Reference Manual
00809-0100-3003, Rev BA
August 2021

GDU-Incus

Ultrasonic Gas Leak Detector

EMERSON

Important instructions

Emerson designs, manufactures, and tests products to function within specific conditions. Because these products are sophisticated technical instruments, it is important that the owner and operation personnel strictly adhere both to the information printed on the product nameplate and to all instructions provided in this manual prior to installation, operation, and maintenance.

⚠ WARNING

Installing, operating, or maintaining an Emerson product improperly could lead to serious injury or death from explosion or exposure to dangerous substances.

Comply with all information on the product, in this manual, and in any local and national codes that apply to the product.
Do not allow untrained personnel to work with this product.
Use Emerson parts and work procedures specified in this manual.

Authorized personnel for installing, operating, servicing, and maintaining the GDU-Incus are instructed and trained qualified personnel of the operating company and the manufacturer.

It is the operating company's responsibility to:

- Train staff.
- Observe safety regulations.
- Follow the Reference Manual.

Operators must:

- Have been trained.
- Have read and understood all relevant sections of the Reference Manual before commencing work.
- Know the safety mechanisms and regulations.

To avoid personal injury and loss of property, do not install, operate, maintain, or service this instrument before reading and understanding this reference manual and receiving appropriate training.

⚠ WARNING

Heavy instrument

The GDU-Incus weighs approximately 40 lb. (18 kg).
Take care when lifting and carrying the unit.
Ensure that all bolts and fixings selected for mounting are suitable for the weight and that the wall, pole, or mounting surface is solid and stable.

⚠ WARNING

Physical access

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

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

NOTICE

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Contents

1 Introduction

1.1 Product overview

The GDU-Incus is an ultrasonic gas leak detector used for detecting airborne ultrasound generated from pressurized gas leaks. Airborne ultrasound is generated when gas moves from a high pressure area to a low pressure area with a ratio in excess of 1.8 to 1 upstream to downstream. However, Emerson only recommends this detector for pressures above 2 bar (30 psi) gauge. The intensity of airborne ultrasound generated is dependent on a number of factors including gas pressure, gas leak size, and gas temperature.

The detector uses four individual Piezo ceramic sensing heads designed using a patent-pending floating crystal design. The sensor design makes the sensing heads virtually indestructible and totally immune to temperature, moisture, and other contaminants found in hazardous areas. The detector uses a continuous electronic monitoring test feature to ensure complete functionality.

The detector has a large dynamic range, which allows use in a wide range of applications, from offshore platforms to gas transportation systems. The multi-stage amplifier ensures a linear output across the entire detector range without drop-off at each end of the range.

The detector is not designed to detect specific gas types, LEL, or ppm. It responds instantaneously to the ultrasound produced by a wide range of gas leak sizes and remains unaffected by even the most extreme weather conditions. The detector is rated to IP66/IP67 and NEMA® Type 4X to withstand harsh environments.

The detector is supplied with a 4-20 mA analog output, a HART® interface, and two configured relays.

1.2 Service support

For technical support, contact your Emerson representative or email safety.csc@emerson.com.

The Response Center will ask for product model and serial numbers and will provide a Return Material Authorization (RMA) number.

The Response Center will also ask for the installation and application details.

⚠ WARNING

Hazardous substances

Individuals who handle products exposed to a hazardous substance can avoid injury if they are informed of and understand the hazard. If the product being returned was exposed to a hazardous substance as defined by the Occupational Safety and Health Administration (OSHA), a copy of the required Safety Data Sheet (SDS) for each hazardous substance identified must be included with the returned goods.

1.3 Product recycling/disposal

Consider recycling equipment and packaging. Dispose of the product and packaging in accordance with local and national legislations and regulations.

2 Installation

2.1 Safety messages

Instructions in this section may require special precautions to ensure the safety of personnel performing the operations.

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury.

Ensure that only qualified personnel perform the installation.

The area in which the detector is mounted must be in accordance with the certification of the apparatus and in accordance with local or national standards.

Do not modify the enclosure or component parts; this will compromise the Hazardous Area Certification.

Ensure that all wiring and power supply to the detector is within specified operating parameters.

Except for the terminal cover, the GDU-Incus is a sealed unit. The main enclosure may be opened only by Emerson or Emerson-authorized personnel. All warranties and certifications are nullified if the seals are tampered with or broken.

The GDU-Incus is supplied without cable glands. Ensure that all cable entry threads are sealed with an appropriate plug to eliminate water ingress and thread damage. At installation, remove all shipping cable entry plugs and replace them with approved Ex d cable glands or blanking plugs to meet hazardous locations requirements. If the detector is to be installed in a Zone 1 Hazardous Area, an Ex d barrier seal must be used.

⚠ WARNING

Electrical hazard

Electrical shock could cause death or serious injury.

Use extreme caution when making contact with leads and terminals.

⚠ CAUTION

Equipment damage

Identification tags must be firmly secured to the GDU-Incus bracket to prevent unwanted, locally-generated, ultrasonic noise. Refer to Figure 2-1.

2.2 Unpack and inspect

Procedure

1. Carefully remove all components from the packaging.

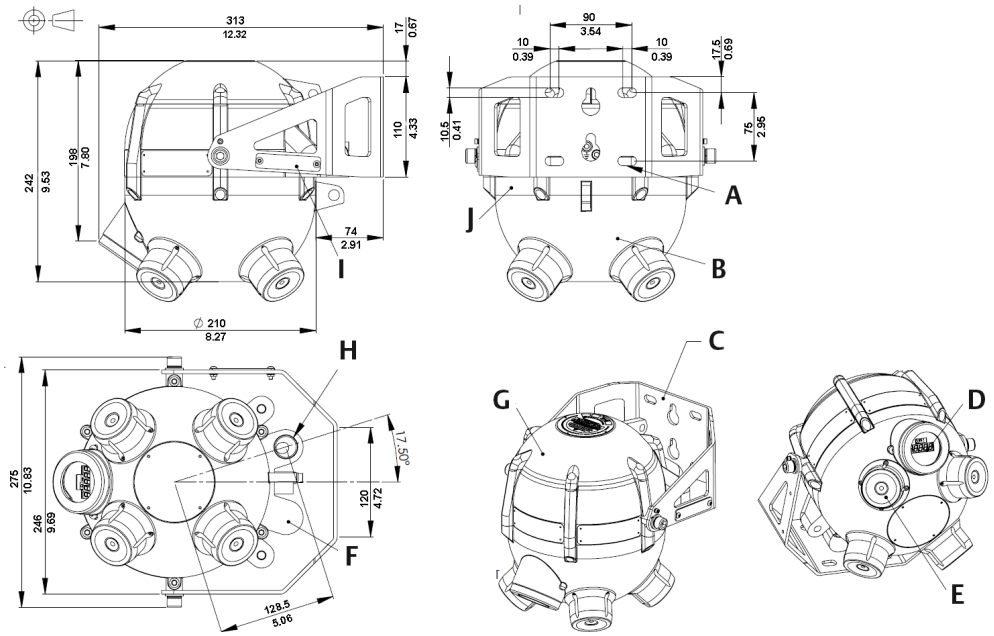
2. Verify the components against the enclosed packing list.
3. Inspect all components for obvious damage, such as broken or loose parts.
4. If any components are missing or damaged, contact your local Emerson representative or the factory immediately.

2.3 Dimensions

Refer to Figure 2-1 for the dimensions of the GDU-Incus.

Note
Dimensions are in millimeters (top number) and inches (bottom number).

Figure 2-1: Dimensions



A. Suitable for M10 or equivalent
B. Main body enclosure (housing)
C. Standard mounting bracket shown. U-bolt kits (for pole mounting) and a "DNV" certified bracket are available.
D. Display
E. Sensor head (four positions)
F. Customer cable entry position available for dual entry/relay output (ATEX/IECEx units only)
G. Terminal compartment housing
H. Customer cable entry M20 standard. M250.5 in (13 mm) NPT or 0.75 in (19.0 mm) NPT alternative
I. Identification tag (sold separately) can be mounted on either side of bracket using holes provided.
J. Top body enclosure (housing)

2.4 Installation procedure

Emerson recommends mounting the GDU-Incus between 10 and 16 ft. (3 and 5 m) above the floor level to eliminate ground reflections and absorption. You may mount the detector lower than 10 ft. (3 m), but that may reduce the coverage; contact an Emerson representative for more details.

Check the area of installation for equipment capable of generating high levels of spurious airborne noise that would not be classified as "normal background noise", such as pressure release valves, etc. If any are present in the detector range of coverage, contact Emerson or monitor the detector when activated to ensure immunity.

2.4.1 Mechanical installation

The detector incorporates a dedicated flameproof terminal compartment certified to Ex d and a flameproof main electronics compartment certified to Ex d, both sealed to IP66/IP67.

⚠ CAUTION

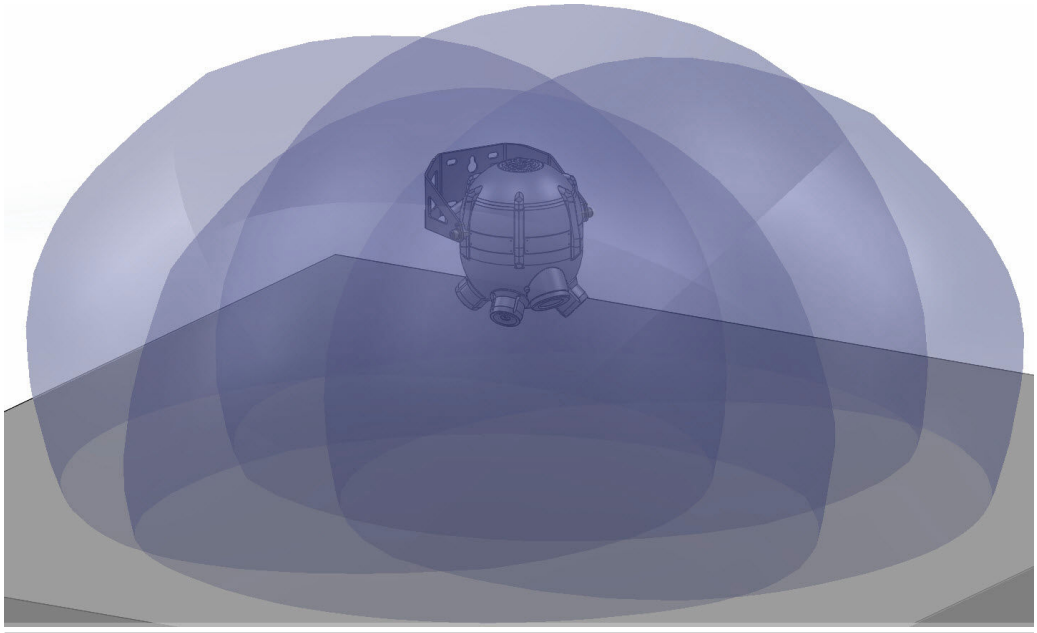
Take care when removing the terminal cover during installation to ensure that the flamepath surfaces are not scratched or damaged. See Wire the detector for more information.

The detector has a large detection radius capability; take care when positioning it to use the maximum coverage while eliminating blind spots and spurious alarms.

The detector has a variety of mounting options to incorporate installation into most situations in industrial environments, such as wall/flat surface mounting (Mount to wall or flat surface), vertical pole mounting (Mount to a pole), and mounting in an environment where DNV certification is required (Mount DNV certified detector).

The detector should be mounted so that the four sensor heads are pointing vertically downwards towards the floor or ground. See Figure 2-2.

Figure 2-2: Three-Dimensional View of Detector Coverage.



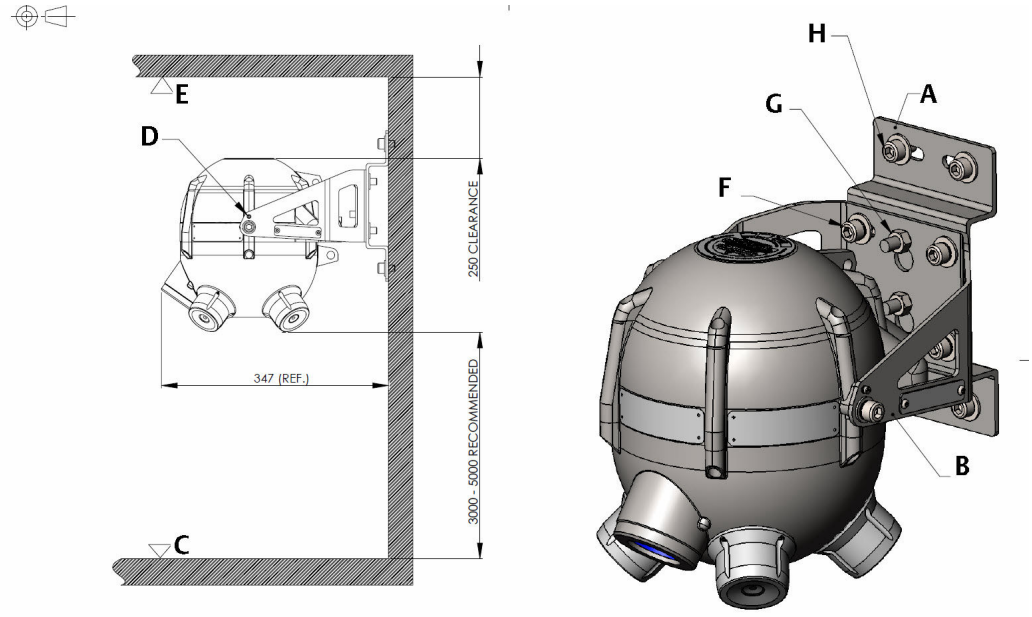
The detector uses four independent sensor heads for full coverage. Figure 2-2 shows a three-dimensional view of the coverage (detector not to scale) at a 10-ft. (3 m) height above floor level with the detector pointing vertically downwards. The detector coverage is specified as meters radius at the floor level, as this is the minimum sensing distance. As shown, the entire area below the detector is covered, as well as some of the area above and around the detector. Each sensor overlaps the next, so multiple sensors cover areas underneath the detector.

2.5 Mounting

2.5.1 Mount to wall or flat surface

When mounting on a vertical flat surface, such as a wall with no significant vibration, use the standard mounting bracket supplied with the detector. If you suspect vibration at the fixing point, contact an Emerson representative for additional options.

Figure 2-3: Wall/Flat Surface Mounting Diagram



Dimensions in mm.

A. *Wall mounting bracket*
B. *Standard bracket*
C. *Floor*
D. *Vertical mounting locking fastener, typical both sides*
E. *Roof*
F. *See Step 3.*
G. *See Step 2.*
H. *See Step 1.*

Note
GDU-Incus assembly weight: approximately 40 lb. (18 kg). Ensure fixings are capable of supporting assembly weight and local standards for shock loading.

Figure 2-4: Wall Mounting Drilling Template

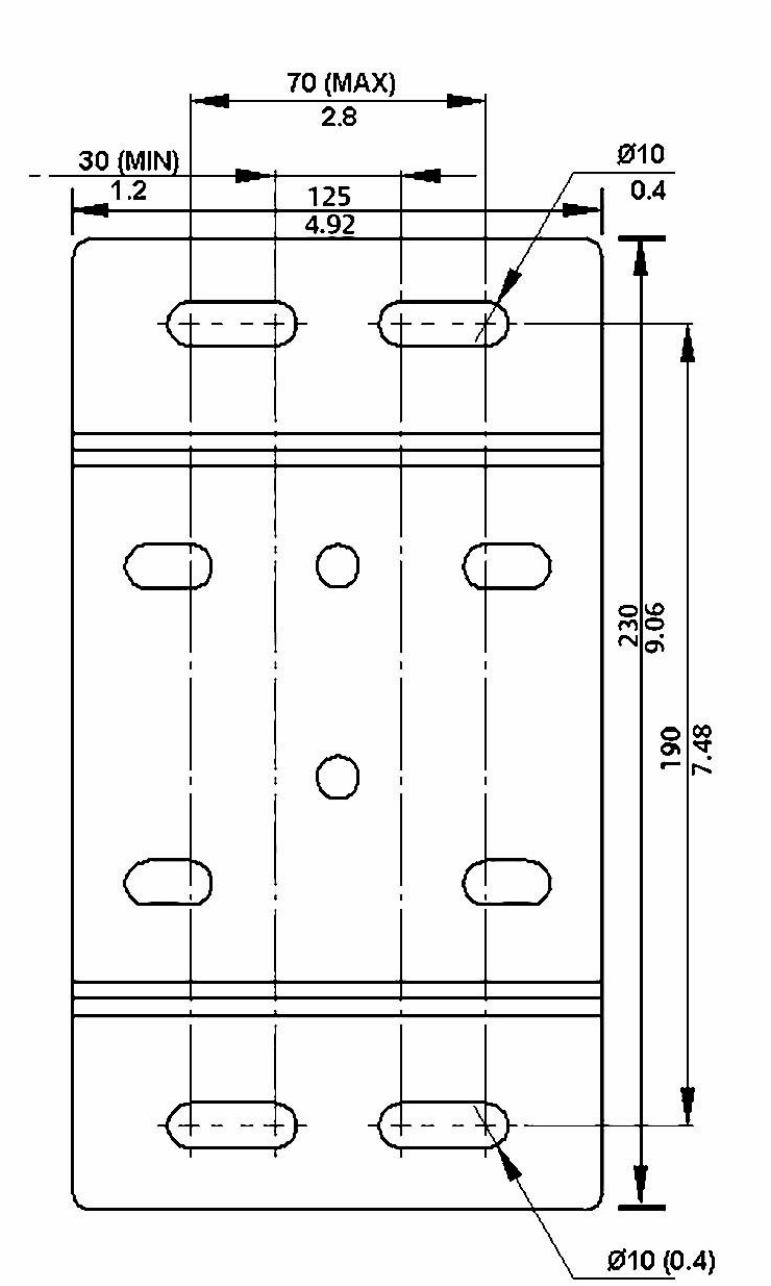


Figure 2-4 shows the position of the mounting slots on the wall mounting bracket supplied with the standard GDU-Incus. Drill pairs of Ø 0.4-in. (10 mm) holes on the mounting surface between 1.2 in. (30 mm) and 2.8 in. (70 mm) apart, with a vertical distance of 7.48 in. (190 mm) between the two pairs of holes.

Procedure

1. Attach wall mounting bracket to wall of flat horizontal support using four M10 bolts.

2. Position the detector so that the standard bracket is on the studs of the wall bracket. Secure the brackets together using the two M10 nuts supplied.
3. Permanently fix the brackets together using the socket head bolts and nuts supplied.

   Make sure to use spring washers.

2.5.2 Mount to a pole

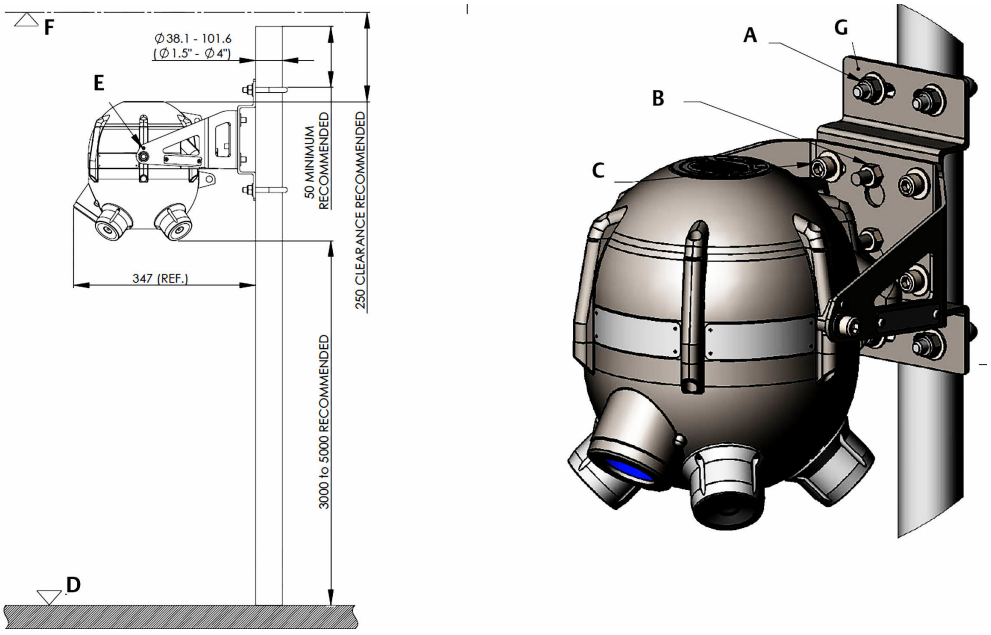
In large open areas, Emerson recommends mounting the detector on a pole to take advantage of the large omni-directional detection coverage.

Mount the detector 10 to 16 ft. (3 to 5 m) high to eliminate reflections and ground absorption. You may mount the detector lower than 10 ft. (3 m), but coverage may be reduced; contact an Emerson representative for details.

Make sure the pole complies with local standards and is capable of supporting the detector weight at the installation height, taking environmental factors into consideration.

Attach the detector to the pole using two U-bolts fixed to the pole mounting adapter (you can use the wall bracket for pole mounting if the pole is 1.5 to 2-in. (38.1 to 50.8 mm) diameter. Emerson suggests torquing to 45 Nm, but use local standards in the first instance.

Figure 2-5: Pole Mounting Diagram



A. See Step 1.
B. See Step 2.
C. See Step 3.
D. Floor
E. Vertical mounting locking fastener
F. Roof
G. Pole mounting adapter

Note

Specify U-bolt and pole mounting adapter size at time of order. Standard parts are available for tube sizes from Ø 1.5 in. (38.1 mm) to 4 in. (101.6 mm).
Weight of detector is 40 lb. (18 kg) approximately. Specify free-standing pole size to support the detector to local standards. Ensure calculations employ suitable civic factor of safety to support extended weight at detection height. Ensure nyloc fixing nuts are tightened to 45 Nm or to applicable local standards.

Procedure

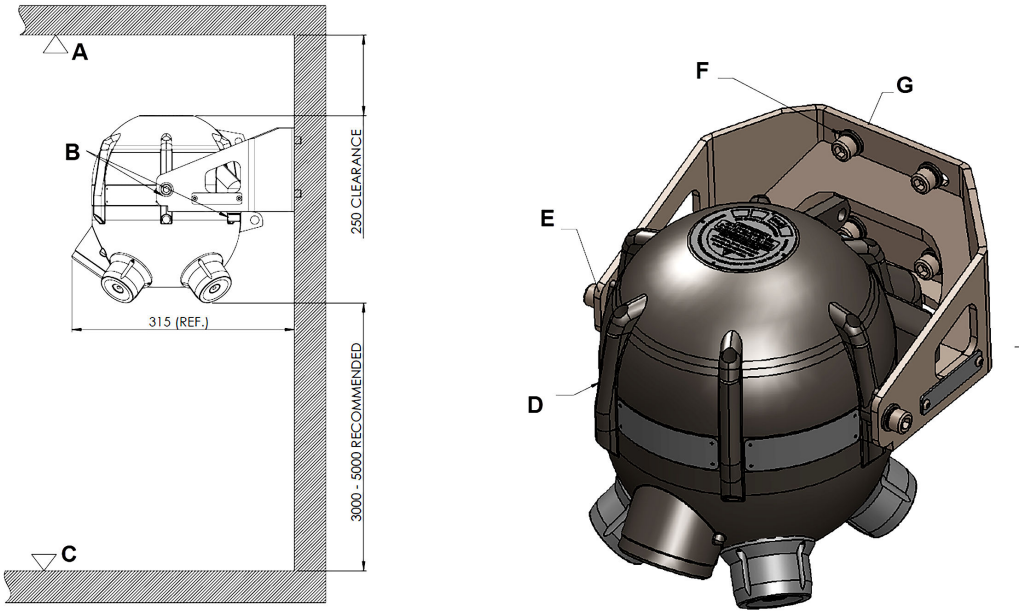
1. Attach pole mounting adapter to pole using two M10 U-bolts. Secure using nyloc nuts and/or spring washers.
2. Position the detector so that the standard bracket is on the studs of the pole adapter. Secure the brackets together using the two M10 nuts provided.
3. Permanently fix the brackets together using the socket head bolts and nuts supplied.

   Use spring washers.

2.5.3 Mount DNV certified detector

When an installation requires equipment to be DNV certified, you must mount the detector using a DNV mounting bracket.

Figure 2-6: DNV Mounting Diagram



A. *Roof*
B. *Detector permanently locked in vertical position by 4X M10 bolts (one either side and two on underside of bracket)*
C. *Floor*
D. *See Step 3.*
E. *See Step 2.*
F. *See Step 1.*
G. *DNV mounting bracket: GDU-02-412*

Figure 2-6 shows the mounting arrangement for DNV installation. Torque all bolts to 45 Nm and use spring washers in all cases.

Figure 2-7: DNV Mounting Drilling Template

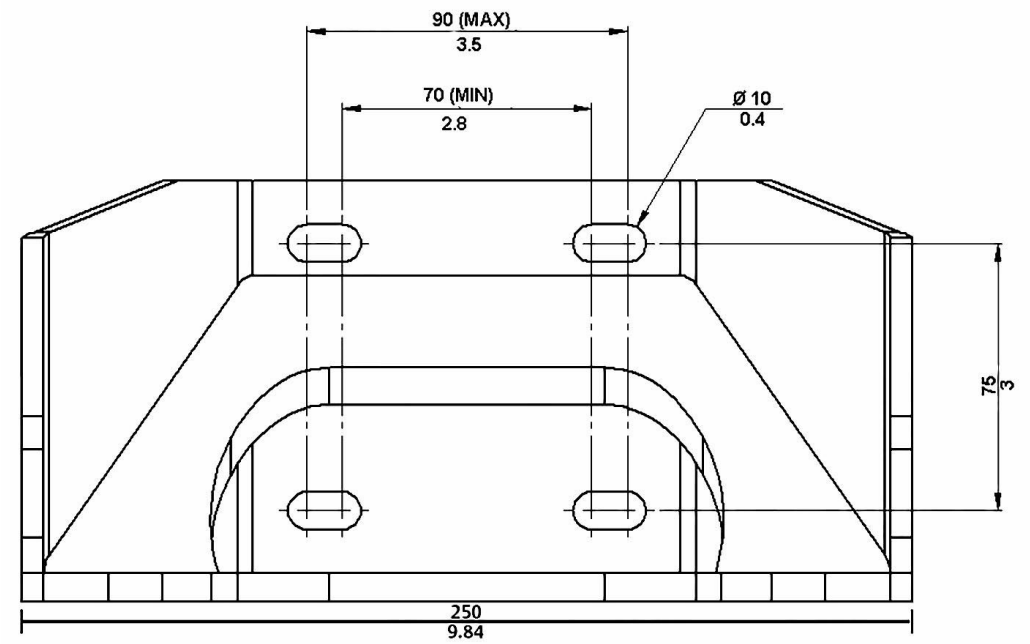


Figure 2-7 shows the position of the mounting slots on the DNV mounting bracket supplied with the DNV detector. Drill pairs of Ø 0.4-in. (10 mm) holes between 2.8 in. (70 mm) and 3.5 in. (90 mm) apart, with a vertical distance of 3 in. (75 mm) between the two pairs of holes.

Procedure

1. Attach DNV mounting bracket directly to wall or flat horizontal support using 4 M10 bolts as shown.

   Use spring washers.
2. Rest the detector on the flat base plate of the DNV bracket and secure using M10 bolts either side, making sure to use spring washers.
3. Secure the detector to the base plate using two M10 bolts, making sure to use spring washers.

2.6 Terminal compartment wiring

⚠ WARNING

Failure to follow these installation guidelines could result in death or serious injury.

Ensure that only qualified personnel install the detector.

⚠ WARNING

Electrical shock could cause death or serious injury.

Use extreme caution when making contact with the leads and terminals.

Do not open the detector's enclosure in a classified area or where an explosive atmosphere may be present unless the power to the detector has been removed.

The detector's terminal cover is certified to flameproof standards; do not open it while energized.

NOTICE

Connect the detector housing to local ground via the external earth point as shown in Figure 2-12. Make sure the ground wire is a minimum of 4 mm^2 (8 AWG) and as short as possible. Make sure termination at the detector is suitable for M6 (0.25-in.) fastener. Ensure earth wire is attached using the supplied spring washer.

The standard GDU-Incus is temperature rated between -40 and +185 °F (-40 and +85 °C), and the heated variant is temperature rated between -67 and +185 °F (-55 and +85 °C). Ensure that all cable is rated to the appropriate temperature of installation.

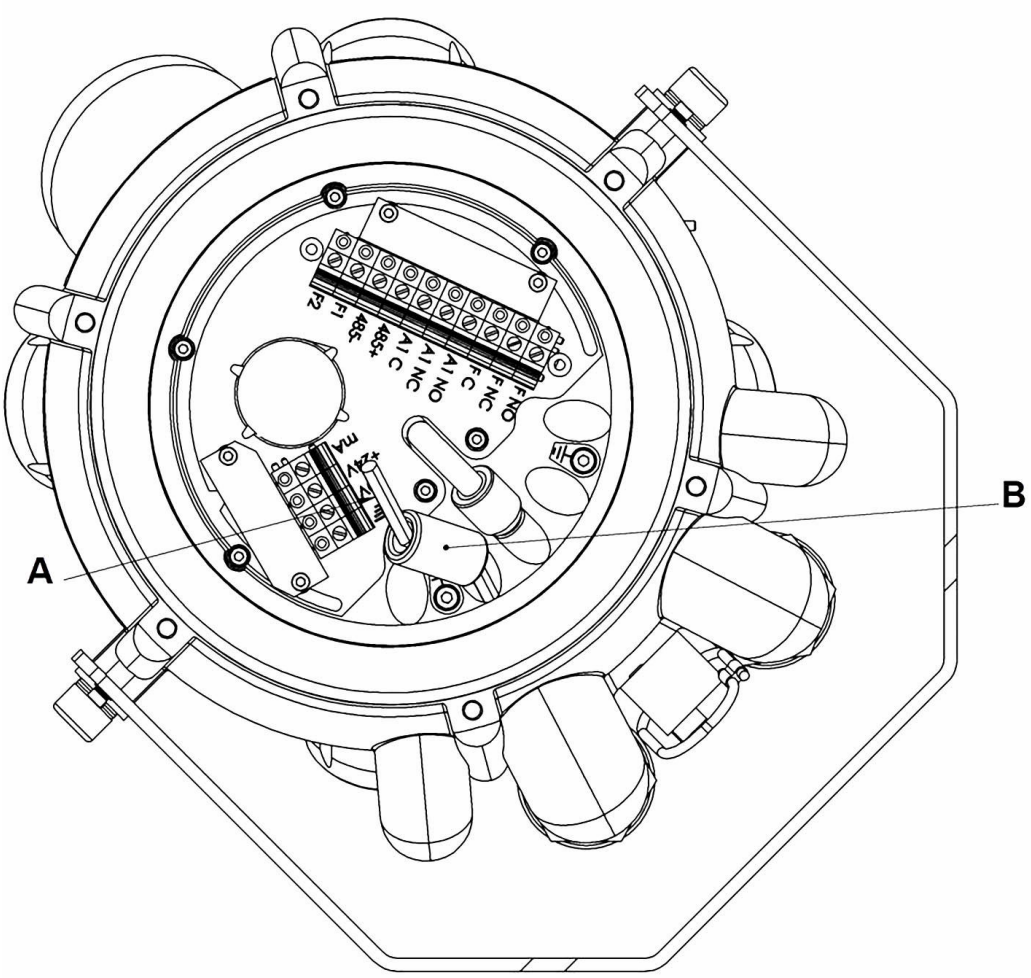
2.6.1 Wire the detector

NOTICE

Wiring codes and regulations may vary. Wiring must comply with all applicable regulations relating to the installation of electrical equipment in a hazardous area and is the installer's responsibility. If in doubt, consult a qualified official before wiring the system.
In applications where wiring is installed in a conduit, do not use the conduit for wiring to other equipment.

For full EMC requirements, ensure incoming cables are threaded through the ferrite beads (provided with the detector). See Figure 2-8.

Figure 2-8: Ferrite Bead Locations



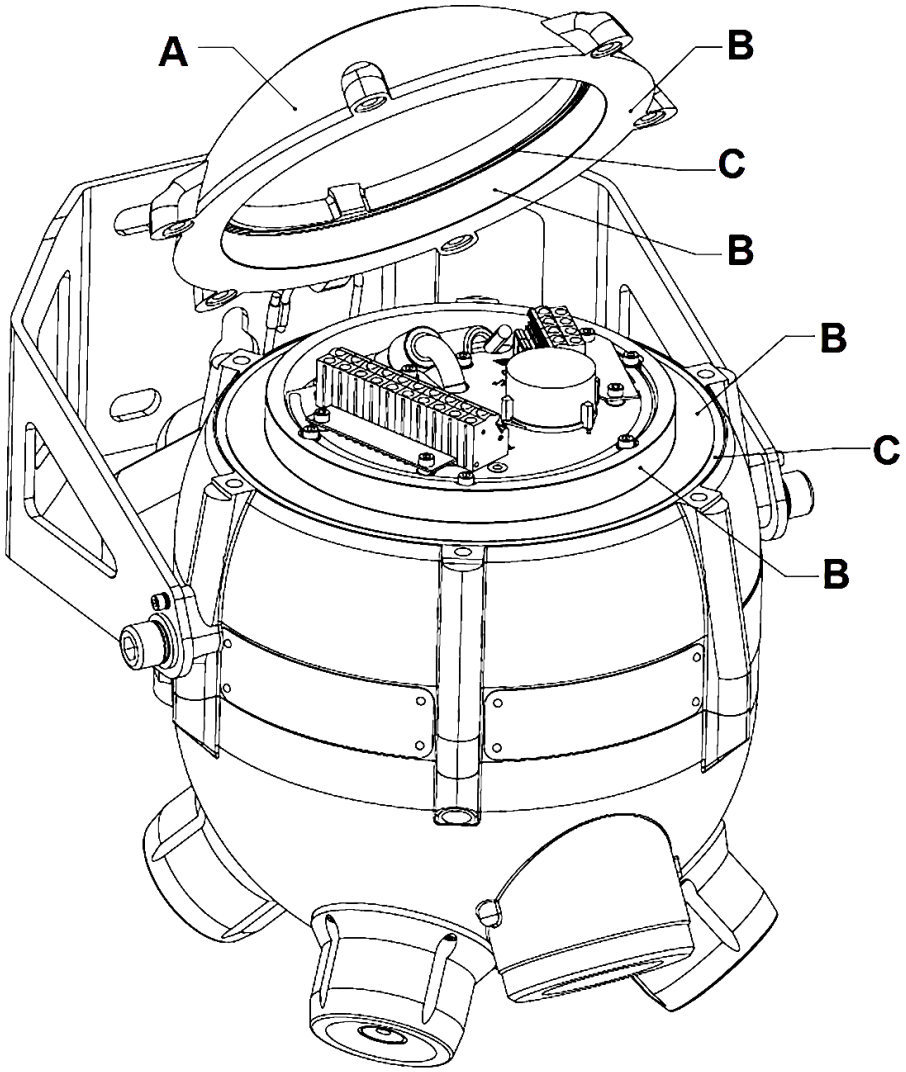
A. Thread cable through ferrite
B. Ferrite

Procedure

1. To gain access to the terminal compartment, undo the six terminal cover fixing screws and raise the terminal cover vertically until clear of the main enclosure.

   The terminal cover is held in place with a stainless steel wire. You can lower the terminal cover to the side of the detector during installation, but take care to ensure the flame path is not damaged. Refer to Figure 2-9 for the flamepath details.

Figure 2-9: Flame Path Details



A. Terminal cover
B. Flame path
C. O-ring

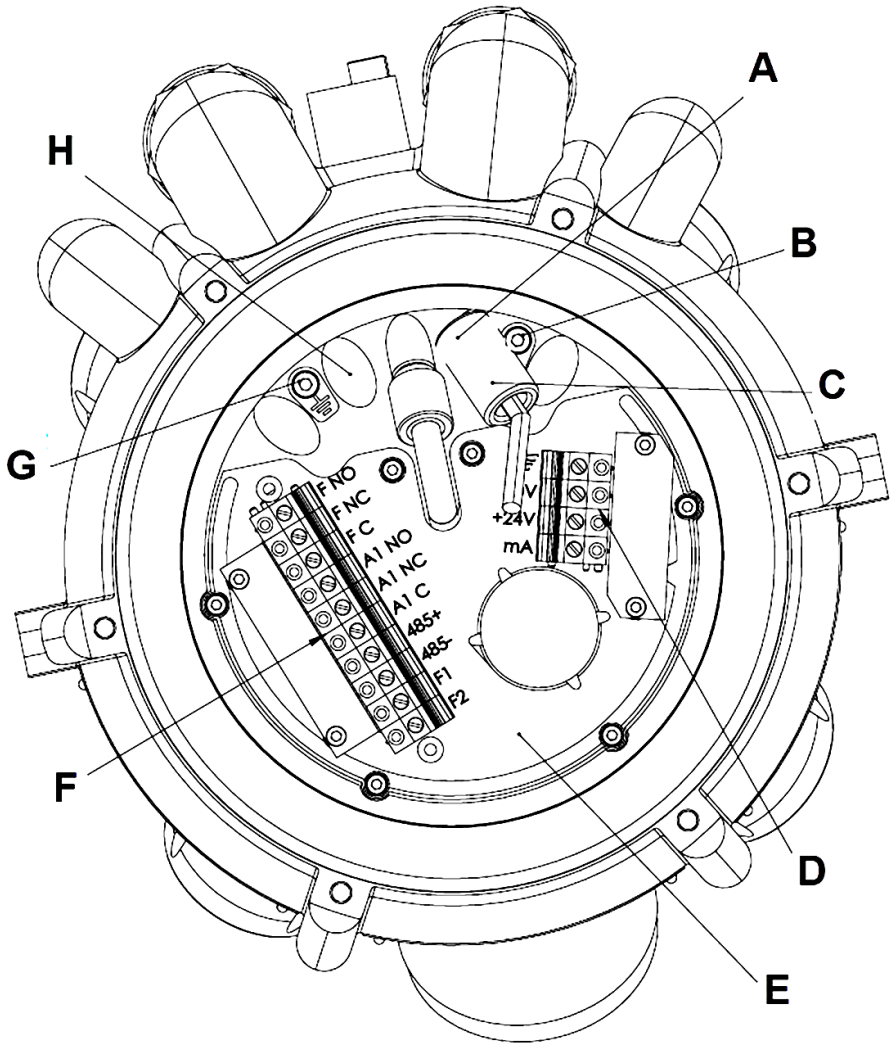
2. Seal the terminal compartment with two O-rings to prevent water ingress.

   Before closing, Emerson recommends visually inspecting the detector to ensure the O-rings are in place and undamaged. Also check the flame paths of the terminal

cover and main enclosure for signs of damage. See Figure 2-9 for O-ring and flame path positions.

3. Connect cable shield to instrument earth in the control room only unless extra radio frequency interference (RFI) protection is required and all local and site grounding regulations are met, in which case, terminate the shield to local ground via one of the internal earth points shown in Figure 2-10.

Figure 2-10: GDU-Incus Terminal Compartment Diagram



A. Customer cable entry position 1
B. M4 internal earth point for use with multiple cable entry
C. Ferrite supplied in box
D. Terminal row 1
E. Terminal board
F. Terminal row 2
G. M4 internal earth point for use with multiple cable entry
H. Customer cable entry position 2 (not available for FM certified detectors)

Figure 2-10 shows a view of the GDU-Incus with the terminal cover removed. For single entry enclosures, enter customer cable via position 1; use positions 1 and 2 for dual entry enclosures.

The terminals are separated into power and communications for terminal row 1 and relay outputs for terminal row 2.

4. Tighten the six terminal cover fixing screws to a torque of 9 Nm.

⚠ WARNING

Ensure cable entry is via suitable hazardous area approved and ingress protection certified cable glands (customer supplied) or conduit.

The ATEX/IECEx approved GDU-Incus has two positions for M20 cable glands, while the FM approved detector has one position for ¾-in. national pipe thread (NPT) conduit.

Fit cable glands and conduit in accordance with manufacturers' instructions for assembly to a certified flame-proof enclosure.

Seal all unused cable entries with a flame-proof certified plugging device.

Ensure all cable gland and plugging devices are ingress protected to the same standard as the enclosure to maintain certification and are suitable for the size of the cable used.

If the detector is to be installed in an ATEX Zone 1 Hazardous Area, use an Exd barrier seal.

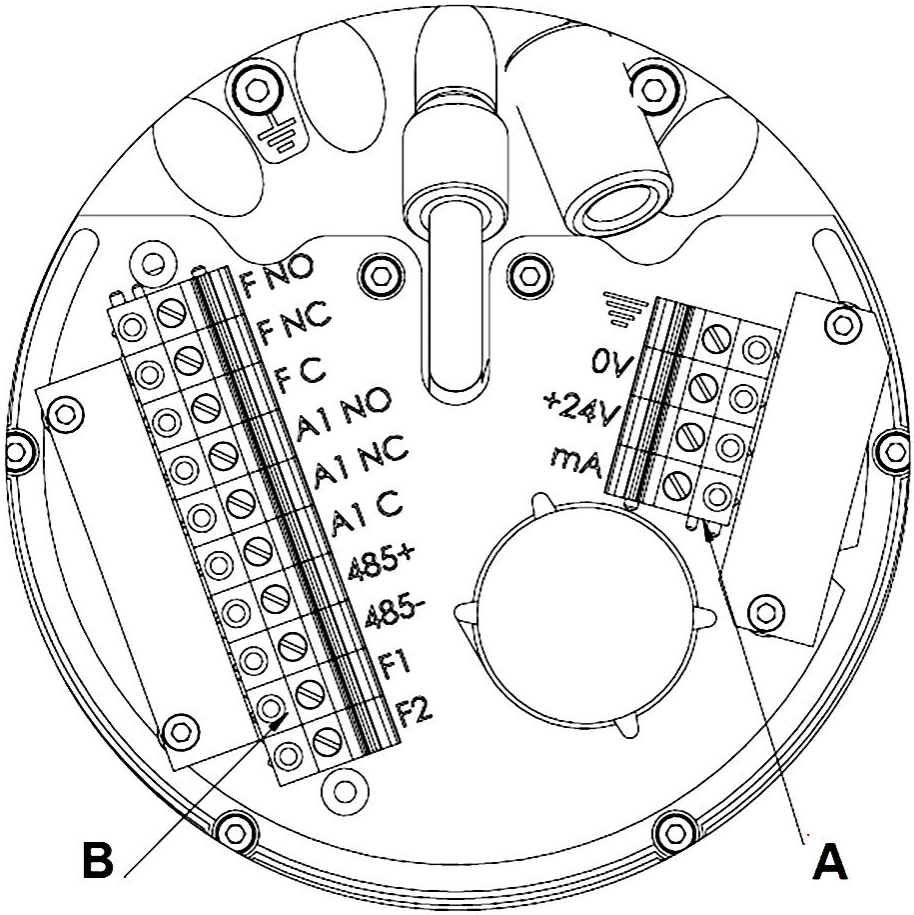
Seal all FM approved detectors (US and Canada) within 18 in. (457.2 mm) of enclosure entry using a suitably rated conduit seal.

NOTICE

The terminal cover label specifies thread size for cable entry.

2.6.2 Wiring configurations

Figure 2-11: Electrical Connection Drawing



A. Terminal row 1
B. Terminal row 2

Table 2-1: Terminal Row 1

Symbol	Description
	Single cable entry internal earth
0V	24 V return - (0 V)
+24v	+24 Vdc (15 to 30 Vdc)
mA	4-20 mA output

Table 2-2: Terminal Row 2

Abbreviation	Description
F NO	Fault relay normally open
F NC	Fault relay normally closed
F C	Fault relay circuit contact
A1 NO	Alarm 1 normally open
A1 NC	Alarm 1 normally closed
A1 C	Alarm 1 circuit contact
485+	Factory use only
485-	Factory use only
F1	Factory use only
F2	Factory use only

Refer to Table 2-1 and Table 2-2 for descriptions of the cable entries for terminal rows 1 and 2.

According to standard, connect three-wire connection cables to Terminal Row 1 in positions +24 v, 0 V, and current loop output connected to the mA terminal. The maximum loop resistance is 500 Ω.

Current source is the standard default operation; current sink is an option you should specify when you order.

Relay data: 1.4 A, 30 Vdc switch voltage.

Related information

Relay options

2.7 External cables

⚠ WARNING

Choose customer cable in accordance with hazardous area certification and applicable local regulations.
The GDU-Incus has a temperature rating of 185 °F (85 °C). When used in areas with an ambient temperature above 140 °F (60 °C), ensure cable has a rating that is equal to or exceeds the proposed maximum working temperature.

The following data indicates maximum cable length restriction due to voltage drop based on a nominal input voltage of 24 Vdc.

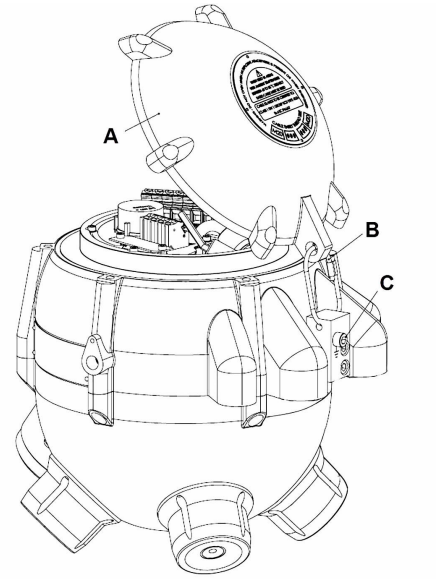
Conductor cross sectional area/gauge	Maximum cable length for standard, non-heated GDU-Incus	Maximum cable length for heated GDU-Incus
0.5 mm^2, 20 AWG	1770 ft. (540 m)	240 ft. (75 m)

Conductor cross sectional area/gauge	Maximum cable length for standard, non-heated GDU-Incus	Maximum cable length for heated GDU-Incus
1.0 mm^2, 18 AWG	2800 ft. (855 m)	380 ft. (115 m)
1.5 mm^2, 16 AWG	4470 ft. (1360 m)	620 ft. (185 m)
2.5 mm^2, 14 AWG	7120 ft. (2170 m)	990 ft. (300 m)

2.8 External ground

Connect the detector housing to local ground via the external earth point as shown in Figure 2-12.

Figure 2-12: External Grounding Point



A. Terminal cover in open position
B. Terminal cover restraint
C. M6 external earth point

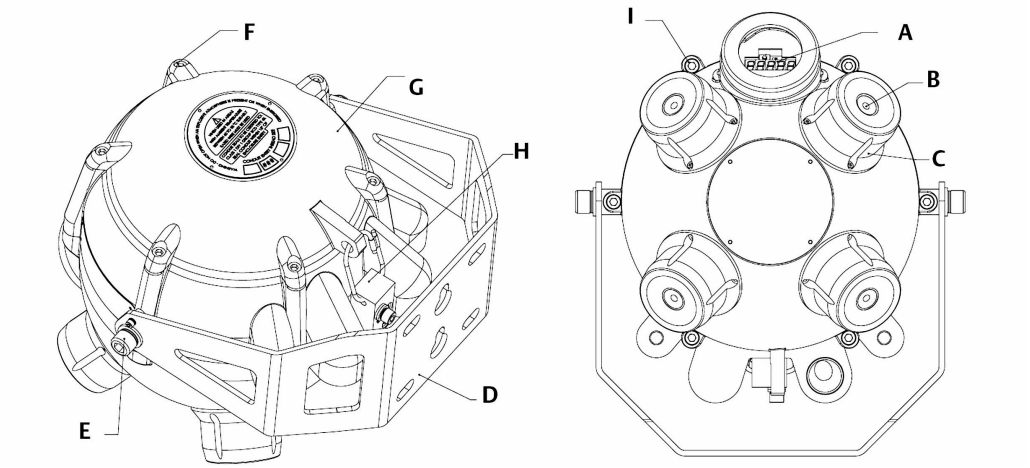
2.9 Commissioning

2.9.1 Visual inspection

Before powering the detector, inspect the following:

Refer to Figure 2-13 for key locations on the GDU-Incus when completing this inspection.

Figure 2-13: Components of the GDU-Incus



A. Display
B. Sensor (four positions)
C. Sensor pod (four positions)
D. Mounting bracket
E. Enclosure mounting point
F. Terminal cover bolts (six positions). Tighten to 9 Nm.
G. Terminal cover
H. External earth point
I. Main enclosure bolts (six positions). Do not remove or adjust.

- Ensure detector is correctly situated for area of detection.
- Ensure mounting bracket is secured to mounting points on the detector and mounting surface/pole.
- Check pole mount (if present) for suitability to withstand detector weight and measurement
- Ensure external earth is correctly attached using spring washer.
- Ensure correct cable gland installation and appropriate certification or local regulations have been observed. Check correct cable installation in the terminal compartment; ensure terminal compartment flame paths and seals are intact.
- Ensure incoming cable is threaded through ferrite beads (Figure 2-8).

- Tighten terminal cover bolts to the 9 Nm recommended torque.
- Verify main enclosure bolts are in place. Emerson torques these bolts at the factory; do not adjust or tamper with them.
- Check display glass for damage or contaminants that may display.
- Ensure correct operating supply voltage.

2.9.2 Power up

Upon power up, a brief functionality check runs to ensure detector functionality; this lasts no more than five seconds. Once completed, the detector goes into normal operation using the factory/customer defaults specified at time of order or signals any faults that may be present.

In addition, the display shows the real-time ultrasonic sound level, the detector becomes responsive to commands for function setup via hand-held TREX or AMS, and all relays are energized or de-energized as per defaults.

Note
If Emerson has set the detector at the factory for specific site requirements, Emerson recommends carrying out the steps in Check sensor functionality before you finish commissioning.

Related information

Fault outputs

3 Operation

3.1 Normal operation

On power-up, the detector initializes a diagnostic check and then enters normal operation mode as per factory default settings.

Factory operation mode 71 settings

- 4-20 mA = 4-120 dB (linear scale factor).
- Relays are energized open; loss of power causes alarm (fail-safe).
- Relays are set to non-latching.
- Reset alarms enabled; allows latched relays to be reset and restarts alarm delay.
- Alarm level set to 70 dB for relay output.
- Delay time set to 15 seconds for relay output.
- All communication ports are active and ready to receive commands.

3.1.1 Alarm level

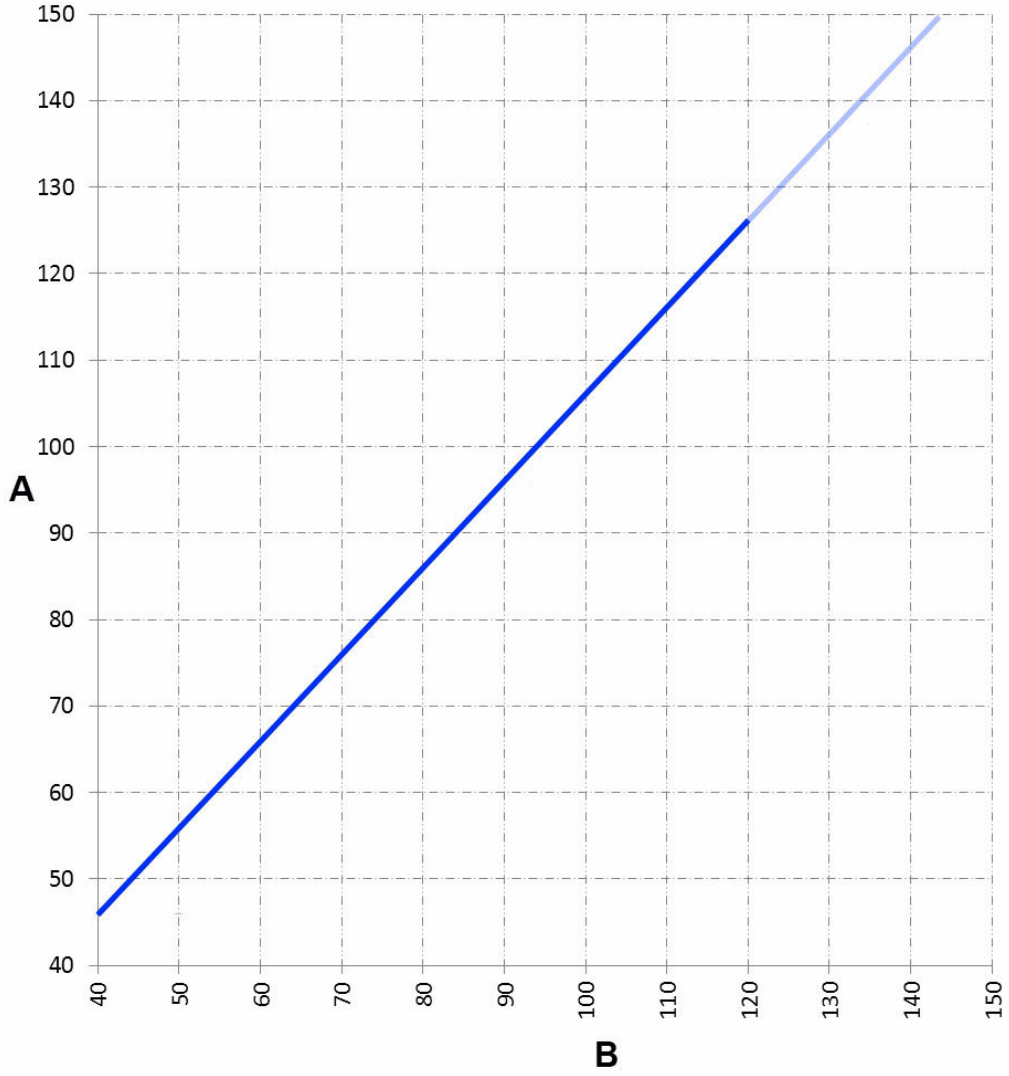
The alarm level is the ultrasonic sound level at which an alarm state is triggered. During the alarm state, the display flashes, the relays switch states, and the current loop becomes active if one or more sensors were in fault mode (if no sensors are in fault, the current loop will already be outputting dB level).

To avoid false alarms, Emerson recommends setting the alarm level above the background level established by mapping when all processes are operational. If you don't know the background level, Emerson recommends using the detector to analyze the background. Take care to observe all processes that may cause intermittent ultrasonic noise, such as pressure relief valves.

Contact an Emerson representative for advice on alarm levels.

Note
The higher the alarm level, the smaller the detector coverage radius; it is therefore important to establish a safe alarm level at the lowest permissible rate.

Figure 3-1: Suggested Alarm Levels



A. Alarm level (dB), 6 dB above background sound level
B. Background sound level (dB)

Figure 3-1 shows the suggested alarm level settings (6 dB above background sound level) for known background sound levels. The values shown have been found to provide sufficient immunity against most spurious alarms; however, take care to survey the area of installation for potential spurious noise.

If you don't know background levels, use typical historical process background levels along with a safety factor. Contact an Emerson representative for historical values and guidance.

You can set alarm levels in the detector (via HART®/TREX/AMS) or at the control panel. Most installations set the alarm levels in the control system. However, please note that the best practice is to have the control panel and the GDU-Incus's internal alarm level to always mirror each other. The reason for this is when the detector is in a sensor fault condition, the detector's mA output will be a constant 2 mA and will not change to the real

time mA output (which can be converted to real-time dB) until the device's internally set alarm level is reached or exceeded.

For example, assume a sensor fault is present and the detector's internal alarm level is set at 70 dB. The detector's mA output will be 2 mA until the real time dB level meets or exceeds 70 dB, at which point the detector's mA output will change to the mA value that coincides with the real-time 70 db level the detector is sensing.

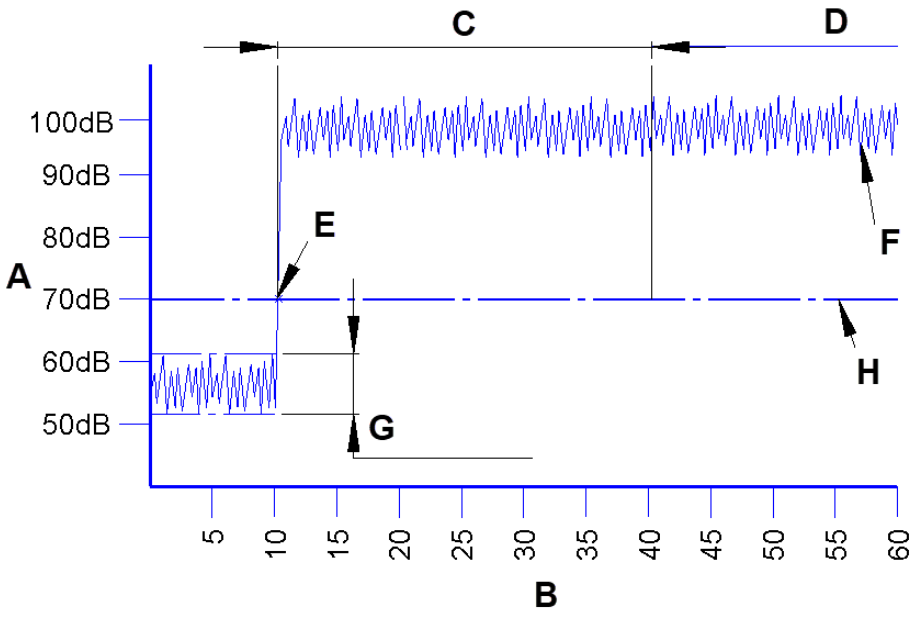
Lastly, the display on the detector will read the real time dB values at all times, regardless of the mA loop output.

3.1.2 Delay time

To avoid spurious alarms, Emerson recommends using a delay time for non-toxic gas applications or when instantaneous detection is not required. The delay timer is activated from the point at which the alarm threshold is first exceeded.

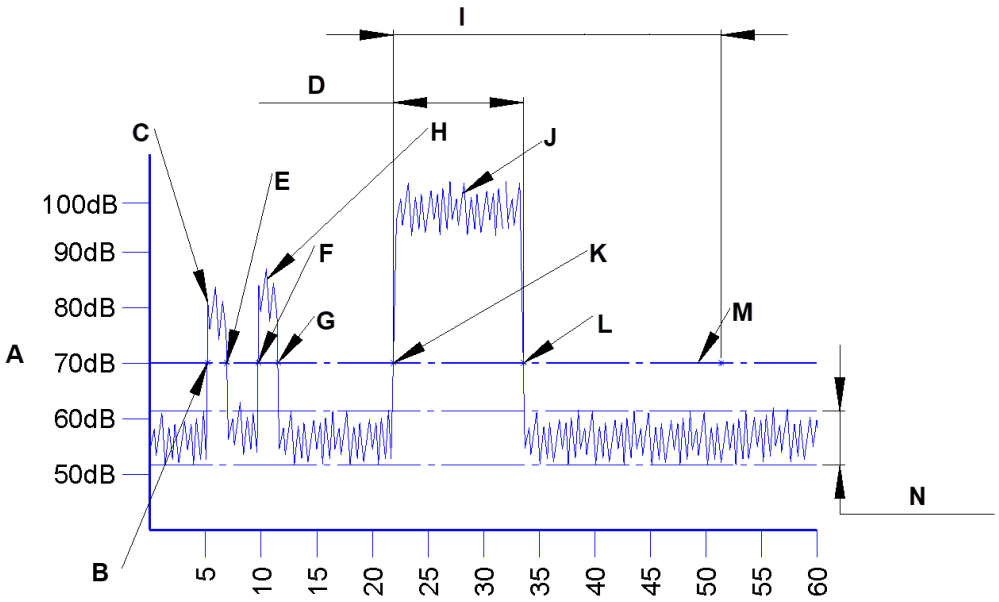
If ultrasonic noise drops below the alarm level threshold, the delay time is reset as shown in Figure 3-3. If the ultrasonic noise level remains above the alarm level threshold for the duration of the delay time, the alarm is activated as shown in Figure 3-2.

Figure 3-2: Graph Showing Alarm Activation with Leak



A. Ultrasonic sound level
B. Time duration (seconds)
C. Delay time (30 seconds)
D. Delay reached - alarm
E. Delay start point
F. Ultrasonic noise level
G. Background noise level
H. Alarm level

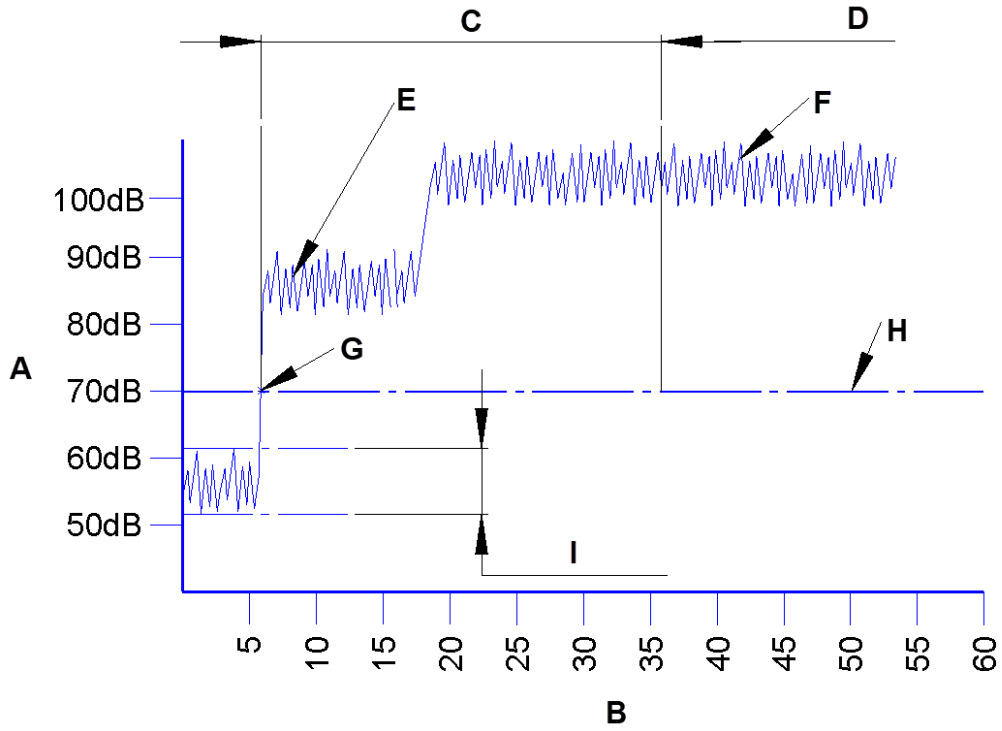
Figure 3-3: Graph Showing No Alarm Activation with Spurious Noise



A. Ulstrasonic sound level
B. Delay start point
C. Noise 1
D. Alarm dB exceeded
E. Delay reset
F. Delay start point
G. Delay reset
H. Noise 2
I. Delay time (30 seconds)
J. Noise 3
K. Delay start point
L. Delay reset
M. Alarm level
N. Background noise level

In Figure 3-3, noises 1 and 2 are spurious noise spikes of approximately 1.5 seconds, typical of man-made ultrasonic noise produced through normal maintenance procedures. Noise 3 is a longer spurious noise of approximately 13 seconds, typical of a pressure relief valve. Delay time is introduced to ignore spurious noise spikes, as the detector will reset when noise level drops below alarm level before the delay time is reached.

Figure 3-4: Graph Showing Alarm Activation with Spurious Noise and Leak



A. Ultrasonic sound level
B. Time duration (seconds)
C. Delay time (30 seconds)
D. Delay reached - alarm
E. Noise 1
F. Noise 2
G. Delay start point
H. Alarm level
I. Background noise level

Figure 3-4 shows detector response when a leak is encountered during a spurious noise spike, such as a pressure relief valve. Noise 1 represents a pressure relief valve actuating for approximately 13 seconds before a leak (noise 2) occurs. The detector starts the delay time when the pressure relief valve opens and continues to monitor for leaks. If a leak occurs during a spurious noise spike, the delay time is reduced by the duration of the spurious noise spike.

It is important to identify all spurious noise spikes of significant duration within the detector coverage. Emerson recommends setting the alarm delay to a value greater than the maximum spurious noise spike operating duration. If two or more spurious noise sources are situated within the detector coverage area, Emerson recommends assessing whether activation of these sources can overlap in time, in which case you should extend the delay time accordingly.

The factory alarm delay value is set at 15 seconds. To modify this value, connect to the GDU-Incus with a hand-held TREX device or AMS. Please note when changing the alarm delay that setting values 0 to 99 are in 10 second increments and 100 to 127 are in 1 second increments. 0 and 100 represent instantaneous alarms. For example, 1 represents a 10 second alarm delay, and 99 represents a 990 second alarm delay; whereas 101 represents a 1 second alarm delay, and 127 represents a 27 second alarm delay. Therefore, the factory alarm delay value for 15 seconds would be 115. See Table 3-1 for more information.

Table 3-1: Alarm Delays

Desired alarm delay value	Actual input value in TREX/AMS
15 seconds (factory default)	115
10	1 or 110
30	3
60	6
0	0 or 100

3.1.3 Automatic self-test

The automatic self-test checks the complete detector every 320 milliseconds by sending an electrical signal of known amplitude through the sensing circuitry and analyzing the result, without interrupting the normal functionality of the sensor.

If drift, component failure, or damage occurs, the automatic self-test signals a fault.

Related information

Fault outputs

3.2 Check sensor functionality

Emerson calibrates the sensors on the GDU-Incus at the factory; they do not need to be adjusted. Before operation, Emerson recommends functionality checks to ensure correct installation. On power-up, the detector performs a diagnostic check to ensure all main functions are operational and continuously monitors the sensors via the built-in self-test.

The sensor's functionality can be verified using the GDU-01-TT Ultrasonic Test Transmitter and the following procedure:

1. Ensure that the background ultrasonic level is suitable for the distance of the proposed transmitter test.
2. Aim the transmitter at the sensor face from a known distance. The detector's display dB level will rise according to the hand-held device used and the distance.
3. Check all four sensors, if possible, by moving around the detector and repeating.

3.3 Output options

The GDU-Incus comes with the following industry-standard forms of communication:

- Analog (4-20 mA)
- HART® communication protocol
- Two configured relays

This enables the detector to be operated as part of a system, as a standalone unit, or hard wire linked to form a sub network.

3.3.1 Relay options

The GDU-Incus has two relays configured as follows for the standard factory default:

Table 3-2: Relay Defaults

Relay	Type	Factory default setting
1	Fault	Energized in normal operating condition, de-energized in fault condition, non-latching
2	Alarm	Energized in normal operating condition, de-energized in fault condition, non-latching

Table 3-3: Relay Data

Maximum switching current	1.4 A
Maximum switching voltage	30 Vdc

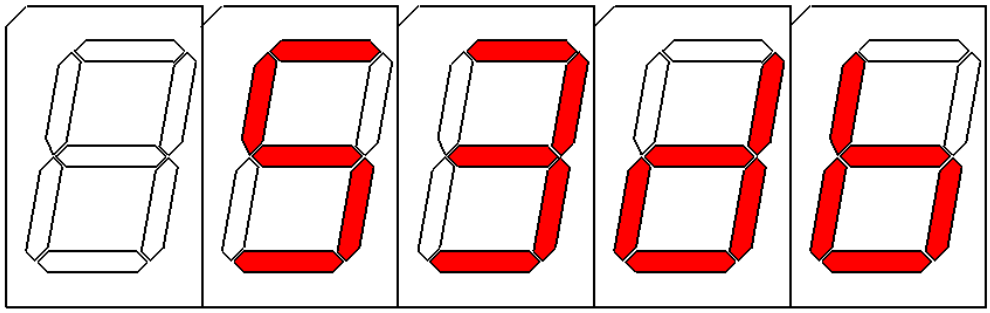
You can change relay configuration to suit installation requirements with the user changeable functions; options include normally open/normally closed condition and latching/non-latching.

3.4 Display

The GDU-Incus incorporates a five-digit segment, 0.31-in. high x 0.16-in. wide (8 mm high x 4 mm wide) character light-emitting diode (LED) display with red numerals as standard.

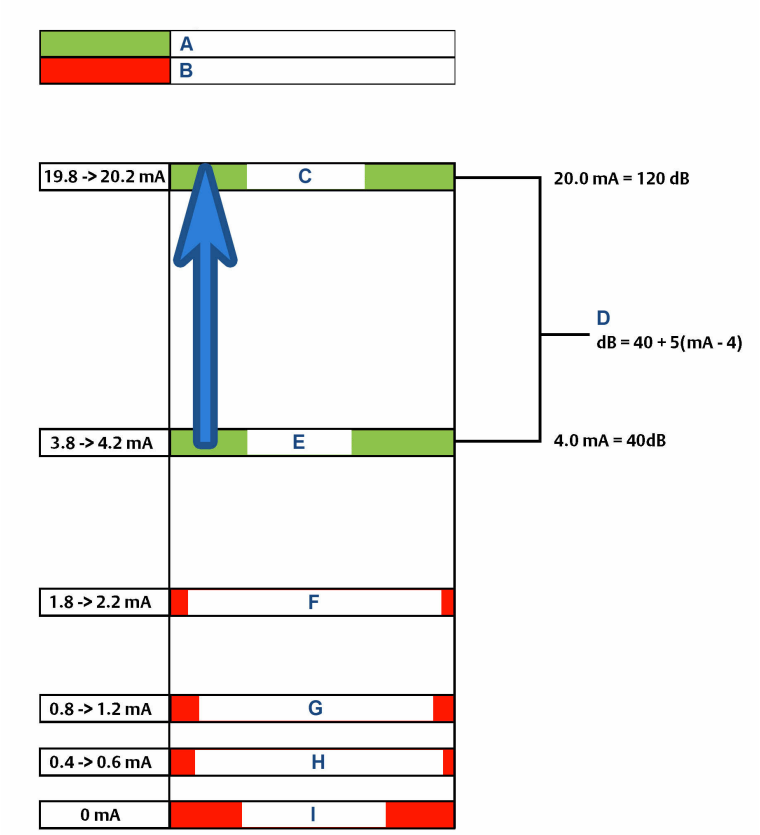
During operation, the real-time dB level is continuously shown while below the programmed alarm level and flashing when above the programmed alarm level.

Figure 3-5: Example of Real-Time dB Level Display: 53 db



3.5 4-20 mA output

Figure 3-6: 4-20 mA Output Values (Example Shows Default Op-Mode 71)



A. Normal operation
B. Detector fault detected
C. 100 percent of range
D. Linear scale
E. 0 percent of range
F. 2.0 mA sensor head test fault(1)
G. 1.0 mA internal process fault
H. 0.5 mA all sensor heads failed
I. 0 mA major fault

Figure 3-6 shows the 4-20 mA output values for the detector during normal operation and under various fault conditions. The value on the left side shows the mA output tolerance band; internal fault is set for a 1.0 mA output with a tolerance of 0.8 to 1.2 mA, for example.

All mA outputs are grouped in descending order to signify importance and to allow for instant status recognition.

(1) The GDU-Incus is providing coverage when the 2.0 mA sensor test fault is active.

Normal operation between 4 to 20 mA (±0.2 mA): detector working, no fault conditions.

Related information

2.0 mA sensor test fault
Fault outputs

4 HART® functionality

The GDU-Incus has HART communication enabled by default. The HART communication mode is standard current output FSK, to HART protocol revision number 7.

The device reports the primary variable (PV) measurement of sound pressure level in units of dB. The secondary variable (SV) reports the internal case temperature (degrees Celsius) of the detector. The tertiary variable (TV) reports the temperature of the heated section of the detector if the heater option is fitted; otherwise, it will report the same data as the secondary variable.

A device driver (DD) file for Emerson AMS and the hand-held TREX field terminals is available from Emerson. In addition, you can use the detector with FDT frame applications using a generic DTM with limited functionality.

The Incus HART Field Device Specification provides full technical details of the HART interface.

Note

1. The detector does not support the delayed-response mechanism, burst-mode, or write protection.
2. The HART device parameters **Tag** and **Long Tag** are set to *INCUS* and *GDU-02-INCUS* by default. If unique identification is required, set up the parameters on site.

5 Maintenance

5.1 Hand-held test

You can use the GDU-01-TT test transmitter to emit an ultrasonic tone of 40 kHz with a sound pressure level of approximately 106 dB at 3 ft. (1 m). Using the GDU-01-TT hand-held device makes testing the GDU-Incus and other types of ultrasonic detectors quick and cost-effective, as you can test at floor level at distances of up to 26 ft. (8 m) (dependent on background noise) if you can achieve line of sight with the sensor.

Emerson recommends disabling all alarms and monitoring the 4-20 mA output from the control room or observing it on the display. Test to ensure that the sensors are functioning correctly in addition to any internal test function contained within the detector. Emerson recommends doing a hand-held test in line with existing site maintenance procedures.

Note
Ensure that any internal test functions are disabled or deactivated when doing a handheld test to avoid spurious results.

⚠ WARNING

This device will need a Hot Work Permit.

5.2 Troubleshooting

The GDU-Incus cannot be repaired in the field.

If a problem develops, carefully check installation and wiring. If you determine that the problem is caused by an electronic or other defect, contact your Emerson representative.

Related information

Service support

5.2.1 Fault outputs

2.0 mA sensor test fault

One or more sensor heads fail to respond with the correct value during the automatic self-test.

Output is continuous at 2.0 mA unless the test is subsequently passed successfully or an alarm condition occurs, in which case the normal sound level is transmitted on the current loop.

Related information

Alarm level

1.0 mA internal process fault

Continuous 1.0 mA (±0.2 mA) output for any known internal or external faults that include over-voltage, high/low external voltage, blown fuse, or high/low internal voltage.

0.5 mA all sensors dead fault

Continuous 0.5 mA (±0.2 mA) output, indicating that all four sensors have failed self-test. Firmware version 3.4 onwards.

Recommended action

Contact your Emerson representative.

Zero mA major fault

Zero (0) mA output is either caused by a total loss of power to the detector or a serious microprocessor fault.

Potential cause

Loss of power.

Recommended action

Apply power to the detector.

Potential cause

Serious microprocessor fault.

Recommended action

Contact your Emerson representative.

5.3 Storage

Store the detector in a location free from dust and moisture.

Make sure the storage temperature is well within the limits of the certified temperatures of the equipment.

A Theory of operation

The GDU-Incus is omni-directional. Emerson recommends mounting it between 10 and 16 ft. (3 and 5 m) above the area of interest to eliminate ground absorption and reflections.

Emerson recommends ultrasonically mapping the area where the detector is to be situated prior to installation or at commissioning while all processes are running to establish a background noise level for alarm purposes. Set the alarm level above the background noise level. Contact your Emerson representative for more information regarding mapping.

The detector responds instantaneously to pressurized gas leaks or other sources of ultrasonic noise between 25 kHz and 100 kHz. Therefore, Emerson recommends building in a delay time to the control system or programming it in the detector when using it in stand-alone mode to prevent spurious alarms. Emerson recommends setting the delay time at a minimum of 15 seconds, but increase this time in response to the process located near the detector as shown in Figure 3-2.

Several factors affect the maximum area which can be monitored by a single detector. These factors include:

- Background (ambient) ultrasound level
- Gas pressure
- Leak size
- Gas temperature
- Environmental conditions

Emerson has formulated a series of calculations that take all of these external factors into account in order to determine accurate coverage information for most installations. Contact an Emerson representative to advice on appropriate coverage for each installation.

Emerson recommends completing a verification test of the GDU-Incus after installation and in line with existing site maintenance procedures. You can verify the detection coverage at installation or as part of a maintenance schedule using the GDU-01-TT Ultrasonic Test Transmitter, which electrically replicates the airborne ultrasound generated from a pressurized gas leak using a piezoelectric disc and can activate alarm conditions with any ultrasonic gas leak detector.

Compared to other ultrasonic and traditional forms of detection, the GDU-Incus has the following advantages:

- Gas does not need to reach the sensor to be detected.
- Unaffected by weather conditions.
- Sensors are unaffected by temperature, pressure, moisture, and contamination build-up.
- Multiple sensor redundancy in each unit.
- Continuous self-test function.

- No calibration required, which results in cost savings over the detector lifecycle.
- Can be remotely tested from up to 26.2 ft. (8 m) distance, saving on maintenance scaffold costs.
- 4-20 mA current loop with HART® communication as standard, plus relay outputs for Fault and Alarm conditions.
- Can operate standalone or as part of an interfaced control system.

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For more information: **www.emerson.com**