

BIOGAS 300



OPERATING MANUAL



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1 Manual guidelines

1.1 Document history

Issued by	Issue date	Change control ID	Issue No.	Reason for change
CAM	23/04/15	N/A	01	First issue

1.2 Safety Symbol

Information in this manual that may affect the safety of users and others is in the following format:

 Warning	Warning text will be placed here.
--	-----------------------------------

Failure to follow this information may result in physical injury that in some cases could be fatal, cause damage to the equipment or to the environment.

1.3 Hyperlinks


Hyperlinks to other sections of this manual, websites or email addresses are in the following format:

www.geotechuk.com

1.4 Notes

Important/useful information and instructions are shown clearly throughout the manual in a note format.

For example:

 Note: For further information please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk .
--


2 Introduction


2.1 General

Welcome to the BIOGAS 300, a gas analyser that has been designed and manufactured in the UK by Geotech, an ISO 9001, and ISO 17025 accredited company whose products are distributed and supported worldwide. For more information about Geotech and its history, please refer to our website www.geotechuk.com.

The BIOGAS 300 is designed to measure methane concentrations generated in small-scale anaerobic digesters. It has been developed to include the latest design and technology to provide the user with a fast, simple to use and accurate monitoring system.

This manual explains how to install, operate, and maintain the BIOGAS 300 range of systems.

 Note: The BIOGAS 300 can be used in other applications that require the measurement of methane. For further information please contact your local distributor, or our sales team at Geotech on +44(0)1926 338111 or email sales@geotech.co.uk.

 Note: Whilst robust in design, the BIOGAS 300 is a sensitive piece of scientific equipment and is to be treated as such.

2.2 Safety Instructions

Warning

The BIOGAS 300 comes with a guard that covers all accessible components with mains power. This guard must only be removed when power to the system is isolated. Failure to isolate the supply could result in an electric shock.

It is the responsibility of the owner of this equipment to complete a risk assessment on its installation, operation, and maintenance prior to it being used.

Inhaling toxic gases may be harmful to health and in some cases may be fatal. It is the responsibility of the

user to ensure that he/she is adequately trained in the safety aspects of the gases being used and appropriate procedures are followed. In particular, where hazardous gases are being used, the gas exhausted from the system must be piped to an area where it is safe to discharge the gas, or returned to the process.


- Suitably trained personnel should carry out the installation in accordance with the applicable code of practice.
- Repair and maintenance of this equipment should be carried out in accordance with the applicable code of practice.
- Only Geotech approved components are to be used as replacement parts.
- If the equipment is likely to be exposed to aggressive substances, e.g. acidic liquids, gases that may attack metals or solvents that may affect polymeric materials, then it is the responsibility of the user to take suitable precautions. E.g. regular checks are part of routine inspections or establishing from the material's datasheet that it is resistant to specific chemicals.

 **Warning**

When opening the cabinet great care must be taken by the operator as mains voltages are present. It is the responsibility of the owner of the equipment to ensure that all personnel are adequately trained.

The equipment should not be altered in any way other than described within this operating manual. Alterations or changes outside of this operating manual could make the equipment unsafe.

It is vital that the instructions in this operating manual are followed closely. Failure to comply could cause an injury to the operator.





 Note: If there is any uncertainty, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

2.3 Range of Environmental Conditions



- The system is only for use in ambient temperatures in the range 0°C to 50°C.
- The BIOGAS 300 is designed for use outdoors and has an IP65 rating.
- The mains voltages (110-240V) can fluctuate up to $\pm 10\%$ of the nominal voltage.
- The system is only for use in ambient pressures in the range 750 to 1450mbar.

2.4 Safety Symbols Used on the BIOGAS 300

The following safety symbols may be used on the BIOGAS 300:

	Protective conductor terminal
	Caution, risk of electric shock
	Caution
	Caution, risk of hot surface

Warning

Where the symbol  or  is used in the BIOGAS 300, the operating manual must be consulted.

3 BIOGAS 300 Overview

3.1 Features



Easy to self-install, operate, and maintain, the BIOGAS 300 is a cost effective fixed system biogas analyser for CH₄ monitoring. It is ideal for 500kW or reduced scale anaerobic digestion plants, from agricultural to food waste applications. The BIOGAS 300 builds on field-proven gas analysis technology to offer effective and simple online monitoring with Modbus data outputs.

- Market leading reliability
- 0-100% CH₄ measurement as standard
- Single sample point
- Configurable sample duration
- Simple 'push-button' operation
- Easy to read LED transfective display
- Modbus communication
- Stores last reading for easy-viewing
- Gas return to process as standard
- IP65 ABS enclosure

3.2 Options

- 4-20mA analogue data output (replaces Modbus)
- Loop-powered isolators are available for connecting to current sinking inputs with the 4-20mA option.

3.3 Benefits

- No training required
- Low cost of ownership
- Quick and easy installation
- Compact self-contained system
- Moisture removal included as standard
- Zero service downtime with hot-swappable module
- Clear servicing schedules
- Field-proven technology
- Simple user calibration

3.4 Main Applications

- Small-scale anaerobic digestion projects
- Food and animal waste
- Food processing plants
- Dairy plants

3.5 Key Components



Figure 1 – BIOGAS 300 external components

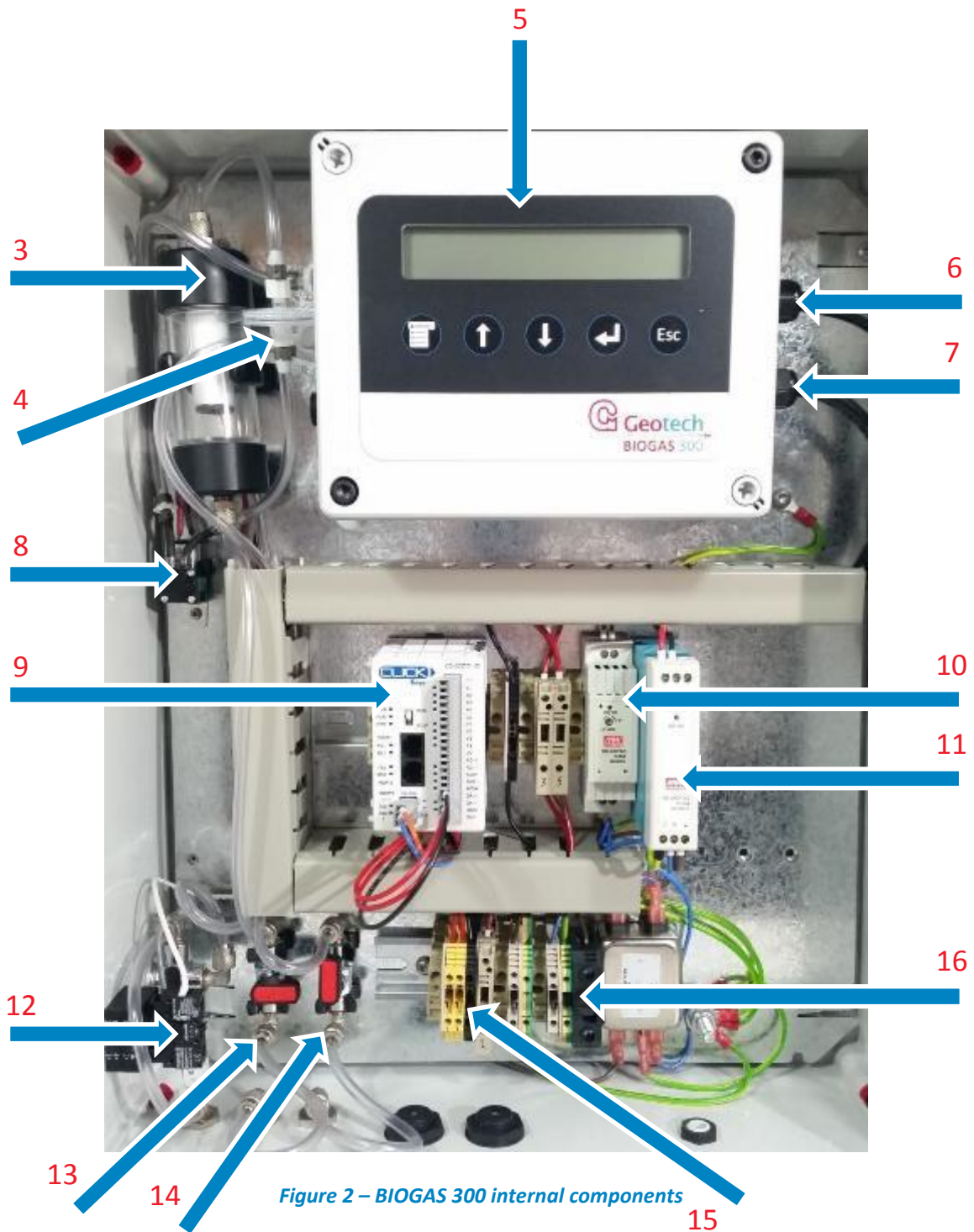



Figure 2 – BIOGAS 300 internal components

Note: For clarity, the protective guard that covers the mains terminals has been removed in this image.



Figure 3 - BIOGAS 300 front components

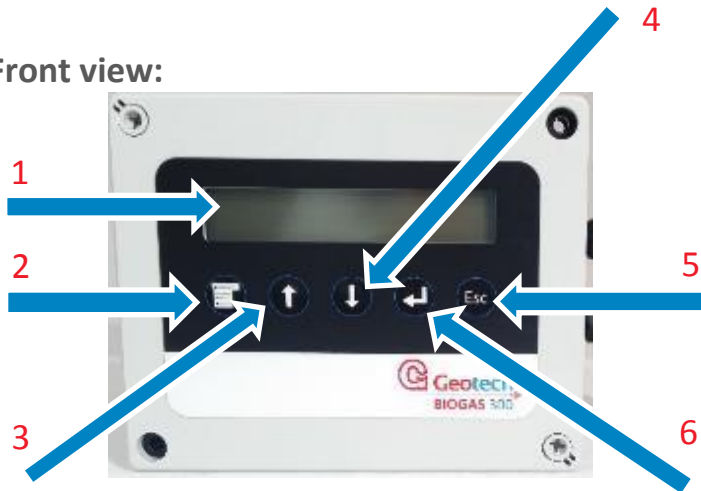
- 1) Gas-in ball valve
- 2) Sample button
- 3) Catchpot
- 4) Inline PTFE filter
- 5) BIOGAS 300 module
- 6) Control harness
- 7) Communications harness
- 8) Pump (optional)
- 9) PLC (with 4-20mA option)
- 10) 24vdc power supply (with 4-20mA option)
- 11) 5vdc power supply
- 12) Sample button and gas-in ball valve (internal location)
- 13) Drain ball valve
- 14) Gas-out ball valve
- 15) Data output terminals (Modbus / 4-20mA / loop-powered isolators)
- 16) Mains input terminals
- 17) Local distributor information

 Note: The data output terminals will be for Modbus, 4-20mA, or loop-powered isolators depending on the option chosen at point of manufacture.

3.6 BIOGAS 300 Module Features

3.6.1 Physical Characteristics of the Module

Front view:



Reference:

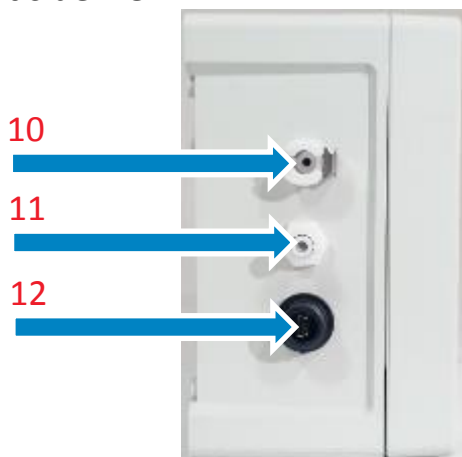
- 1) Display
- 2) Menu key
- 3) Scroll up
- 4) Scroll down
- 5) Escape key
- 6) Return key

Rear view:



- 7) Manufacturer's label
- 8) Serial number
- 9) Product option number

Left side view:



- 10) Gas inlet port
- 11) Gas outlet port
- 12) USB port

3.6.2 Definitions

Front View

Reference

1) Display

Definition

Shows information to the user

2) Menu key

Press the 'menu' key to navigate to the 'menu' from the standby screen.

3) Scroll up

Press ↑ to navigate through menu options. Also used to increment values in certain menu items.

4) Scroll down

Press ↓ to navigate through menu options. Also used to decrement values in certain menu items.

5) Escape key

Exits screens without saving changes. Also used as a backspace key in certain menu items.

6) Return key

The ↵ key accepts/confirms choices made by the operator for various functions and operations.

Rear View

7) Manufacturer's label

This displays information regarding the manufacturer, such as contact details.

8) Serial number

This is the unique identification number for the BIOGAS 300 module.

9) Product option number

This is the unique record for the internal configuration of the BIOGAS 300 module at time of manufacture or last service.

Left Side View

10) Gas inlet port

Gas sample enters the BIOGAS 300 module here. Also used as the connection point for calibration gas.

11) Gas outlet port

Gas sample exits the BIOGAS 300 module here.

12) USB port

Used by Geotech service team.

4 Installation

4.1 Pre-Installation Requirements

4.1.1 General

It is Geotech's recommendation that the installation of the BIOGAS 300 is carried out in accordance with this operating manual. Any electrical work should be carried out by a competent electrician and any relevant codes of practice should be followed.

In order to effectively install the BIOGAS 300 system it is important that the site is ready and in a fit state. In particular, the following points should be noted:

 **Warning**

Power should NOT be applied before all piping and wiring has been completed and tested.


Only a qualified person should make electrical connections to the system.


- This operating manual has been read and fully understood.
- A risk assessment has been performed that includes installation, operation, and maintenance of the system and the removal, where practicably possible, of any identified hazards.
- Applicable codes of practice identified.
- The BIOGAS 300 system has been received on site, unpacked, packaging contents checked, and checked for obvious damage.
- A suitable location is determined for the installation of the instrumentation.




Note: Refer to section [Mounting the Enclosure](#) for items that need to be considered.

- A suitable mains supply as detailed in this manual is installed.
- All required gas lines are installed.

 Note: Inlet pressure to the BIOGAS 300 system must not exceed 50 mbars (0.7psi) gauge on non-pumped versions. Where this is exceeded, either a pumped BIOGAS 300 is required or additional flow restriction is required.

 Note: Inlet pressure to the BIOGAS 300 system must not exceed 350 mbars (5psi) gauge on pumped versions. Where this is exceeded, additional pressure regulation is required.

- Output data cable has been installed (if required) to the BIOGAS 300 location.

 Note: Failure to comply with any of the above may result in additional time on site and additional costs.

4.1.2 Package Contents

Check the product box for the following items:

- BIOGAS 300 system
- Padlock and key set
- Operating manual – found in plastic wallet on the inside of the enclosure door
- Customer wiring diagram – found in plastic wallet on the inside of the enclosure door
- Calibration certificate – found in plastic wallet on the inside of the enclosure door
- Three 6mm compression fittings – found in the bulkheads on the enclosure base (see annotation 1, 2, and 3 on [Figure 4 - BIOGAS 300 connection points](#)).

4.1.3 Storage of the System and Module

The BIOGAS 300 system and module should not be exposed to extremes of temperature. It is the user's responsibility to ensure the system and module are kept within their ambient operating temperature range.

4.1.4 Ventilation Requirements

There is an enclosure breather fitted to the BIOGAS 300 situated at the base of the enclosure (see annotation 5 on [Figure 4 - BIOGAS 300 connection points](#)). It is the user's responsibility to ensure that there is a free circulation of air around the cabinet.

⚠ Warning

If the system is being installed indoors, it is Geotech's recommendation that a methane leak detector is placed nearby to the system to inform operators of a leak before entering the room. This is not supplied by Geotech.

4.2 External Customer Connections

The installation will require the operator to connect a mains cable, output cable (if required), drain pipe, and gas pipes to the equipment. [Figure 4 - BIOGAS 300 connection points](#) identifies the available connection points on the BIOGAS 300:

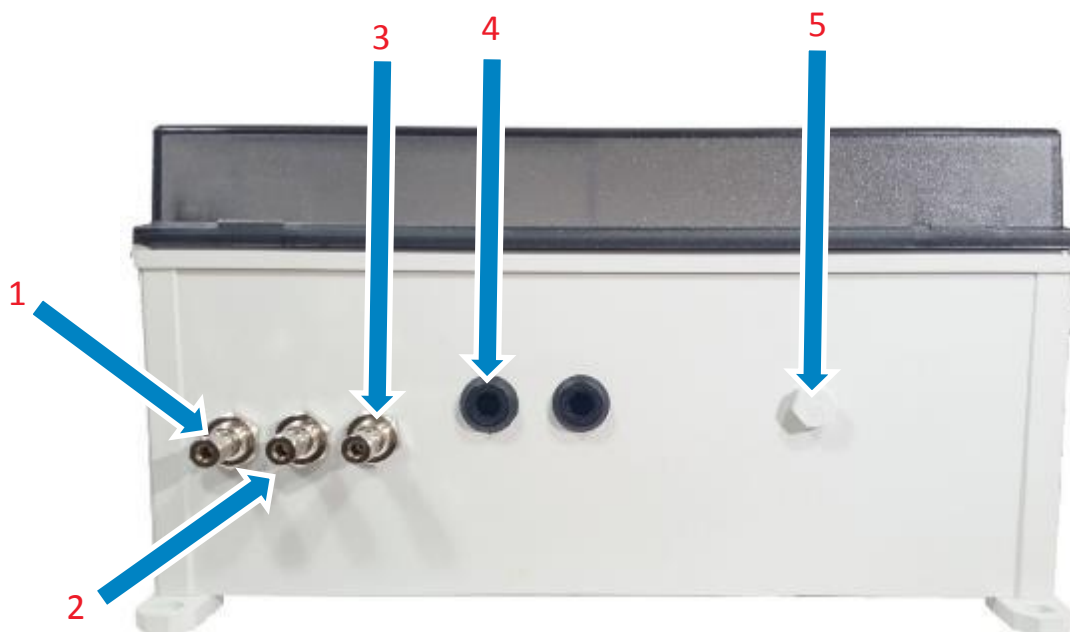



Figure 4 - BIOGAS 300 connection points

- 1) Gas inlet
- 2) Drain
- 3) Process return (gas out)
- 4) Customer cable entry x 2
- 5) Breather vent

 Note: There are two stopping plugs, one for the mains input cable, and one for data output cable (if used). An M20 stopping plug (annotation 4) must be removed where a cable gland is to be placed. If data outputs are not being used, the remaining M20 stopping plug must remain in place in order to maintain the IP rating of the enclosure.


 **Warning**

The mains and output cables must enter the cabinet via a cable gland (see [Cable Gland Selection and Cord Anchorage](#)) and the mains supply should be isolated (see [Mains Wiring](#)).

4.3 Mounting the Enclosure

The system is contained in one enclosure that is weatherproof and has a rating of IP65. Although the enclosure is IP65, consideration should be given to mounting it in an area that is protected from the worst of the weather. For example, maintenance of the system will be made easier and safer if it is not exposed to driving rain.

Positioning the enclosure in direct sunlight should be avoided as this may increase the internal temperature of the cabinet to outside of the operating temperature range of the equipment.

 Note: If it is difficult to position the BIOGAS 300 system out of direct sunlight, measures should be taken to protect the system, such as a basic cover to provide shade.

The enclosure is to be mounted to a solid brick wall or framework (preferably stainless steel) capable of holding the weight of the system. The weight of the enclosure and contents will depend on the options that are fitted, but the

maximum weight is 10kg. It is therefore recommended that the installation be undertaken by a minimum of two people.

<p>⚠ Warning</p>	<p>Although the wall mounting brackets are fitted and tested at manufacture, during transit it is possible that they could have worked loose. Prior to installation, ensure the wall mounting brackets are securely fitted to the BIOGAS 300 system.</p>
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Four mounting brackets are supplied and fitted to each corner of the BIOGAS 300. Suitable nut and bolt or raw bolt arrangements will have to be defined by the operator for fixing to the wall or framework (it is recommended that these are stainless steel). The enclosure should be mounted as square and level as possible to ensure that the door can be closed correctly.

<p>⚠ Warning</p>	<p>Failure to mount the enclosure square and level could result in the enclosure door failing to close correctly. If this occurs, the IP rating of the enclosure would be void and water will enter the system resulting in a hazard.</p>
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Dimensions of the enclosure are provided in [Figure 5 - BIOGAS 300 mounting bracket dimensions](#).

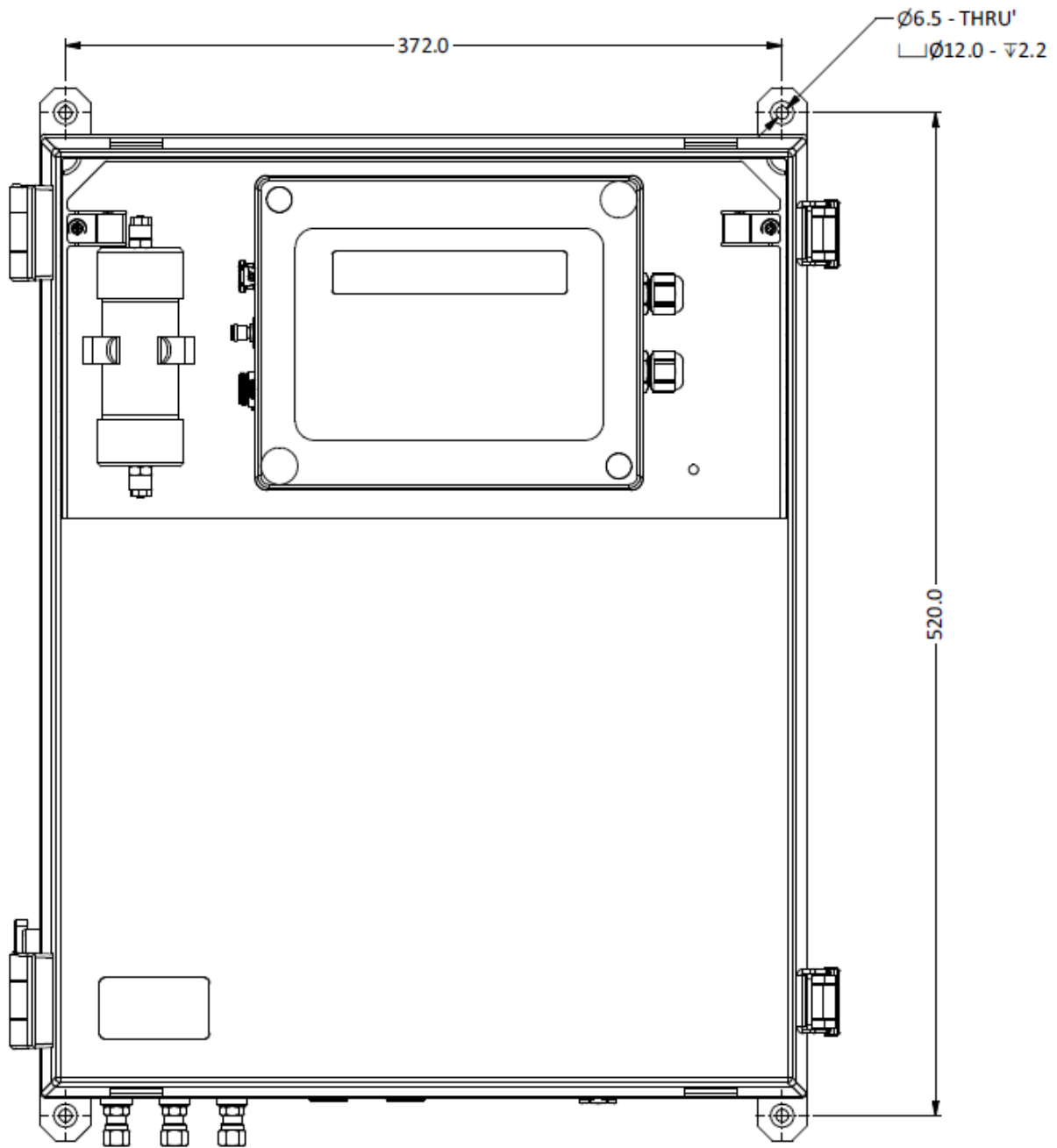


Figure 5 - BIOGAS 300 mounting bracket dimensions

4.4 Connecting the Gas Lines to the BIOGAS 300

4.4.1 Sample Line

Care should be taken in routing the sample line, especially in cold environments. The sample line may need insulating or even trace heating to prevent freezing of water within the pipe. This is not part of the BIOGAS 300 system and is the responsibility of the operator.

- The sample should be taken from a suitable location at the required monitoring point. It is recommended that a valve be incorporated in the assembly so that the gas can be shut off if the sample line is removed.




Figure 6 – Ball valve assembly

- The line should connect to the upper surface of a horizontal pipe or on a vertical standing pipe. This will prevent excessive amounts of water entering the sample line.
- The gas connection on the system comes with a 1/8" BSP compression fitting suitable for 6mm outer diameter tubing. It is recommended that stainless steel tubing be used where possible.
- The sample tube should be connected to the bulkhead named 'GAS INLET' – see annotation 1 on [Figure 4 - BIOGAS 300 connection points](#).
- Ensure all tube connections are tight and free from leaks.



Note: The maximum distance the BIOGAS 300 can be from the sample point is 50 meters.

4.4.2 Process Return

 Note: The sampled gas can only be returned to the process if the BIOGAS 300 system is fitted with an internal pump – see annotation 8 on [Figure 2 – BIOGAS 300 internal components](#).

This is the line where measured gas from the system is exhausted. It can be returned to the process or vented to atmosphere.

Care should be taken in routing the process return line, especially in cold environments. The process return line may need insulating or even trace heating to prevent freezing of water within the pipe. This is not part of the BIOGAS 300 system and is the responsibility of the operator.

- The gas exhaust line should be returned to a suitable location at the required point. It is recommended that a valve be incorporated in the assembly so that the gas can be shut off if the sample line is removed. See [Figure 6 – Ball valve assembly](#).

 **Warning**

If the gas is being exhausted to atmosphere, it should be to a safe and well-ventilated area.

- A ball valve should be incorporated in to the piping close to the BIOGAS 300 system, even when being vented to atmosphere. This ball valve will be used as part of pressure testing the system during routine maintenance.
- The gas connection on the system comes with a 1/8” BSP compression fitting suitable for 6mm outer diameter tubing. It is recommended that stainless steel tubing be used where possible.
- The gas exhaust line should be connected to the bulkhead connector labelled ‘PROCESS RETURN’– see annotation 3 on [Figure 4 - BIOGAS 300 connection points](#).
- Ensure all tube connections are tight and free from leaks.

 **Warning**

The gas being exhausted at this point of the system will be flowing at approximately 100ml/min if a pump is fitted. Where the system does not have a pump, this will be dependent on the input pressure.

4.5 Drain

The system incorporates a catchpot and drain for removal of liquid to help prevent water from entering the system (see annotation 3 on [Figure 2 – BIOGAS 300 internal components](#)). However, additional water filtering may be required where the sample is heavily contaminated with water.

Care should be taken in routing the drain line, especially in cold environments. The drain line may need insulating or even trace heating to prevent freezing of water within the pipe. This is not part of the BIOGAS 300 system and is the responsibility of the operator.

Alternatively, the contents can be emptied in to a suitable container and disposed of in a safe manner.

- The drain line should be connected to the bulkhead connector labelled 'DRAIN'– see annotation 2 on [Figure 4 - BIOGAS 300 connection points](#).
- The drain line should be run to a position where it is safe to discharge the small amount of liquid that is removed from the sample gas.
- The contents of the catchpot are drained under gravity. Therefore, any tubing needs to be lower than the drain compression fitting.
- The drain connection on the system comes with a 1/8" BSP compression fitting suitable for 6mm outer diameter tubing. It is recommended that stainless steel tubing be used where possible.
- Inspection of the catchpot is required before each use to check if liquid has been collected. The catchpot can be seen through the enclosure door to the left of the module – see annotation 3 on [Figure 3 - BIOGAS 300 front components](#).
- Refer to the [Emptying the Catchpot](#) section of this operating manual for how to drain the catchpot.
- When taking a gas sample, ensure the drain ball valve (see annotation 13 on [Figure 2 – BIOGAS 300 internal components](#)) is in the closed (horizontal) position.

⚠ Warning

The catchpot can hold approximately 100ml of liquid. Dependent upon the application the liquid removed may be contaminated and should be discharged to an area where it is safe to do so.

This line may also vent sample gas for a brief period during each draining operation if the sample inlet and gas out valves are not closed.

4.6 Protective Cover

The BIOGAS 300 has a protective cover fitted inside the main enclosure to cover areas where mains voltages are present. This cover must be removed in order to wire the mains and data output cables to the BIOGAS 300 system, and to replace fuses.

⚠ Warning

The cover must only be removed when power to the system has been isolated. Failure to isolate the power before removing the cover could result in an electric shock.

The cover is removed by unscrewing three M5 x 12mm button head screws with a 3mm hexagon tool (see [Figure 7 – Protective guard removal and fitting](#)). The cover and screws must be kept safe once removed to ensure that they are not lost and can be refitted once installation is complete.

To fit the cover, simply align the holes in the protective cover with the three pillars fixed to the BIOGAS 300 back plate and screw in to place using the 3mm hexagon tool.



Note: For clarity, images of the BIOGAS 300 system in this operating manual do not include the protective cover.

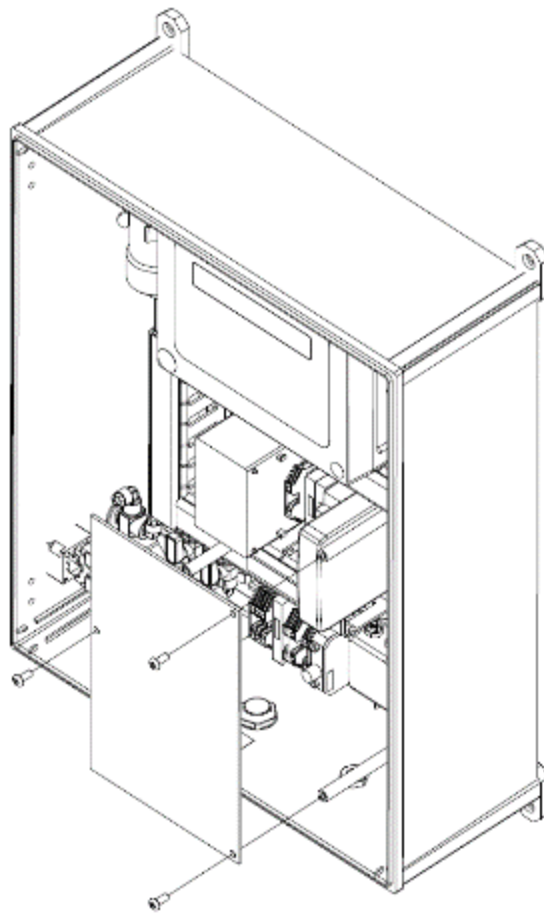


Figure 7 – Protective guard removal and fitting

4.7 Cable Gland Selection and Cord Anchorage

To maintain the integrity of the enclosure a cable gland of IP65 or better must be used and tightened to the manufacturer’s recommended torque.

In addition, the cable gland must have a means of anchoring the cable. The cord anchorage shall relieve the conductors of the cord from strain, including twisting, where they are connected within the equipment, and shall protect the insulation of the conductors from abrasion. The protective earth conductor, if any, shall be last to take the strain if the cord slips in its anchorage.

Cord anchorages shall meet the following requirements:

- The cord shall not be clamped by a screw that bears directly on the cord.
- Knots in the cord shall not be used.

- It shall not be possible to push the cord into the equipment to an extent that could cause a hazard.
- Failure of the cord insulation in a cord anchorage that has metal parts shall not cause accessible conductive parts to become hazardous live.
- It shall not be possible to loosen the cord anchorage without the use of a tool.
- It shall be designed so that cord replacement does not cause a hazard, and it shall be clear how the relief from strain is provided.

⚠ Warning

A compression bushing shall not be used as cord anchorage.

Failure to meet the above requirements could make the equipment unsafe and result in a hazard.

 Note: Refer to the [BIOGAS 300 Consumable Products](#) of this operating manual for products available from your local distributor or Geotech.

4.8 Cable Conductor Sizes and Cable Insulation Requirements

4.8.1 Cable Conductor Sizes

For the mains and data output wiring, the conductor must be suitably selected for the current carrying capacity, the environment, and the distance to the supply.

⚠ Warning

Incorrect cable selection could result in a hazard.

4.8.2 Cable Insulation Requirements

For the mains and data output wiring, the cable insulation must comply with a recognised standard and have a flammability rating of V1 or better.

⚠ Warning

Incorrect cable selection could result in a hazard.

4.9 Mains Wiring

4.9.1 Protective Earthing and Mains Supply

The safety of the equipment depends on it being effectively earthed via the mains supply.

The mains requirement for the system can be found on the side of the enclosure and is shown on [Figure 8 – BIOGAS 300 electrical label](#):

Manufactured by Geotechnical Instruments (UK) Ltd. Sovereign House, Queensway, Leamington Spa, Warwickshire, England, CV31 3JR	
Model	BIOGAS 300
Serial no./year of manufacture	
Supply voltage	110 - 240v AC 50/60Hz
Power consumption	110 V - 75 W 240 V - 110 W
DO NOT REMOVE FUSES WHEN ENERGISED	
ISOLATE SUPPLY VOLTAGE BEFORE ACCESSING EQUIPMENT	
CE 0518	
OPEN 	PROCESS START
CLOSE 	

Figure 8 – BIOGAS 300 electrical label

The mains fuse rating (FS1) in the system is 3.15A.

The equipment must be provided with a double-pole switched and fused mains supply. The switch must be mounted as close to the equipment as practicably possible so that it can be easily reached and clearly identified as the disconnecting device for the system.

The mains cable must be three core cable (live, neutral and earth) and enter the enclosure via a cable gland (see [Cable Gland Selection and Cord Anchorage](#)) through one of the two available ‘customer cable’ entry points (see annotation 4 on [Figure 4 - BIOGAS 300 connection points](#)).

4.9.2 How to Wire the Mains Supply

Warning	<p>Only a qualified person should make electrical connections to the system.</p> <p>Ensure the power is isolated and the Protective Cover is removed before wiring to the system.</p>
----------------	---

Failure to connect a suitable earth to the system could result in serious injury.

The equipment must be provided with a double-pole switched and fused mains supply. The switch must be mounted as close to the equipment as practicably possible and clearly identified as the disconnecting device for the system.

If using armoured cable, the armour must not be used as the main earth connection for the BIOGAS 300. If earthing of the armour is required, this must not be taken from the BIOGAS 300.

All cables should be crimped with an appropriate ferrule for the size of the cable being used. In addition, the cable insulation must be housed adequately within the protective sheath of the ferrule.

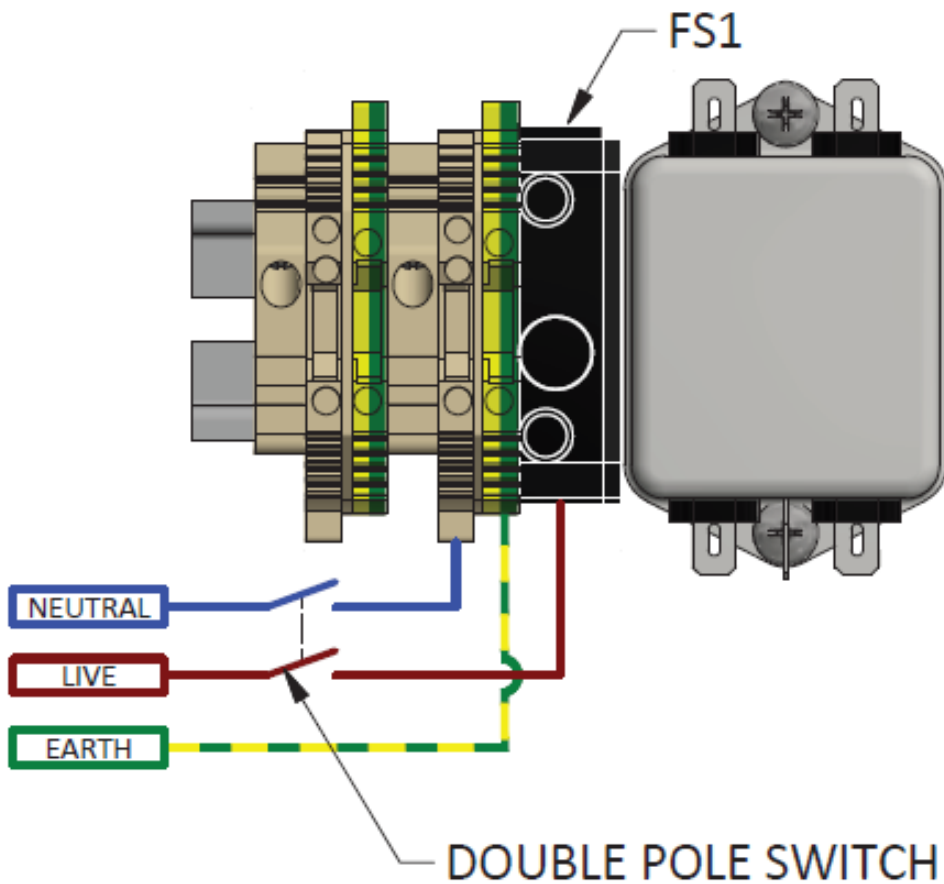
Terminals that are wired should be tightened to a minimum of 35cN/m. Failure to tighten to this requirement could affect the safety of the apparatus.

Cable glands should meet requirements of [Cable Gland Selection and Cord Anchorage](#).

Refer to annotation 16 on [Figure 2 – BIOGAS 300 internal components](#) for the location of the mains wiring terminals, and [Wiring Diagram 1 – Mains wiring](#) for how to wire the mains cable to the BIOGAS 300 system. A label within the system identifies the appropriate inputs, namely from left to right neutral (N), earth (E), and live (L).



Note: For cable conductor sizes and cable insulation requirements, please refer to section [Cable Conductor Sizes and Cable Insulation Requirements](#).



Wiring Diagram 1 – Mains wiring

4.10 Modbus Digital Output

If Modbus digital outputs are being used, the cable must enter the enclosure via a cable gland (see [Cable Gland Selection and Cord Anchorage](#)), with suitable cable through one of the two available ‘customer cable’ entry points (see annotation 4 on [Figure 4 - BIOGAS 300 connection points](#)).

A label within the system identifies the appropriate outputs, namely from left to right ‘+’, ‘-’, and ‘LG’. Refer to annotation 15 on [Figure 2 – BIOGAS 300 internal components](#) for the Modbus terminal connections.

⚠ Warning

The BIOGAS 300 Modbus terminals must only be used for standard Modbus communications. No other connections must be made as they may affect the safety of the equipment.

4.10.1 Wiring the BIOGAS 300 Modbus Outputs

Warning

Only a qualified person should make electrical connections to the system.

Ensure the power is isolated and the [Protective Cover](#) is removed before wiring to the system.

The input voltage range to the BIOGAS 300 terminals must not exceed -7 to +12V. Operating outside of this range could affect the safety of equipment.

If using armoured cable, the armour must not be used as the main earth connection for the BIOGAS 300. If earthing of the armour is required, this must not be taken from the BIOGAS 300.

All cables should be crimped with an appropriate ferrule for the size of the cable being used. In addition, the cable insulation must be housed adequately within the protective sheath of the ferrule.

Terminals that are wired should be tightened to a minimum of 35cN/m. Failure to tighten to this requirement could affect the safety of the apparatus.

Cable glands should meet requirements of [Cable Gland Selection and Cord Anchorage](#).

Wire the outputs in accordance with [Wiring Diagram 2 – Modbus wiring](#). For optimum performance, it is recommended that screened twisted pair cable be used.

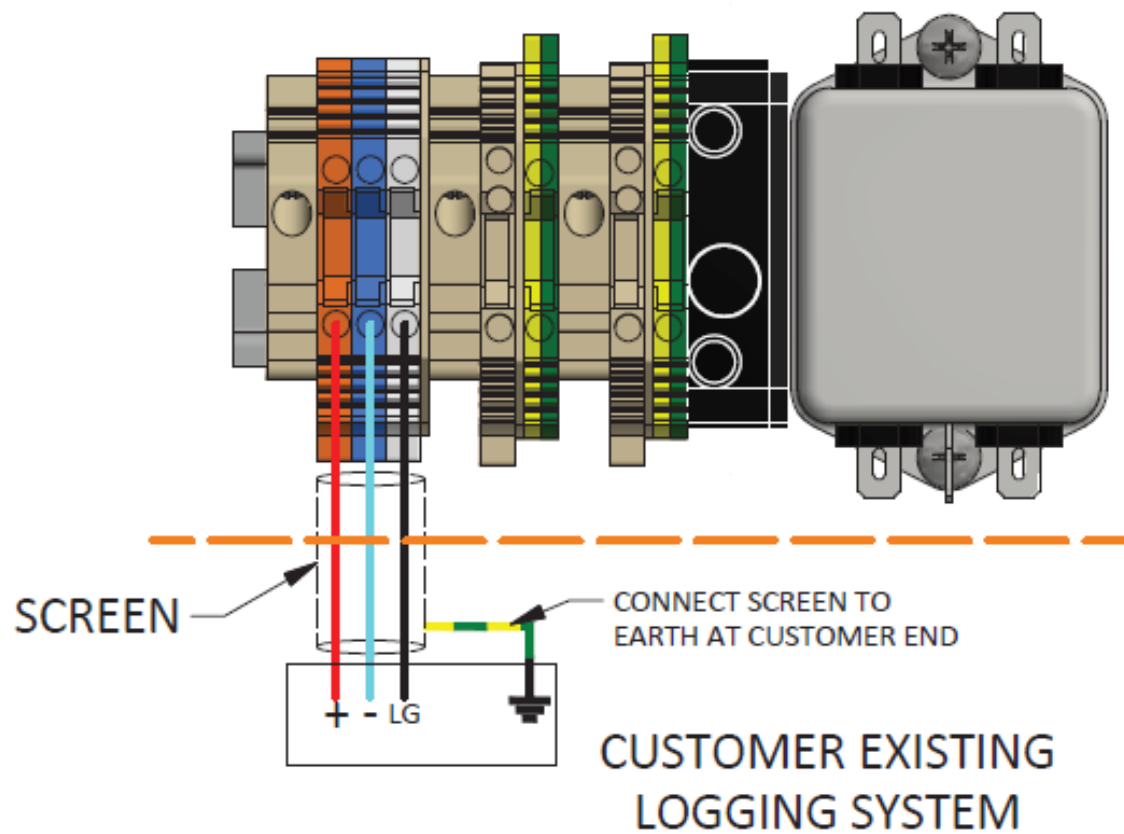


Note: For cable conductor sizes and cable insulation requirements, please refer to section [Cable Conductor Sizes and Cable Insulation Requirements](#).

When wiring the outputs the twisted pairs must be as follows:

Terminal Colour	Wiring Information	Pair
Orange	Signal A (RS485) '+'	Pair one
Blue	Signal B (RS485) '-'	
White	Logic Ground (0V) 'LG'	Pair two

BIOGAS 300 SYSTEM






Wiring Diagram 2 – Modbus wiring

4.10.2 Configuration of the BIOGAS 300 Modbus Port


The BIOGAS 300 Modbus port has been configured as follows:

Node Address	1
Baud Rate	9600
Parity	None
Stop Bits	1
The BIOGAS 300 module acts as a slave.	
The protocol is MODBUS RTU.	

-  Note: A termination resistor of 200 ohms is fitted internally between the positive and negative Modbus signals of the BIOGAS 300, which must be the last connection on the 'bus'. Similarly, the master device on the 'bus' should have a termination resistor.
-  Note: If it is not possible for the BIOGAS 300 to be last on the bus, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.
-  Note: The node address is set to '1' as default. This can be changed via the menu on the BIOGAS 300 module, refer to [Modbus Slave Add. \(Address\)](#).

4.10.3 Readable Parameters of the BIOGAS 300

Below is a table of addresses that can be read from the BIOGAS 300. All contents of the Modbus registers are signed 16-bit integers.

-  Note: The example column is an example of the contents for a CH₄ reading of 40.8% taken at 17:45 on 6th January 2015.

Address	Alternative Address	Parameter	Example
18	30019	Time of last reading: minute	45
19	30020	Time of last reading: hour	17
20	30021	Time of last reading: day	6
21	30022	Time of last reading: month	1
22	30023	Time of last reading: year	15
23	30024	Last CH ₄ reading	408 (% reading x 10)

4.11 4-20mA Outputs

If analogue outputs are being used, the cable must enter the enclosure via a cable gland (see [Cable Gland Selection and Cord Anchorage](#)), with suitable cable through one of the two available ‘customer cable’ entry points (see annotation 4 on [Figure 4 - BIOGAS 300 connection points](#)).

The outputs ‘current sink’ in to the BIOGAS 300 and labels identify the appropriate outputs namely from left to right (‘CH1’ and ‘CH2’). Refer to annotation 15 on [Figure 2 – BIOGAS 300 internal components](#) for the 4-20mA terminal locations.

It is important for the user to understand the analogue inputs on their logging system. There are two types – ‘current sink’ and ‘current source’.



Note: The BIOGAS 300 module communicates with the PLC using Modbus in order for the system to provide analogue outputs. The slave address that the PLC is reading from is ‘1’. Changing the Modbus slave address on the BIOGAS 300 will stop the 4-20mA outputs from working correctly.

4.11.1 Wiring the BIOGAS 300 to ‘Current Source’ Inputs

Warning

For this method, the operating voltage input in to the BIOGAS 300 must not exceed 30v. Operating outside of this value could affect the safety of the apparatus.

Only a qualified person should make electrical connections to the system.

Ensure the power is isolated and the [Protective Cover](#) is removed before wiring to the system.

If using armoured cable, the armour must not be used as the main earth connection for the BIOGAS 300. If earthing of the armour is required, this must not be taken from the BIOGAS 300.

All cables should be crimped with an appropriate ferrule for the size of the cable being used. In addition, the cable

insulation must be housed adequately within the protective sheath of the ferrule.

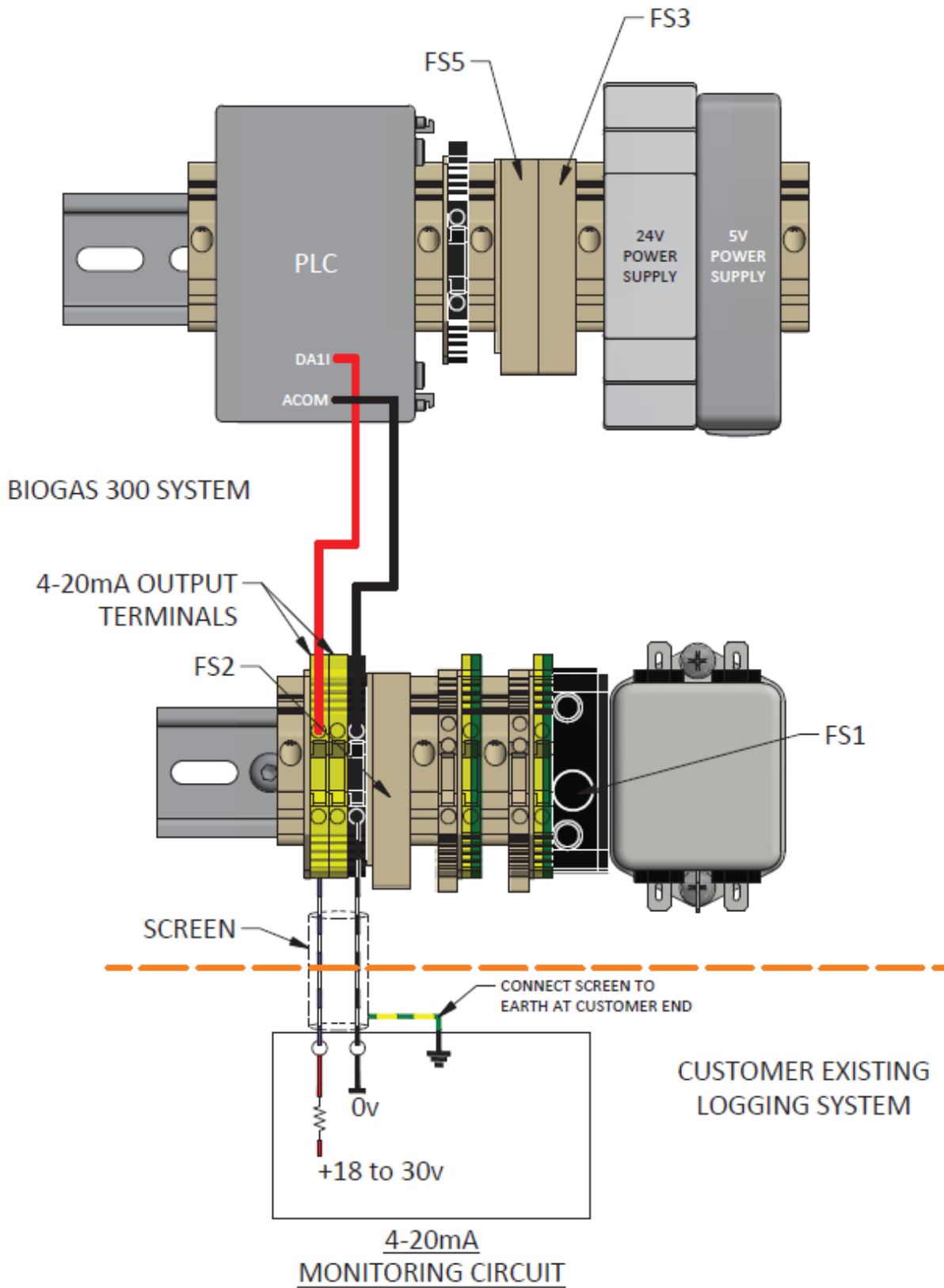
Terminals that are wired should be tightened to a minimum of 35cN/m. Failure to tighten to this requirement could affect the safety of the apparatus.

Cable glands should meet requirements of [Cable Gland Selection and Cord Anchorage](#).

Wire the outputs in accordance with [Wiring Diagram 3 – 4-20mA to current source inputs](#), for optimum performance it is recommended that screened twisted pair cable be used.



Note: For cable conductor sizes and cable insulation requirements, please refer to section [Cable Conductor Sizes and Cable Insulation Requirements](#).



Wiring Diagram 3 – 4-20mA to current source inputs

4.11.2 Wiring the BIOGAS 300 to 'Current Sink' Inputs

Warning

Only a qualified person should make electrical connections to the system.

Ensure the power is isolated and the [Protective Cover](#) is removed before wiring to the system.

If using armoured cable, the armour must not be used as the main earth connection for the BIOGAS 300. If earthing of the armour is required, this must not be taken from the BIOGAS 300.


All cables should be crimped with an appropriate ferrule for the size of the cable being used. In addition, the cable insulation must be housed adequately within the protective sheath of the ferrule.

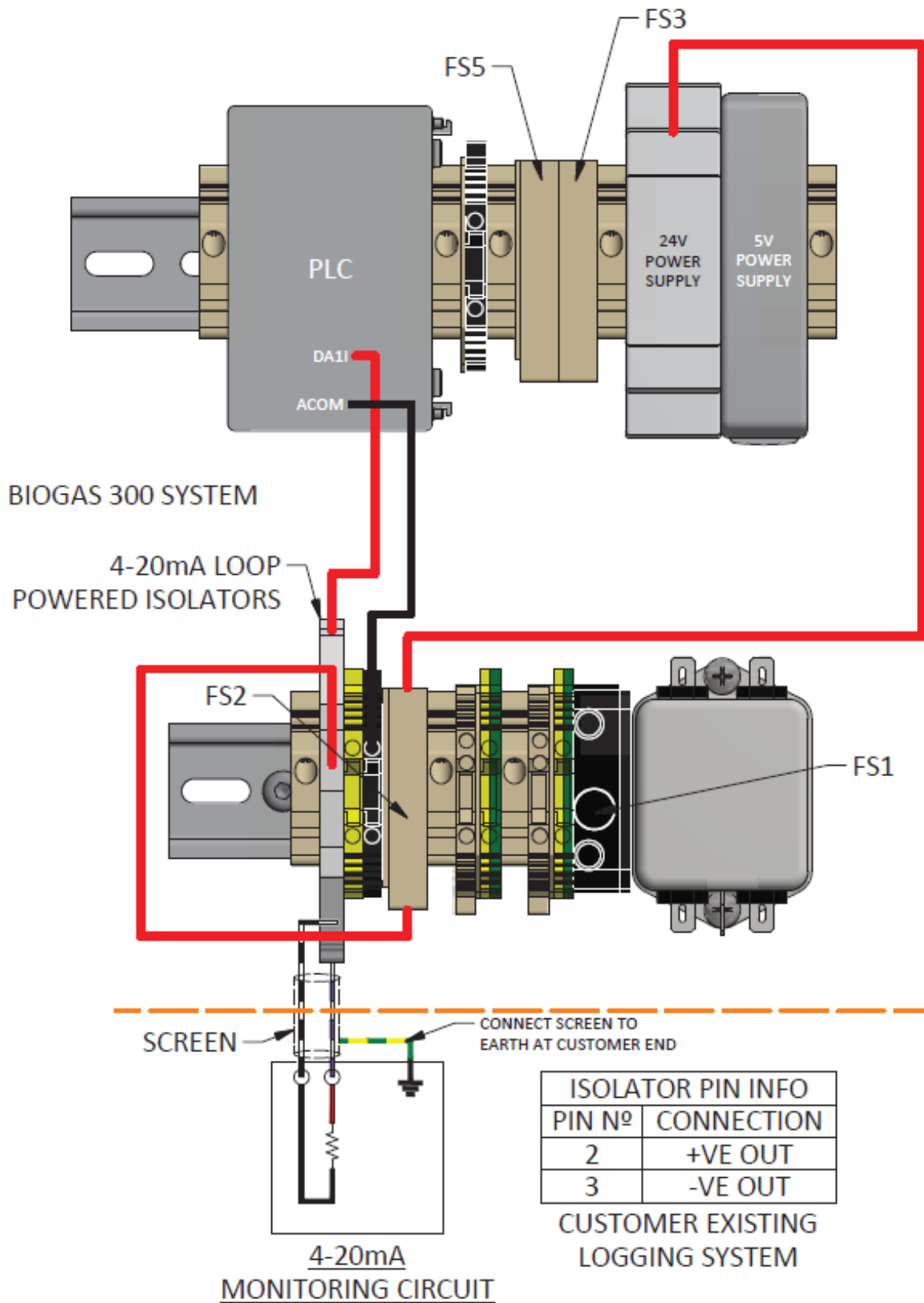
Terminals that are wired should be tightened to a minimum of 35cN/m. Failure to tighten to this requirement could affect the safety of the apparatus.

Cable glands should meet requirements of [Cable Gland Selection and Cord Anchorage](#).

When wiring the system to current sink inputs 'loop powered isolators' must be used to convert the signal. These are an optional extra and can be purchased at time of manufacture or post-sale.

Wire the outputs in accordance with [Wiring Diagram 4 – 4-20mA to current sink inputs](#) using the recommended loop powered isolator. For optimum performance, it is recommended that screened twisted pair cable be used.

 Note: For cable conductor sizes and cable insulation requirements, please refer to section [Cable Conductor Sizes and Cable Insulation Requirements](#).



Wiring Diagram 4 – 4-20mA to current sink inputs

4.11.3 4-20mA Scaling

The following table details the scaling on the 4-20mA channel:

Gas	4mA Reading	20mA Reading
CH ₄	0.0%	100.0%

4.12 Security

The BIOGAS 300 system is supplied with a padlock and key for the operator to use at their discretion. This padlock has been supplied to give the operator of the equipment confidence that the components within it can be secure. In addition, it can be used to protect other operators from the risks associated with mains powered equipment or to stop unauthorised changes to the BIOGAS 300 system settings.

The padlock can be used on either cabinet hinge, [Figure 9 – Cabinet hinge](#) and [Figure 10 – Padlock fitted](#) show the location of the hinge and padlock respectively.



Figure 9 – Cabinet hinge




Figure 10 – Padlock fitted



Note: In the event the padlock key is lost or misplaced, please contact your local distributor, or our sales team at Geotech on +44(0)1926 338111 or email sales@geotech.co.uk for a replacement.

4.13 Final Checks

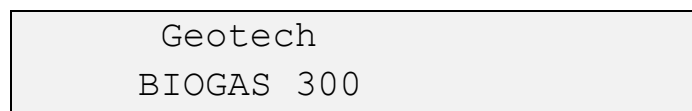
- Ensure all gas connections to the system are leak free – refer to section [Pressure Test](#) of this operating manual for instructions on how to perform this.
- Ensure the gas inlet and drain ball valves are closed (refer to annotation 1 on [Figure 1 – BIOGAS 300 external components](#) and annotation 13 on [Figure 2 – BIOGAS 300 internal components](#)), these must be in the horizontal position.
- Ensure that gas out ball valve is open (refer to annotation 14 on [Figure 2 – BIOGAS 300 internal components](#)), this must be in the vertical position.
- Turn the power on to the system. Several seconds after power is applied, the module will turn on and display the ‘Geotech BIOGAS 300’ logo (see [Screen 1 – Power on screen](#)).
- Once this is complete, the system will go in to standby mode (see [Screen 2 – Standby mode](#)) awaiting the operator to request a sample to be taken.
- It is strongly recommended that a known concentration of gas be passed through the system to ensure that it still reading correctly following installation. Refer to the [Gas Check](#) section of this operating manual for further information on this process.


 Note: For further information please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

5 General Operation Instructions

5.1 Switching the BIOGAS 300 System On

- 1) The module will automatically turn on when power to the system is turned on. If this does not happen, refer to the [Problem Solving](#) section of this operating manual.
- 2) If the power on is successful, the 'Geotech BIOGAS 300' logo will appear on screen.



Screen 1 – Power on screen

- 3) Following this, the module will go in to standby mode awaiting instruction from the operator to take a gas sample.

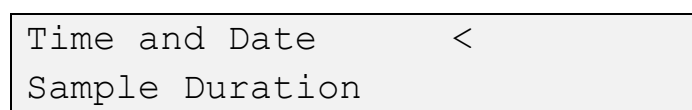


Screen 2 – Standby mode

 Note: The display backlight is turned off in standby mode.


5.2 Menu

An example of the menu is shown in [Screen 3 – Menu](#). The menu is accessed by pressing the menu key from [Screen 2 – Standby mode](#):



Screen 3 – Menu

The menu allows the operator to set specific parameters and perform operational tasks.

 Note: If the system is in the process of taking a reading, access to the menu will be restricted.

In total, there are nine menu options available:

- Time and Date

- Sample Duration
- User Calibration
- Factory Settings
- Last Reading
- Information
- Diagnostics
- Modbus Slave Add. (address)
- Standby

Options can be scrolled through using the ↑ and ↓ keys on the keypad (refer to annotations 3 and 4 on [Physical Characteristics of the Module](#)). The selectable option is indicated by the ‘<’ symbol and selected using the ↵ key (refer to annotation 6 on [Physical Characteristics of the Module](#)).

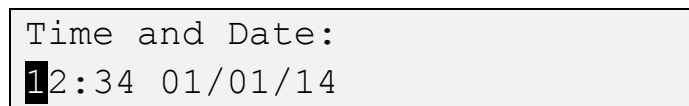


Note: The keyboard is scanned continuously. The menu is displayed for 240 seconds and if no options are chosen, the standby screen will be displayed.

5.2.1 Time and Date

This option allows the user to set the time and date on the module.

- 1) Using the ↑ or ↓ keys, navigate to the ‘Time and Date’ option in the menu and select the option using the ↵ key.




Screen 4 – Set time and date

- 2) Press the ‘Esc’ key to exit without saving any changes.
- 3) The inverted digit represents an editable item. Use the ↑ and ↓ keys to increase or decrease the numerical value. Once correct, or if already correct, pressing the ↵ key will advance to the next editable item.

```
Time and Date:
15:37 07/01/15
```

Screen 5 – Time and date post edit

 Note: Using the 'Esc' key from the second numerical value onwards acts as a back key.




- 4) Pressing the \leftarrow key on the last digit of the year saves the new time and date to memory. The display will briefly inform the operator if the time and date has been accepted ([Screen 6 – Time and date set OK](#)) or if there is an error ([Screen 7 – Time and date set incorrectly](#)), followed by returning the operator to the menu.

```
Time and Date:
15:37 07/01/15    OK
```

Screen 6 – Time and date set OK

```
Time and Date:
15:37 30/02/15  ERROR
```

Screen 7 – Time and date set incorrectly

-  Note: The time format is 24 hours.
-  Note: The only available date format is DD/MM/YY
-  Note: If the time and date entry is invalid, the time and date will not be saved and the previous setting will be used until rectified.

5.2.2 Sample Duration

This option allows the operator to define the duration of the sample once the sample button (refer to annotation 2 on [Figure 1 – BIOGAS 300 external components](#)) is pressed.

- 1) Using the \uparrow or \downarrow keys, navigate to the 'Sample Duration' option in the menu and select the option using the \leftarrow key.

```
Sample Duration:
180 seconds
```



Screen 8 – Set sample duration

- 2) Press the 'Esc' key to exit without saving any changes.



- 3) The inverted digit represents an editable item. Use the ↑ and ↓ keys to increase or decrease the numerical value. Once correct, or if already correct, pressing the ← key will advance to the next editable item.

Sample Duration:
 450 seconds

Screen 9 – Sample duration post edit.

-  Note: Using the 'Esc' key from the second numerical value onwards acts as a back key.
-  Note: The sample duration should be set to a time that suits the distance the system is situated from its monitoring point and any other factors that may need to be considered e.g. system pressure.

- 4) Pressing the ← key on the last digit of the duration saves the new sample duration to memory. The display will briefly inform the operator if the sample duration has been accepted ([Screen 10 – Sample duration set OK](#)) or if there is an error ([Screen 11 – Sample duration set incorrectly](#)), followed by returning the operator to the menu.

-  Note: The minimum permissible sample duration is 10 seconds and the maximum is 999 seconds.
-  Note: If the duration entry is invalid, the sample duration will not be saved and the previous setting will be used until rectified.

Sample Duration:
 450 seconds OK

Screen 10 – Sample duration set OK

Sample Duration:
 005 seconds ERROR

Screen 11 – Sample duration set incorrectly

5.2.3 User Calibration

The ability has been provided to perform a calibration on the CH₄ channel. This calibration ensures the accuracy of the system in its current operating condition. To ensure optimum performance please ensure your BIOGAS 300 module is returned for service and calibration on time.

- 1) Using the ↑ or ↓ keys, navigate to the 'User Calibration' option in the menu and select the option using the ↵ key.

```
Ensure inlet valve
is closed – press ↵
```

Screen 12 – User calibration prompt

- 2) Press the 'Esc' key to exit without saving any changes.



Note: For more information on user calibration, please refer to section [Calibration](#) in this operating manual.

5.2.4 Factory Settings

This option will clear the user calibration zero and span settings, and set the date of the last user calibration to 00/00/00.

- 1) Using the ↑ or ↓ keys, navigate to the 'Factory Settings' option in the menu and select the option using the ↵ key.

```
Restore factory    N<
settings?         Y
```

Screen 13 – Restore factory settings menu

- 2) Use the ↓ keys to select 'Y' for yes to restoring the factory settings or remain at 'N' for no.
- 3) Pressing the ↵ key on 'Y' will restore the systems factory settings and show a confirmation message for three seconds before returning the operator to the menu.

```
Factory settings restored
```

Screen 14 – Factory settings restored

- 4) Pressing the ↵ key on 'N' will return the operator to the menu.

5.2.5 Last reading

This option allows the operator to view the last stored reading in the systems memory. In addition, this reading will be available in the Modbus registers or output on the 4-20mA channel.

- 1) Using the ↑ or ↓ keys, navigate to the ‘Last Reading’ option in the menu and select the option using the ↵ key.

CH4 60.3%	12:54
	05/01/14

Screen 15 – View last reading

- 2) The screen will display the last reading and the time and date that it was stored. There are no options when in this screen. To exit back to the menu, press the ‘Esc’ key.

5.2.6 Information


This option allows the operator to view important information about their system, such as the serial number of the module, next service due date, and firmware version. This information may be required when contacting your local distributor or our technical support team for assistance.

- 1) Using the ↑ or ↓ keys, navigate to the ‘Diagnostics’ option in the menu and select the option using the ↵ key.

Serial No.	BGM0001
Firmware	V 1.23

Screen 16 – Information

- 2) Using the ↑ or ↓ keys allows the operator to navigate through the available pages that can be seen. The information that can be viewed is:
 - Serial No.: the serial number for the BIOGAS 300 module. It will be in the format ‘BGMnnnn’.
 - Firmware: the firmware version that the BIOGAS 300 module has installed. It will be in the format ‘V n.nn’.
 - Gas sensor: details of the additional gas sensor if fitted.

 Note: This option is not yet available and ‘None’ will therefore be displayed.

- Factory cal: the date that the BIOGAS 300 module was last factory serviced and calibrated. It will be in the date format ‘DD/MM/YY’.

- Service due: the date that the BIOGAS 300 module is due its next factory service and calibration. It will be in the date format 'DD/MM/YY'.
- User cal: is the date that the BIOGAS 300 module was last user zeroed, spanned or both. It will be in the date format 'DD/MM/YY'.

3) To exit to the menu, press the 'Esc' key.

5.2.7 Diagnostics

This option allows the operator to view the diagnostics screen. The operator may be requested to view this screen if they contact their local distributor or our technical support team for assistance.


1) Using the ↑ or ↓ keys, navigate to the 'Diagnostics' option in the menu and select the option using the ↵ key.

CH4	f=09847	55.4%
REF	f=10327	

Screen 17 – Diagnostics

2) To exit to the menu, press the 'Esc' key.

3) Using the ↑ or ↓ keys allows the operator to navigate through the available channels that can be seen.

 Note: Whilst in the diagnostics screen, the pump (if fitted) can be turned on and off by using the ↵ key.

5.2.8 Modbus Slave Add. (Address)

This option allows the operator to set the slave address for Modbus communications. The slave address is set to '1' as default but can be changed in the event that there is already a device on the bus with this address.

1) Using the ↑ or ↓ keys, navigate to the 'Modbus Slave Add.' option in the menu and select the option using the ↵ key.


Modbus Slave Add.:
001

Screen 18 – Set Modbus slave address


- 2) Press the 'Esc' key to exit without saving any changes.
- 3) The inverted digit represents an editable item. Use the ↑ and ↓ keys to increase or decrease the numerical value. Once correct, or if already correct, pressing the ← key will advance to the next editable item.


```
Modbus Slave Add.:
102
```

Screen 19 – Modbus slave address post edit

 Note: Using the 'Esc' key from the second numerical value onwards acts as a back key.

- 4) Pressing the ← key on the last digit of the address saves the new Modbus slave address to memory. The display will briefly inform the operator if the address has been accepted ([Screen 20 – Modbus slave address set OK](#)) or if there is an error ([Screen 21 – Modbus slave address set incorrectly](#)), followed by returning the operator to the menu.

 Note: The minimum permissible slave address is 001 and the maximum is 255.

 Note: If the address entry is invalid, the address will not be saved and the previous setting will be used until rectified.

```
Modbus Slave Add.:
102                OK
```

Screen 20 – Modbus slave address set OK


```
Modbus Slave Add.:
272                ERROR
```

Screen 21 – Modbus slave address set incorrectly

5.2.9 Standby

This option allows the operator to place the BIOGAS 300 module in to standby mode.

- 1) Using the ↑ or ↓ keys, navigate to the 'Standby' option in the menu and select the option using the ← key to place the system in to standby mode and display [Screen 2 – Standby mode](#).

 Note: Alternatively, standby mode can be entered by pressing the 'Esc' key when in the menu.

5.3 Taking a Reading


5.3.1 Detailed Instructions

This section explains how to take a reading on the BIOGAS 300 system. In addition, a simple flow chart can be followed in [Simple Instructions – Flow Chart](#) (see page [54](#)).

- 1) Ensure that there is no liquid in the catchpot that could cause a blockage and if required empty the contents (refer to section [Emptying the Catchpot](#) of this operating manual for instructions).
- 2) The operator firstly needs to open the gas inlet valve on the side of the enclosure (see annotation 1 on [Figure 1 – BIOGAS 300 external components](#)).
- 3) Once the gas is turned on, the operator needs to press the sample button (see annotation 2 on [Figure 1 – BIOGAS 300 external components](#)) to instruct the BIOGAS 300 system to begin sampling.
- 4) Upon being pressed, the BIOGAS 300 module will exit standby mode and the screen will illuminate to advise the operator to ensure that the gas inlet valve is open.

```
Sampling – inlet      valve
must be OPEN!
```

Screen 22 – Sampling

 Note: To cancel a reading, pressing the 'Esc' key will return the BIOGAS 300 system to standby mode.

- 5) After five seconds, the screen will change to display a live reading. At this point, a timer in the right hand side of the screen counts down to inform the operator when the sample will be completed.


```
CH4  23.7%  127s to
                wait
```

Screen 23 – Countdown to sample

- 6) Once the countdown is completed, the final reading will be stored on screen for five seconds with a date and time stamp.

CH4	59.7%	13:37
		06/01/15


Screen 24 – Final reading

 Note: In addition, the reading will be stored in memory for access via the menu (see section [Last reading](#)) and the Modbus registers (see section [Readable Parameters of the BIOGAS 300](#)).


- 7) Once the reading is stored, the operator needs to close the gas inlet valve. During the time that the final reading is on screen, the time and date stamp will change to a message informing the operator to close the valve for a period of ten seconds.

CH4	59.7%	CLOSE
		Valve!

Screen 25 – Close inlet valve message

 **Warning** Failure to turn off the gas supply could cause a hazard.

- 8) Finally, after ten seconds of the reading being on screen, the BIOGAS 300 system will automatically enter standby mode; see [Screen 2 – Standby mode](#).

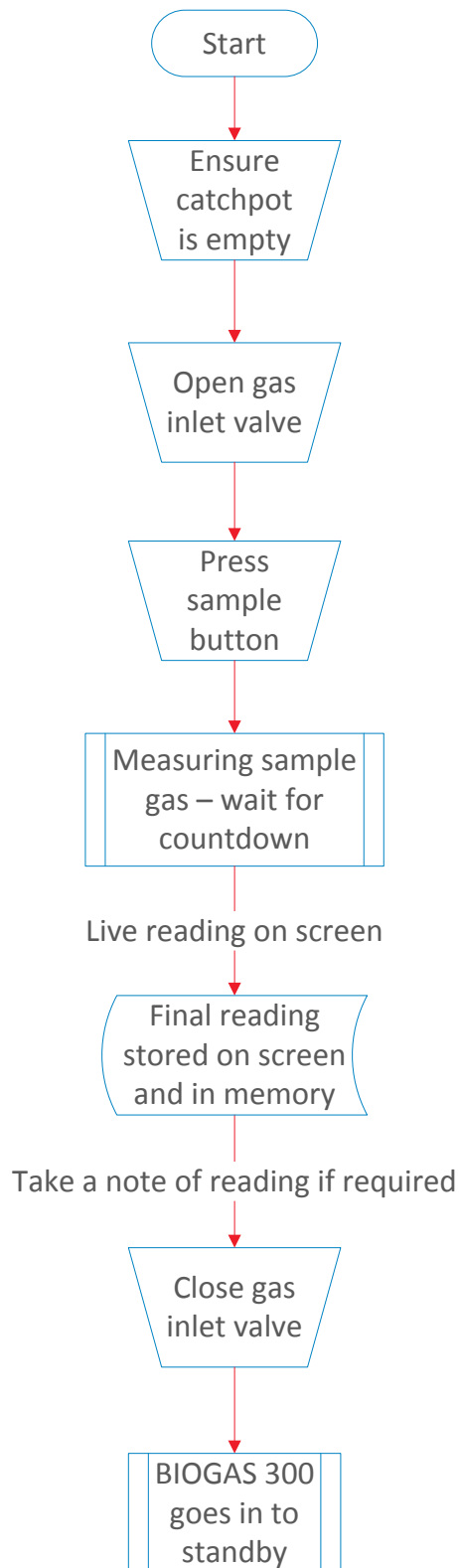
 Note: The BIOGAS 300 will monitor for a flow of gas before entering standby mode. If a gas flow is still present, the screen will change to display another message informing the operator to turn off the gas supply. This message will stay on the screen until no flow is detected or the 'Esc' key is pressed:

Valve is still open- please CLOSE valve!

Screen 26 – Valve is still open message

5.3.2 Simple Instructions – Flow Chart

Flow Chart 1 – Simple process overview explains how to take a reading on the LOGAS 300 system:



Flow Chart 1 – Simple process overview

5.4 Switching the BIOGAS 300 System Off

The BIOGAS 300 system can only be turned off at the switched mains supply that is installed in section [Mains Wiring](#).

 **Warning**

Attempting to turn off the BIOGAS 300 system in any other way could cause a hazard or damage to the system.


6 Calibration

6.1 Calibration Introduction

The BIOGAS 300 system is carefully calibrated at manufacture and when returned for service using a number of gas concentrations and temperature points. However, it is sometimes desirable to carry out a calibration process between services.

The BIOGAS 300 measures CH₄ as standard and this channel can be user calibrated. This section will describe in detail the correct procedure to calibrate this gas channel.


 Note: This does not replace the factory service and calibration.

 Note: If this calibration is completed incorrectly, it may decrease the accuracy of the system.

Two important terms that are used within this section are ‘zero’ and ‘span’:

Zero: The point at which the system is calibrated when there is none of the target gas present.

Span: The point at which the system is calibrated when there is a known concentration of the target gas present.

 Note: A more detailed explanation of user calibration can be found in section [User Calibration Explained](#).

6.2 Required Calibration Equipment

6.2.1 Gas

User calibration of the system will greatly improve the data accuracy in the range of the calibration gas used and the environmental conditions for which the BIOGAS 300 is calibrated. This may cause less accurate readings of concentrations outside of this calibrated range.

Users should select the correct calibration gas for the expected gas levels on their particular application. In addition, nitrogen (N₂) can be used for a zero

calibration. If this is not available, then clean ambient air can be used with systems with an internal pump.

⚠ Warning

Calibration gases can be dangerous. For each gas used, the appropriate material safety data sheet must be read and fully understood before proceeding.

6.2.2 Flow Regulator

The regulator supplied by Geotech (see annotation F in section [BIOGAS 300 Consumable Products](#)) has been configured to deliver a fixed flow of 300ml/min. As the regulator's flow is factory set it only requires a few turns to open, but no adjustment will be necessary.



Note: If using a regulator that was not supplied by Geotech, please ensure the flow rate is adjusted to a maximum of 300ml/min. Suitable pressure relief should be ensured to protect the system from over-pressurisation – typically 3-5psi (200-350mbar).

⚠ Warning

When the system is being calibrated, in cases of over-pressurisation, the 1/16" port on the red pressure relief valve (supplied with the Geotech pressure regulator) will release gas to protect the BIOGAS 300 module.

It is recommended that the exhaust tubing from the BIOGAS 300 system/module and pressure relief valve emerge in a well-ventilated area.

Ensure there are no leaks in the tubing and connections before carrying out a user calibration.

The calibration of the BIOGAS 300 should be carried out in a safe area with all necessary precautions taken when using dangerous, explosive, or toxic gases.

6.3 Gas Check

After the BIOGAS 300 system has been installed and pressure tested, it is recommended that a gas check be performed to ensure it is still accurate, as damage could have occurred during installation and/or transit.

In addition, this gas check can be performed as part of regular maintenance to validate the accuracy of the system and determine whether a user calibration is required.

The gas used for the check should be representative of the gas within the application, for example, 60% CH₄ balanced with 40% CO₂.

- 1) Connect the gas bottle as per [Connecting a Gas Bottle to the BIOGAS 300 System](#).
- 2) Ensure the system is powered on and access the 'Diagnostics' option from the 'menu' (see [Diagnostics](#)). The CH₄ live reading is shown on the far right of the first row (see [Screen 17 – Diagnostics](#)).
- 3) Open the pressure regulator to allow gas to flow through the BIOGAS 300 module.
- 4) Allow a suitable amount of time for a stable reading, three minutes should suffice.
- 5) Ensure the CH₄ reading is close to the certified value of the gas bottle. If required, a user calibration can be performed later.
- 6) Close the pressure regulator to stop the flow of gas through the BIOGAS 300 module.
- 7) Disconnect the gas bottle as per [Disconnecting a Gas Bottle from the BIOGAS 300 System](#).


Press the 'Esc' key twice to return the BIOGAS 300 module to standby mode.


6.4 CH₄ User Zero Calibration

As a minimum, Geotech recommends that a user zero calibration be carried out monthly to compensate for any drifting of the infrared source. A calibration should be performed at a time of day and temperature that is typical of the monitoring pattern. This will ensure the user calibration is as accurate as possible.

There are two methods for zeroing the BIOGAS 300:

- using bottled nitrogen (recommended) or
- using the internal pump (if fitted) with clean, ambient air:

 Note: If an internal pump is not fitted, bottled nitrogen or a gas containing none of the target gas (e.g. air) must be used.

 Note: Depending upon the application, a user zero may be required more or less frequently. This is to be determined by the user as part of their maintenance procedure.

6.4.1 Detailed Instructions for Bottled Nitrogen User Zero

This section explains how to user zero calibrate the CH₄ channel on the BIOGAS 300 system using bottled nitrogen. In addition, a simple flow chart can be followed in [Flow Chart 2 – CH₄ user zero calibration](#) (see page 65).

- 1) Set-up the calibration equipment as found in section [Connecting a Gas Bottle to the BIOGAS 300 System](#).
- 2) From the menu, select the 'User Calibration' option. [Screen 12 – User calibration prompt](#) will be presented to the operator.
- 3) Ensure the gas inlet valve is in the closed position and acknowledge the message by pressing the ↵ key. The operator will be presented with the 'user calibration menu'.

CH ₄ Zero	<
CH ₄ Span	

Screen 27 – CH₄ user calibration menu

- 4) From the user calibration menu, select 'CH4 Zero' to display the 'CH4 Zero menu'.

```
Bottled N2      <
Pumped Air
```

Screen 28 – CH₄ Zero menu

- 5) Select the 'Bottled N2' option in the menu using the ← key to display an instruction to connect the gas.

```
Attach N2 to module
gas inlet – press ←
```

Screen 29 – Connect N₂ instruction

- 6) Ensure the bottled nitrogen is connected to the gas inlet of the BIOGAS 300 module (see annotation 10 on [Physical Characteristics of the Module](#)) and open the regulator to start flowing gas. Press the ← key when ready to begin the zeroing countdown.


```
CH4    0.5%    179s to
                    wait
```

Screen 30 – CH₄ zeroing

- 7) Allow the system to count down to zero seconds in order to obtain a good zero calibration. Once this time has elapsed, the system will perform an automatic zero and inform the operator if it completed.

```
CH4    0.0%    Press
←-Accept, Esc-Cancel
```

Screen 31 – CH₄ zero completed

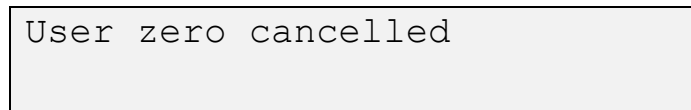
 **Note:** Always ensure that the on-screen reading is stable before accepting the zero calibration. If you notice that the reading is still changing or has become negative after the elapsed time, press the 'Esc' key and perform the zero calibration again.

- 8) Press the ← key to 'accept' the user calibration of the CH₄ channel or 'Esc' to cancel without saving any changes. A confirmation screen will be displayed for either action and will be shown for three seconds.

```
User zero accepted
```

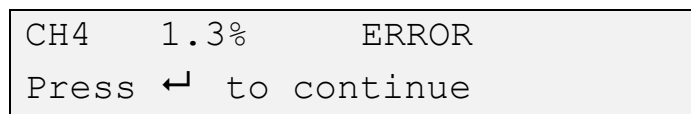


Screen 32 – User zero accepted



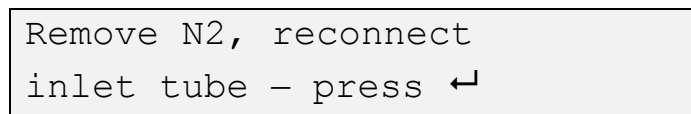
Screen 33 – User zero cancelled

- 9) If there was an error, [Screen 34 – CH₄ zero error](#) is shown. Press \leftarrow to continue.



Screen 34 – CH₄ zero error

- 10) Following the confirmation messages or continuing after an error, the operator will be prompted to disconnect the bottled nitrogen and reconnect the BIOGAS 300 module tubing (follow [Disconnecting a Gas Bottle from the BIOGAS 300 System](#)).



Screen 35 – Disconnect N₂ and restore input instruction

⚠ Warning

Ensure the regulator is turned off before disconnecting the gas bottle.


Note: If the zero failed and you wish to retry, do not disconnect the gas and reconnect the tubing. Return to the user calibration menu (step [4](#)) and repeat the zeroing process.

If zeroing continues to fail, refer to the [User Calibration Explained](#) section of this manual. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

- 11) Once the tubing has been reconnected, press the \leftarrow key to exit to the ‘user calibration menu’; see [Screen 27 – CH₄ user calibration menu](#).

6.4.2 Detailed Instructions for User Zero in Air

This section explains how to user zero calibrate the CH₄ channel on the BIOGAS 300 system using the system pump and clean, ambient air. In addition, a simple flow chart can be followed in [Flow Chart 2 – CH₄ user zero calibration](#) (see page [65](#)).

 Note: If the BIOGAS 300 does not have a system pump (see annotation 8 on [Figure 2 – BIOGAS 300 internal components](#)) the user zero calibration will fail.

- 1) Set-up the calibration equipment as found in section [Set-Up for Using Clean Ambient Air Zero](#).
- 2) From the menu, select the 'User Calibration' option. [Screen 12 – User calibration prompt](#) will be presented to the operator.
- 3) Ensure the gas inlet valve is in the closed position and acknowledge the message by pressing the ← key. The operator will be presented with the user calibration menu.

```
CH4 Zero          <
CH4 Span
```

Screen 36 – CH₄ user calibration menu

- 4) From the user calibration menu, select 'CH₄ Zero' to display the 'CH₄ zero menu'.

```
Bottled N2
Pumped Air      <
```

Screen 37 – CH₄ zero menu

- 5) Use the ↓ key to navigate to the 'Pumped Air' option and select using the ← key to display an instruction to disconnect the inline PTFE filter.

```
Open PTFE filter to air -
press ←
```

Screen 38 – Open PTFE filter to air

- 6) Allow the inline PTFE filter (see annotation 4 on [Figure 2 – BIOGAS 300 internal components](#)) to be open to clean, ambient air (a length of tubing

can be attached and routed to a location if required). Press the \leftarrow key when ready to begin the zeroing countdown.


```
CH4    0.5%    179s to
                    wait
```

Screen 39 – CH₄ zeroing

- 7) Allow the system to count down to zero seconds in order to obtain a good zero calibration. Once this time has elapsed, the system will perform an automatic zero and inform the operator if it completed.

```
CH4    0.0%    Press
 $\leftarrow$ -Accept, Esc-Cancel
```

Screen 40 – CH₄ zero ok

 Note: Always ensure that the on-screen reading is stable before accepting the zero calibration. If you notice that the reading is still changing or has become negative after the elapsed time, perform the zero calibration again.

- 8) Press the \leftarrow key to 'accept' the user calibration of the CH₄ channel or 'Esc' to cancel without saving any changes. A confirmation screen will be displayed for either action and will be shown for three seconds.

```
User zero accepted
```

Screen 41 – User zero accepted

```
User zero cancelled
```

Screen 42 – User zero cancelled

- 9) If there was an error, [Screen 43 – CH₄ zero error](#) is shown. Press \leftarrow to continue.

```
CH4 1.3%    ERROR
Press  $\leftarrow$  to continue
```

Screen 43 – CH₄ zero error

- 10) Following the confirmation messages or continuing after an error, the operator will be prompted to reconnect the inline PTFE filter (follow [Set-Up Following Clean Ambient Air Zero](#)).

```
Reconnect PTFE filter –  
press ←
```

Screen 44 – Reconnect inline PTFE filter instruction

- Note: If the zero failed and you wish to retry, do not reconnect the inline PTFE filter. Return to the user calibration menu (step [4](#)) and repeat the zeroing process.
- If zeroing continues to fail, refer to the [User Calibration Explained](#) section of this manual. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

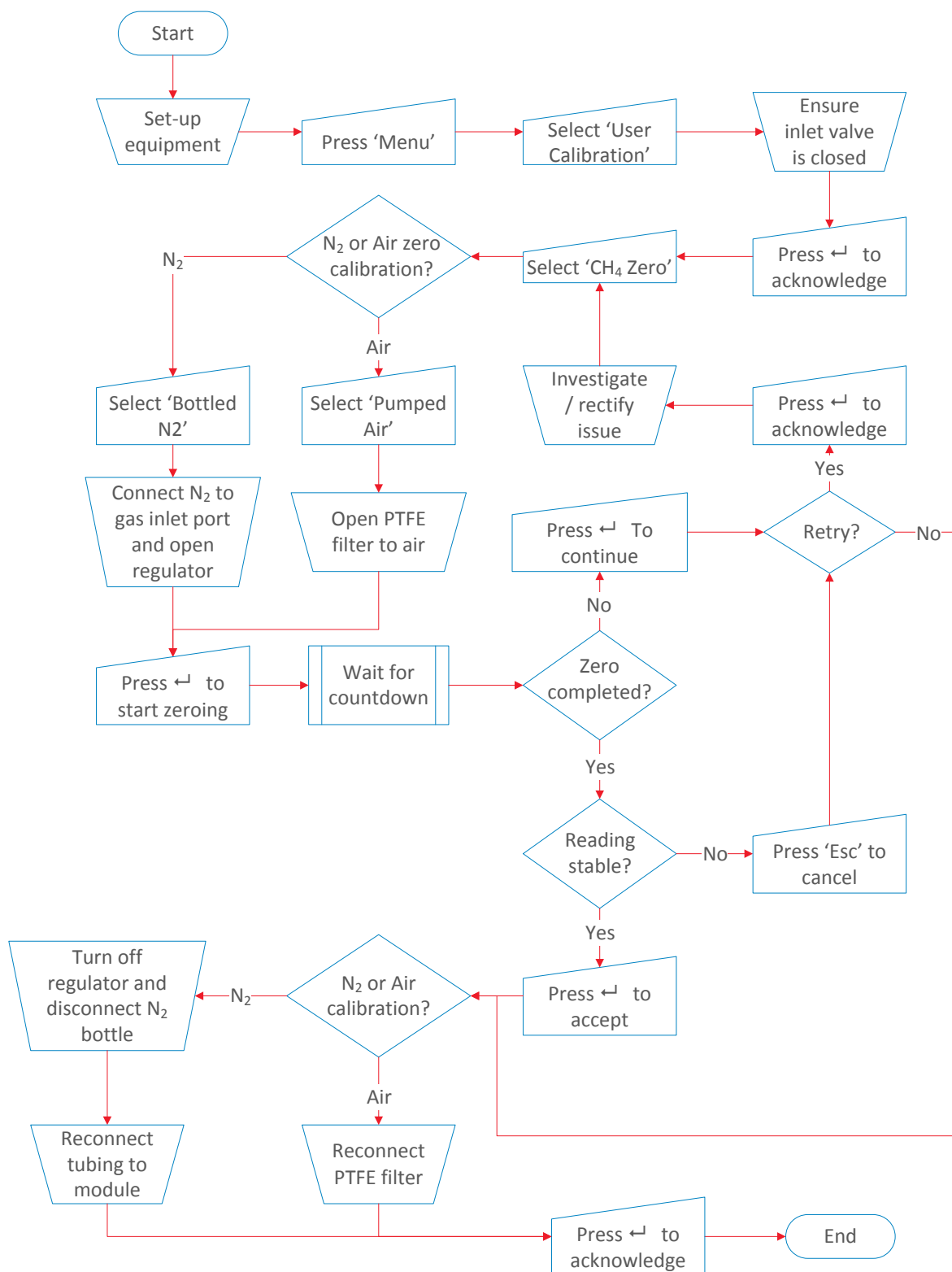
11) Once the inline PTFE filter has been reconnected, press the ← key to exit to the 'user calibration menu'; see [Screen 36 – CH4 user calibration menu](#).

Warning

Ensure the inline PTFE filter fitting has been fully secured to ensure that there are no gas leaks.

6.4.3 Simple User Zero Calibration Instructions – Flow Chart

[Flow Chart 2 – CH4 user zero calibration](#) explains how to perform a user zero calibration on the CH₄ channel of the BIOGAS 300 system:



Flow Chart 2 – CH₄ user zero calibration

6.5 CH₄ User Span Calibration

Geotech recommends that a user span calibration be carried out following a user zero.

In order to achieve the best accuracy, we recommend that users should select the correct calibration gas for the expected gas levels on their particular application. A calibration should be performed at a time of day and temperature that is typical of the monitoring pattern. This will ensure the user calibration is as accurate as possible.

 Note: This may cause less accurate readings of concentrations outside of this calibrated range. For further information, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

6.5.1 Detailed Instructions for User Span Calibration

This section explains how to user calibrate the CH₄ channel on the BIOGAS 300 using a known concentration of gas. In addition, a simple flow chart can be followed in [Flow Chart 3 – CH₄ user span calibration](#) (see page [70](#)).

- 1) Set-up the calibration equipment as found in section [Connecting a Gas Bottle to the BIOGAS 300 System](#).
- 2) From the menu, select the 'User Calibration' option. [Screen 12 – User calibration prompt](#) will be presented to the operator.
- 3) Ensure the gas inlet valve is in the closed position and acknowledge the message by pressing the ↵ key.

```
CH4 Zero
CH4 Span      <
```

Screen 45 – CH₄ user calibration menu

- 4) From the user calibration menu, select 'CH₄ Span' to enter the span gas concentration.

```
Enter CH4 span gas:
40.0%
```



Screen 46 – Enter CH₄ concentration

- 5) The inverted digit represents an editable item. Using the ↑ and ↓ keys, enter the concentration of gas being used, (this can usually be found on the gas canister). Once correct, or if already correct, pressing the ↵ key will advance to the next editable item.

```

Enter CH4 span gas :
60.0%
  
```

Screen 47 – Enter CH₄ concentration post edit

-  Note: Using the ‘Esc’ key from the second numerical value onwards acts as a back key.
-  Note: The permissible gas concentration range is 4.5% to 70%. A value outside of this range will display an error and return the operator to the CH₄ calibration menu.

- 6) Pressing the ↵ key on the last digit saves the gas concentration to memory and displays an instruction to connect the gas to the BIOGAS 300 module.

```

Attach gas to module gas
inlet – press ↵
  
```

Screen 48 – Connect gas instruction

- 7) Ensure the gas bottle is connected to the gas inlet of the BIOGAS 300 module (see annotation 10 on [Physical Characteristics of the Module](#)) and open the regulator to start flowing gas. Press the ↵ key when ready to begin the span calibration countdown.

```

CH4   5.3%   179s to
                wait
  
```


Screen 49 – CH₄ spanning

- 8) Allow the system to count down to zero seconds in order to obtain a good span calibration. Once this time has elapsed, the system will perform an automatic span and inform the operator if it completed.

```

CH4   60.1%   Press
↵-Accept, Esc-Cancel
  
```

Screen 50 – CH₄ span completed

 Note: Always ensure that the on-screen reading is stable before accepting the span calibration. If you notice that the reading is still changing after the elapsed time, perform the span calibration again.

- 9) Press the \leftarrow key to 'accept' the span calibration of the CH₄ channel or 'Esc' to cancel without saving any changes. A confirmation screen will be displayed for either action and will be shown for three seconds.

User span accepted

Screen 51 – User span accepted

User span cancelled

Screen 52 – User span cancelled

- 10) If there was an error, [Screen 53 – CH₄ span error](#) will be shown. Press \leftarrow to continue.

CH₄ 12.3% Error
Press \leftarrow to continue

Screen 53 – CH₄ span error

- 11) Following the confirmation messages or continuing after an error, the operator will be prompted to disconnect the gas bottle and reconnect the BIOGAS 300 module tubing (follow [Disconnecting a Gas Bottle from the BIOGAS 300 System](#)).


Remove gas, reconnect
inlet tube – press \leftarrow


Screen 54 – Disconnect gas bottle instruction



Warning

Ensure the regulator is turned off before disconnecting the gas bottle.

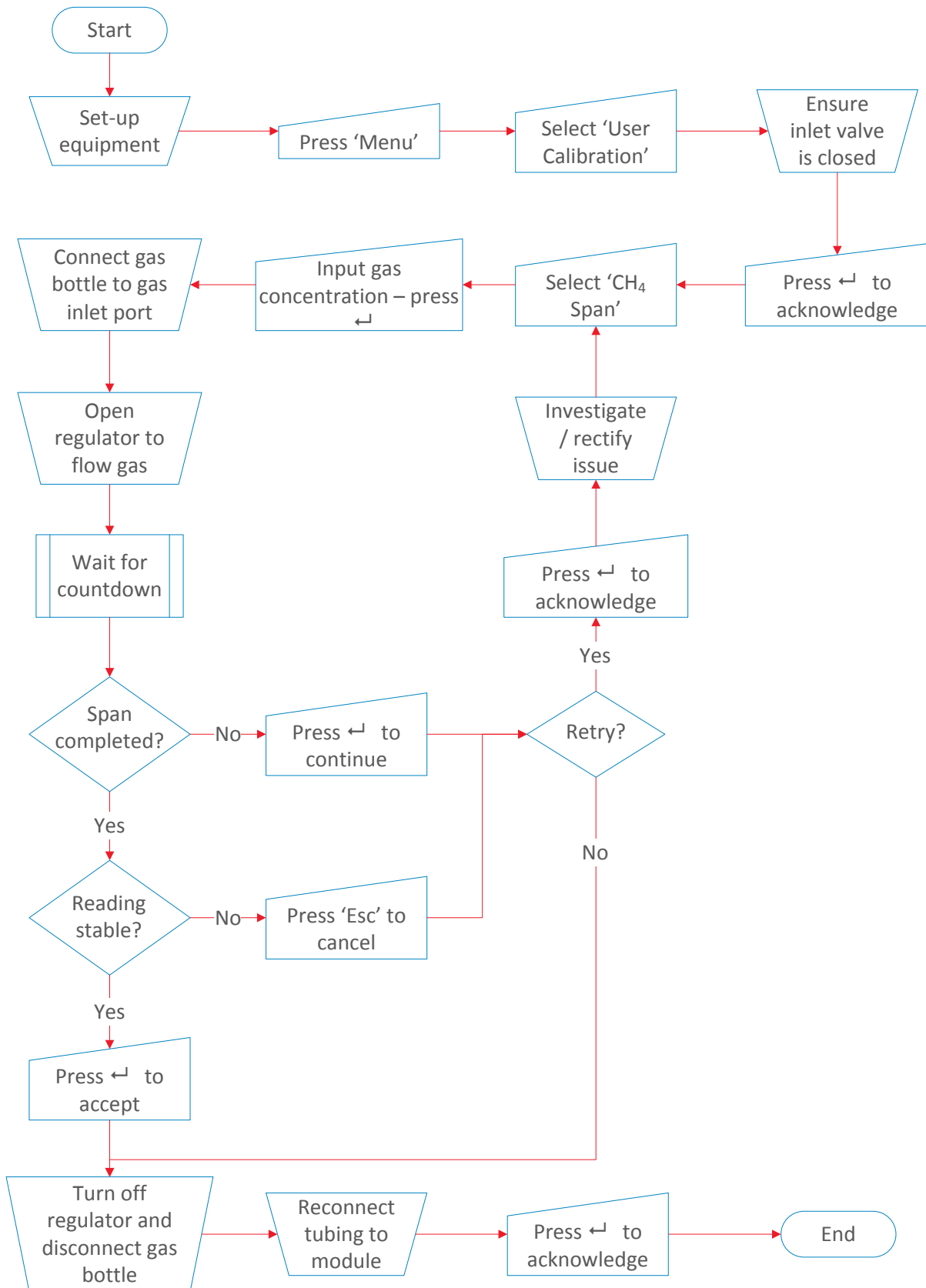
 Note: If the span calibration failed and you wish to retry, do not disconnect the gas and reconnect the tubing. Return to the user calibration menu and repeat the spanning process (step [4](#)).

 Note: If spanning continues to fail, refer to the [User Calibration Explained](#) section of this operating manual. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

12) Once the tubing has been reconnected, press the ↵ key to exit to the 'user calibration menu' ([Screen 45 – CH4 user calibration menu](#)).

6.5.2 Simple User Span Calibration Instructions – Flow Chart

[Flow Chart 3 – CH4 user span calibration](#) explains how to perform a user span calibration on the CH₄ channel of the BIOGAS 300 system:






Flow Chart 3 – CH₄ user span calibration

6.6 Connecting a Gas Bottle to the BIOGAS 300 System

⚠ Warning

Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)






This section explains how to connect a gas bottle to the BIOGAS 300 module for a user calibration or gas check.

Op.	Image	Instruction
1		Ensure that the gas in valve is closed.
2		Ensure that the drain and gas out valves are closed.
3		Attach the pressure regulator to the gas bottle and ensure it is adequately tightened.

⚠ Warning

Ensure that the regulator is fitted to the bottle at arm's length in case of a gas leak.

Ensure that no cross threading occurs during tightening of the regulator.




		During the rare occasion that gas does leak from the seal, place the bottle and regulator on the floor and leave the area until the leak has stopped. DO NOT attempt to solve the leak as this could be dangerous.
4		<p>Ensure that the gas bottle has adequate pressure (i.e. is not empty)</p> <p> Note: Ensure the pressure regulator is not turned on.</p>
5		Attach the tubing from the gas bottle and regulator to the gas inlet port of the BIOGAS 300 module.
If your system exhausts to the atmosphere:		
6a		Open the gas out valve.
If your system exhausts to the process:		
6b	No image	Disconnect the tubing from the gas outlet port of the BIOGAS 300 module and attach a length of tube long enough to exhaust to a safe area.
 Warning	Ensure the gas in and gas out valves are closed to stop release of gas.	


6.7 Disconnecting a Gas Bottle from the BIOGAS 300 System

⚠ Warning

Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)

This section explains how to disconnect a gas bottle from the BIOGAS 300 module following a user calibration or gas check.

Op.	Image	Instruction
1	No image	Ensure the pressure regulator is turned off.
2		Ensure that the gas in valve is closed.
3		Ensure that the drain and gas out valves are closed.
4		Ensure the gas bottle supply is turned off and disconnect the tubing of the gas bottle and regulator from the gas inlet port of the BIOGAS 300 module.

5		<p>Reconnect the system tubing to the gas inlet port of the BIOGAS 300 module.</p> <p><i>Note:</i> This should be positioned behind the inline PTFE filter.</p> <p><i>Note:</i> Ensure that the coupling 'clicks' in to place</p>
6	No image	<p>If the tubing from the gas outlet port of the BIOGAS 300 module was removed, this needs reconnecting.</p> <p><i>Note:</i> Ensure that the coupling 'clicks' in to place.</p>
<p>Warning</p>		<p>It is critical that the connections are fully secured to ensure that no gas leaks in to the main enclosure.</p>
7	No image	Close the enclosure door.
<p>Warning</p>		<p>Once the BIOGAS 300 tubing has been reconnected, it is recommended that a Pressure Test be completed to ensure that the system is leak free.</p>




6.8 Set-Up for Using Clean Ambient Air Zero

⚠ Warning



Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)

This section explains how to set-up the system so that clean ambient air can be purged through the BIOGAS 300 module for a user calibration or gas check.

Note: This option can only be performed if the BIOGAS 300 system has an internal pump fitted.

Op.	Image	Instruction
1		Ensure that the gas in valve is closed.
2		Ensure that the drain and gas out valves are closed.
3		Disconnect the fitting from the base of the inline PTFE filter.

If your system exhausts to the atmosphere:




4a		Open the gas out valve.
If your system exhausts to the process:		
4b	No image	Disconnect the tubing from the gas outlet port of the BIOGAS 300 module and attach a length of tube long enough to exhaust to a safe area.
 Warning	Ensure the gas in and gas out valves are closed to stop release of gas.	

6.9 Set-Up Following Clean Ambient Air Zero

⚠ Warning

Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)

This section explains how to reconnect the tubing in the BIOGAS 300 system following an air zero calibration.

Op.	Image	Instruction
1		Ensure that the gas in valve is closed.
2		Ensure that the drain and gas out valves are closed.
3		Reconnect the fitting to the base of the inline PTFE filter. <i>Note: Ensure this is fully tightened.</i>

⚠ Warning

It is critical that the connections are fully secured to ensure that no gas leaks in to the main enclosure.


4		Open the gas out valve.
5	No image	Close the enclosure door.

⚠ Warning

Once the BIOGAS 300 tubing has been reconnected, it is recommended that a **Pressure Test** be completed to ensure that the system is leak free.

7 Maintenance

This section outlines the maintenance requirements which the operator needs to perform on the system and instructions for user replaceable components.


 Note: For further information please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

Warning

The use of non-Geotech approved parts being fitted to the equipment may cause a hazard.

The system should not be altered in any way other than described in this operating manual. Alterations outside of this operating manual could cause a hazard, make the equipment unsafe, and void any warranty.

7.1 Maintenance Schedule

 Note: This maintenance schedule is a minimum guide and dependent upon the application and usage of the BIOGAS 300 system, may need to be adapted accordingly.

As a minimum, Geotech recommend that each month the following be undertaken to ensure the BIOGAS 300 system is in its optimum working and safe condition:

- Inspect the BIOGAS 300 system for damage.
- Empty the catchpot (see [Emptying the Catchpot](#)).
- Inspect, and replace if required, the coalescing catchpot filter (see [Replacing the Catchpot Filter](#)).
- Inspect, and replace if required, the inline PTFE filter (see [Replacing the Inline PTFE Filter](#)).
- Perform a pressure test to ensure there are no leaks (see [Pressure Test](#)).
- Perform a gas check to determine the accuracy of the system (see [Gas Check](#)).

- If required, perform a user calibration (see [Calibration](#)).

- ✍ Note: It is the operator's responsibility to keep a record of when and what maintenance has been performed.
- ✍ Note: If you suspect the BIOGAS 300 system to have been damaged and are unsure of the consequences of this, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.
- ✍ Note: Inspection of the catchpot and inline filter may be required more frequently depending upon the application and the likelihood of liquid in the sample gas.
- ✍ Note: After performing a gas check or calibration, it may be necessary to perform a further pressure test on the equipment to ensure it has remained leak free.

7.2 BIOGAS 300 Consumable Products

Optional replacement parts may be purchased for the BIOGAS 300 from your local distributor or Geotech directly. Please refer to our website

(www.geotechuk.com) for further details on pricing and how to order:





Ref	Description	Part Number
A	Catchpot with coalescing filter and drainage tubing	BG300.S1 (for non-air purge system) BG300.S2 (for air purge system)
B	Coalescing filter for catchpot x 5	GA3K.S1
C	Inline PTFE filters (pack of 10) Inline PTFE filters (pack of 30)	GA4.2 GA4.2(30)
D	5m length 4mm i.d tubing	GA3K.S6
E	Fuses	Please contact us
F	Check gas regulator used in conjunction with calibration gas canister. This valve controls the flow of gas – c/w safety valve.	GA6.8
G	Calibration gas	Please contact us

H	M20 Cable gland, plastic, IP68, with strain relief	BG300.S4
I	M20 Cable gland for armoured cable, IP66, twin pack	BG300.S5

7.3 Emptying the Catchpot



Warning


Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)

Op.	Image	Instruction
1	No image	Isolate the power to the system
2		Ensure that the gas in valve is closed.
3		Ensure that the drain and gas out valves are closed.


Warning


Ensure the gas in and gas out valves are closed to stop release of gas.

4		<p>Disconnect the fitting from the base of the inline PTFE filter.</p> <div style="border: 1px dashed blue; padding: 5px; margin-top: 10px;"> <p> Note: Ensure that the inline PTFE filter is still connected to the length of tube from the catchpot.</p> </div>
---	---	--


5		Open the drain valve to allow liquid to empty from the catchpot.
---	---	--


<p>⚠ Warning</p>	<p>The catchpot can hold approximately 100ml of liquid. Dependent upon the application the liquid removed may be contaminated and should be discharged to an area where it is safe to do so.</p> <p>This line may also vent sample gas for a brief period during each draining operation if the sample inlet and gas out valves are not closed.</p>
-------------------------	---

6		Once the catchpot has emptied, close the drain valve.
---	--	---

7		<p>Reconnect the fitting to the base of the inline PTFE filter.</p> <p>Note: Ensure this is fully tightened.</p>
---	---	---

<p>⚠ Warning</p>	<p>It is critical that the connections are fully secured to ensure that no gas leaks in to the main enclosure.</p>
-------------------------	--

8		Open the gas out valve.
---	---	-------------------------



9	No image	Close the enclosure and turn the power to the system back on.
 Warning Once all maintenance is completed, it is recommended that a <u>Pressure Test</u> be completed to ensure that the system is leak free.		

7.4 Replacing the Catchpot Filter

⚠ Warning






Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)






The coalescing catchpot filter should be replaced if showing signs of contamination or saturated with liquid. Failure to replace the filter will result in the gas flow being restricted or blocked to the BIOGAS 300 module. In addition, it will cause a flow fail error.





Op.	Image	Instruction
1	No image	Isolate the power to the system
2	No image	Drain the catchpot of any contents. Refer to Emptying the Catchpot .
3		Ensure that the gas in valve is closed.
4		Ensure that the drain and gas out valves are closed.

⚠ Warning

Ensure the gas in and gas out valves are closed to stop release of gas.

5		<p>Disconnect the gas in and gas out tubes from the BIOGAS 300 module.</p>
6		<p>Remove the catchpot from its clip.</p>
7		<p>Using a 10mm spanner, remove the tubing from the catchpot base.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> Note: Keep the compression fitting safe.</p> </div>
8		<p>Unscrew the catchpot base and clear plastic tube from the catchpot top as one assembly.</p>

9			<p>Unscrew the filter stop from underneath the filter.</p> <div style="border: 1px dashed blue; padding: 5px; margin-top: 10px;"> <p> Note: Keep the filter stop safe.</p> </div>
10			<p>Remove the coalescing filter from the threaded bar and replace with new.</p>
11			<p>Replace the filter stop and tighten into place.</p>
12			<p>Reattach the catchpot base and clear plastic tube assembly to the catchpot top and tighten into place.</p>

13		<p>Attach the tubing to the fitting on the catchpot base and tighten the compression fitting using a 10mm spanner.</p>
<p>⚠ Warning</p>		<p>It is critical that the connections are fully secured to ensure that no gas leaks in to the main enclosure.</p>
14		<p>Fit the catchpot back in to its clip.</p> <p><i>📌 Note: Orientation is critical. The outside fitting is to be facing the back of the enclosure.</i></p>
15		<p>Once secure, reconnect the gas in and gas out tubing to the BIOGAS 300 module, ensuring tubing is not trapped or kinked.</p> <p><i>📌 Note: The tubing should be positioned behind the inline PTFE filter.</i></p>
16		<p>Open the gas out valve.</p>
17	<p>No image</p>	<p>Close the enclosure door and turn the power to the system back on.</p>



⚠ Warning

Once all maintenance is completed, it is recommended that a **Pressure Test** be completed to ensure that the system is leak free.

Replacing the Inline PTFE Filter




⚠ Warning	Mains voltages are present within the BIOGAS 300 system and great care needs to be observed. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)
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The inline PTFE filter should be replaced if showing signs of contamination or saturated with liquid. Failure to replace the filter will result in the gas flow being restricted or blocked to the BIOGAS 300 module. In addition, it will cause a flow fail error.

Op.	Image	Instruction
1	No image	Isolate the power to the system
2		Ensure that the gas in valve is closed.
3		Ensure that the drain and gas out valves are closed.

⚠ Warning	Ensure the gas in and gas out valves are closed to stop release of gas.
------------------	---

4		Rotate fitting anti-clockwise and disconnect it from the base of the inline PTFE filter.
---	---	--

5		Rotate filter anti-clockwise and remove filter from the top fitting.
6		Attach a new inline PTFE filter to the top fitting by rotating clockwise.
7		Attach the remaining tubing and fitting to the inline PTFE filter by turning clockwise.
⚠ Warning		It is critical that the connections are fully secured to ensure that no gas leaks in to the main enclosure.
8	No image	Close the enclosure door and turn the power to the system back on.
⚠ Warning		Once all maintenance is completed, it is recommended that a Pressure Test be completed to ensure that the system is leak free.

7.5 Pressure Test

7.5.1 General

After any maintenance operations in this section are performed, the system must be pressure tested to ensure it is leak free. In addition, a pressure test should be performed as part of routine maintenance. The following sections outline the required equipment, the set-up, and the procedure for the pressure test.

⚠ Warning

Failure to pressure test the system could result in gas leaking in to the enclosure causing a hazard.

7.5.2 Required Equipment

To perform the test procedure, the following equipment will be required:

- 0-200mbar pressure gauge with minimum of 10mbar increments
- T-piece fitting suitable for tubing
- A ball valve
- Pressure application device, such as a manual pump
- Fittings and tubing to connect to the system bulkheads.

7.5.3 Set-Up

[Figure 11 – Pressure test equipment set-up](#) shows an example of how the equipment will look when performing the test procedure.

- Connect a length of tubing to the 'GAS INLET' line of the BIOGAS 300 system.
- Fit a t-piece to the tubing. One end of this t-piece should go to the pressure gauge. The other end should go to the manual pump.
- Close the ball valve incorporated in to the 'PROCESS RETURN' line to create a blockage.

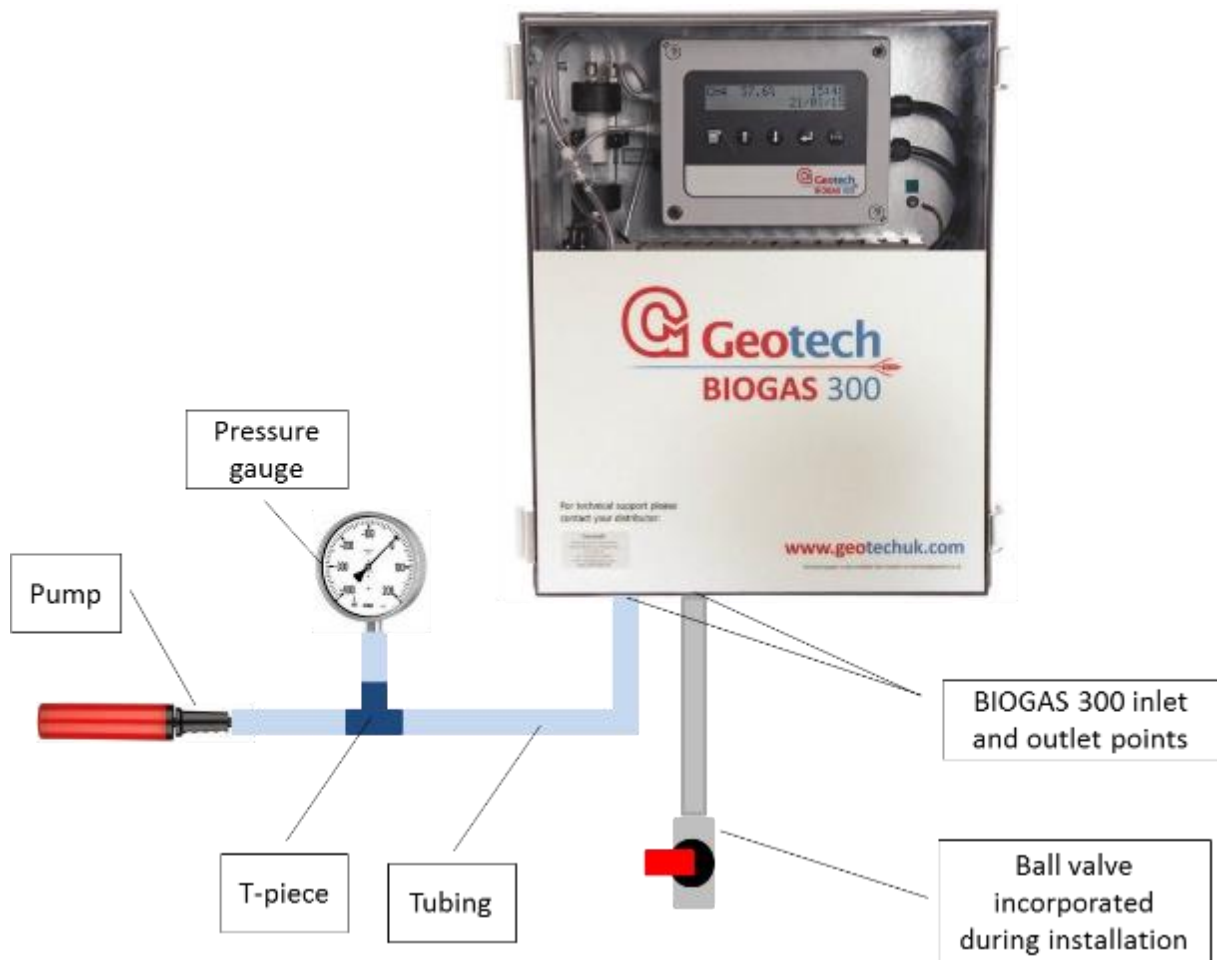



Figure 11 – Pressure test equipment set-up

7.5.4 Pressure Test


The system does not need to be powered on to perform this test.

- Ensure the gas in and gas out ball valves are open and the drain valve is closed.
- Ensure the ball valve on the return to process line is closed.
- Carefully, apply a pressure of 100mbar to the gas in line and ensure it is stable.

 Note: Ensure that the pressure is not increased too quickly causing pressures to exceed 100mbar.

- Monitor the pressure reading for one minute and ensure it does not drop by more than 10mbar.
- If this test passes, the system is deemed leak free.

- If this test fails, the system needs to be investigated to ascertain the source of the leak. Once rectified, repeat the pressure test to ensure the problem is resolved.

 Note: If assistance is required, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

7.6 Cleaning and Decontamination

The equipment must be isolated from the mains supply prior to cleaning or decontamination. The enclosure can be cleaned externally using a mild soapy water and non-abrasive cloth.

Should the need arise for the BIOGAS 300 module to be returned for service, it is the responsibility of the owner to ensure that the module has been decontaminated or that Geotech has been made aware of any contaminants that may be present, prior to it being returned.

Warning

Only the exterior of the enclosure should require cleaning. Cleaning the interior could result in injury due to mains power being present.

Do not rub the enclosure with a dry cloth as this could result in a build-up of static charge.


8 Service

8.1 General

The BIOGAS 300 module should be regularly serviced to ensure correct and accurate operation. Geotech recommends a service and recalibration every **12 months**.

It is recommended that only qualified engineers service the BIOGAS 300 module. Failure to observe this will result in the warranty becoming invalid.

To determine when your BIOGAS 300 module is due for a service, refer to the [Information](#) section of this operating manual.


 Note: For further information on how to return your BIOGAS 300 module for service, please contact your distributor or our service team at Geotech on +44(0)1926 338111 or email service@geotech.co.uk.






8.2 Replacement BIOGAS 300 Module for Service – Hot Swap




The BIOGAS 300 has been designed to avoid unnecessary downtime and a temporary BIOGAS 300 module can be supplied during service upon request. Below are instructions on how to swap out the BIOGAS 300 module for service.

Warning

Isolate the mains supply before performing this operation. If there is any uncertainty, seek advice from a professional. Alternatively, contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk to arrange a site visit. (Please note a charge may be applicable.)




Op.	Image	Instruction
1	No image	Isolate the power to the system
2		Ensure that the gas in valve is closed.

3		<p>Ensure that the drain and gas out valves are closed.</p>
<p>⚠ Warning Ensure the gas in and gas out valves are closed to stop release of gas.</p>		
4		<p>Remove the top trunking to gain access to the two cable harness connectors.</p>
5		<p>Disconnect the 4-way connector block.</p>
6		<p>Disconnect the 10-way connector block.</p>
7		<p>Disconnect the gas in and gas out tubes from the BIOGAS 300 module.</p>

8		<p>Remove the top right and bottom left hexagon bolts that secure the BIOGAS 300 module to the back plate using a 5mm hexagon key.</p>
9		<p>Slide the BIOGAS 300 module off the pillars.</p>
10		<p>Slide the new BIOGAS 300 module on to the two pillars and secure using the two hexagonal bolts.</p>




⚠ Warning

Excessive tightening of the hexagonal bolts will cause the shoulder washers and/or the BIOGAS 300 module enclosure to crack. This will result in additional charges.

11		<p>Reconnect the gas in and gas out tubing to the BIOGAS 300 module.</p> <ul style="list-style-type: none">  Note: The tubing should be positioned behind the inline PTFE filter.  Note: Ensure that the couplings 'click' in to place
----	---	--

⚠ Warning

It is critical that the connections are fully secured to ensure that no gas leaks in to the main enclosure.

12		Reconnect the 10-way connector block.
13		Reconnect the 4-way connector block.
14		Ensure the connectors are positioned within the trunking and refit the trunking cover to the top trunking. <div style="border: 1px dashed blue; padding: 5px; margin-top: 10px;"> ✍ Note: Locate the 10-way connector with available slot in trunking for ease. </div>

⚠ Warning	Ensure no cables are trapped when refitting the trunking cover.
--	---

15	No image	Close the enclosure door and turn the power on to the system
----	----------	--

⚠ Warning	Once the BIOGAS 300 tubing has been reconnected, it is recommended that a Pressure Test be completed to ensure that the system is leak free.
--	---

✍ Note: After replacing the BIOGAS 300 module, Geotech recommend that a Gas Check be performed on the system to ensure it is still reading accurately. If required, a user calibration can also be performed; refer to the Calibration section of this operating manual for more information.

9 Problem Solving

This section discusses various problems that may be encountered, and warnings or error messages that the operator may receive during general operation of the BIOGAS 300. For further assistance please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.1 System Will Not Power On

Ensure the switched mains supply is turned on and check that the LED is illuminating on the 5v power supply. If it is not, check the mains fuse (fuse 1) and replace if necessary.

If it is illuminating, check the fuse for the 5v supply to the BIOGAS 300 module (fuse 3) and replace if necessary (refer to section [Fuses](#) for correct fuse information).

**Warning**

Do not remove fuses whilst energised.

If the problem persists, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.2 Under and Over Range Codes

If a reading is under range (i.e. below zero) it will display 'less than' chevrons (<<<<<). This can occur if:

- a channel has been incorrectly user calibrated.
- the BIOGAS 300 module has been damaged (e.g. during transit).
- the BIOGAS 300 module has drifted out of calibration or it is due a factory calibration.

If a reading is over range (i.e. above the maximum allowed value) it will display 'more than' chevrons (>>>>>). This can occur if:

- for the same reasons as an under range error.

- the channel has been incorrectly calibrated.
- the channel is reading more than its acceptable limit (e.g. CH₄ > 100%).
- potential cross gas effects.

In most circumstances, a return to factory settings (see [Factory Settings](#)) and performing a user calibration (see [Calibration](#)) will resolve the error. If the error is not cleared by performing these tasks, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.3 System Lock-Up

If for any reason the BIOGAS 300 'locks up' and will not recognise button presses, isolate the supply to the system and leave the system switched off for sixty seconds. After this duration, turn the power back on and check the systems operation.

If the problem persists, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.4 Modbus Outputs Not Working

Please refer to section [Modbus Digital Output](#) in this operating manual and ensure that the configuration of the Modbus port is correct, that the wiring is correct as per [Wiring Diagram 2 – Modbus wiring](#), and that the BIOGAS 300 system is last on the bus.

In addition, also check that no two nodes on the bus have the same slave address. If this is the case, the BIOGAS 300 slave address can be changed by referring to section [Modbus Slave Add. \(Address\)](#) in this operating manual.

If the problem persists, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.5 Analogue Outputs Not Working

Please refer to section [4-20mA Outputs](#) in this operating manual to ensure the outputs have been wired correctly to the type of input to which they are connected.

The PLC in the BIOGAS 300 is reading from module slave address '1'. Ensure that the Modbus slave address in the BIOGAS 300 module is set to '1'; see [Modbus Slave Add. \(Address\)](#).

Ensure that the PLC is in 'run' mode.

Ensure switch is in
'run' position

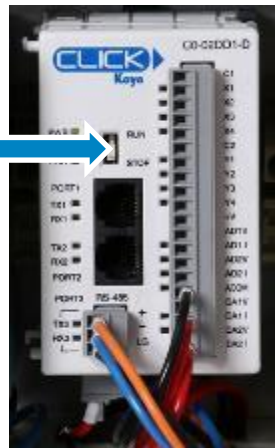


Figure 12 – PLC mode of operation

Check that your 4-20mA input channel is being interpreted correctly; refer to [4-20mA Scaling](#).

Finally, check fuse two, which can be used to provide power to the 4-20mA loop.

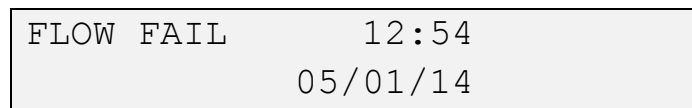
If the problem persists, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.6 Flow Fail

A flow fail occurs when there is not enough gas flowing through the BIOGAS 300 module. This can be for a number of reasons:

- You are sampling against a vacuum outside of the range of the system.
- There are blockages in the system.
- There is a gas leak in the system.
- If no pump is fitted in the system and the pressure from the sample is not high enough.

A flow fail is indicated on the display when taking a reading or in 'last reading' menu option by the flow fail warning.



Screen 55 – Flow fail warning

The first item to check is that the gas in and gas out ball valves (see annotation 1 on [Figure 1 – BIOGAS 300 external components](#) and annotation 14 on [Figure 2 – BIOGAS 300 internal components](#)) is in the open position when taking a reading.

If the valves are open and the problem persists:

- if there is a pump fitted, ensure that the system is not operating against a vacuum outside of its operating range. Refer to the latest technical specification (available at www.geotechuk.com) for further information.
- if no pump is fitted, check that the pressure in the sample line is greater than the minimum required. Refer to the latest technical specification (available at www.geotechuk.com) for further information.
- empty the catchpot of any contents (see [Emptying the Catchpot](#)).
- replace inline PTFE filter (see [Replacing the Inline PTFE Filter](#)).
- replace the catchpot filter (see [Replacing the Catchpot Filter](#)).

- visually check for damaged pipes or obvious signs of leaks.
- perform a pressure test (see [Pressure Test](#)).
- retest the system.

If after performing the above steps the problem is still present, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.7 Fuses

Warning

The use of alternative fuses may affect the safety of the apparatus.

Ensure the power is isolated and the [Protective Cover](#) is removed before replacing fuses. Once replaced, the protective cover will need to be fitted.

Please refer to the following table for the designation and location of each fuse together with its type and rating:

Designation	Circuit	Rated voltage	Rated current	Type
FS1	Mains input	250v	3.15A	20mm time delay, LBC T3.15AL250V
FS2	24v supply for 4-20mA loop	250v	100mA	20mm time delay, LBC T100mAL250V
FS3	5v supply	250v	1A	20mm time delay, LBC T1AL250V
FS4	Currently not used	-	-	-
FS5	24v supply	250v	1A	20mm time delay, LBC T1AL250V



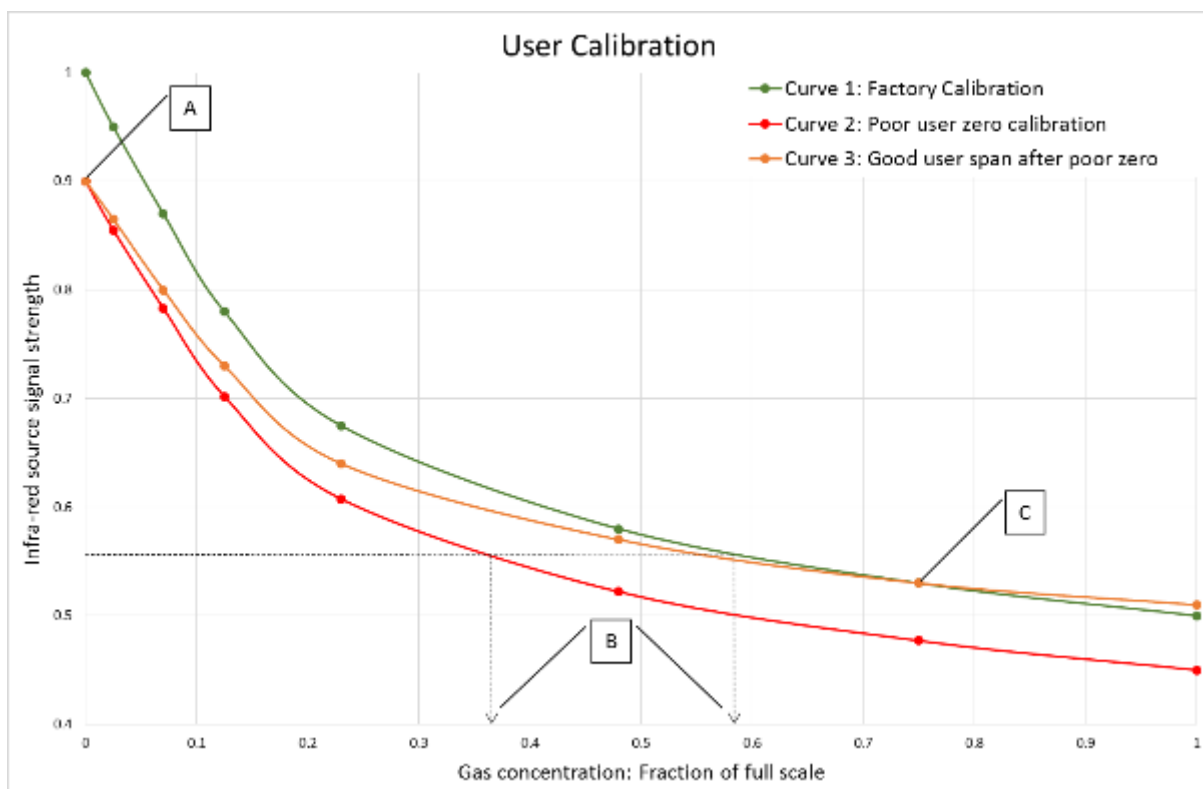
Note: Please contact your local distributor, or our sales team at Geotech on +44(0)1926 338111 or email sales@geotech.co.uk for further information.

9.8 User Calibration Explained

9.8.1 General

User calibration is a means of optimising the performance of the BIOGAS 300 system to the current operating conditions such as temperature and pressure as well as correcting for analyser drift caused by the infrared source.

User calibration has two operations, zero and span, and each may be performed individually. However, for a complete user calibration both must be completed.



Graph 1 – User calibration explained



9.8.2 Factory Calibration

When the BIOGAS 300 module is factory calibrated, a stable gas curve is generated (see curve 1 on [Graph 1 – User calibration explained](#)). This curve is then used to determine the gas concentration based on the infrared signal strength after being absorbed by the gas.

9.8.3 User Zero Calibration

A zero calibration is used to correct the entire curve for the infrared source and filter variations caused by aging and induced drift due to dirt and other contaminants. If done correctly, there is often no need to complete a span calibration, as the new curve will follow closely to the factory calibration curve (curve 1 on [Graph 1 – User calibration explained](#)).

The zero calibration is very sensitive and a rushed or poor calibration, (such as the target gas still being present), will result in a zero error; see point A on curve 2 of [Graph 1 – User calibration explained](#). This also produces an error throughout the remainder of the curve proportional to signal strength, but the effect on the span is significant, see point B on [Graph 1 – User calibration explained](#).

-  Note: To perform an accurate user calibration it is critical that a good user zero has been performed. Geotech recommend that this be done in nitrogen in order to guarantee that none of the gas of interest is present.
-  Note: To obtain a good zero it may be necessary to flow nitrogen for several minutes, especially if the BIOGAS 300 system has been subjected to high levels of CH₄ previously, in order to ensure there are no remains of the target gas present. On the BIOGAS 300, this would result in performing a number of zero calibrations to purge the gas out, or flowing the gas whilst in the diagnostics screen.

9.8.4 User Span Calibration

A span calibration is used to optimise the analyser at the span calibration concentration (see point C on [Graph 1 – User calibration explained](#)) for the current operational conditions. It corrects the span point but leaves the zero unadjusted (this will be left at the last user zero if this has been performed) and should be done at the concentration of interest in the particular application.

If the user zero is poor and the span calibration is good, it will correct the gas curve for the point of interest, but other points on the curve could be incorrect, see curve 3 on [Graph 1 – User calibration explained](#).

9.8.5 Trouble Shooting

9.8.5.1 User Zero Calibration Failed

Three possible reasons for this are that:

- The BIOGAS 300 module is trying to zero to a level which is outside the predetermined range set when the module was last factory calibrated
- The gas is not stable i.e. it is still purging out the measured gas.
- The system is not seeing a flow of gas.

To rectify this:

- ensure the BIOGAS 300 module contains none of the gas that is being zeroed by flushing through with nitrogen, or clean ambient air if this is not available and repeat a user zero calibration.
- ensure the correct zero calibration has been selected (nitrogen or pumped air) and retry.
- ensure the flow regulator on the gas bottle is open (if being used).

If after performing the above steps the problem is still present, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.8.5.2 User Span Calibration Failed

Check the span target (see [Screen 46 – Enter CH4 concentration](#)) is set to the value given on the calibration bottle. If not, correct and re-span the channel.

In addition, check that the flow regulator on the gas bottle is open.

If the problem persists, repeat an entire user calibration by zeroing the channel prior to performing a span calibration.



Note: Always ensure that the on-screen reading is stable before accepting the span calibration. If you notice that the reading is still changing after the elapsed time, accept the calibration, and perform the span calibration again.

If after performing the above steps the problem is still present, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

9.9 CH₄ Reading Low

If you believe that the CH₄ reading is lower than you expect, there could be two reasons for this:

- There could be a leak in the tubing and when running the pump (if fitted) you could be drawing in diluting the sample. Refer to the [Pressure Test](#) section of this operating manual for instructions on how to pressure test the BIOGAS 300 system.
- The BIOGAS 300 has drifted since its calibration and may be due a user calibration; see section [Calibration](#) of this operating manual for further information.

If after performing the above steps the problem is still present, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

10 BIOGAS 300 Warranty Terms and Conditions

Geotech will repair or replace (at Geotech's discretion) any goods supplied by the company in respect to defects arising within **12 months** from date of purchase or delivery, whichever is later, provided that:

- the defect is due to faulty parts or workmanship provided by Geotech.
- proof of delivery/purchase must be provided to Geotech for any claims. This includes a Geotech sales order, invoice, or delivery note.
- all warranty repairs can only be carried out by Geotech or its authorised agents. In certain circumstances, permission may be granted by Geotech for the owner to replace a supplied part under warranty.
- any repair or replacement component under warranty will not extend the warranty period of the system.
- products must have been returned for service and calibration as recommended by Geotech or its authorised agents.
- where replacement parts have been supplied by Geotech under warranty, the replaced parts must be returned to Geotech. If not returned, Geotech reserve the right to charge for the replacement part.
- if no fault is found an investigation charge may apply.
- technical support **MUST** be notified in the event of a pending warranty claim. They will then issue a warranty reference number that must be included in any return. Failure to provide this will void any warranty claim.

The following is not included:

- Normal wear and tear of parts that might wear out over time, or be consumed, is not covered. Parts not covered include, but not limited to, the inline PTFE filter and tubing.
- A service is not part of a warranty claim.
- Accidental damage, including dropping during installation.
- Damage as a result of vandalism.
- Faults arising from use of the equipment that is not in accordance with standard operating procedures laid out in Geotech's operating manual.
- Faults arising from use of the equipment in unsuitable applications.


- Repairs or alterations carried out by parties other than Geotech, its authorised agents, or under the instruction of Geotech.
- Any data stored on the equipment that may be lost.
- A claim due to a failure in maintaining the system in accordance with the operating manual.
- A claim as a result of poor quality or inadequate repairs.
- Any business related losses such as income, profits, and contracts (as far as the law allows).


The following voids the warranty:


- When non-approved Geotech parts have been used for repair or maintenance.
- When parts are added, or alterations made, to the system outside the scope of the operating manual.
- The BIOGAS 300 module has been opened, unless by Geotech approved service centres (where applicable).
- The BIOGAS 300 system has been opened in poor weather conditions that have resulted in damage to any of its components.
- The equipment has been stored or installed outside of the operating range and environmental conditions determined in the operating manual.

Service Warranty:

- Geotech offer a three-month warranty period, following a Geotech service, to cover any defects that have arisen because of that service.

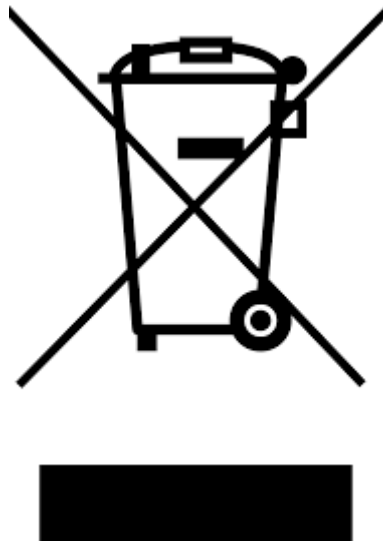
 Note: Warranty repair is only granted after an investigation by Geotech.

 Note: For assistance in determining if your equipment qualifies for warranty investigation, please contact your local distributor, or our technical support team at Geotech on +44(0)1926 338111 or email technical@geotech.co.uk.

 Note: For any other queries please contact your local distributor, or our sales team at Geotech on +44(0)1926 338111 or email sales@geotech.co.uk.

Geotech reserve the right to update these terms and conditions without notice.

11 WEEE Compliance



The wheeled bin symbol displayed on electrical equipment supplied by Geotech signifies that the apparatus must not be disposed of through the normal municipal waste stream but through a registered recycling scheme.

The Waste Electrical and Electronic Equipment Directive (WEEE) make producers responsible in meeting their obligations, with the fundamental aim of reducing the environmental impact of electrical and electronic equipment at the end of its life.


Geotech is registered with the Environmental Agency as a producer and has joined a recycling scheme provider that manage and report on our electrical waste on our behalf.



Note: When your instrument is at the end of its life, please contact your local distributor, or our sales team at Geotech on +44(0)1926 338111 or email sales@geotech.co.uk, who will advise you on the next step in order to help us meet our obligations.

12 Sample Certificate of Calibration

A calibration certificate will be issued following a calibration during manufacture or service of the BIOGAS 300 module. Below is a sample certificate.

CERTIFICATION OF CALIBRATION	
	ISSUED BY: GEOTECH LABORATORY Date of Calibration: 09/03/2015 Certificate Number: BGM0004_150309
Page 1 of 1 Pages Approved by Signatory	
GEOTECHNICAL INSTRUMENTS (UK) LTD Sovereign House, Queensway, Leamington Spa, Warwickshire, CV31 3JR UNITED KINGDOM Tel: +44 (0) 1926 338111 Fax: +44 (0) 1926 338110 E-mail: service@geotech.co.uk www.geotechuk.com	
C Millar Calibration Engineer	
Customer: GEOTECHNICAL INSTRUMENTS (UK) LTD Sovereign House Queensway Leamington Spa Warwickshire CV31 3JR UNITED KINGDOM	
Description: Gas Analyser	Model: BIOGAS 300 Module Serial Number: BGM0004
Methane (CH₄)	
Certified Gas (%)	Instrument Reading (%)
49.8	49.6
15.1	15.0
5.03	5.1
All concentrations are molar. CH ₄ readings recorded at: 35.0 C Barometric Pressure: 1010 mbar	
End of Certificate	

13 EU Declaration of Conformity

EU Declaration of Conformity

This Declaration of Conformity is issued under the sole responsibility of the manufacturer:

Geotechnical Instruments (UK) Ltd.
Sovereign House, Queensway Industrial Estate
Leamington Spa, Warwickshire
CV31 3JR
ENGLAND

Product: BIOGAS 300

Type of equipment: Entry level fixed system biogas analyser for CH4 monitoring.



The BIOGAS 300 described above is in conformity with the relevant Union harmonisation legislation:

2014/30/EU: Electromagnetic capability (EMC)

- EN 50270:2006

2014/35/EU: Low Voltage Directive

- EN 61010-1:2010

Signed for and on behalf of:



Name: Mr. Dean Kavanagh

Position: Programme Director

Done at: Geotechnical Instruments (UK) Ltd

On: 20th April 2016

14 Glossary of Terms

Term	Definition
Air purge	Process used to clear out gas from the tubing within the BIOGAS 300 system. Used as part of a user zero in air.
Baro	The atmospheric pressure at the given location. Measured in milli bar (mb/mbar).
CH ₄	Methane
Coalescing catchpot filter	The filter used to drop water droplets from the sample gas into the catchpot.
Current sink	The BIOGAS 300 'sinks' the 4-20mA into its output terminals. Therefore, the customer must supply a circuit that sources current or use loop powered isolators.
Factory settings	Default settings pre-set at time of manufacture or service.
Firmware	Firmware is the term by which the internal analyser software is known and is not accessible by the client. This firmware is updated to the latest version when the analyser is returned to Geotech for servicing.
Hazard	A potential source of harm.
Hazardous live	Capable of rendering an electric shock or electric burn.
Infrared source	The component used to provide a source of infrared light that can be absorbed by the gas.
Infrared source drift	The component used to provide a source of infrared light has changed its brightness, and may not have been fully compensated by the reference channel. This may be due to age or contamination.
Inline PTFE filter	The component used to help protect the BIOGAS 300 module from water ingress.
Loop powered isolator	A module that isolates a 4-20mA loop and drives the signal to customer's current inputs.
Material safety data sheet	A document that contains information about a particular substance.
Modbus	Modbus is a serial communications protocol and is means of connecting industrial electronic devices.
PLC	Programmable Logic Controller – is a simple computer, used specifically in the BIOGAS 300 to provide analogue outputs.

Polymeric materials	Organic material, natural or synthetic, with high molecular weight made of repetitive structural units. Examples include wool and PVC.
Pump	Used to draw the gas sample from the monitoring point to the BIOGAS 300.
Reference channel	An infrared channel that has no sensitivity to the gas of interest that is used as a baseline for the CH ₄ absorption.