer.Refer to Figure 6-2.

6.2 Display controller

The six buttons on the display controller control operation of the Rosemount CT5100: Figure 6-2.

Figure 6-2: Display Controller Buttons



A. LCD display
B. Configurable button
C. Scroll up button
D. Scroll down button

The LCD displaycan be used to display:

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

Use the two scroll buttonsto scroll through the information on the LCD display. Use the right-hand scroll button to scroll up and the left-hand scroll button to scroll down.

The other four buttons are configured to perform different functions according to the software screen that is shown on the LCD display.

6.3 Gas Sensor Main screen

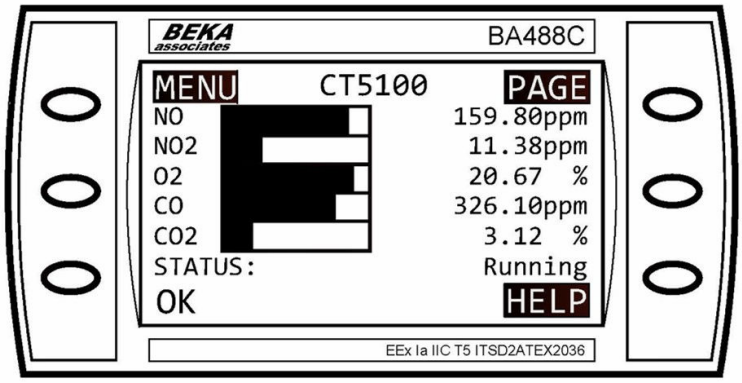
When the analyzer is switched on at the end of the start-up procedure, the ***Gas Sensor Main*** screen (Figure 6-3) appears.

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 6-3: Gas Sensor Main Screen



The ***Gas Sensor Main*** screen displays the gas concentration measurements obtained by the analyzer. In the example shown in Figure 6-3 the gases nitric oxide (NO), nitrogen dioxide (NO_2), oxygen (O_2), carbon monoxide (CO), and carbon dioxide (CO_2) are being measured and, for each gas, the concentration detected is in parts per million (ppm) or percentage as applicable.

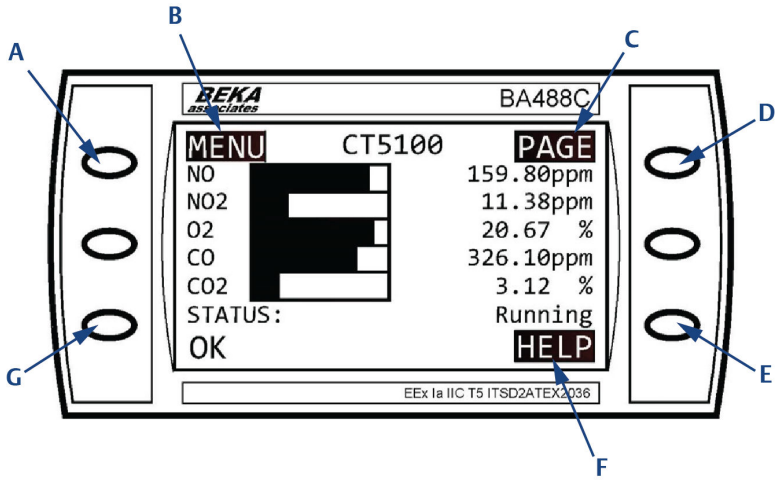
The NO_x reading is the total nitrogen oxide reading, a combination of nitric oxide (NO) and nitrogen dioxide (NO_2).

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 6-3, the analyzer is **Running** and **OK** (e.g., no faults have been identified). This area of the display shows any errors detected by the software.

On the software screens, highlighted items are links to other screens in the software. To access a screen, press the button next to the highlighted item.

Figure 6-4: Gas Sensor Main Screen Buttons



*A. **MENU** button*
*B. **MENU** text*
*C. **PAGE** text*
*D. **PAGE** button*
*E. **HELP** button*
*F. **HELP** text*
*G. **STATUS** button*

PAGE A link between the ***Gas Sensor Main*** screen and the ***Pressure and Temperature*** screen (described in Pressure and Temperature screen). Press **PAGE** to toggle between these two screens.

HELP A link to the ***Help*** system. Press **HELP** to go to the ***Help*** screen (described in Help system).

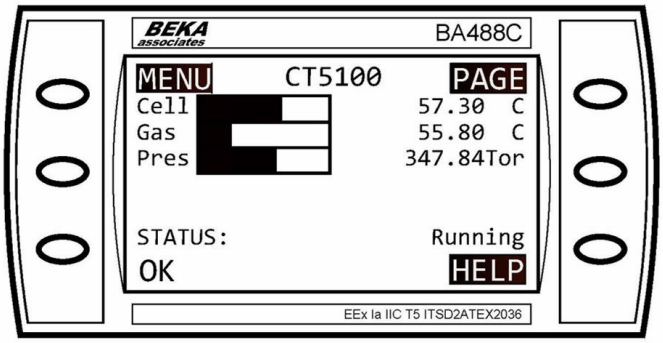
MENU A link to the ***Main menu*** of the software. Press **MENU** to go to the ***Main menu*** screen (described in Main menu).

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 **STATUS** to get further information on the error.

6.4 Pressure and Temperature screen

The ***Pressure and Temperature*** screen (Figure 6-5) shows pressure and temperature measurements taken inside the analyzer.

Figure 6-5: Pressure and Temperature Screen



The **Cell** reading is the temperature, in °C, for the analysis cell.

The **Gas** reading is the temperature, in °C, of the gas within the analysis cell.

The **Pres** reading is the pressure, in Torr, inside the analysis cell.

NOTICE

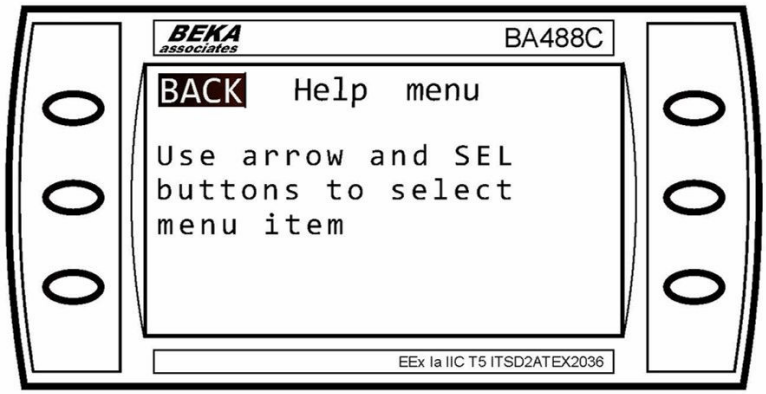
A Torr is a non-SI unit of pressure defined as 1/760 of standard atmospheric pressure and is equal to the fluid pressure of 1 mm of mercury.

6.5 Help system

The analyzer software includes a context-sensitive help system. Press **HELP**, 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 **HELP** was pressed. Figure 6-6 shows an example of a ***Help*** screen.

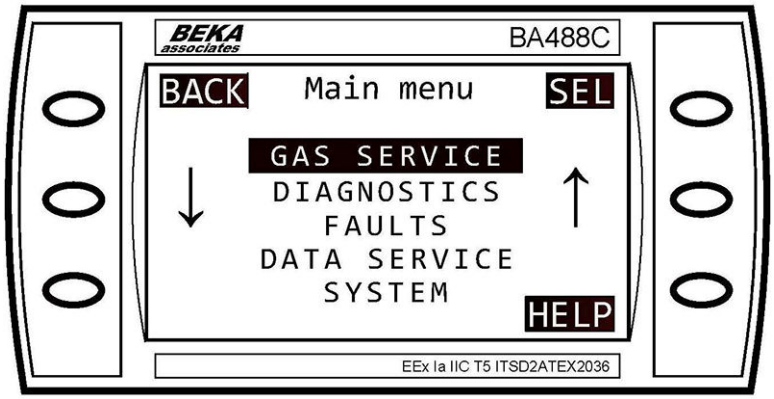
Figure 6-6: Example of a Help Screen



6.6 Main menu

To access the ***Main menu*** (Figure 6-7), press **MENU** on either side of the ***Gas Sensor Main*** screen (Figure 6-3) or the **Pressure and Temperature** screen (Figure 6-5). The ***Main menu*** (Figure 6-7) is used for calibration, diagnostics, fault finding, downloading data, and shutting down the analyzer.

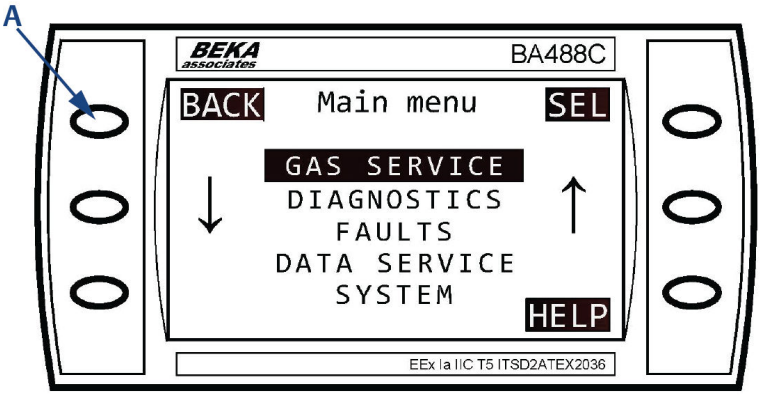
Figure 6-7: Main Menu



6.7 BACK button

On most of the software screens, the top lefthand button (Figure 6-8) is configured as a **BACK** button. Press **BACK** to return to the previous screen.

Figure 6-8: BACK Button



A. BACK button

7 Start-up procedure

7.1 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

7.2 Preparation for use

Install and fully commission the Rosemount CT5100 before starting it up.

⚠ WARNING

BURN HAZARD

Personal injury and/or damage to property may result if these safety precautions are not observed.

Some parts of the analyzer may be heated to 374 °F (190 °C). To prevent burns, do not touch any of the hot parts. All components of a analyzer are hot unless it has been switched off and allowed to cool down.

Before fitting, removing, or performing any maintenance on the analyzer, make sure that it has been switched off and allowed to cool for at least two hours. Before performing any maintenance on or, in the vicinity of the analysis cell, allow the analyzer to cool for at least twelve hours, as the analysis cell is insulated against heat loss.

When handling the analyzer, always use suitable protective gloves.

These precautions are especially important when working at heights. If a burn is received, seek medical treatment immediately.

⚠ CAUTION

EQUIPMENT DAMAGE

Failure to perform pre-system start-up checks may cause damage to equipment.

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 starting up, ensure that electrical power, sample gas handling facilities, and any required calibration gases are available to the analyzer.

7.3 Start-up procedure

NOTICE

The gases shown in the screenshots and the measurements thereof may be different from those shown in your Rosemount CT5100. They indicate the functionality of the software, which is the same regardless of the gases being measured.

NOTICE

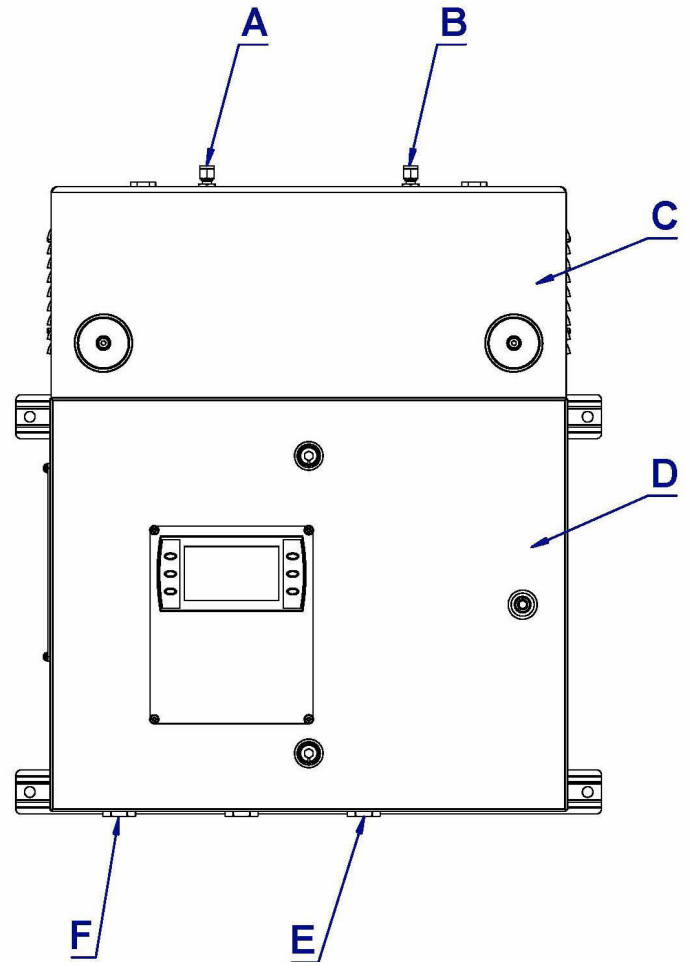
To stop the start-up procedure at any time, set the main circuit breaker to **OFF**.

Procedure

1. Visually inspect the analyzer's exterior for signs of damage, corrosion, gas leaks, or overheating. Report anything found to the maintenance organization.
2. Ensure that the analyzer has been installed correctly as described in Install.
3. Ensure that the top cover is fitted to the analyzer. If it is not, report it to the maintenance organzation and do not proceed further until the top cover has been fitted.
4. Ensure that the door to the electrical compartment is closed and locked. If you cannot close and lock the door, report it to the maintenance organization and do not proceed further until the door has been repaired.
5. Ensure that the gas handlying system is turned off.
6. Ensure that the external circuit breaker is set to **OFF**.
7. Visually examine the gas ports.

   If necessary, refer to Figure 7-1 to ensure that the sample supply line and the sample return line are correctly attached.

Figure 7-1: Gas Inlet and Outlet and Electrical Connections



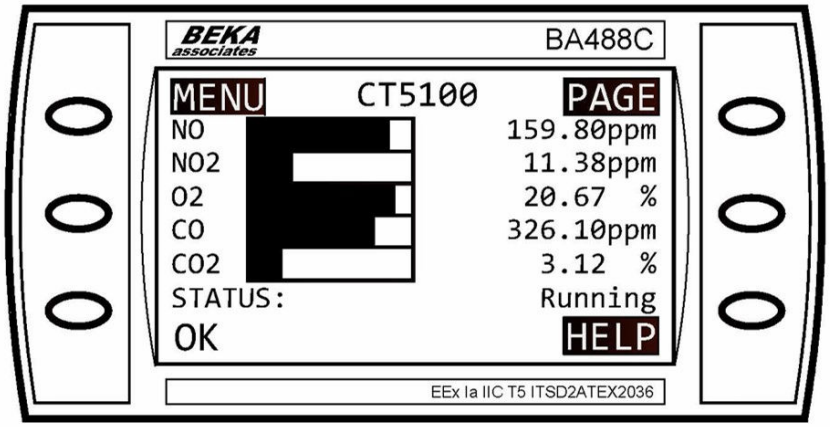
A. Sample gas input port
B. Sample gas return port
C. Top cover (cell compartment)
D. Laser/electrical compartment
E. Analog/digital power entry point
F. Power entry point

8. Ensure that the electrical connection has been made to the power entry point at the base of the analyzer (Figure 7-1).
9. Start up the system that vents the sample gas exiting the analyzer.
10. Switch the circuit breaker to **ON**, applying electrical power to the analyzer.

    The control PC that forms part of the analzyer is configured to automatically load the necessary gas sensor software and configuration files.

    The software automatically starts the start-up sequence. After a few seconds, the ***Gas Sensor Main Screen*** appears on the display controller.

Figure 7-2: Gas Sensor Main Screen



If the screen does not appear, report the fault to the maintenance organization.

11. Start up the system for venting the sample gas exiting the analyzer.
12. Start up the gas handling system that conditions the sample gas before it is fed into the analyzer.

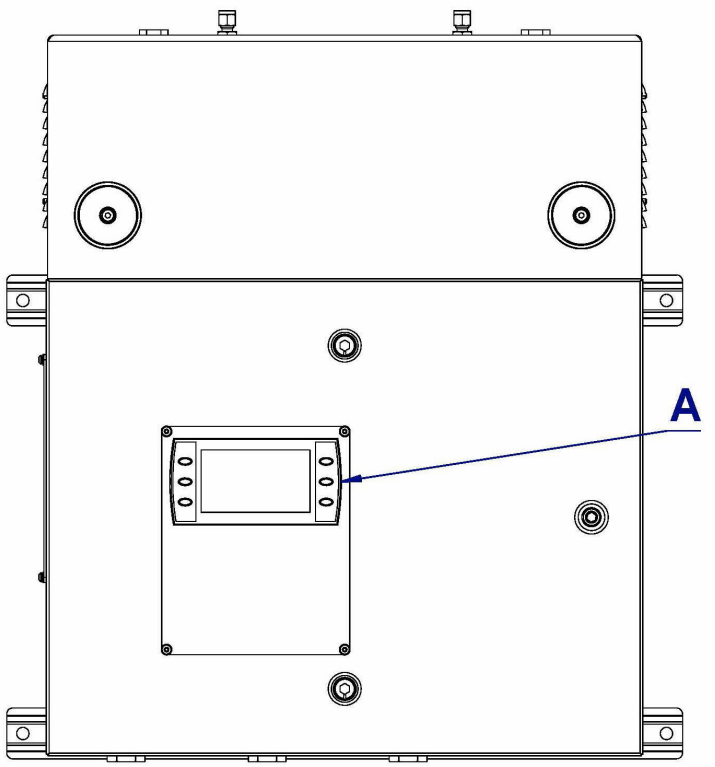
At the end of the start-up procedure, that gas measurements initially appear as **0.00 ppm** until the first readings are taken. After a few seconds, the initial gas concentrations are displayed.

The start-up procedure is now complete.

7.4 Front panel controls and indicators

Configure the analyzer from the control display located on the front panel (Figure 7-3).

Figure 7-3: Front Panel



A. Display controller

NOTICE

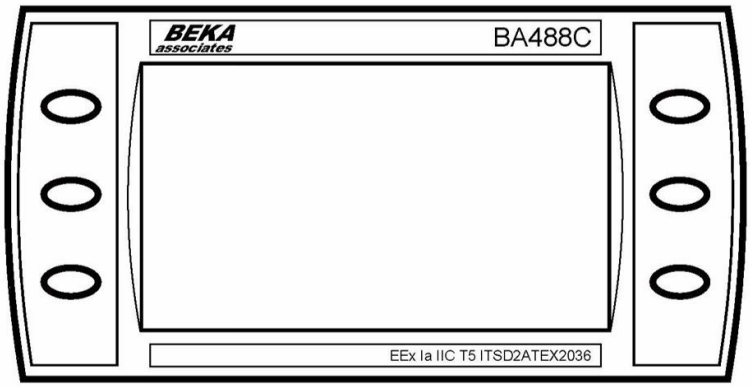
ON/OFF circuit breaker

There are no **ON/OFF** switches on the analyzer. A customer-provided external circuit breaker controls the application of electrical power to the analyzer.

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.

The display controller primarily controls operation of the analyzer (Figure 7-4).

Figure 7-4: Display Controller



⚠ WARNING

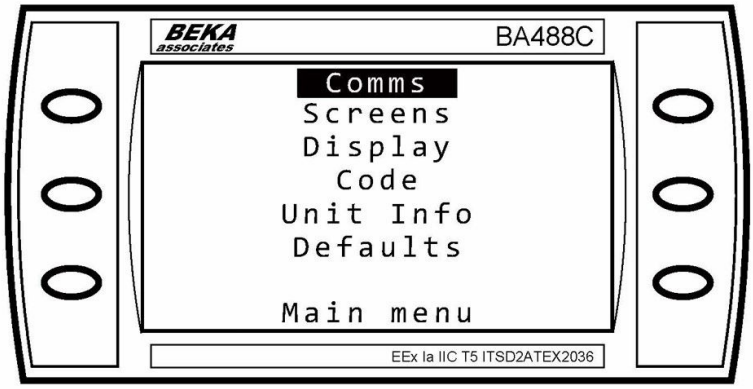
Failure to follow these instructions may cause warranty invalidation, property damage, and/or personal injury or death.

DO NOT, under any circumstances, press the top two buttons on the display controller simultaneously. This will override the system code supplied with the analyzer and display the default program screen for the controller.

This will lock the software controlling the analyzer requiring the analyzer to shut down externally and restarted risking a possible corruption of the software and loss of the analyzer operation during the shutdown and restart process.

It is essential that only trained, qualified personnel operate the controls on the analyzer.

Figure 7-5: Default Program Screen



8 Operating the analyzer

8.1 Introduction

This section describes the normal operation of the analyzer.

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

BURN HAZARD

Some parts of the analyzer may be heated to 374 °F (190 °C). All components of the analyzer are hot unless it has been switched off and allowed to cool down. Personal injury and/or damage to property may result if these safety precautions are not observed. These precautions are especially important when working at heights.

To prevent burns, do not touch any of the hot parts.

Before fitting, removing, or performing any maintenance on the analyzer, ensure that it has been switched off and allowed to cool for at least two hours. Before performing any maintenance on or in the vicinity of the analysis cell, allow the analyzer to cool for at least twelve hours, as the analysis cell is insulated against heat loss.

When handling the analyzer, always use suitable protective gloves.

If you receive a burn, seek medical treatment immediately.

8.2 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.

During normal operation, either the ***Gas Sensor Main*** screen (Figure 8-1) or the ***Pressure and Temperature*** screen (Figure 8-2) is shown on the display controller. To toggle between these two screens, press **PAGE**..

Figure 8-1: Gas Sensor Main Screen

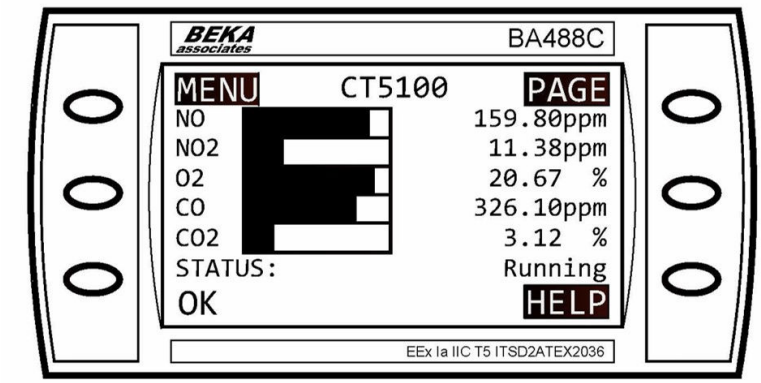
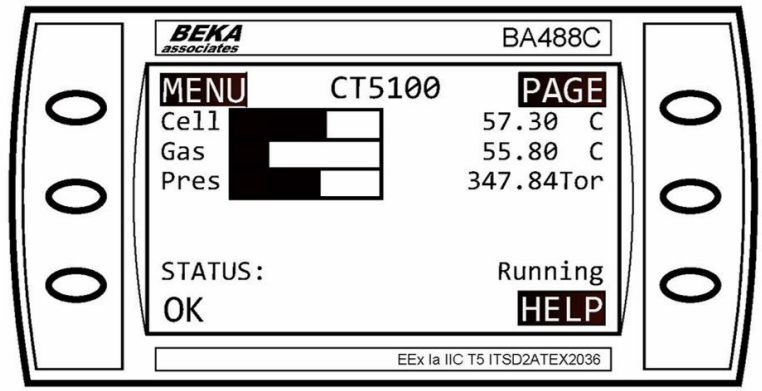


Figure 8-2: Pressure and Temperature Screen



9 Shutdown procedure

9.1 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
- When the analyzer is switched off for re-calibration

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

BURN HAZARD

Some parts of the analyzer may be heated up to 374 °F (190 °C). All parts of the analyzer are hot unless it has been switched off and allowed to cool down. Personal injury and/or damage to property may result if these safety precautions are not observed. These precautions are particularly important when working at heights.

To prevent burns, do not touch any of the hot parts.

Before fitting, removing, or performing any maintenance on the analyzer, ensure that it has been switched off and allowed to cool for at least two hours. Before performing any maintenance on, or in the vicinity of, the analysis cell, allow the analyzer to cool for at least twelve hours, as the analysis cell is insulated against heat loss.

When handling the analyzer, always use suitable protective gloves.

If you receive a burn, seek medical treatment immediately.

9.2 Shutdown procedure

⚠ 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.

   ⚠ WARNING

   HIGH PRESSURE GAS AND AIR

   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).

3. Turn off the gas used to purge the analyzer.

4. Press **MENU** on the display controller in either the ***Gas Sensor Main*** screen (Figure 9-1) or the ***Pressure and Temperature*** screen (Figure 9-2).

Figure 9-1: Gas Sensor Main Screen

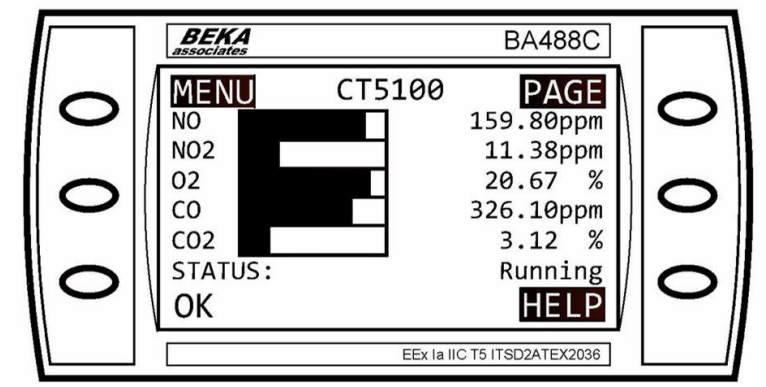
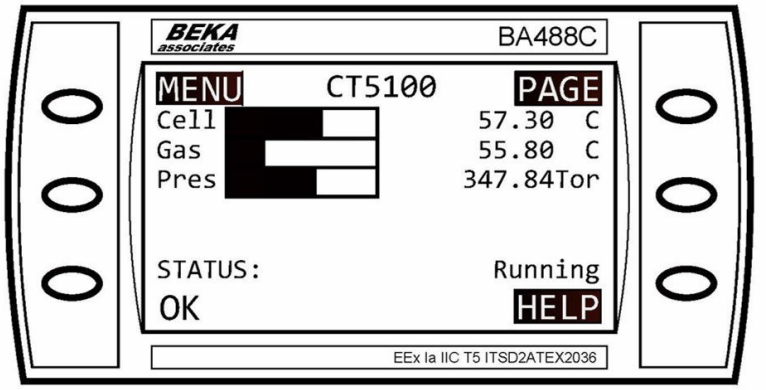
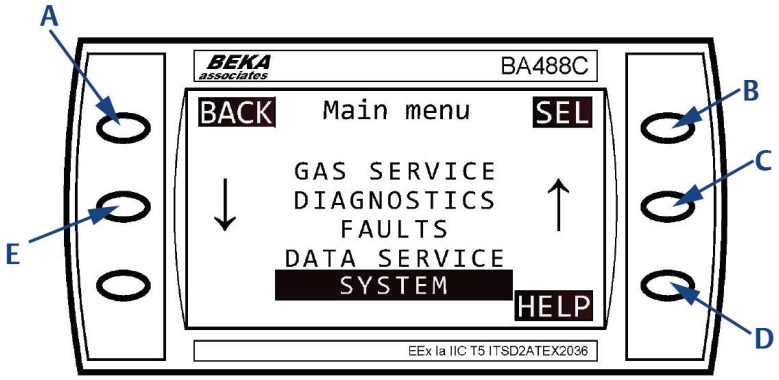


Figure 9-2: Pressure and Temperature Screen



The ***Main menu*** (Figure 9-3) opens.

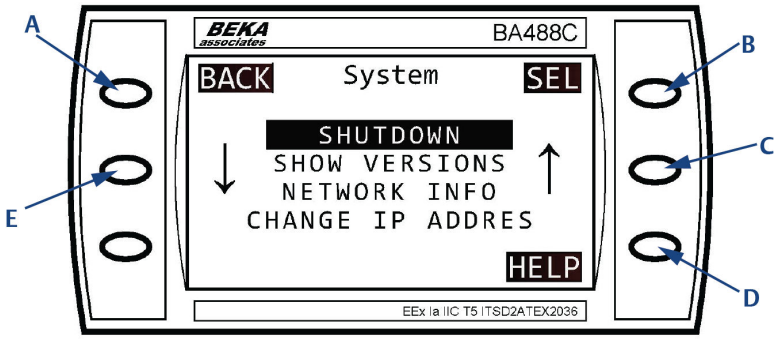
Figure 9-3: Main Menu



*A. **BACK** button*
*B. **SELECT** button*
*C. **Scroll up** button*
*D. **HELP** button*
*E. **Scroll down** button*

5. On the display controller, select **System** as shown in Figure 9-3.
6. Press **SEL** (select).
   The ***System*** screen opens. Refer to Figure 9-4.

Figure 9-4: System Screen



*A. **BACK** button*
*B. **SELECT** button*
C. Scroll up button
*D. **HELP** button*
E. Scroll down button

7. Use scroll up (C) and scroll down (E) to select **SHUTDOWN** as shown in Figure 9-4. Then press **SEL** (select).
   The ***Shutdown*** screen (Figure 9-5) opens.

Figure 9-5: Shutdown Screen

8. Press **YES**.
   The analyzer shuts down.
9. Set the external secondary circuit breaker to **Off**. Lock-out and tag-out the secondary circuit breaker.
10. Set the external main circuit breaker to **Off**. Lock-out and tag-out the main circuit breaker.

10 Gas calibration

10.1 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.

The validation procedure is essentially the same as the calibration procedure, except that it does not adjust the analyzer measurements to match the calibration standard.

⚠ WARNING

EQUIPMENT DAMAGE

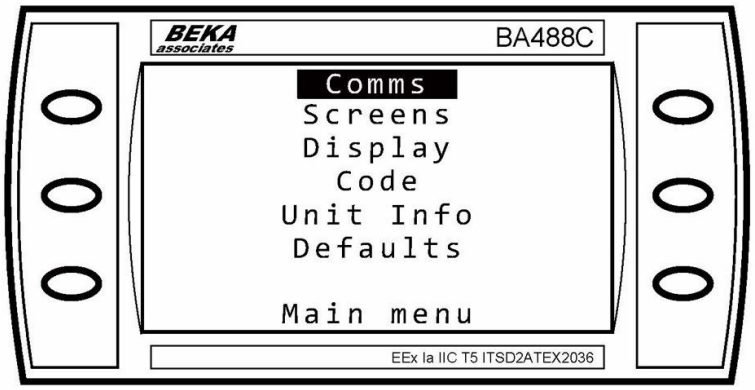
Failure to follow may cause warranty invalidation, property damage, and/or personal injury or death.

DO NOT, under any circumstances, press the top two buttons on the display controller simultaneously. This will override the system code supplied with the analyzer and display the default program screen for the controller.

This will lock the software controlling the analyzer requiring the analyzer to shut down externally and restart, risking a possible corruption of the software and loss of the analyzer operation during the shutdown and restart process.

It is essential that only trained, qualified personnel operate the controls on the analyzer.

Figure 10-1: Default Program Screen



10.2 Main menu calibration routines

Calibration is performed under the control of the analyzer software, using calibration routines built into the software.

Access calibration functions through the ***Main menu*** (Figure 10-4).

Procedure

1. To get the ***Main menu***, press **MENU** on the ***Gas Sensor Main*** screen (Figure 10-2) or ***Pressure and Temperature*** screen (Figure 10-3).

NOTICE

Press **BACK** to cancel the procedure and return to the previous screen.

Figure 10-2: Gas Sensor Main Screen

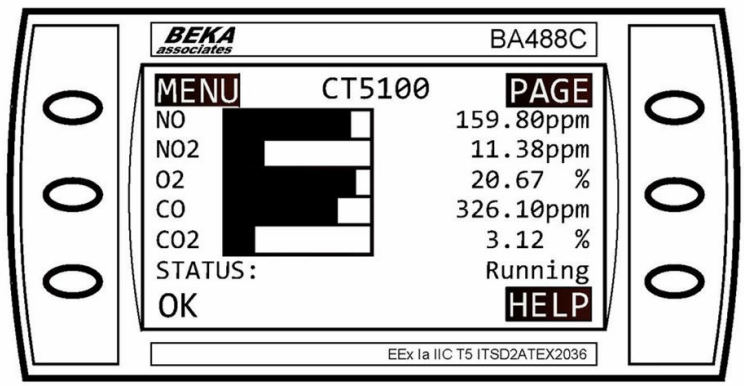


Figure 10-3: Pressure and Temperature Screen

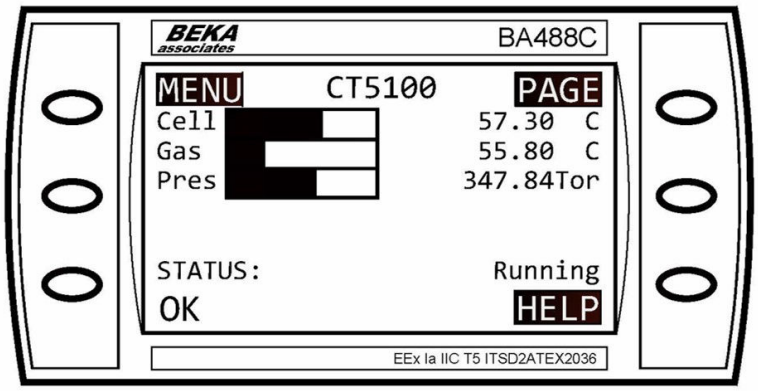
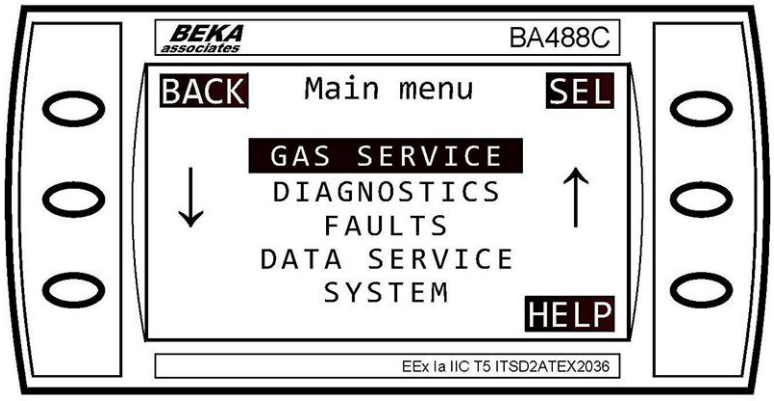


Figure 10-4: Main Menu

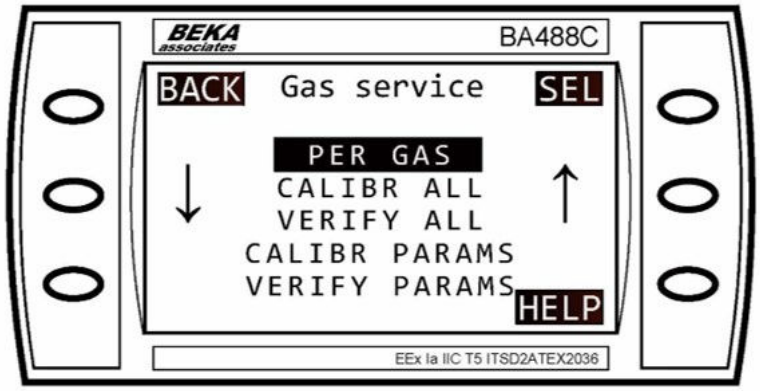


Use the ***Main menu*** (Figure 10-4) to access the software routines and screens necessary for this process.

2. Use the middle buttons (↓ and ↑) to scroll up or down to select **GAS SERVICE**.

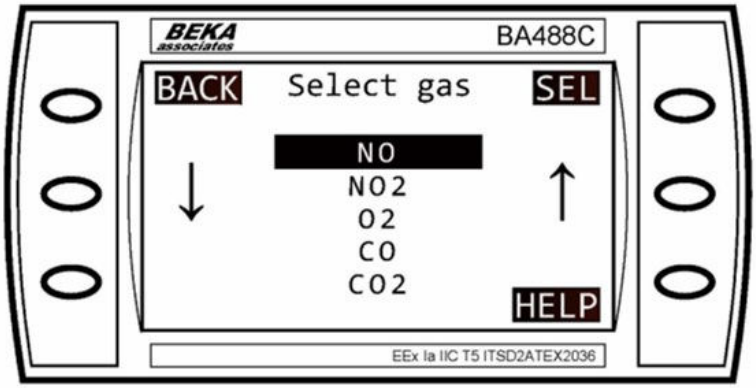
3. Press **SEL**.

Figure 10-5: Gas Service (PER GAS)



4. Use the middle buttons (↓ and ↑) to scroll up or down to select **PER GAS.**
5. Press **SEL**.

Figure 10-6: Select Gas (NO)



6. Use the middle buttons (↓ and ↑) to scroll up or down to select the desired gas (e.g., **NO**).
7. Press **SEL**.

8. To check or change the current offset value, select **ZERO OFFSET** and press **CAL** to view.

Figure 10-7: Action

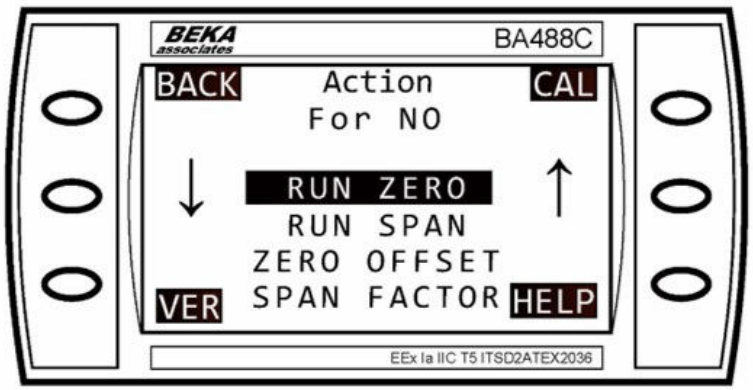
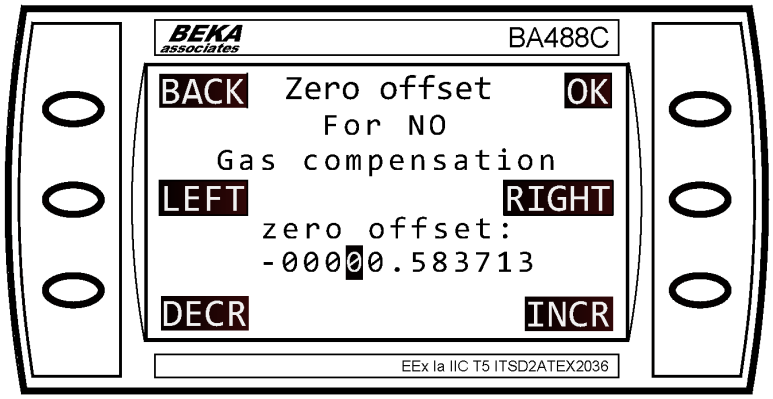


Figure 10-8: Zero Offset Screen



9. Use the **LEFT, RIGHT, INCR** (increase), and **DECR** (decrease) buttons to enter the desired offset (**-0.587313** in Figure 10-8).
10. Press **OK** to confirm.

    The factory default offset is zero, and under normal circumstances, the offset should never be a positive number.

    If it is shown as positive, press **LEFT** until the space to the left of the number is highlighted, then select **INCR** to change it to a minus (**–**) sign.

11. To check or change the current span value, select **SPAN FACTOR** and press **CAL** to view.

Figure 10-9: Input Type

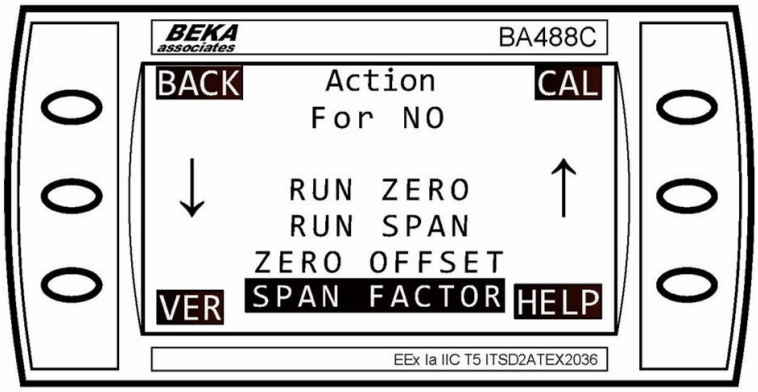
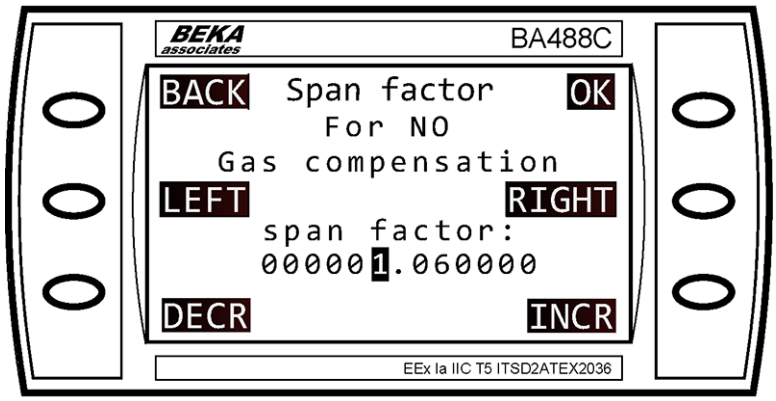


Figure 10-10: Span Factor Screen



12. Use the **LEFT, RIGHT, INCR** (increase), and **DECR** (decrease) buttons to enter the desired offset (**1.06 ppm** in Figure 10-10).
13. Press **OK** to confirm.

    The factory default span factor is 1, and under normal circumstances, the offset should be between 0.8 and 1.2.

10.2.1 Zero calibrate an individual gas

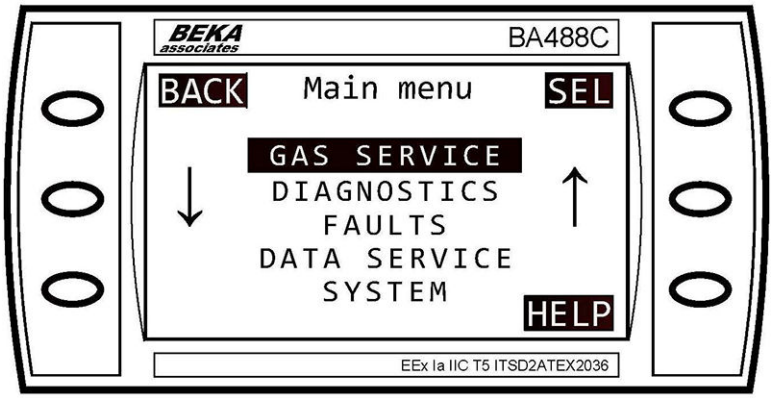
Procedure

1. To get to the ***Main menu***, press **MENU** on the ***Gas Sensor Main*** screen (Figure 10-2) or the ***Pressure and Temperature*** screen (Figure 10-3).

Note
To cancel the procedure, press **BACK** to return to the previous screen.

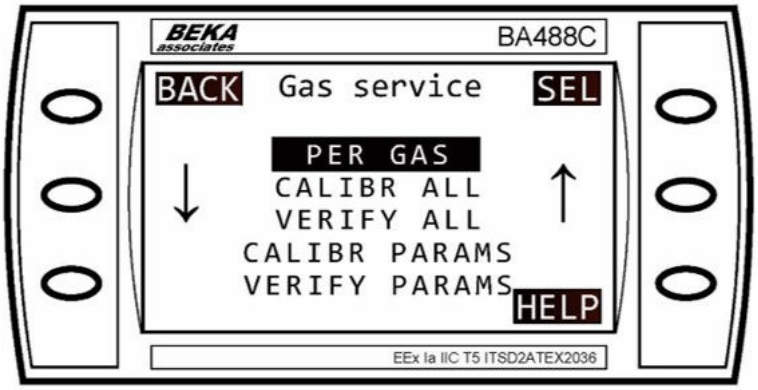
2. Use the middle buttons (↓ and ↑) to scroll up or down to select **GAS SERVICE**. Press **SEL**.

Figure 10-11: Main Menu (GAS SERVICE)



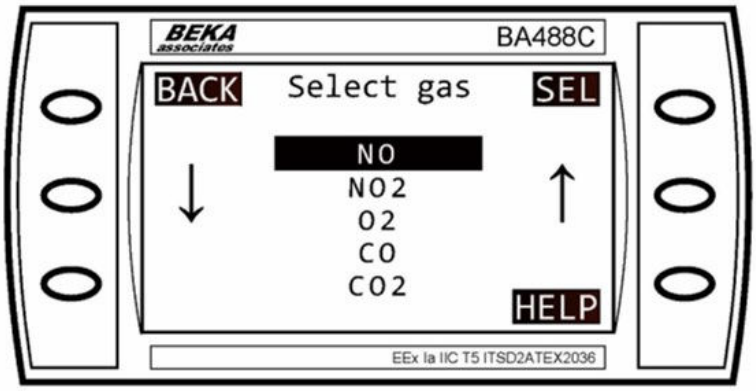
3. Use the middle buttons (↓ and ↑) to scroll up or down to select **PER GAS**. Press **SEL**.

Figure 10-12: Gas Service Menu (PER GAS)



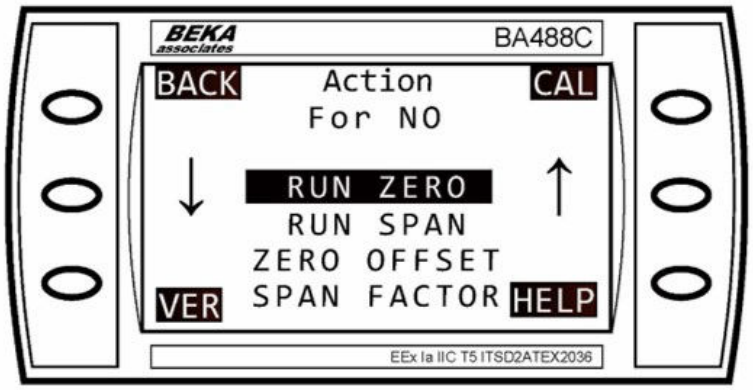
4. Use the middle buttons (↓ and ↑) to scroll up or down to select the desired gas (e.g., **NO**). Press **SEL**.

Figure 10-13: Select Gas (NO)



5. Use the middle buttons (↓ and ↑) to scroll up or down to select **RUN ZERO**.

Figure 10-14: Action Screen for NO (RUN ZERO)

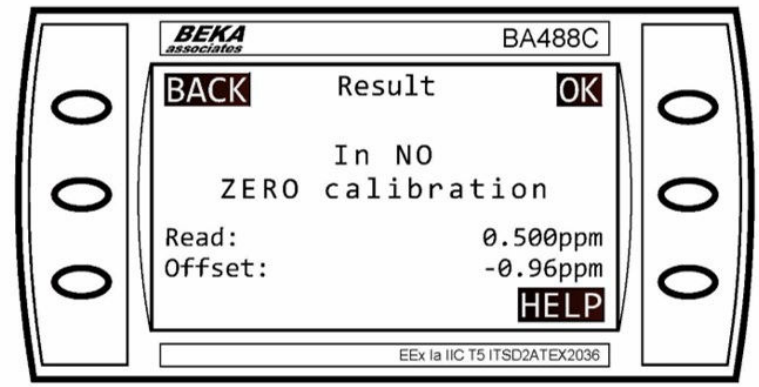


6. Press **CAL** to calibrate, or **VER** to verify.
   Figure 10-15 displays as the calibration progresses.

Figure 10-15: Calibration

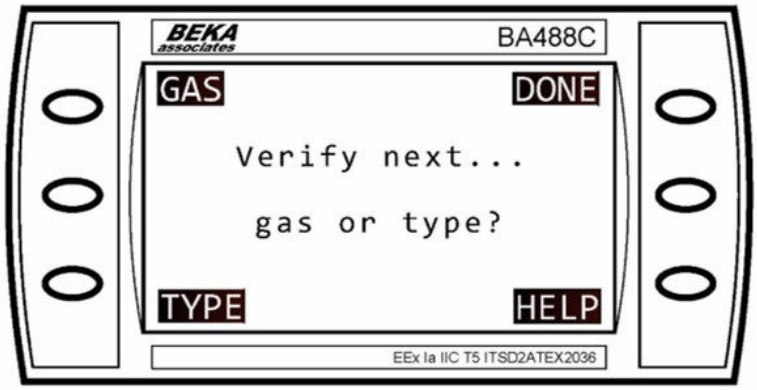
Once complete, the program will automatically open the ***Result*** screen .

Figure 10-16: Result Screen



7. Press **OK**.
   The ***Verify next*** screen displays.

Figure 10-17: Verify Next Screen



8. Press **DONE** to finish.
   - To calibrate additional gases, select **GAS** and repeat Step 1 through Step 7.
   - To change types, select **TYPE**.

This completes the process, and the display will return to the ***Main menu***.

10.2.2 Span calibrate an individual gas

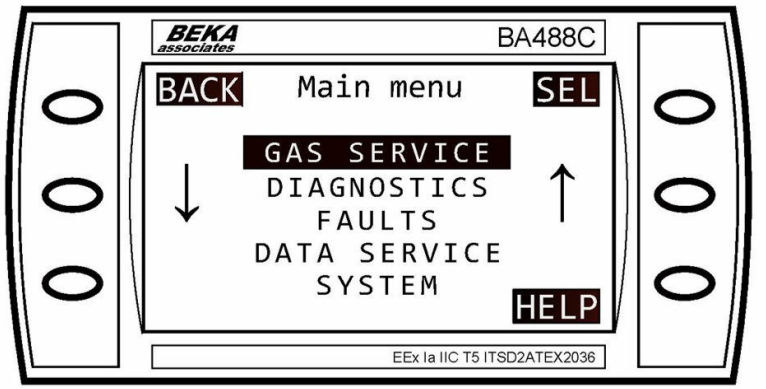
Procedure

1. ***Gas Sensor Main***To get to the ***Main menu***, press the **MENU** button on the screen (Figure 10-2) or the ***Pressure and Temperature*** screen (Figure 10-3).

Note
To cancel the procedure and return to the previous screen, press **BACK**.

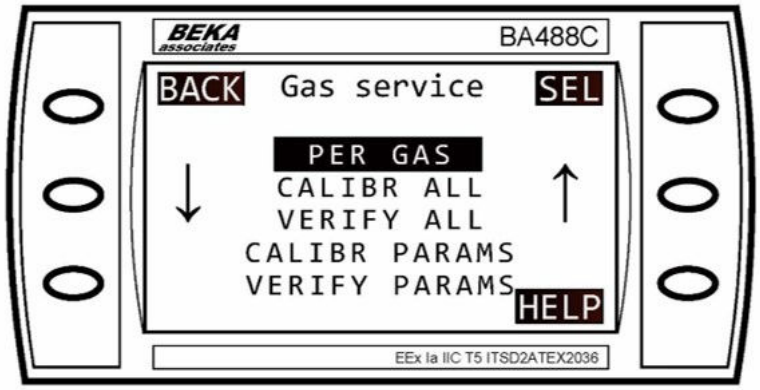
2. Use the middle buttons (↓ and ↑) to scroll up or down to select **GAS SERVICE**. Press **SEL**.

Figure 10-18: Main Menu (GAS SERVICE)



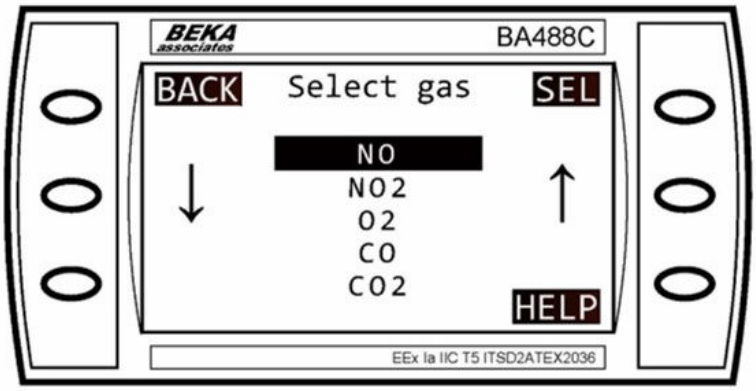
3. Use the middle buttons (↓ and ↑) to scroll up or down to select **PER GAS**. Press the **SEL** button.

Figure 10-19: Gas Service (PER GAS)



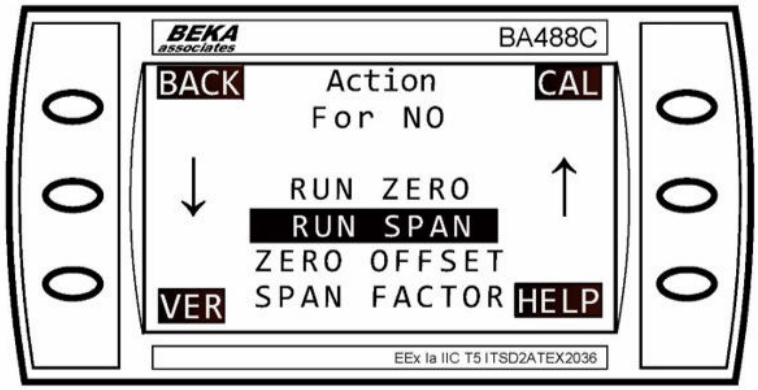
4. Use the middle buttons (↓ and ↑) to scroll up or down to select the desired gas (e.g. **NO**). Press **SEL**.

Figure 10-20: Select Gas (NO)



5. Use the middle buttons (↓ and ↑) to scroll up or down. Select **RUN SPAN**. Press **CAL** to calibrate, or **VER** to verify.

Figure 10-21: Action (RUN SPAN)

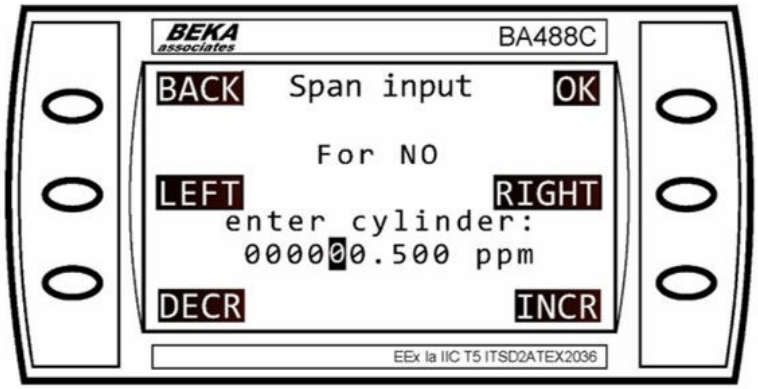


The ***Calibration*** screen show as the calibration progresses.

Figure 10-22: Calibration

6. Using the **LEFT, RIGHT, INCR** (increase), and **DECR** (decrease) buttons, enter the cylinder concentration (e.g., **25 ppm**).

Figure 10-23: Span Input



7. Press **OK** to confirm.

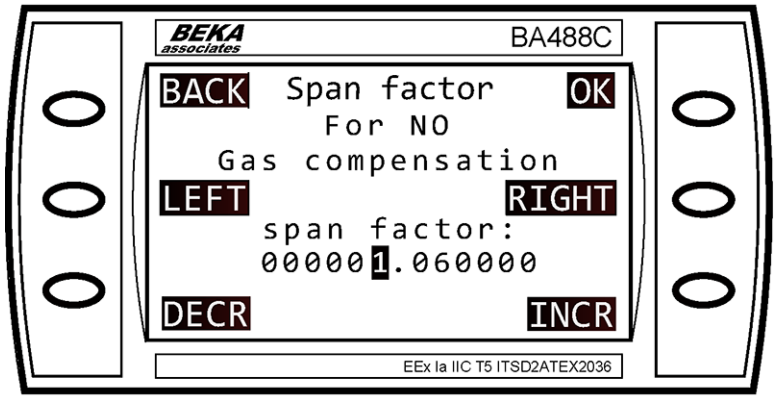
   Once complete, the program will automatically open ***Span input For NO*** (Figure 10-23).

NOTICE

If an excessively high or low span factor is calculated (<0.7 or > 1.3 for example,) and if the calibration gas is a different concentration from that set above, it will be rejected and the previous span factor will be displayed and will continue to be used.

8. Press **OK**.
   The ***Result*** screen displays.

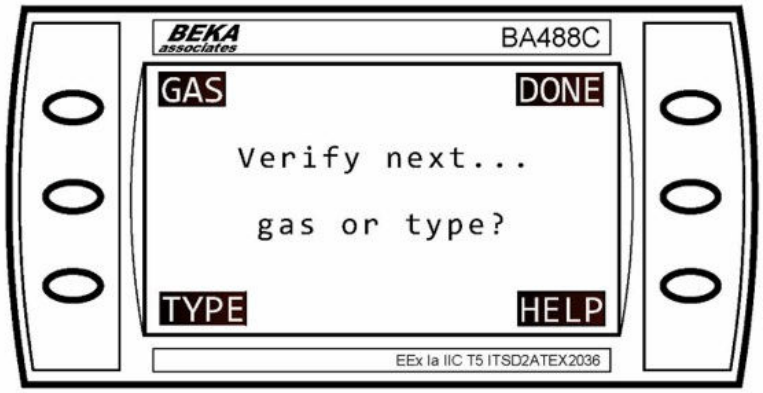
Figure 10-24: Result



9. Press **DONE** to finish.

   Refer to Figure 10-25.

Figure 10-25: Calibration Complete



This completes the process, and the display will return to the ***Main menu***.

10.2.3 Calibrate all gases (zero and span)

On systems with valve control, it is possible to run a calibration on all gases. The valves will sequentially switch through each of the span and zero gases.

This option is not practical to use on systems which require manual valve switching.

In order to set the cylinder concentration when using a new span gas cylinder, it is necessary to perform a single gas calibration as described in Span calibrate an individual gas. This concentration will then be stored for future calibrations.

Procedure

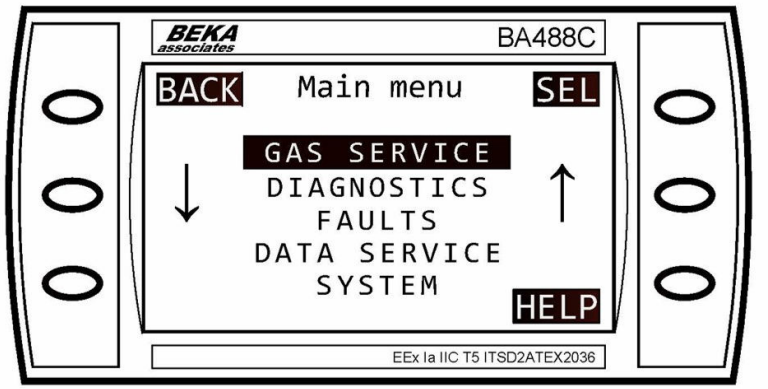
1. To get to the ***Main menu***, press **MENU** on the ***Gas Sensor Main*** screen (Figure 10-2) or the ***Pressure and Temperature*** screen (Figure 10-3).

NOTICE

To cancel the procedure and return to the previous screen, press **BACK**.

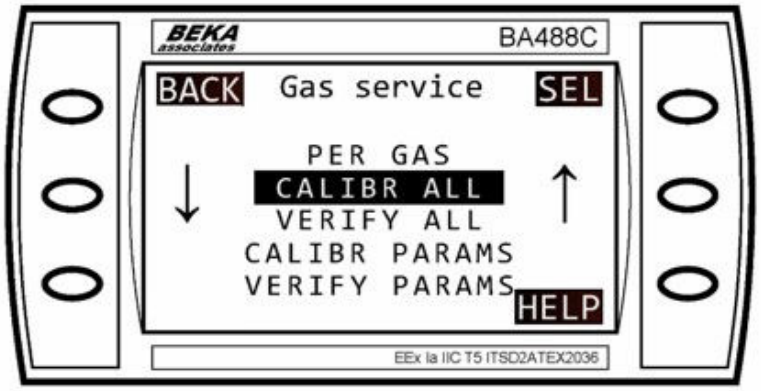
2. Use the middle buttons (↓ and ↑) to scroll up or down to select **GAS SERVICE**. Press **SEL**.

Figure 10-26: Main Menu (GAS SERVICE)



3. Use the middle buttons (↓ and ↑) to scroll up or down to select **CALIBR ALL**. Press **SEL**.

Figure 10-27: Gas Service (CALIBR ALL)



The system will work through the zero and span calibration process for all readings. The ***Please wait*** screen will be displayed. This takes approximately one minute per gas depending on the purge time.

Figure 10-28: Calibration

The ***Finished*** screen displays when the zero and span calibration processes complete.

Figure 10-29: Calibration (Finished)

4. Press **BACK**.

   This completes the process, and the display returns to the ***Main menu***.

10.2.4 Change the automatic calibration settings

Procedure

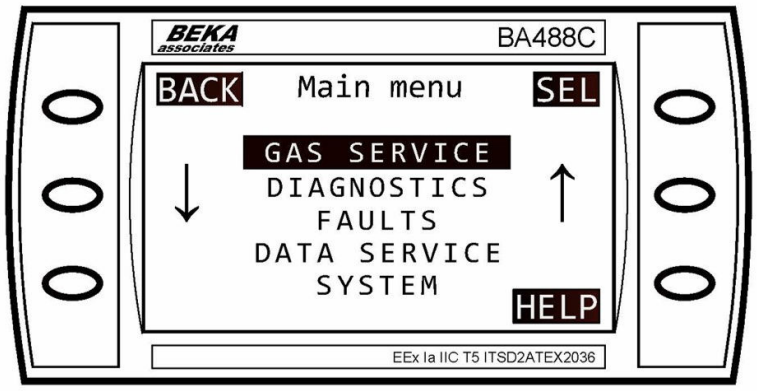
1. To get to the ***Main menu***, press **MENU** on the ***Gas Sensor Main*** screen (Figure 10-2) or the ***Pressure and Temperature*** screen (Figure 10-3).

   NOTICE

   To cancel the procedure and return to the previous screen, press **BACK**.

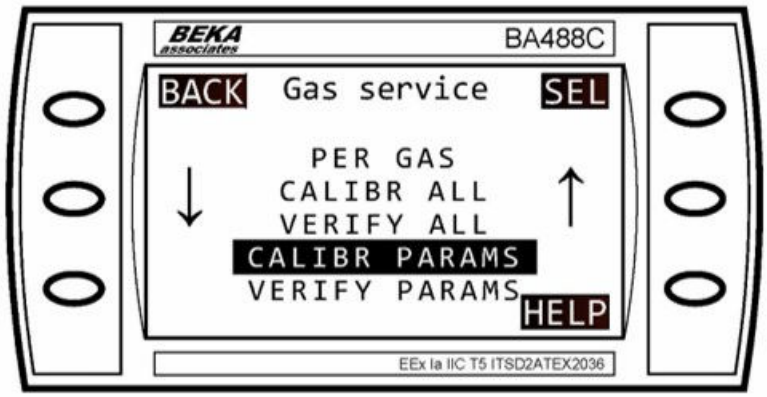
2. Use the middle buttons (↓ and ↑) to scroll up or down to select **GAS SERVICE**. Press **SEL**.

Figure 10-30: Main Menu (GAS SERVICE)



3. Use the middle buttons (↓ and ↑) to scroll up or down to select **CALIBR PARAMS** or **VERIFY PARAMS** for validation settings). Press **SEL**.

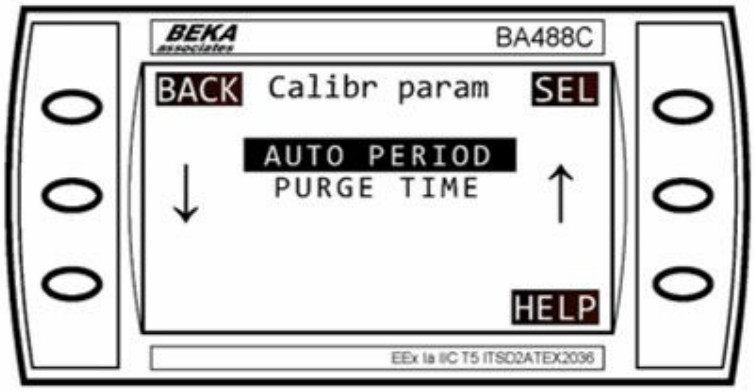
Figure 10-31: Gas Service (CALIBR PARAMS)



This section applies to systems configured to perform automatic calibration at timed intervals only.

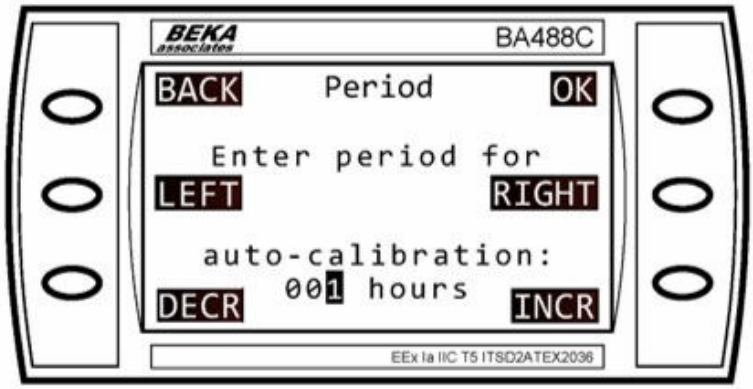
4. To adjust the frequency of automatic calibration, use the middle buttons (↓ and ↑) to scroll up or down
5. Select **AUTO PERIOD**.
6. Press **SEL**.

Figure 10-32: Calibr param (AUTO PERIOD)



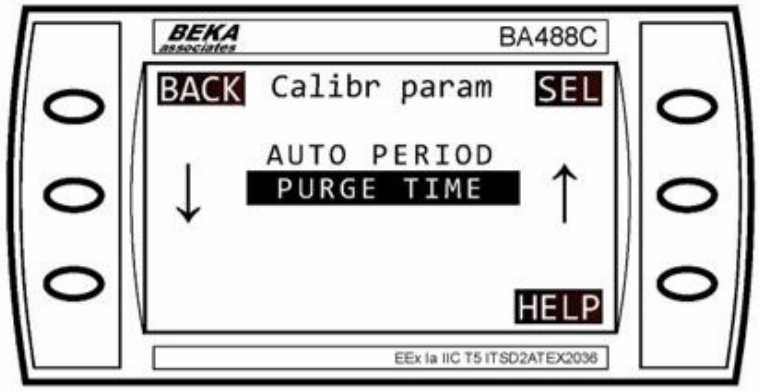
7. To change the time and the units (days, hours, minutes and seconds) between calibrations, use the **LEFT, RIGHT, INCR** (increase), and **DECR** (decrease) buttons to set the number and time interval.

Figure 10-33: (Calibration) Period



8. Press **OK**.
9. To adjust the length of time for the span gas to flush the cell, use the middle buttons (↓ and ↑) to scroll up or down and select **PURGE TIME**.

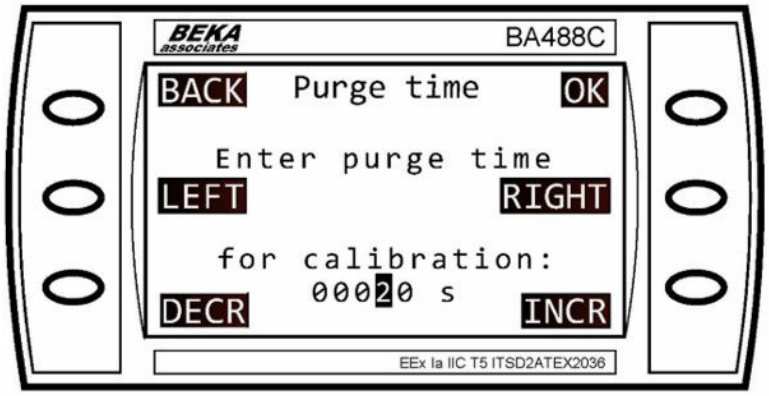
Figure 10-34: Calibr param (PURGE TIME)



10. Press **SEL**.

11. To change the time between opening the valve and performing the calibration, use the **LEFT, RIGHT, INCR** (increase), and **DECR** (decrease) buttons to set the number and time interval.

Figure 10-35: Purge Time



12. Press **OK**.

11 Troubleshooting and diagnostics

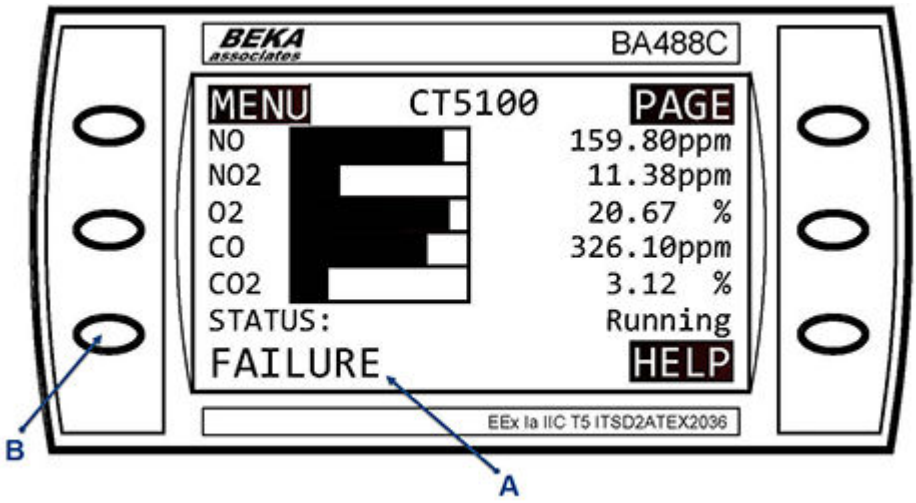
11.1 Use the Built-in-Self-Test (BIST) fault diagnostics

The analyzer has a Built-In-Self-Test (BIST) function that 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. To access and control the BIST, use the display controller mounted on the door of the electrical compartment.

The BIST runs in the background when the analyzer is operating and continuously monitors the analyzer for faults.

If the BIST detects a fault, the **STATUS** display in the bottom left-hand corner of the ***Gas Sensor Main*** screen (Figure 11-1) will change from **OK** to flashing the word **FAILURE**.

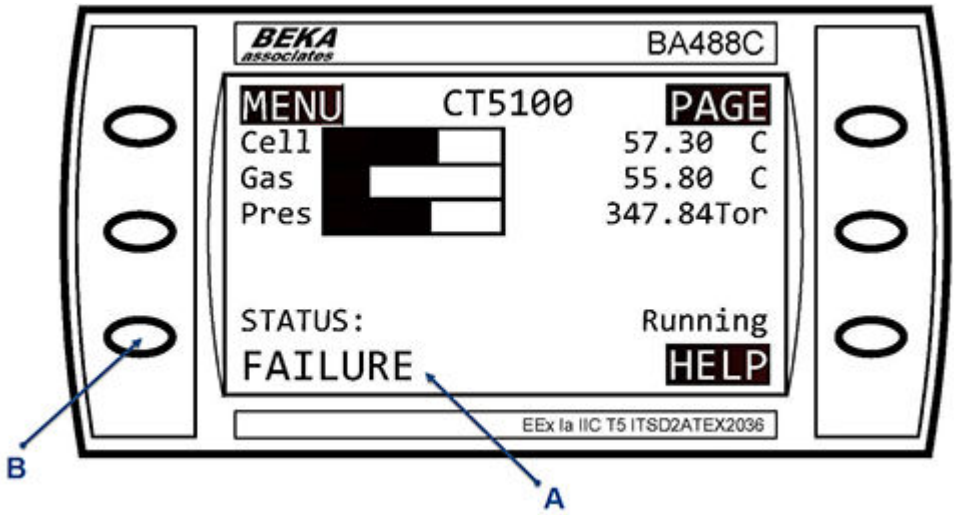
Figure 11-1: Gas Sensor Main Screen



*A. **FAILURE** message*
*B. **FAILURE** button*

Similarly, if the BIST detects a fault and the ***Pressure and Temperature*** screen (Figure 11-2) is being displayed, the STATUS display in the bottom left-hand corner of the screen will change from **OK** to flashing the word **FAILURE**.

Figure 11-2: Pressure and Temperature Screen



A. ***FAILURE*** *message*
B. ***FAILURE*** *button*

Procedure

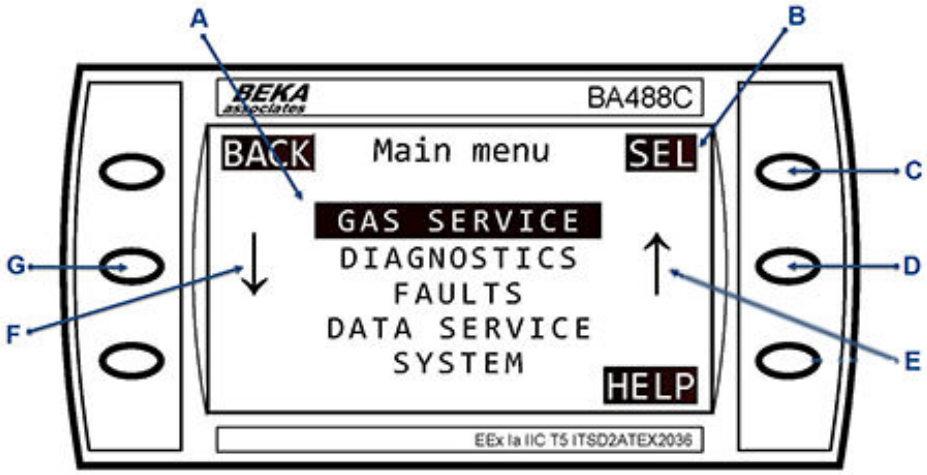
1. On either the ***Gas Sensor Main*** screen (Figure 11-1) or the ***Pressure and Temperature*** screen (Figure 11-2), press **FAILURE** button to go to the ***Faults Menu*** screen (Figure 11-5).

   Controls and display controller provides details of how to use the controls on the display controller and functions of the **BACK** and **HELP** buttons.

2. You can also access the ***FAULTS*** menu through the ***Main Menu*** (Figure 11-3) as follows:

a) In the ***Gas Sensor Main*** screen, Figure 11-1 or the Pressure and Temperature screen (Figure 11-2), press **MENU**.
The ***Main Menu*** screen (Figure 11-3) opens.

Figure 11-3: Main Menu Screen

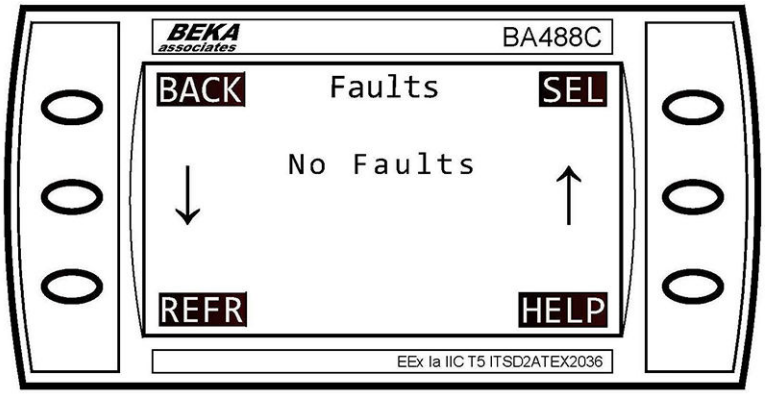


A. Calibration and maintenance options
*B. **SEL** text*
*C. **SEL** button*
D. Scroll Up button
E. Scroll Up arrow
F. Scroll Down arrow
G. Scroll Down button

b) Using the **Scroll Up** button (D) and **Scroll Down** button (G), select **FAULTS**.
Refer to Figure 11-3.

c) Press **SEL**(C).
The ***Faults*** menu opens.

Figure 11-4: Faults Menu - No Faults Indicated

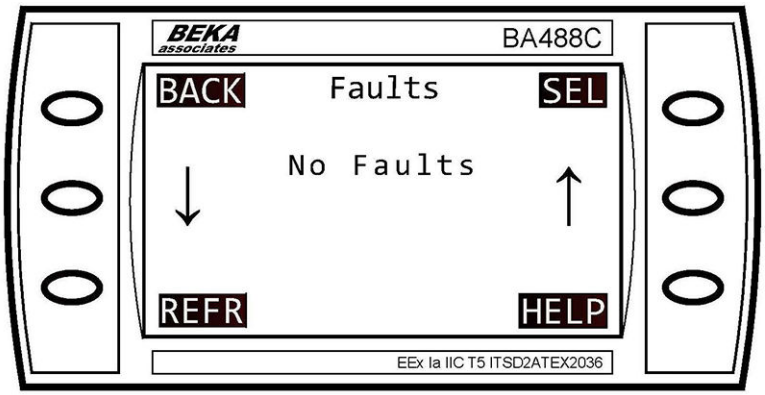


11.2 Use the Faults menu

The ***Faults*** menu displays a list of faults affecting the analyzer that have been identified by the built-in self test (BIST).

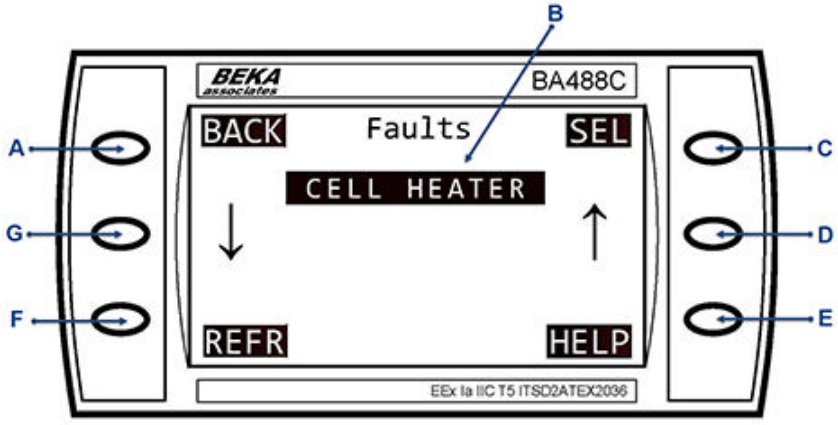
If no faults have been identified by the BIST the central area of the ***Faults*** menu will display **No FAULTS** (see Figure 11-5).

Figure 11-5: Faults Menu - No Faults Indicated



Procedure

1. Press **REFR** to refresh the fault list.

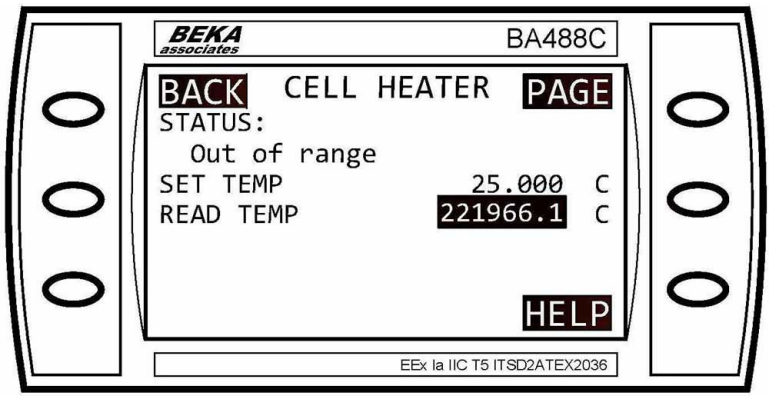


*A. **BACK** button*
B. Fault list
*C. **SEL** button*
*D. **Scroll Up** button*
*E. **HELP** button*
*F. **REFR** button*
*G. **Scroll Down** button*

2. Use the **Scroll Up** (D) and **Scroll Down** (G) buttons to highlight a fault for further investigation by the BIST system.
3. Once the fault that you wish to diagnose has been highlighted, press **SEL** to select that fault.
   The ***Fault Display*** screen for the component that is reporting an error will then open.

   The ***Fault Display*** screen will display the parameters of the suspect component. Figure 11-6 shows an example of a fault display; the precise data that will be displayed will vary depending upon where the fault has occurred.

Figure 11-6: Fault Display Screen



Examine the data shown on the ***Fault Display*** 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.support@emerson.com for advice and assistance.

If there are more parameters than can be displayed on the available screen space, a **PAGE** message will appear in the top right-hand corner of the screen, and the top right-hand button will become the associated **PAGE** button. Press **PAGE** to display the next page of parameters.

11.3 Failure diagnosis principles

Failure diagnosis of the analyzer comprises interpretation of system fault messages shown on the LCD display, visual examination, and functional failure diagnosis.

The normal start point should be to use the Built-In-Self-Test (BIST) facility to attempt to identify any faults. If that fails to identify the fault, if the analyzer fails to start correctly, or if the display controller is not working, perform the functional failure diagnosis.

Electrical power to operate the analyzer is provided through the host equipment supplied by the customer.

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

The failure diagnosis procedures described in this section assume that any host equipment provided by the customer is fully functional. Always confirm that the host equipment is fully serviceable before performing failure diagnosis on the analyzer.

The host equipment includes:

- A two-pole main isolator (circuit breaker) that controls the application of electrical power to the analyzer
- Power cables and interconnecting wiring that connect to the analyzer
- Pneumatic pipes/hoses and associated T-pieces, pneumatic connectors and fittings, etc., that route the gas sample to and from the analyzer
- Any gas conditioning equipment necessary to condition the gas sample before it is routed to the analyzer

11.4 Repairable faults

The repair and servicing procedures given in this manual describe all repairs and servicing that can be undertaken by the customer maintenance personnel. In all cases, the repair is directly replace the faulty item with a known serviceable item.

All other items must be repaired or replaced by Emerson.

NOTICE

In general, if any optical component other than the cell assembly, laser module, and the detector are deemed unserviceable, the analyzer must be repaired by Emerson personnel. The repair, replacement, and alignment of the optical components requires the use of specialized optical test/calibration equipment and procedures to ensure the correct operation of the unit.

11.5 Tools and test equipment

All tools required when performing failure diagnosis are standard hand tools.

The only test equipment required when performing failure diagnosis is a multi-meter that may be used to perform continuity checks on electrical wiring during an inspection.

11.6 General troubleshooting and diagnostics information

The Rosemount CT5100 is specifically designed to run unattended indefinitely, to automatically resolve system issues, and to recover from power failures and return to a normal working state. This troubleshooting guide is intended to assist maintenance personnel when the analyzer has not appeared to be working normally for a period of more than five minutes.

If the procedures given in this section fail to return the analyzer to normal operation or do not identify a fault, notify your service agent for further assistance.

11.7 Navigate the Diagnostics menu

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

Procedure

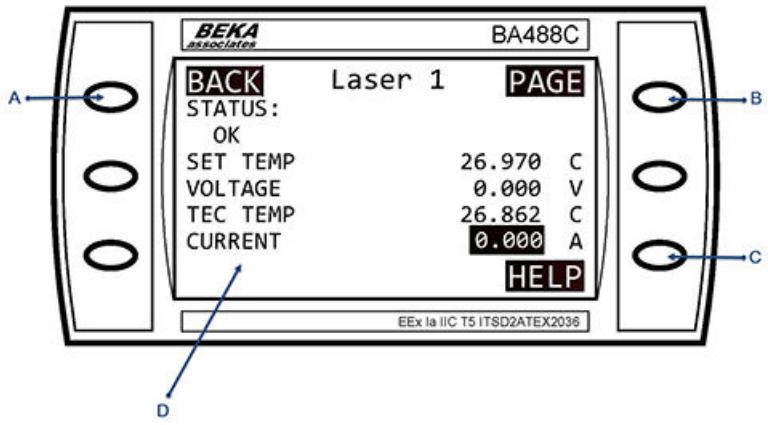
1. Select **DIAGNOSTICS** on the ***Main menu*** to open the ***Diagnostics*** menu.

Figure 11-7: Diagnostics Menu

*A. **BACK** button*
*B. **SEL** button*
*C. **Scroll Up** button*
*D. **HELP** button*
E. List of components
*F. **REFR** button*
*G. **Scroll down** button*

2. Press **REFR** to refresh the fault list.
3. Use the **Scroll Up** and **Scroll Down** buttons to highlight a component for the BIST to further investigate.
4. Once you have highlighted the component you wish to diagnose, press **SEL** to select it. In the example in Figure 11-7, **LASER 1** is highlighted.
   The ***Diagnostics*** screen for that component opens.

Figure 11-8: Laser 1 Diagnostics Menu

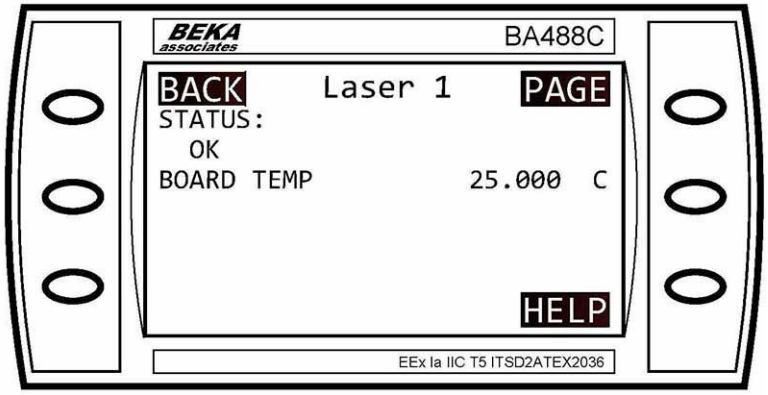


*A. **BACK** button*
*B. **PAGE** button*
*C. **HELP** button*
D. Parameters

The component diagnostic screen shows the parameters of the component selected from the ***Diagnostics*** menu. In the example shown in Figure 11-8, the parameters of Laser 1 are shown. The parameters data displayed vary depending upon which component was selected for diagnosis.

5. Examine the parameters on the display to determine if the suspect component has failed or is operting outside of its correct parameters. If you do not have the necessary information to determine if the suspect component is faulty, contact Emerson for advice and assistance.
   If there are more parameters than can be displayed on the available screen space, a **PAGE** message will appear in the top right corner of the screen as shown in Figure 11-8, and the top right button will become the associated **PAGE** button.
6. Press **PAGE** to display the next page of parameters.
   In the example shown in Figure 11-8, pressing the **PAGE** button will display the second page of parameter data for Laser 1.

Figure 11-9: Laser 1 Diagnostics Menu (Page 2)



11.8 Visually examine the analyzer

If the Built-in-Self-Test (BIST) fails to identify the problem, the next step is a visual examination of the analyzer.

Procedure

1. Open the door of the electrical compartment and remove the top cover.
   Refer to Remove the top cover.
2. Visually examine the analyzer's exterior for signs of damage.
3. Visually inspect the optical and electrical components inside the analyzer.
   Refer to Figure 3-4.
4. If any loose connections are found in the electrical compartment, refer to the wiring diagrams (Engineering drawings) to identify and repair the connection.
5. Refit the top cover and close the electrical compartment door.

11.9 Functional failure diagnostics

If the Built-in-Self Test and the visual examination fail to identify the fault, perform the failure diagnostics and recommended actions.

11.9.1 No illuminated LEDs on Power supply unit (PSU) when analyzer switched ON.

Recommended actions

1. Check mains power is available.
2. If OK, replace PSUs.

11.9.2 Nothing powers up when connected to mains

Recommended actions

1. Check AC fuses (number 1 and number 2)
2. Replace if necessary.

11.9.3 Only MOXA and BEKA powers up

Condition

The start-up screen displays **BEKA**; all other electronic modules remain unpowered.

Recommended actions

1. Check the 12 V PSU is working (LED illuminated).
2. If the 12 V PSU is not working, replace it.
3. If PSU is OK, check 12 Vdc fuse (number 3) and replace if necessary.

11.9.4 BEKA and MOXAs do not start up (light emitting diodes [LEDs] not illuminated)

Condition

All electronics modules are powered up with various on board LEDs.

Recommended actions

1. Check that the 24 V power supply unit (PSU) is working (LED illuminated).
2. If the PSU is not working, replace it.
3. If the PSU is OK, check 24 Vdc fuse (number 4) and replace if necessary.

11.9.5 No display at all on BEKA but MOXA (if available) is ON

Recommended actions

1. Check 24 Vdc fuse (number 4); replace if necessary.
2. Check connections from BEKA panel to 24 Vdc power supply and BEKA barrier (if applicable).
3. If the interconnecting cable is OK, replace BEKA display panel.

11.9.6 NAMUR relay light-emitting diode (LED) is OFF and no FAILURE reported on BEKA

Recommended actions

1. Check power connections from peripheral board to relay.
2. If the interconnecting cable is working, replace NAMUR relay.

11.9.7 BEKA shows low/noisy gas readings with FAILURE status

Condition

The ***Faults*** page my display **MISALIGNMENT** on Gas Sensor 3, weak or no pulses from the affected laser with **Misalignment of laser** under **Paths** in the **Monitoring** tab, and possibly a **Pulse too noisy** messsage.

Recommended actions

1. Check laser module power connection is intact.
2. Check laser is enabled on Gas Sensor 3.
3. Check current, TEC, and volt readings on Gas Sensor 3.
4. If these are different from expected values or out of range, replace laser module.

11.9.8 BEKA shows low/noisy O_2 gas readings with FAILURE status

Condition

The ***Faults*** page my display **MISALIGNMENT** on Gas Sensor 3, weak or no pulses from the affected laser with **Misalignment of laser** under **Paths** in the **Monitoring** tab, and possibly a **Pulse too noisy** messsage.

Recommended actions

1. Ensure power supply to O_2 detector (LED ON) is present.
2. Check detector output cables are intact.
3. Ensure O_2 laser module is working properly (check laser current, volt and TEC readings on Gas Sensor 3).
4. If the power supply and output cables are working, but the O_2 laser module is not, replace O_2 detector

11.9.9 BEKA shows low/noisy gas readings for all gases (except O_2) with FAILURE status

Condition

The ***Faults*** page my display **MISALIGNMENT** on Gas Sensor 3, weak or no pulses from the affected laser with **Misalignment of laser** under **Paths** in the **Monitoring** tab, and possibly a **Pulse too noisy** messsage.

Recommended actions

1. Ensure laser modules are working properly (check laser current, voltage, and TEC readings on Gas Sensor 3); replace if necessary.
2. Check the cable between motherboard and detector TEC PCB (14- way ribbon cable); replace if necessary.

3. Check 10-way cable from detector TEC PCB to VIGO; replace if necessary.
4. Check detector output cable is intact, replace if necessary.
5. If items 1 – 4 are all OK, replace VIGO detector.

11.9.10 BEKA shows low/noisy gas readings for all gases with FAILURE status

Condition

The ***Faults*** page my display **MISALIGNMENT** on Gas Sensor 3, weak or no pulses from the affected laser with **Misalignment of laser** under **Paths** in the **Monitoring** tab, and possibly a **Pulse too noisy** messsage.

Recommended actions

1. Visually check all external optics for dust or damage and clean if necessary.
2. Ensure cables to detectors are intact.
3. Check all power rails (±12 V and -5 V) are OK and VIGO temp control is working.
4. If not, check power supply ribbon cable from motherboard.
5. If all above are OK, then replace detector TEC board.
6. Clean external optics.
7. If damaged, replace external optics.
8. If not external optics, visually check cell mirrors for dust and clean if necessary.
9. If cell mirrors are damaged or corroded, replace the cell assembly.
10. Replace power supply ribbon cable
11. Replace detector TEC board.

11.9.11 BEKA shows incorrect pressure reading

Condition

If out of range, readings display format will change to white on black.

Recommended actions

1. Check connection cable between pressure sensor and peripheral board and/or barrier if applicable.
2. If the interconnecting cable is OK, replace pressure sensor

11.9.12 BEKA display shows FAILURE status

Condition

The ***Faults*** page shows **CELL HEATER** fault due to temperature being out of range with cell temperature reading either a constant value (short circuit) or a high value of 21,000 and above.

Recommended actions

1. Check connection cable between cell temperature PT100 sensor and peripheral board.
2. If interconnecting cable is OK, replace cell temperature PT100 resistance temperature device (RTD).

11.9.13 BEKA display shows FAILURE status, and the Faults page shows CELL HEATER fault due to temperature being out of range

Recommended actions

1. Ensure all connections to peripheral board are intact.
2. Check cell temperature PT100 sensor is working properly.
3. Check heater relay is working (LED ON). If it is not, check relay power supply.
4. If all are OK, replace cell assembly heater block.

11.9.14 BEKA display shows wrong gas temperature reading

Condition

The gas temperature reading is either a constant value (short circuit) or a high value of 21000 and above (open circuit) with gas readings being possibly affected.

Recommended actions

1. Check connection cable between gas temperature PT100 sensor and peripheral board.
2. If interconnecting cable is OK, replace gas temperature PT100 resistance temperature device (RTD).

11.9.15 BEKA does not display any temp and pressure values and NAMUR relays not working

Recommended actions

1. Check power supply to peripheral board.
2. Check 20-way ribbon cable from motherboard to peripheral board.
3. Check connections to sensors and relays.
4. If all are OK, replace peripheral board.

11.9.16 BEKA display won't show any information or only displays Start-up screen

Recommended actions

1. Check SD Card is connected; if SD card is not working, replace it.
2. Ensure the 12 V PSU and 12 Vdc fuse are OK; if 12 Vdc fuse is not working, replace it.
3. Ensure connection to BEKA from motherboard is intact; if is not, replace it.
4. Check other outputs (digital and analog) are OK (if available).
5. If all interconnecting cables are OK, replace the motherboard PCB.

12 Repair and replacement

12.1 Repair policy

Only qualified personnel should repair and maintain the Rosemount CT5100

The analyzer has a number of parts that can be repaired and/or replaced with spare parts supplied by Emerson.

In all cases the repair must be by direct replacement of the faulty item with a known serviceable item purchased from Emerson.

NOTICE

Some faults can only be repaired by Emerson. Where an item is unserviceable, and no replacement procedure is given in this manual, then the fault must be repaired by Emerson.

12.2 Open the electrical compartment door

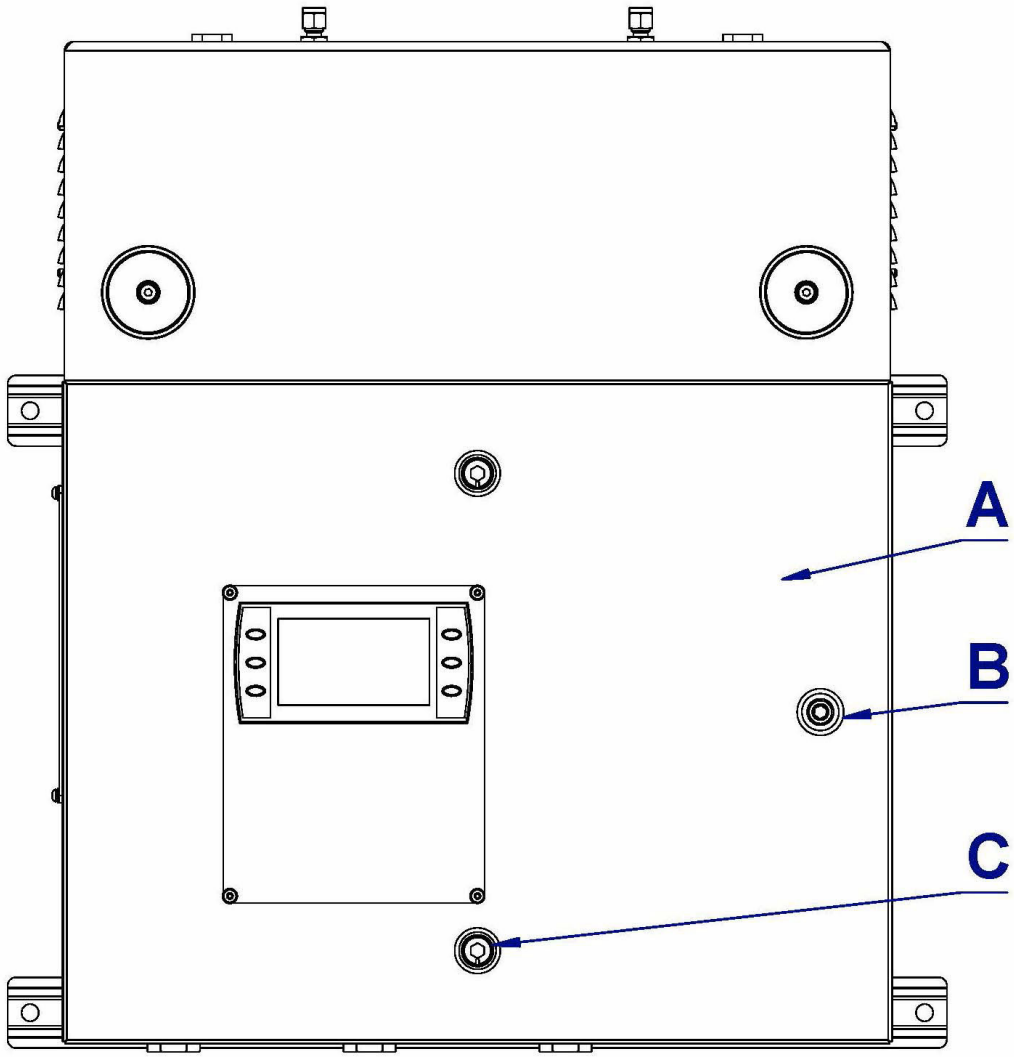
To gain access to the electrical compartment and the components mounted on the inside of the door, open the door on the front of the analyzer as follows:

Procedure

Using an 8 mm hex key, loosen the compression screw (B) and cam latch screws (C) to unlock the door (A), then open the door.

See Figure 12-1.

Figure 12-1: Electrical Compartment Door



A. Electrical compartment door
B. 1 off compression latch
C. 2 off cam latches

12.3 Close the electrical compartment door

The procedure for closing and locking the door to the electrical compartment is the reverse of the opening procedure.

⚠ CAUTION

EQUIPMENT DAMAGE

Failure to perform pre-system start-up checks may cause damage to the equipment.

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

Before starting up, ensure that electrical power, sample gas handling facilities, and any calibration gases that are required are available to the analyzer .

⚠ CAUTION

EQUIPMENT DAMAGE

Damage to the analyzer may result from a failure to follow the start-up procedure.

Always follow the start-up procedure.

Procedure

1. Close the electrical compartment door.
2. Using an 8 mm Allen key, tighten the compression screw (B) and cam latch screws (C) to lock the door (A).
   See Figure 12-1.
3. Restart the analyzer.
   Refer to Start-up procedure for the start-up procedure.

12.4 Replace the fuses

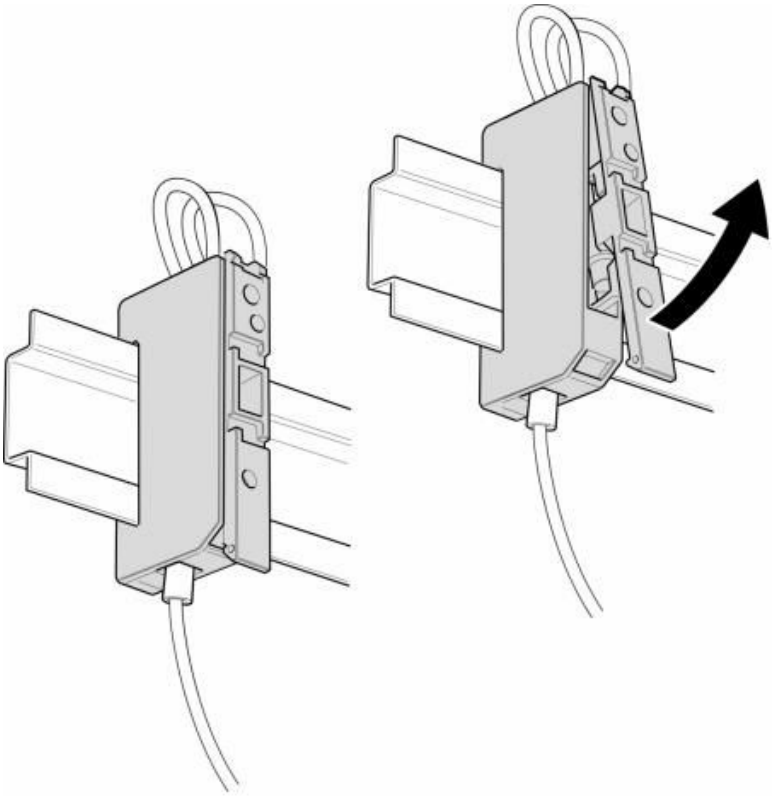
The analyzer contains internal fuses. This procedure is used to replace all internal fuses; therefore, the replacement of only one is described.

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.

2. Open the door of the electrical compartment.

Figure 12-2: Fuse Holder

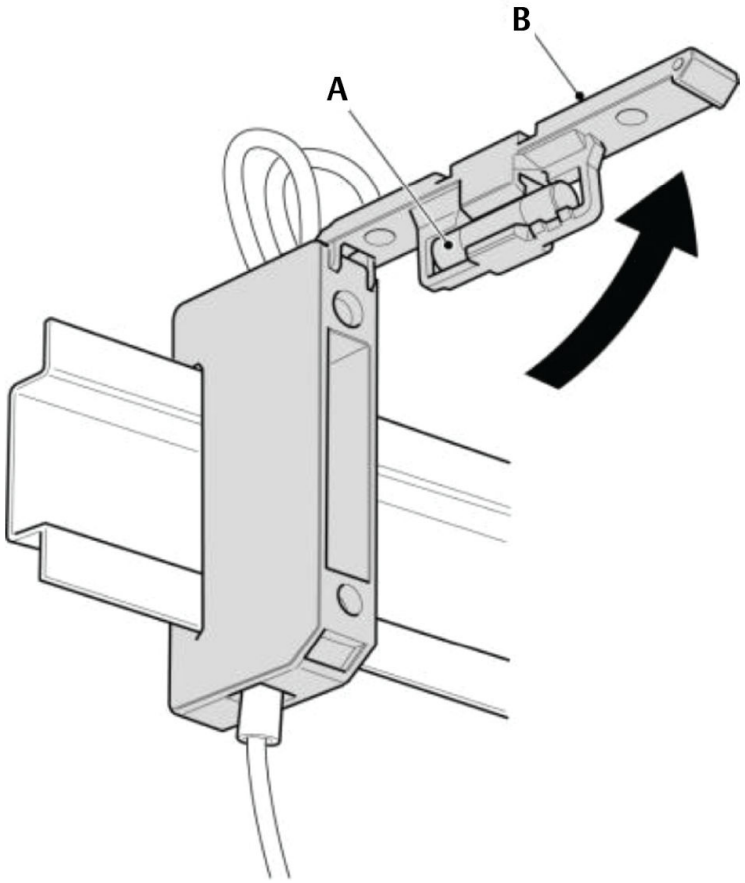


As shown in Figure 12-2 each fuse is located inside a fuse holder that is mounted on the lower DIN Rail. For clarity, Figure 12-2 only shows one of the fuse holders, which is shown in both the closed and partially open positions.

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 up the upper part of the fuse holder as shown in Figure 12-2.

4. Fully raise the upper part of the fuse holder (B) as shown in Figure 12-3 and then push out the old fuse (A).

Figure 12-3: Replacing the Fuse



A. Fuse
B. Fuse holder

⚠ WARNING

CORRECT FUSES

Failure to use the correct fuses may result in personal injury or death and/or damage to persons and/or property.

Only replace fuses with fuses of the same type and rating.

5. Fit the replacement fuse into the fuse holder.
   Refer to Table 12-1 and verify 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 door of the electrical compartment and restart the analyzer.

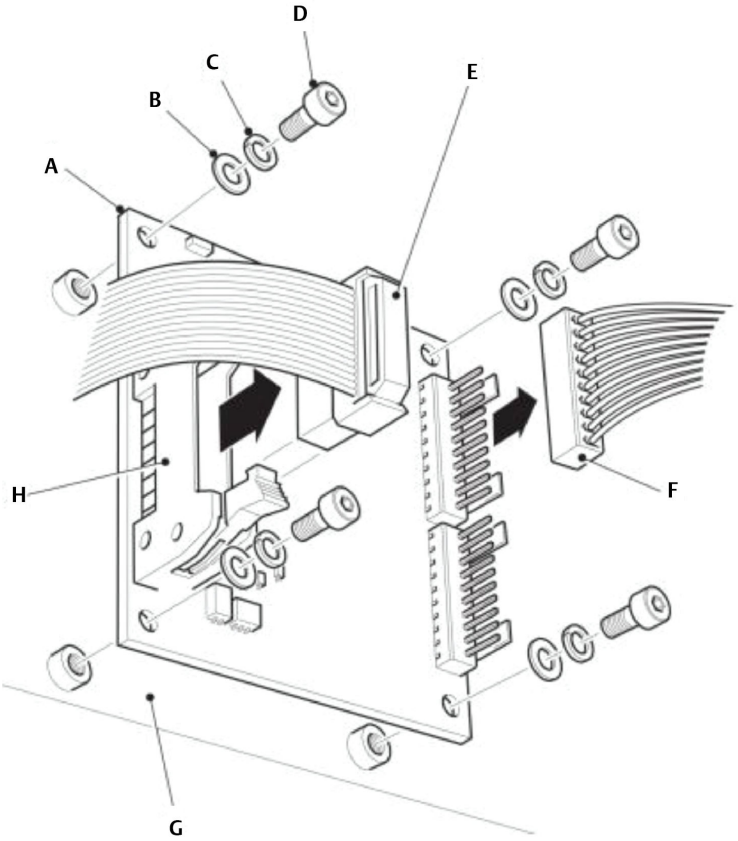
Table 12-1: Fuse Requirements

Fuse	Function	Rating	Schurter part number
1	Live line 110/230 Vac (following mains filter)	3.15 A, 250 V, fast acting ceramic	0001-1009
2	Neutral line 110/230 Vac (following mains filter)	3.15 A, 250 V, fast acting ceramic	0001-1009
3	Analyzer 12 Vdc supply rail	5 A, 250 V, fast acting ceramic	0001.1011
4	Analyzer 24 Vdc supply rail	3.15 A, 250 V, fast acting ceramic	0001-1009

12.5 Replace the TEC board

To replace the TEC board, refer to Figure 12-4 and complete the following steps.

Figure 12-4: Replacing the TEC Board



A. *TEC board*
B. *M3 flat washer*
C. *M3 spring washer*
D. *M3 x 6 mm socket head cap screw*
E. *Ribbon cable (to motherboard)*
F. *Wiring harness (to detector module)*
G. *Backplate*
H. *Connector for ribbon cable*

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Tag or otherwise identify all wiring harnesses before disconnecting.

4. Open the locking arms of the connector (H) for the ribbon cable and disconnect the ribbon cable (E) from the TEC board (A).
5. Disconnect the wiring harness (F) from the TEC board.
6. Remove and retain the four off M3 x 6 mm hex cap screws (D) and associated spring washers (C) and flat washers (B) that secure the TEC board to the back plate.
7. Remove the TEC board from the backplate (G).
8. Discard the unserviceable TEC board.
9. Examine the replacement TEC board for damage during shipping or storage.
10. Fit the TEC board (A) in position on the backplate (G) in the same orientation.

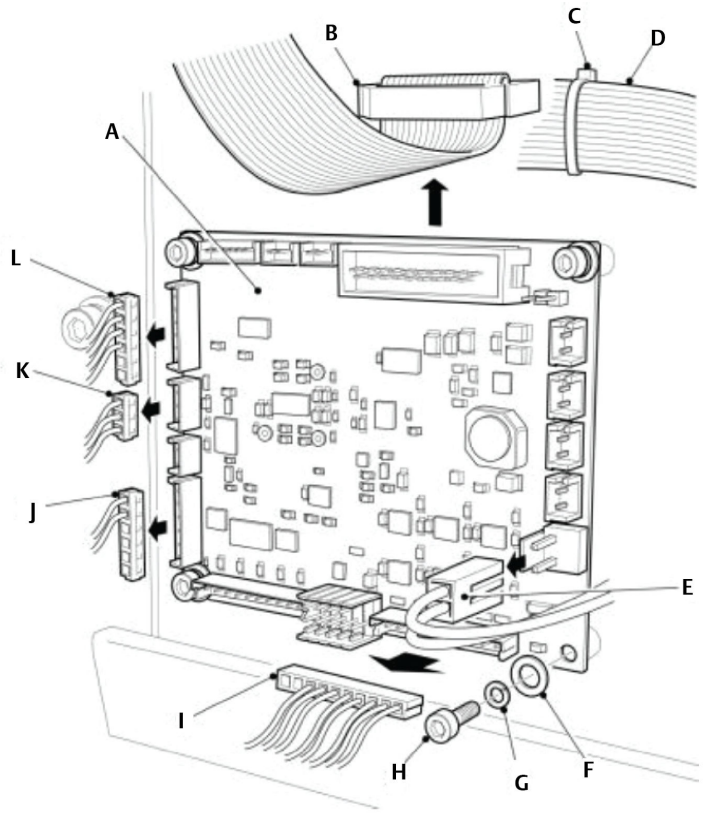
    Using the packaging from the replacement TEC board, send the unserviceable TEC board to Emerson for evaluation.
11. Secure the TEC board by fitting the four screws (D) and associated spring washers (C) and flat washers (B) that were retained during the removal procedure.
12. Apply Loctite® 222 to the four off M3 screws and torque tighten the screws to 0.75 Nm.
13. Connect the wiring harness (F) to the TEC board.
14. Connect the ribbon cable (E) to the connector (H) for the ribbon cable on the TEC board.

    Confirm that the ribbon cable securely fits to the connector.
15. Close the door of the electrical compartment and restart the analyzer.

12.6 Replace the peripheral board

To replace the peripheral board, refer to Figure 12-5 and complete the following steps.

Figure 12-5: Replacing the Peripheral Board



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

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.

2. Open the door of the electrical compartment.
3. Tag or otherwise identify all wiring harnesses before disconnecting.
4. Disconnect the 12 V power wiring harness (E) from the peripheral board (A).

NOTICE

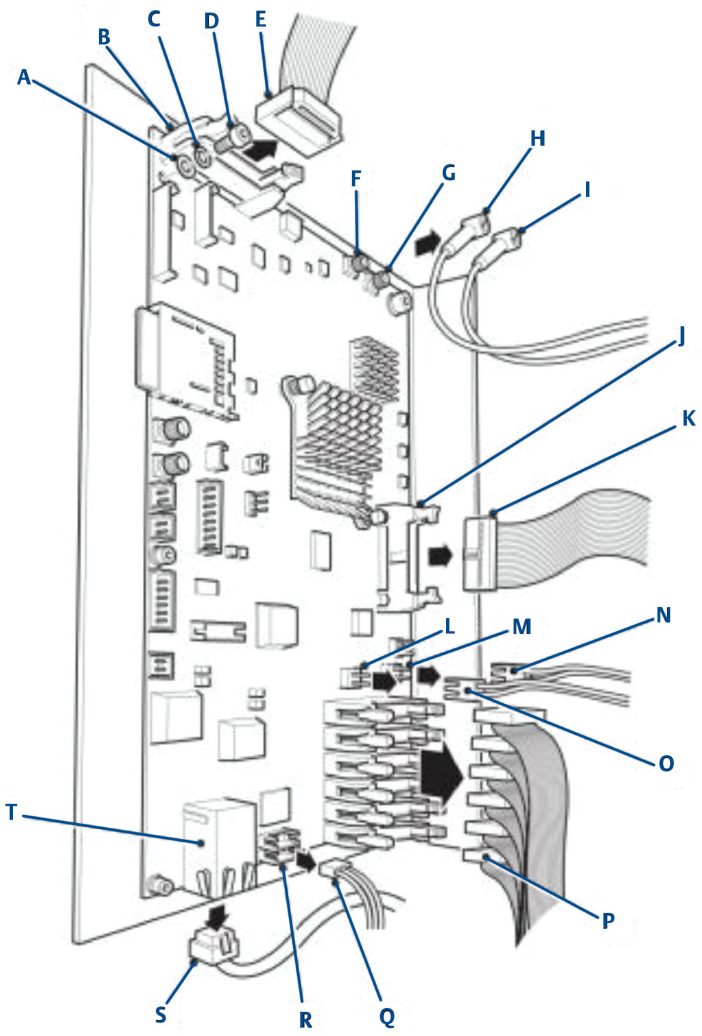
The other end of the 12 V power wiring harness (H) is connected to connector J11 on the motherboard.
A ribbon cable (E) that connects the TEC board to the motherboard runs across the top of the peripheral board and is secured with a cable tie (C) to the connector of the ribbon cable (B) that plugs into the peripheral board.

5. Cut the cable tie (C) that secures the TEC board ribbon cable (E) to the connector of the peripheral board ribbon cable (B). Carefully move the TEC board ribbon cable clear of the peripheral board.
6. Disconnect the peripheral board ribbon cable (B) from the peripheral board.
7. Disconnect the relay wiring harness (I) from the peripheral board.
8. Disconnect the three connectors (J, K, and L) of the gas/cell temperature monitoring harness from the peripheral board.
9. Remove and retain the four screws (H) and associated spring washers (G) and flat washers (F).
10. Remove and discard the peripheral board.
11. Place the peripheral board (A) in position on the backplate.
12. Secure the peripheral board by fitting the four screws (H) and the associated spring washers (G) and flat washers (F) retained during the removal procedure.
13. Torque tighten the screws to 0.6 Nm.
14. Connect the three connectors (J, K, and L) of the gas/cell temperature monitoring harness to, respectively, connectors J9, J24, and J37 on the peripheral printed circuit card (PCC).
15. Connect the relay wiring harness (I) to the peripheral board.
16. Connect the peripheral board ribbon cable (B) to the peripheral board.
17. Secure the TEC board ribbon cable (D) to the connector of the peripheral board ribbon cable (B) with a cable tie (C).
18. Connect the 12 V power wiring harness (E) to the peripheral board (A).
19. Close the door of the electrical compartment and restart the analyzer.

12.7 Replace the motherboard

To replace the motherboard, refer to Figure 12-6 and complete the following steps.

Figure 12-6: Replacing the Motherboard



A. M3 flat washer
B. Ribbon cable connector J12
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 input wiring harness
O. 12 V power output wiring harness
P. Laser module ribbon cable
Q. HMI Display wiring harness
R. Connector J22
S. Ethernet cable
T. Ethernet connector

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Tag or otherwise identify all wiring harnesses before disconnecting.
4. On the motherboard, disconnect the TEC board ribbon cable (E) from connector J12 (B).
   Refer to Figure 12-6.
5. Disconnect the Detector Module 1 TRIGGER OUT wiring harness (I) from connector J31 (G).

   NOTICE

   The Detector Module 2 TRIGGER OUT wiring harness (H) is an optional item that only forms part of those analyzers that are fitted with an O_2 detector.

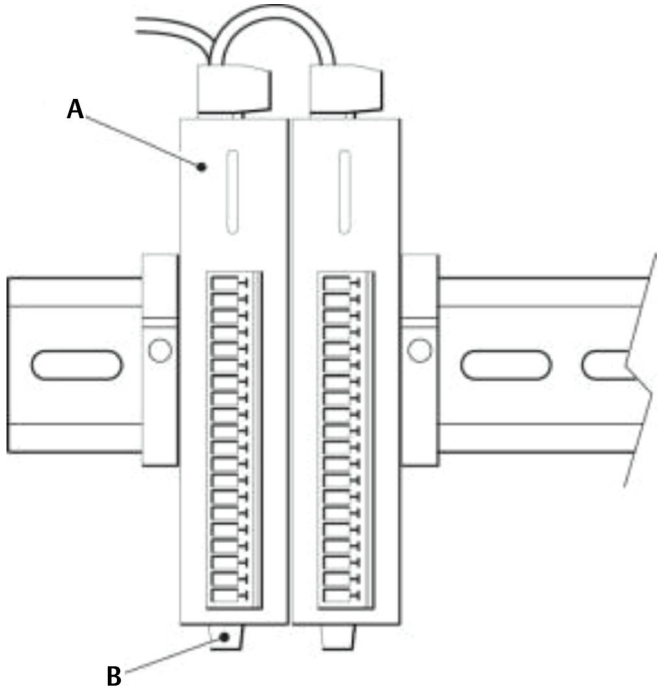
6. Disconnect the Detector Module 2 TRIGGER OUT wiring harness (H) from connector J32 (F).
7. Disconnect the Laser Module ribbon cables (P) from the motherboard.
   The number of Laser Module ribbon cables to be disconnected will vary depending upon the application that the analyzer has been configured for.
8. Disconnect the 12 V power output wiring harness (O) from connector J17 (L).
9. Disconnect the 12 V power input wiring harness (N) from connector J16 (M).
10. Disconnect the peripheral PCB ribbon cable (K) from connector J7 (J).
11. Disconnect the Ethernet cable (S) from the Ethernet connector (T).
12. Disconnect the HMI display wiring harness (Q) from connector J22 (R).
13. Remove and retain the six screws (D) and associated spring washers (C) and flat washers (A).
14. Remove and discard the unserviceable motherboard.
15. Inspect the replacement motherboard for signs of damage or delamination.
16. Place the motherboard in position on the backplate and secure by fitting the six screws (D) and the associated spring washers (C) and flat washers (A) retained in Step 13. Torque tighten the screws to 0.6 Nm.

17. Connect the HMI display wiring harness (Q) to connector J22 (R).
18. Connect the Ethernet cable (S) to the Ethernet connector (T).
19. Connect the peripheral PCB ribbon cable (K) to connector J7 (J).
20. Connect the 12 V power input wiring harness (N) to connector J16 (M).
21. Connect the 12 V power output wiring harness (O) to connector J17 (L).
22. Connect the Laser Module ribbon cables (P) to the motherboard. Ensure 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.
23. Connect the Detector Module 1 TRIGGER OUT wiring harness (I) to connector J31 (G).
24. If applicable, connect the Detector Module 2 TRIGGER OUT wiring harness (H) to connector J32 (F).
25. Connect the TEC board ribbon cable (E) to connector J12 (B).
26. Close the door of the electrical compartment and restart the analyzer.

12.8 Replace the Ethernet in/out relay modules

The Ethernet in/out relay modules are located on the right-hand side of the lower DIN rail. The number of Ethernet in/out relay modules may vary depending upon the application of the analyzer. To replace the Ethernet in/out relay modules, refer to Figure 12-7 and complete the following steps.

Figure 12-7: Lower DIN Rail – Right Side



A. Ethernet in/out relay module
B. Lever

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Disconnect the wiring harnesses from the top and the output connectors from the front of the Ethernet in/out relay module (A).
4. Release the Ethernet in/out relay module from the DIN rail by pressing a small lever (B) on the underside of the Ethernet in/out relay module. While continuing to press the lever, remove the Ethernet in/out relay module from the DIN rail.
5. Discard the unserviceable Ethernet in/out relay module.
6. Inspect the replacement Ethernet in/out relay module for damage.
7. Place the replacement Ethernet in/out relay module (A) in its correct location on the DIN rail.
8. Press the small lever (B) on the underside of the Ethernet in/out relay module and push the module onto the DIN rail.
9. Release the small lever and check that the Ethernet in/out relay module is secure.
10. Connect the wiring harnesses to the Ethernet in/out relay module.
11. Close the door of the electrical compartment and restart the analyzer.

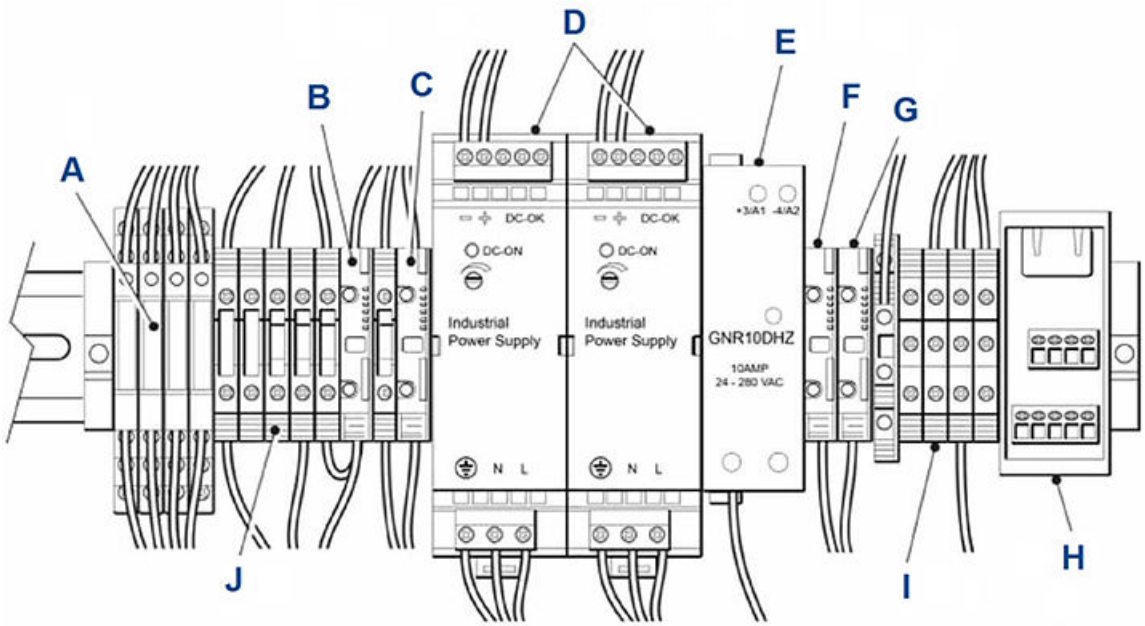
12.9 Lower (main) DIN rail electronic components

Figure 12-8 shows the electronic components located on the lower DIN rail.

See Replace the fuses to replace a fuse.

The terminal blocks (I and J) and low-power status relays (A) should not require replacement during the expected life of the equipment.

Figure 12-8: Lower DIN Rail



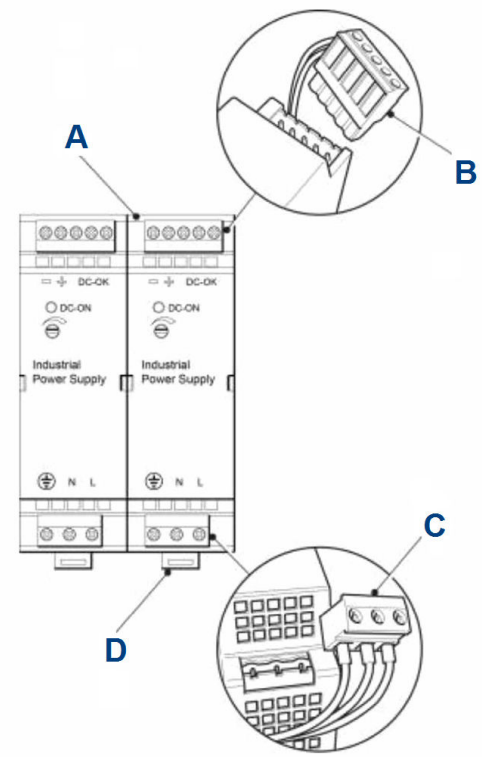
A. Status relays
B. Fuse holder for fuse F4
C. Fuse holder for fuse F3
D. Power supplies
E. 10 Amp solid state relay
F. Fuse holder for fuse F1
G. Fuse holder for fuse F2
H. Ethernet connector
I. Terminal blocks
J. Terminal blocks

12.10 Replace a DC power supply

Use this procedure and the wiring diagrams in Engineering drawings to replace a DC power supply.

The two DC power supplies are identical; therefore, the replacement procedure for only one is described. To replace a DC power supply from the DIN rail, refer to Figure 12-9 and complete the following steps.

Figure 12-9: Replacing a DC Power Supply



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

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Disconnect the wiring harness connector (B) from the top of the DC power supply (A).
4. Disconnect the wiring harness connector (C) from the bottom of the DC power supply.
5. Press the small lever (D) on the underside of the DC power supply to release it from the DIN rail. While continuing to press the lever, remove the DC power supply from the DIN rail.
6. Discard the unserviceable DC power supply.
7. Inspect the replacement DC power supply for damage.
8. Place the replacement DC power supply (A) in its correct location on the DIN rail.
9. While pressing the small lever (D) on the underside of the DC power supply to the down position, push the DC power supply onto the DIN rail.

10. Release the small lever and check that the DC power supply is secure.
11. Connect the wiring harness connector (C) to the bottom of the DC power supply.
12. Connect the wiring harness connector (B) to the top of the DC power supply.
13. Close the door of the electrical compartment and restart the analyzer as described in Start-up procedure.

12.11 Replace the 10 Amp solid state relay

To replace the 10 Amp solid start relay, refer to Figure 12-8, item E and complete the following steps.

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Disconnect the wiring connectors from the 10 Amp solid state relay (E).
4. Remove and discard the unserviceable 10 Amp relay.
5. Inspect the replacement relay for damage.
6. Place the replacement 10 Amp relay (E) in its correct location on the DIN rail.
7. Make the wiring connections to the relay.
8. Close the door of the electrical compartment and restart the analyzer as described in Start-up procedure.

12.12 Replace the Ethernet connector

The Ethernet connector is clipped onto the DIN rail.

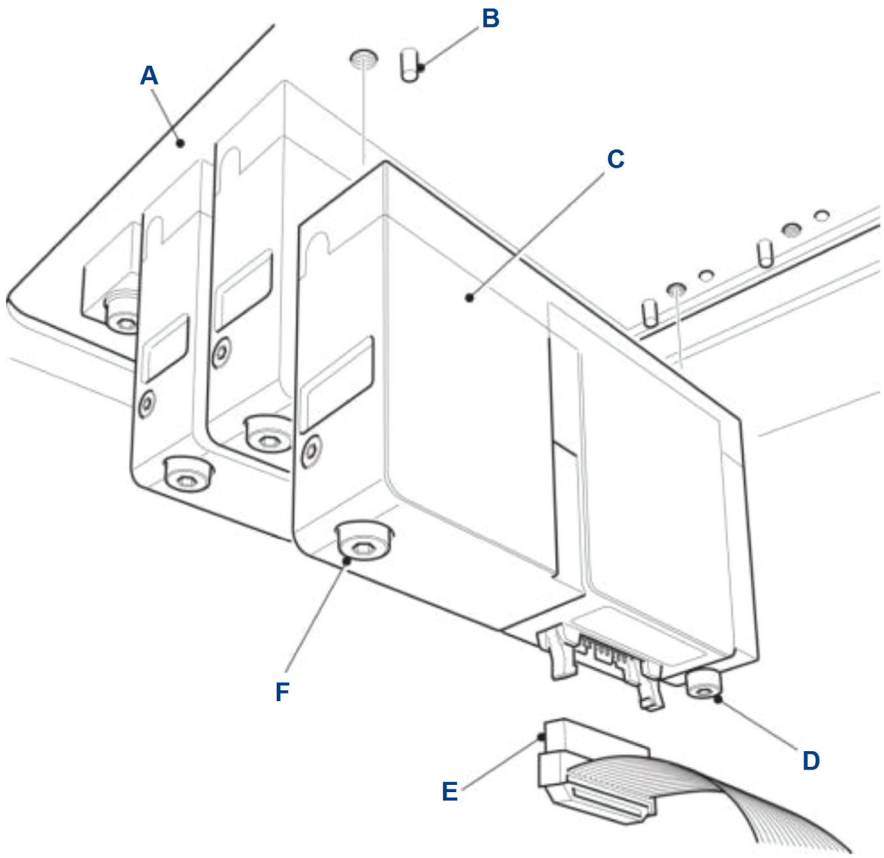
Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Disconnect the wiring harnesses from the Ethernet connector (H).
   Refer to Figure 12-8.
4. Unclip the Ethernet connector (H) from the DIN rail.
   Refer to Figure 12-8.
5. Inspect the replacement Ethernet connector for damage.
6. Clip the replacement Ethernet connector into its correct location on the DIN rail.
   Check that the DC power supply is secure.
7. Connect the wiring harnesses to the Ethernet connector.
8. Close the door of the electrical compartment and restart the analyzer as described in Start-up procedure.

12.13 Replace the laser module

The number of laser modules may vary depending upon the application of the analyzer. The laser modules are located on the underside of the optical compartment base plate.

Figure 12-10: Replacing the Laser Module



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

Procedure

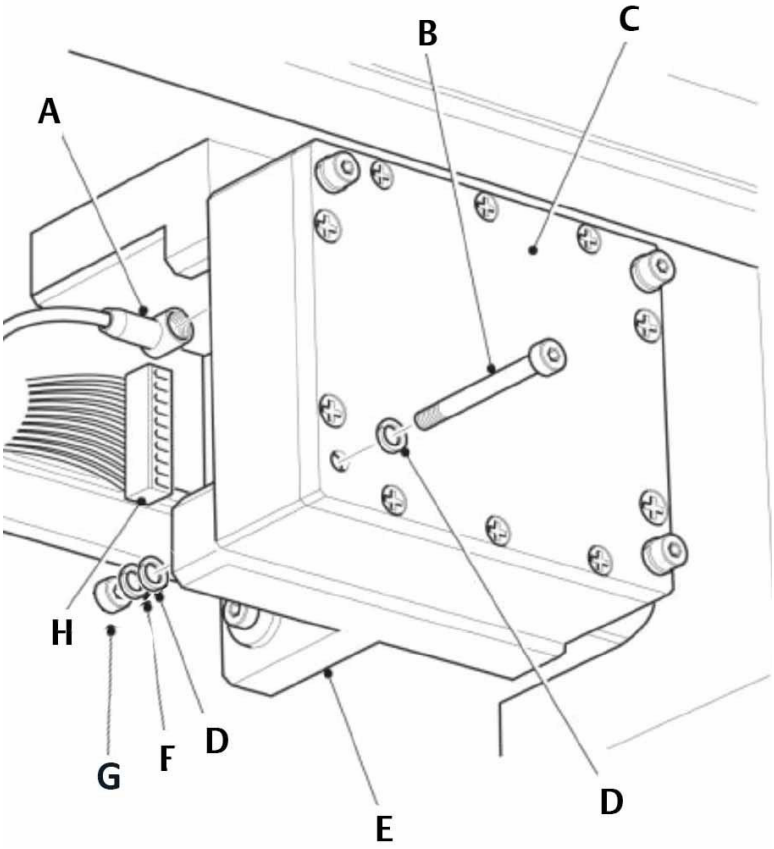
1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
   Refer to Figure 12-10.
3. Disconnect the ribbon cable (E).

4. Release the two captive screws (D and F).
5. Remove and discard the unserviceable laser module (C).
6. Inspect the new laser module for any damage.
7. Fit the new laser module in position on the base plate (A).
   The laser module must mate with the two locating pins (B) on the base plate.
8. Secure the laser module by tightening the two captive screws (D and F).
9. Connect the ribbon cable (E) to the laser module.
10. Close the door of the electrical compartment and restart the analyzer.

12.14 Replace the detector module

The detector module is located on the underside of the optical compartment base plate.

Figure 12-11: Replacing the Detector Module



A. *Trigger OUT harness*
B. *M3 x 35 mm socket head cap screw*
C. *Detector module*
D. *M3 plain washer*
E. *Detector bracket*
F. *M3 spring washer*
G. *M3 nut*
H. *Wiring harness*

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Disconnect the trigger OUT harness (A).
   Refer to Figure 12-11.

4. Disconnect the wiring harness (H).
5. Remove and retain the four screws (B) nuts (G), plain washers (D) and spring washers (F).
6. Remove and discard the unserviceable detector module (C).
7. Inspect the new detector module for damage.
8. Fit the new detector module in position on the detector bracket (E). Secure the detector module with the four screws, nuts and washers retained in Step 5 (B, D, F, and G).
9. Connect the wiring harness (H) to the detector module (C).
10. Connect the trigger OUT harness (A) to the detector module (C).
11. Close the door of the electrical compartment and restart the analyzer.

12.15 Replacing the O_2 detector

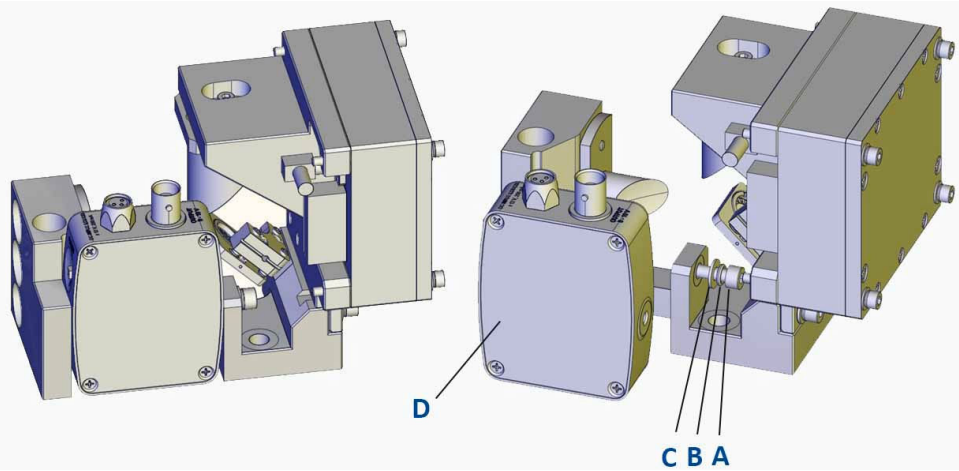
The O_2 detector is located on the underside of the optical compartment base plate. First determine which detector type is fitted: 1 or 2. Replace the O_2 detector identified using the following steps.

12.15.1 Replace O_2 detector (type 1)

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.

3. Disconnect the Bayonet Neill–Concelman (BNC) cable and the power cable from the O_2 detector (D).



A. M4 socket head cap screw
B. M4 spring washer
C. M4 plain washer
D. O_2 detector sub-assembly

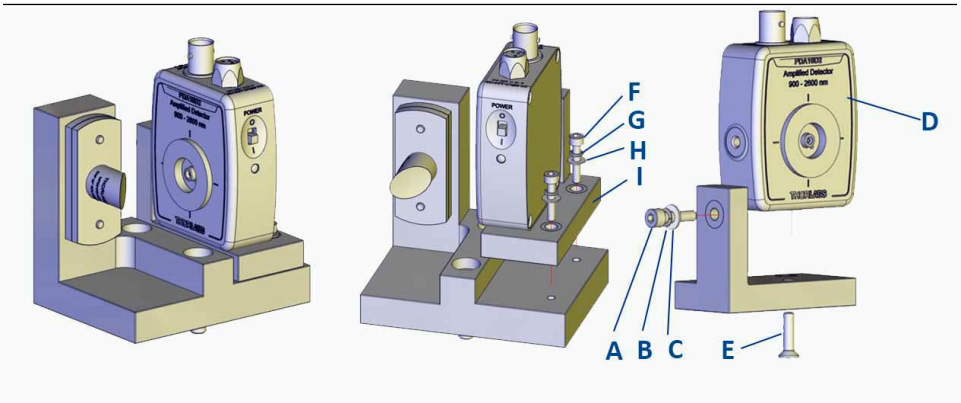
4. Remove and retain the M4 socket head cap screw (A), spring washer (B) and plain washer (C) used to secure the O_2 detector.
5. Remove the O_2 detector.
6. Inspect the replacement O_2 detector for damage.
7. Fit the replacement O_2 detector (D) in position using the M4 socket head cap screw (A), spring washer (B) and plain washer (C) removed previously secure the O_2 detector to the base.
8. Connect the power cable by screwing it onto the mating connector on the O_2 detector.
9. Connect the BNC cable to the O_2 detector.
10. Close the door of the electrical compartment and restart the analyzer.

12.15.2 Replace O_2 detector (type 2)

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.

3. Disconnect the Bayonet Neill–Concelman (BNC) cable and the power cable from the O_2 detector (D).



A. M4 socket head cap screw
B. M4 spring washer
C. M4 plain washer
D. O_2 detector sub-assembly
E. M4 countersunk screw
F. M3 socket head cap screw
G. M3 spring washer
H. M3 plain washer
I. Bracket

4. Remove and retain the two M3 socket head cap screws (F), spring washers (G), and plain washers (H) used to secure the O_2 detector bracket (I) to the base.
5. Remove and retain the M4 socket head cap screw (A), spring washer (B), plain washer (C), and the M4 counter sunk screw (E) used to secure the O_2 detector to the bracket.
6. Remove the O_2 detector.
7. Inspect the replacement O_2 detector for damage.
8. Fit the replacement O_2 detector (D) in position. Using the M4 socket head cap screw (A), spring washer (B), plain washer (C), and the M4 counter sunk screw (E), secure the O_2 detector to the bracket.
9. Use the two M3 socket head cap screws (F), spring washers (G) and plain washers (H) to connect the O_2 detector and bracket (I) to the base.
10. Connect the power cable by screwing it onto the mating connector on the O_2 detector.
11. Connect the BNC cable to the O_2 detector.
12. Close the door of the electrical compartment and restart the analyzer.

12.16 Replace the main terminal board

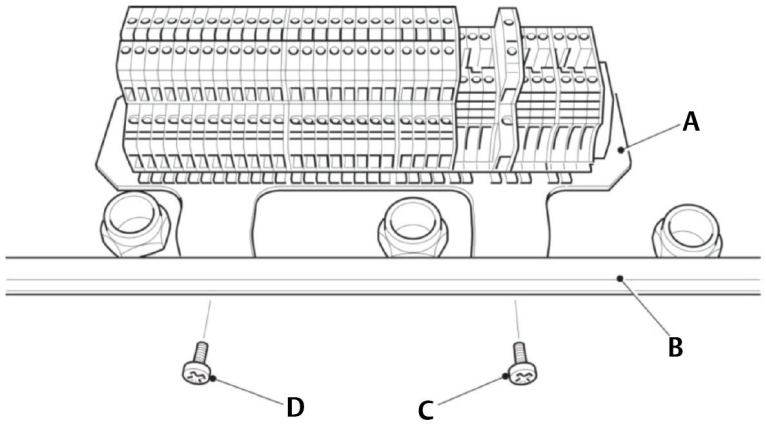
Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Open the door of the electrical compartment.
3. Tag or otherwise identify all wiring harnesses before disconnecting.

NOTICE

It is possible to replace individual terminal blocks in the main terminal board without removing the complete main terminal block.

4. Disconnect the wiring harnesses from the main terminal board.

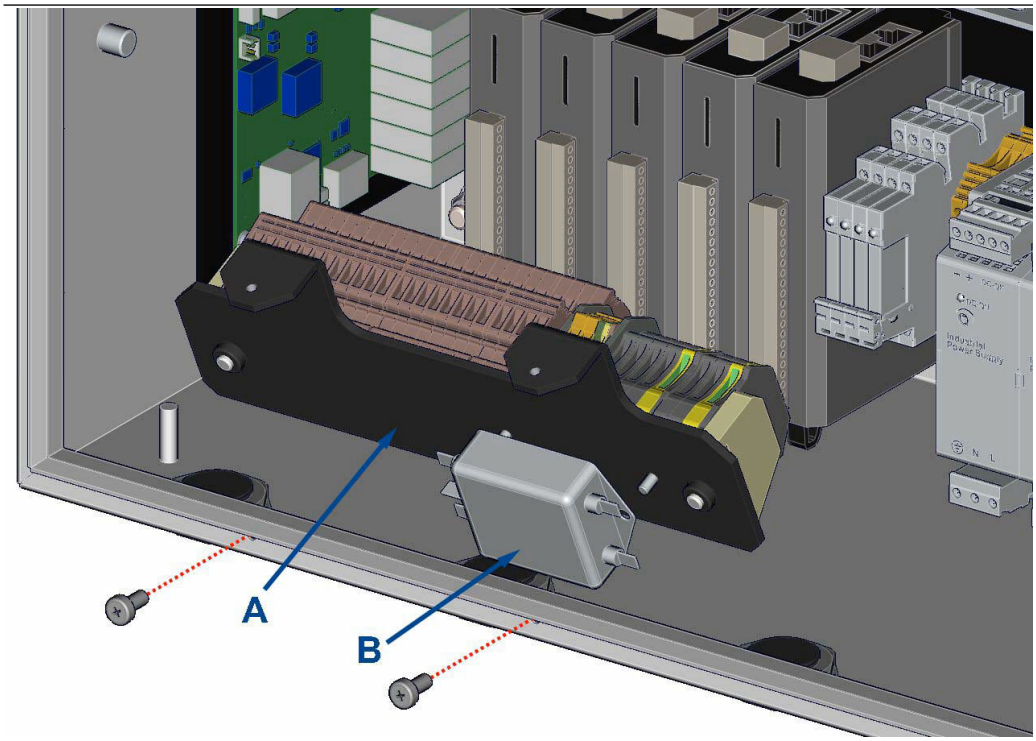


A. Main terminal board
B. Carcass
C. M5 x 12 mm self-sealing cross pan head screw
D. M5 x 12 mm self-sealing cross pan head screw

5. Remove and discard the two self-sealing screws (C and D).
6. Remove the main terminal board.
7. Inspect the replacement main terminal board for damage.
8. Fit the main terminal board (A) in position at the front of the carcass (B).
9. Secure the main terminal board by fitting the two self-sealing screws (C and D).
   Use new self-sealing screws.
10. Connect the wiring harnesses to the main terminal board.
11. Close the door of the electrical compartment and restart the analyzer.

12.17 Replace the mains power filter

The mains power filter is located on the underside of the main terminal board. Its purpose is to protect the analyzer against spikes and surges in the mains power.



A. Mains terminal board
B. Power filter

Procedure

1. Remove the main terminal board.
2. Turn the main power terminal board upside down.
3. Disconnect the wiring harnesses from the mains power filter.
4. Remove and retain the two nuts that secure the mains power filter to the underside of the main terminal board.
5. Remove and discard the mains power filter.
6. Inspect the replacement mains power filter for damage.
7. Fit the mains power filter to the main terminal board and secure with the two nuts retained in Step 4.
8. Connect the wiring harnesses to the mains power filter.
9. Fit the main terminal board.

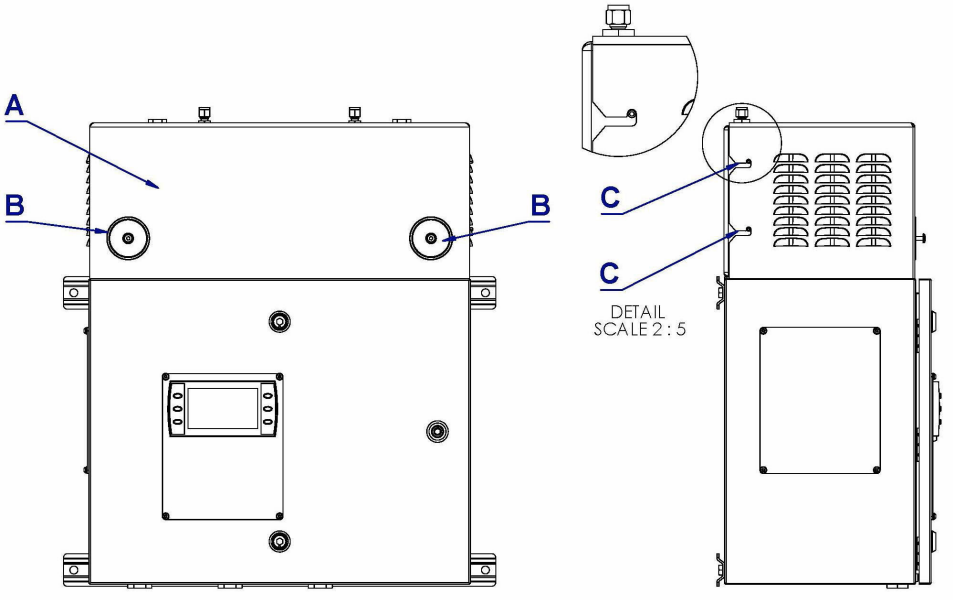
12.18 Remove the top cover

To gain access to the pneumatic compartment, it is necessary to remove the top cover.

Procedure

1. Rotate the two locking mechanisms counterclockwise to release the front of the top cover.

Figure 12-12: Removing the Top Cover

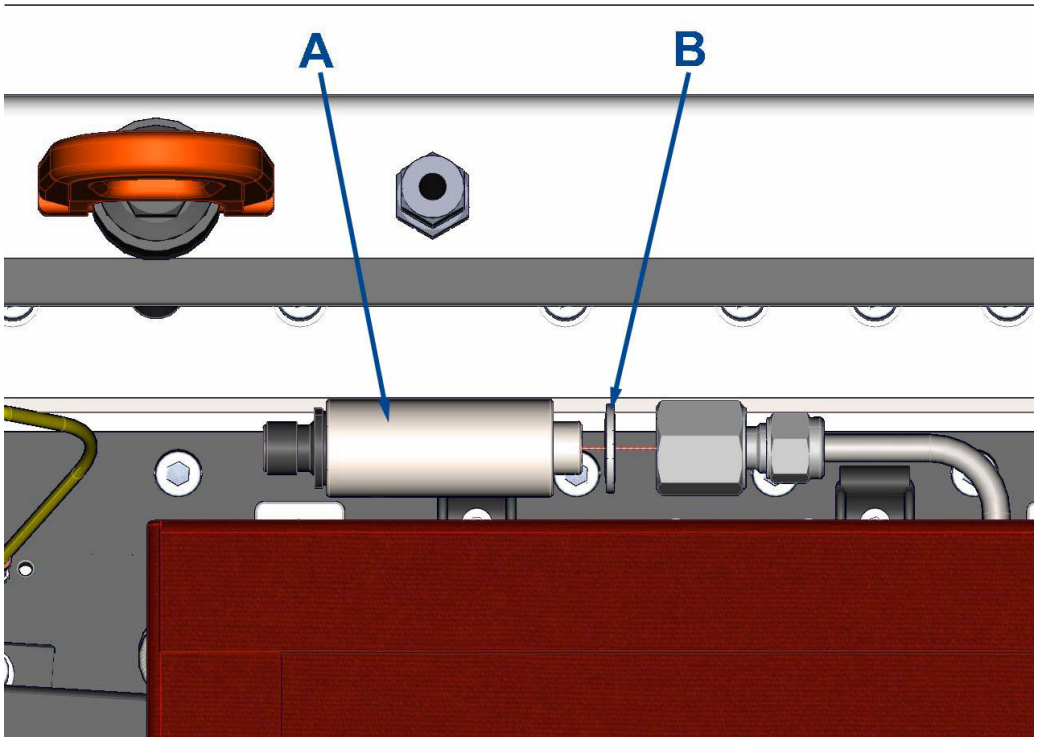


A. Top cover
B. Locking mechanism
C. Notches

2. Lift the top cover a short distance upwards and then forwards to disengage the right-angled notches (C) on the top cover from the mating lugs on the chassis beneath.
3. Lift the top cover clear of the analyzer.
4. Examine the top cover for signs of physical damage.
5. Inspect all wiring positions/cables runs to ensure nothing can get trapped/nipped when the cover is refitted; use cable ties if required.
6. Carefully lift the top cover into position.
7. Re-engage the right-angled notches (C) on the top cover from the mating lugs on the chassis beneath.
8. Rotate the two locking mechanisms (A) clockwise to lock the front of the top cover (B) in position.

   Refer to Figure 12-12.

12.19 Replace the pressure sensor



A. Pressure sensor
B. Dowty washer

Procedure

1. Carefully cut and remove any cable ties that secure the gas sensor wiring harness.
2. Disconnect the gas sensor wiring harness from connector block on the DIN rail.
3. Use a spanner on the sensor's 6¼ mm hex fitting and remove the sensor from the baseplate.
4. Discard the faulty sensor and Dowty washer.
5. Inspect the replacement sensor and washer for damage. If, damaged, contact your local Customer care Representative.
6. Insert the replacement Dowty washer on the base of the temperature sensor and insert into the baseplate.
7. 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.

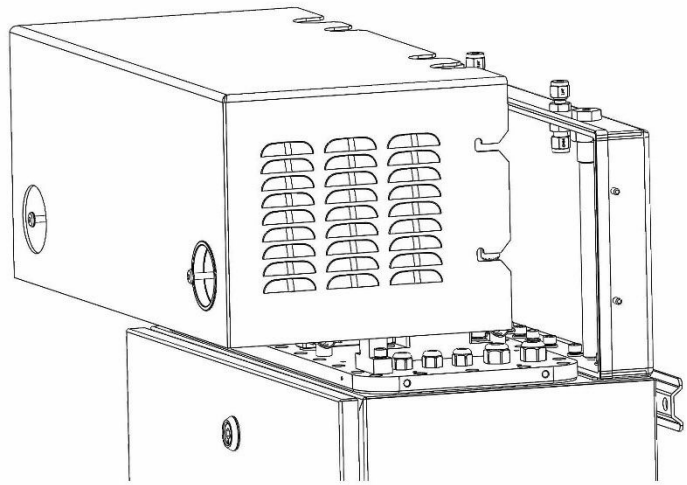
8. Reconnect the wiring harness and fit with cable ties.

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 the analyzer.

12.20 Replace the PT100 cell temperature sensor

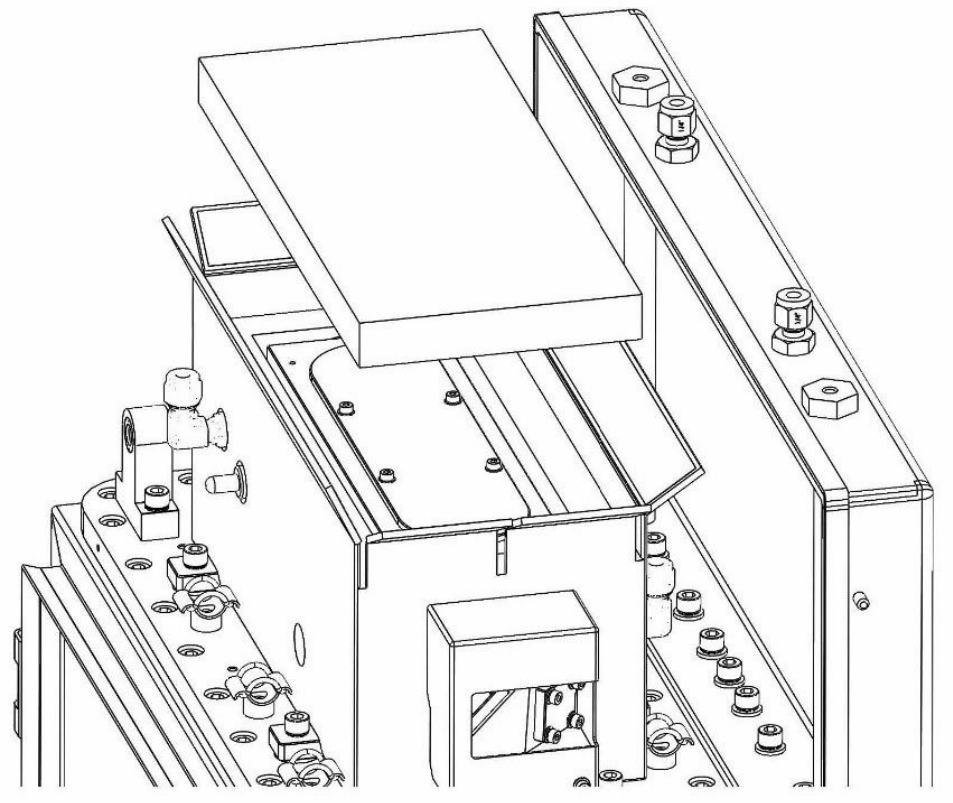
Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Remove the top cover.



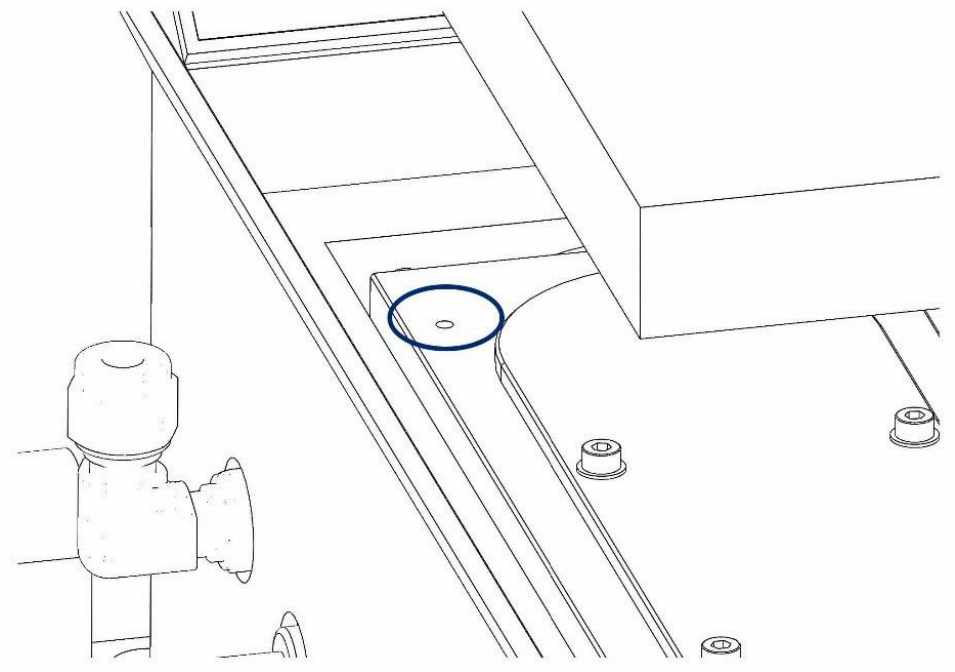
3. Tag or otherwise identify all wiring harnesses connected to the PT100 cell temperature sensor disconnecting.
4. Note the routing of the PT100 cell temperature sensor wiring and the location of any cable ties used.

5. Open the insulation around the analysis cell and remove the top section of insulation.



6. Carefully cut and remove any cable ties and release any cable clips used to secure the PT100 cell temperature sensor wiring.
7. Disconnect the PT100 cell temperature sensor wiring.

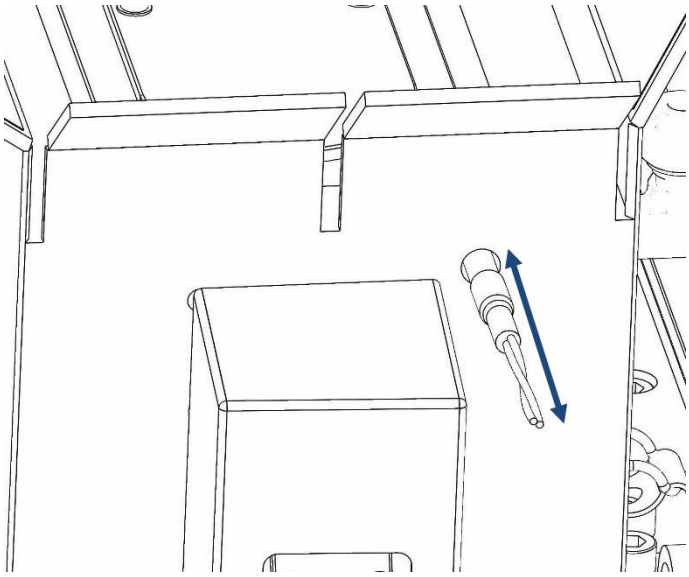
8. Loosen the grub screw, located at the top of the cell, used to secure the PT100 cell temperature sensor.



9. Taking hold of the wires next to the insulation, gently pull the PT100 cell temperature through the insulation until it is free.

Note
The hole diameter in the insulation is slightly smaller than the diameter of the PT100.

10. Install the new PT100 cell temperature sensor in the analysis cell, taking care not to damage/kink the cables at the end of the sensor when pushing the sensor through the insulation.



11. Tighten the grub screw to secure the PT100 cell temperature sensor in position.
12. Route the PT100 cell temperature sensor wiring , as noted in Step 3.
13. Secure the gas temperature sensor wiring harness with cable ties and cable clips in the locations that were noted in Step 3.
14. Refit the top section of insulation.
15. Fit the top cover and restart the analyzer.

12.21 Cleaning the cell mirrors

Only clean the cell mirrors during service intervention if there is a decrease in the laser pulse amplitudes that is likely caused by contamination of the cell.

⚠ CAUTION

Always take anti-static precautions, using a static dissipative mat and anti-static wrist strap when handling electronic components and assemblies.

12.21.1 Equipment materials

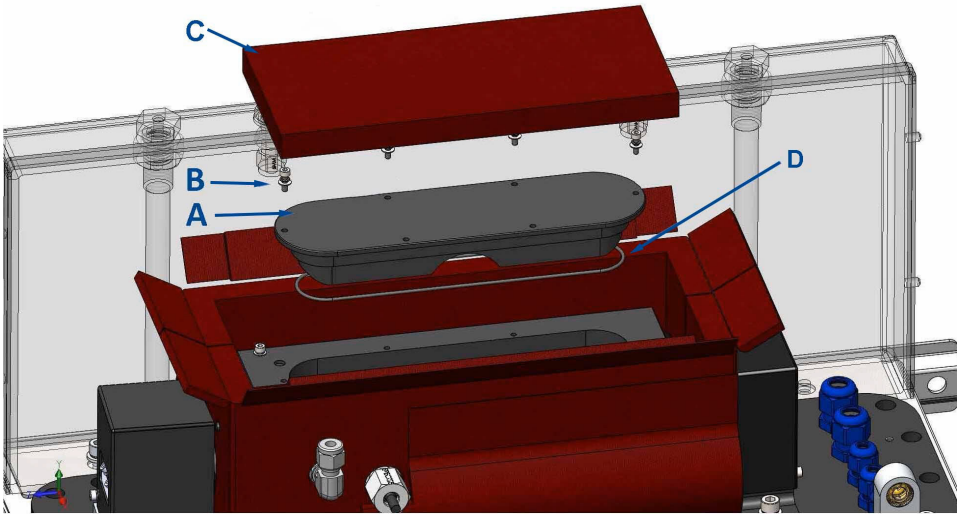
The following equipment and materials are required when cleaning the cell mirrors:

- Spectroscopic grade methanol or ethanol
- Optical grade lens tissue
- Invertible air duster
- Hex head keys, sizes 1.5 mm to 4 mm

12.21.2 Remove the cell lid

Procedure

1. Shut down the analyzer.
   Refer to Shutdown procedure.
2. Remove the analyzer top cover.
   Refer to Remove the top cover.
3. Tag or otherwise identify all wiring harnesses before disconnecting.
4. The cell Insulation is closed using Velcro® flaps. Open the flaps and lift the cell lid insulation (C) to access the cell lid.
5. Remove and retain the six cell lid fasteners (B).
6. Remove the cell lid, taking care not to damage the O-ring seal (D).



A. Cell lid
B. Cell lid fasteners
C. Cell lid insulation
D. O-ring

12.21.3 Clean the cell mirrors with air duster

Emerson recommends initially cleaning the cell mirrors with an invertible air duster to remove any particulates or dust that may have contaminated the surface. Following cleaning with the air duster, check the pulses to see if any improvement has been made.

Procedure

1. Before using the aerosol, test it away from the mirrors a few times to remove any moisture in the aerosol.
   Do not touch the mirrors.

2. Use only short bursts of around one second of air on each mirror. Apply three or four short bursts to each mirror.
3. Re-assemble the analysis cell.
4. Plug in the electrical connectors and start up the sensor.

Postrequisites

Allow the cell temperature to stabilize and check the pulses in the gas sensor software. If pulses have returned to a usable signal size, proceed to operate the analyzer. Otherwise, take a note of the signal sizes and go to next step Clean the mirrors with lens tissue and spectroscopic grade methanol.

12.21.4 Clean the mirrors with lens tissue and spectroscopic grade methanol

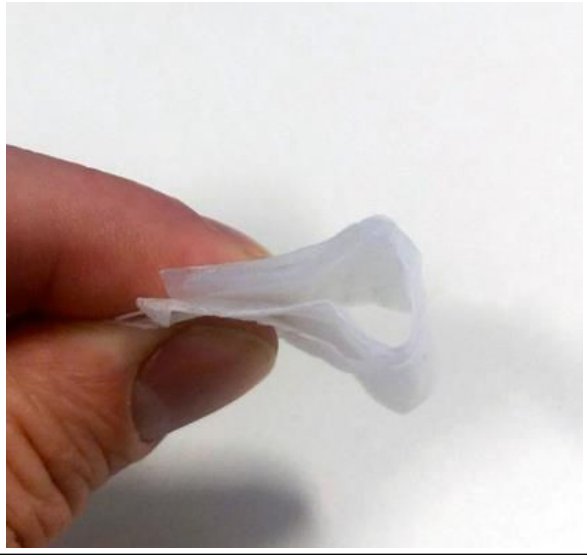
If cleaning with an invertible air duster does not recover the pulses to a useable level, try cleaning with spectroscopic grade methanol and optical grade lens tissue.

⚠ CAUTION

Clean with care, as the mirrors have highly polished surfaces, which may be damaged by contact cleaning.

Procedure

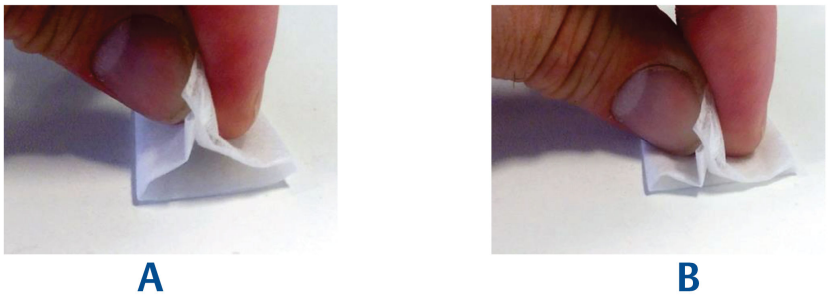
1. Fold a piece of lens tissue several times to produce a soft loop of tissue.



2. Apply a small amount (one or two drops) of spectroscopic grade methanol to the front of the tissue loop.

3. To prevent scratching the mirrors do not apply any direct pressure to the mirrors.

Figure 12-13: Correct Cleaning Technique



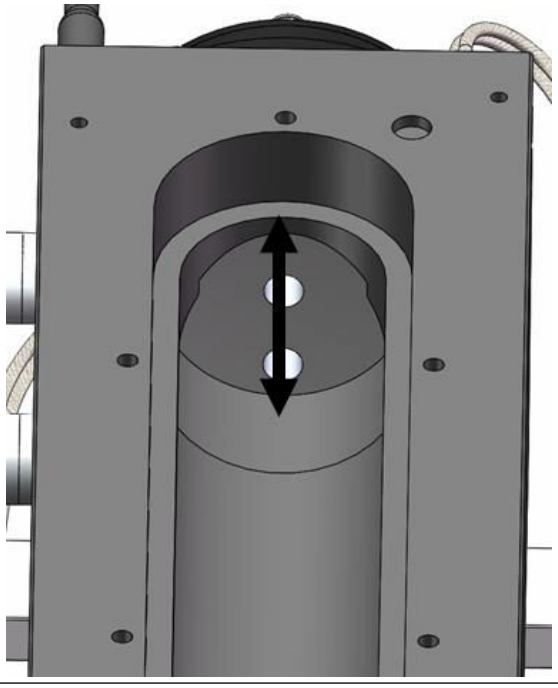
A. Correct
B. Incorrect

4. Clean the mirrors using the lens tissue in the direction shown in Figure 12-14.

⚠ CAUTION

Be careful to wipe across the mirror surface to prevent any residue marks appearing on the mirror surface where the solvent has evaporated.

Figure 12-14: Cleaning the Mirrors



5. Reassemble the analysis cell.

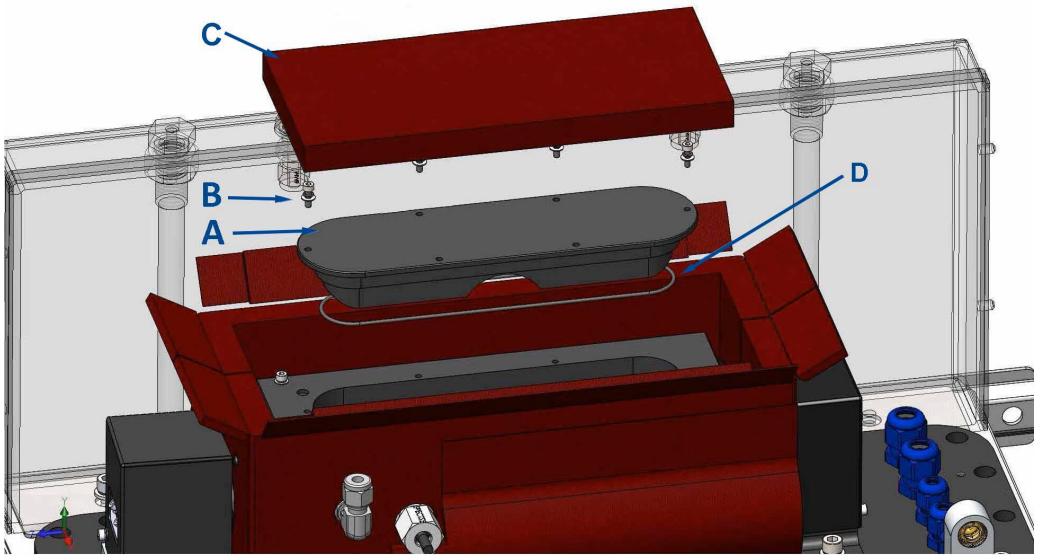
See Assemble the analysis cell .

6. Plug in the electrical connectors and start up the sensor.
7. Allow the cell temperature to stabilize and check the pulses in the gas sensor software. If the pulses have returned to a usable signal size proceed to operate the analyzer.

Note
If pulses have not returned to a usable signal size, contact Emerson for assistance.

12.21.5 Assemble the analysis cell

Figure 12-15: Assembling Analysis Cell



A. Cell lid
B. Cell lid fasteners
C. Cell lid insulation
D. O-ring

Procedure

1. Fit the O-ring (D) to the cell lid (A).
2. Pass the cell lid insulation (C) over the bracket before attaching the bracket (E) to the cell lid using the bracket fastener (G).
3. Fit the cell lid Insulation into position and secure using the Velcro® flaps.

12.22 Spare parts list

Item	Part No.	Description	Picture
240 V heater cartridge	P-6000-00321	Watlow cartridge ¼-in. OD x 190 mm x 200 W	
Relay, Crouzet	P-6001-00045	Solid state relay, 10 A, 280 Vac	
Temperature sensor	P-6000-00718	PT100 stainless steel 0.24-in. (6 mm) 752 °F (400 °C)	
Analog output module	P-6001-00013	Module, Moxa Ethernet 6 Channel, analog	
Digital output module	P-6001-00012	Module, Moxa Ethernet 6 Channel, digital	
Display screen	P-6001-00219	Panel mount display module	
TEC detector	E-4004-6303-B	Module, detector TEC	N/A
O_2 detector	P-6001-00040	Detector, O_2	N/A
Heater 120 V, certified	P-6001-00015	SL Blocktherm DKA 80 W heater block	
Power supply 12 V	P-6001-00017	72 W switch mode DIN rail panel mount power	
Power supply 24 V	P-6001-00018	90 W switch mode DIN rail panel mount power	
Mirror	M-1000-3420	Mirror, general steering, 0.8 x 0.8 in. (20 x 20 mm)	N/A
Main cell window	M-1000-0178	Window, cell main	N/A

Item	Part No.	Description	Picture
Output cell window	M-3000-1454-03	2M / 5M cell output window assembly (low temperature gold cor)	N/A
Input cell window	M-3000-0738-03	2 M / 5 M cell input window assembly (low temperature gold cor)	N/A
O-ring material is selected based on the sample gas analyzed. Standard O-rings ONLY are listed below. Contact cascade.support@emerson.com to confirm the material selection for the gas being analyzed.			
Cell window	P-6000-00108	O-ring, 1.5 x 0.06 in. (37.1 x 1.5 mm) Viton®, cell window	N/A
Inner cell window	BS029V75	O-ring BS029 - 1.49 x 0.07 in. (37.82 x 1.78 mm) Viton, cell window inner	N/A
Cell lid	P-6000-00245	O-ring 4.74 x 0.07 in. (120.37 x 1.78 mm) Viton, cell lid	N/A

13 Preventative maintenance

13.1 Cleaning the analyzer

⚠ WARNING

ELECTRIC SHOCK

The analyzer operates using mains voltage, which may cause death or serious injury to personnel. Death, personal injury, and/or damage to persons and/or property may result if this is not observed.

Confirm that the cirucit breakers are set to **OFF** and locked out and tagged out before cleaning. The analyzer must be earthed.

13.1.1 Clean external surfaces

Prerequisites

Important
The door and top cover must be closed.

Procedure

1. Shut down the analyzer as described in Shutdown procedure.
2. To clean the exterior surfaces of the analyzer, dampen and then wring out a clean cloth with a mild liquid general purose detergent.

   ⚠ CAUTION

   EQUIPMENT DAMAGE

   Do not drench the cloth to avoid liquid entering the system. Do not apply detergent to the display, as this may damage the screen.
3. Using a clean dry cloth, dry the analyzer after cleaning.

13.1.2 Clean internal surfaces

⚠ CAUTION

EQUIPMENT DAMAGE

Under no circumstances can da damp cloth be used to clean components inside the analyzer (the only exception being when cleaning the cell mirrors).

Procedure

1. Shut down the analyzer as described in Shutdown procedure.

2. Use an invertible air duster to remove andy dust build up from inside the analyzer.

   Before using the aerosol, test it away from the analyzer a few times to remove any moisutre from inside the aerosol.

3. Use only short bursts to remove any debris, taking care to blow material away from the mirrors/lasers and detector.

13.2 Maintaining the analyzer

⚠ 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.

13.3 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 13-1.

Table 13-1: 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.
Every three months (quarterly)	1. Perform the monthly check detailed in the previous row. 2. Purge the long path cell mirrors. 3. Check the X-Shift calibration of the lasers. Contact your local service representative for guidance.
Annually	1. Perform the three-monthly check detailed in the previous row. 2. Perform a laser wavelength calibration. Contact your local service representative for guidance.

A Engineering drawings

Use the wiring diagrams for the Rosemount CT5100 analyzer to assist with troubleshooting faults. You can use these diagrams to locate the position of a wiring connector should it become disconnected.

Table A-1: List of Engineering Drawings

Drawing number	Description
W-2000-0035 (Sheets 1-5)	Rosemount CT5100 heated

GENERAL NOTES:

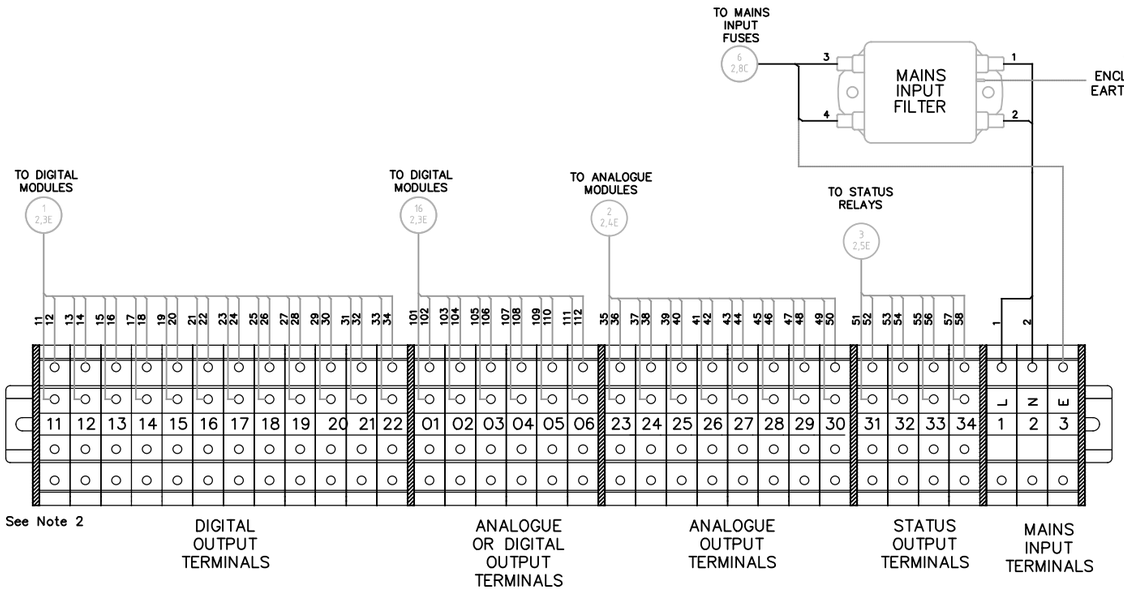
1.MAXIMUM NUMBER OF USER TERMINALS SHOWN, THESE MAY BE REDUCED DEPENDANT ON NUMBER AND TYPE OF ANALOGUE/DIGITAL OUTPUTS REQUIRED.

2. MOXA MODULES MAY BE ANY COMBINATION OF ANALOGUE OUTPUT (E1241T) OR DIGITAL (E1214T) OR ANALOGUE INPUT (E1240T) TO A MAXIMUM OF FIVE

3. DETECTOR 2 IS OPTIONAL AND MAY BE OMITTED

4. THE RJ45 INTERFACE MODULE IS OPTIONAL AND MAY BE OMITTED

5. UP TO A MAXIMUM OF 6 LASERS MAY BE FITTED



USER CONNECTIONS	
TERMINAL	FUNCTION
1	SENSOR SYSTEM SUPPLY (L)
2	SENSOR SYSTEM SUPPLY (N)
3	EARTH
11	DIGITAL OUTPUT 1
12	DIGITAL OUTPUT 2
13	DIGITAL OUTPUT 3
14	DIGITAL OUTPUT 4
15	DIGITAL OUTPUT 5
16	DIGITAL OUTPUT 6
17	DIGITAL OUTPUT 7
18	DIGITAL OUTPUT 8
19	DIGITAL OUTPUT 9
20	DIGITAL OUTPUT 10
21	DIGITAL OUTPUT 11
22	DIGITAL OUTPUT 12
23	ANALOGUE OUTPUT 1
24	ANALOGUE OUTPUT 2
25	ANALOGUE OUTPUT 3
26	ANALOGUE OUTPUT 4
27	ANALOGUE OUTPUT 5
28	ANALOGUE OUTPUT 6
29	ANALOGUE OUTPUT 7
30	ANALOGUE OUTPUT 8
31	STATUS OUTPUT 1 (Check Function)
32	STATUS OUTPUT 2 (Maintenance Required)
33	STATUS OUTPUT 3 Out Of Specification)
34	STATUS OUTPUT 4 (Failed)
01	ANALOGUE OR DIGITAL INPUT / OUTPUT
02	ANALOGUE OR DIGITAL INPUT / OUTPUT
03	ANALOGUE OR DIGITAL INPUT / OUTPUT
04	ANALOGUE OR DIGITAL INPUT / OUTPUT
05	ANALOGUE OR DIGITAL INPUT / OUTPUT
06	ANALOGUE OR DIGITAL INPUT / OUTPUT

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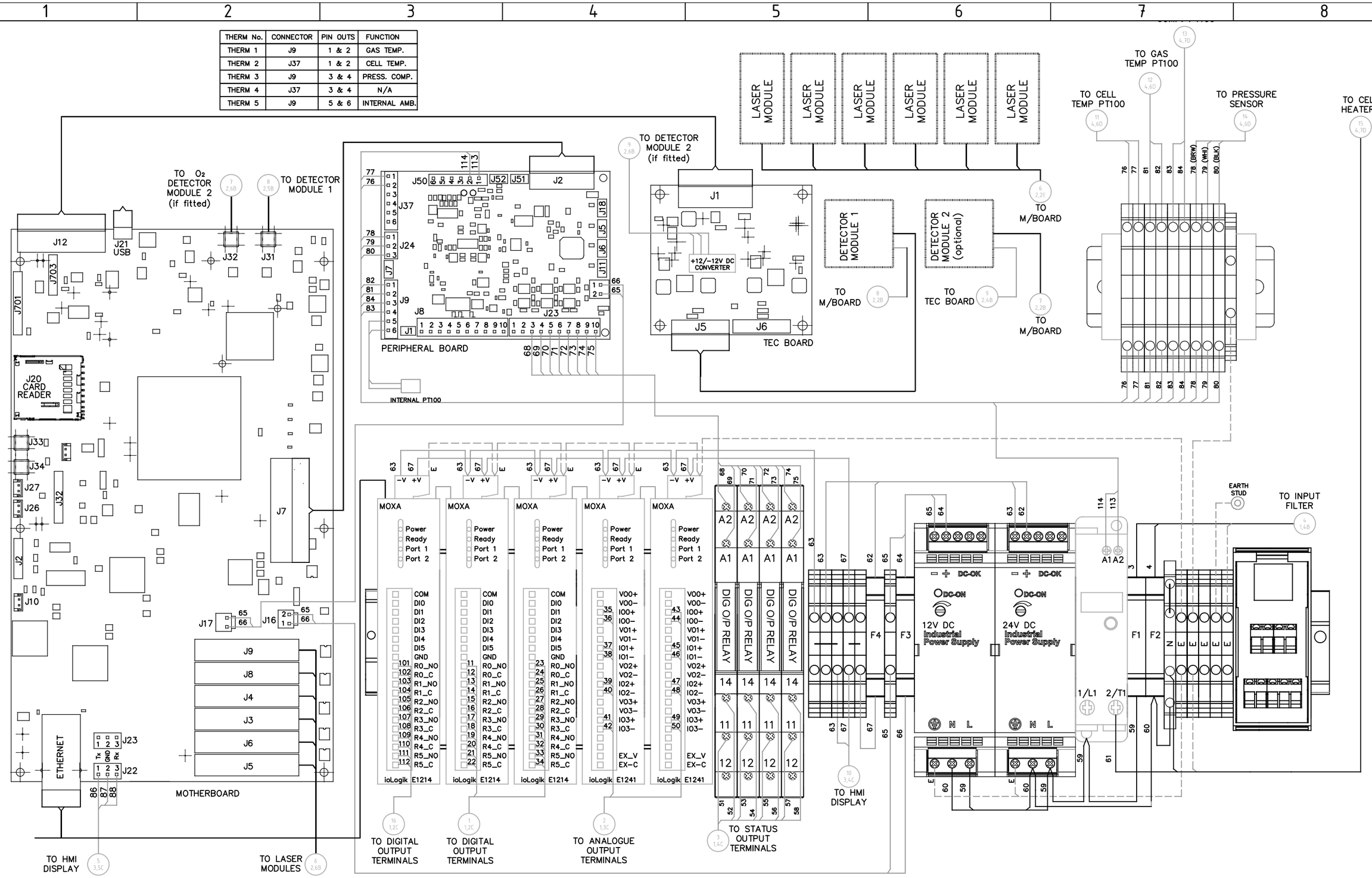
CHECKED BY	DMC
ISSUE DATE	27/04/2020

SHEET 1 OF 5

1 / 1,2A — BALLOON I.D. NO. / DRAWING SHEET LOC. / DRAWING SHEET NO.

THERM No.	CONNECTOR	PIN OUTS	FUNCTION
THERM 1	J9	1 & 2	GAS TEMP.
THERM 2	J37	1 & 2	CELL TEMP.
THERM 3	J9	3 & 4	PRESS. COMP.
THERM 4	J37	3 & 4	N/A
THERM 5	J9	5 & 6	INTERNAL AMB.



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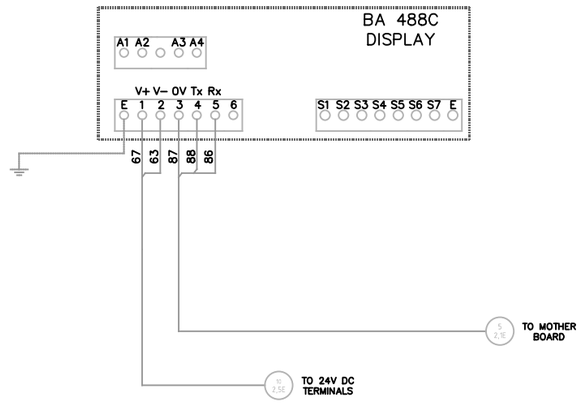
SHEET 2 OF 5

BALLOON I.D. NO.
DRAWING SHEET LOC.
DRAWING SHEET NO.

DRG No:W-2000-0035 REVISION:D
DATE LAST SAVED:27-Apr-20 11:45 SAVED BY:E1290412
TEMPLATE: 7.3.3.00001-06

VIEW ON REAR OF FRONT COVER



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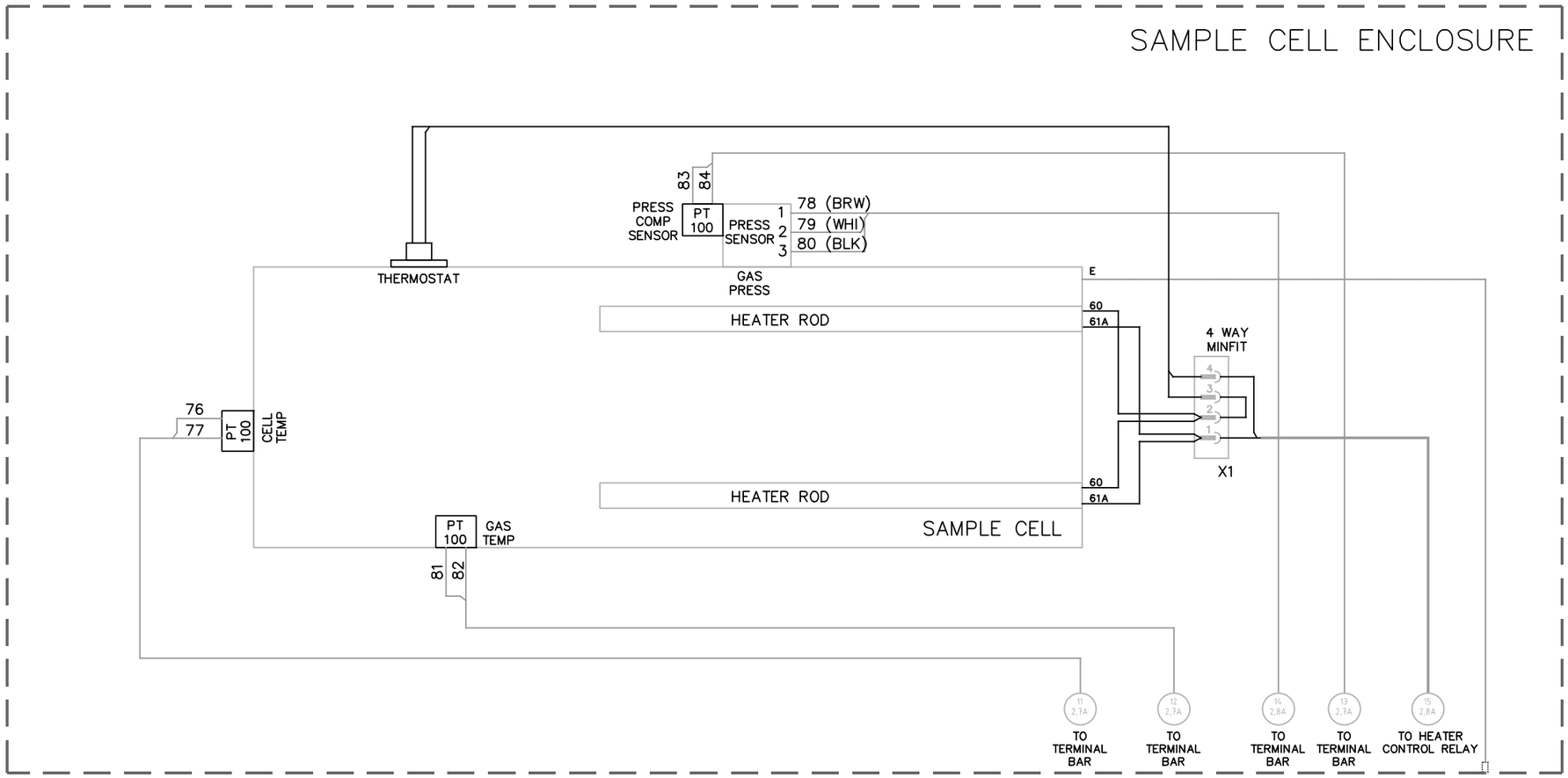
DRG No:W-2000-0035 REVISION:D
SAVED BY:E1290412
DATE LAST SAVED:27-Apr-20 13:23
TEMPLATE: 7.3.3.00001-06



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SHEET 4 OF 5

1 / 1,2A — BALLOON I.D. NO. / DRAWING SHEET LOC. / DRAWING SHEET NO.

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SAVED BY:E1290412
DATE LAST SAVED:27-Apr-20 13:23
TEMPLATE: 7.3.3.00001-06

MOD / REV	DESCRIPTION OF CHANGE	CCAR	BY / DATE	APR'D / DATE
C	TRANSFERRED TO NEW TEMPLATE, STATUS RELAYS ON SHEET 2 ENLARGED FOR CLARITY OF READING. CHANGE CONTROL SHEET ADDED	CN 1572	JMC 19/10/18	MD 20/10/18
D	UPDATED DIAGRAMS TO INCLUDE 5th MOXA FOR GENERAL PURPOSE CERTIFICATION	CN 2005	BG 27/04/20	

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