

Rosemount™ CT5100 QSG Continuous Gas Analyzer



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.

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.

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

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 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.

Use only replacement parts and components authorized by Emerson.

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**

Some parts of the analyzer may be heated to 374 °F (190°C). 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 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 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

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

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 7-1](#) and [Figure 7-2](#).

⚠ 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.

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1 Introduction

1.1 Description

The Rosemount™ CT5100 Continuous Gas Analyzer, referred to hereafter as the Rosemount CT5100, or analyzer, is an electronic sensor that uses laser spectroscopy to perform analysis of process gas streams.

Important

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

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](#) .

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

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

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

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 document describes the software version as: 5.7.13.

2 Description

2.1 System overview

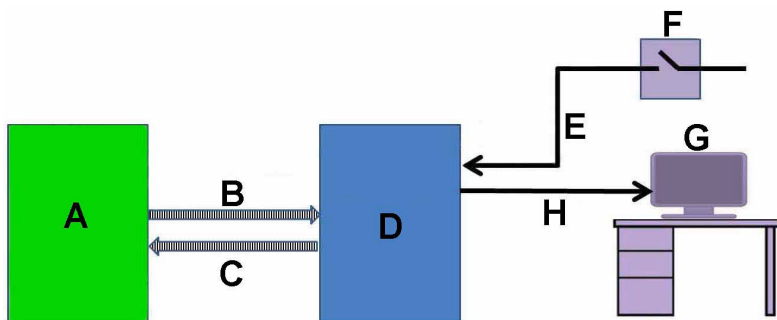
A complete Rosemount™ CT5100 system consists of the analyzer, and the associated interconnecting wiring and gas piping.

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

The 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 2-1](#), 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.

Figure 2-1: 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 inlet and outlet ports that can be connected to a gas handling system and control and analysis electronics. The number of

lasers installed depends upon customer requirements. The complete system operates at either 110 or 240 Vac 50/60 Hz supply.

3 Specifications

3.1 Detailed system specifications

Table 3-1 gives the physical characteristics of the analyzer. Schematic diagrams of the sensor and mounting points are shown in Figure 3-1 and Figure 3-2. Table 3-2 gives the general characteristics of the analyzer.

Table 3-1: 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

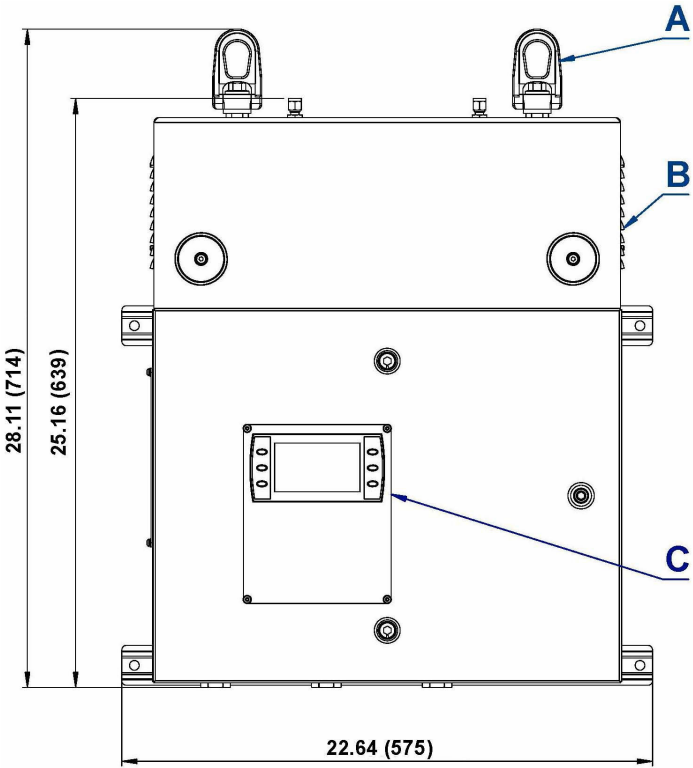
Table 3-2: General Characteristics

Rosemount CT5100	Value	Units	Comment
Instrument supply voltage	110 to 240	Vac	50/60 HZ \pm 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, CaF ₂ windows, and FKM (typically Viton™) or FFKM (typically Kalrez™) O-rings

Table 3-2: General Characteristics (continued)

Rosemount CT5100	Value	Units	Comment
Measurement technique	N/A	N/A	Mid infrared (IR) absorption spectroscopy
Mid IR source	N/A	N/A	Quantum Cascade Laser
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	$\frac{1}{4}$ 6	in. mm	Swagelok® type, factory-configured, specify on order
Outlet (exhaust) gas port connector	$\frac{1}{4}$ 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

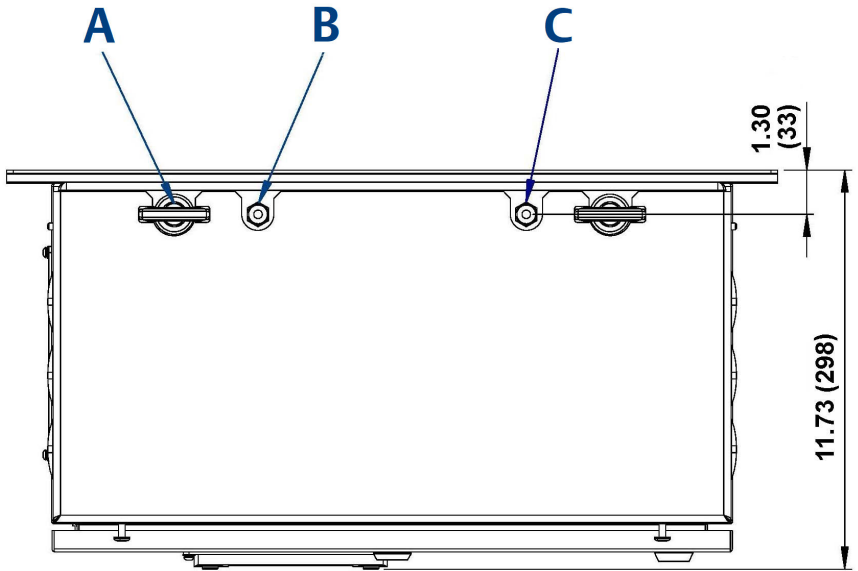
Figure 3-1: Rosemount CT5100 Dimensions - Front View



Dimensions are in inches (mm).

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

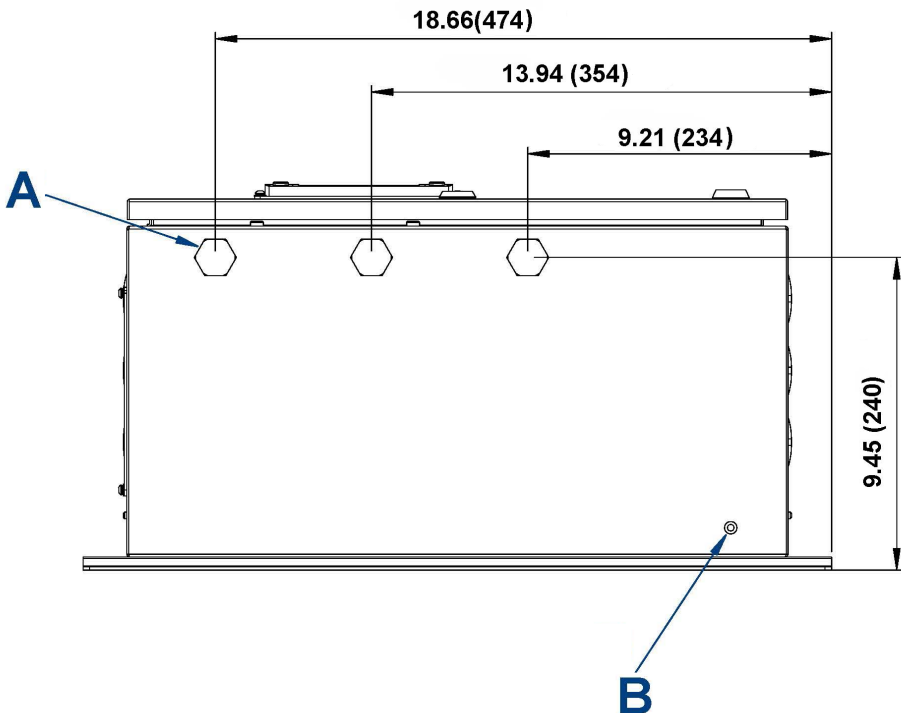
Figure 3-2: Rosemount CT5100 Dimensions - Top View



Dimensions are in inches (mm).

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

Figure 3-3: Rosemount CT5100 Dimensions - Bottom View



Dimensions are in inches (mm).

- A. Cable glands
- B. Earth point

Table 3-3: 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 particulate density	5	mg/m ³	Maximum
Sample gas particulate size	10	µm	Maximum

Table 3-3: Environmental Characteristics (continued)

Environmental characteristic	Value	Units	Comment
IP code	IP66 (electrical compartment enclosure) IP20 (optical compartment enclosure)	N/A	IP to IEC 60529
Sensor humidity range	10 to 95	%	Relative humidity (non-condensing) at 113 °F (45 °C)

4 Install

4.1 Site selection

The Rosemount CT5100 has a T3 temperature classification which specifies the maximum surface temperature 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.

4.2 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 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 properly 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.

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 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.

4.3 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 properly 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.

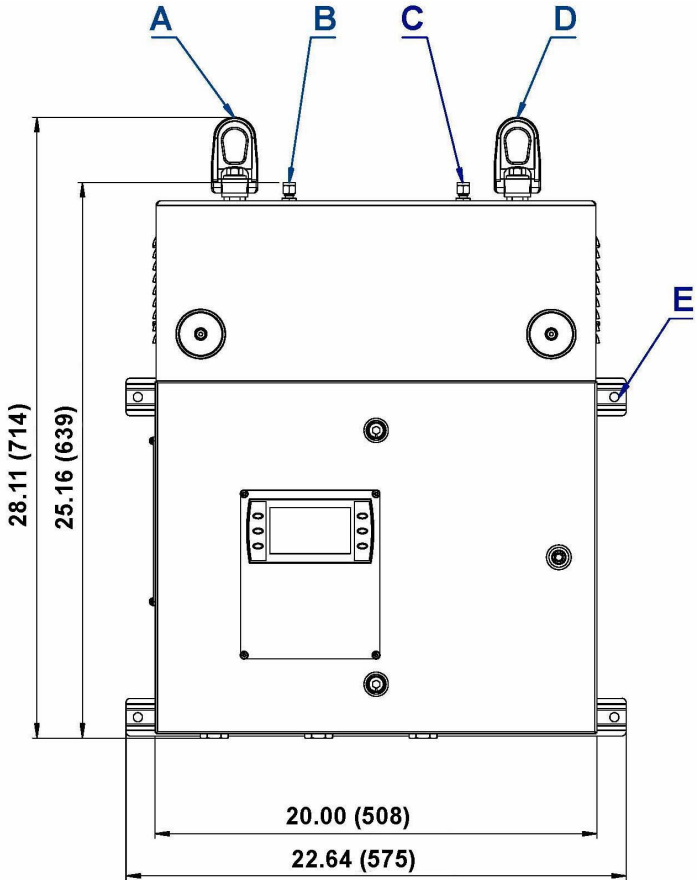
The analyzer weighs 117 lb. (53 kg).

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 4-1: Front View Dimensions



Dimensions are in inches (mm).

- 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

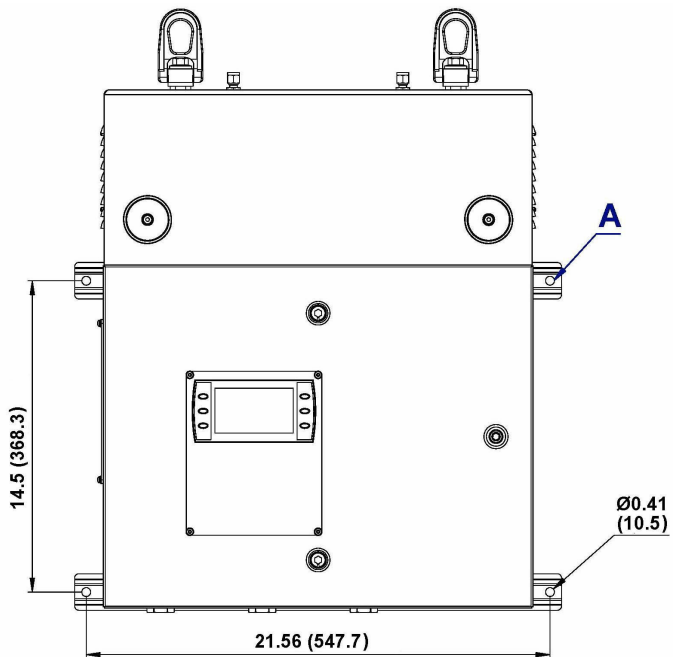
3. One person should carefully guide the equipment while the other person operates the lifting equipment.

4. Use safety approved and tested lifting equipment to lift the analyzer from the stable platform.
5. 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 4-2](#) shows the locations of the mounting points on the analyzer.
6. Mount the analyzer using four M8 ($\frac{3}{8}$ -in.) fasteners to attach to the wall. Do not overtighten the fasteners..

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

7. Remove the lifting eyes and retain them for future use.
Threads must be protected with a suitable grease and plastic grommets.

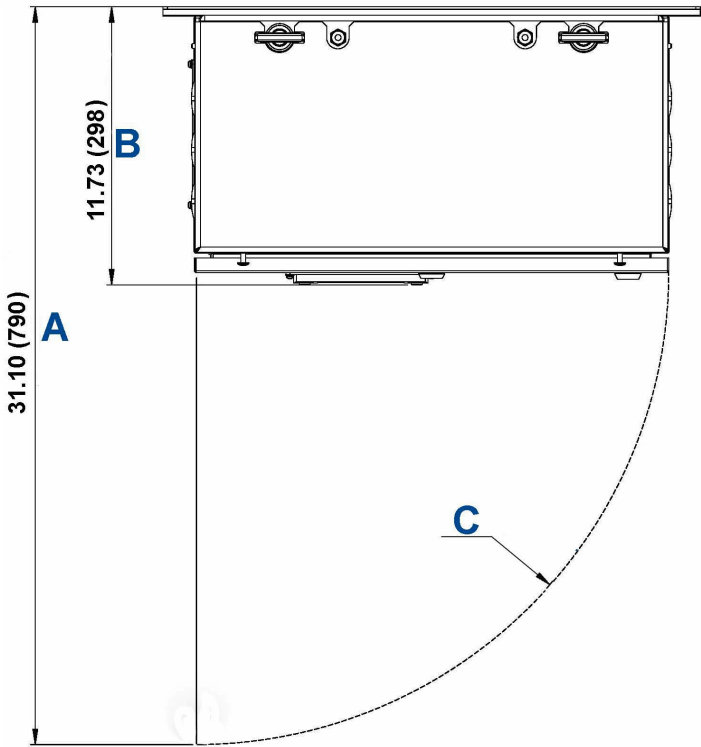
Figure 4-2: Mounting Details



Dimensions are in inches (mm).

A. *Mounting points*

Figure 4-3: Clearance with Door Open



Dimensions are in inches (mm).

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

Postrequisites

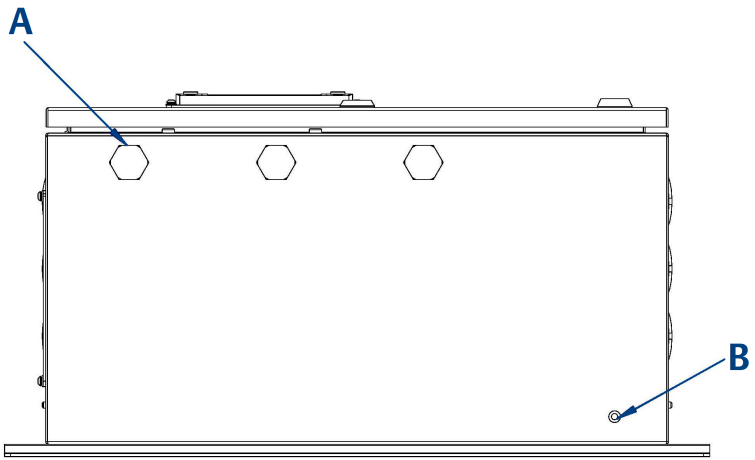
After mounting, do not place any additional load on the analyzer, or leave any loose items on flat surfaces.

4.4 Connecting the electrical/electronic inputs and outputs

4.4.1 AC power

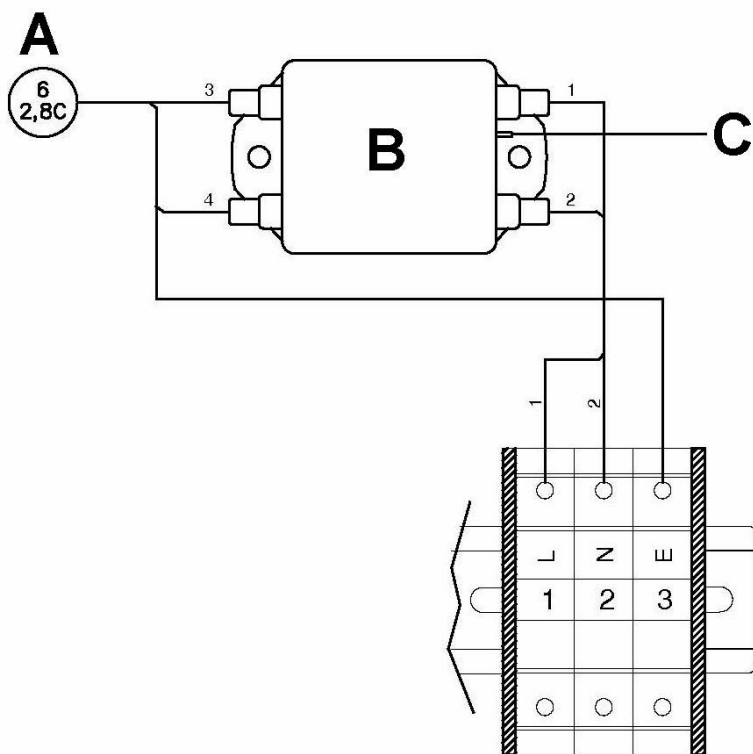
Power is connected to the analyzer instrumentation through the power entry point fitted to the base of the analyzer. Refer to [Figure 4-4](#).

Figure 4-4: 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 4-5: Power Entry Point Connections

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

Table 4-1: 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 4-6](#).

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

Table 4-2: Electrical Power Requirements

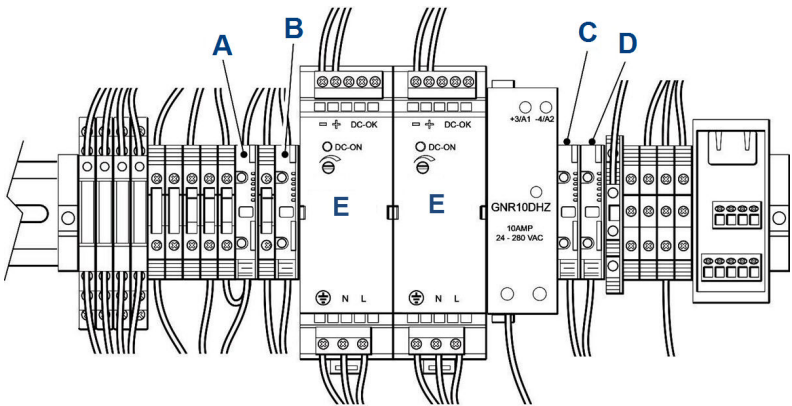
Electrical supply	Power consumption	Voltage	Fuse
Instrumentation supply voltage	500 W	100 to 230 Vac, 50/60 Hz ±10%	3.15 A internal fuses F1 and F2

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](#).

4.4.2 Fuses

Figure 4-6 shows the location of the fuses.

Figure 4-6: 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 4-3: 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
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

4.4.3 Connecting the sample supply and return line

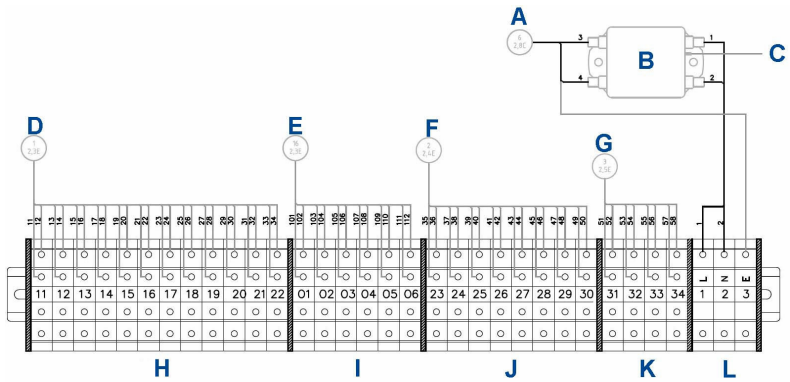
Sample gas supply and sample return connections are ¼-in. (6 mm) "Hamlet" compression tube fittings. To avoid the risk of gas leaks, confirm that these connections are made correctly and tightly. Both the sample gas supply pipe and the sample return pipe should be thermal insulated.

The maximum sample gas supply pressure is 2 BarG.

4.4.4 Connecting the signal cables

The signal cables are connected to the system through conduit outlets (B and C as shown in [Figure 1](#)). 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 4-7: 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 4-4: 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

Table 4-4: System Wiring (continued)

Terminal	Function
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	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

4.4.5 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.

4.4.6 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.

4.4.7 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.

4.4.8 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.

4.4.9 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.

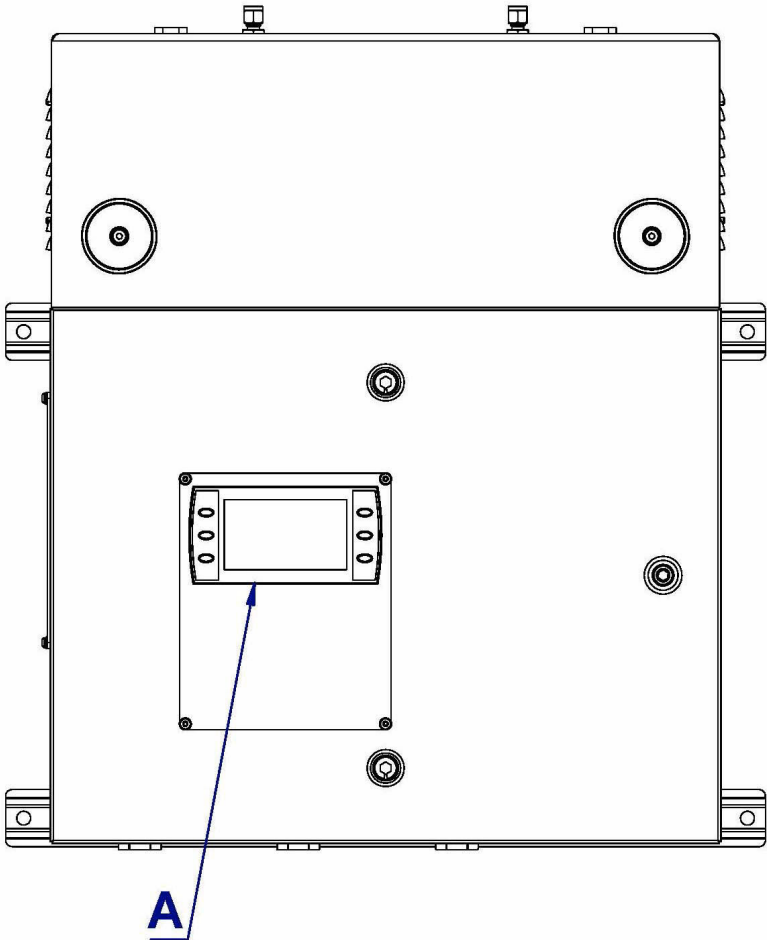
4.4.10 Commissioning

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.

5 Controls and display controller

5.1 Front panel controls and indicators

The Rosemount™ CT5100 is configured from the control display located on the front panel.



A. Display controller

NOTICE

ON/OFF circuit breaker

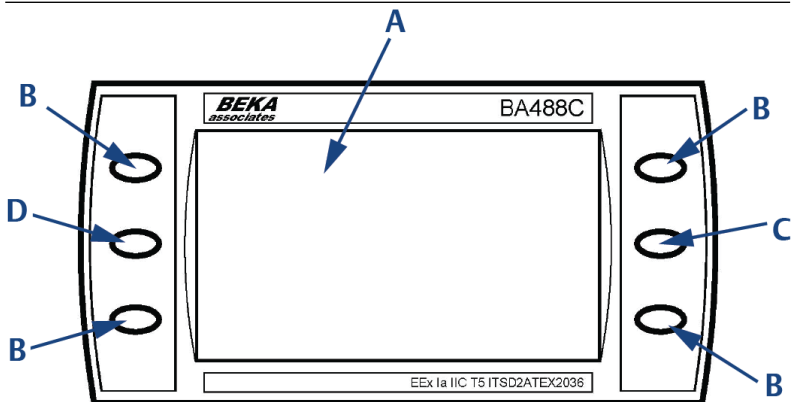
There is no **ON/OFF** switch on the analyzer. The external circuit breaker controls the application of electrical power to the analyzer.

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

The display controller controls operation of the analyzer.

5.2 Display controller

The six buttons on the display controller control operation of the Rosemount CT5100.



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

The LCD display can be used to display:

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

Use the two scroll buttons to 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.

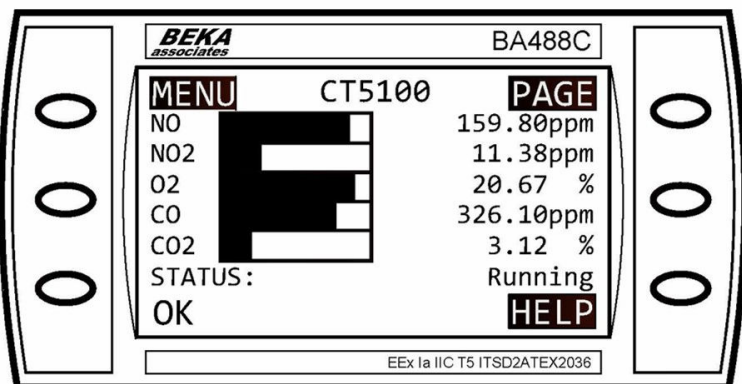
5.3 Gas Sensor Main Screen

When the analyzer is switched on at the end of the start-up procedure, the **Gas Sensor Main** screen 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.



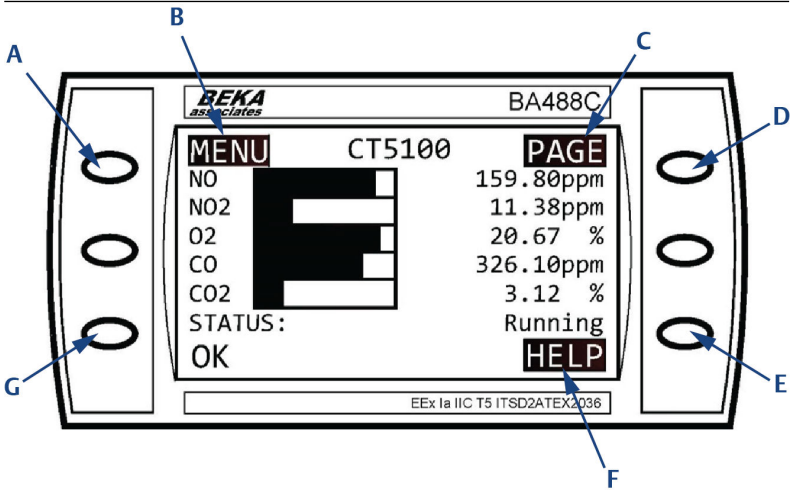
The **Gas Sensor Main** screen displays the gas concentration measurements obtained by the analyzer. In the example shown in the gases are being measured and, for each gas, the concentration detected is in parts per million (ppm).

The NO_x reading is the total nitrogen oxide reading, a combination of nitric oxide (NO) and nitrogen dioxide (NO₂).

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 the analyzer is **Running** and **OK** (e.g. no faults have been identified).

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.



- 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.

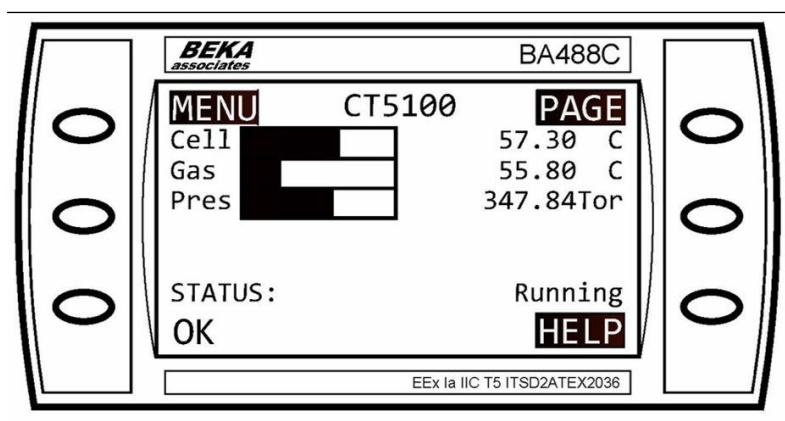
HELP A link to the *Help* system. Press to go to the *Help* screen (described in [Help system](#)).

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.

5.4 Pressure and Temperature screen

The *Pressure and Temperature* screen shows pressure and temperature measurements taken inside the analyzer.



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.

5.5 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.

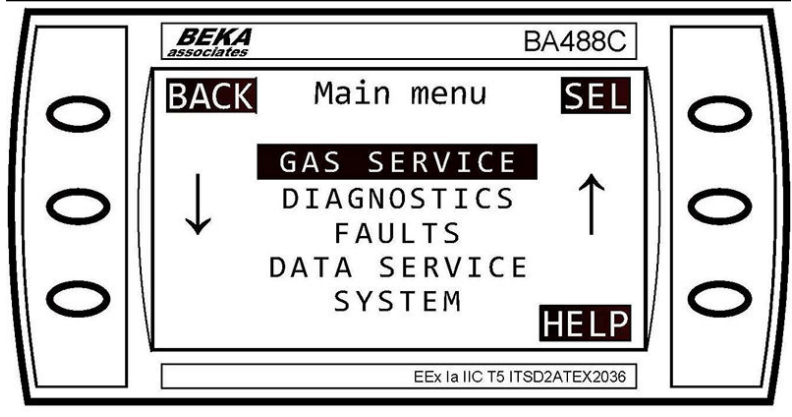
The help system contains a number of different **Help** screens, each conveying a different message. As the help system is context-sensitive, the **Help** screen that appears is the one that is most appropriate to the software function engaged when **HELP** was pressed. [Figure 5-1](#) shows an example of a **Help** screen.

Figure 5-1: Example of a Help Screen



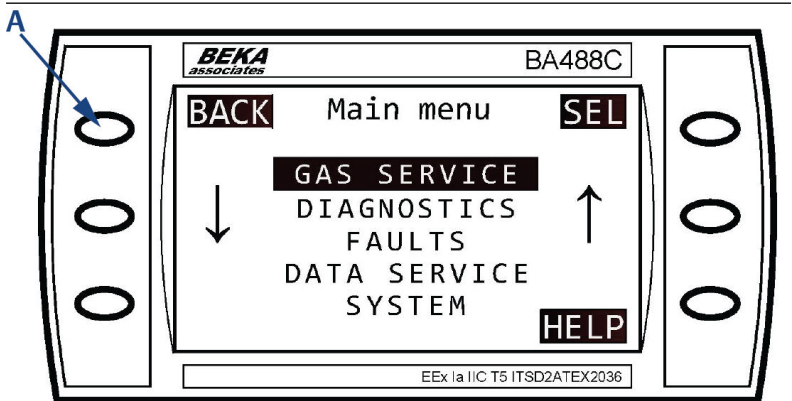
5.6 Main menu

To access the *Main menu*, press MENU on either side of the *Gas Sensor Main* screen (#unique_38/[unique_38_Connect_42_CT5100ExGasSensorMainScreen](#)) or the *Pressure and Temperature* screen (#unique_31/[unique_31_Connect_42_CT5100PressureandTemperatureScreen](#)). The *Main menu* is used for calibration, diagnostics, fault finding, downloading data, and shutting down the analyzer.



5.7 BACK button

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



A. *BACK* button

6 Start-up procedure

6.1 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

6.2 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.

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.

6.3 Start-up procedure

NOTICE

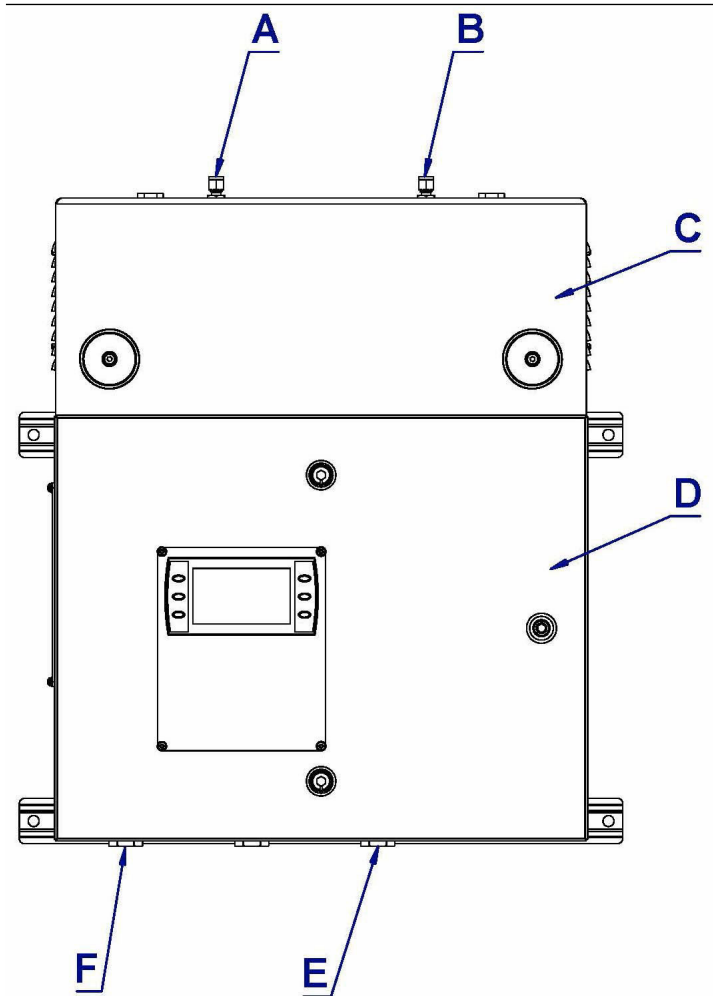
The gases shown in the screenshots and the measurements thereof may be different from those shown in your Rosemount CT5100. They indicate the functionality of the software, which is the same regardless of the gases being measured.

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 organization 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 handling system is turned off.
6. Ensure that the external circuit breaker is set to **OFF**.
7. Visually examine the gas ports.
Ensure that the sample supply line and the sample return line are connected to the correct port.



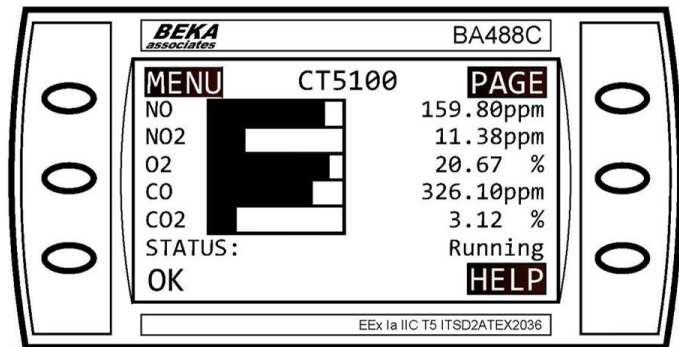
- A. Sample gas input port
- B. Sample gas return port
- C. Top cover (cell compartment)
- D. Laser/electrical compartment
- E. Analog/digital power entry point
- F. Power entry point

8. Ensure that the electrical connection has been made to the power entry point at the base of the analyzer.
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 analyzer 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.



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

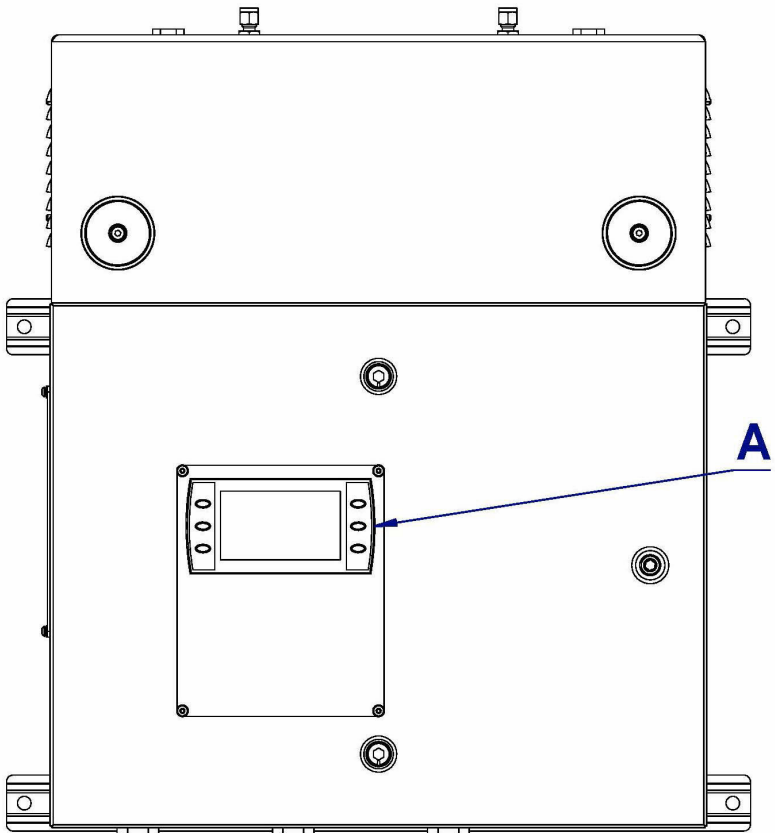
11. Start up the system for venting the sample gas exiting the analyzer.
12. Start up the gas handling system that conditions the sample gas before it is fed into the analyzer.

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.

6.4 Front panel controls and indicators

Configure the analyzer from the control display located on the front panel.



A. Display controller

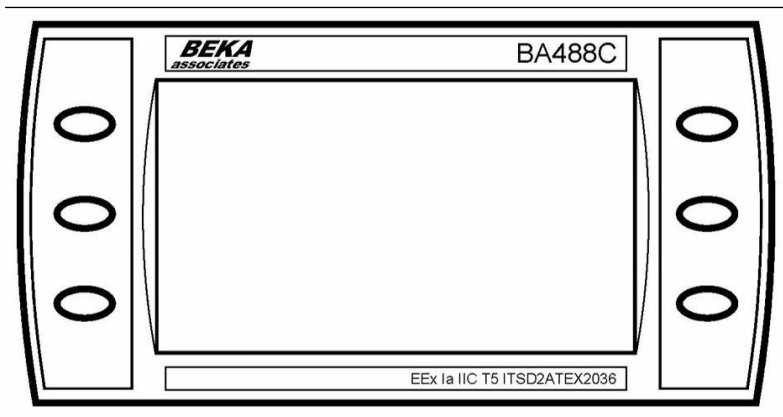
NOTICE

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.



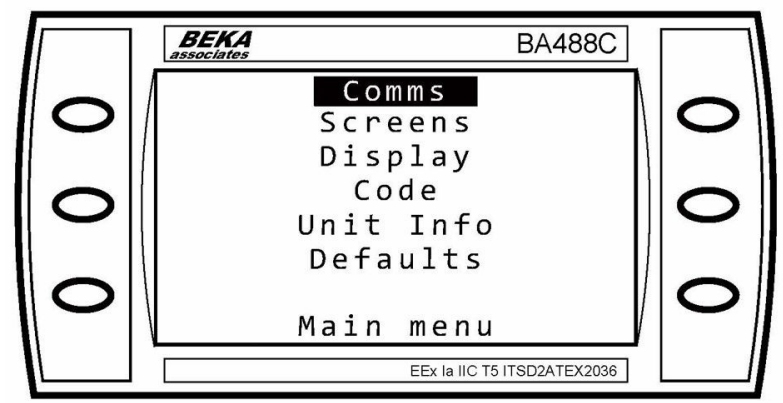
⚠ WARNING

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.



7 Operating the analyzer

7.1 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.

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.

7.2 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 7-1) or the **Pressure and Temperature** screen (Figure 7-2) is shown on the display controller. To toggle between these two screens, press **PAGE**.

Figure 7-1: Gas Sensor Main Screen

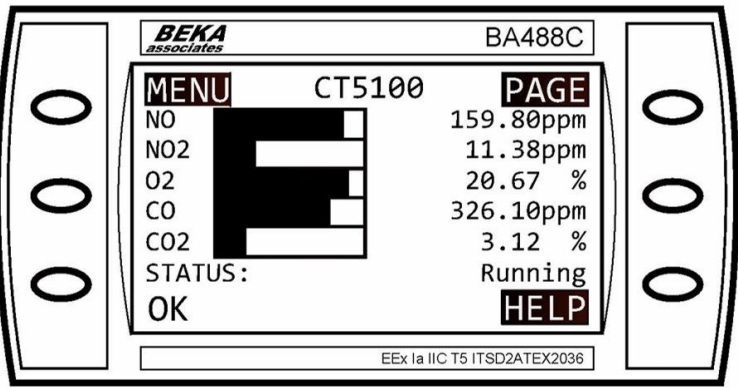
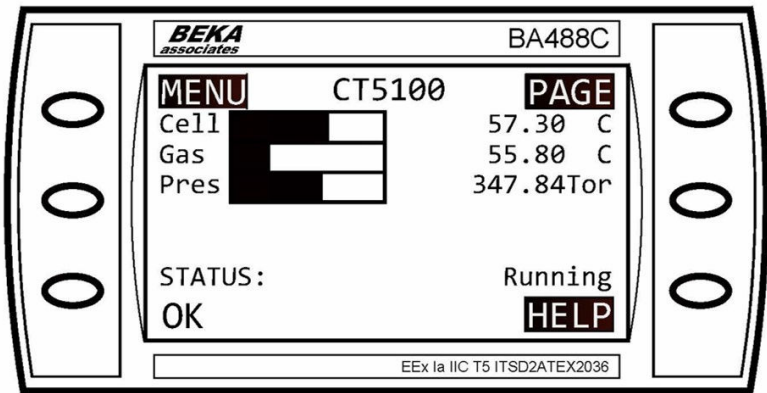


Figure 7-2: Pressure and Temperature Screen



8 Shutdown procedure

8.1 Safety precautions

⚠ CAUTION

EQUIPMENT DAMAGE

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

Always follow the shutdown procedure.

The analyzer normally operates continuously. It should only be necessary to shut down the analyzer in the following circumstances:

- In order to perform repairs or maintenance on the analyzer
- When the analyzer has to be switched off as part of a plant shutdown or plant maintenance

Use the display controller to perform the shutdown procedure. Refer to [Display controller](#) for the display controller navigation instructions.

NOTICE

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

⚠ WARNING

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.

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 Shutdown procedure

To shut down the analyzer.

⚠ WARNING

EXPLOSION HAZARD

Unauthorized operation of the gas handling system when maintenance is being performed on the analyzer or on its associated pipes/hoses may result in gas being released, causing fire or explosion. Failure to lock out the gas handling system may cause death.

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

Procedure

1. Shut down the gas handling system that conditions the sample gas and feeds it to the analyzer. Always lock-out the gas handling system to prevent its unauthorized operation during maintenance, which may cause an escape of gas.

⚠ WARNING

EXPLOSION HAZARD

Failure to vent sample gas may cause death.

Vent the sample gas in the system to prevent fire or explosion during maintenance and to prevent damage to the analyzer during shutdown.

Purge the sample gas in the pipes leading to the analyzer to prevent hazards to personnel during maintenance.

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

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

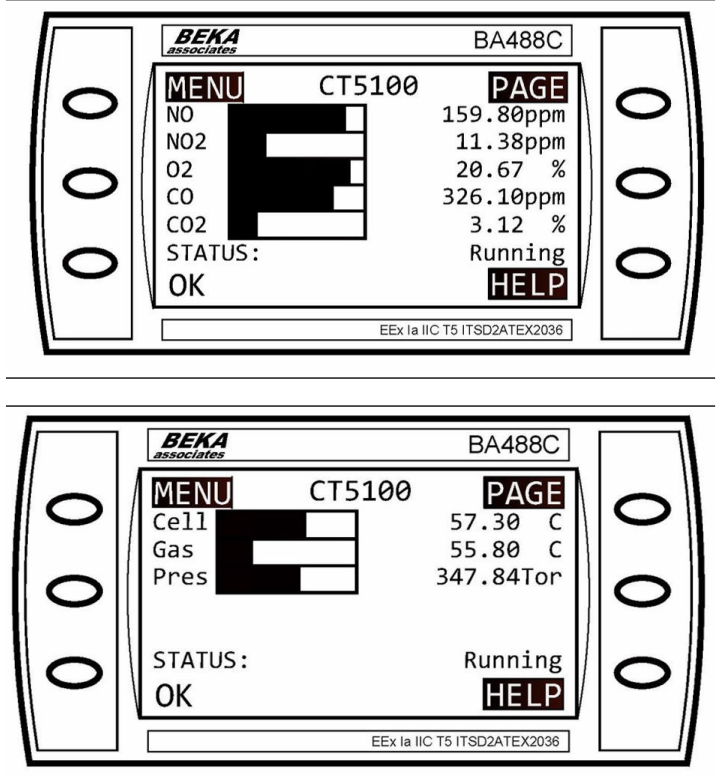
2. Purge any sample gas in the pipe/hose from the gas handling system to the analyzer using factory air or nitrogen supply.

⚠ WARNING

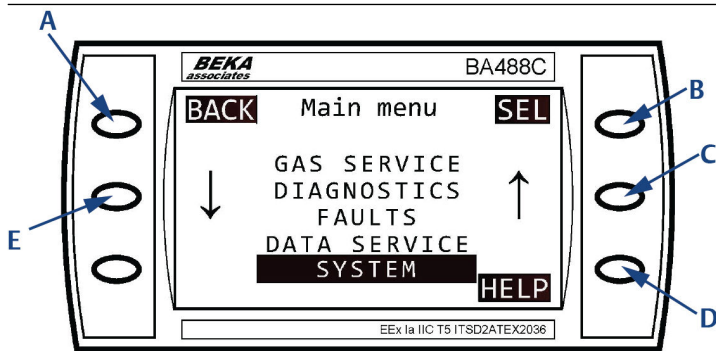
HIGH PRESSURE GAS AND AIR

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 or the *Pressure and Temperature* screen.



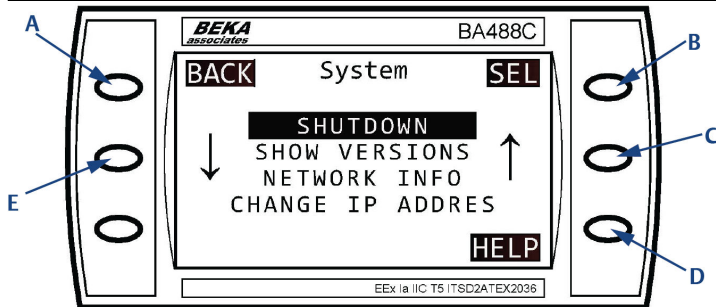
The *Main menu* opens.



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

5. On the display controller, select **System**.

6. Press **SEL** (select).
The **System** screen opens.



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

- Use scroll up and scroll down to select **SHUTDOWN** . Then press **SEL** (select).
The **Shutdown** screen opens.



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

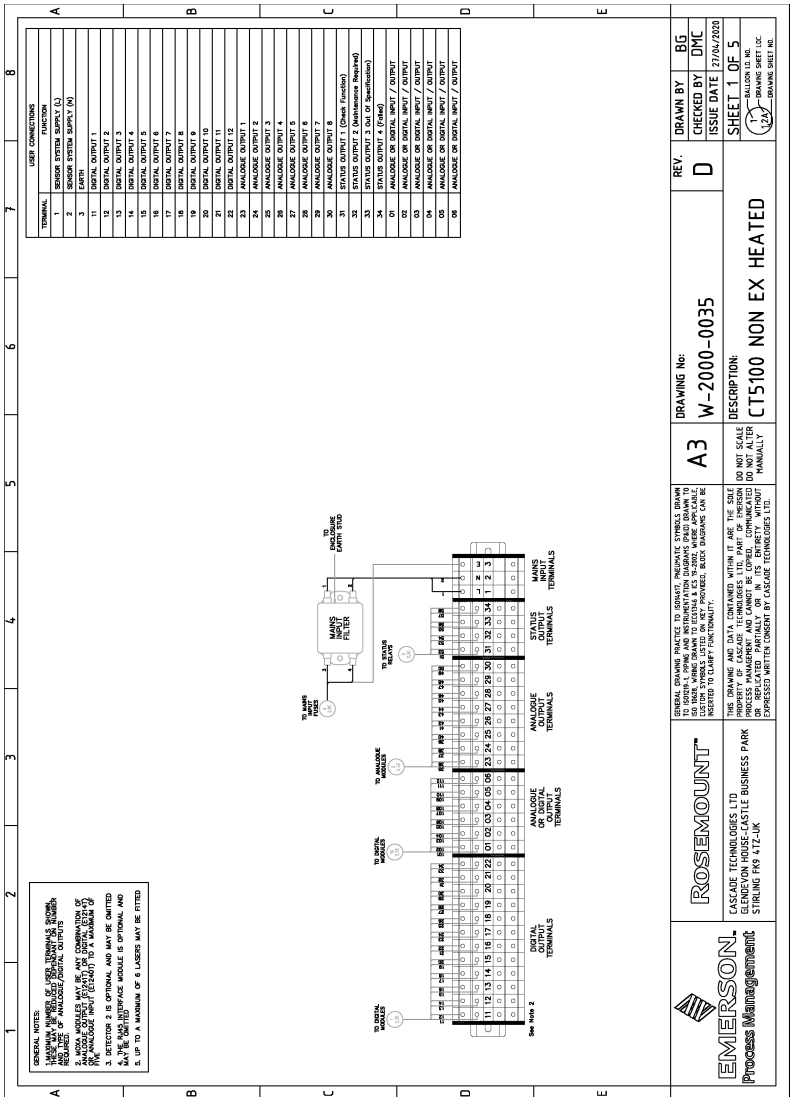
A Engineering drawings

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

A.1 Wiring diagram W-2000-0035 (page 1)



A

B

C

D

E

A3

REVISIONS: SCALE: 1:1
 DO NOT SCALE DRAWING
 FOR CONSTRUCTION
 DIMENSIONS TO BE TAKEN FROM
 DRAWING UNLESS OTHERWISE
 SPECIFIED

ISSUE DATE: 27/01/2020

SHEET 1 OF 5

BALLOON NO. 135

DRAWING SHEET NO.

ROSEMOUNT

CASCADE TECHNOLOGIES LTD

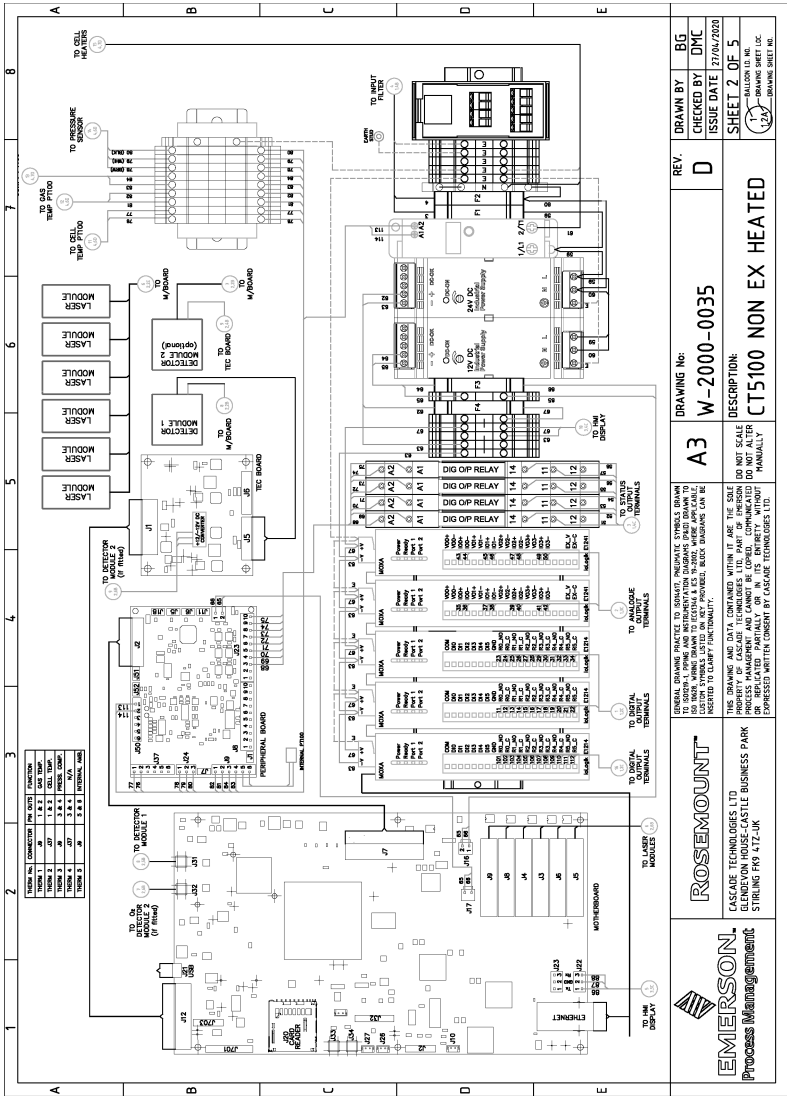
GLENDEVON HOUSE-CASTLE BUSINESS PARK



STIRLING FK9 4TJ-UK

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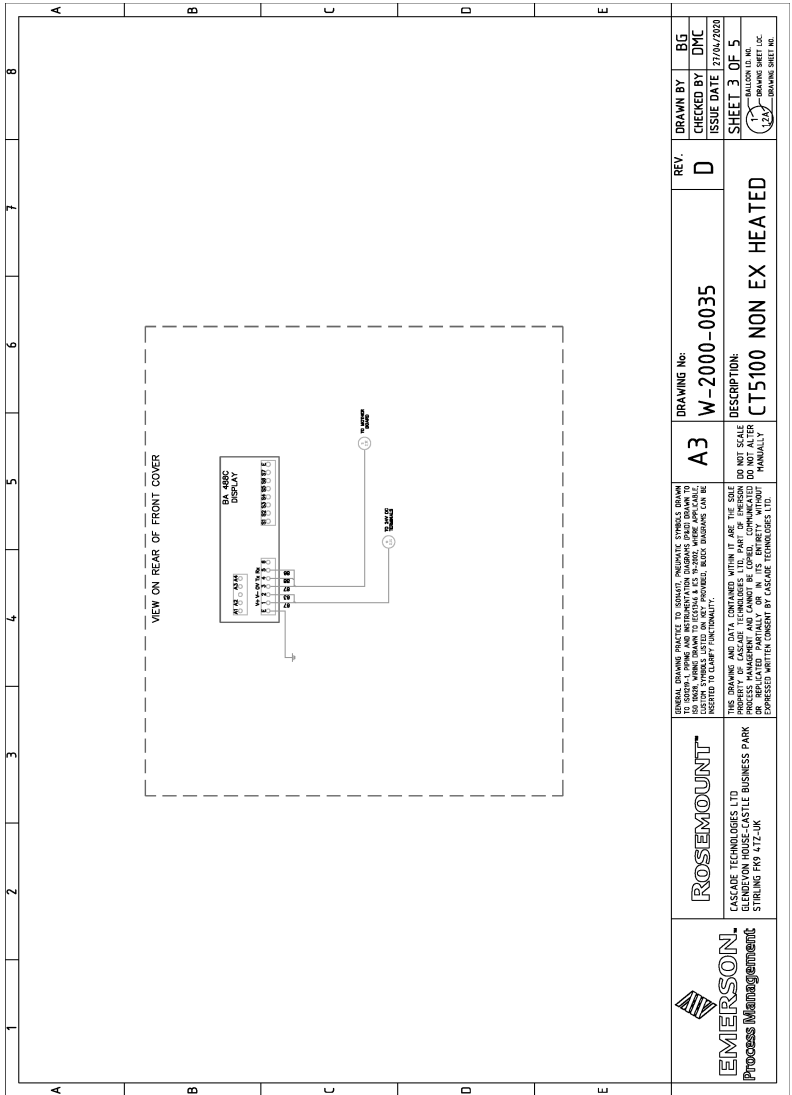
REVISIONS: SCALE: 1:1
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A.2 Wiring diagram W-2000-0035 (page 2)

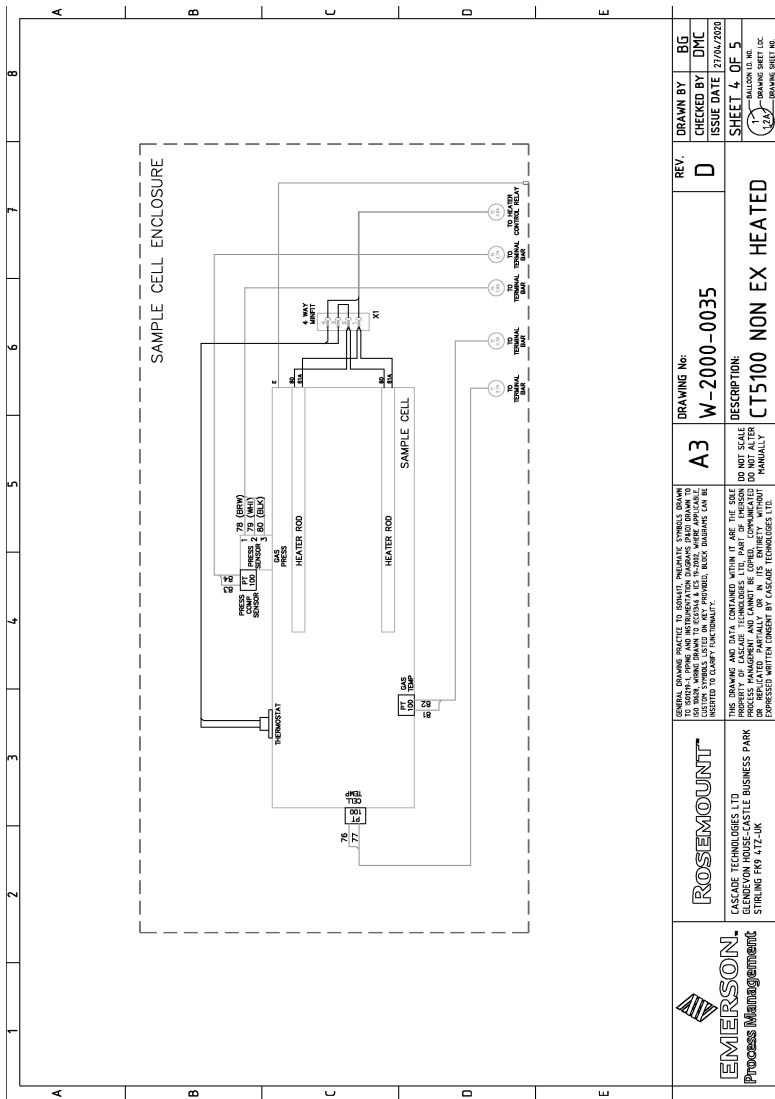


		DRAWING No: W-2000-0035	DRAWN BY BG
		DESCRIPTION: CT5100 NON EX HEATED	CHECKED BY DMC
CASCADE TECHNOLOGIES LTD ELEVATION HOUSE-CASTLE BUSINESS PARK 3 STIRLING RD 41E-50K		REV: D	ISSUE DATE 27/04/2020
EMERSON Process Management		SHEET 2 OF 5	DRAWING SHEET NO. -BALLON ID: 00 -BRAND SHEET ID: -PROCESS SHEET ID:

A.3 Wiring diagram W-2000-0035 (Page 3)



A.4 Wiring diagram W-2000-0035 (Page 4)



A.5 Wiring diagram W-2000-0035 (Page 5)

A		B		C		D		E	
1		2		3		4		5	
6		7		8		9		10	
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16		17		18		19		20	
21		22		23		24		25	
26		27		28		29		30	
31		32		33		34		35	
36		37		38		39		40	
41		42		43		44		45	
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CASCADE TECHNOLOGIES


Glendevon House
Castle Business Park
Stirling FK9 4TZ
Scotland


- +44 1786 447 721
- +44 1786 475 822
- cascade.support@emerson.com

EUROPE REGIONAL OFFICE


Emerson Automation Solutions
Neuhofstrasse 19a PO Box 1046
CH-6340 Baar
Switzerland

- +41 (0) 41 768 6111
- +41 (0) 41 768 6300
- cascade.support@emerson.com

 [Linkedin.com/company/Emerson-Automation-Solutions](https://www.linkedin.com/company/Emerson-Automation-Solutions)

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AMERICAS

Emerson Automation Solutions
10241 West Little York, Suite 200
Houston, TX 77040 USA

- Toll Free 866 422 3683
- +1 713 396 8880 (North America)
- +1 713 396 8759 (Latin America)
- +1 713 466 8175
- cascade.support@emerson.com

MIDDLE EAST AND AFRICA REGIONAL OFFICE

Emerson Automation Solutions
Emerson FZE
Jebel Ali Free Zone
Dubai, United Arab Emirates, P.O. Box
17033

- +971 4 811 8100
- +971 4 886 5465
- cascade.support@emerson.com

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