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INSTALLATION GUIDE

CoreSense M10

Multi-gas Monitoring System



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Table of Contents

1 Safety

| | |
|--|----|
| Symbol Definitions..... | 5 |
| Personnel Safety | 7 |
| General Lifting and Carrying Precautions.. | 7 |
| Handling the Analytical Unit..... | 8 |
| Handling the Sensor Head | 8 |
| Electrical Safety..... | 8 |
| INSTALLATION ON ENERGIZED TRANSFORMERS..... | 9 |
| Cybersecurity..... | 9 |
| Improper Use | 10 |
| Technical Limit Values | 10 |

2 Introducing CoreSense M10

| | |
|---|----|
| Analytical Unit..... | 12 |
| Analytical Unit Status LEDs..... | 14 |
| Analytical Unit Communication Ports | 14 |
| Touchscreen | 15 |
| Sensor Head and Communication Cable..... | 16 |
| Sensor Head Status LEDs | 17 |

3 Preparing for Installation

| | |
|---|----|
| Considering Meteorological Conditions | 19 |
| Installing the Analytical Unit..... | 20 |
| Clearance Requirements..... | 20 |
| Siting the Sensor Head | 21 |
| Clearance Requirements..... | 23 |
| Planning the Cabling..... | 24 |
| Planning Communications..... | 25 |
| Gathering Installation Tools | 26 |
| Supplied Tools..... | 26 |
| Recommended Tools (not supplied)..... | 26 |
| Personal Protection Equipment | 26 |
| Spare Parts | 26 |
| Using Proper Fluid Version | 27 |

4 Installing the Analytical Unit

| | |
|--|----|
| Precautions..... | 29 |
| Installing Mounting Posts | 29 |
| Installing Shock Absorbers | 31 |
| Placing the Analytical Unit On Shock Absorbers..... | 32 |

| | |
|-----------------------------------|----|
| Earthing the Analytical Unit..... | 34 |
| Safety..... | 34 |

5 Installing the Sensor Head

| | |
|----------------------------------|----|
| Precautions..... | 37 |
| Connecting the Sensor Head | 38 |
| Purging the Sensor Head | 41 |
| Earthing the Sensor Head | 43 |

6 Connecting CoreSense M10

| | |
|--|----|
| Safety | 45 |
| Routing the Sensor Head Conduit to the Analytical Unit..... | 46 |
| Connecting Gas Lines..... | 48 |
| Connecting the Internal Communication Cable..... | 49 |
| | 49 |
| Connecting the Sensor Head DC Power Cable | 50 |
| Connecting the Sensor Head AC Power Cable.. | 50 |
| Removing the Terminal Block Cover..... | 50 |
| Connecting the Cable..... | 52 |
| Connecting the Mains AC Power Cable..... | 54 |
| Safety..... | 54 |
| Connecting the Cable..... | 55 |
| Installing the Molecular Sieve..... | 58 |
| Powering Up CoreSense M10 | 58 |
| Establishing SCADA Connections..... | 58 |
| Establishing RS-485 Connections..... | 59 |
| Establishing Analog 4–20 mA Connections . Outputs..... | 60 |
| Inputs | 61 |
| Installing Relays..... | 62 |
| Establishing Optical Ethernet Connections . | 63 |
| Closing the Analytical Unit Door | 63 |

7 Configuring CoreSense M10

| | |
|-----------------------------------|----|
| Establishing Communications..... | 66 |
| Modifying Default Passwords..... | 67 |
| Setting Date and Time | 68 |
| Activating the Thermal Pump | 70 |

8 Maintenance and Troubleshooting

| | |
|--|----|
| Closing the Analytical Unit Door | 71 |
| Cleaning the System | 71 |
| Troubleshooting..... | 71 |
| Understanding Cabinet LEDs..... | 72 |
| Understanding Sensor Head LEDs | 73 |
| Exporting System Logs..... | 74 |
| Giving Access To Administrative Aettings On the SCADA Port..... | 75 |
| Installing Firmware Updates | 76 |
| Updating With a Web Browser (preferred method)..... | 76 |
| Updating With a USB Key..... | 77 |
| Taking an Oil Sample | 79 |

9 Technical Specifications

| | |
|--------------------------------------|----|
| Electrical Specifications | 83 |
| Output Circuits (alarm relays) | 83 |
| Environmental Specifications..... | 84 |
| Mechanical Specifications | 84 |
| Measurement Specifications | 84 |
| Laser | 85 |
| Communication..... | 86 |

A Physical Installation Checklist..... 87

B Installing the Molecular Sieve..... 89

| | |
|-------------------------|----|
| Required Material | 89 |
| Installation..... | 89 |

C Connector Definitions 95

| | |
|-------------------------|----|
| Inputs and Outputs..... | 95 |
| Power and Relays | 97 |

D CoreSense M10 Configurations 99

Safety

This chapter provides an overview of the safety precautions that must be observed when operating the instrument. For personnel and system safety, and to obtain optimum performance, read this manual **carefully and thoroughly** before installing, using, or maintaining the instrument.



NOTICE

The design of this guide is based on the assumption that the CoreSense™ M10 system is installed on a de-energized transformer. However, it is possible to install the system on an energized transformer, assuming that all necessary safety precautions are heeded. See “INSTALLATION ON ENERGIZED TRANSFORMERS” on page 9 for important information about installation of CoreSense M10 systems on energized transformers.

If you do not fully understand the information contained in this guide, or if the instrument shows any signs of damage, contact ABB. Refer to the back cover of this manual for contact information.

Symbol Definitions

This document uses the following symbols to bring attention to key technical and safety-related information.



DANGER—SERIOUS DAMAGE TO HEALTH/RISK TO LIFE

Indicates a hazardous situation that, if not avoided **will** result in death or serious injury. When this symbol is encountered on the hardware, refer to the documentation for important safety information.



WARNING—DAMAGE TO HEALTH/RISK TO LIFE

Indicates a hazardous situation that, if not avoided **could** result in death or serious injury. When this symbol is encountered on the hardware, refer to the documentation for important safety information.



CAUTION—DAMAGE TO HEALTH

Indicates a hazardous situation that, if not avoided, could result in **minor or moderate injury**.



NOTICE

Indicates information considered important, but not hazard related, that could impact things **other than personal injury**, like property damage.



WARNING—HIGH VOLTAGE

Indicates the presence of electrical energy at voltages high enough **to inflict harm on living organisms.**



WARNING—LASER RADIATION

Indicates the presence of a laser related hazard. It also indicates the type of laser in use, its wavelength and its safety class.



WARNING—SHARP EDGES

Indicates the presence of sharp edges that could cause personal injury if touched.



WARNING—HOT SURFACES

Indicates the presence of heat sufficient enough to cause burns.



ELECTROSTATIC DISCHARGES

Indicates a device or part of a device that is susceptible to electrostatic discharges.



Identifies any terminal intended for connection to an external conductor for protection against electrical shock in case of a fault, or the terminal of a protective earth (ground) electrode.



Identifies protective earth conductor terminals.



Indicates the presence of direct current.

Personnel Safety



WARNING

Failing to comply with any of the instructions, precautions or warnings contained in this manual is in direct violation of the standards of design, manufacture, and intended use of the instrument.

ABB assumes no liability for the user's failure to comply with any of these safety requirements, which may result in personal injuries and/or instrument damages.

- Do not, under any circumstances, remove warning and caution labels. Information must be available at all times for the security of the user.
- If the instrument is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- The instrument is intended for field installation by qualified service personnel according to manufacturer's installation instructions and local/national wiring requirements.
- Operators must strictly observe all applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical devices.

General Lifting and Carrying Precautions

The use of proper methods for lifting and handling objects protects against injury and makes work easier. Over time, safe lifting technique should become a habit.

The following are essential steps to safe lifting and handling:

- Eyeball the load and check overall conditions. Do not attempt the lift by yourself loads that appear to be too heavy or unwieldy.
- Make sure that there is enough room for movement, and that the footing is secure.
- Be careful with your balance. Feet should be shoulder width apart, with one foot behind the object that is to be lifted and the other just beside it.
- Bend your knees (do not stoop). Keep your back straight (not necessarily vertical) and tuck your chin (it helps straightening your back).
- Grip the load with the palm of your hands and your fingers.
- Push UP with your legs.
- Keep arms and elbows close to your body while lifting.
- Carry the load close to your body. Do not twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.
- To lower the object, again, bend your knees (do not stoop). To deposit the load on a bench or shelf, place it on the edge and push it into position. Make sure your hands and feet are clear when placing the load.

Handling the Analytical Unit

The CoreSense M10 analytical unit weighs 65 kg (144 lb). It is not designed to be installed by one person. At least two people should be installing this unit.

To avoid personal injuries, make sure to follow the proper lifting and carrying instructions when handling the instrument.

Handling the Sensor Head

The CoreSense M10 sensor head weighs 8 kg (18 lb). To avoid personal injuries, make sure to the proper lifting and carrying instructions when handling the instrument.



WARNING

Do not grab the sensor head by the mounting threads. Thread edges are sharp and pose a risk of personal injury.



WARNING

The sensor head contains an internal heater. Thus, some parts of the sensor head may be hot when powered, i.e. all parts in contact with hot oil. **Always handle the sensor head with caution.**

During operation, the brass mounting interface to the transformer valve becomes hot. **Avoid** touching the surface of the mounting interface.

Electrical Safety



WARNING

Failing to comply with any of the instructions, precautions or warnings contained in this manual is in direct violation of the standards of design, manufacture, and intended use of the instrument.

ABB assumes no liability for the user's failure to comply with any of these safety requirements, which may result in personal injuries and/or instrument damages.

ONLY qualified personnel may perform the electrical installation of the monitoring system.

In accordance with international safety standards, the monitoring system uses a three-wire power cord or line typically connected to an electrical panel that provides grounding for the monitor chassis.

- CoreSense M10 is an overvoltage category II instrument.
- An external circuit breaker with a 8 A rating or less must be installed on the AC source and labeled in compliance with your country's national electrical code. Also, if required by this code, a circuit breaker or switch in the building installation, marked as the disconnect switch, shall be in close proximity to the equipment and within easy reach of the operator.
- Before opening the analytical unit cabinet, cut power at the distribution panel circuit breaker.
- Ensure that the equipment, and any device or power cord connected to the analytical unit, is properly grounded.
- Make sure that the analytical unit earth is at the same potential as the transformer earth.

- **ONLY** use power cords equipped with a protective earthing terminal.
- Protective earthing connections (grounding) must be active at all times.



DANGER

The absence of grounding can lead to a potential shock hazard that could result in serious personnel injury.

If an interruption of the protective earthing is suspected, cut the power to the analytical unit at the plant distribution panel and have the electrical circuit tested.

- In accordance with IEC61010-1 edition 3.0, to prevent contamination of the electronics by outside elements, the analytical unit cabinet cover shall be opened only under controlled environmental conditions defined as:
 - **Temperature:** between 5 °C (41 °F) and 40 °C (104 °F)
 - **Maximum relative humidity:** 80% for temperatures up to 31 °C (87 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F).
- Do not expose sensor head innards to rain or snow.
- Use only fuse(s) specified as appropriate for this equipment (see “Technical Specifications” on page 83).

INSTALLATION ON ENERGIZED TRANSFORMERS



DANGER

The installation area **must** be secured. Tape off all limits of approach to the installation area, and ensure that all personnel understand the risks associated with the installation procedure.

- The CoreSense M10 sensor head must be installed near ground level.
- Plan AC power connection to the analytical unit prior to all other work (connection location, needs for additional fuses, etc.)
- De-energize the section of the analytical unit where the AC power cable will be connected. This should be double-checked.
- All work **in the analytical unit** should be done while the unit is de-energized.
- Communication connections (Ethernet or SCADA) can be performed on energized transformers.

Cybersecurity

This product is designed to be connected to, and communicate information and data via a network interface. It is the user’s sole responsibility to provide, and continuously ensure, a secure connection between the product and the user’s network or any other network (as the case may be).

Users shall establish and maintain any and all appropriate measures (such as, but not limited to, the installation of firewalls, the application of authentication measures, the encryption of data, the installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized accesses, interferences, intrusions, leakages and/or theft of data or information.

ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB strives to maintain cybersecurity for its products and services. By visiting the web page, you will find notifications about newly found software vulnerabilities and options to download the latest software. It is recommended that you visit this web page regularly:

<http://new.abb.com/about/technology/cyber-security>

Information about your product is also available on the product page:

<https://www.hitachienergy.com/offering/product-and-system/transformers/transformer-service/advanced-services-for-transformers/condition-monitoring/coresense-m10-multi-gas-dga-analyzer>

Improper Use

For configuration purposes, the sensor head can be powered when it does not contain any oil.

However, the thermal pump **must be** turned OFF. This can be done via the web interface (for more information, see “Activating the Thermal Pump” on page 70). The CoreSense M10 is delivered with the thermal pump turned OFF.

When installation is complete and air has been purged from the sensor head, make sure to enable the thermal pump via the web interface.



NOTICE

The thermal pump is designed to operate while immersed in transformer oil. It will fail **within minutes** if operated in air.

It is prohibited to use the monitoring system for any of the following (including, but not limited to):

- A climbing aid, e.g., for mounting purposes.
- A support for external loads, e.g., as a support for pipes.
- By adding material, e.g., by painting over the name plate, or welding/soldering on parts.
- By removing material from the sensor head, e.g., by drilling the housing.

Repairs, alterations, and enhancements, or the installation of replacement parts, are only permissible as far as these are described in this manual. Approval by ABB must be requested in writing for any activities beyond this scope. Repairs performed by ABB-authorized centers are excluded from this article.

Technical Limit Values

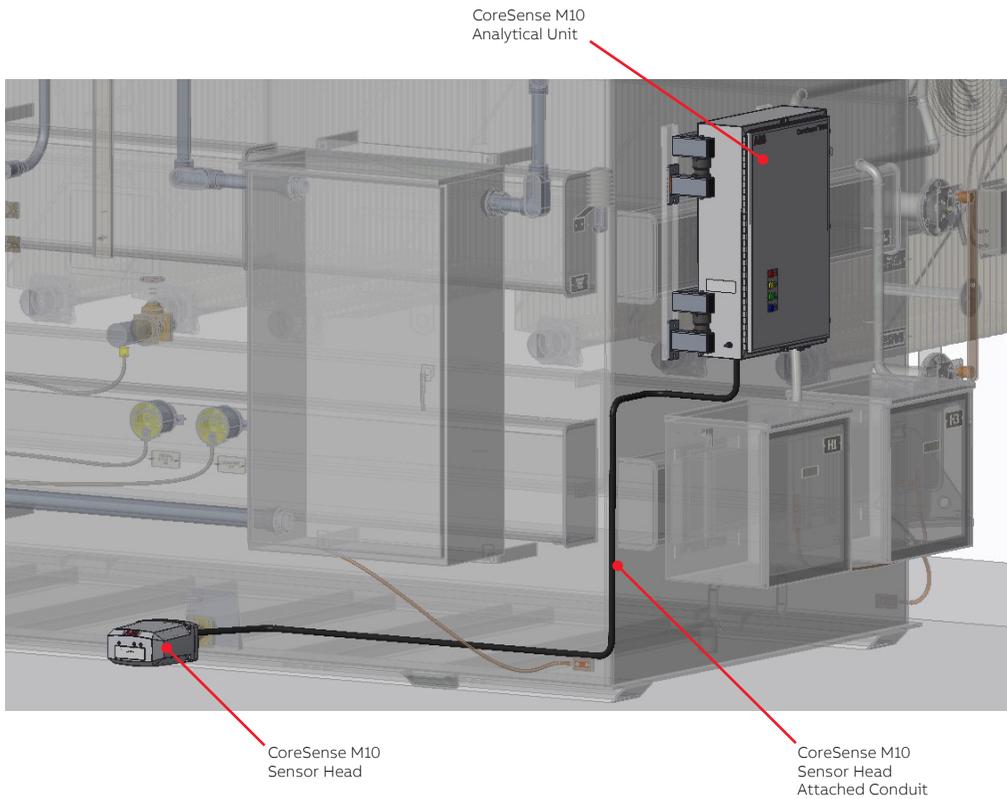
The instrument is designed for use exclusively within the values stated on the nameplates and within the technical limit values specified on the data sheets.

CHAPTER 2

Introducing CoreSense M10

CoreSense M10 continuously monitors dissolved gas levels in transformer oil to provide early warnings for incipient transformer faults. Additionally, CoreSense M10 can also continuously monitor moisture levels, as moisture can accelerate transformer aging.

Figure 1 Overview of CoreSense M10 Multi-gas Monitoring System



Analytical Unit

As part of the CoreSense M10 multi-gas monitoring system, the analytical unit is where gases extracted from the transformer are analyzed. Analysis results allow for prevention of incipient transformer faults. It is also the part of the system equipped for external communication and system configuration.

Figure 2 Overview of CoreSense M10 Analytical Unit (closed)

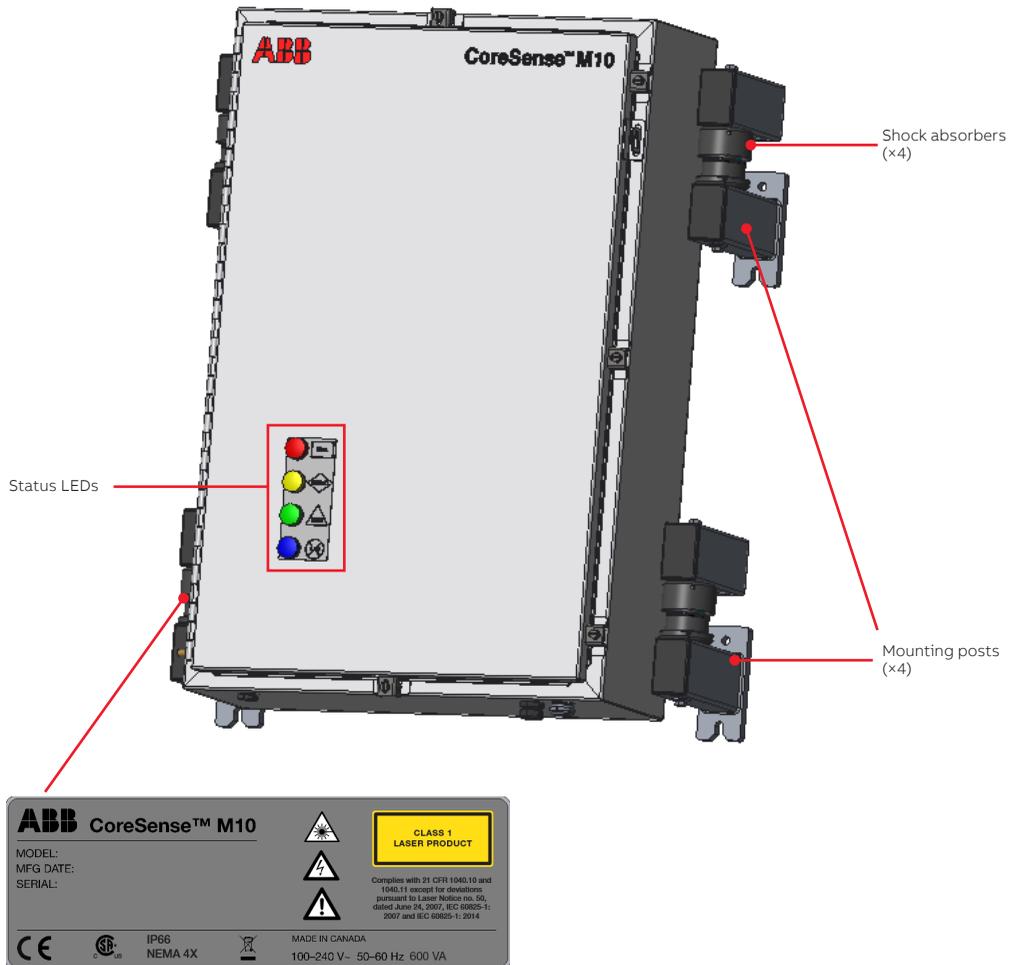
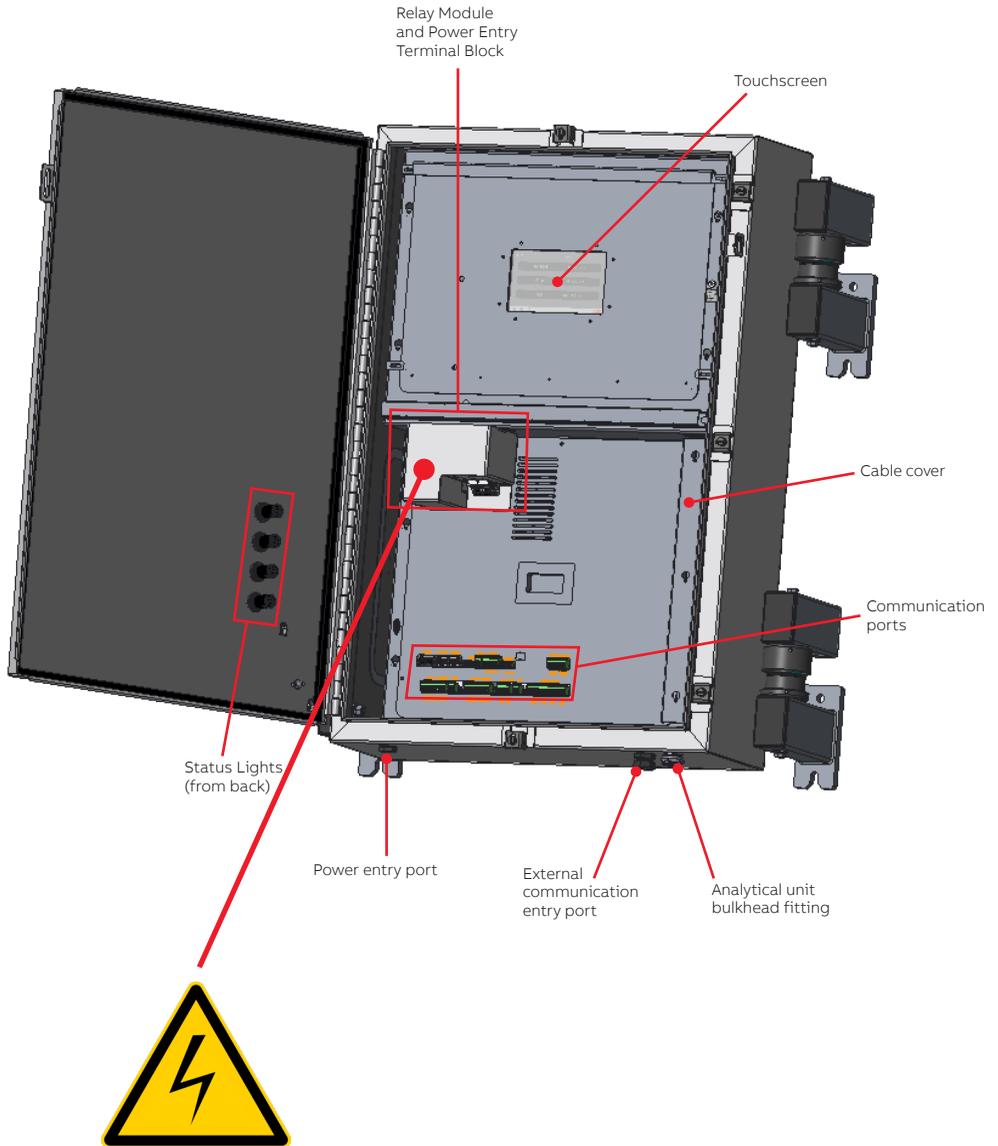


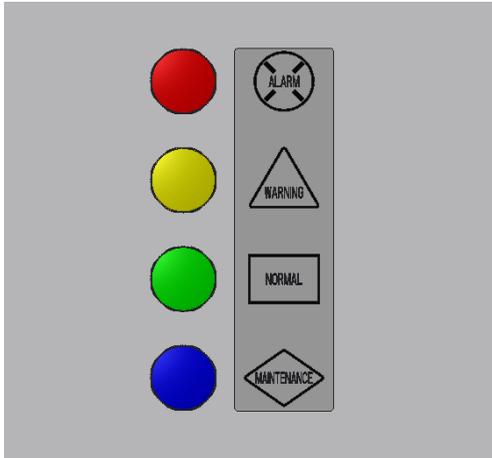
Figure 3 Overview of CoreSense M10 Analytical Unit (open)



Analytical Unit Status LEDs

The meanings of the various analytical unit status LEDs are explained in “Maintenance and Troubleshooting” on page 71.

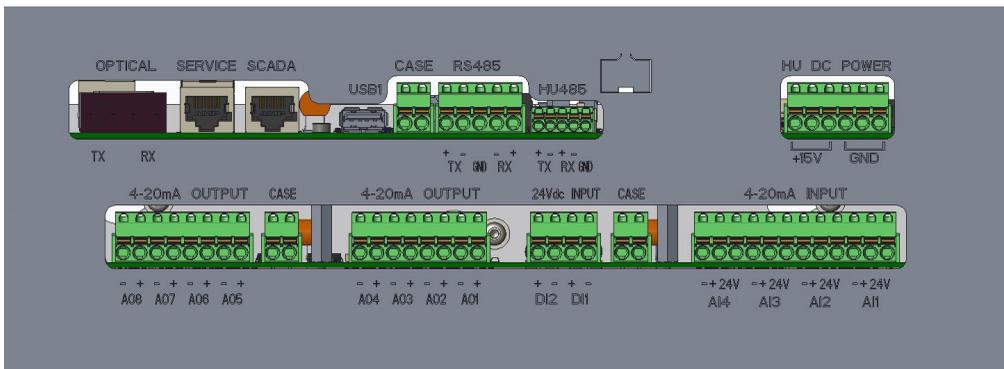
Figure 4 Analytical Unit Status LEDs



Analytical Unit Communication Ports

The purpose of each of these ports is explained in more details in “Connecting CoreSense M10” on page 45 and “Appendix C” on page 95.

Figure 5 Analytical Unit Communication Ports



Touchscreen

The touchscreen inside the analytical unit allows you to monitor values and acknowledge events on site. After startup, the Dashboard page might be empty for the first 30 minutes.

Figure 6 CoreSense M10 Analytical Unit Touchscreen (Dashboard panel)

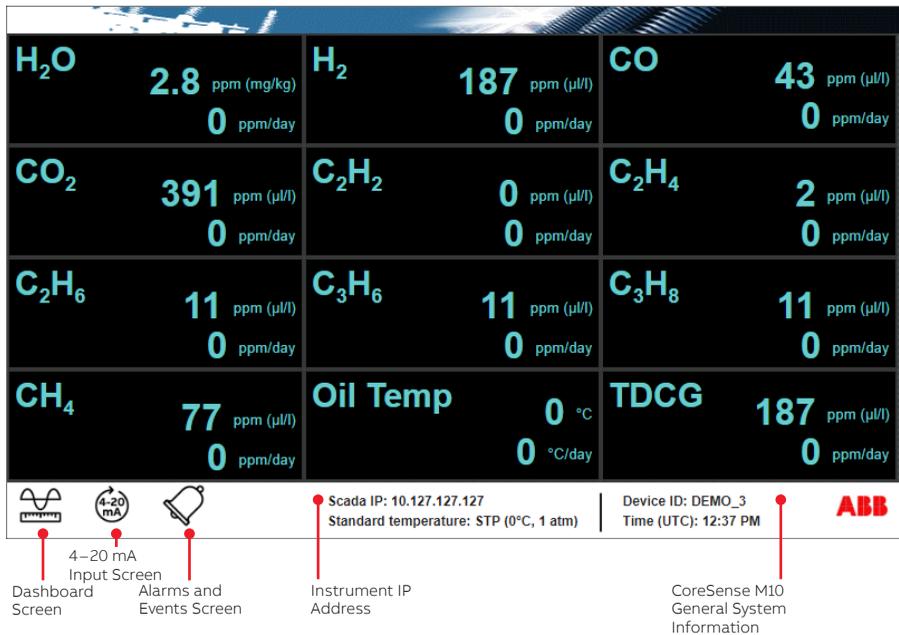


Figure 7 CoreSense M10 Analytical Unit Touchscreen (4-20 mA input panel)

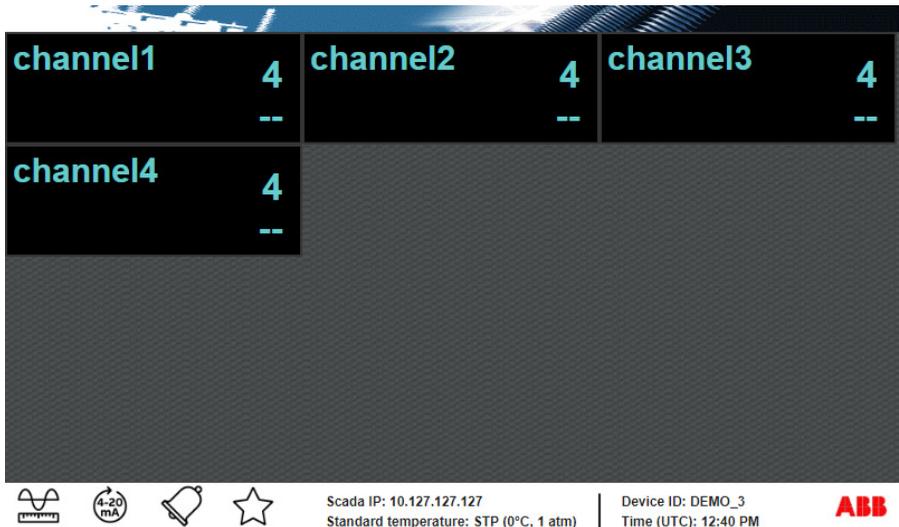


Figure 8 CoreSense M10 Analytical Unit Touchscreen (Alarms and events panel)

| DATE | TYPE | DESCRIPTION |
|------------------------|----------------------|---|
| March 18, 2019 8:40 AM | Sensor status | Sensor channel 4 changed its status from OFFLINE to NORMAL. |
| March 18, 2019 8:40 AM | Sensor status | Sensor channel 3 changed its status from OFFLINE to NORMAL. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Params changed from {channelIndex=3, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0} to {channelIndex=3, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0}. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Sensor enabled changed from false to true. |
| March 18, 2019 8:39 AM | Sensor status | Sensor channel 1 changed its status from OFFLINE to NORMAL. |
| March 18, 2019 8:39 AM | Sensor status | Sensor channel 2 changed its status from OFFLINE to NORMAL. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Params changed from {channelIndex=2, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0} to {channelIndex=2, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0}. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Sensor enabled changed from false to true. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Params changed from {channelIndex=1, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0} to {channelIndex=1, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0}. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Sensor enabled changed from false to true. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Params changed from {channelIndex=0, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0} to {channelIndex=0, max20Value=0, min4Value=0, max4Value=0, min20Value=0, min4Value=0, max20Value=0, min4Value=0}. |
| March 18, 2019 8:39 AM | Configuration Change | The configuration parameter Sensor enabled changed from false to true. |
| March 15, 2019 3:49 PM | System startup | Startup completed |

Scada IP: 10.127.127.127
 Standard temperature: STP (0°C, 1 atm) | Device ID: DEMO_3
 Time (UTC): 12:40 PM

Sensor Head and Communication Cable

As part of the CoreSense M10 multi-gas monitoring system, the sensor head extracts gases from the transformer and routes them through its permanently attached conduit for analysis inside the analytical unit. LEDs provide status information about the ongoing processes (see “Maintenance and Troubleshooting” on page 71).

Figure 9 Overview of CoreSense M10 Sensor Head (back)

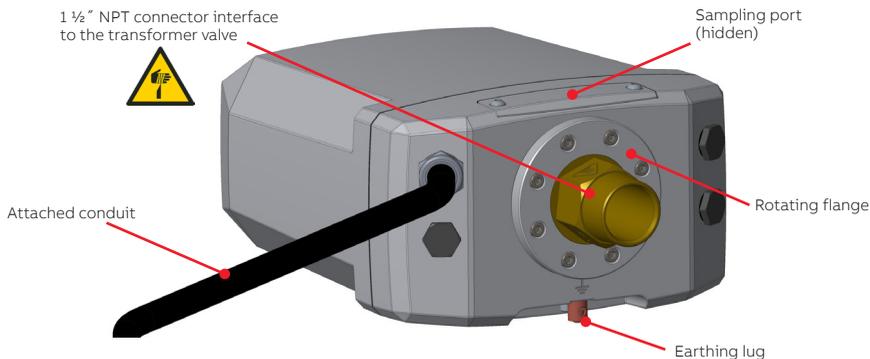
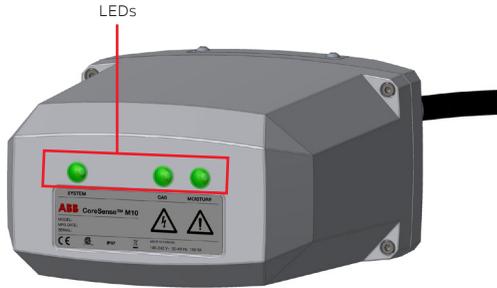


Figure 10 Overview of CoreSense M10 Sensor Head (front)



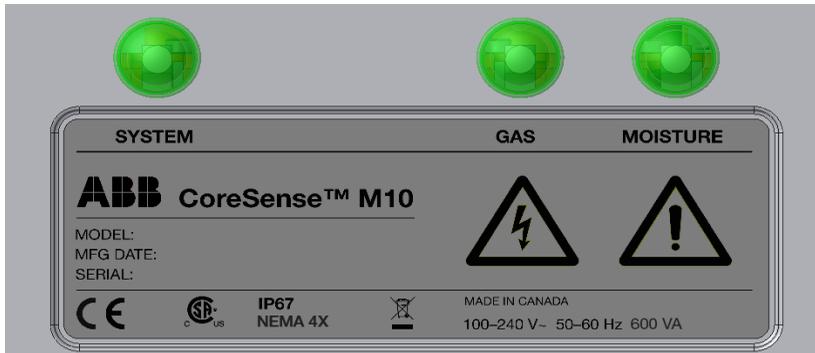
NOTICE

The length of the conduit attached to the sensor head is 10 meters (33 feet). Make sure that the distance between the sensor head and analytical unit is **at most** 10 meters.

Sensor Head Status LEDs

The meanings of the various analysis sensor head status LEDs are explained in “Maintenance and Troubleshooting” on page 71.

Figure 11 Sensor head status LEDs



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Preparing for Installation

Installing the CoreSense™ M10 monitoring system requires some planning. You need to plan:

- the physical location of the monitoring system analytical unit and sensor head,
- the power supply to the analytical unit cabinet (connection location, need for additional fuses, etc.)
- the necessary cables (see “Electrical Specifications” on page 83 and “Communication” on page 86,
- the required tools.

On a transformer, several mounting locations may be available for installing the analytical unit and sensor head (see Figure 12 and Figure 14) (see also “INSTALLATION ON ENERGIZED TRANSFORMERS” on page 9).

Care should be taken to select a mounting location:

- where the analytical unit will have sufficient clearance.
- that will allow for the analytical unit touchscreen to be positioned at eye level.
- where the sensor head will be exposed to maximal oil flow and minimal oil temperature fluctuations.

Considering Meteorological Conditions

Installation of the CoreSense M10 monitoring system **should not** be performed under the following meteorological conditions:

- In rain or snow
- In **highly** windy/dusty conditions
- At temperatures below 5 °C (41 °F) or above 40 °C (104 °F)

If the relative humidity level is above 80%.

(at temperatures up to 31 °C [87 °F], and decreasing linearly to 50% at 40 °C [104 °F])



NOTICE

The installer may pre-assemble the CoreSense M10 (connecting the sensor head conduit to the open analytical unit cabinet, close the cabinet) in a temperature- and humidity-controlled location (building, back of truck, etc.) that meets the proper environmental standards, and then bring the whole assembly on location where installation can be completed regardless of meteorological conditions.

Also, the installer can build a temperature-controlled temporary shelter at the installation site and proceed to the installation there as long as environmental conditions are met.

CoreSense M10 should not be installed in areas directly exposed to the sun at any moment of the day. Consider a north-facing installation or providing a complete sun shield.

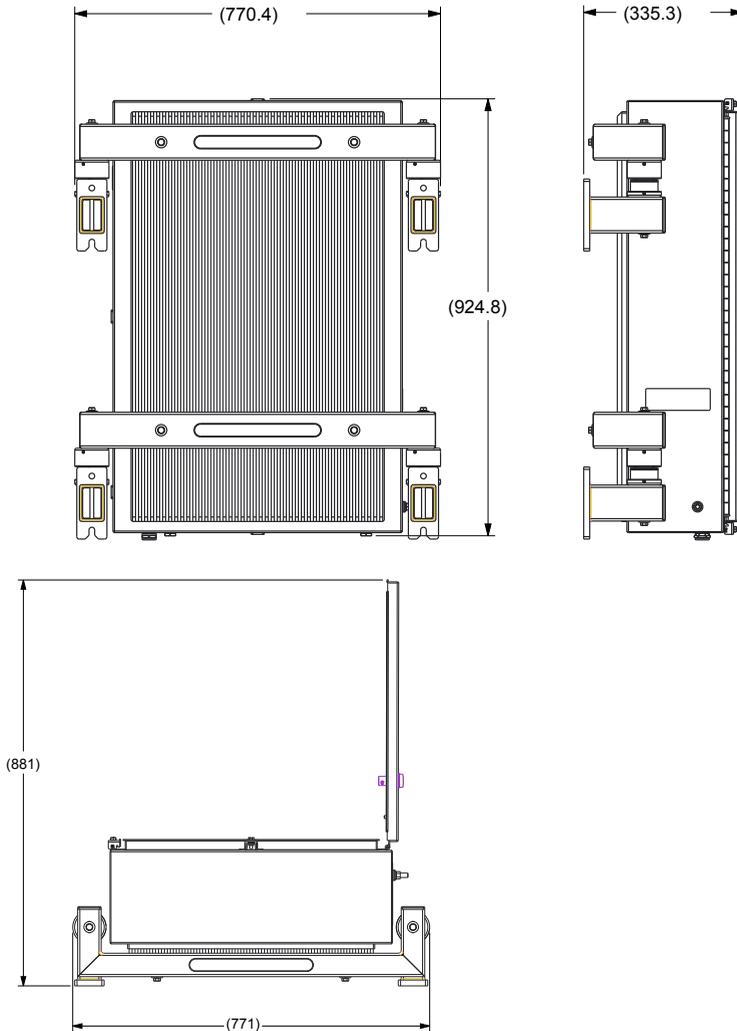
Installing the Analytical Unit

Since the CoreSense M10 analytical unit can be installed on the transformer wall or a wall adjacent to the transformer, there are a few physical limitations to take into account before installing the CoreSense M10 analytical unit.

Clearance Requirements

You need to make sure that you have enough room to install the unit. You need enough clearance to be able to install the unit mount properly, and also enough clearance to be able to fully open the unit door. Below are the clearance requirements for the analytical unit.

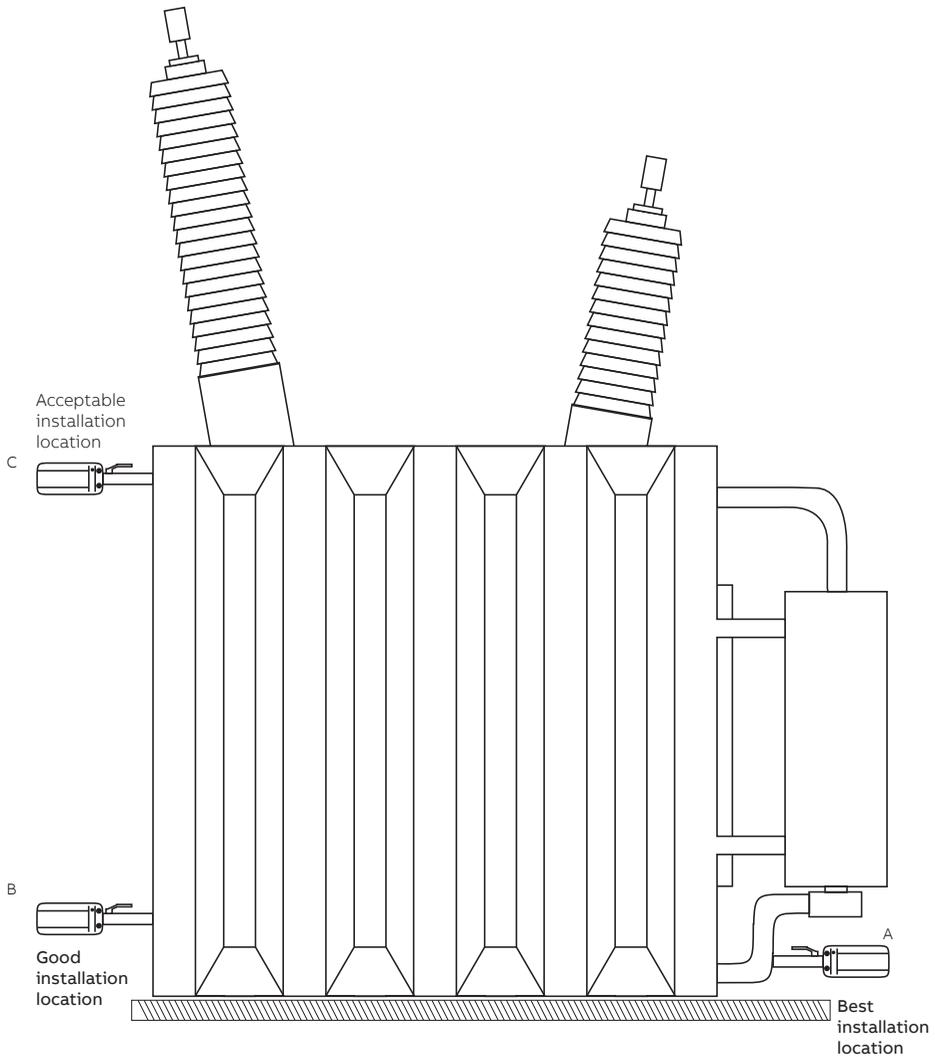
Figure 12 CoreSense M10 Analytical Unit Dimensions and Clearance Requirements (in millimeters)



Siting the Sensor Head

The CoreSense M10 sensor head can be installed at various locations on the transformer.

Figure 13 Possible Locations for Sensor Head on a Transformer



The following table can be used to help select the best location for the sensor head:



WARNING—ENERGIZED TRANSFORMER

In Figure 13, locations C **must not** be used in case of installation on an energized transformer.

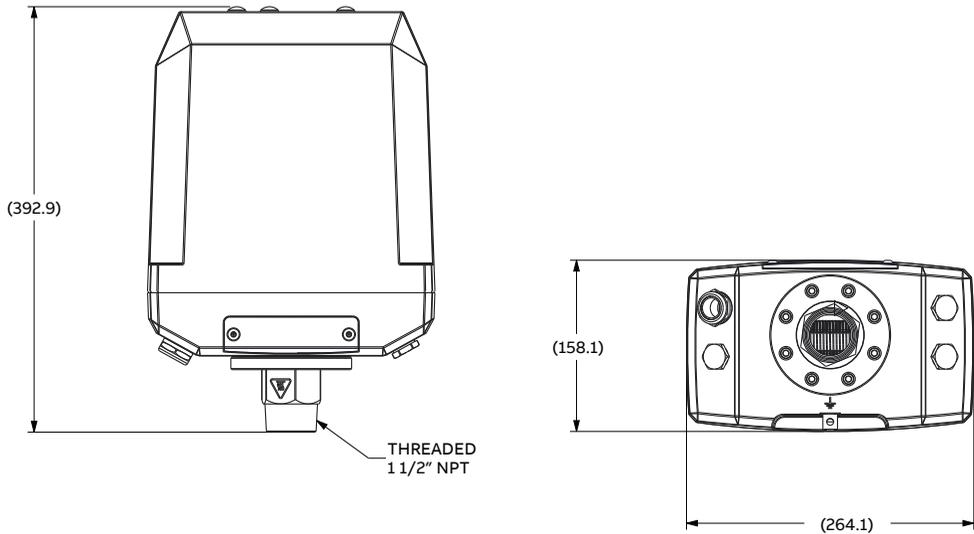
Table 1 Sensor head locations

| Location | Benefits | Issues |
|------------------------------|--|--|
| A (Radiator return) | <ul style="list-style-type: none"> Good oil flow Low operating temperature Easily accessible Allows installation without an outage | <ul style="list-style-type: none"> Good connection flange is not always present Physical constraints may require complex curved tubing |
| B (Drain valve) | <ul style="list-style-type: none"> Low operating temperature Easily accessible Always present Allows installation without an outage | <ul style="list-style-type: none"> Often is connected to a baffle or downwards pointing tube inside the tank, in these cases it cannot be used Sometimes connected to a globe valve, in this case it cannot be used Low oil flow could increase reaction time Sludge can accumulate at this location |
| C (Top tank [fill valve]) | <ul style="list-style-type: none"> Good oil flow from thermal convection Often present Never connected to a baffle or downwards pointing tube | <ul style="list-style-type: none"> Temperature may exceed 100 °C (212F) Difficult to access, installation requires working at height May require an outage for installation NOT TO BE USED FOR INSTALLATION ON ENERGIZED TRANSFORMERS |

Clearance Requirements

First, you need to make sure that you have enough room to install the head. Below are the clearance requirements for the unit.

Figure 14 CoreSense M10 Sensor Head Dimensions (in millimeters)



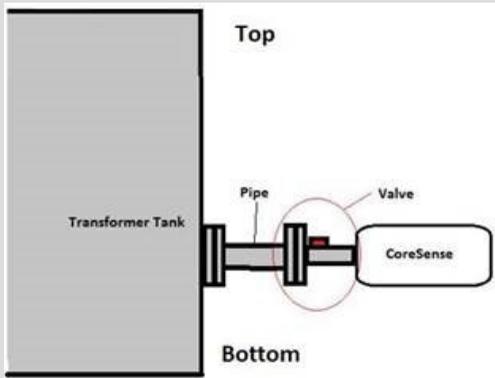
NOTICE

The pipe between the transformer tank and the sensor head can not be longer than 40 cm (15 in).

There should be no baffle or downward pointing pipes in the transformer, behind the wall.

The piping must be level (i.e., it cannot change elevation since this will prevent proper oil flow).

The valve type should be ball, gate or butterfly. Globe valves should be avoided since they restrict oil flow.



Planning the Cabling

Select cabling according to your communication needs. Refer to the table below for recommended cable gauge or type.



NOTICE

Table 2 gives a general description of the necessary cables. More detailed information is found in Figure 85 on page 99.

Always comply with national codes and electrical standards.

Table 2 Recommended Cable Gauge and Type

| Cable | Gauge/Type | Maximum length |
|--------------------|--|------------------------|
| Power | Copper-only wire (stranded WITH FERRULE or solid) | 15 m (50 ft) (AWG #12) |
| | AWG #18 to AWG #12 90 °C 600V, UL and CSA type | 10 m (33 ft) (AWG #18) |
| Ground (earthing) | 10 or 6 AWG | 15 m (50 ft) |
| RS-485 | 24 AWG | 1220 m (4003 ft) |
| Alarm relays | 16 or 14 AWG | N/A |
| 4–20 mA | 18 AWG | N/A |
| SCADA (Ethernet) | Category 5 cable | 100 m (328 ft) |
| OPTICAL (Ethernet) | ST-ST full duplex 62.5/125 multi-mode fiber | 2000 m (6562 ft) |
| SERVICE (Ethernet) | Category 5 cable | 3 m (10 ft) |
| USB (service port) | USB key only | N/A |

Planning Communications

The digital protocols supported by the system are Modbus, DNP3, and IEC 61850. Modbus and DNP3 are available on the RS-485 serial interface, the Ethernet SCADA port or the optical Ethernet port. IEC 61850 is available on the Ethernet SCADA port or the optical Ethernet port.

Table 3 below shows the RS-485 serial configuration. These values cannot be modified.

Table 3 Default RS-485 Configuration

| | |
|--------------|------|
| Baud rate | 9600 |
| Data bit | 8 |
| Stop bits | 1 |
| Parity | None |
| Flow control | None |



NOTICE

When using Modbus, the slave ID is **1 and cannot be changed**.

When using DNP3, the outstation ID is **1 and cannot be changed**.

Table 4 Summary of Communication Parameters

| Port | Default communication setup | Setting options from web page | Protocol |
|--------------------|--|--|---|
| RS-485 | Baud rate | 9600 | n/a |
| | Data bit | 8 | n/a |
| | Stop bit | 1 | n/a |
| | Parity | None | n/a |
| | Flow control | None | n/a |
| SCADA (Ethernet) | <ul style="list-style-type: none"> Static (IP 10.127.127.127) (if no network connected to port at startup) | Static IP; DHCP client Administrator settings on SCADA port can be enabled or disabled using the web interface. | Web http port 80/tcp Modbus TCP port 502/tcp DNP3 port 20000/tcp IEC61850 MMS port 102/tcp |
| OPTICAL (Ethernet) | <ul style="list-style-type: none"> DHCP client if network connected to port at startup | When the fiber optic port is in use, the Ethernet SCADA port must not be used. | |
| SERVICE (Ethernet) | Default static IP address for CoreSense: 172.16.100.1 | ABB remote access can be enabled or disabled using the web interface. | |



NOTICE

For best results it is recommended to configure the Modbus or DNP3 master with a timeout of 10000 ms and 5 retries.

Minimum delay between polls shall be at least 100 ms.

Gathering Installation Tools

Once you have finished planning your installation, you need to assemble a set of all the equipment necessary to perform the installation.

Supplied Tools

- Metric hex (Allen) key set: 2.5 mm, 4 mm, 5 mm
- SAE open end wrench: ¼ in (6.35 mm), ⅝ in (7.98 mm)

Recommended Tools (not supplied)

- 50.8 mm (2.0 in) wrench, or adjustable wrench
- 13 mm (½ in) wrench, or adjustable wrench
- 8 mm (0.3 in) wrench, or adjustable wrench
- 8 × 10 mm (⅜ in) bolts, washers, and lock washers (for mounting post installation)
- Cement anchors if mounted directly to a cement firewall
- Torque wrench
- Flat head screwdriver
- Drill and drill bits
- Bolt inserts
- Roll of Teflon® (PTFE) tape or thread sealant for pipes
- Bucket and rags
- Level
- Wire stripper and wire cutter
- Laptop with a web browser (for sensor commissioning) (the latest version of Chrome, Firefox, Microsoft Edge and Safari is recommended)
- Straight RJ45 Ethernet cable (for sensor commissioning)
- Optical termination equipment (if installing the optional optical Ethernet port)
- Transformer valve adapter (when applicable)

Personal Protection Equipment

- Hard hat
- Safety shoes
- Gloves
- Arc flash protected overalls
- Protective glasses

Spare Parts

The following is included with the monitoring system:

- Bleeding hose (ID 3.175 mm [⅜ in]): for sampling

Using Proper Fluid Version

CoreSense M10 can be ordered for use with different transformer fluids. Make sure you get the proper version that is needed on the transformer you are about to install the system on. The following table shows the list of transformer fluid and the correspondant CoreSense M10 configuration that is required. The configuration must be specified at time of order.



WARNING

Proper CoreSense configuration shall be installed according to transformer fluid

- CSM10-ST for use with Mineral Oil only
- CSM10-NE for use with Natural Esters
- CSM10-SE for use with Synthetic Esters
- CSM10-SL for use with Silicone fluid

Table 5 Transformer Fluid Product Code

| Transformer fluid | Fluid Code | CoreSense M10 - Product Code on the Name Plate |
|-------------------|------------|--|
| Mineral oil | ST | CSM10-ST-1.5-4X-SH (same as CS-M10-1.5) |
| | | CSM10-ST-N50-4X-SH (same as CS-M10-50) |
| | | CSM10-ST-1.5-4X-HH |
| | | CSM10-ST-N50-4X-HH |
| Natural ester | NE | CSM10-NE-1.5-4X-SH |
| | | CSM10-NE-N50-4X-SH |
| | | CSM10-NE-1.5-4X-HH |
| | | CSM10-NE-N50-4X-HH |
| Synthetic ester | SE | CSM10-SE-1.5-4X-SH |
| | | CSM10-SE-N50-4X-SH |
| | | CSM10-SE-1.5-4X-HH |
| | | CSM10-SE-N50-4X-HH |
| Silicone | SL | CSM10-SL-1.5-4X-SH |
| | | CSM10-SL-N50-4X-SH |
| | | CSM10-SL-1.5-4X-HH |
| | | CSM10-SL-N50-4X-HH |

See “CoreSense M10 Configurations” on page 99 for the complete product code matrix and descriptions.

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Installing the Analytical Unit

Once your installation plan is complete and you have gathered all the necessary tools, you can proceed with installation of the CoreSense™ M10 multi-gas monitoring system.



NOTICE

The following procedures are recommendations based on best practices, but final decisions as to the best method of installing the analytical unit belong to the technical person in charge on site.



NOTICE

The analytical unit must be installed on a vertical or near-vertical wall (no more than 2° from vertical).

Precautions



WARNING

Installing the CoreSense M10 multi-gas monitoring system requires at least a team of two.



WARNING

The CoreSense M10 analytical unit weighs over 65 kg (144 lb). It could cause serious injuries or even death if it were to tip over and/or fall on someone.

Installing Mounting Posts

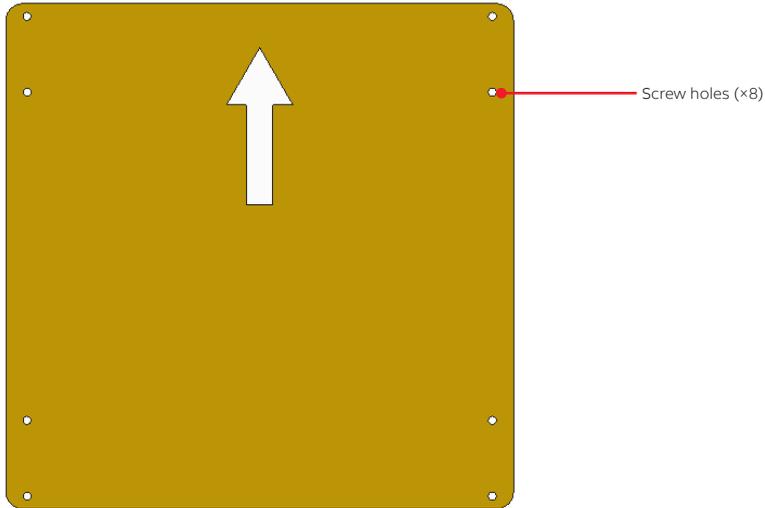
Mounting posts are used to fix the analytical unit to a vertical surface (transformer wall or adjacent wall). When installing the mounting posts, keep in mind that, once installed, the analytical unit touchscreen should be at approximately eye level.

Installing the mounting posts is the first step in installing the CoreSense M10 system.

To do so:

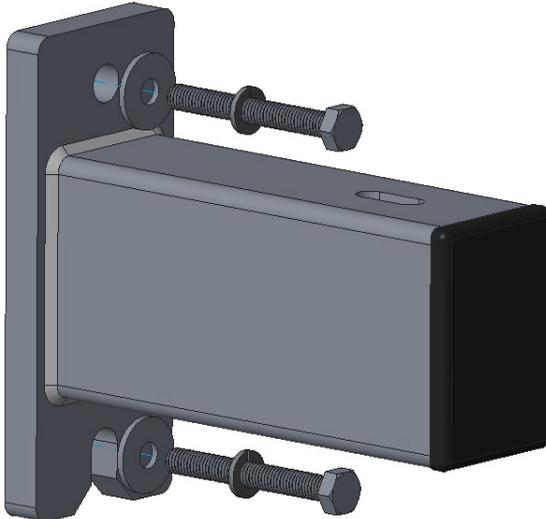
- 1 Position the provided installation template flat on the wall where the analytical unit will be installed.
- 2 Mark the location of the eight 10 mm (0.375 in) screw holes on the wall. It is recommended that one team member holds the installation template while another proceeds with the markings.

Figure 15 Analytical Unit Installation Template



- 3** With a drill powerful enough, and appropriate drill bits, drill the eight screw holes.
- 4** Screw in the four mounting posts as shown below (screws, washers and lock washers **not** provided).

Figure 16 Installing a Mounting Post



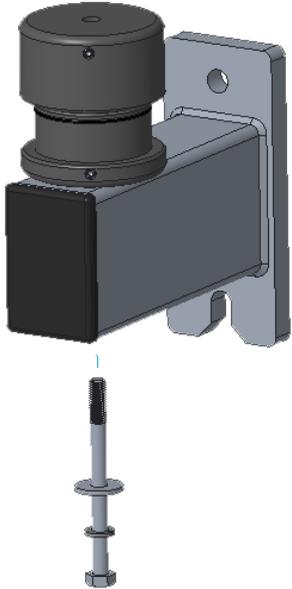
Installing Shock Absorbers

Once the mounting posts are properly installed, you need to install the shock absorbers that are designed to counter system and environmental vibrations.

To do so:

- 1 Position a shock absorber on a mounting post.
- 2 Position the nuts and washers.
- 3 Tighten the provided M8 screw by hand, and then up to the required torque (21.1 N·m [15.6 lb.ft]).

Figure 17 Screwing In Shock Absorbers



- 4 Repeat steps 1 to 3 for the three remaining shock absorbers.

Placing the Analytical Unit On Shock Absorbers



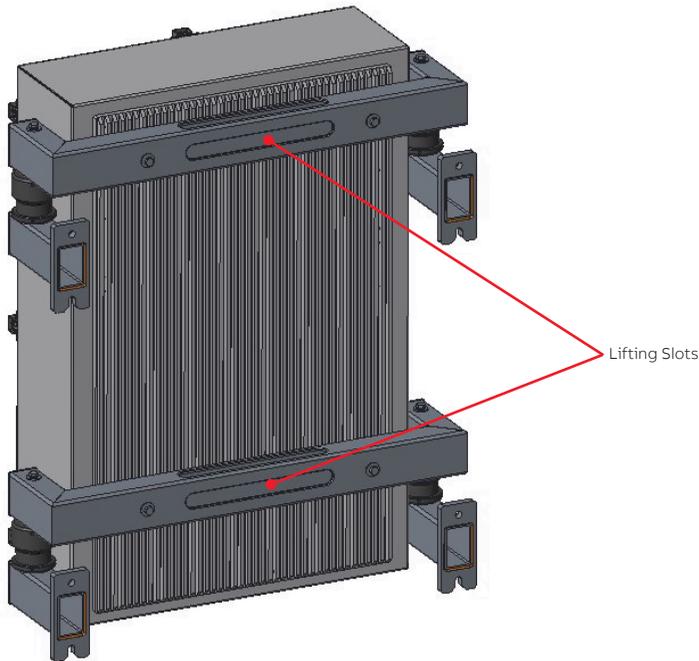
WARNING

The CoreSense M10 analytical unit weighs over 65 kg (144 lb). It could cause serious injuries or even death if it were to tip over and/or fall on someone.

Once the mounting posts and shock absorbers are properly installed, you need to position the analytical unit.

ABB recommends using a sling and a crane to lift the unit up on to the mounting posts. To this end, slots are designed in the unit mounting frame to help lift up the unit.

Figure 18 Lifting Slots on Back of Unit

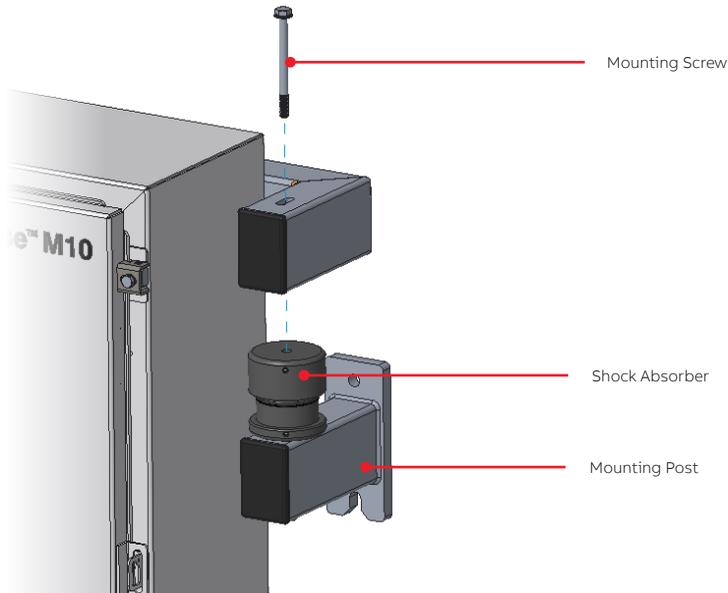


However, the following procedure explains how an installation team should install the unit **by hand**. It is important to follow the general lifting and handling precautions given on page 7.

To place the unit on the mounting posts:

- 1 With one team member on each side of the analytical unit, lift the unit upright.
- 2 With proper lifting technique, lift up the analytical unit and lower it on the four shock absorbers. Make sure that the top holes on the shock absorbers are properly aligned with the bottom holes in the mounting frame (see Figure 19).

Figure 19 Positioning the Unit on Shock Absorbers

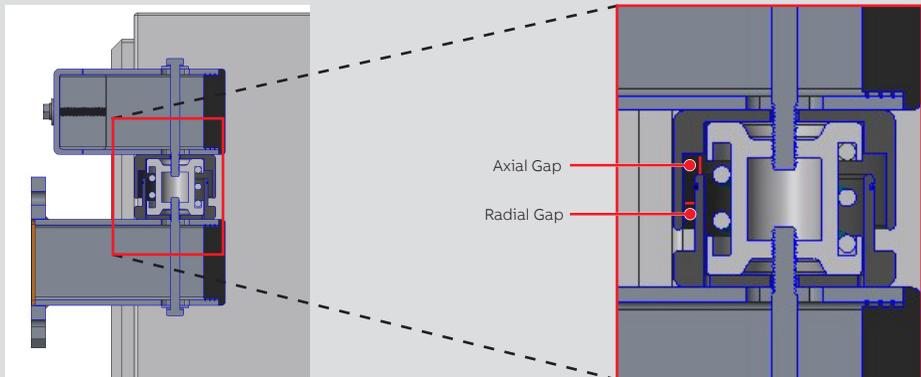


- 3 Insert the screw through the mounting frame and in the shock absorbers. Shock absorbers minimize the effects of vibrations, shocks, and bumps on the analytical unit, and provide a certain amount of protection against seismic activity (Class 1 of IEC 60255, part 21).



NOTICE

It is **critical** that the two cups maintaining the internal spring aligned do not come in contact with each other, either radially or axially, as this would cancel the protective effects of the shock absorber.



- 4 Tighten the M8 screw by hand, and then up to the required torque (21.1 N·m [15.6 lb.ft]).
- 5 Repeat steps 3 and 4 for the three remaining shock absorbers.

Earthing the Analytical Unit

Safety

ONLY qualified personnel may perform the electrical installation of the monitoring system.

In accordance with international safety standards, the monitoring system uses a three-wire power cord or line typically connected to an electrical panel that provides grounding for the monitor chassis.

- Ensure that the equipment, and any device or power cord connected to the analytical unit, is properly grounded.
- Make sure that the analytical unit earth is at the same potential as the transformer earth.
- **ONLY** use power cords equipped with a protective earthing terminal.
- Protective earthing connections (grounding) must be active at all times.



DANGER

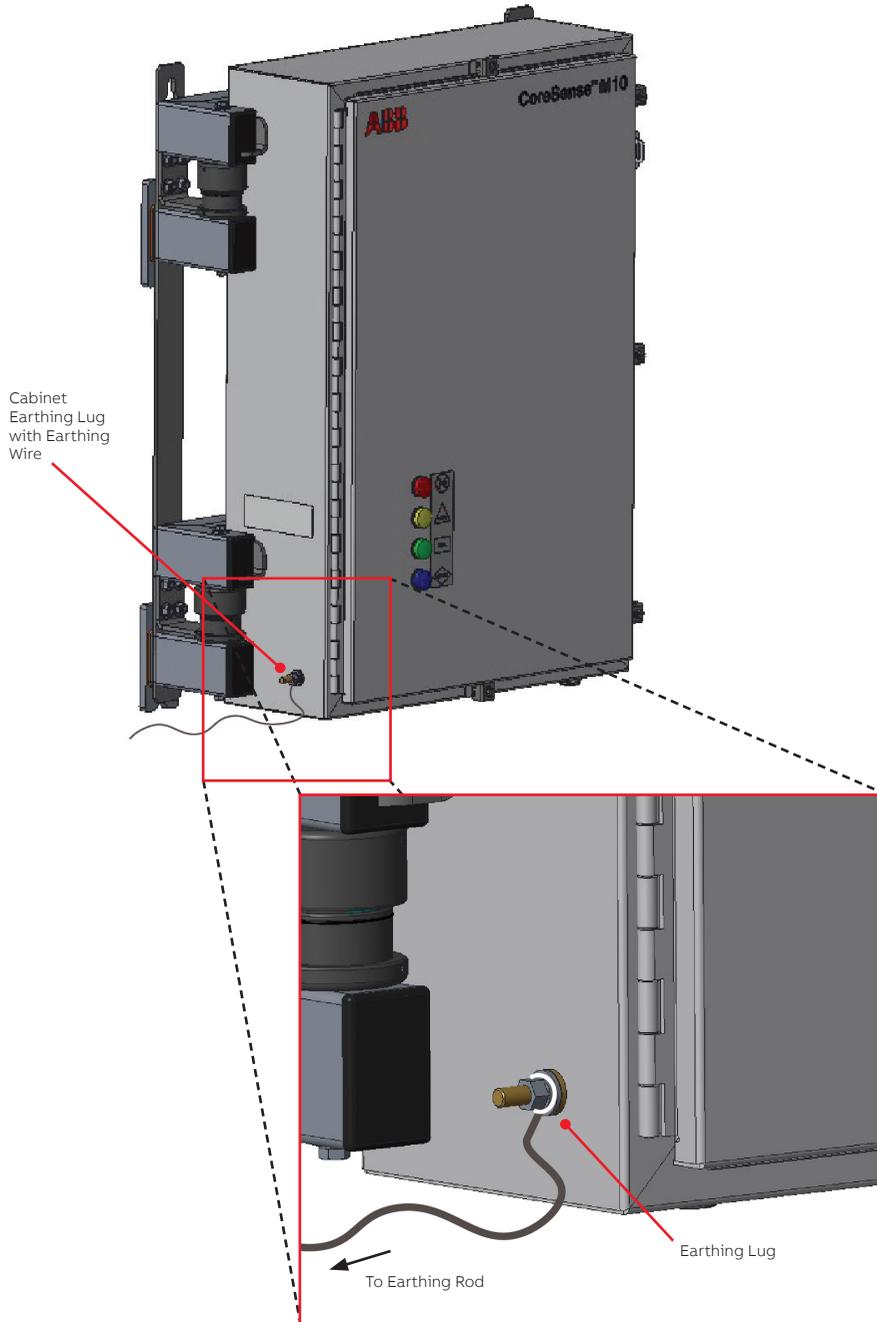
The absence of grounding can lead to a potential shock hazard that could result in serious personnel injury.

If an interruption of the protective earthing is suspected, cut the power to the analytical unit at the plant distribution panel and have the electrical circuit tested.

To earth the analytical unit cabinet:

- 1** Attach one end of the earthing wire to an earthing rod in the ground in the vicinity of the transformer (for grounding wire gauge, see Table 2 on page 24).
- 2** Attach the other end of the earthing wire to the cabinet earthing lug located outside the cabinet, on the left hand side (see Figure 20 on page 35).

Figure 20 Cabinet Earthing Lug



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Installing the Sensor Head

Once your installation plan is complete and you have gathered all the necessary tools, you can proceed with installation of the CoreSense™ M10 multi-gas monitoring system.

Precautions



WARNING

Do not grab the sensor head by the mounting threads. Thread edges are sharp and pose a risk of personal injury.



WARNING

Do not handle the sensor head by the attached conduit. This could break the interface between the conduit and the fitting, possibly losing the IP rating and allowing for substance (water) ingress.



NOTICE

Do not expose sensor head innards to rain or snow.

The CoreSense M10 sensor head is delivered with the thermal pump turned OFF. When installation is complete and the sensor head is in contact with oil, make sure to enable the thermal pump (see "Activating the Thermal Pump" on page 70).



NOTICE

The thermal pump is designed to operate while immersed in transformer oil. It will fail **within minutes** if operated in air.

Connecting the Sensor Head

The sensor is designed to be installed on a 1.5 NPT transformer valve.

- 1 Remove the black rubber cap covering the sensor head male fitting. Make sure that both the sensor head male fitting and the transformer valve female fitting are clean.

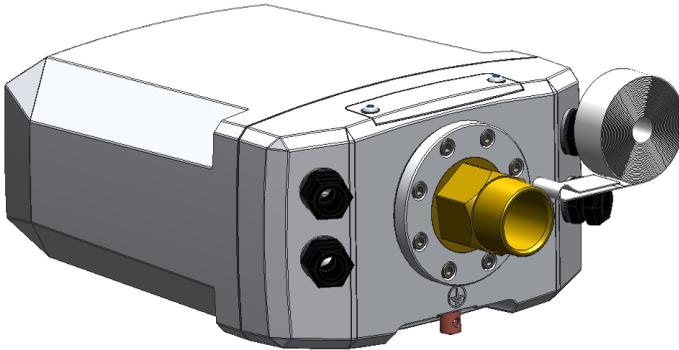


NOTICE

Do not expose the sensor head innards to rain or snow.

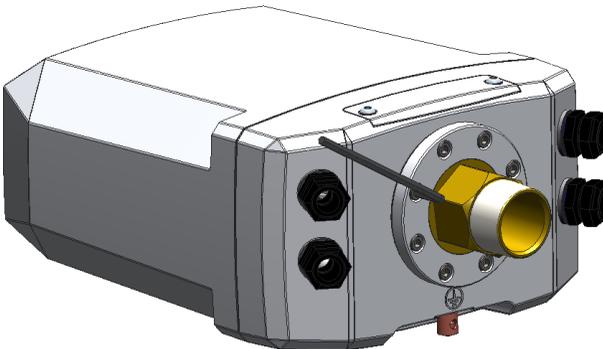
- 2 Wrap the sensor head fitting thread with Teflon (PTFE) tape. Thread sealant for pipes can also be used for this task.

Figure 21 Fitting Teflon Tape on Sensor Head



- 3 Loosen the eight rotating flange screws with the 5 mm (0.2 in) hex key so that the flange can rotate freely.

Figure 22 Loosening the Rotating Flange Screws



- 4 Connect the sensor head to the transformer valve.

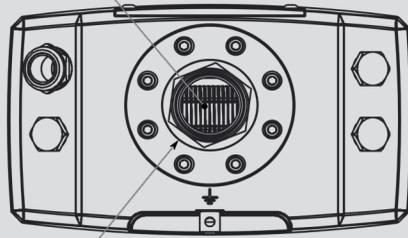


NOTICE

DO NOT remove the sensor head oil port

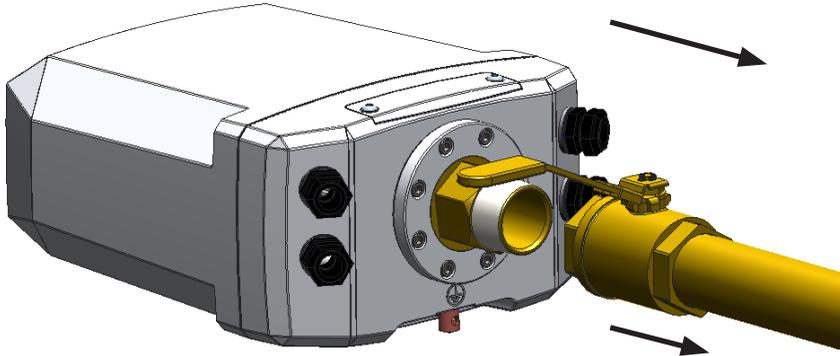
A gas extractor is located directly behind the sensor head oil port. The gas extractor is fragile. Take all necessary precautions to avoid damaging it.

Gas extractor



Oil connector

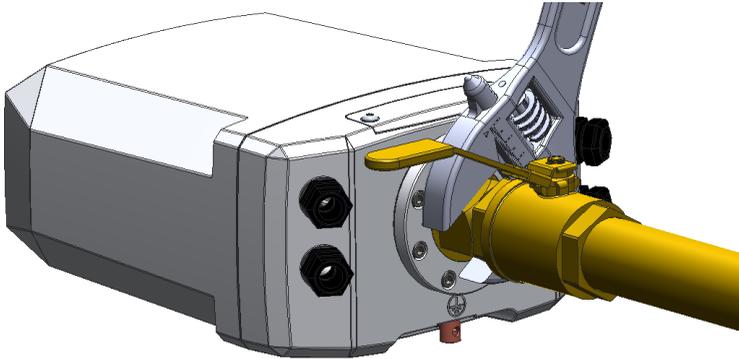
Figure 23 Connecting the Sensor Head



An optional adapter can be used if the valve fitting is not NPT 1.5 (e.g., most North American valves are NPT 2).

6 Tighten the connection with a wrench (50.8 mm [2-in] or adjustable wrench).

Figure 24 Tightening the Connection



7 Once the head-valve connection is fully tightened, make sure that the sensor head is positioned **horizontally** and that its sampling access panel is pointing upwards. Rotate the head as necessary.



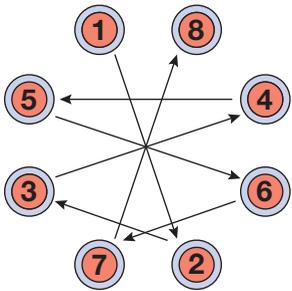
NOTICE

Failure to position the CoreSense M10 sensor head horizontally, with the access panel pointing upwards, will cause the thermal pump to malfunction and may result in erroneous readings.

8 Tighten all rotating flange screws by hand.

9 With the 5 mm hex key, tighten the rotating flange screws to 8.1 N·m (6.0 lbf·ft) according to the tightening pattern below.

Figure 25 Screw Tightening Pattern



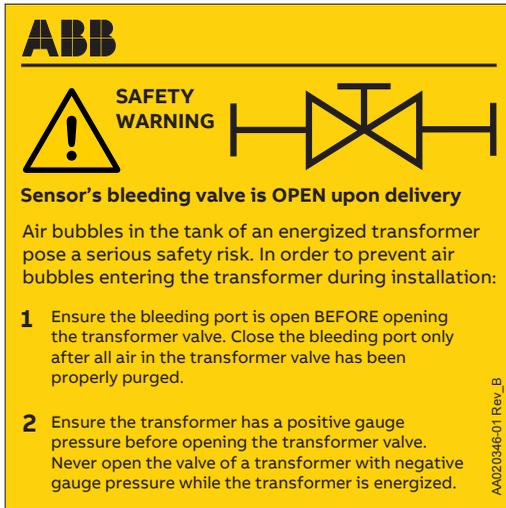
NOTICE

The rotating flange screws must be tightened to 8.1 N·m (6.0 lbf·ft) to prevent oil leaking from the rotating flange.

Do not apply excessive torque.

Purging the Sensor Head

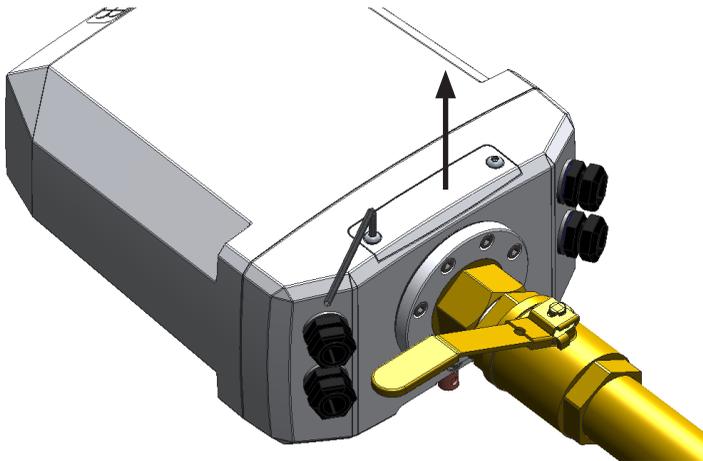
Once the sensor head has been properly installed, you need to purge the air out of the unit. This is performed through the sampling adapter. As indicated by the label on top of the adapter cover (see image below), the sensor head sampling adapter port is delivered in an open state.



To purge the sensor head:

- 1 Remove the external sampling port cover located on top of the sensor with the 4 mm hex key.

Figure 26 Removing the Sampling Port Cover



- 2 Connect the provided bleeding hose (ID 3.18 mm [0.125 in]) to the sampling adapter.
- 3 Direct the other end of the bleeding hose in an oil container to collect all the purged oil.
- 4 Slowly open the transformer valve and wait until oil comes out of the sensor (about 20 seconds; this ensures that all air is purged).

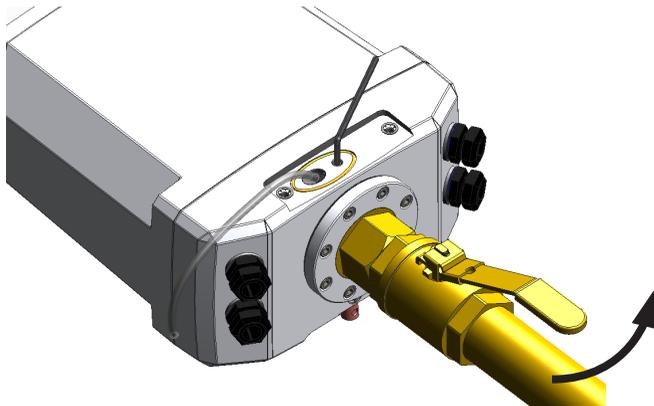


NOTICE

Make sure that the transformer is in positive pressure **before** opening the transformer valve.

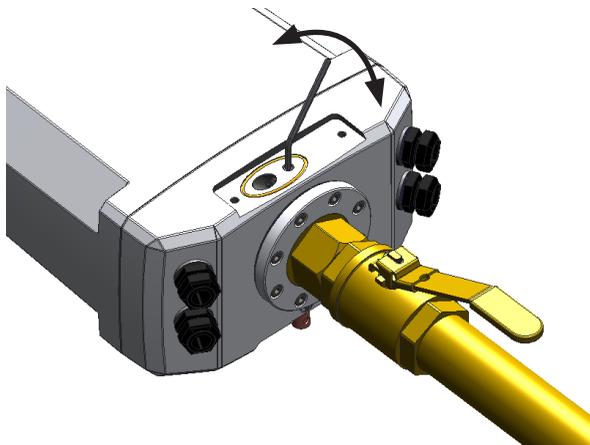
Make **ABSOLUTELY SURE** that there are no bubbles left in the bleeding hose.

Figure 27 Opening the Transformer Valve



- 5 Tighten the bleed screw to a maximum torque of 2.26 N·m (20 lbf·in).

Figure 28 Tightening the Bleed Screw



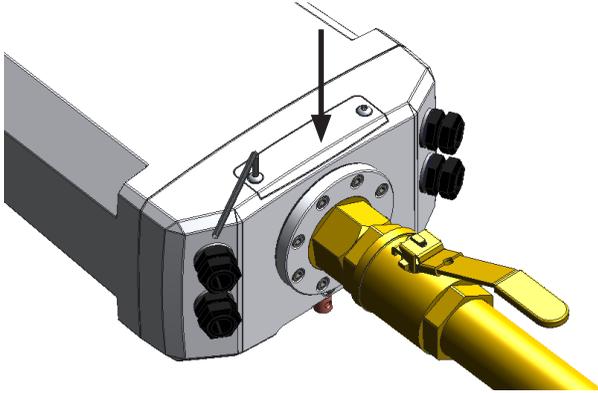
NOTICE

Do not apply excessive torque.

- 6 Wipe excess oil with a clean cloth.

7 Re-install the external sampling port cover and secure it with the 4 mm hex key.

Figure 29 Re-installing the Sampling Port Cover

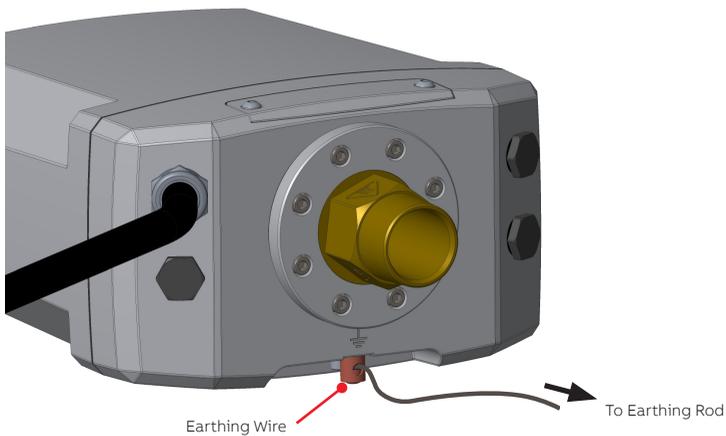


Earthing the Sensor Head

To earth the sensor head:

- 1 Attach one end of the earthing wire to an earthing rod in the ground in the vicinity of the sensor head (for grounding wire gauge, see Table 2 on page 24).
- 2 Attach the other end of the earthing wire to the sensor head earthing lug located underneath the head.

Figure 30 Attaching the Earthing Wire To the Sensor Head



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Connecting CoreSense M10

Once the CoreSense M10 analytical unit and sensor head are installed, you have to connect the two via the conduit attached to the sensor head. You also need to supply power to the system.



WARNING

Failing to comply with any of the instructions, precautions or warnings contained herein is in direct violation of the standards of design, manufacture, and intended use of the instrument.

ABB assumes no liability for user failure to comply with any of these safety requirements, which may result in personal injuries and/or instrument damages.

Safety

ONLY qualified personnel may perform the electrical installation of the monitoring system.

In accordance with international safety standards, the monitoring system requires a three-wire power cord or line typically connected to an electrical panel that provides grounding for the analytical unit and sensor head.

- CoreSense M10 is an overvoltage category II instrument.
- An external circuit breaker with a 8 A rating or less must be installed on the AC source and labeled in compliance with your country's national electrical code. Also, if required by this code, a circuit breaker or switch in the building installation, marked as the disconnect switch, shall be in close proximity to the equipment and within easy reach of the operator.
- Operators must strictly observe all applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical devices.
- Before opening the analytical unit cabinet, disconnect power at the distribution panel circuit breaker.
- Ensure that the equipment and any device or power cord connected to it is properly grounded.
- Make sure that system and transformer grounds are at the same potential.
- **ONLY** use power cords equipped with a protective grounding terminal.
- Protective grounding connections must be active at all times.



DANGER

The absence of grounding can lead to a potential shock hazard that could result in serious personnel injury.

If an interruption of the protective grounding is suspected, cut the power to the system at the plant distribution panel and have the electrical circuit tested.

- In accordance with IEC61010-1 edition 3.0, to prevent contamination of the electronics by outside elements, the analytical unit cabinet cover shall be opened only under controlled environmental conditions defined as:
 - **Temperature:** between 5 °C (41 °F) and 40 °C (104 °F)
 - **Maximum relative humidity:** 80% for temperatures up to 31 °C (87 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F).
- Use only fuse(s) specified as appropriate for this equipment (see “Technical Specifications” on page 83).
- Should you need to add access holes on any side of the analytical unit, it is **your** responsibility to use methods, tools and parts that ensure that the analytical unit remains compliant with the NEMA 4x standard.

Routing the Sensor Head Conduit to the Analytical Unit

The sensor head and analytical unit are linked by a single conduit permanently attached to the sensor head. That conduit contains all gas, communication, and power lines necessary for interaction between sensor head and analytical unit during system operation.

To connect the attached conduit to the analytical unit, you first need to access the unit connection ports.

To do so:

- 1 Open the analytical unit door:
 - a Loosen the screws that hold the five latches over the door.
 - b Slide the latches away from the door.
 - c Open the door.

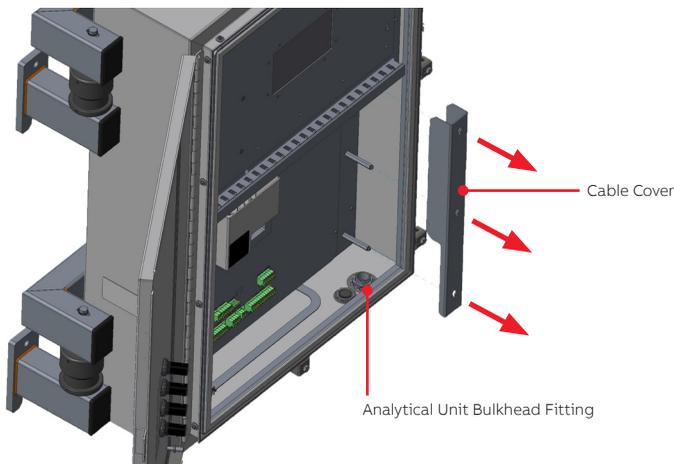


WARNING

Before opening the door, make sure that nothing is sitting on top of the cabinet, as this could fall and cause personnel injuries.

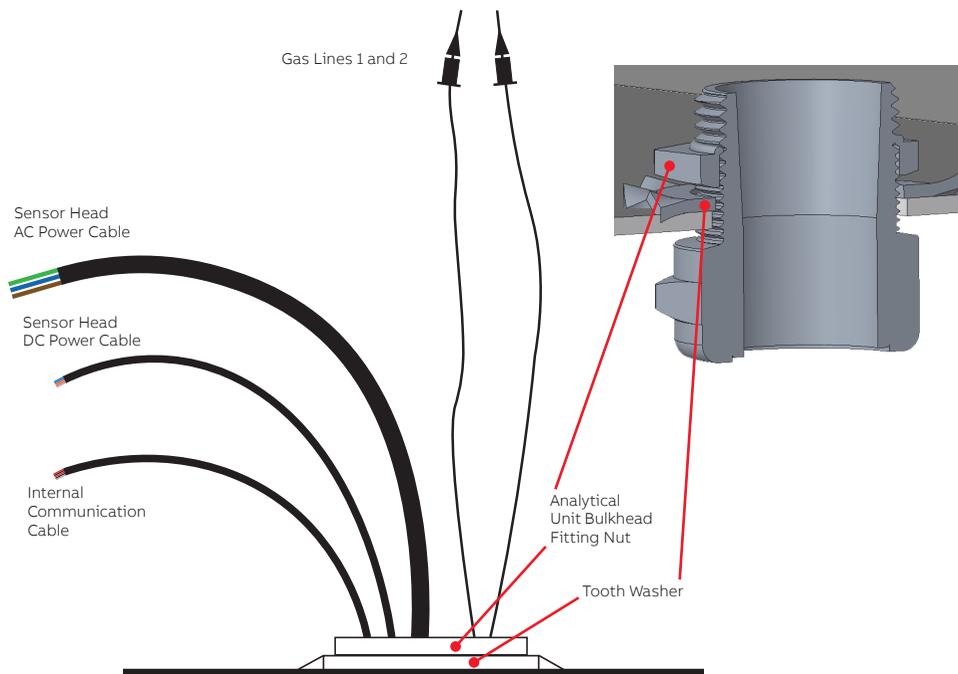
- 2 Unscrew and remove the cable cover (see Figure 31 on page 46.)

Figure 31 Removing the Internal Cable Cover



- 3 Remove the cover from the analytical unit bulkhead fitting.
- 4 On the attached conduit, remove the cover from over the internal cables.
- 5 Remove the bulkhead fitting nut and tooth washer from the small plastic bag tie-wrapped near the conduit end.
- 6 From the attached conduit, route the five internal cables and conduit connector end through the bulkhead fitting.

Figure 32 Cables Coming From the Attached Conduit (once inside the cabinet)



- 7 Slide the tooth washer over the routed cables so that it comes in contact with the bulkhead.
- 8 Slide the bulkhead fitting nut over the routed cables and onto the tooth washer.
- 9 Screw the nut to the sensor head conduit connector head coming through to the analytical unit bulkhead fitting.



NOTICE

To ensure that the analytical unit retains its environmental protection rating, make sure that the cable connector is pressed hard against the fitting gasket.

Connecting Gas Lines

Gas lines route gases from the sensor head to the analytical unit. They are made from semi-rigid stainless steel tubing.



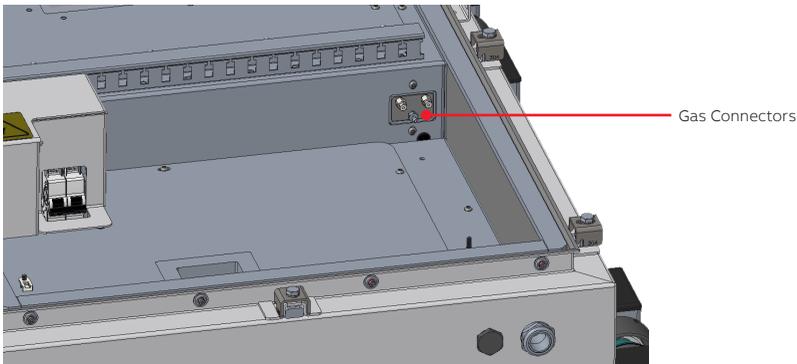
NOTICE

You can connect any of the gas lines to any of the two gas connectors inside the unit.

To connect the gas lines:

- 1 Stretch out the gas line tubing slightly to bring its tip to a gas connector inside the cabinet.

Figure 33 Gas connectors inside the cabinet



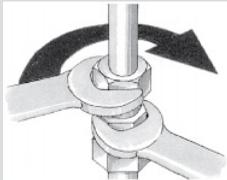
- 2 Push the tip slowly but firmly into the connector opening until you feel it make contact at the bottom of the opening.
- 3 Tighten the screw by hand as much as possible.
- 4 Once tightness has been achieved, apply a final $\frac{1}{8}$ to $\frac{1}{4}$ turn (45° to 90°) with a small wrench.



NOTICE

Use a second wrench to prevent movement on the fitting body.

Do not apply excessive force as this might permanently damage the connection.



The conduit screw must be properly tightened to prevent gas leaking from the connection point.

- 5 Repeat steps 1 to 4 for the second gas line.
- 6 Route the three remaining cables (sensor head AC, sensor head DC, Modbus) immediately to the left of the bulkhead fitting.
- 7 Put back the cable cover.

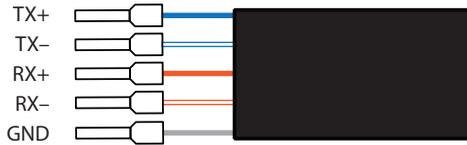
Connecting the Internal Communication Cable

The sensor head and analytical unit communicate via a proprietary communication cable.

To connect the communication cable:

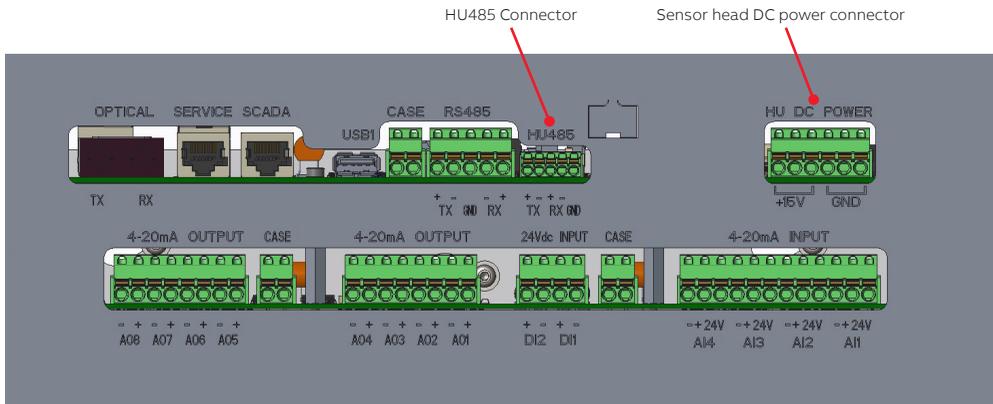
- 1 Of the cables coming from the sensor head conduit, identify the one with the orange and blue internal wires.

Figure 34 Communication Cable Configuration



- 2 Connect each of the five wires in the appropriate socket on the HU485 connector (see below).

Figure 35 Analytical Unit Connection Board



NOTICE

For more information on the various communication cables used, see Table 4 on page 25 and “Connector Definitions” on page 95.

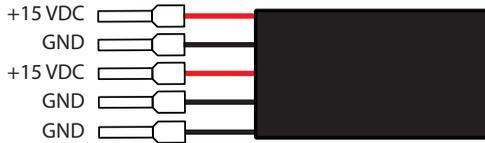
For more information on configuring the communication protocols, refer to the CoreSense M10 Monitoring System User Guide.

Connecting the Sensor Head DC Power Cable

The sensor head DC power cable sends low voltage power to the sensor head for almost every electrical task except the heating element.

- 1 Of the cables coming from the sensor head conduit, identify the one with the red and black internal wires.

Figure 36 Low power cable configuration



- 2 Connect each of the five wires in the appropriate socket on the sensor head DC power connector (HU DC Power, Figure 35).

Connecting the Sensor Head AC Power Cable

To connect the sensor head AC power cable, you first need to access the power entry terminal block. Once the terminal block is accessible, you need to route the power cable as explained in the following pages.

Removing the Terminal Block Cover

To make the terminal block accessible, you first need to remove its cover.



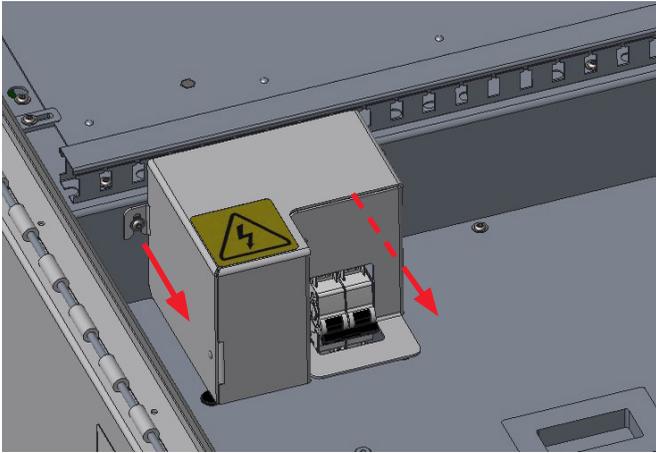
WARNING

Before opening the analytical unit door, make sure that nothing is sitting on top of the unit, as this could fall and cause personnel injuries.

- 1 Open the analytical unit door:
 - a Loosen the screws that hold the five latches over the door.
 - b Slide the latches away from the door.
 - c Open the door.

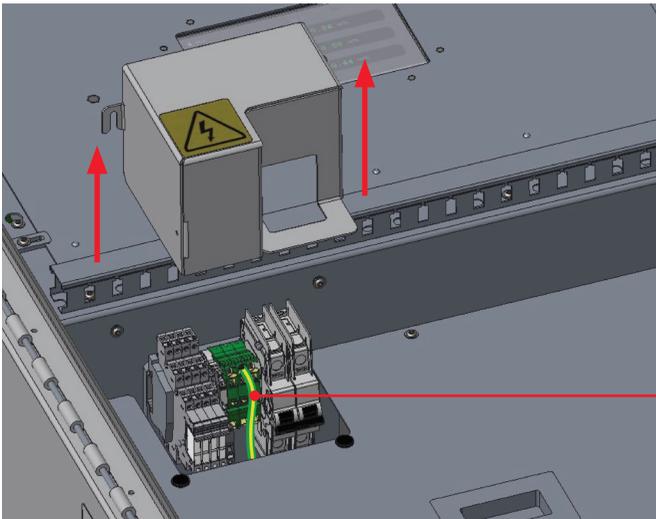
2 Loosen the two screws holding the terminal block cover in place (see Figure 37).

Figure 37 Loosening the Two Screws Holding the Terminal Block Cover



3 Slide out the terminal block cover, exposing the terminals.

Figure 38 Removing the Terminal Block Cover



System Electronics
Grounding Cable

Connecting the Cable

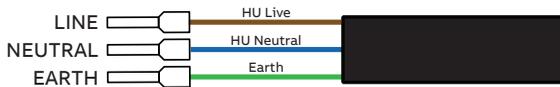


NOTICE

All terminals are properly identified in the instrument itself to simplify installation.

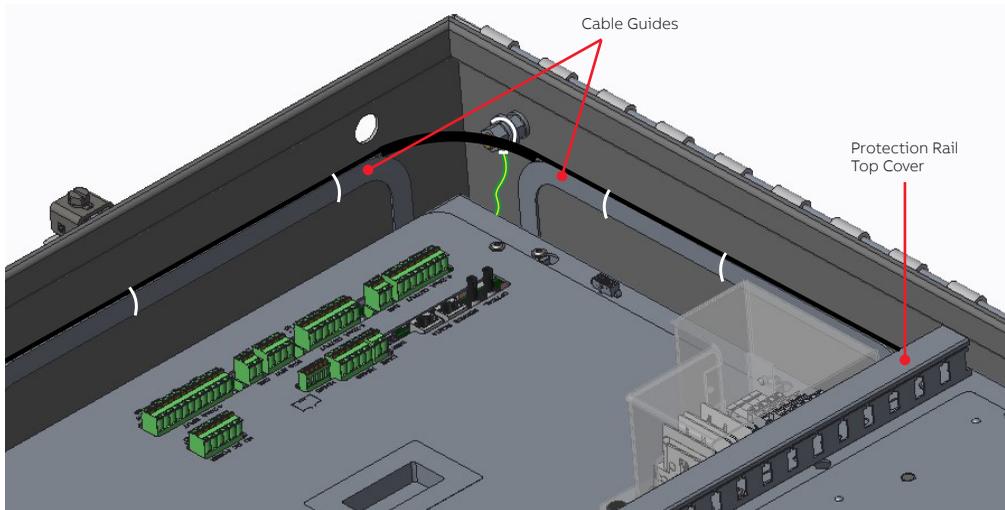
- 1 Of the cables coming from the sensor head conduit, identify the one with green, blue and brown internal wires. This is the AC power cable.

Figure 39 Sensor Head AC Power Cable Configuration



- 2 Route the wire under the cable guides found at the bottom and on the left-hand side of the analytical unit cabinet (see Figure 40 on page 52.)

Figure 40 Routing the Sensor Head AC Power Cable

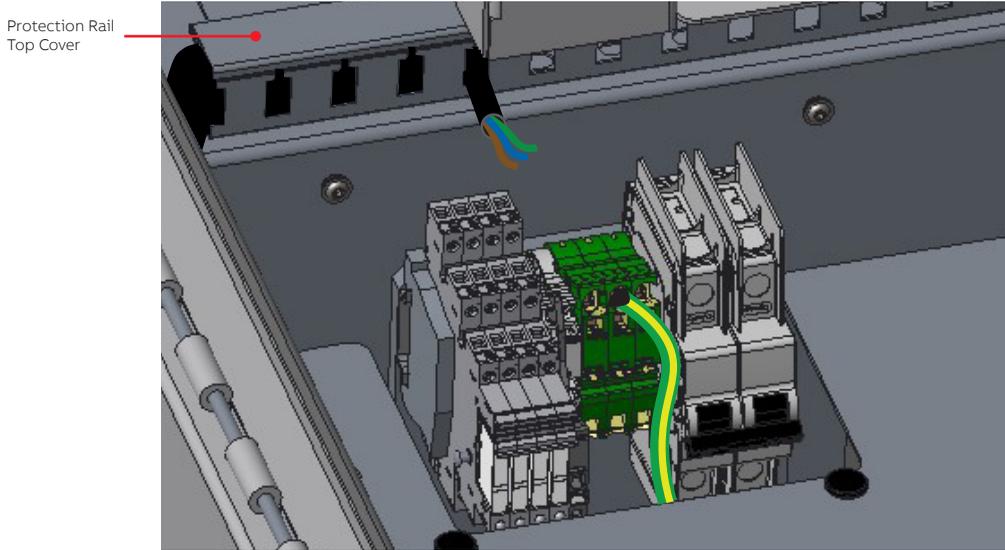


NOTICE

Once the installation is complete, it is strongly suggested to use tie wraps (in white on Figure 40) to secure the cables to the cable guides.

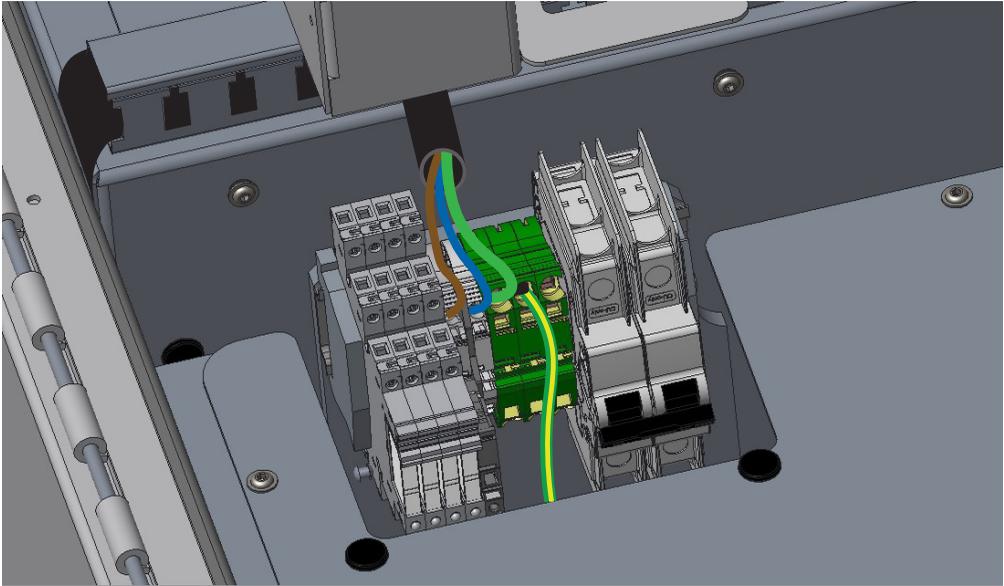
- 3 Remove the protection rail top cover (see Figure 40) and continue routing the wire through the upper protection rail all the way to the appropriate terminal, as illustrated in Figure 41.

Figure 41 Routing the Sensor Head AC Power Cable To the Terminal Block



4 Connect each wire in the appropriate terminal.

Figure 42 Connecting the Sensor Head AC Wires



Connecting the Mains AC Power Cable

Once all internal connections have been completed, you need to bring power to the analytical unit from the power distribution panel.



NOTICE

It is the user's responsibility to provide a power cord that fits local electrical requirements.

Safety

ONLY qualified personnel may perform the electrical installation of the monitoring system.

In accordance with international safety standards, the monitoring system requires a three-wire power cord or line typically connected to an electrical panel that provides grounding for the analytical unit and sensor head.

- Operators must strictly observe all applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical devices.
- Ensure that the equipment and any device or power cord connected to it is properly grounded.
- Make sure that the system earth is at the same potential as the transformer earth.
- **ONLY** use power cords equipped with a protective grounding terminal.
- Protective grounding connections must be active at all times.



DANGER

The absence of grounding can lead to a potential shock hazard that could result in serious personnel injury.

If an interruption of the protective grounding is suspected, cut the power to the system at the plant distribution panel and have the electrical circuit tested.

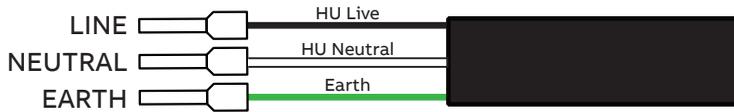
- In accordance with IEC61010-1 edition 3.0, to prevent contamination of the electronics by outside elements, the analytical unit cabinet cover shall be opened only under controlled environmental conditions defined as:
 - **Temperature:** between 5 °C (41 °F) and 40 °C (104 °F)
 - **Maximum relative humidity:** 80% for temperatures up to 31 °C (87 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F).
- Do not expose the analytical unit innards to rain or snow.
- An external circuit breaker with a 8 A rating or less must be installed on the AC source and labeled in compliance with your country's national electrical code. Also, if required by this code, a circuit breaker or switch in the building installation, marked as the disconnect switch, shall be in close proximity to the equipment and within easy reach of the operator.



WARNING—ENERGIZED TRANSFORMER

In case of an installation on energized transformers, plan this power connection prior to all other work (connection location, needs for additional fuses, etc.)

Figure 43 Mains AC power cable configuration



| | | | |
|------------|----------------------------|---|------------------------------|
| AC Live | 100–240 V AC, single phase | Copper-only wire (stranded WITH FERRULE or solid) | Flat screwdriver Ø 6.0 mm |
| AC Neutral | 50–60 Hz | AWG #18 to AWG #12 | |
| | 8A max. | 90 °C 600V, UL and CSA type | |
| AC Earth | | | Flat screwdriver Ø 3.5 mm |



NOTICE

The mains power cable must be able to withstand a minimal top operating temperature of 90 °C.

Connecting the Cable



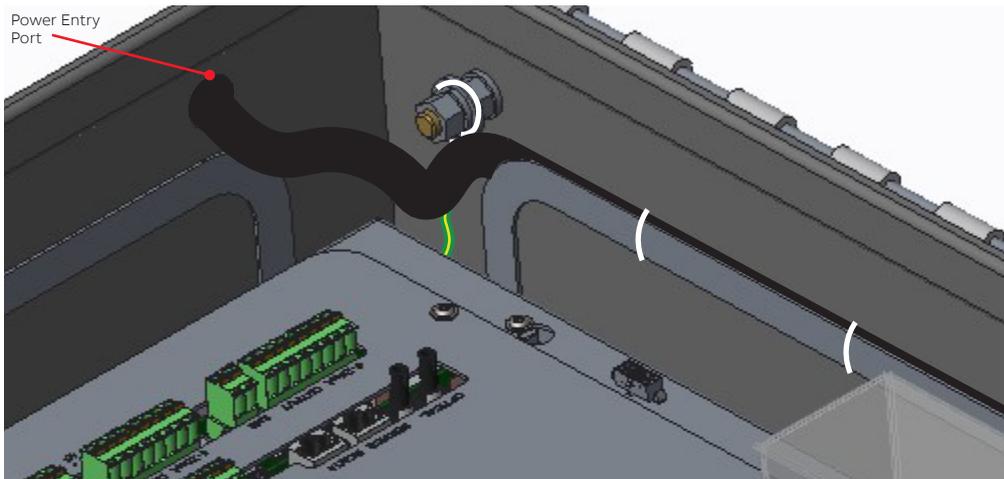
NOTICE

All terminals are properly identified in the instrument itself to simplify installation.

To connect the cable:

- 1 Insert the cable through the power entry port and route it under the cable guide found on the left-hand side of the analytical unit cabinet (see Figure 44 on page 55).

Figure 44 Routing the Mains Power Cord Toward the Power Entry Terminal Block



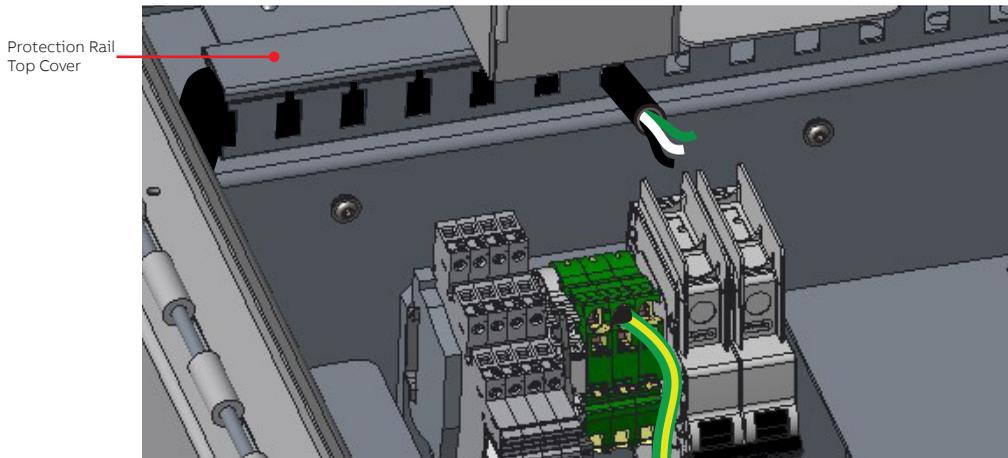


NOTICE

Once the installation is complete, it is strongly suggested to use tie wraps (in white on Figure 44) to secure the cables to the cable guides.

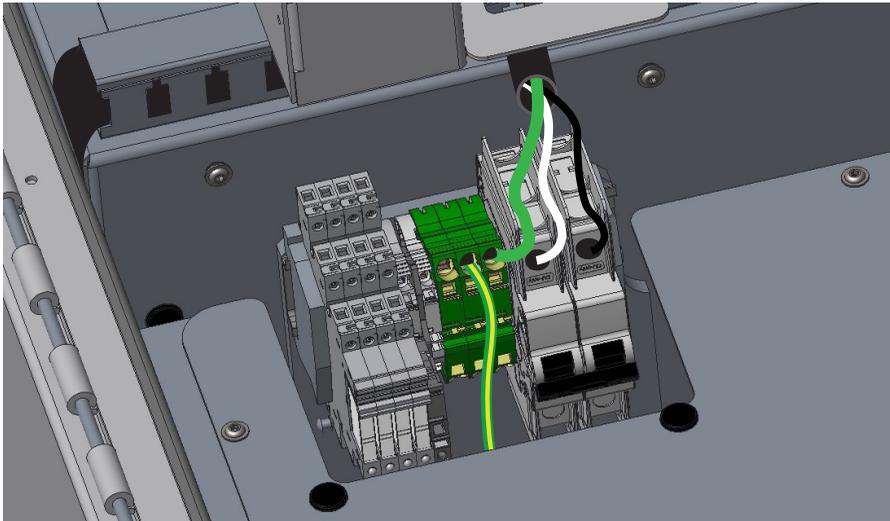
Remove the protection rail top cover and continue routing the wire through the upper protection rail all the way to the appropriate terminal, as illustrated in Figure 44.

Figure 45 Routing the Mains Power Cable To the Terminal Block (sensor head AC cable not shown, for clarity)



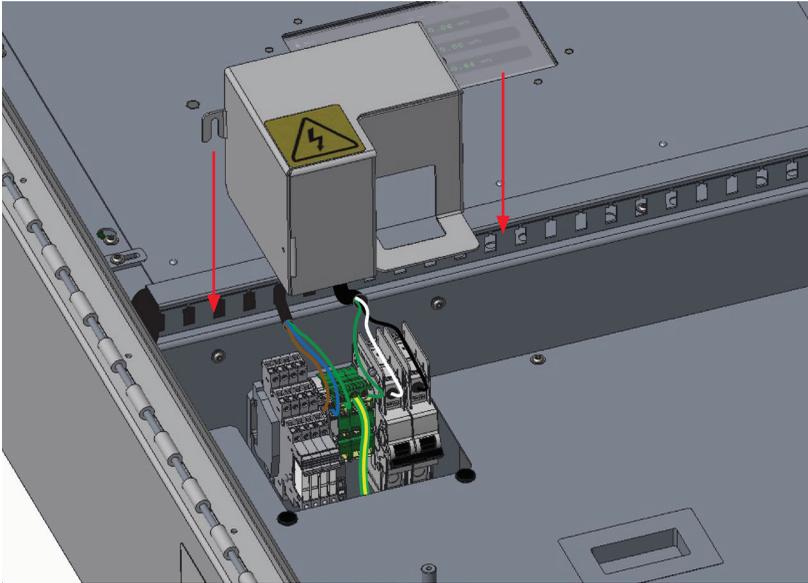
2 Connect each wire in the appropriate terminal, as shown below.

Figure 46 Connecting the Mains Power AC Cable (sensor head AC cable not shown, for clarity)



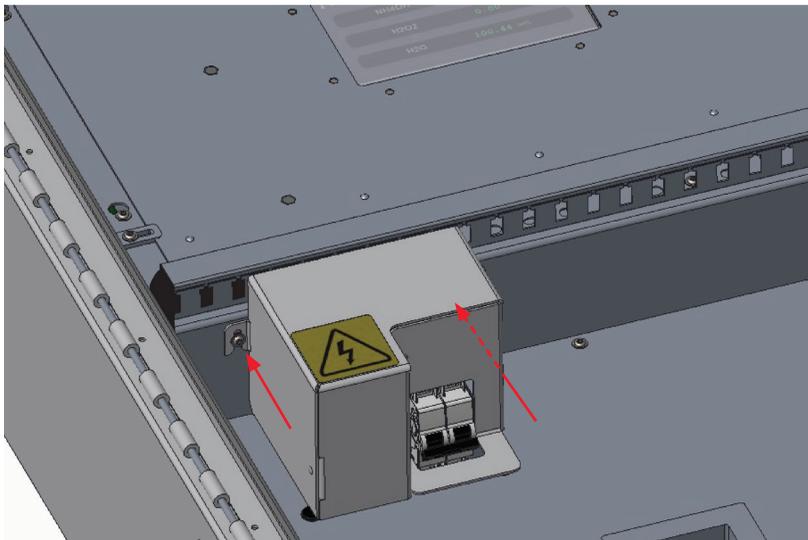
3 Once both AC power cables are properly connected, put back the terminal block cover.

Figure 47 Putting Back the Terminal Block Cover



4 Tighten the screws that hold the terminal block cover.

Figure 48 Tightening the two screws holding the terminal block cover



Installing the Molecular Sieve

You must install the ABB molecular sieve inside the CoreSense M10 analytical unit to absorb humidity and contaminants, and to prolong the life cycle of the unit's sources. For the detailed procedure, see "Installing the Molecular Sieve" on page 89.

Powering Up CoreSense M10

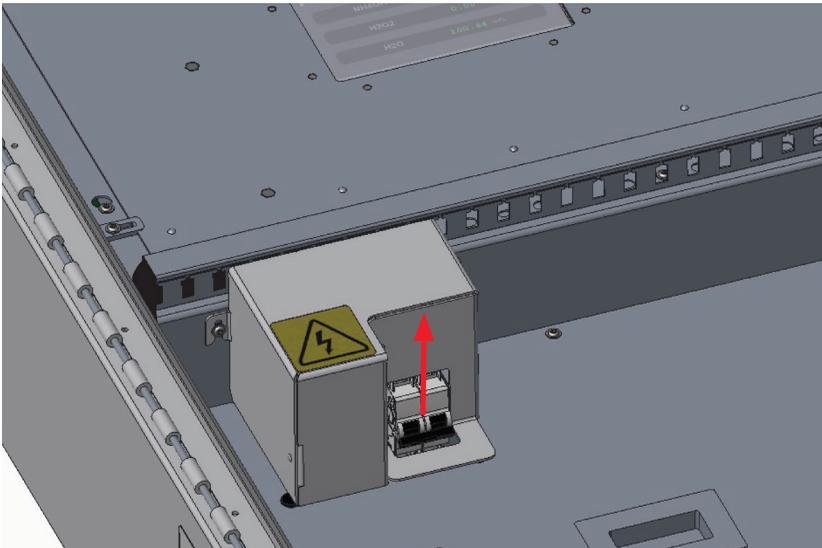


NOTICE

NEVER try and start the system if the ambient temperature is below $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$).

Once all connections are properly set, you can power up the monitoring system. To do so, simply close each breaker switch, as shown in Figure 49.

Figure 49 Pulling Breaker Switches to Power Up the Monitoring System



Establishing SCADA Connections

ABB recommends using a **Cat5** Ethernet cable.



NOTICE

Do not use the optical Ethernet port when using the copper-based SCADA Ethernet port.

Establishing RS-485 Connections

The RS-485 can be used in full- or half-duplex mode (see Figure 50). All signals on RS-485 (J18) are isolated.

The RS-485 interface is intended to be used in point-to-point mode. There is no need to add a 120 Ω termination on the receiver (Rx); the resistor is present on board. The transmitter (Tx) must be terminated at the other end.

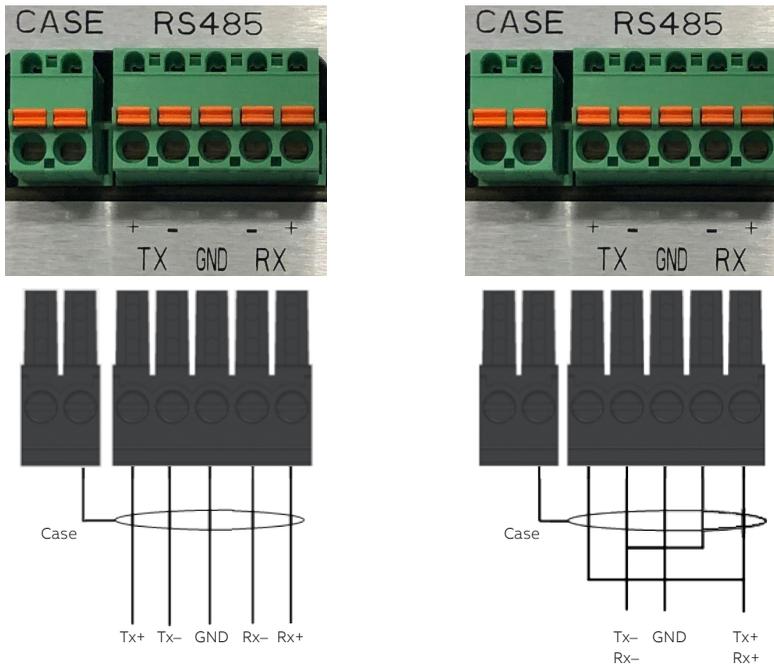
Other RS-485 topologies are not supported.



NOTICE

Use only shielded cable for wiring the RS-485 interface.

Figure 50 RS-485 Wiring Details (full duplex - left, half duplex - right)



NOTICE

For more information on the various communication cables used, see Table 4 on page 25 and “Connector Definitions” on page 95.

For more information on configuring the communication protocols, refer to the CoreSense M10 Monitoring System User Guide.

Establishing Analog 4–20 mA Connections

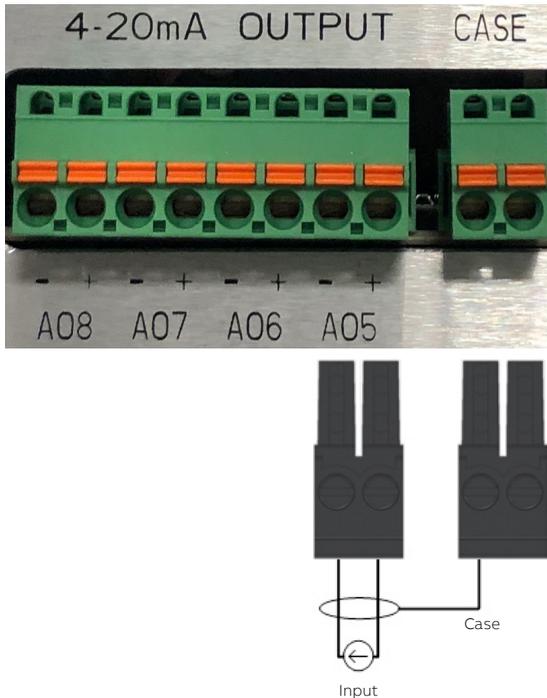
Outputs



WARNING

Use only shielded cables for wiring the 4–20 mA outputs interface.

Figure 51 Wiring 4–20 mA Analog Outputs



NOTICE

For more information on the various communication cables used, see Table 4 on page 25 and “Connector Definitions” on page 95.

For more information on configuring the communication protocols, refer to the CoreSense M10 Monitoring System User Guide.

Inputs

The 4–20 mA input range can be configured using the web interface.



WARNING

Shielded cable must be used for connecting to the 4–20 mA outputs.

Figure 52 Self-powered Analog Input Wiring

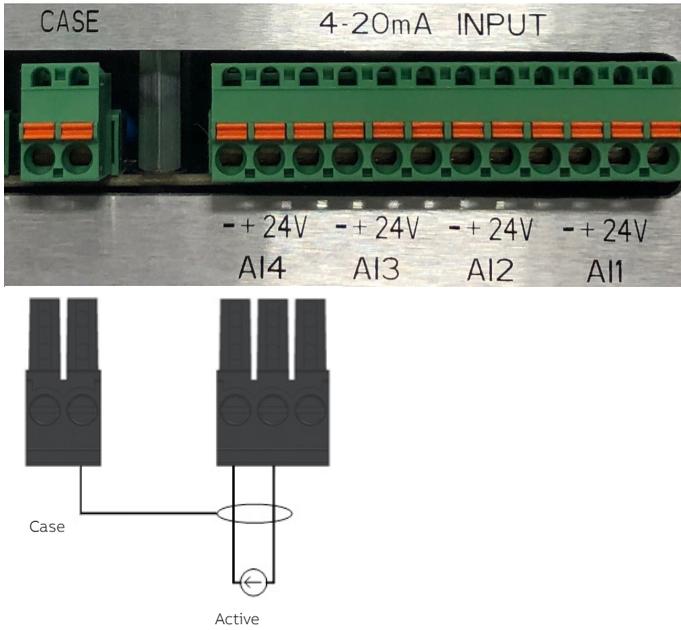
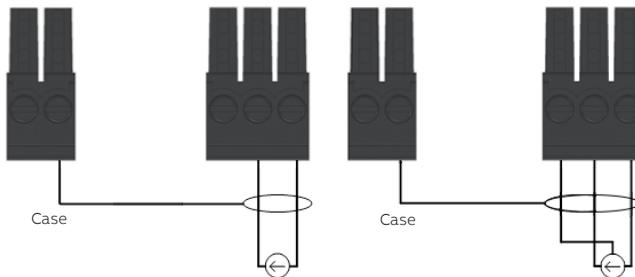


Figure 53 Loop-powered Analog Input Wiring (two-wire - left, three-wire - right)



NOTICE

For more information on the various communication cables used, see Table 4 on page 25 and “Connector Definitions” on page 95.

For more information on configuring the communication protocols, refer to the CoreSense M10 Monitoring System User Guide.

Installing Relays

This is the diagram to install the communication relays between external sensors and the CoreSense M10. These relays are underneath the terminal box (see Figure 3 on page 13). For more information, see “Power and Relays” on page 97.

Figure 54 Relays

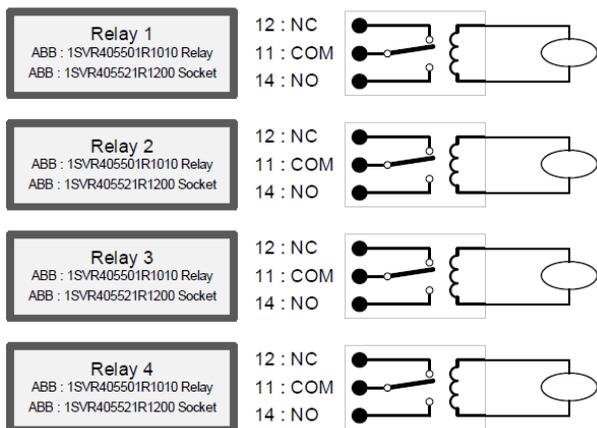


Table 6 Relay Behavior

| | |
|--|---|
| Relay 1 (Maintenance) | 1 if the instrument is functional (blue LED off) 0 if there is a problem with the CoreSense M10 (blue LED lit) |
| Relay 2 (System) | 1 if no gas alarm is active (green LED lit) 0 if an alarm is active (warning or alarm). (green LED off) |
| Relay 3 (Warning) | 1 if one of the elements analyzed by CoreSense M10 is in warning (yellow LED lit) 0 if no warning on analyses (yellow LED off) |
| Relay 4 (Alarm) | 1 if one of the elements analyzed by CoreSense M10 is in alarm (red LED lit) 0 if no alarm on analyses (red LED off) |
| Examples of combined relay behavior | |
| 1-1-0-0 | System OK |
| 0-0-0-0 | Internal problems, and gas concentration predictions not possible |
| 1-0-1-0 | If a gas concentration is above a threshold but below an alarm |
| 1-0-0-1 | In case of excessive gas concentrations |

Establishing Optical Ethernet Connections

Use 62.5/125 μm or 50/125 μm multimode optical fibers to connect to the 100Base-FX optical Ethernet connector. Before connecting the optical transceiver, see “Communication” on page 86 for more information on the optical characteristics. Make sure optical power levels and wavelength are within the specified range.



NOTICE

Do not use the copper-based SCADA Ethernet port when using the optical Ethernet port.

For more information on the various communication cables used, see Table 4 on page 25 and “Connector Definitions” on page 95.

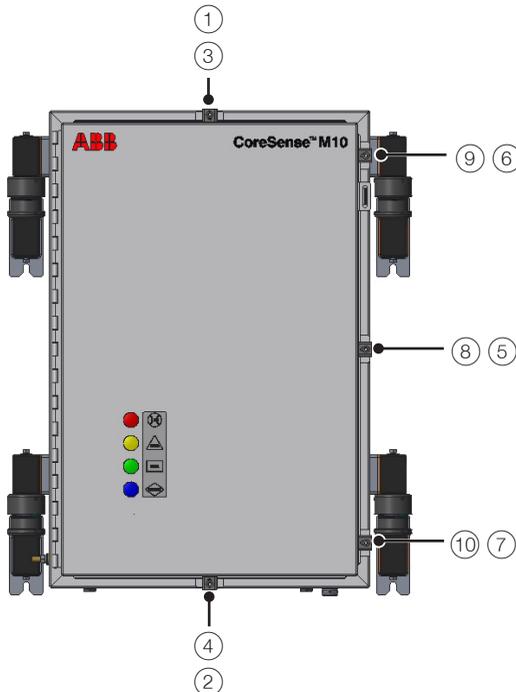
For more information on configuring the communication protocols, refer to the CoreSense M10 Monitoring System User Guide.

Closing the Analytical Unit Door

The CoreSense M10 analytical unit complies with the IP66 and NEMA 4X standards.

To ensure that the unit remains compliant when you close the unit door, you must tighten the unit latch screws to **9 N·m (80 lbf.in)** according to the sequence indicated below:

Figure 55 CoreSense M10 door latch tightening sequence



Page intentionally left blank

Configuring CoreSense M10

Once CoreSense M10 is properly installed and powered, you must configure basic system parameters at system startup.



NOTICE—CYBERSECURITY

This product is designed to be connected to, and communicate information and data via a network interface. It is the user's sole responsibility to provide, and continuously ensure, a secure connection between the product and the user's network or any other network (as the case may be).

Users shall establish and maintain any and all appropriate measures (such as, but not limited to, the installation of firewalls, the application of authentication measures, the encryption of data, the installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized accesses, interferences, intrusions, leakages and/or theft of data or information.

ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB strives to maintain cybersecurity for its products and services. By visiting the web page, you will find notifications about newly found software vulnerabilities and options to download the latest software. It is recommended that you visit this web page regularly:

<http://new.abb.com/about/technology/cyber-security>

Information about your product is also available on the product page:

<https://www.hitachienergy.com/offering/product-and-system/transformers/transformer-service/advanced-services-for-transformers/condition-monitoring/coresense-m10-multi-gas-dga-analyzer>

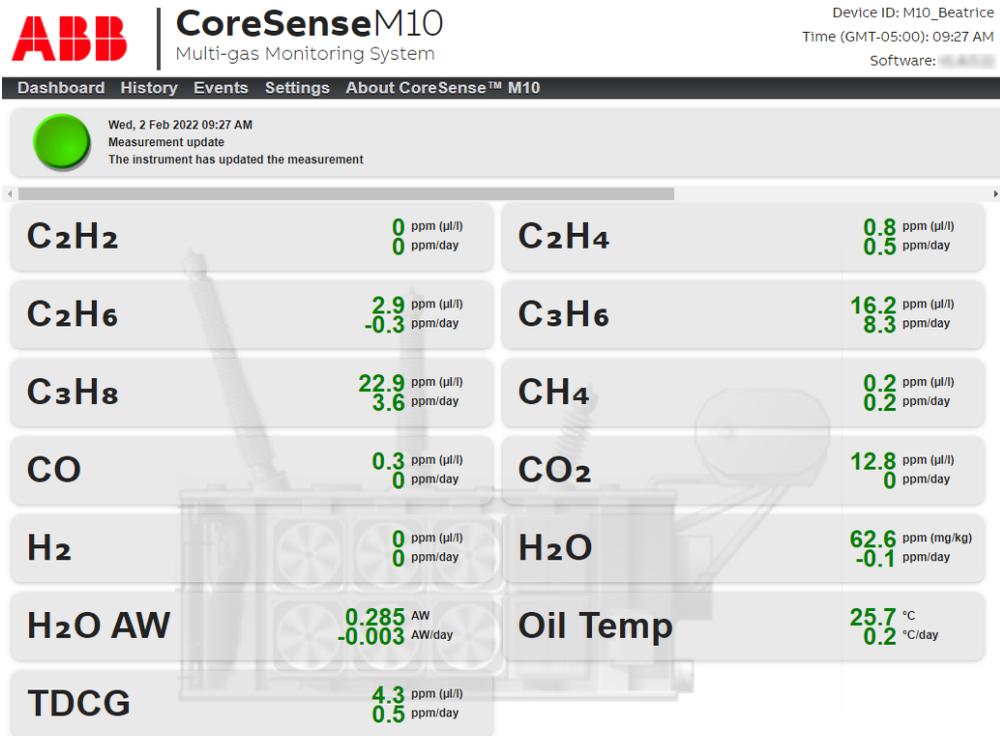
Establishing Communications

To establish communication, you need to connect to the system.

To do so:

- 1 With a straight RJ45 Ethernet cable, connect your laptop to the SCADA communication port on the analytical unit (see “Analytical Unit Communication Ports” on page 14).
- 2 Open your web browser and point it to the default IP address <http://10.127.127.127>
This address points to the CoreSense M10 dashboard.

Figure 56 CoreSense M10 Dashboard



Modifying Default Passwords

With the CoreSense M10 system, parameters and functions are made available depending on the password used to access the system (rather than user names).

For cybersecurity reasons, it is absolutely mandatory to change the default passwords. Not doing so could expose your entire network to cyberattacks.

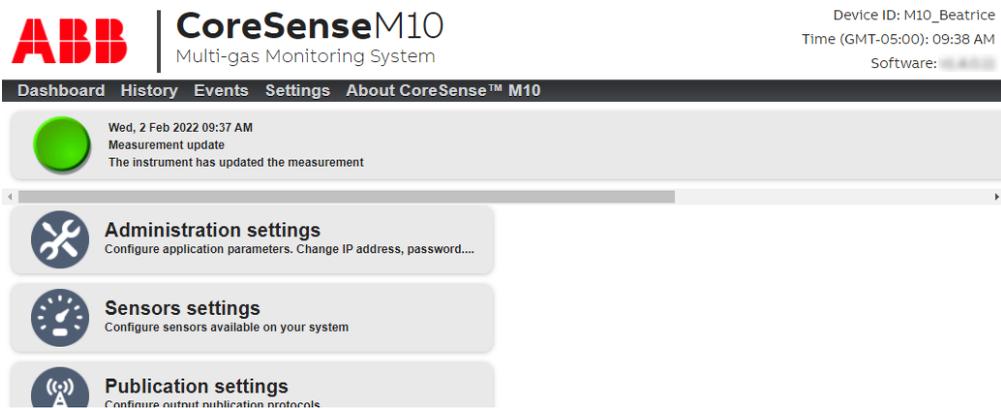
The default operator and administrator passwords are:

- Operator **Ack**
- Administrator **Admin**

To modify passwords:

- 1 From the CoreSense M10 dashboard (see Figure 56), click **Settings**. The Settings page appears.

Figure 57 CoreSense M10 Settings Page



- 2 Click **Administration settings**.

The first time that you try to access this page, you will be asked to enter a password. Enter the administrator password shown above. The Administration settings page appears.

- 3 In the **General settings** section, enter passwords for both operators and administrators.

NOTICE

i Passwords accept letters (including capitals) and numbers, **but not special characters**. Passwords cannot be more than 25 characters long.

Figure 58 General settings Section

| General settings | |
|------------------|------------------|
| Operator | Administrator |
| Password | Password |
| Confirm password | Confirm password |

- At the bottom of the page (depending on the size of your screen, you might have to scroll down), click **Apply** to save the new passwords that meet the security criteria set by your company, and confirm these.

Figure 59 Apply Button

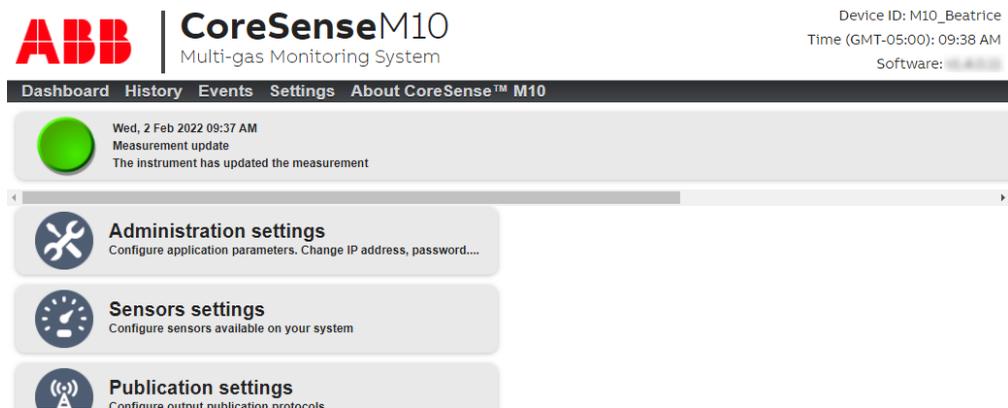


Setting Date and Time

To set the system date and time:

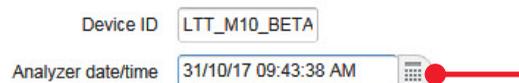
- From the CoreSense M10 dashboard (see Figure 56), click **Settings**. The Settings page appears.

Figure 60 CoreSense M10 Settings Page



- Click **Administration settings** and enter your password (for more information on setting passwords, see page 67).
- In the **Analyzer settings** section of the Settings page, click the small calendar icon to the right of the **Analyzer date/time** field. A calendar appears where you can select a date and enter the time.

Figure 61 Accessing the Analyzer Calendar



To accurately report event times, you must configure time settings.



NOTICE

All **instrument** dates and times are stored in coordinated universal time (UTC). A properly configured browser will automatically translate those dates and times into local time for dashboard and event display.

Therefore, the computer connected to the CoreSense M10 shall be set to the **local timezone** for the following operations to be successful.

Figure 62 Setting System Date and Time

The screenshot shows the configuration interface for the CoreSense M10. At the top, there is a green notification bubble that says "Measurement update" and "The instrument has updated the measurement". Below this is the "Analyzer settings" section, which includes fields for "Device ID" (Beatrice), "Analyzer date/time" (20/03/18 04:30:19 PM), "Use NTP Server" (unchecked), and "NTP Server IP Address". A calendar overlay is open over the "Analyzer date/time" field, showing the month of March 2018. The date 20 is selected. Below the calendar are drop-down menus for the time: 04, 30, 19, and PM. Below the "Analyzer settings" is the "General settings" section, which includes fields for "Operator" (Admin), "Password", and "Confirm password". At the bottom is the "Miscellaneous settings" section, which includes a checkbox for "Enable ABB remote access".

- 4 Browse to select the appropriate date.
- 5 From the drop-down menus at the bottom of the calendar, select the appropriate time.
- 6 At the bottom of the page (depending on the size of your screen, you might have to scroll down), click **Apply** to save the selected date and time.

Activating the Thermal Pump



NOTICE

The thermal pump is designed to operate while immersed in transformer oil. It will fail **within minutes** if operated in air.

For configuration purposes, the sensor head can be powered when it does not contain any oil. However, **the thermal pump must be turned OFF.**

The CoreSense M10 sensor head is delivered with the thermal pump turned OFF. When installation is complete and the sensor head is in contact with oil, make sure to activate the thermal pump.

To activate the thermal pump:

- 1 From the CoreSense M10 dashboard (see Figure 56), click **Settings**. The Settings page appears (see page 68).
- 2 Click **Administration settings** and enter your password (for more information on setting passwords, see Figure 60 on page 68).
- 3 Scroll down to the **Application settings** section and check the **Enable thermal pump** box.
- 4 At the bottom of the page, click **Apply** to confirm activation of the thermal pump.

Figure 63 Enabling the Thermal Pump

The screenshot shows the 'Settings' page of the CoreSense M10. The 'Application settings' section is visible, containing a dropdown menu for 'Local HMI language' set to 'English'. Below this, a red warning message states: '*Be sure your CoreSense is properly connected to drain valve before enabling this feature. Changes will be applied after reboot.' Underneath the warning, the 'Enable thermal pump' checkbox is checked. The 'Spectrometer settings' section is partially visible below, with an unchecked checkbox for 'Enable residual ratio on CH₄, C₂H₂, C₂H₄, C₂H₆, C₃H₆, C₃H₈, CO and CO₂'. At the bottom of the settings area, there are three buttons: 'Apply', 'Cancel', and 'Restart analyzer'.

Maintenance and Troubleshooting

Troubleshooting might happen occasionally. Most of the time, service has to be performed by authorized service personnel. If such situations arise, you will need to contact after-sales service.

- In accordance with IEC61010-1 edition 3.0, to prevent contamination of the electronics by outside elements, the analytical unit cabinet cover shall be opened only under controlled environmental conditions defined as:
 - **Temperature:** between 5 °C (41 °F) and 40 °C (104 °F)
 - **Maximum relative humidity:** 80% for temperatures up to 31 °C (87 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F).
- Do not expose the cabinet innards to unstable weather events (rain, snow, hail, etc.)
- Use only fuse(s) specified as appropriate for this equipment (see “Technical Specifications” on page 83).

Closing the Analytical Unit Door

The CoreSense M10 analytical unit complies with the IP66 and NEMA 4X standards.

Before you close the door, it is important to verify that the screws holding the cable cover on the right-hand side, and the screws holding the terminal block cover are tightened so as not to cause vibrations when the unit is operational.

To ensure that the unit remains standards-compliant when you close the unit door, you must tighten the unit latch screws to **9 N·m (80 lbf.in)** by following the sequence indicated on page 63.

Cleaning the System

In accordance with your company’s procedure:

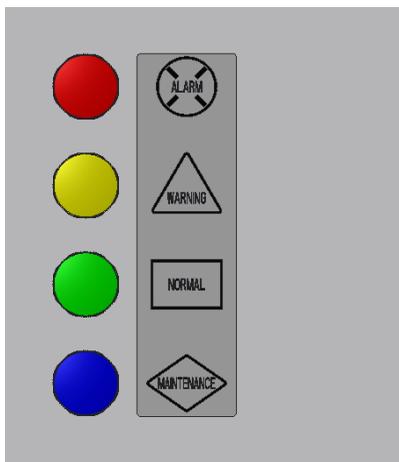
- Perform a visual inspection of the sensor head and analytical unit, checking for oil leaks, and water, snow or sand accumulations. Wipe off any such accumulation with a clean cloth.
- Make sure that all enclosures and the connecting cable are properly secured.

Troubleshooting

Most problems that could happen within the CoreSense M10 monitoring system will be recorded as events in the Events log. You will be informed of these problems either with alarms or by looking at the LEDs on the system cabinet or sensor head. The meaning of the various LEDs is explained below.

Understanding Cabinet LEDs

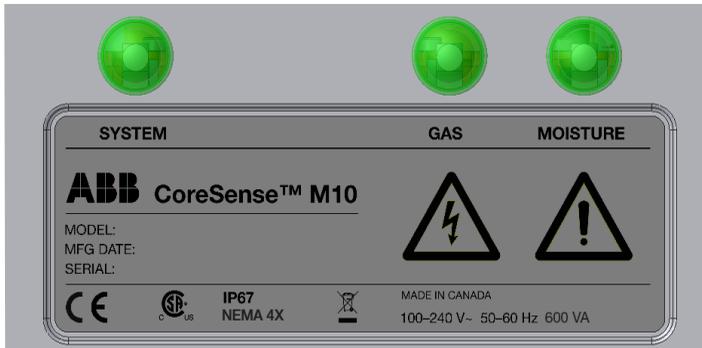
Figure 64 Analytical Unit Status LEDs



| | Solid | Blinking |
|--|--|---|
| RED  ALARM | An alarm threshold has been reached by any of the measured parameters. For more information on gas alarm thresholds, refer to the CoreSense M10 User Guide. | N/A |
| YELLOW  WARNING | A warning threshold has been reached by any of the measured parameters. For more information on gas warning thresholds, refer to the CoreSense M10 User Guide. | N/A |
| GREEN  NORMAL | Normal operating conditions. | The analyzer is starting up. |
| BLUE  MAINTENANCE | Unit requires immediate maintenance. User attention is required as the sensor is either operating outside its nominal specifications or experiencing a fault condition. Consult the event log and contact your local service representative. | User attention is required as the last working pump or source is being used. An event is created accordingly and a service call should be made. NOTE: The blinking blue LED can be lit at the same time as other LEDs, or when a measurement is missing for a certain period of time (90 minutes by default). |

Understanding Sensor Head LEDs

Figure 65 Sensor Head Status LEDs



| | System | Gas | Moisture |
|---|---|---|---|
| GREEN  | The sensor is powered up and operating normally. | All gas levels and rate-of-change are below user-configured WARNING thresholds. | Both the moisture level AND the moisture 24-hour rate-of-change are below user-configured WARNING thresholds. |
| BLUE  | <p>Unit requires immediate maintenance.</p> <p>Solid: During system updates or when user attention is required as the sensor is either operating outside its nominal specifications or experimenting a fault condition. Consult the event log and contact your service representative.</p> <p>Blinking: User attention is required as the last working pump or source is being used. An event is created accordingly and a service call should be made.</p> <p>NOTE: The blinking blue LED can be lit at the same time as other LEDs or when a measurement is missing for a certain period of time (90 minutes by default).</p> | N/A | N/A |

| | System | Gas | Moisture |
|--|--|---|---|
| <p>YELLOW</p>  <p>WARNING</p> | <p>Solid: While the cabinet is starting up.</p> <p>Solid: A warning threshold has been reached by any of the measured gases. It remains lit until the associated WARNING event has been acknowledged. For more information on gas warning thresholds, refer to the CoreSense M10 User Guide.</p> | <p>The last measured gas level OR 24-hour rate-of-change of at least one gas is above user-configured WARNING thresholds.</p> <p>For more information on gas warning thresholds, refer to the CoreSense M10 User Guide.</p> | <p>The last measured moisture level OR 24-hour rate-of-change are above user-configured WARNING thresholds.</p> <p>For more information on gas warning thresholds, refer to the CoreSense M10 User Guide.</p> |
| <p>RED</p>  <p>ALARM</p> | <p>An alarm threshold has been reached by any of the measured gases. It remains lit until the associated ALARM event has been acknowledged. For more information on gas alarm thresholds, refer to the CoreSense M10 User Guide.</p> | <p>The last measured gas level OR 24-hour rate-of-change of at least one gas is above user-configured ALARM thresholds.</p> <p>For more information on gas alarm thresholds, refer to the CoreSense M10 User Guide.</p> | <p>The last measured moisture level OR 24-hour rate-of-change are above user-configured ALARM thresholds.</p> <p>For more information on gas alarm thresholds, refer to the CoreSense M10 User Guide.</p> |

Exporting System Logs

Should you need to call after-sales service (contact information on the back cover of this manual), you will be asked to provide the system log file of your CoreSense M10. To provide this file, you need to export it from the instrument.

To do so:

- 1 From the CoreSense M10 dashboard screen, click **Settings**. The settings menu page appears.
- 2 In the **Settings** menu page, click **System Logs**.

Figure 66 System Logs Menu Page



Device ID: M10_Beatrice
Time (GMT-05:00): 15:28 PM
Software: [REDACTED]

Dashboard History Events **Settings** About CoreSense™ M10

Tue, 1 Feb 2022 03:23 PM
Measurement update
The instrument has updated the measurement

Logs
[Dropdown Menu] Export All

File content

3 Click **Export All**.

At this point, you will be asked to specify what you want to do with the resulting .csv file, Regardless of the browser in use, you will have the option to save the .zip file. By default, the file name will include the device ID.

4 From the **Save** file dialog box that appears, select the location where you want to save of the zip file that contains the complete set of log files and data required for a full diagnostic of the CoreSense M10. This is the file that you will need to send to the after-sales service.

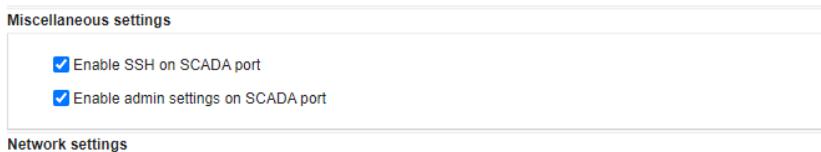
Giving Access To Administrative Aettings On the SCADA Port

If you enable access to the administrative settings on the SCADA port, all users logging into the system with an operator password **will not** have access to the administrative settings.

To enable this feature:

- 1** From the CoreSense M10 dashboard (see Figure 56 on page 66), click **Settings**. The Settings page appears (see Figure 60).
- 2** Click **Administration settings** and enter your password if necessary (for more information on passwords, see “Modifying Default Passwords” on page 67).
- 3** In the **Miscellaneous** section, check the **Enable admin settings on SCADA port**.

Figure 67 Enabling Remote Access for Service Personnel



4 At the bottom of the page, click **Apply** to save the information that you just entered.

From now on, operators accessing the system with the operator password will not have access to administrative settings.

Installing Firmware Updates

At some point in the future, you might be asked by a service representative to update your system firmware. This can be done with a web browser (remotely or locally) or a USB key (locally).

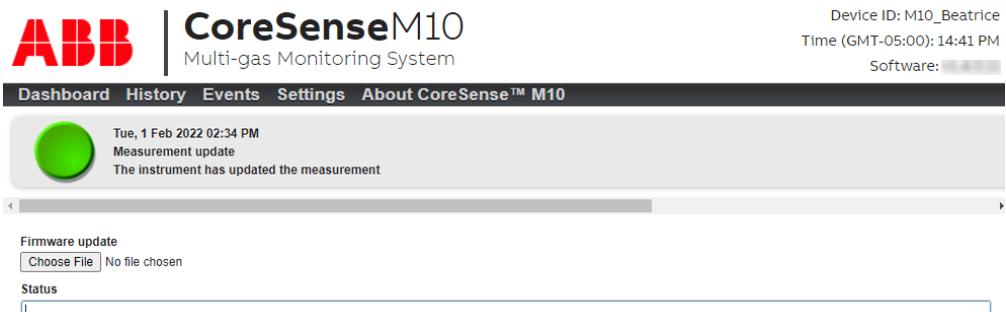
Before performing any firmware update, it is **strongly recommended** to export your system logs and history files.

Updating With a Web Browser (preferred method)

To update the firmware via a web browser:

- 1 Skip to step 2 if you are working remotely. Otherwise, open the CoreSense M10 cabinet and connect your laptop to an Ethernet communication port (SCADA or SERVICE) of the analytical unit with a straight RJ45 Ethernet cable.
- 2 Open your web browser and point it to the required IP address:
 - if connected to the SCADA port: the static IP address (<http://10.127.127.127>) or the address indicated on the local HMI;
 - if connected to the SERVICE port: <http://172.16.100.1> (or fix address set for this interface)This address points to the CoreSense M10 dashboard.
- 3 From the CoreSense M10 dashboard, click **Settings**. The Settings page appears.
- 4 Click **Update firmware** and enter your password (if necessary). The firmware update page appears.

Figure 68 Firmware Update Page



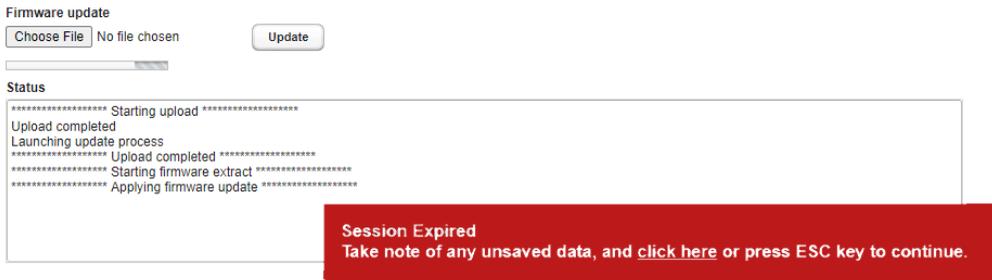
- 5 Click **Choose File**.
- 6 In the **Open** window that appears, locate and select the firmware file (.zip) sent to you by the service representative.
- 7 Click **Open**. You return to the firmware update page. The name of the file that you selected appears next to the **Choose File** button and the **Update** button is now active.
- 8 Click **Update**.
The file is uploaded to your system and the firmware update takes place.



NOTICE

Do not exit the browser during the firmware update process.

Figure 69 Firmware Update in Progress



Your system reboots once the firmware is updated.

- 9 After the system has been automatically rebooted, return to the web page and click **About CoreSense M10** to make sure that the application version is the one given to you by the service representative.

Updating With a USB Key

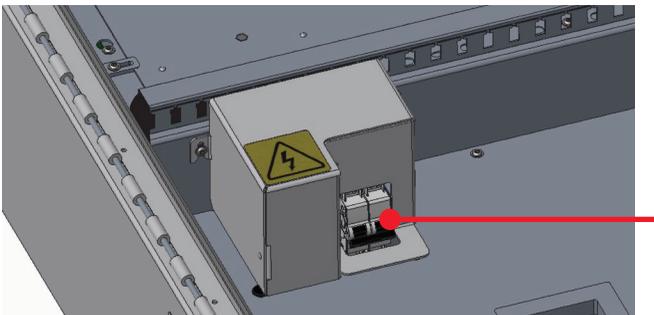


NOTICE

If the update process do not seem to work on your first try, try it again with a different brand of USB key or update remotely (see "Updating With a Web Browser (preferred method)" on page 76).

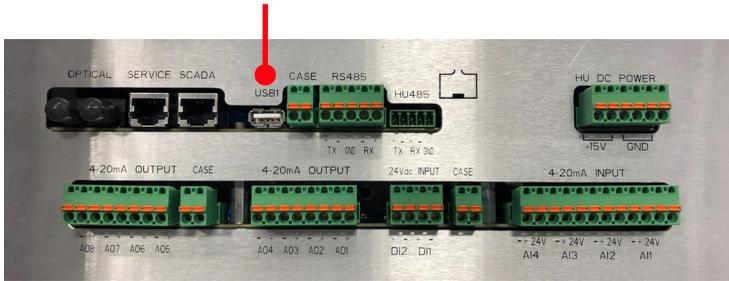
- 1 From your computer, extract the zip file sent to you by the ABB service representative at the root level of a USB key.
- 2 Open the CoreSense M10 cabinet.
- 3 Shutdown the instrument using the main power switch.

Figure 70 Instrument Main Power Switch



- 4 Insert the USB key on the USB port of the CoreSense M10 cabinet.

Figure 71 Instrument USB Port



- 5 Turn on the instrument using the main power switch (see Figure 4). The update process will start automatically and take a few minutes. Messages will appear on the local screen during the update process. Also, the instrument may reboot two or three times depending on the required updates for your system. The update process is complete once a message appears indicating to remove the USB key and reboot.
- 6 When this message appears, remove the USB key.
- 7 Power off the system for a few seconds and power it on again. You may be asked to calibrate the screen by touching the 4 crosses displayed on the screen.

Figure 72 Screen Calibration



The system firmware is considered complete after this last step. Wait until the **Dashboard** page is displayed for at least 4 minutes (after the reboot, the **Dashboard** page might be empty for the first 20 minutes).

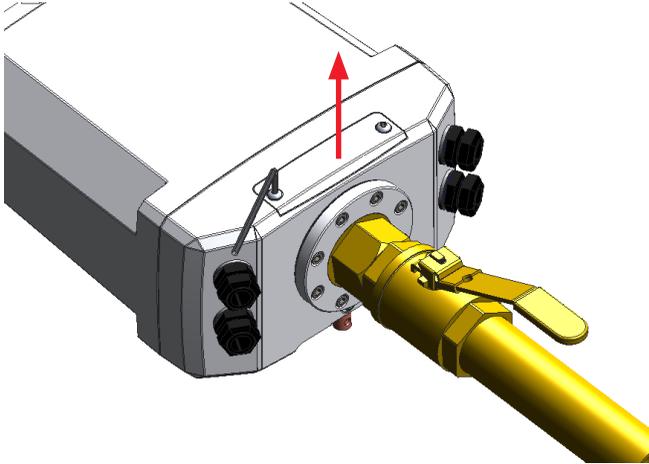
Taking an Oil Sample

Occasionally, you might need to take an oil sample from the transformer to send to laboratories for analysis. Oils samples are gathered from the sensor head.

To do take an oil sample:

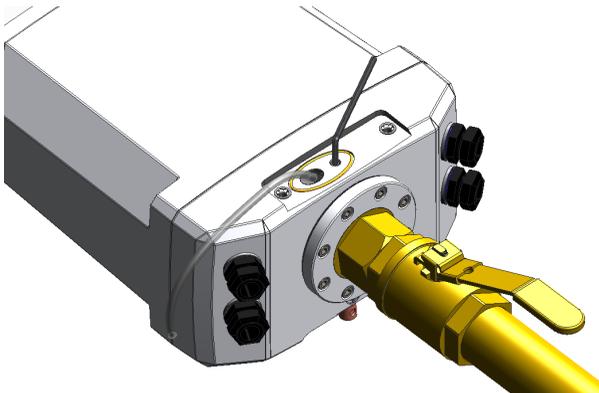
- 1 Remove the external sampling port cover located on top of the sensor with the 4 mm hex key.

Figure 73 Removing the External Sampling Port Cover



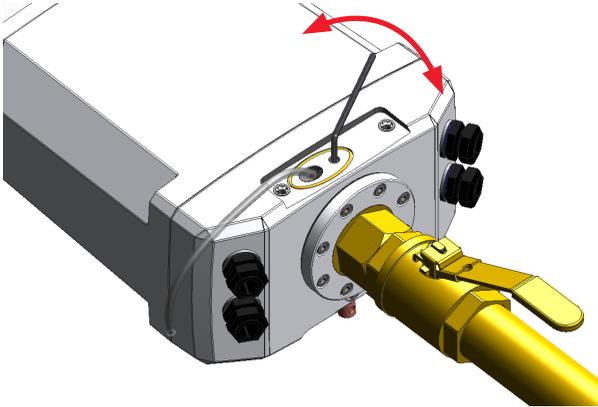
- 2 Connect the provided bleeding hose (ID 3.18 mm [0.125 in]) to the sampling adapter.
- 3 Direct the other end of the bleeding hose in an oil container to collect the sample.

Figure 74 Connecting the Bleeding Hose To the Sampling Adapter



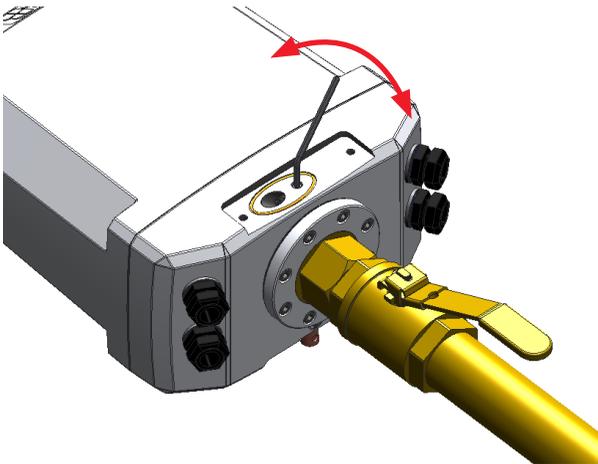
4 Loosen the bleed screw with the 4 mm hex key and wait until oil comes out of the sensor.

Figure 75 Loosening the Bleed Screw



5 Once you have gathered enough sample oil, tighten the bleed screw to a maximum torque of 2.26 N·m (20 lbf.in).

Figure 76 Tightening the Bleed Screw



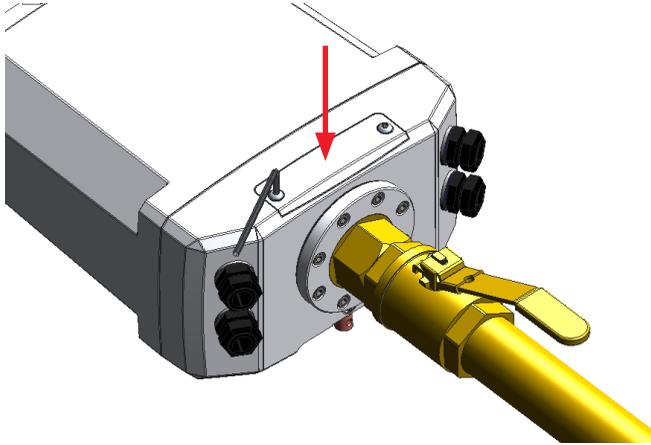
NOTICE

Do not apply excessive torque.

6 Wipe excess oil with a clean cloth.

7 Re-install the external sampling port cover and secure it with the 4 mm hex key.

Figure 77 Re-installing the External Sampling Port Cover



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Technical Specifications

The following pages indicate the CoreSense™ M10 technical specifications.



NOTICE

While the initial (cold start) accuracy of the sensor is likely to be within specifications, a settling period of approximately 12 hours is strongly recommended to allow electronic components to fully warm up and the internal temperature to stabilize.

Electrical Specifications

| | | |
|---------------------------------|------------------------|---|
| Voltage input | | 100 to 240 V AC, single phase, 50 to 60 Hz |
| Line voltage fluctuation | | Not to exceed 10% of the nominal line voltage |
| Power consumption | | 600 VA |
| Maximum current | | 5.0 A |
| Fuse type | Sensor head | 1 × 2.0 A/250 V (5 × 20 mm), slow-blow |
| | Analytical unit | 1 × 3.15 A/250 V (5 × 20 mm), slow-blow |

Output Circuits (alarm relays)

| | | |
|---|------------------|-------------------------------------|
| Kind of output | | 1 c/o (SPDT) |
| Rated operational voltage U₂ (IEC/EN 60947-01) | | 250 V AC |
| Minimum switching voltage | | 5 V at 100 mA |
| Maximum switching voltage | | 400 V AC/250 V DC |
| Minimum switching current | | 10 mA at 10 V |
| Rated operational current (IEC/EN 60947-5-1) | | |
| | AC12 (resistive) | 6 A |
| | AC15 (inductive) | 1.5 A |
| | AC15 (inductive) | 3 A |
| | DC12 (resistive) | 6 A |
| | DC13 (inductive) | 1 A |
| | DC13 (inductive) | 0.22 A |
| | DC13 (inductive) | 0.11 A |
| Maximum making (inrush) current | | 15 A, 240 V AC |
| Minimum switching power | | 10 mA at 10 V (AgSnO ₂) |

| | |
|---|---|
| Maximum switching (breaking) power (AC1 [resistive]) | 1500 VA, 250 V AC |
| Contact resistance | 100 mΩ (at 1 A/6 V DC) |
| Rated insulation voltage | 250 V AC |
| Rated impulse withstand voltage U_{imp} | between coil and contacts 4 kV 1 min |
| | between open contacts 1 kV 1 min |

Environmental Specifications

| | |
|--------------------------------------|--|
| Operating ambient temperature | -50 °C to 55 °C (-58 °F to 131 °F) |
| Operating ambient humidity | 5% to 95% RH, non-condensing |
| Shipping/storage temperature | -40 °C to 70 °C (-40 °F to 158 °F) |
| Pollution degree | 4 (outdoor use), 2 (internal) |
| Operating altitude | -610 m to 2000 m (-2001 ft to 6562 ft) |
| Oil temperature at valve | -20 °C to 120 °C (-4 °F to 248 °F) |
| Oil pressure at valve | 0 to 1000 kPa/0 to 10 bar/0 to 145 psi |

Mechanical Specifications

| Sensor head | |
|--|---|
| Dimensions (L × W × H) | 392 × 264 × 158 mm (15.43 × 10.39 × 6.22 in) |
| Weight | 8.0 kg (17.6 lb) |
| Interface to transformer | 1.5 NPT, male thread |
| Enclosure | IP67/NEMA 4X/C4 |
| Analytical unit | |
| Dimensions (with mount) (L × W × H) | 685 × 863 × 292 mm (26.76 × 33.97 × 11.49 in) |
| Weight | 64.9 kg (143.3 lb) |
| Enclosure | IP66/NEMA 4X |

Measurement Specifications

| Hydrogen Sensor (H ₂) | Standard Performance [SH] | High Performance [HH] |
|---|--|-----------------------------------|
| Range (ppm) | 25 to 5,000 | 5 to 5,000 |
| Accuracy (ppm) | ±25 (or ±20%, whichever is higher) | ±5 (or ±20%, whichever is higher) |
| Response time | T90 typical 30 minutes, T90 max 60 minutes | |
| Moisture (H ₂ O) | | |
| Measurement range (aw) | 0 to 1 (0 to 100% RH) | |
| Measurement accuracy (aw) | ±0.02 (±2% RH) | |
| Range (ppm) | 0 to 60 @ 25 °C (77 °F) or 0 to 180 @ 55 °C (131 °F) ±3% (Mineral Oil) | |
| Temperature measurement accuracy | ±0.2 °C (±0.4 °F) | |

| Carbon Monoxide (CO) | |
|--|------------------------------------|
| Range (ppm) | 2 to 5,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Carbon Dioxide (CO ₂) | |
| Range (ppm) | 5 to 20,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Methane (CH ₄) | |
| Range (ppm) | 1 to 10,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Acetylene (C ₂ H ₂) | |
| Range (ppm) | 0.5 to 10,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Ethylene (C ₂ H ₄) | |
| Range (ppm) | 2 to 10,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Ethane (C ₂ H ₆) | |
| Range (ppm) | 2 to 10,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Propene (C ₃ H ₆) | |
| Range (ppm) | 20 to 10,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |
| Propane (C ₃ H ₈) | |
| Range (ppm) | 10 to 10,000 |
| Repeatability (%) | ±5 (or ±LDL, whichever is greater) |

Laser

| | |
|------------|-------------------|
| Type | Solid state VCSEL |
| Wavelength | 763 nm |
| Output | 3 mW |
| Class | 1 |

Communication

| | |
|---------------------------|---|
| Digital interfaces | RS-485 serial port 2 × RJ45 100Base-T Ethernet ports 100base-FX fiber optic Ethernet port USB port |
| Protocols | Modbus RTU over RS-485 and Modbus TCP over Ethernet DNP3 over RS-485 and Ethernet IEC 61850 over Ethernet |
| Analog interfaces | 4 dry-contact relays for alarms 8 analog 4–20 mA outputs for publishing values 4 analog 4–20 mA inputs for reading external sensors |

Physical Installation Checklist

- The system date is set properly using the CoreSense M10 web interface from a computer set to the timezone of the installation area.
- The thermal pump is enabled (see “Activating the Thermal Pump” on page 70). While the thermal pump is disabled, the SYSTEM LED is yellow.
- Visual inspection of the installation (oil leaks).
- Cable glands are tight and secure.
- The sensor head and analytical unit are properly grounded.
- Teflon® (PTFE) tape (or thread sealant) was applied on the 1.5 NPT fitting, as per “Installing the Sensor Head” on page 37.
- The proper torque was applied to secure the eight bolts on the sensor head rotating flange, as described in “Installing the Sensor Head” on page 37.
- The two bolts for the sensor head external sampling cover are secure.
- The five retaining screws of the CoreSense enclosure are properly secured.
- The SYSTEM, GAS, and MOISTURE LEDs are green at the back of the sensor head.
- The green LED is lit on the analysis unit.
- Dispose of any collected oil according to company regulations and local laws.

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Installing the Molecular Sieve

You must install the molecular sieve (assembly no. 0048-13-1-00011-01) inside the CoreSense M10 analytical unit to absorb humidity and contaminants, and to prolong the life cycle of the unit's sources.



WARNING—HOT SURFACES

Indicates the presence of heat sufficient enough to cause burns.



ELECTROSTATIC DISCHARGES

The hardware contained inside the **optical box compartment** is sensitive to electrostatic discharges. Take all necessary measures to avoid damaging electronic components. Use the ESD ground point to connect yourself with the instrument (see Figure 20 on page 35).

Before proceeding with the installation, make sure to wear the personal protection equipment indicated on page 26.

Required Material

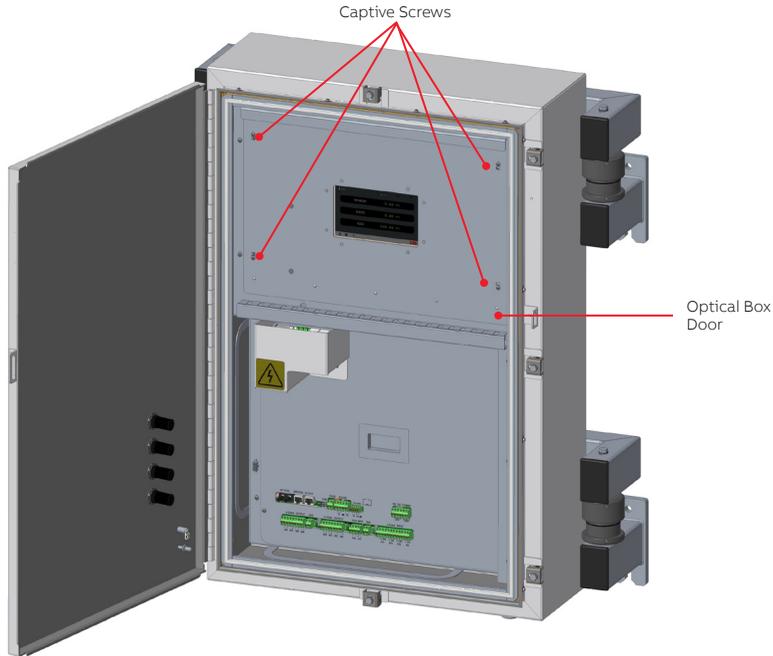
- Molecular sieve kit no. 0048-13-1-00011-01
- Isopropyl alcohol
- $\frac{7}{16}$ -inch wrench
- 2.5 mm hex (hexagonal, Allen) key
- Heat gun (if ambient temperature is below 15 °C)
- CoreSense M10 Installation Guide (this document)

Installation

To install the molecular sieve:

- 1 With a $\frac{7}{16}$ -inch wrench, unscrew the 5 locking latch screws to open the analytical unit door; see Figure 55 on page 63 to locate the locking latches).
- 2 With a 2.5 mm hex key, unscrew the four captive screws to open the optical box door (see Figure 78).

Figure 78 Unscrewing Captive Screws From the Optical Box Door



- 3 Remove the molecular sieve assembly from its sealed bag and temporarily place the molecular sieve can on the optical box floor.

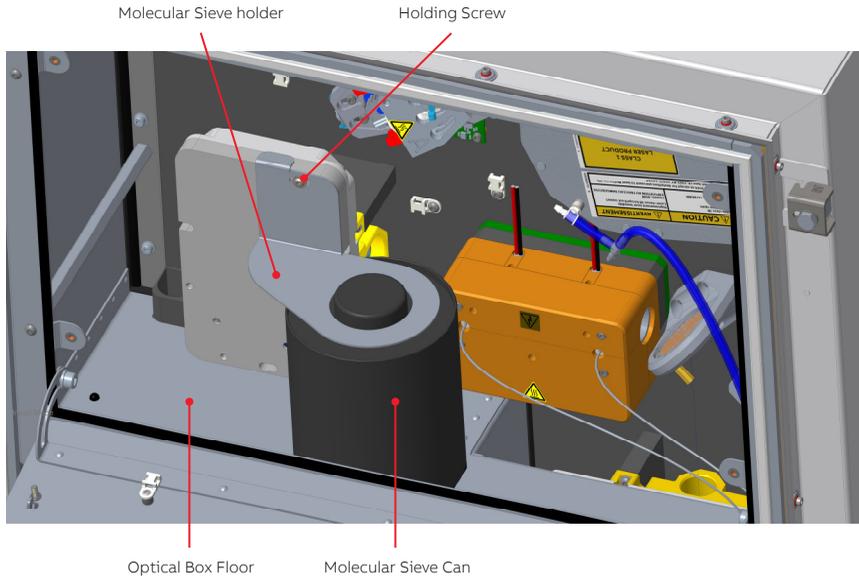


NOTICE

Do not open the molecular sieve can.

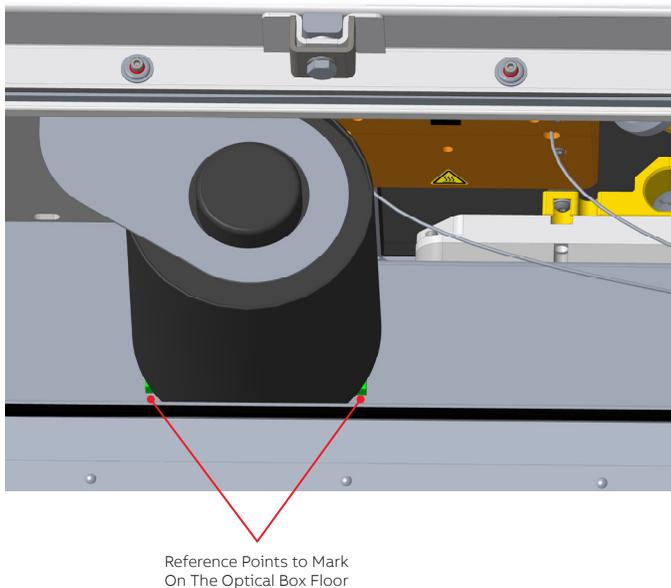
- 4 Place the molecular sieve holder as shown in Figure 4 and install the holding screw.

Figure 79 Molecular Sieve Assembly Inside the Optical Box



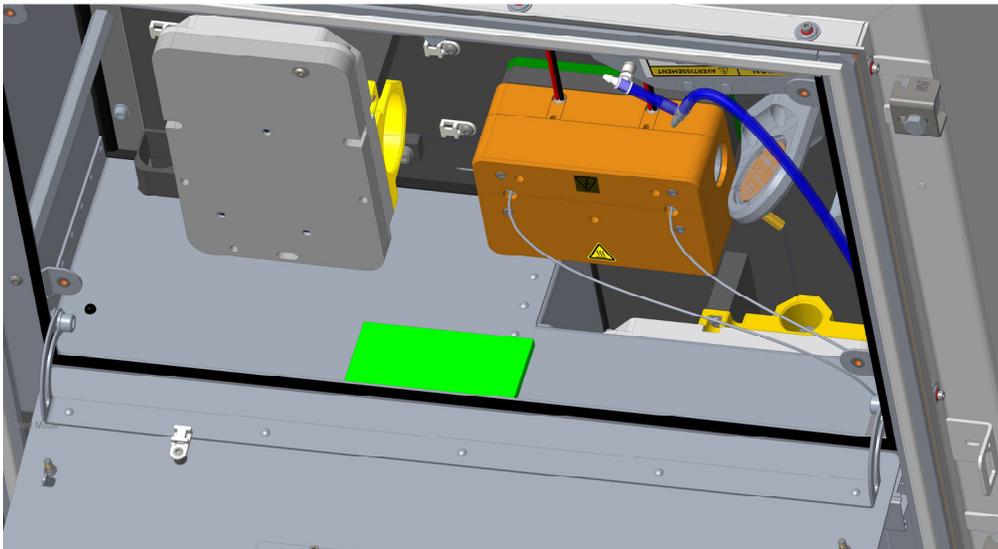
- 5 Center the molecular sieve can with its holder, sliding it as needed (there is some play to that effect in the slot where the holding screw is inserted).
- 6 Mark reference points on the optical box floor to later position the two corners of the adhesive strip.

Figure 80 Centering the Molecular Sieve Can



- 7 Remove the molecular sieve holder and can and, with isopropyl alcohol, clean the area of the optical box floor where an adhesive strip will be placed.
- 8 Peel off the bottom part of the velcro liner located underneath the molecular sieve can and place it on the optical box floor according to the reference marks made at step 6.

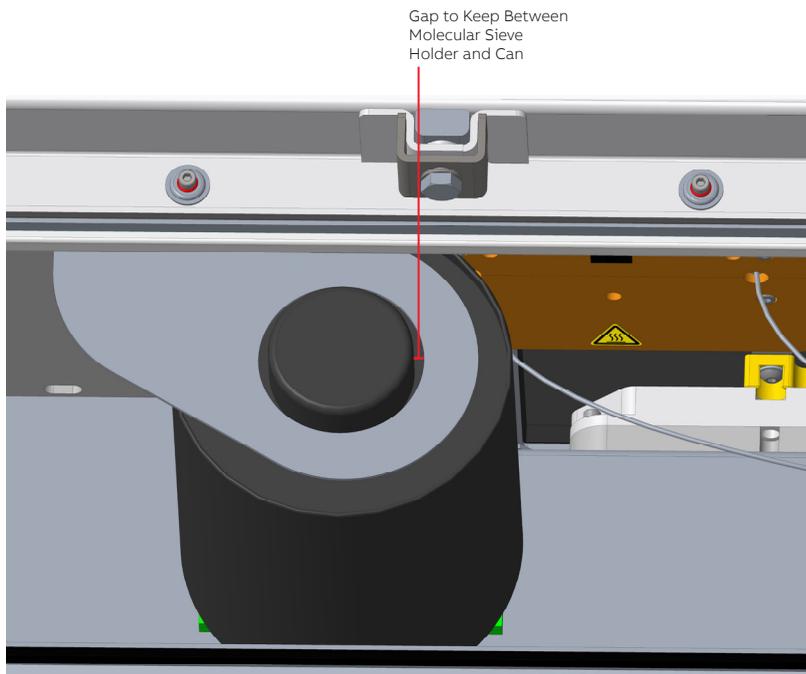
Figure 81 Placing the Adhesive Strip



To improve adhesion if ambient temperature is below 15 °C, use a heat gun to warm up the surface that will receive the adhesive strip.

- 9 Install the molecular sieve holder and can (see Figure 82) by sticking the top part of the velcro liner to the bottom part that you just installed on the optical box floor. Make sure that the molecular sieve holder is neither touching the can, nor the surrounding parts, and that there is a gap between the holder and the can to avoid the transmission of vibrations to the assembly.

Figure 82 Avoiding Interference With the Molecular Sieve Holder



- 10** Torque the holding screw with a 2.5 mm hex key at **9 lbf-in.**
- 11** Close back the optical box door and torque the four captive screws with the 2.5 mm hex key at **9 lbf-in.**
- 12** Close the analytical unit (see “Closing the Analytical Unit Door” on page 63).

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Connector Definitions

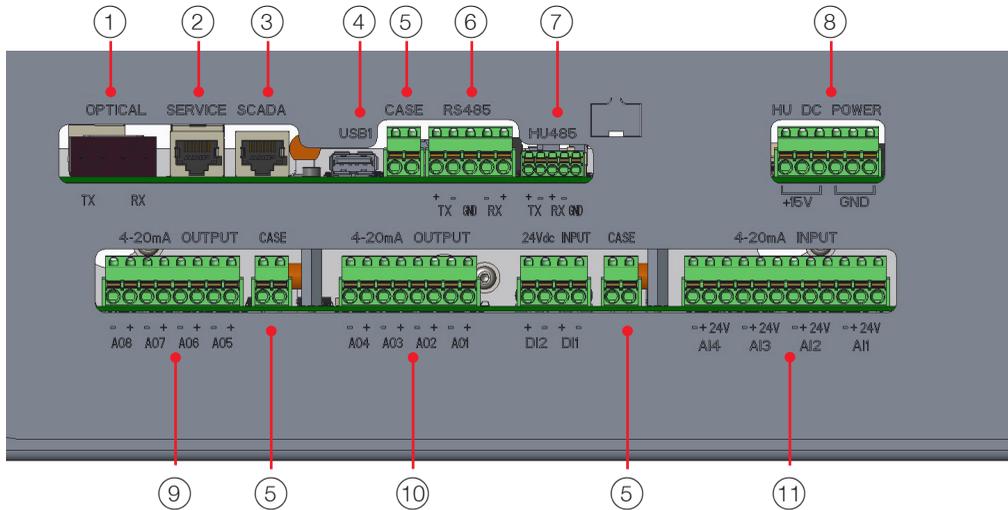
Inputs and Outputs



NOTICE

You **must** use copper wires **only**. Using other types of conductors could damage the instrument AND void the warranty.

Figure 83 Analytical Unit Communication Ports

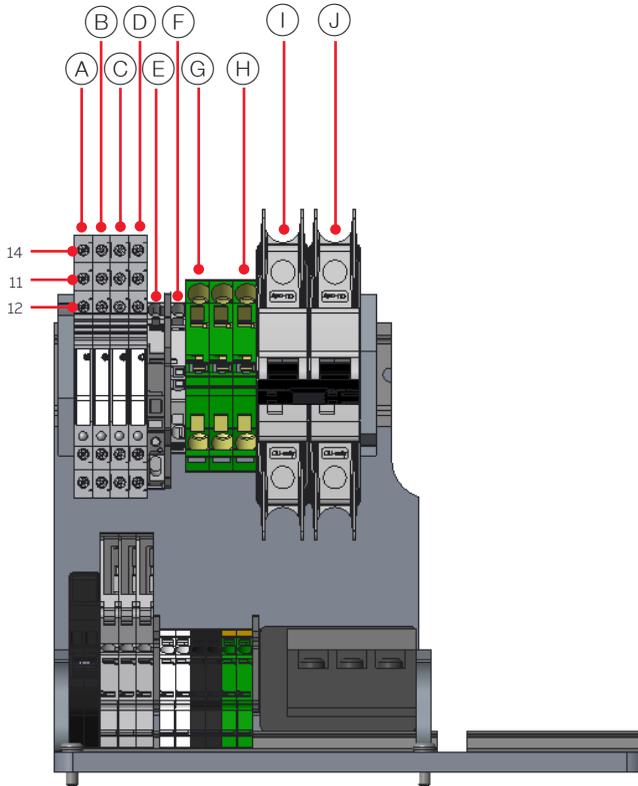


| Connector | Connection | Type | Wire | Max. length | Screwdriver | |
|-----------|------------|--------------------|-------------------|--|------------------|---------------|
| ① | OPTICAL | Optical Ethernet | ST-ST full duplex | 62.5/125 multi-mode | 1220 m (4003 ft) | n/a |
| ② | SERVICE | Ethernet | Category 5 | Straight | 3 m (10 ft) | n/a |
| ③ | SCADA | Ethernet | Category 5 | Straight | 100 m (328 ft) | n/a |
| ④ | USB | USB 2.0 | A | n/a | n/a | n/a |
| ⑤ | CASE | 1. CASE 2. CASE | Shield | Stranded AWG #24 to AWG #16 WITH FERRULE | n/a | Flat Ø 3.5 mm |

| | Connector | Connection | Type | Wire | Max. length | Screwdriver |
|---|------------------|---|-----------------------------|--|------------------|---------------|
| ⑥ | RS485 (SCADA) | 1. TX+ 2. TX- 3. RX- 4. RX+ 5. RET | RS-485 | Stranded AWG #24 to AWG #16 WITH FERRULE | 1220 m (4003 ft) | Flat Ø 3.5 mm |
| ⑦ | HU485 | 1. TX+ 2. TX- 3. RET 4. RX- 5. RX+ | RS-485 | Precabled | 10 m (33 ft) | Flat Ø 2.5 mm |
| ⑧ | HU DC POWER | 1. +15V 2. +15V 3. +15V 4. RET 5. RET 6. RET | +15 V power supply 3.15A | Precabled | 10 m (33 ft) | Flat Ø 3.5 mm |
| ⑨ | 4–20mA OUTPUT | A08-. OUT8- A08+. OUT8+ A07-. OUT7- A07+. OUT7+ A06-. OUT6- A06+. OUT6+ A05-. OUT5- A05+. OUT5+ | 4–20 mA 24 V max. | Stranded AWG #24 to AWG #16 WITH FERRULE | n/a | Flat Ø 3.5 mm |
| ⑩ | 4–20mA OUTPUT | A04-. OUT4- A04+. OUT4+ A03-. OUT3- A03+. OUT3+ A02-. OUT2- A02+. OUT2+ A01-. OUT1- A01+. OUT1+ | 4–20 mA 24 V max. | Stranded AWG #24 to AWG #16 WITH FERRULE | n/a | Flat Ø 3.5 mm |
| ⑪ | 4–20mA INPUT | 1. IN4- 2. IN4+ 3. +24V 4. IN3- 5. IN3+ 6. +24V 7. IN2+ 8. IN2- 9. +24V 10. IN1- 11. IN1+ 12. +24V | 4–20 mA 24 V max. | Stranded AWG #24 to AWG #16 WITH FERRULE | n/a | Flat Ø 3.5 mm |

Power and Relays

Figure 84 Power and relay connections (front view)



| Connector | Connection | Type | Wire | Screwdriver |
|--------------------------|------------|--------------|---|---------------------------|
| A Alarm 1 Maintenance | 14 - NO | 6 A/250 V AC | Copper only wire Stranded AWG #18 WITH FERRULE OR Solid copper AWG #18 to AWG #14 | Flat screwdriver Ø 3.5 mm |
| | 11 - COM | | | |
| | 12 - NC | | | |
| B Alarm 2 System | 14 - NO | | | |
| | 11 - COM | | | |
| | 12 - NC | | | |
| C Alarm 3 Warning | 14 - NO | | | |
| | 11 - COM | | | |
| | 12 - NC | | | |
| D Alarm 4 Alarm | 14 - NO | | | |
| | 11 - COM | | | |
| | 12 - NC | | | |

| | Connector | Connection | Type | Wire | Screwdriver |
|-----|---------------|------------|----------------------|--|---|
| (E) | HU AC live | | 120–240 V AC | Copper only wire Stranded AWG #18 WITH FERRULE | Flat screwdriver Ø 3.5 mm |
| (F) | HU AC neutral | | 50/60 Hz | | |
| (G) | HU AC earth | | 3.15 A max. | | |
| (H) | AC earth | | | Copper only wire Stranded AWG #18 to AWG #12 WITH FERRULE OR Solid AWG #18 to AWG #12 | Flat screwdriver Ø 3.5 mm |
| (I) | AC neutral | | 120–240 V AC | | Flat screwdriver Ø 6 mm or Phillips #2 |
| (J) | AC live | | 50/60 Hz 8 A max. | | |



NOTICE

All terminals are properly identified in the instrument itself to simplify installation.

CoreSense M10 Configurations

Figure 85 Product Code Matrix for CoreSense M10

| | | CSM10 | - | ST | - | 1.5 | - | 4X | - | SH | - | STD |
|----------------------------|---|---------------------|---|----|---|-----|---|----|---|----|---|-----------------|
| Product | | | | | | | | | | | | |
| CSM10 | CoreSense M10 Multigas | | | | | | | | | | | |
| Transformer Fluid | | | | | | | | | | | | |
| ST | Mineral Oil | | | | | | | | | | | |
| NE | Natural Ester Fluid | | | | | | | | | | | |
| SE | Synthetic Ester Fluid | | | | | | | | | | | |
| SL | Silicone Fluid | | | | | | | | | | | |
| Transformer Interf: | | Transformer Adaptor | | | | | | | | | | |
| 1.5 | NPT Interface (1.5 inch) | | | | | | | | | | | |
| N50 | N50 Interface (50 cm) | | | | | | | | | | | |
| Environment | | | | | | | | | | | | |
| 4X | NEMA 4X (Salt spray) | | | | | | | | | | | (CoreSense M10) |
| C5 | Coastal and offshore areas, High salinity | | | | | | | | | | | (Not Available) |
| Hydrogen sensor | | | | | | | | | | | | |
| SH | Standard Performance Hydrogen sensor | | | | | | | | | | | |
| HH | High Performance Hydrogen sensor | | | | | | | | | | | |
| Software | | | | | | | | | | | | |
| STD | Standard | | | | | | | | | | | |
| Warranty | | | | | | | | | | | | |

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Hitachi Energy Customer Center

Phone:

1-800-290-5290

www.hitachienergy.com/contact-us

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