

## BioGas ✓ CDM PORTABLE GAS ANALYZER OPERATION MANUAL



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## 1 Introduction

LANDTEC is the premier manufacturer of products, instruments and software for landfill gas extraction and for regulatory monitoring compliance. LANDTEC has provided the landfill industry with a technologically innovative family of products for more than a decade. These products are the result of field-proven experience in design, operation and maintenance of landfills for environmental compliance.

The BioGas  $\checkmark$  CDM, designed by LANDTEC, is specifically designed for use on Clean Development Mechanism Digesters to monitor Bio Gas. The instrument samples and analyzes the Methane, Carbon Dioxide and Oxygen content of Bio Gas. The BioGas  $\checkmark$  CDM also has the ability to analyze Bio Gas for Hydrogen Sulfide (H<sub>2</sub>S) when used with an optional gas pod. The readings are displayed and can be stored in the instrument and downloaded to a personal computer for reporting, analyzing and archiving.

The BioGas ✓ CDM instrument is shipped in a protective hard case with a foam interior that offers additional protection, transportation convenience and component hardware storage. When properly sealed, the hard case is watertight. The hard case is equipped with a pressure relief valve (located under the handle on the case) that is normally kept closed. If there is a change in elevation, the hard case may not open until the pressure relief valve is opened to equalize internal pressure. When shipping a BioGas ✓ CDM back to LANDTEC for calibration or service, always ship it in the original packaging to protect unit from damage.

Carefully unpack the contents of the BioGas ✓ CDM, inspect and inventory them. The following items should be contained in your package:

- ➤ The BioGas ✓ CDM instrument
- ➢ BioGas ✓ CDM Operation Manual
- Registration/Warranty Card
- > Soft carrying case with replaceable protective window and carrying strap
- > Clear ¼" vinyl sampling hose assembly (5 ft.) with external water trap filter assembly
- Blue ¼" vinyl pressure sampling hose (5 ft.)
- > Spare internal particulate filter element
- > Polypropylene male connector (hose barb) connects to blue vinyl tubing
- > Spare external water trap filter element
- > 100-240 volt battery charger
- Software on CD-ROM
- > RS-232 serial cable for computer/instrument communications
- > Temperature probe (optional)
- Hard carrying case

Complete the Registration/Warranty Card and return it to LANDTEC. The model and serial numbers are located on the back of the BioGas ✓ CDM instrument.

Immediately notify shipping company if the BioGas ✓ CDM unit or accessories are damaged due to shipping. Contact LANDTEC immediately if any items are missing.

For questions regarding instrument operation and procedures, please contact LANDTEC at:

Customer Service or Technical Support	(800) 821-0496 Extension 6131
Factory Service	(800) 821-0496 Extension 6141
Sales USA/International	(800) LANDTEC (526-3832)/(800)821-0496

## 2 General Operational Features

#### 2.1 Physical Characteristics of BioGas / CDM

Number entry Keys

Backlight operation -

and '0' (zero) Key



#### 2.2 Storage

Do not keep the instrument in the trunk of a car or shed because it may be exposed to temperature extremes.

Pump operation and Back Space Key

When not in use, instruments should be kept in a clean, dry and warm environment such as an office.

The instrument batteries should be discharged and fully charged at least once every four weeks regardless of indicated charge state. The discharge function may be carried out by turning on the unit and selecting '**© Reset functions'** from the main menu and leaving the unit powered on at the Pass-code screen over night. Typically the instrument will automatically turn off after approximately 15 minutes of non use to save batteries but the power save function is disabled in the Pass-code screen.

#### 2.3 Battery/Charging

# The Battery Charger IS NOT covered by the unit UL certification. Therefore, when connected to the Battery Charger, the instrument IS NOT intrinsically safe and should not be used in confined spaces.

The battery used in the BioGas ✓ CDM is a Nickel Metal Hydride manufactured as an encapsulated pack from six individual cells. This type of battery is not so susceptible to "memory effects" as Nickel Cadmium batteries, although it is not recommended that the unit be given short-term charges. When the flashing LED indicates "Trickle Charge" the charging is completed and the unit can be disconnected from the charger.



The battery charger indicates when the unit is charging, charged or if there is a fault. A full charge should take approximately 2 hours.

#### 2.4 Instrument Certification

The BioGas√CDM is UL/Sira certified for use in hazardous locations. Specifically certification as to intrinsic safety for use in hazardous locations Class I, Zone 1, AEx ib d IIA T1 (Ta=32°F to +104°F).

For the certification to remain in tact it is vital the instructions in this manual are followed closely and repairs of this equipment be carried out in accordance with the applicable code of practice by an approved repair facility.

It is the responsibility of the operator to determine the protection concept and classification required for a particular application.

#### 2.5 Safety Information

The BioGas ✓ CDM is normally used for measuring gases from digester sites inhaling these gases, or gases from other sites 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 analyzer must be piped to an area where it is safe to discharge the gas. Hazardous gas can also be expelled from the instrument when purging with clean air.

#### 2.6 Turning the Instrument On/Off

When switching the instrument on, a long beep will sound, followed by the LANDTEC logo being displayed and the self-test will commence. Whenever a key is pressed the unit will emit a short 'beep' as an acknowledgement. This function cannot be turned off.

When switching the instrument off, the On/Off button must be held down for approximately 2-3 seconds, at which point a clean air purge will be carried out. If for any reason the instrument 'locks-up' and will not switch off, press and hold the On/Off button for 15 seconds. This will force the instrument to switch off.

#### 2.7 Warm-up Self Test

When switched on, the instrument will perform a predetermined self-test sequence taking approximately 30 seconds, during this time many of the instrument's functions are tested, including:

- General operation
- Pump function
- Gas flow measurement
- Calibration
- Backlight function
- Solenoid function

During the self-test, the following information is also displayed:

- Software version
- Serial Number. Calibration due date.
- Date format.
- Operating language.
- Communication Baud rate.

#### 2.8 Warning and Error Display

During the self-test, if any operational parameters are out of specification or the pre-programmed recommended calibration/service date has passed errors or warnings may be displayed. Only three errors/warnings can be displayed at any time. To ascertain if more errors occurred, use the 'ó' and 'ô' key to scroll up/down the list, to exit from this screen press the "Enter/Store" key 'Ù'.

#### 2.8.1 WARNING Displayed

All warnings displayed will be prefixed by the word '**WARNING**' followed by a relevant description. Two types of warnings may be displayed.

- 1. General warnings that may not have an effect on the instrument's function and those where the selftest has detected a function that is outside the usual programmed operating criteria (e.g. Battery charge low, memory nearly full, etc.).
- 2. Specific warnings of operational parameters that can affect the performance of the instrument (e.g. O<sub>2</sub> Cell out of calibration, CH<sub>4</sub> out of calibration, CO<sub>2</sub> out of calibration, etc.).

The most likely reason for the errors is either an incorrect user calibration, or sensor failure. If an incorrect user calibration has caused the warning, it should be correctable by way of returning the instrument to factory settings, zeroing or carrying out a user calibration as necessary for the relevant function.

#### 2.8.2 ERROR Displayed

All errors displayed will be prefixed by the word '**ERROR**' followed by a number and description. The errors detected by the self-test are usually caused by a user calibration being out of specification or possibly memory corruption. This will have an effect on the functionality of the instrument and should be corrected before use (e.g. 01 - User cal data,  $CH_4$  reading or channel out of specification, 02 - User cal data,  $CO_2$  reading out of specification).

If any other Warnings or Errors are displayed, contact LANDTEC for further information. **LANDTEC is the ONLY authorized service center for the BioGas CDM instrument in the Americas.** 

#### 2.9 Main Menu Screen

Upon self-test completion, the BioGas ✓ CDM will display the main menu screen. All operations are carried out from this starting point. The following information is displayed at this time:

- ① -Field Calibration
- @ -Instrument Information
- ③ -Adjust screen contrast
- ④ -Take Reading
- S -View Data
- 6 -Reset Functions
- Battery Charge graph (5 segment, flashes at 20% remaining)
- Memory Usage graph (5 segment, flashes at 5% remaining)

#### 2.10 Optional Gas Pods

Optional Hydrogen Sulfide gas pods are available for use with the BioGas CDM. These pods are available in three different PPM ranges. Connection to the instrument is made via the data port and exhaust port. The Gas Pods are not classified as intrinsically safe they should not be attached or detached from the instrument in hazardous areas.

Gas Type	Range (PPM)	Resolution (PPM)
H <sub>2</sub> S	0-50	0.1
	0-200	1.0
	0-5000	35

Gas pods are intended for use as an inexpensive detection means and not for regulatory reporting purposes. If the BioGas CDM, fitted with a Gas Pod, indicates the presence of the selected gas, further testing should be performed with regulatory approved instrumentation. LANDTEC recommends that field calibration be performed using the relevant gas and concentration, prior to sampling with a gas pod. If calibrated properly the accuracy of these gas pods are typically 5-10%FS.

#### 2.11 Memory

The instrument's memory is volatile. It is maintained by a battery back-up system, which will maintain the memory while the battery is being changed.

The memory is not to be used as a permanent storage medium and any data should be transferred to a more permanent storage medium as soon as possible. An Instrument should never be stored for prolonged periods with valuable data in its memory.

Although unlikely, sudden shocks, high levels of electromagnetic interference or static discharge may cause memory corruption or loss. If this occurs, the instrument should be Cold Started and the calibration reset to factory settings before further use. Cold starting will erase all data in the instrument including resetting the time and date to the default value.

#### 2.11.1 Cold Start

#### THIS FUNCTION SHOULD BE USED ONLY AS A LAST RESORT.

(For Gas Calibration Error Messages, confirm that Factory Settings and User Calibration are done).

A Cold Start should only be carried out to correct an instrument if no other course of action has proved successful. This function **WILL ERASE** the instrument memory entirely. After a cold start is performed the

user will need to reset the instrument to factory settings, perform a field calibration and reset the internal time/date to the default settings. Please note that the time/date may only be updated through the communication software. It cannot be updated manually.

To carry out a cold start, turn the instrument on and allow it to go through the self test. From the main menu select '**© Reset functions'** this will bring up the Pass-code screen. Enter the pass code **54321** and press 'Ù' to confirm.

After the pass-code entry has been accepted, the instrument will display the Rest menu. There are four options from this screen;

- 1 Return to factory settings
- 2 Cold Start
- 3 Operating Language
- 0 Main Menu

Select option '①' if it is desired to clear the field calibration and reset the factory calibration settings. Press key '①' to confirm this operation or press key '③' to exit to the Reset Menu. If you select '①' to confirm returning to factory settings a message will be displayed confirming the operation. Pressing '①' Yes will clear the field calibration information and reset factory calibration values. Pressing '①' No will return to the Reset Menu.

ONLY select option '@' if a Cold Start is to be carried out. Press key '0' to confirm this operation or press key '0' to exit to the Reset Menu. If you select '0' to confirm cold start a message will be displayed confirming the operation. Pressing '0' Yes will clear all memory in the instrument. Pressing '0' No will return to the Reset Menu.

#### 2.11.2 Operating Language

This function allows the user to select from the available languages loaded in the instrument.

#### 2.12 RF Interference

The gas sensors, especially the Methane sensor, are sensitive to RF interference.

Any device that transmits radio waves can cause your gas readings to fluctuate. Cell phones are the most common cause of the problem. You should never use your cell phone while you are taking gas readings.

## 3 LANDTEC System Gas Analyzer Manager (LSGAM)

#### 3.1 Getting Started

The following instruments are supported the LANDTEC Gas Analyzer Manager



The computer may need some administrative privileges to install the program.

Once the software is installed on your computer with an internet connection this instrument communications program has Auto application updates. This enables you to always have the most current version of the instrument communications LSGAM.

#### 3.1.1 Installation with the CD

Insert the CD into your CD ROM drive and wait for the setup to auto start. Click on the Launch Setup button and follow the onscreen instructions



Once the software is installed you will have a shortcut icon on your desktop which you will use to start the LSGAM instrument program.

#### 3.1.2 Connecting your Instrument



4.





- 1. Connect the INSTRUMENT with the RS232 download Cable to your Computer
- 2. Instrument must be powered on and in the Main Menu screen before starting the software.
- 3. Launch the LSGAM software by clicking on the *is the solution of the soluti*

This is the first screen you will see when starting the program.



If an update has been completed by our IT group when connected to the internet you will receive the notice below.



You may choose either OK or Cancel if this returns you to the desktop you will then need to click on the LSGAM shortcut again.

#### 3.2 LSGAM software

The LSGAM software will automatically search for the instrument.

Note: If the auto detection is unsuccessful please ensure the instrument is in the MAIN MENU screen.

Click on the 44 this will start the instrument search again.

Lit Setup   Readings   Instrument (	g In		I BioGas √ CDM Si Num Ar	nstrument Date: ervice Due Date: Number of Ids: ber of Readings: vailable Memory: Battery Level:	Imperial Dec 19, 2007 2:52:40 PM Jan 1, 2004 2:32:26 PM 0 0 100%
roiect		Instrument			
roject	×	Instrument	nstrument Contents	<u> </u>	Send to Instrument
roject Bio Gas Project (Local) Device Id	Flow Device	Instrument Current Ir Device Id	nstrument Contents	Flow Device	Send to Instrument
oject Bio Gas Project (Local) Device Id BIOINLET	Flow Device Onfrice Plate	Instrument Current Ir Device Id	nstrument Contents	Flow Device	5end to Instrument
Bio Gas Project (Local) Device Id BIOINLET BIOUTLET	Flow Device Orfice Plate User Input	Instrument Current Ir Device Id	nstrument Contents	Flow Device	Send to Instrument

#### 3.2.1 Java

The Java programming is an import part of this software and will be loaded with the CD install.

Using JRE version 1.6.0_I User home directory = C:	)1 Java HotSpot(TM) Client VM \Documents and Settings\bheerdink			
c: clear console window f: finalize objects on fina g: garbage collect h: display this help mess m: print memory usage o: trigger logging p: reload proxy configur q: hide console ANDTEC System Ga	lization queue age ation as Analyzer Manager			
iect Readings View Ard	nive Route			
er Id:	Log In	d Complete	BioGas √ CDM Ser I Numbe Ava	Serial Number:         BM10373           Version:         BIOGAS 1.10L 12/10/201           Units:         Imperial           trument Date:         Dec 19, 2007 2:52:40 PM           ice Due Date:         Jan 1, 2004 2:32:26 PM           Jumber of Ids:         0           rof Readings:         0           Iable Memory:         100%           Battery Level:         81%
iject Setup   Readings   Instrume	nt Configuration   Links	Instrument		
Project			mont Contonte	Send to Instrument
Project Bio Gas Project (Local)	<u>×</u>	Current Instr	unienc concents	
Project Bio Gas Project (Local)	Flow Device	Current Instr		
Project Bio Gas Project (Local) Device Id BIO INILET	Flow Device Orifice Plate	Current Instr		iow Device
Project Bio Gas Project (Local) Device Id BIOINLET BIOUTLET	Flow Device Orifice Plate User Input	Device Id	F F	low Device



will be in the task tray at the bottom of your computer screen where your time is

shown. When starting the program the consol may appear in the back ground of the LSGAM window. You can also open it from the icon with a right click and open consol from the menu that appears. The java console will document what the software is creating. You may be asked to copy and send the java consol to our Support group if you are having a problem with the upload or download application.

There should also be an icon on your desk top like this **called GAM** log this also can help our IT department analyze any problem you might have when this log is sent to them.

The first screen you will see while the Gem is downloading will tell you when the instrument is found.

LANDTEC System Login User Id: Password: Log In	BioGas ✓ CDM found on COM5	Instrument Serial Number: BM10373 Version: B10GAS 1.10L 12/10/2003 Units: Imperial Instrument Date: Dec 19, 2007 3:29:17 PM BioGas & CDM Service Due Date: Jan 1, 2004 3:29:25 PM Number of Ids: Number of Ids: Number of Ids: Battery Level: 99%
Project Setup   Reagings   Instrument Configure	tion   Links	Send to Instrument

Once the download is complete the information about your Gem will be displayed in the top right hand corner.

_	Serial Number:	BM10373
	Version:	BIOGAS 1.10L 12/10/2007
10 A	Units:	Imperial
	Instrument Date:	Dec 19, 2007 3:22:55 PM
BioGas ✓ CDM	Service Due Date:	Jan 1, 2004 3:09:03 PM
	Number of Ids:	3
	Number of Readings:	1
	Available Memory:	99%
	Battery Level:	81%

If time and in the instrument and your PC are different you will receive the message below.



#### 3.2.2 Creating your Project

oject Readings Vi	ew Archive Route	
New Project	Ctrl+N	-
Save Current Projec	t CtrHS	F
Delete Current Proj	ect	
Add Id	Ctrl+NumPad +	
Import Ids		
Comments	Ctrl+C	
Site Ouestions	C#I+O	

Now you can create your local project. Select the Project button from the list select the New Project option.

Choose the option Create an empty project.

Create New Project	×
Please enter a name for your new project	
Project Name:	
Create a new empty project	
C Create a new project with comments and site questions from current project	
C Create a new project from the data in my instrument	
Done Cancel	

You now need to give the project a name in this screen. Once you have entered the name the done button will be come available and clicking on done will put your project in the project list below

Note: An empty project means it has no IDs, and you will be creating a complete new project.

Device Id	Flow Device	

#### 3.2.3 Add New ID

When selecting [Add New ID] the screen below will appear for entering the Device ID. This ID will need to be 8 characters. It is also necessary to choose a flow device the pump run time is the count downtime for collecting

your gas sample. The instrument shuts off at the end of the second's entered. You can extend the pump time or shut the pump off with instrument pump key or with pressing 1 to store reading. The ID screen below uses 90 seconds as a general entry.

Device Id:	BIOINLET	
Device Type:	Bio-Digester Port	*
Flow Device:	Orifice Plate	*
Internal Pipe Diameter:	2.0 in	
Orifice Diameter:	0.5 in	
Pump Run Time:	90 Seconds	
Device Information:	Inlet for Digester	
	Take H2S Reading	

#### < Add New Id

Device Id	BIOINLET	
Device Type	Bio-Digester Port	
Flow Device	Bio-Flo 1.5	*
Internal Pipe Diameter	Bio-Flo 1.5	
Orifice Diameter	Bio-Flo 2	
Dumo Dum Timo	Bio-Flo 3	
Pump Run Time	. User Input	
Device Information		

You will have this list of flow devices to choose from.

Bio-Flo 1.5 - Bio-Flo -2 - Bio-Flo -3 - Orifice Plate - User Input

(If there is no flow device you will choose User Input.)

A completed ID will look similar to the above. It will include the following things;

Device ID must be 8 charters

Device type will be Bio-Digester port

Flow device is described on the pervious ID entry page

Be sure you enter a pump run time

Device information can be entered but is not necessary

If you want to take a H2S Reading you need to put a check mark in the box as shown below.

Device Id:	BIOINLET	
Device Type:	Bio-Digester Port	¥
Flow Device:	Orifice Plate	*
Internal Pipe Diameter:	2.0 in	
Orifice Diameter:	0.5 in	
Pump Run Time:	90 Seconds	
Device Information:	Inlet for Digester	_
	↓ ▼ Take H25 Reading	

Eight (8) is the limit of IDs you can send to the Instrument.

You can create a project with the information that is in your Gem that was downloaded when the instrument was connected. All you will have to do is give the project a name.



#### 3.2.4 Save the Project

With any choice of creating a project "always" Be sure you save the project.



You may create as many projects as you need **BUT** you can only use a set of IDs one time.

The following IDs are alre	ady in use:
ID	Project
BIOINLET	Bio Gas Project
BIOUTLET	Bio Gas Project
NorthSP1	Bio Gas Project

## 3.3 (Local) projects

After creating the project and saving the project it will be storied on you PC. All IDs, you have created for the project will remain together as one file to send to the instrument. These will all be available when you chose the (Local) project from the pull down.

The Projects will be there for you to choose from each time you connect LSGAM to your instrument.

NDTEC System Login ir Id: ssword:	Reading Dow	vnioad Complete	Instrument Serial N BioGas ✓ CDM Service DU Number Number of Re Available M Batter	umber: BM10373 ersion: B10GAS 1.10L 12/10/200 Units: Imperial Dobe: Jan 17, 2008 3:38:07 PM of Ids: 3 adargs: 1 emory: 006/0 Level: 06/0 41%
Project Bio Gas Project (Local) Bio Gas Project (Local)		Instrument	rument Contents	Send to Instrument
D Test Project (Local)		Device Id	Flow De	vice
BIOINLET	Orifice Plate	BIOINLET	Orifice F	late
BIOUTLET	User Input	BIOUTLET	User In	put
NorthSP1	Bio-Flo 1.5	NorthSP1	Bio-Flo	1.5

By placing the mouse arrow over the ID you will see the set up information for that ID.

d: ord:	log In	Download Complete	Instrument	Serial Number: BM10373 Version: BIOGAS 1.10L 12/10/200 Units: Imperial Instrument Date: Jan 17, 2008 3.41:34 PM Service Due Date: Jan 1, 2004 2:35:03 PM Number of Readings: 1 Available Memory: 055% Battery Level: 41%
: Setup   Read	ngs   Instrument Configuration   Links			
Bio Gas P	roject (Local)	Current Ir	nstrument Contents	Send to Instrument
Bio Gas P	roject (Local) 💌	Current Ir	nstrument Contents	Send to Instrument  Flow Device
Bio Gas P Device Id BIOINLET	roject (Local)	Current In Device Id BIOINLET	nstrument Contents	Send to Instrument      Flow Device  Orifice Plate
Bio Gas P Device Id BIOINLET BIOUTLET	roject (Local) Flow Device Orfice Plate User Insut	Current In Current In BIOINLET BIOUTLET	nstrument Contents	Send to Instrument Flow Device Orifice Plate User Input

#### 3.4 Moving IDs to send to the Instrument

Place the mouse arrow at the edge of the first hold down the left key the arrow will change to Select control then A on your key board to highlight all. You can now drag the list to the Instrument side of the screen.

ANDTEC System Login		Uploading Rou	ute	- Instrument -	Serial Number:	BM10373
	IDs	Complete	0 uploaded.		Version: Units:	BIOGAS 1.10L 12/10/2 Imperial
ssword:					Instrument Date:	Jan 17, 2008 3:49:23 I
				BioGas ✓ CDM	Number of Ids:	Jan 1, 2004 2:35:03 P 0
					Number of Readings:	1
Lo	g In				Available Memory:	96%
ject Setup   Reagings   Instrument C	g In		- Instrument		Available Memory: Battery Level:	96% 41%
Jject Setup   Reagings   Instrument C Project Bio Gas Project (Local)	p In	×	Instrument	rument Contents	Available Memory: Battery Level:	96% 41% Send to Instrument
Lo pject Setup   Reagings   Instrument C Project Bio Gas Project (Local) Device Id	3 In Units Flow Device	¥	Instrument Current Inst Device Id	rument Contents	Available Memory: Battery Level:	96% 41% Send to Instrument
Lo pject Setup   Reagings   Instrument C Project Bio Gas Project (Local) Device Id BIOUTLET	p In onfiguration   Links   Flow Device User Input	¥	Instrument Current Inst Device Id	rument Contents	Available Memory: Battery Level:	96% 41% Send to Instrument
Lo oject Setup   Reagings   Instrument C Project Bio Gas Project (Local) Device Id BIOUTLET BIOINLET DIVISION	Plow Device User Input Onfice Plate	<b>y</b>	Instrument Current Inst Device Id	rument Contents	Available Memory: Battery Level:	96% 41% Send to Instrument
Lo oject Setup   Readings   Instrument C Project  Bio Gas Project (Local) Device Id BIOUTLET BIOINLET NorthSP1	Flow Device User Input Onfice Plate Bio-Flo 1.5	×	Instrument Current Inst Device Id	rument Contents	Available Memory: Battery Level:	96% 41% Send to Instrument
Lo oject Setup   Readings   Instrument C Project [Bio Gas Project (Local) Device Id BIOUTLET BIOUNLET NorthSP1	Flow Device User Input Orfice Plate Bio-Flo 1.5	×	Instrument Current Inst Device Id	rument Contents	Available Memory: Battery Level:	96% 41% Send to Instrument

Once you have dragged the list or any selection of IDs to the instrument side the line will change were you have the pointed the mouse arrow and the circle will be come a box.

		Uploading Route		Instrument	Serial Number	** RM10373
ssword:	IDs	Complete	0 uploaded.	BioGas ✔ CDM	Version Units Instrument Date Service Due Date Number of Ids Number of Readings Available Memory Battery Leve	1: BIOGAS 1.10L 12/10/20 2: Imperial 2: Jan 17, 2008 3:51:22 PI 2: Jan 1, 2004 2:35:03 Ph 2: 0 2: 1 4: 95% 4: 95%
rect Setup   Reagings   Instrument C Project Bio Gas Project (Local)	nfiguration   Links		trument	rument Contents		Send to Instrument
Device Id	Flow Device		Device Id	1	Flow Device	(
BIOUTLET	User Input		BIOUTLET		User Input	
	Orifice Plate		BIOINLET		Orifice Plate	
BIOINLET	Bio-Flo 1.5		NorthSP1		Bio-Flo 5	
BIOUTLET	User Input Orifice Plate Bio-Fio 1.5		BIOUTLET BIOINLET NorthSP1		User Input Orifice Plate Bio-Flo 1 5	

Upon releasing the mouse key your IDs will be in the instrument list. Now select Sent to Instrument.

Send to Instrument

#### 3.5 Editing a ID

Offline projects will have "(local)" next to their names. You can edit by highlighting the ID right click and choose from the menu.

Bio Gas Project (Local)	<u>.</u>
Device Id	Flow Device
BIOUTLET	User Input
NorthSP1	Bin-Fin 1.5
BIOINLET	Edit Device Id
SouthSP1	Delete Selected Device Id(s)
NorthSP2	Delete Selected Device (0(3)
SouthSP2	Restore Selected Device Id(s)
SouthSP3	User Input
NorthSP3	User Input

Device Id:	NorthSP1	
Device Type:	Bio-Digester Port	*
Flow Device:	Bio-Flo 1.5	*
Internal Pipe Diameter:	1.5 in	
Orifice Diameter:	1.0 in	
Pump Run Time:	120 Seconds	
Device Information:	Sample Port	
	Take H2S Reading	

#### To delete a ID from the file

Bio Gas Project (Local)	*
Device Id	Flow Device
BIOUTLET	User Input
NorthSP1	Sie Ele 1 E
BIOINLET	Edit Device Id
SouthSP1	Delete Selected Device Id(s)
NorthSP2	Restore Colected Daviso Id/o
SouthSP2	Restore Selected Device Id(s)
SouthSP3	User Input
NorthSP3	User Input
Cruth CO4	0.5

When a line is shown through the ID it is deleted as shown below

Bio Gas Project (Local)	
Device Id	Flow Device
IOUTLET	User Input
lorthSP1	Bio-Flo 1.5
IOINLET	Orifice Plate
jouthSP1	Orifice Plate
VorthSP2	Orifice Plate

Select Restore ID from the same menu the line will be removed.

Page 20

If you have the IDs set up correctly, moved them to the instrument side and are ready to load them to your



3.6 Clearing ID (s) from your instrument or Deleting a Project

I content instrament c	ontents Send to Instrument
Deuise Id	Flow Device
Device Iu	Flow Device
DIVUILE+	User Input
NorthSP1	Bio-Fio-1-5
BIOINLET	Orifice Plate
SOUCHSP1	Orifice Plate
NorthSP2	Orifice Plate
SouthSP2	Bio-Fio 1.5
SouthSP3	User Input
NorthSP3	User Input-

In current instrument contents when selecting the **Clear ID List** option it will draw lines through the IDS. You then need to select **Send to Instrument**. This will clear all IDs from the Instrument.

Currenc Instrument Co							
Device Id	Flow Device						
BIOUTLET	User Input						
NorthSP1	Bio-Flo-1.5						
BIOINLET	Orifice Plate						
SouthSP1	Orifice Plate						
NorthSP2	Orifice Plate						
SouthSP2	Bio-Flo-1.5						
SouthSP3	User Input						
North	input.						

You may also delete one ID from a list by highlighting the ID RIGHT CLICK with your mouse and select the Delete Selected Device option. If you have selected the wrong ID and deleted then you may select the restore option to put the ID back in your list.

If you need to remove a project from your computer you chose the project you wish to remove on the project side then select Delete Current Project.



If Delete Current Project is chosen you will receive the message below



Yes will remove all files that have been created with this project.

#### 3.7 Instrument Configuration

Instrument Settings	Date/Time Sett	ings						
Date/Time Settings	- Date							r Time
Misc Options Units of Measurement		Fet	oruary	Ŧ	2008	¥		11 + : 16 + : 00
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Set Date/Time
	27	28	29	30	31	1	2	
	3	4	5	6	7	8	9	
	10	11	12	13	14	15	16	
	17	18	19	20	21	22	23	Set to System Date/Time
	24	25	26	27	28	29	1	
	2	3	4	5	6	7	8	

You will need to set your time and date from this screen if it is not correct.

<ul> <li>Instrument Settings</li> <li>Date/Time Settings</li> <li>Misc Options</li> <li>Units of Measurement</li> </ul>	Misc Options	
	Low Flow Warning: 50 (ml/Minute) Purge Time: 30 (Seconds)	
	Set Options	

These are options in the instrument that may be changed if you wish to. LANDTEC recommends leaving them set to the default values.

Instrument Settings	Units or measurement		
		C Metric	Imperial (USA)
Data Logging	Transducer Pressure:	Millibars (mb)	Inches water ("H20)
Miss Options	Barometric Pressure:	Millibars (mb)	Inches mercury ("Hg)
Ab Units of Massurement	Temperature:	Degrees Celsius (°C)	Degrees Fahrenheit (°F)
	Flow:	Meters cubed per hour (m <sup>3</sup> /h)	Standard cubic feet/min (SCFM)
	Power:	Kilowatts (KW)	British Thermal Units (BTU)
	Anemometer:	Meters per second (m/s)	Meters cubed per hour (m³/h)
	Pipe Diameter:	Millimeters (mm)	Inches (")
		Set Units	

You may use Imperial or Metric unites of measurement. To change unites a Password is needed. This may be obtained from LANDTEC.

Chang	e Unit	ts of Me	easurem	ent		×
	Please instrum	enter the re ient's units o	quired passw of measureme	iord to int.	) change th	ne
Passwor	rd: 📔					
			Don	e	⊆ancel	

#### 3.8 Instrument Readings

#### 3.8.1 To save your readings file

When you open the readings file your project will be listed **ONLY** if you have created a project with these IDs that you have taken readings. Your readings will be shown with no project listed

1000	
Project F	Poster
No Project>	
	Vo Project> Vo Project> Vo Project> Vo Project>

Example of a file if you have no ID or have not created a project .

and the second se						
igust 23, 2007 5:03:17 PN	1PDT [1]	Post R	eadings	Export Reading	s <u>C</u> lear Instrument Readings	
				<u> </u>		
Device Id	Date Time	CH4	CO2	Oz	Comments	Project

#### 3.8.2 Export Readings

To save your readings to an csv file for your excel work sheet you will choose the Export Readings button.

Project Setup Readings	Instrument Configuration   Links			
August 6, 2007 2:57:14	PM PDT [23]	Post Readings	Export Readings	Clear Instrument Readings

You will now see the stamp readings screen.

S	tamping Information
	Field Technician:
	Download Technician:
	Ambient Temperature:
	Precipitation:
	Wind Speed:
	Wind Direction:
	Done Cancel

You need to fill in the above information. or receive the message below if you do not fill in the above screen.



This screen will allow you to review you readings before saving

	5	<b>V</b>	~	V	1	2		1	V	1	V	V	5	7	
			CH4	C02	02	Balance	%LE	LBaro. Press.	CO	H25	502	NO2	CL2	H2	1
	Device ID	Date/Time	%	%	%	%	%	inches Hg	ppm	ppm	ppm	ppm	ppm	ppm	1
7	BIOINLET	12/19/07	0.0	0.0	20.4	79.6	0.0	29.0	N/A	N/A	N/A	N/A	N/A	N/A	1.
~	BIOINLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N/A	N/A	1
7	BIOUTLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N/A	N/A	Ϊ.
7	BIOUTLET	1/17/08 3	0.0	0.0	20.6	79.4	0.0	28.85	N/A	N/A	N/A	N/A	N/A	N/A	1

Project Setup Readings Instrumer February 12, 2008 11:16:10 AM PST Device Id BIOINLET BIOINLET BIOUTLET BIOUTLET	ent Configuration   Links	Post R	ľ		<b>V</b>		00										
Project Setup Readings Instrumer February 12, 2008 11:16:10 AM PST Device Id BIOINLET BIOINLET BIOUTLET BIOUTLET	ent Configuration   Links   ST [4]	Post R		1.01	And and a second s				V	V		V	V		V		
Device Id BIOINLET BIOINLET BIOUTLET BIOUTLET			지지	Device ID BIOINLET BIOINLET	Date/Time 12/19/07 1/17/08 2	CH4 % 0.0 0.0	CO2 % 0.0 0.0	O2 % 20.4 20.6	Balance % 79.6 79.4	%LEL % 0.0 0.0	Baro. Press. inches Hg 29.0 28.86	CO ppm N/A N/A	H2S ppm N/A N/A	SO2 ppm N/A N/A	NO2 ppm N/A N/A	CL2 ppm N/A N/A	H2 ppm N/A N/A
BIOINLET BIOINLET BIOUTLET BIOUTLET	Date Time	CH4	V	BIOUTLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N/A	N/A
BIOINLET BIOUTLET BIOUTLET	12/19/07 3:04 PM	0.0	7	BIOUTLET	1/17/08 3	0.0	0.0	20.6	79.4	0.0	28.85	N/A	N/A	N/A	N/A	N/A	N/A
BIOUTLET BIOUTLET	1/17/08 2:54 PM	0.0															
BIOUTLET	1/17/08 2:56 PM	0.0															
	1/17/08 3:14 PM	0.0															
			4	[													2

Example of how the export screen will appear.

								Number of R	eadings	: 4					
÷	Export	Reading	s to	CS	V										×
		V	◄	◄	◄	V	~		◄	◄	•	◄	◄	◄	
	Device ID	Date/Time	CH4 %	CO2 %	02 %	Balance %	%LEI %	.Baro. Press. inches Hg	CO ppm	H2S ppm	SO2 ppm	NO2 ppm	CL2 ppm	H2 ppm	ł
2	BIOINLET	12/19/07	0.0	0.0	20.4	79.6	0.0	29.0	N/A	N/A	N/A	N/A	N/A	N/A	1.
2	BIOINLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N/A	N/A	1
2	BIOUTLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N/A	N/A	ī
2	BIOUTLET	1/17/08 3	0.0	0.0	20.6	79.4	0.0	28.85	N/A	N/A	N/A	N/A	N/A	N/A	ī.

Taking the check mark out of the box beside a row will remove that reading or above will remove the column you do not want in the csv file you are saving. All downloaded will be saved by time

Log In

January 31, 2008 10:35:47 AM PST [5]	*	Post R	leadings	Export R	eadings	Clear Instrument Reading
February 12, 2008 11:16:10 AM PST [4]			r			
February 11, 2008 1:07:00 PM PST [1]		CH4	CO2	O2		Comments
February 11, 2008 11:57:11 AM PST [?]		0.0	0.1	20.3		
February 11, 2008 8:54:41 AM PST [?]		0.0	0.1	19.9		
February 7, 2008 11:12:35 AM PST [?]	_	0.0	0.1	20.2		
February 7, 2008 8:52:50 AM PST [?]		0.0	0.1	20.4		
February 6, 2008 1:39:19 PM PST [?]		0.0	0.1	20.4		
January 31, 2008 10:35:47 AM PST [5]	-					

F

	<b>V</b>	<b>v</b>	~	V	~	<b>V</b>	~	V	7	~	~	~	F
			CH4	CO2	02	Balance	%LEL	Baro. Press.	CO	H25	502	NO2	C
	Device ID	Date/Time	%	%	%	%	%	inches Hg	ppm	ppm	ppm	ppm	PF
~	BIOINLET	12/19/07	0.0	0.0	20.4	79.6	0.0	29.0	N/A	N/A	N/A	N/A	N,
~	BIOINLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N,
~	BIOUTLET	1/17/08 2	0.0	0.0	20.6	79.4	0.0	28.86	N/A	N/A	N/A	N/A	N,
~	BIOUTLET	1/17/08 3	0.0	0.0	20.6	70.4			812.6	NI/A	61/0	NI/0	61
					2010	/9.4	0.0	28.85	N/A	14/10	19/0	19/14	JIN.
-					2010	1/3.4	0.0	28.85	N/A	14/19	19/0	19/0	

Select the Save File button to save to a csv file.

When saving the Readings File you will receive this screen to select the location and give the file a name



#### 3.8.3 Clearing Readings from your Instrument

Project Setup Readings Instrument Configuration Links			
August 6, 2007 2:57:14 PM PDT [23]	Post Readings	Export Readings	Clear Instrument Readings

Then to clear readings from the instrument choose this button

-				
$\langle \varphi \rangle$	By continuing the instrument	with this oper	ation, all readings	in re
	you sure you	want to do thi	s?	

You will receive this message to make sure you wish to delete the readings.

#### 3.8.4 Archiving

To archive a project and/or readings file Choose the Create Archive from the Archive options.



You will see this screen to save your archived file.

🗢 Save						×
Save in:	Archive F	les		- 🤉	9 📖 🚍	
My Recent Documents						
Desktop						
My Documents						
My Computer						
My Network	File name:	LSGAM_West				Save
Places	Files of type:	All Files			×	Cancel

This archive file will give you the ability to e mail a file to another user of the LSGAM program. To put the files in the LSGAM program select the Restore from Archive option

Restore From Archive...

The screen below will open for you to select the file.

open	-		
Look in:	Archive Files	<u> </u>	1 📁 🛄 🗇
My Recent Documents	LSGAM_West.gam		
Desktop			
<i>(</i>			
ly Computer	Ele pamei		
ly Network			
Places	Files of type: GAM Archiv	ve File	<ul> <li>Cance</li> </ul>

#### 3.9 LANDTEC System Login

The on line user will login to LANDTEC System site.

This login screen will always be in the left hand corner of the screen but unless your company is a subscriber to the LANDTEC System EnviroComp internet service you will not use this login or have a User ID and password.

Jser Id:	_
Password:	

## 4 General Operations Menu

The following features and functions are selectable from the main;

- ① -Field Calibration
- @ -Instrument Information
- 3 -Adjust screen contrast
- ④ -Take Reading
- 5 -View Data
- 6 -Reset Functions

#### 4.1 Field Calibration

Whenever carrying out a user calibration function it is important to ensure the correct value gas is entered into the instrument. Additionally, in the case of a zeroing function, ensure only certified gas or ambient air is used and no connection is made to a sample point during the process. The calibration cylinders sold by LANDTEC have a volume of 17 liters. The regulator, sold by same, is set to 0.5 liters per minute and 5 psig maximum flow pressure. A normal field calibration usually requires the gas to be running for about two minutes.

A field calibration should be carried out prior to use or when the ambient operating temperature changes greater than +/- 20 degrees Fahrenheit.

Upon selecting '**① Field Calibration**' the instrument will display a summary of the last gas calibration and the date it was done (if available in memory). The Field Calibration Summary is broken up into five stages;

Stage 1 – Zero  $CH_4$  (and  $H_2S$  if optional pod is being used) Stage 2 – Span  $CO_2$  and  $CH_4$ Stage 3 – Zero  $O_2$ Stage 4 – Span  $O_2$ Stage 5 – Span  $H_2S$  (if optional pod is being used)

There are three options available from the Field Calibration Summary Screen;

- ① -Calibrate Now
- ② -Calibration Check
- 3 -Main Menu

The calibration and calibration check procedures follow the five stages shown above. The instrument has extensive instructions to walk the user though each stage.

#### 4.1.1 Calibrate Now

#### Stage 1

Selecting  $\oplus$  -Calibrate Now brings up the Clean Air Purge Screen. All hoses should be disconnected from sample points and optional gas pod should be attached, if being used. Pressing ' $\oplus$ ' Begins the purge cycle. Typically the purge is set to 30 seconds but can be changed though LSGAM. It is important to allow the purge to occur especially if using the optional gas pod.

After the purge is complete the Zero  $CH_4$  and  $H_2S$  screen is displayed. Press the 'O' pump key to draw fresh air through the instrument or allow certified gas with no  $CH_4$  or  $H_2S$  to flow through the instrument. Wait until the gas readings are stable then press 'O' to zero the channels. The instrument will display a 'user zero complete' message and proceed to the Span  $CH_4$  and  $CO_2$  screen.

#### Stage 2

On all the span screens the "Target" value is the certified value of the calibration gas being used, it is crucial that this value is correct. If the target value shown is not the same as the gas being used, press the '⑤' to change the certified target value. Once the target value is correct flow the calibration gas through the instrument, the pump can be used if necessary. Wait until the gas readings are stable then press '①' to span calibrate the channels. The instrument will display a 'Calibration Complete' message and proceed to the Zero  $O_2$  screen.

#### Stage 3

If using a gas mix with no oxygen for the  $CH_4$  and  $CO_2$  span, it can be left attached and flowing gas. Wait until the gas reading for  $O_2$  is stable, and has settled to its lowest value, then press the ' $\oplus$ ' to zero the channel. The instrument will display a 'user zero complete' message and proceed to the Span  $O_2$  screen.

#### Stage 4

Ensure that the gas being supplied has the desired amount of oxygen and that the Target value matches the gas being supplied. If the target value shown is not the same as the gas being used, press the '⑤' to change the certified target value. Once the target value is correct flow the calibration gas through the instrument, the pump can be used if necessary. Wait until the gas reading is stable then press '①' to span/calibrate the channel. The instrument will display a 'Calibration Complete' message and proceed to the Span  $H_2S$  screen.

#### Stage 5

If using the optional gas pod ensure that the pod is connected and ensure that the gas being supplied has the desired amount of Hydrogen Sulfide and that the Target value matches the gas being supplied. If the target value shown is not the same as the gas being used, press the '⑤' to change the certified target value. Once the target value is correct flow the calibration gas through the instrument, the pump can be used if necessary. Wait until the gas reading is stable then press '①' to span/calibrate the channel. The instrument will display a 'Calibration Complete' message and proceed to the field calibration summary screen.

If not using the optional gas pod press the ' $^{\circ}$ ' to Skip the H<sub>2</sub>S span and the instrument will proceed to the field calibration summary screen.

#### **Field Calibration Summary**

Upon completion of the stages above the field calibration summary screen will detail the results from each stage. The values shown are the values after the stage was completed. If there are dashes '----' it indicates that this stage was skipped or not successfully completed. There are three options available. Pressing the ' $\mathbb{O}$ ' will store the calibration record, display a 'calibration complete and stored in memory' message and continue to the main menu.

Pressing the '@' will start the calibration process over again and press the '3' will return to the main menu without storing the results.

Note, once one or more of the calibration zero or span operations is/are preformed the instrument will be using those calibration parameters even if the results are not stored.

#### 4.1.2 Calibrate Check

The calibration check process is identical to the calibration process but it does not adjust the instruments channels it only checks the channels against known gas values.

#### Stage 1

Selecting  $\oplus$  -Calibrate Now brings up the Clean Air Purge Screen. All hoses should be disconnected from sample points and optional gas pod should be attached, if being used. Pressing ' $\oplus$ ' Begins the purge cycle. Typically the purge is set to 30 seconds but can be changed though LSGAM. It is important to allow the purge to occur especially if using the optional gas pod.

After the purge is complete the Zero  $CH_4$  and  $H_2S$  screen is displayed. Press the '③' pump key to draw fresh air through the instrument or allow certified gas with no  $CH_4$  or  $H_2S$  to flow through the instrument. Wait until the gas readings are stable then press '①' to continue. The instrument will proceed to the Span  $CH_4$  and  $CO_2$  screen.

#### Stage 2

On all the span screens the "Target" value is the certified value of the calibration gas being used, it is crucial that this value is correct. If the target value shown is not the same as the gas being used, press the '⑤' to change the certified target value. Once the target value is correct flow the calibration gas through the instrument, the pump can be used if necessary. Wait until the gas readings are stable then press '①' to continue. The instrument will proceed to the Zero  $O_2$  screen.

#### Stage 3

If using a gas mix with no oxygen for the  $CH_4$  and  $CO_2$  span, it can be left attached and flowing gas. Wait until the gas reading for  $O_2$  is stable, and has settled to its lowest value, then press the ' $\oplus$ ' to continue. The instrument will proceed to the Span  $O_2$  screen.

#### Stage 4

Ensure that the gas being supplied has the desired amount of oxygen and that the Target value matches the gas being supplied. If the target value shown is not the same as the gas being used, press the '⑤' to change the certified target value. Once the target value is correct flow the calibration gas through the instrument, the pump can be used if necessary. Wait until the gas reading is stable then press '①' to continue. The instrument will proceed to the Span H<sub>2</sub>S screen.

#### Stage 5

If using the optional gas pod ensure that the pod is connected and ensure that the gas being supplied has the desired amount of Hydrogen Sulfide and that the Target value matches the gas being supplied. If the target value shown is not the same as the gas being used, press the '⑤' to change the certified target value. Once the target value is correct flow the calibration gas through the instrument, the pump can be used if necessary. Wait until the gas reading is stable then press '①' to continue. The instrument will proceed to the calibration check summary screen.

#### Calibration Check Summary

Upon completion of the stages above the calibration check summary screen will detail the results from each stage. The values shown are the values after the stage was completed. If there are dashes '----' it indicates that this stage was skipped or not successfully completed. There are three options available.

Pressing the ' $\oplus$ ' will store the calibration check record, display a 'cal. check complete and stored in memory' message and continue to the main menu.

Pressing the '@' will start the calibration process and press the '3' will return to the main menu without storing the results.

Note, once one or more of the calibration zero or span operations is/are preformed the instrument will be using those calibration parameters even if the results are not stored.

#### 4.2 Instrument Information

This function allows the user to view a verity of information about the instrument including;

- Serial number
- Service Plan
- When Service is due
- Last Field Calibration date
- Operating Language
- Communication baud rate
- Number for readings in memory
- Number of IDs in memory
- Date format
- Current time and date setting

#### 4.3 Adjust Screen Contrast

The BioGas ✓ CDM automatically adjusts the screen contrast according to the ambient temperature to maintain normal viewing.

The contrast can be manually adjusted by pressing '③' from the main menu. This will bring up the Adjust Contrast screen. The '④' and '⑥' keys can be used as cursor keys to adjust the contrast. The manual contrast setting is stored when the '①' key is pressed.

## 5 Taking Readings

Prior to going on site, it is good practice to ensure:

- All necessary ID codes have been uploaded via LSGAM software.
- The time and date are correct.
- The water trap has a clean and dry filter fitted.
- The inlet-port particulate filter is clean and dry.
- A supply of spare filters is available in case of accidental water blockage or contamination.
- The battery has a good charge (minimum 25% charge, even if only a few readings are required).
- The memory has sufficient space available.
- The CH<sub>4</sub>, CO<sub>2</sub> and O<sub>2</sub> (H<sub>2</sub>S for Gas Pod if fitted) readings have been zeroed without gas concentration present.
- Check the span calibration with a known concentration calibration gas.

Travel to the site with the analyzer in the vehicle's interior - not in the trunk or truck bed, where it may be subjected to extremes of temperature and possible shock damage. Do not place the analyzer against anything hot (e.g. gas extraction pipe, car body or in an unattended car during the summer). This may cause erroneous readings.

When moving around a site, protect the instrument from strong direct sunlight, heavy rain or wind-chill. Strong direct sunlight can raise the temperature of the instrument beyond its operating range. If this occurs, the LCD display will appear almost black and the contrast setting cannot alter the contrast. Typically no permanent damage is done and after the instrument cools the screen will become readable again.

Always use the water trap! If the water trap becomes flooded, change the filter immediately and ensure all tubes are clear before re-use.

Readings can be taken with or without IDs loaded in the instrument. However an ID must be used if the instrument is going to calculate flow. When using IDs it is essential that the relevant ID be uploaded to the Instrument. An ID **cannot** be entered from the Instrument.

## 5.1 Select ID

To take a reading press '**④**' from the main menu, if IDs are loaded in the instrument select the ID by pressing the appropriate number. If none of the IDs are to be used, press the '**Ù**' key to continue with out an ID. The process begins with information about the ID selected or lack of an ID selected. Then a clean air purge will be completed. After the purge cycle the instrument will proceed to the zero pressure transducers screen.

#### 5.2 Pressure Readings

Zeroing the pressure transducers is recommended if accurate pressure readings or flow calculations are necessary. The instrument has complete on screen instructions on how to perform this operation. After the transducers are zeroed the hoses can be attached to the sample points where pressure readings are required and the pressure can be stored. It is important to allow the pressure to stabilize, this typically takes 15 to 30 seconds, after connecting or disconnecting the hoses to obtain accurate pressure readings.

#### 5.3 Temperature Readings

Temperature readings can be manually input or obtained automatically by the optional temperature probe. If using the instrument to calculate flow a temperature reading is required. Once a temperature is stored the instrument will automatically proceed to the gas readings screen.

#### 5.4 Gas Readings

When the instrument enters the gas reading screen the pump will automatically come on and run for the specified sampling duration. The pump key can be pressed to extend the sample time if necessary. It is important to allow the gas readings to stabilize before storing the reading.

On the gas readings screen the previously stored pressure and temperature readings are shown. If any of these values are incorrect pressing the '@' key will allow re-reading the pressures and temperature. If the data is good and the gas readings are stable pressing the '@' key will store the reading and the instrument will display a 'complete reading stored' message and return to the main menu.

#### 5.5 View Readings

The readings stored can be viewed by pressing the '⑤' key from the main menu. Any calibration or calibration check information as well as gas sample readings can be viewed. When viewing the calibration data there are three readings stored for each calibration. One labeled 'C\_BEFORE' which is what the instrument was reading before the field calibration. One labeled 'C\_AFTER' which is what the instrument read after the field calibration and one labeled 'C\_TARGET' which is the target values that were used during the field calibration.

Calibration check readings have two readings associated to each one. The first labeled 'C\_CHECK' which is what the instrument read during the check and the last labeled 'C\_TARGET' which is the target values that were used during the calibration check process.

#### 5.6 Cross-Gas Effect

#### 5.6.1 Methane, Carbon Dioxide and Oxygen

The Methane reading is filtered to an infrared absorption frequency of  $3.41\mu m$  (nominal), the frequency specific to hydrocarbon bonds. Instruments are calibrated using certified Methane mixtures and will give correct readings provided there are no other hydrocarbon gasses present within the sample (e.g. ethane,

propane, butane, etc.). If there are other hydrocarbons present, the Methane reading will be higher (never lower) than the actual Methane concentration being monitored.

The extent to which the Methane reading is affected depends upon the concentration of the Methane in the sample and the concentration of the other hydrocarbons. The effect is non-linear and difficult to predict.

The Carbon Dioxide reading is filtered to an infrared absorption frequency of 4.29µm (nominal), the frequency specific to Carbon Dioxide. Therefore, any other gases usually found on landfill sites will not affect the Carbon Dioxide reading.

The Oxygen sensor is a newly developed galvanic cell type and suffers virtually no influence from  $CO_2$ , CO,  $H_2S$ ,  $NO_2$ ,  $SO_2$  or  $H_2$ , unlike many other types of Oxygen cell.

The infrared sensors will not be "poisoned" by other hydrocarbons. Normal operation will resume as soon as the gas sample has been purged.

Note - there has been one reported incident of a high reading due to the presence of Carbon Disulfide, which has a similar absorption frequency to Carbon Dioxide.

#### 5.6.2 H<sub>2</sub>S Optional Gas Pods

The Gas Pods used to measure  $H_2S$  and CO do suffer from cross-gas effects. Such effects are not accurately specified. However, the following table may be useful as a guide. This table represents how many ppm would be read by a Gas Pod if 100ppm of the interfering gas was applied, (with no other cross-contaminates being present in the sample).

Cell	CO	H₂S	SO <sub>2</sub>	NO <sub>2</sub>	CL <sub>2</sub>	H <sub>2</sub>	CH₄	CO <sub>2</sub>
CO	100	<3	0	<-20	0	<40	0	0
H <sub>2</sub> S	<0.5	100	~20	~-20		~0.1	0	0

**NOTE:** All readings are given in parts per million (ppm). The life of an electrochemical cell is determined by exposure to gasses, typical life being one to two years. It is recommended that Gas Pods be field calibrated at regular intervals.

## 4.7 Troubleshooting

Problem	Corrective Action/Reason
Unit does not turn on or operation is erratic	Battery charge is too low-recharge batteries.
	Unit is too hot - cool down unit and try again.
"Flow Fail" is displayed and an audible alarm	Contact Factory Service.
is heard	Remove blockage and retry
	The particulate filter or water trap filter needs replacing.
Readings taken are not what was expected	Unit may be out of calibration. Calibrate unit with
	known gas concentration.
	Water trap or particulate filters are clogged. Replace
	filter(s).
Readings swing up or down wildly as they are	Cell phones and other sources of RF interference can
being taken	while taking readings. Don't use your cell priorie
Unit displays***** or >>>>	These symbols are substituted when the measured
	reading is out of range of the instruments capabilities in
	some fields or when a value needs to be entered
	manually such as temperature.
Oxygen reading is high on all wells	Check that the water trap housing is screwed on tight.
	instrument inlet
	Check the wellbead inset for cracks replace O-ring on
	insert.
	Field calibrate Oxygen channel.
Unit will not download readings or an error	Verify that the communications software is the right
occurs while downloading.	version for the instrument being used.
	Check that the proper serial port is selected in the
	Contact Factory Service
Methane and Carbon Dioxide readings drift	Perform a field calibration and check well again. Verify
	cal gas is flowing when regulator is turned on.
	Verify all connections are tight and filters are not
	Clogged. Contact Factory Service
Oxygen readings drift	Perform a field calibration - zero and span
	Contact Factory Service.
	,
Black screen displayed when unit turned On	Charge unit over night and try again
	Unit too hot - cool down and try again.
	Try adjusting contrast level.
	Contact Factory Service.
Nothing happens when the Gas Pod is	Remove and re-seat the Gas Pod.
Installed Temperature does not undate when	Contact Factory Service.
temperature probe is installed	Check the probe plug is screwed together tightly
	Contact Factory Service.

## 6 Technical Specifications

## 6.1 Physical

Weight	4.4 lbs.
Size	L 2.48" x W 7.48" x D 9.92".
Case material	Anti-static ABS.
Keys	Membrane panel.
Display	Liquid Crystal Display 40 x 16 characters. Fiber optic woven backlight for low light conditions.
Filters	User replaceable integral fiber filter at inlet port and external PTFE water trap filter.

## 6.2 General

Certifications	UL Certified to Class 1, Zone 1, AEx lb d IIa T1
Temperature measurement	With optional probe 14°F to 167°F.
Temperature accuracy	±3.6ºF (with optional temperature probe).
Communications	RS232 protocol via download lead with variable baud rate.
Relative pressure	±250 mbar from calibration pressure

## 6.3 Power supply

Battery type	Rechargeable Nickel Metal Hydride battery pack containing six 4AH cells. <b>Not user replaceable</b> . Lithium Manganese battery for data retention.
Battery life	Typical use 10 hours from fully charged condition.
Battery charger	Separate intelligent 2A battery charger powered from AC voltage supply (110-230V).
Charge time	Approximately 2 hours from complete discharge.
Alternative power	Can be powered externally for fixed-in-place applications only. Contact CES-LANDTEC for further information.
Battery lifetime	Up to 1,000 charge/discharge cycles.

## 6.4 Gas Ranges

Detection principle	$CO_2$ and $CH_4$ by dual wavelength infrared cell with reference channel. $O_2$ by internal electrochemical cell.				
Oxygen cell lifetime	Approximately 18 months in air.				
Typical Accuracy	Gas	<u>0-5% volume</u>	<u>5-15% volume</u>	<u>15%-FS</u>	
0 - Full Scale	CH₄	±0.5%	±1%	±3% (70%)	
	CO <sub>2</sub>	±0.5%	±1%	±3% (40%)	
	<b>O</b> <sub>2</sub>	±1%	±1%	<b>±1%</b> (25%)	
Response time, T90	$CH_4$	≤20 seconds			
	CO <sub>2</sub>	≤20 seconds			
	O <sub>2</sub>	≤20 seconds			
Range	$CH_4$	$CH_4$ 0-70% to specification, 0-100% reading. $CO_2$ 0-40% to specification, 0-100% reading.			
	CO <sub>2</sub>				
	O <sub>2</sub>	0-25%			

#### 6.5 Pump

Typical flow	300 cc/min.	
Flow fail point	50 cc/min approximately.	
Flow with 200 mbar vacuum	250 cc/min approximately.	
Vacuum	70 inches $H_20$ .	

#### 6.6 Operating Conditions

Operating temp range	32°F to 104°F.			
Relative humidity	0-95% non-condensing.			
Atmospheric pressure range	700-1200 mbar. Displayed in Inches of Mercury (5.9 – 35.4"Hg). Not corrected for sea level.			
Atmospheric pressure accuracy	±5 mbar approximately.			
Case seal	IP65.			

#### 6.7 Optional Gas Pods

Typical Accuracy (Subject to User calibration).	Gas H <sub>2</sub> S	<b>0-Full Scale</b> ±10% FS
Response time, T90	H <sub>2</sub> S	≤60 seconds
Range	H <sub>2</sub> S	0-50 ppm 0-200 ppm 0-5,000 ppm

#### 7.0 Service

The Biogas Check CDM instrument should be regularly serviced to ensure correct and accurate operation. LANDTEC recommends a service and factory recalibration **every 6 months**.