



GROVELEY DETECTION

Groveley Detection Limited
Anchor Works, Groveley Road
Christchurch, Dorset
BH23 3HB
UK

T: +44 (0)1202 483497
F: +44 (0)1202 486658
E: sales@groveley.co.uk

Ultrasonic Gas Leak Detector GDU-01 Manual



This document is copyright and the property of Groveley Detection Ltd.

No part of this document may be reproduced, in any form without prior permission, in writing, from Groveley Detection Ltd.

RELEASE NOTES				
Rev.	Date	Revision History	Prepared	Approval
3.0	10/06	Update Testing & Detector Appearance	ES	DR
2.0	01/06	Revise 3 wire unit to 2 wire 24 Vdc	DR	ES
1.0	06/05	Initial Release	DR	ES
0.1	04/05	Release for Comment	DR	ES

www.groveley.co.uk

*No-one ever regretted
buying quality...*

Ultrasonic Gas Leak Detector

GDU-01 Manual

Table of Contents

2. Introduction.....	3
3. Safety Guidelines.....	3
4. IS Certification Description.....	4
5. Installation of the GDU.....	4
6. Operation	9
7. Functional Test	9
8. Performance Test.....	10
9. System Start Up	10
10. Fault Finding.....	10
11. Maintenance.....	10
12. Technical data.....	11
13. General Arrangement.....	12
14. Ordering Information	13
15. Accessories	13

2. Introduction

The GDU has been designed to detect the airborne ultrasound generated from a pressurised gas leak using a piezoelectric disc and conditioning electronics.

Airborne ultrasound is generated when gas moves from a high-pressure area to a low-pressure area. This is because it expands very rapidly causing turbulent flow and creating a sound wave. The sound wave ranges from audible frequencies into ultrasonic frequencies the level of which depend on three main factors:

- Pressure drop across leak
- Size of leak (area)
- Specific gas properties (molecular weight and specific gas ratio)

The GDU will not detect specific values of LEL or ppm but instead responds instantaneously to sound generated by even small leaks. The GDU is not affected by extreme weather conditions.

GDU construction is from 316 stainless steel mounting hardware and a semi-crystalline Polyphenylenesulphide (PPS) enclosure, IP66 certified.

The GDU uses Industry Standard 4-20mA output to interface to the plant control DCS, PLC or 4-20mA input card. Once connected the alarm level should be adjusted to a level higher than the general background noise to which the GDU is subjected. If general operations create spurious noise a suitable alarm delay should be implemented.

Typical applications include:

- Normally Unattended Installations
- Well bay areas
- Compressor Halls
- Aftercoolers
- Storage and Distribution Networks

3. Safety Guidelines

3.1. Warning

Disconnect all power to the detector before connecting or disconnecting.

The power supply must be adjusted to a MAXIMUM of 30Vdc before powering up; failure to do so could result in damage to the detector or detector electronics.

The GDU is an intrinsically safe unit and therefore should have voltage and current levels limited by the appropriate Ex approved isolator or barrier. See Electrical installation section for details of isolators / barriers.

The detector satisfies ATEX II 1 G D EEx ia IIC T4 -40°C<Ta<+70°C and is certified by certificate number DNV-2005-OSL-ATEX-0327X, preamplifier and sensor type GDU1278.

3.2. Use In Hazardous Areas

Components used have been inspected and approved in accordance with international explosion-protection regulations and should only be used under the specified conditions. The GDU may not be modified in any manner. Appropriate regulations must be observed when carrying out maintenance or inspection and should only be undertaken by competent personnel.

3.3. Accessories

GDU should only be used with Groveley Detection approved accessories and mounting equipment.

3.4. Liability

All liability for the correct function of the GDU is irrevocably transferred to the owner / operator to the extent that the GDU is altered or installed incorrectly by personnel not authorised by Groveley Detection or if the GDU is used in a non conformance to its intended use.

4. IS Certification Description

The certification classification is listed as II (1) G D, EEx ia IIC for the barrier, and II 1 G D, EEx ia IIC T4 for the GDU-01. Each of these designations has a meaning, which describes their usage in a hazardous environment. A hazardous environment in the context of Intrinsic Safety is an area where the presence or possible presence of a flammable gas/air mixture requires that special precautions be taken to avoid the possibility that any electronics placed within the hazardous area becomes a source of ignition.

The table below describes the certification in terms of the ATEX/CENELEC standards as well as what they mean in US IS terms.

ATEX Designation	ATEX Standards	US Equivalent
II	Group II equipment for use other than mines	Class other than Mining
1	Zone 0 locations where explosive gas/air mixtures are always present	Zone 0 locations where explosive gas/air mixtures are always present
G	Designation for gases, vaporous and mist	Not applicable
D	Designation for dusts	Not applicable
CENELEC Designation	CENELEC Standards	US Equivalent
EEx ia	Explosion protection is maintained with up to 2 faults. For use in Zone 0 locations where explosive gas/air mixtures are always present	Exceeds US standards which only requires explosion protection with up to 1 fault. Equivalent to Class I, Division 1
IIB	Group IIB covers for flammable gases including ethylene	Equivalent to Class 1, Group C
IIC	Group IIC includes Group IIB as well as the most easily ignited Hydrogen and Acetylene	Equivalent to Class 1, Group A and B
T4	This relates to the max surface temperature that the unit can attain. T4 is rated 135°C	Same 135°C

Table 1: Certification Description

This section is by no means a tutorial on Intrinsic Safety and it is recommended that anyone operating (or planning to operate) in an IS hazardous area understand clearly all aspects of IS requirements and procedures. Many texts exist on the subject. These should be studied carefully before delving into IS applications for the first time.

5. Installation of the GDU

Performance of the GDU depends on the position chosen for installation; the following should also be noted:

- **Regulations governing the installation of gas detection systems**
- **Regulations concerning connection and routing of IS cabling**

Consideration should be given regarding maintenance and testing routines.

5.1. Detection coverage

Detection coverage for the GDU depends upon four factors:

- Background noise at proposed installation point
- Gas pressure

5.2. Offshore Coverage

Offshore installations tend to install detectors pointing vertically downwards at a height of approximately 3 m, coverage is summarised as:

Sensitivity radius: 12m (0.1 Kg/s) <74dB ambient
 8m (0.1 Kg/s) <84 dB ambient

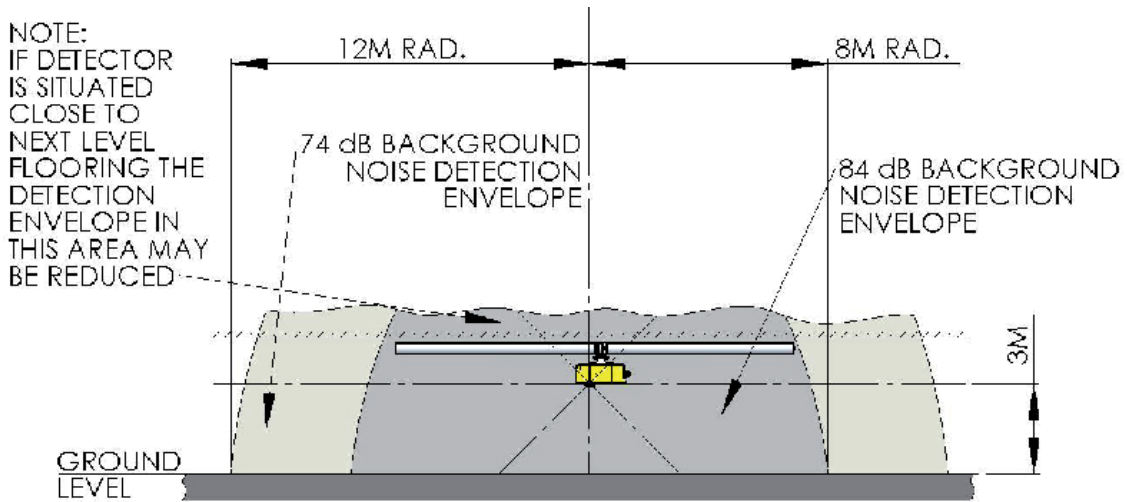


Figure 1. Offshore Installation - Vertical Installation

Consult Groveley if the background noise level can achieve 84dB or above.

5.3 Onshore Coverage

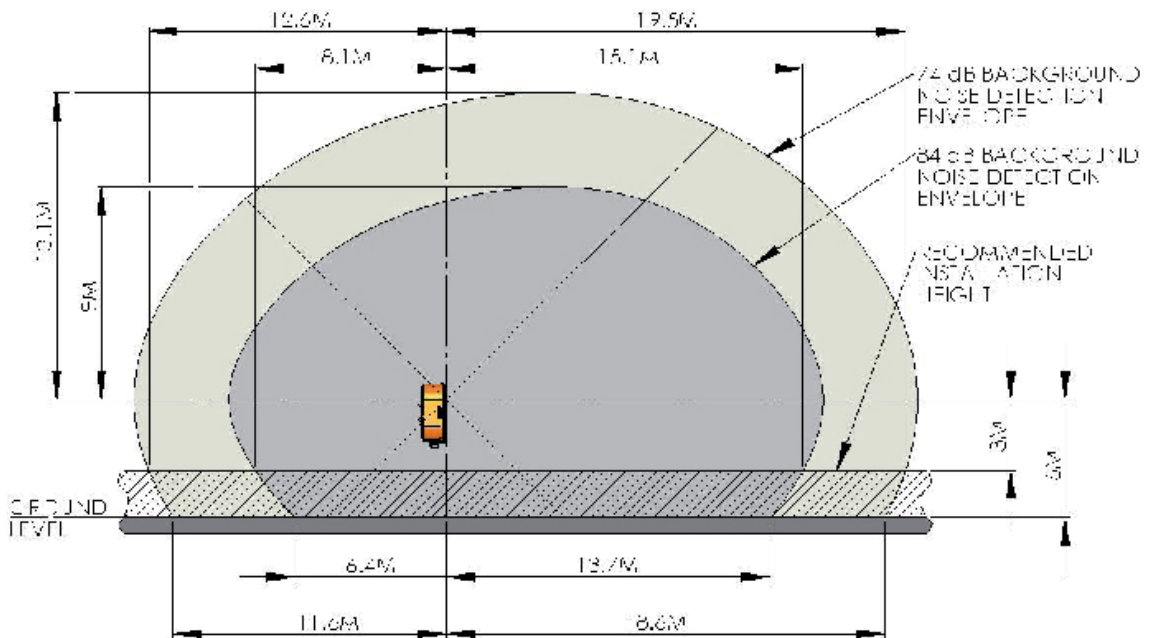


Figure 2. Horizontal Mount at 3m, 74dB, 0.1 Kg/s

5.4. Environment considerations

The GDU should not be installed in areas where the ambient temperature can exceed the specified operating and storage ranges.

Extreme care must be taken if the GDU is to be positioned close to any equipment capable of generating high levels of airborne noise that are not classified as normal background noise such e.g. helipads. Contact Groveley should this be the case.

Identification tags need to be firmly secured to prevent unwanted locally generated ultrasonic noise.

Groveley recommend a deluge cover if the GDU is to be installed in an area which is subject to very extreme weather conditions.

5.5. Mechanical Installation

The GDU is a sealed unit with the exception of the terminal cover; the enclosure is not to be opened by anybody other than Groveley or Groveley Authorised personnel. All warranties are nullified if these seals are broken or tampered with.

The GDU can be mounted simply and quickly in any orientation using Groveley mounting brackets for wall, pipe or a free-standing pole.

As the GDU has more sensitivity when used facing the area of detection Groveley recommend installation with the adjustable range of brackets.

Groveley recommended mounting the GDU with the cable gland pointing downwards to reduce the possibility of unwanted water ingress. Obstructions to the GDU line of sight may lead to a loss of sensitivity.

For areas with the potential for multiple leak points or with very high background noise please consult Groveley before installation.

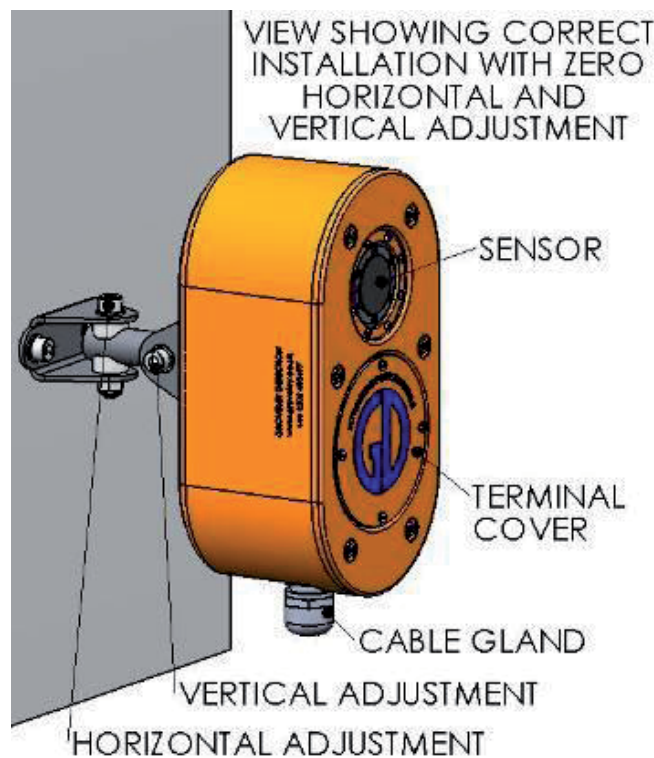


Figure 3. Adjustable Wall Bracket

5.6 Installation Notes

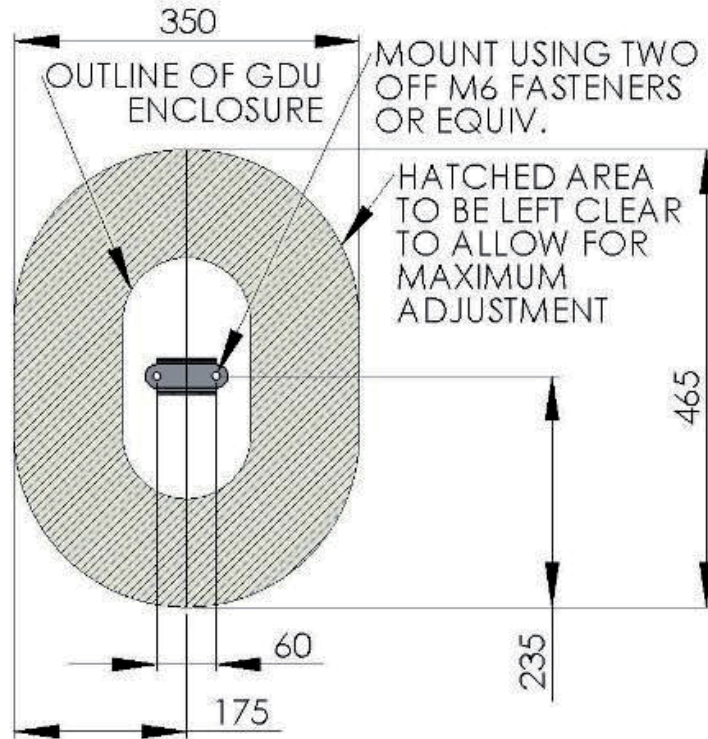


Figure 4. Bracket Footprint

Drill holes for M6 or equiv. fixing bolts. Bolts should be appropriate for fixing surface using manufacturers' instructions. Ensure bolts will be secure before mounting GDU.

GDU can be adjusted to achieve line of sight for proposed detection area using horizontal and vertical adjustment bolts. Ensure the horizontal and vertical adjustment bolts are securely fixed in position before operation of GDU.

Do not alter or remove any part of the mounting bracket.

Ensure that the GDU is free from vibration, obstructions and any item that is not properly secured (cable etc).

If the GDU is to be left mounted before wiring, ensure the cable gland is sealed against water and dust ingress.

Ensure that the terminal cover is fixed and secured.

WARNING: DO NOT POWER THE GDU UNTIL ALL CONNECTIONS HAVE BEEN MADE. THE POWER SUPPLY SHOULD BE SET AS CLOSE TO 24VDC AS POSSIBLE FOR MAXIMUM PERFORMANCE.

The GDU must be used in conjunction with an approved Galvanic Isolator to prevent excess current and voltage passing to the GDU (or hazardous area).

Any certified barrier is acceptable as long as it meets the following:

$$V_i \leq 30V \quad I_i \leq 100mA \quad P_i \leq 0.9W$$

Connecting cable between the barrier and the GDU should be of individually shielded pair construction and the following requirements: The capacitance shall not exceed $0.057\mu F$ and the inductance to resistance ratio shall not exceed $60 \mu H/\Omega$. The cable used may be a separate cable or may be installed in a type "A" or type "B" multicore cable (as defined in clause 53 of BS5501:1982 [EN 50039]) provided that the peak voltage of any circuit within the type "B" multicore cable does not exceed 60V.

5.8 GDU Termination Details

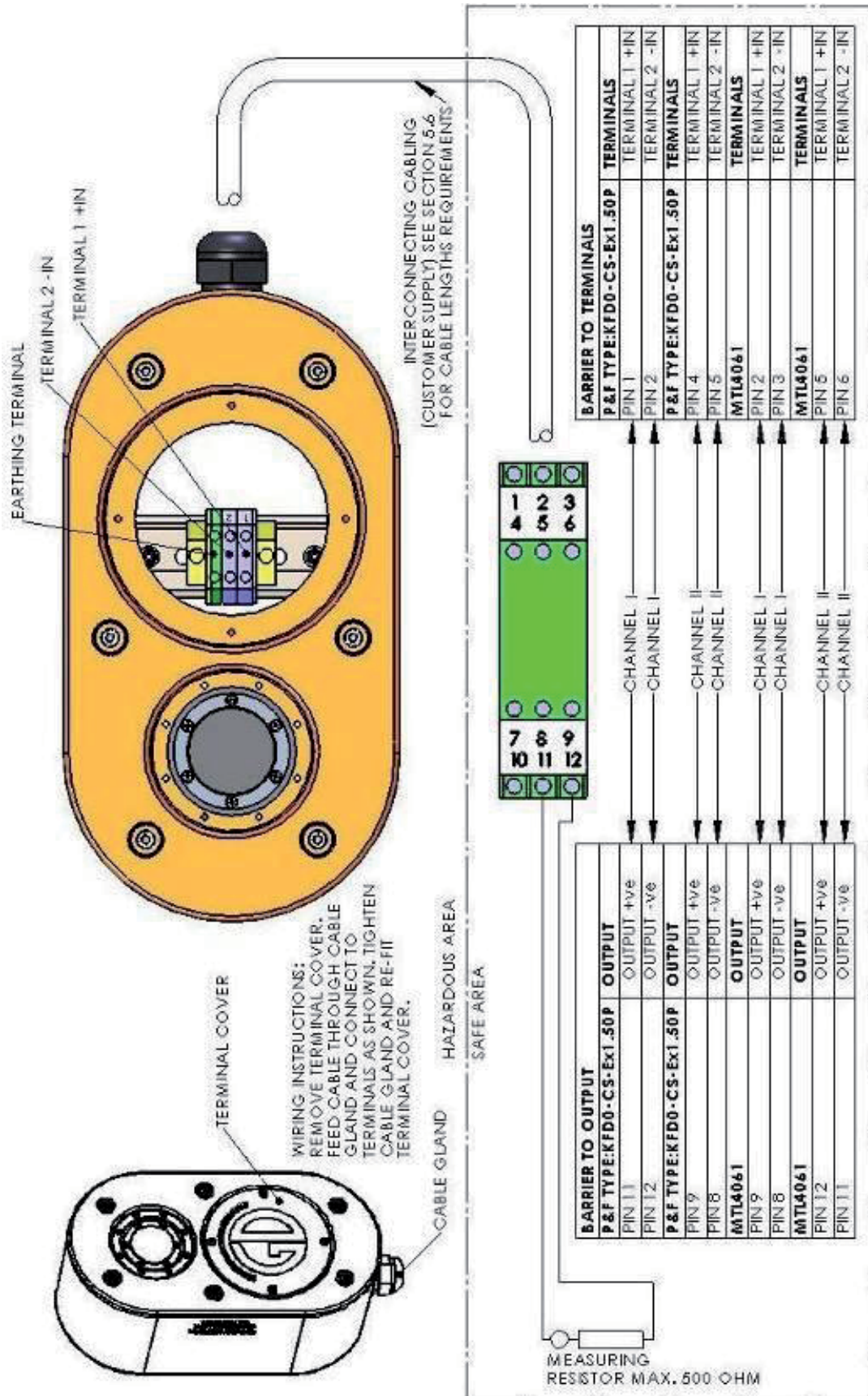


Figure 5. Wiring Diagram

6. Operation

The key for correct operation of the GDU is in its installation, the previous section provides detailed information on the correct installation and set-up to ensure it is within the guidelines of the IS certification.

The GDU has no adjustable controls and is therefore set up by the controlling software giving the end user ultimate flexibility.

6.1. System Start Up

On system start up it is recommended to allow the GDU to run for a set period of time with all processes running with the alarm level set to maximum and inhibited. The detector input should be recorded for analysis before setting the alarm level.

6.2. Recommended Alarm Settings

After background noise analysis it is recommended the alarm level be set as follows:

- Background < 10mA, 2mA background offset
- Background > 10mA, 1mA background offset

This offset is called the "safety margin." Time delays must be employed, typically in the region 15-60 seconds. It is worth noting that each detector is tailored to its local environment, hence the alarm set point (mA threshold) will vary throughout the plant.

6.3. Time Delayed Alarm Activation

In order to minimise unwanted alarms it is essential the control system be capable of time delayed activation. (Delay to alarm – not delay of alarm).

The delay prevents spurious intermittent trips from other ultrasonic sources such as pneumatic valves and tools.

The control system must be capable of monitoring the detector output once the alarm threshold has been breached. Provided the alarm threshold has been exceeded for periods upwards of 15 seconds the control system should consider that the detector is in alarm.

If the GDU is used in combination with other (dissimilar) hazardous gas detection equipment a cascaded logic may be utilised to reduce the delay period.

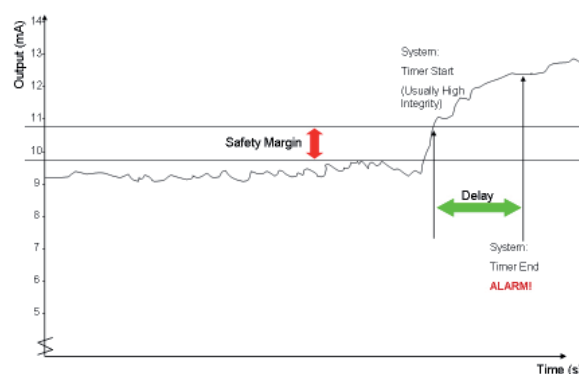


Fig 6. Time Delay - ALARM

7. Functional Test

- To functionally test the detector set the control system alarm time delay to ZERO seconds.
- Using the detector test kit (low pressure, non-flammable aerosol) initiate a release within one metre of the device. Ensure the alarm trip threshold is exceeded.
- Having successfully functionally tested the detector reinstate the control system time delay.

8. Performance Test

- It should be noted that the type of release expected in real service would be generated from a continuous source of pressured gas. Using portable test equipment it is not possible to recreate this sound source for the whole duration of the control system time delay.
- The performance verification kit allows for “burst” release testing only. The outlet pressure of this kit is set to 50 bar, using a hole size of 4 mm gives a mass flow rate of 0.1 Kg/s.
- To verify the performance / mapping of a detector location set the control system alarm time delay to ZERO seconds.
- Using the verification kit initiate a release at the furthest potential leak point, within the mapped detection envelope, directly in line with the detector face. Ensure the alarm trip threshold is exceeded.
- Repeat this test at least one other position within the detection envelope. Note, no more than four tests should be needed to verify the total detection envelope.
- Having successfully verified detector coverage reinstate the alarm system time delay.

9. System Start Up

On start up it is recommended the GDU be allowed to run for a set period with all processes running with the alarm level set to maximum and inhibited. The detector input should be recorded for analysis before setting the alarm level.

10. Fault Finding

The GDU has been designed to perform in the harshest of conditions found offshore.

In the event of detector failure, i.e. the detector output $<4.1\text{mA}$, verify the power at the detector, if there are no problems with the power supply return the unit to Groveley.

11. Maintenance

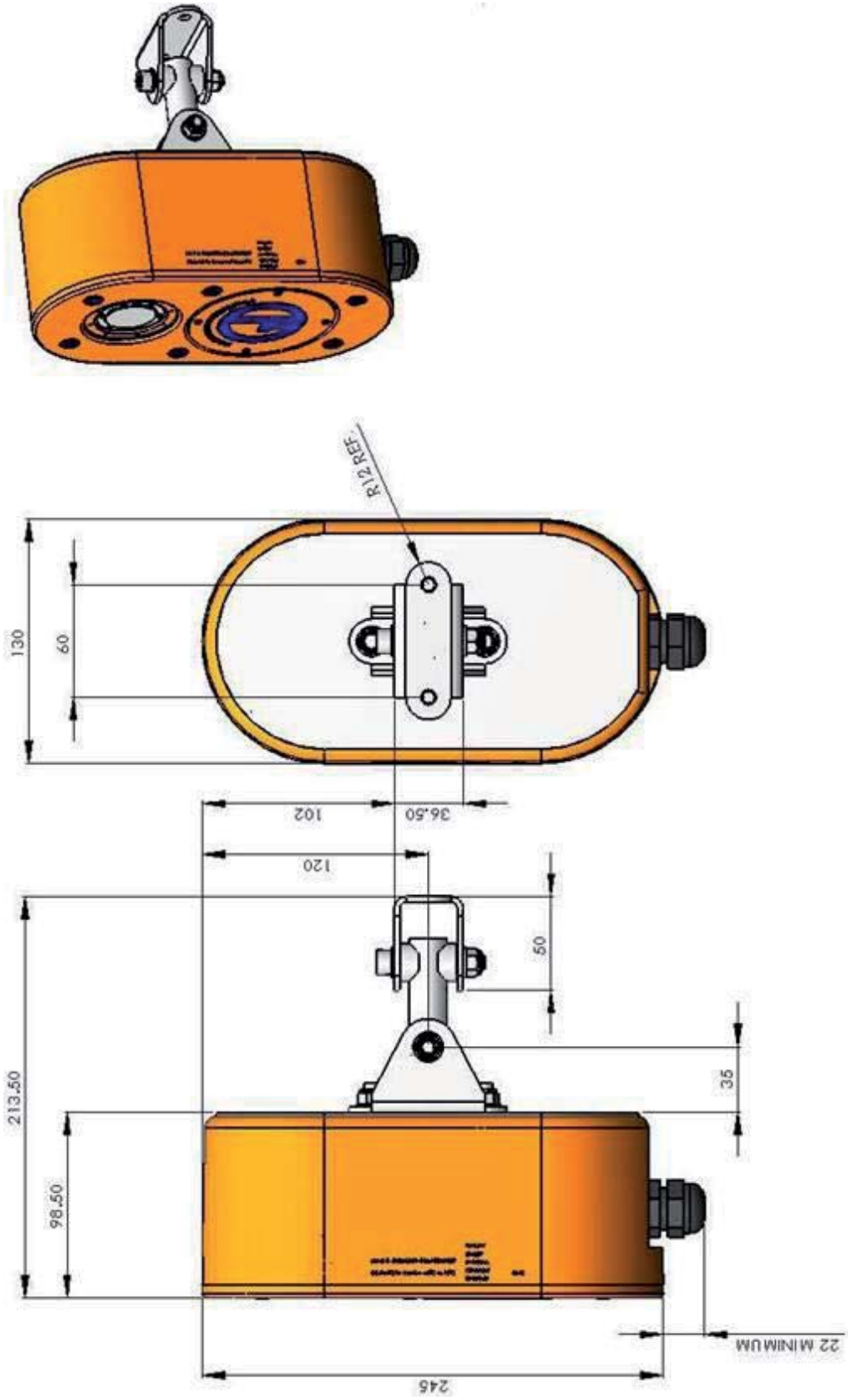
The GDU is a sealed unit which prevents any adjustments or repairs being carried out.

It is recommended that the GDU is tested on a regular basis, in line with installation guidelines to ensure that the sensing face has not been obstructed from the detection area.

12. Technical data

■ Power Required	18 to 30 Vdc at the detector (Consider limitations of barrier)
■ Power Consumption	4mA quiescent 20mA at full output
■ Output Current	Two wire 4-20mA– max. load 500Ω
■ ASL Dynamic Range	>60dB (~35 to 100dB)
■ Frequency Range(s)	30kHz to 80 kHz (Ultrasonic only)
■ Certification	ATEX II 1 G D EEx ia II C T4 U _i = 30V I _i = 100mA C _i = 0.05uF L _i = 100mH
■ Certificate number	DNV-2005-OSL-ATEX-0327X, preamplifier and sensor type GDU1278
■ Dimensions	245mm x 130mm 98.5mm
■ Ingress protection	IP66
■ Shipping weight	2.5kg
■ Enclosure material	Semi-crystalline modified Polyphenylenesulphide & AISI 316 Stainless Steel mounting bracket
■ Cable entry	M20 x 1.5 as standard
■ Operating Temperature	-30° C to 75°C (Standard) -40° C to 75°C (Option)
■ Storage Temperature	-40° C to 85° C
■ Humidity	0 to 100% RH

13. General Arrangement



14. Ordering Information

The GDU is available in a variety of versions with regards to operating temperature range.

14.1. Detector Variations

Part Number	Description	Temperature Range
GDU-01-US-20-24-ST (Standard Unit)	Ultrasonic Gas Leak Detector 30 – 80 kHz 2 wire 24 VDC input, ATEX	-30 to +75°C
GDU-01-US-20-24-LT	Ultrasonic Gas Leak Detector 30 – 80 kHz 2 wire 24 VDC input, ATEX	-40 to +75°C

15. Accessories

- Mapping Tool (GDU-MT-02)
- Test Unit
- Galvanic Isolator
- Wall Mounting Bracket
- Pipe Bracket

18. Help Us to Help You!

Every effort has been made to ensure the accuracy in the contents of our documents, however, Groveley Detection Limited can assume no responsibility for any errors or omissions in our documents or their consequences.

Groveley Detection Limited would greatly appreciate being informed of any errors or omissions that may be found in our documents. To this end we include a form, below, for you to photocopy, complete and return to us so that we take the appropriate action. Thank you.

Please fax or e-mail your response to:

- Fax: +44 (0) 1202 486658
- E-mail QA@groveley.co.uk

From	
Tel:	
Fax:	
Email:	
I suggest the following corrections/changes be made to section.....	
Marked up copies attached (as appropriate)	YES/NO
Please inform me of the outcome of this change	YES/NO
Groveley Detection Ltd:	
Actioned by: _____	Date _____
Response: _____	Date _____