

# GRAINPRO® CARBON DIOXIDE ANALYZER

# INSTRUCTION MANUAL

MA4068RAD0718-1



**“A GREEN, NOT ONLY FOR  
PROFIT COMPANY”**



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## 1. INTRODUCTION

The **GrainPro® Carbon Dioxide Analyzer (CO<sub>2</sub> Analyzer)** is a microprocessor-based instrument used for the detection of %CO<sub>2</sub> (Carbon Dioxide) and uses an NDIR (Nondispersive Infrared) sensor for measuring CO<sub>2</sub> levels range of 0 to 80% CO<sub>2</sub> content. With a microprocessor based unit, it has a data logging facility and can store data in real time which can be downloaded into a computer.

When an NDIR sensor encounters CO<sub>2</sub>, a voltage signal is generated in proportion to the gas concentration. This voltage signal is amplified, digitized and displayed on the instrument's OLED (Organic Light-emitting Diode) display.

The CO<sub>2</sub> Analyzer has the following important parts: gas sensor, signal conditioning electronic circuit, microprocessor board, digital display, a sampling pump and a battery pack. It is powered by a 7.4V Li-ion rechargeable battery.

### 1.1. FEATURES:

- 1.1.1. Portable.
- 1.1.2. More than 5 years sensor expected life span.
- 1.1.3. Backlit 20 x 4 Alphanumeric OLED display.
- 1.1.4. Microprocessor-based instrument, it can log and download data on a computer.
- 1.1.5. Data logging capability for up to 3000 samples.
- 1.1.6. Records gas readings along with time/date.
- 1.1.7. Rechargeable battery pack.
- 1.1.8. Low battery indicator.
- 1.1.9. Enclosed in high temperature resistant plastic.
- 1.1.10. Includes USB cable for PC connectivity.
- 1.1.11. Sampling tube with dust filter.
- 1.1.12. Alarm with audio and visual LED display.

### 1.2. PRODUCT GUARANTEE:





- 1.2.1. In accordance with the terms and conditions herewith, GrainPro Inc. fully guarantees the quality of this product provided it is used according to the instructions in this manual.
- 1.2.2. Please read and understand the manual thoroughly before using the Carbon Dioxide Analyzer.





### 1.3. COMMENTS, COMPLAINTS, AND/OR CLARIFICATIONS:

- 1.3.1. Please contact **customercare@grainpro.com**.  
We shall be glad to address any of your concerns.

## 2. CHECKLIST

Please inspect your GrainPro® CO<sub>2</sub> Analyzer package to ensure it includes the following items:

PART NAME	DESCRIPTION	IMAGE
2.1. CO <sub>2</sub> Analyzer	2.1.1. CO <sub>2</sub> Analyzer, 0-80% range, IR sensor with Rechargeable Battery (7.4 V/1500 mAH Li-ion)	 A handheld yellow and black CO2 analyzer with a red display screen and a keypad.
2.2. Battery Charger	2.2.1. Battery Charger, 110V/250VAC with 4 different types of interchangeable plugs.	 A black battery charger with a coiled cable and four different types of interchangeable power plugs shown below it.
2.3. Sampling Tubes with dust filter	2.3.1. Sampling tube, 40cm with dust filter for inlet  2.3.2. Sampling tube, 40cm with dust filter for outlet	 Two sampling tubes with dust filters. The left tube has a white dust filter and a red label. The right tube has a white dust filter and a black label.
2.4. Screwdriver	2.4.1. Double ended screwdriver.	 A blue double-ended screwdriver with a silver metal tip.

2.5. USB Cable	2.5.1. USB Cable used to connect and download stored data from CO <sub>2</sub> Analyzer to a computer.	
2.6. USB Flash Drive	2.6.1. USB Flash drive includes; a) Software b) CO <sub>2</sub> Analyzer Instruction Manual c) Instruction Video d) GP Audio Visual Presentation e) Flyer (All GP Products)	
2.7. Hard Plastic Case	2.7.1. Hard plastic case, black 28cm x 23cm x 8cm with handle and lock.	
2.8. Calibration Certificate	2.8.1. Calibration certificate	

2.9. Instruction Manual

2.9.1. Instruction manual for CO<sub>2</sub> Analyzer



3. COMPONENTS



Figure 1. Carbon Dioxide Analyzer

COMPONENTS	DESCRIPTION / FUNCTION
------------	------------------------

3.1. Power LED	The green LED lights up when the instrument is turned ON.
3.2. Sampling LED	The blue LED lights up when the instrument is in measurement mode.
3.3. Alarm LED	<p>The red LED lights up when the CO<sub>2</sub> concentration is above the set alarm value.</p> <p>NOTE: Alarm setting can be used for other applications requiring ≥80% CO<sub>2</sub> level.</p>
3.4. "Up" Key	<p>a) Menu Page:</p> <p>Key is used to enter into the Sampling/Purging Mode.</p> <p>b) Sampling Mode:</p> <p>Key is used for selection or to shift the cursor.</p> <p>c) Calibration Mode:</p> <p>Key is used to increase the value of the digit where the cursor is placed.</p> <p>d) Settings Mode:</p> <p>Key is where setting and Turn off are located. In Setting, this Key is used to increase the value of the digit on which the cursor is placed.</p> <p>e) Download/Reset Mode:</p> <p>In this mode, you can download/ erase data or check the battery status. Press this key to download all the stored data/records on your computer.</p>
3.5. "Down" Key	<p>a) Menu Page:</p> <p>Key is used to enter into the Calibration Mode.</p> <p>b) Calibration Mode:</p> <p>Key is used to shift the cursor.</p> <p>c) Sampling Mode:</p> <p>Key is used for selection or to shift the cursor.</p> <p>d) Settings Mode:</p> <p>Key is where setting and Turn off are located. In Setting, this Key is used to shift the cursor.</p> <p>e) Download/Reset Mode:</p> <p>In this mode, you can download/ erase data, or check the battery status. Press this key to delete all the stored data.</p> <p><b>NOTE:</b> Selecting "Erase Data" will result in permanent loss of</p>

	current internal data.
3.6. "Set" Key	<p>a) Menu Page:</p> <p>This key is used to enter into the Setting mode, Exit mode and to Turn off the instrument.</p> <p>b) All other modes:</p> <p>Press this key to exit from the current page.</p>
3.7. "Enter" Key	<p>a) Menu Page:</p> <p>Key is used to enter into the Download/Reset mode.</p> <p>b) Download/Reset Mode:</p> <p>In this mode, you can download/ erase data or check battery status. Press this key to determine the battery status.</p> <p>c) Setting Mode:</p> <p>Key is where setting and power off are located. Press this key to Turn off the instrument.</p> <p>d) All other modes:</p> <p>This key is used to confirm the selected mode and value.</p>

3.8. Display	<p>It is a 20 x 4 alphanumeric OLED display, which indicates:</p> <p>a) Various prompts during initialization process, immediately after turning ON the CO<sub>2</sub> Analyzer.</p> <p>b) CO<sub>2</sub> concentration, Date and Time in the Measurement mode.</p> <p>c) Users can set parameters during Parameters Set mode.</p> <p>d) Calibration data specifically zero - span counts during Calibration mode.</p> <p>e) User friendly prompts during Sampling, Calibration, Data Downloading and other Functions.</p>
3.9. Gas Inlet Port	Used to withdraw the gas from vessel. Sampling tube with dust filter for inlet is connected during Measurement mode.
3.10. Gas Outlet Port	Used to release the gas after sampling. Sampling tube with dust filter for outlet is connected during Measuring mode.
3.11. USB Port	Used to download stored data from CO <sub>2</sub> Analyzer to your computer via USB cable.
3.12. Battery Charge Socket	Used for charging the CO <sub>2</sub> Analyzer.



## 4. SPECIFICATIONS



PARAMETER	STANDARD
<b>Gas Detected</b>	Carbon Dioxide (CO <sub>2</sub> )
<b>Concentration Range</b> , % CO <sub>2</sub>	0 - 80
<b>Resolution</b> , % CO <sub>2</sub>	1
<b>Response Time</b> (T <sub>90</sub> ), second	< 60
<b>Warm Up Time</b> , minute	<1
<b>Sensor Type</b>	NDIR Sensor (Nondispersive Infrared Sensor)
<b>Accuracy</b>	±3 to ±5% of Full Scale range (but also depends on the accuracy of the calibrating gas & method)
<b>Battery</b>	7.4 V/1500 mAH Li-ion (Rechargeable)
<b>Battery Charger</b>	Input: 100-240V 50/60Hz 0.6A Max / Output: 8.4V 10A
<b>Operating Temperature Range</b> , °C (° F)	0 - 40 (32 - 104)
<b>Operating Pressure (Ambient)</b>	±10%
<b>Product weight</b> , kg (lbs)	0.52 (1.2)
<b>Dimension (L x W x T)</b> , cm (inch)	19 x 10.5 x 3.7 (7.5 x 4 x 1.5)
<b>Packed Weight</b> , kg (lbs)	1.5 (3.3)
<b>Packed Dimension</b> , cm (inch)	28 x 23 x 8 (11 x 9 x 3)
<b>Product Life</b> , years	15
<b>Sensor Life</b> , years	5
<b>Calibration Frequency</b> , year	1
<b>Warranty</b> , year	1


## 5. INSTRUMENT OPERATING PROCEDURES

### 5.1. Power On

- 5.1.1 Battery has been discharged to safely comply with export regulations. It is advised to charge the battery using provided charger before using the device.

**NOTE:** Charge until the Red LED on the charger turns Green. See section 5.6.3



- 5.1.2 After fully charge, press and hold the Set Key  for 3 - 4 seconds.

- 5.1.3 Green LED marked POWER will light up.



### 5.2. Initialization

- 5.2.1 Instrument Powers Up

INSTRUMENT STARTS  
IN  
3 .. 2 .. 1 .. 0

- 5.2.2 Instrument Model and Serial number appears

UNIPHOS-225 (PM)  
CO2 GAS MONITOR  
SERIAL NUMBER  
A-XXXX(PM)

- 5.2.3 Instrument Software version appears

SOFTWARE VERSION:  
  
X.XX.XXX

- 5.2.4 Range and Resolution, Current date and time appears

RANGE: XXXXX Unit  
RESO. : XXX Unit  
DATE: DD/MM/YY  
TIME: HH:MM:SS

- 5.2.5 Last Calibration date appears

LAST CALIBRATION  
  
DATE: DD/MM/YY

### 5.2.6 Warming Up for < 60 seconds




5.2.7 At the end of the warming up, the Main Menu page of the CO<sub>2</sub> analyzer will appear. This shows information on the operating mode selection:

- a) "UP" Key for Sampling
- b) "DN" Key for Calibration
- c) "SET" Key for Settings
- d) "ENT" Key for Download/Reset






## 5.3. Setting Mode

5.3.1 Accessing parameter setting mode:

- a) From the Main Menu, press the "SET" Key  to enter into the setting page.




- b) Press "UP" Key , enter password using Up Key  for increasing the value (0 to 9) and Down Key  to shift the cursor.

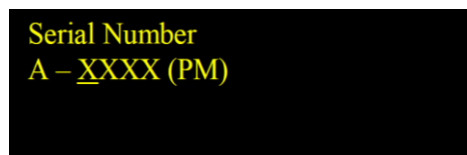
**NOTE:** The password for Setting mode is 123.



- c) Press "ENT" Key  to confirm.

5.3.2 Set Serial Number:

- a) Present serial number will appear.
- b) Just press "ENT" Key  to continue.



**NOTE:** Be careful not to change the serial number.

#### 5.3.3 Set Alarm and Log Time:

- a) Present alarm and log time will appear. Alarm value shall be 99% CO<sub>2</sub> and 1 minute for the log time.
- b) To change the alarm value, use “Up” Key ▲ for increasing the value (0 to 9) and “Down” Key ▼ to shift the cursor. Then press “ENT” Key ↵ to confirm and to move to Log time setting.
- c) To change the Log time value, use “Up” Key ▲ for increasing the value (0 to 9) and “Down” Key ▼ to shift the cursor. Then press “ENT” Key ↵ to confirm.
- d) To change Date and Time, use “Up” Key ▲ for increasing the value (0 to 9) and “Down” Key ▼ to shift the cursor. Then press “ENT” Key ↵ to confirm.

**NOTE:** If the displayed values are not to be changed, press “Set” Key ⏻ to exit from the current page.

Set Alarm:  
XX.XX Unit  
Log Time:  
XX Min



Set Date:  
DD/MM/YY  
Set Time:  
HH:MM:SS

#### 5.4. Sampling Mode

- 5.4.1 Press “Up” Key ▲ in the Menu page to enter the sampling mode and the selection of sampling and purging will appear on the screen.



- 5.4.2 Select Sampling or Purging as per the requirement using “Up” Key ▲ or “Down” Key ▼.

**NOTE:** Make sure that the tube is removed before confirming.

Remove Tubes

Select:  
Sampling/Purging

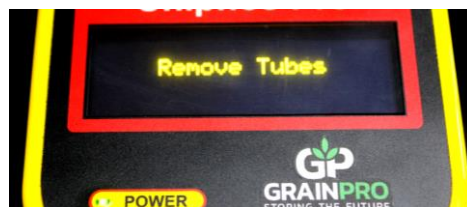
- 5.4.3 Press “Enter” Key ↵ for the selected process.





#### 5.4.4 If the Purging mode is selected;

- CO<sub>2</sub> analyzer will display prompt “Remove tubes”. Remove the tubes if it is connected, then proceed to “Purging” Air (about 1 minute).
- Purging of air is from internal to external tube of the CO<sub>2</sub> analyzer.
- After “Purging” Air , page will return to the Main menu.

**NOTE:** Before sampling, it is advised to conduct “Purging”, to ensure that the functionality of the CO<sub>2</sub> Analyzer is not affected or damaged by the contaminants from the surrounding environment.




#### 5.4.5 If the Sampling mode is selected;

- CO<sub>2</sub> analyzer will display prompt to verify if the tubes were already removed.
- Press “Enter” Key  to start Zero Check (about 7 seconds).
- Connect the 2 sampling tubes with dust filter to the inlet and outlet gas sampling port, then press “Enter” Key  for measuring CO<sub>2</sub>.

**NOTE:** A dust filter must be connected in the inlet of the gas sample line to prevent dust from entering the instrument during measurement.

- CO<sub>2</sub> analyzer will start measuring and logging the concentration with date and time

- Press “Set” Key  to stop the sampling. Then the average reading will display and will enter into the next page.

- Remove sampling tubes for inlet and outlet and

Tubes Removed?  
Press Enter Key

Zero Check  
Please Wait

Connect Tubes  
Press Enter Key




CO<sub>2</sub> : XXX unit

DATE

TIME



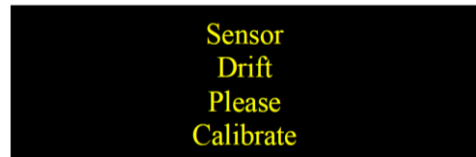
Remove Tubes  
Press Enter Key

press “Enter” Key  to proceed to “Purging” air (about 1 minute).

- g) After “Purging” Air, page will return to the Main menu.



**NOTE:** Any time in the menu page, if zero is not in its acceptable range, it will display “Sensor Drift”. Refer to TROUBLE SHOOTING GUIDE (8) > Sensor Drift (8.5)

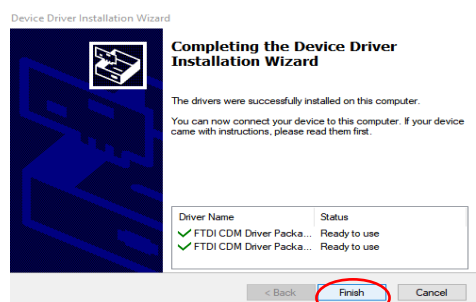
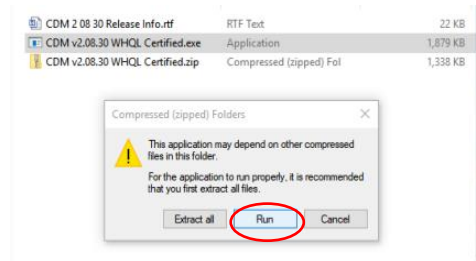


## 5.5. Download / Reset Mode

### 5.5.1 INSTALLATION AND DOWNLOADING FOR WINDOWS

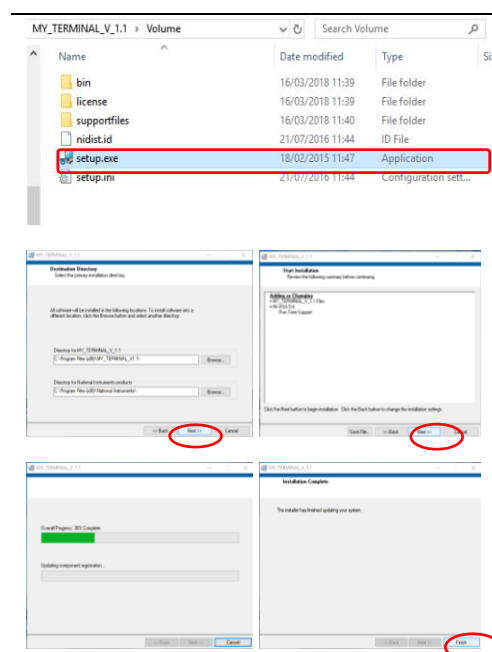
#### 5.5.1.1 Software Installation for Windows

- Install Uniphos Terminal Software from USB Flash drive provided along with the CO<sub>2</sub> Analyzer.
- Open the “USB driver for FT232R” folder.
- Open the “64 bit” folder for Window 8/10 or open the “WIN xp & win7-32 bit” folder for Window XP and Window 7.
- Open the “CDM 2.08.30 WHQL Certified.zip” folder.
- Run “CDM v2.08.30 WHQL Certified.exe” application.
- Click “Extract” to extract the FTDIChip CDM Drivers and click “Next”.





g) Completing the Device Driver Installation Wizard.



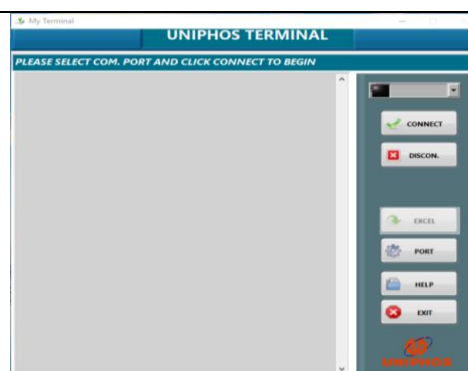
h) After installation of CDM Driver, go back to the USB Flash drive files and open the “MY\_TERMINAL\_V\_1.1” folder.

i) Open the “Volume” folder and Install the application.

### 5.5.1.2 Download Data for Windows

a) After the installation, shortcut folder for “MY\_TERMINAL” was created on the desktop.

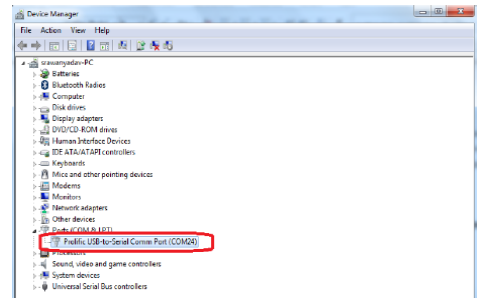
b) Open the folder “MY\_TERMINAL” and “MY\_TERMINAL\_V\_1.11” then the “Uniphos Terminal” window will appear.



- c) Connect the CO<sub>2</sub> Analyzer with your computer via USB Cable provided.



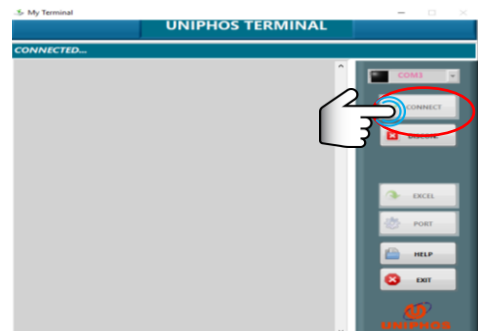
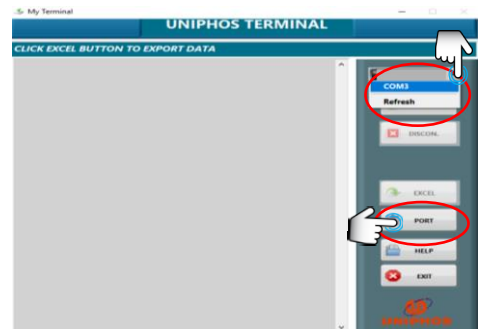
- d) To get the com port number, search for "Device Manager". Go to "Ports (COM&LPT)", click on the drop down list and get the com port number.



- e) Go back to the "Uniphos Terminal" Window and select the com port number.

**NOTE:** General com port settings are:

- Baud Rate: **9600 bits/sec**
- Data Bits: **8**
- Parity: **None**
- Stop bits: **1.0**
- Control Flow: **None**




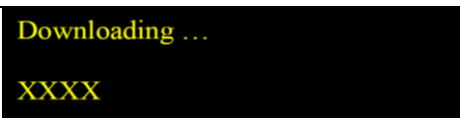
- f) Click "Connect" to initiate the downloading of data.




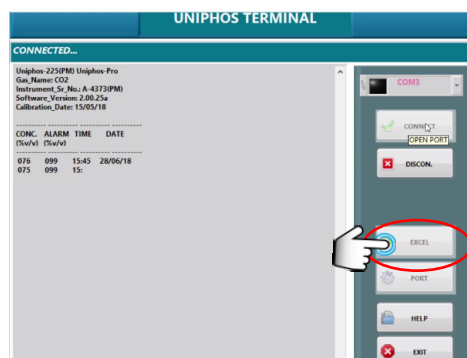
UP - Download Data  
DN - Erase Data  
SET - Exit  
ENT - Battery status



- g) On the CO<sub>2</sub> Analyzer, Press “Enter” Key  in the Menu page to enter the Download / Reset Mode.



- h) To download the complete summary or range of reading on your computer, press “Up” Key .



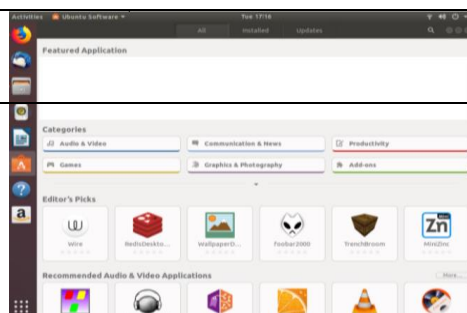
- i) While downloading, number of readings will also appear on the screen.

- j) Summary of data will be displayed on the “Uniphos Terminal” on your computer.

- k) Click on “Excel” button to download and export data to Excel and save data for reference.

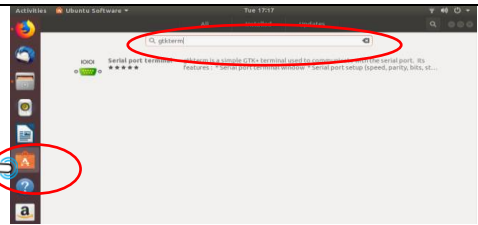
- l) After downloading, page will return to Main Menu.

## 5.5.2 INSTALLATION AND DOWNLOADING FOR LINUX

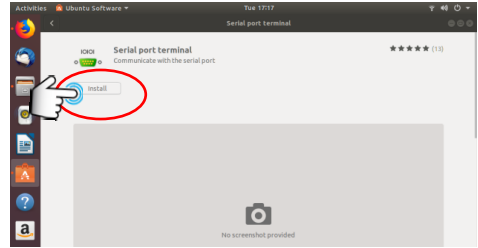


### 5.5.2.1 Software Installation for Linux

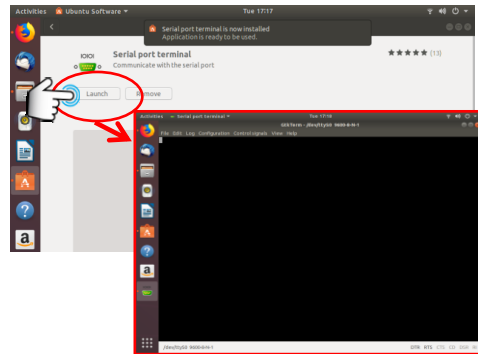
a) Install “**gtkterm**” from “**Ubuntu**” Software on your computer.



b) Open “Ubuntu” Software.



c) On the search bar type “**gtkterm**”.

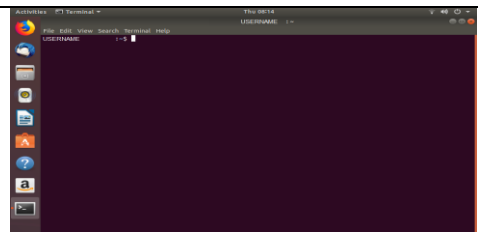


d) Click on the Serial Port Terminal (gtkterm) and install.

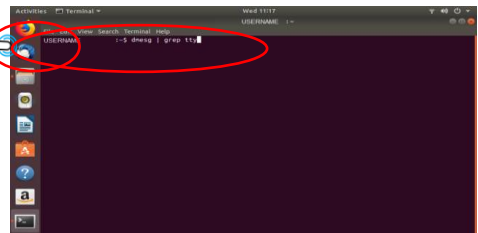
e) After installation, click “Launch” to open the “**gtkTerm**” software.

### 5.5.2.2 Download Data for Linux

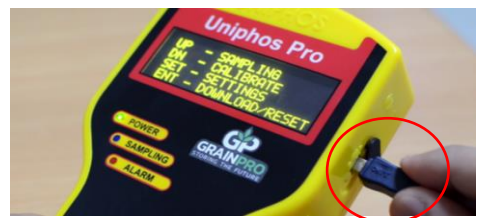
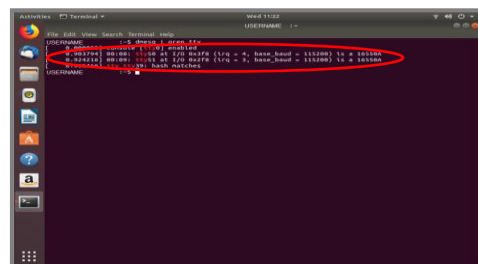
a) Open the Ubuntu's Terminal and check USB Serial port connection.



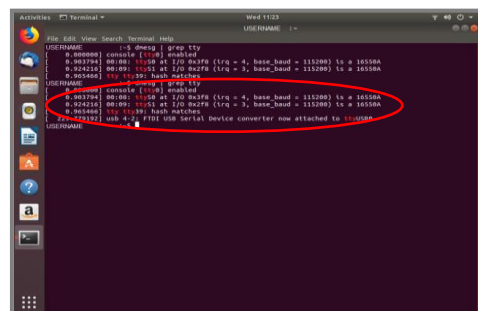
b) While the CO<sub>2</sub> Analyzer is not connected type the command, “**dmesg | grep tty**” on the terminal.



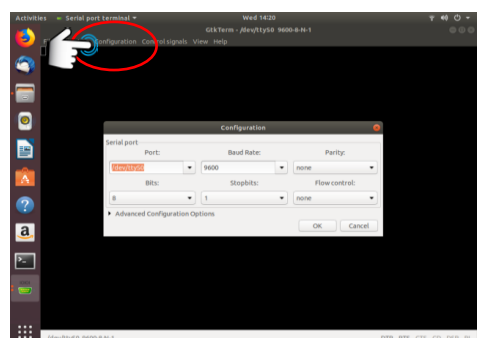
c) No USB connection shall appear.



d) Connect the CO<sub>2</sub> Analyzer with your computer via USB Cable provided.



e) In the terminal, type again the command, “**dmesg | grep tty**.” “USB connection” shall appear on the terminal.



f) Open the **gtkterm** software again and click on **Configuration** from the menu.

g) From the Serial port **Configurations**, configure the parameters as follows:

- **Port:** /dev/ttyUSB0 (usb serial connection of your CO2 Analyzer)
- **Baud Rate:** 9600
- **Parity:** none
- **Bits:** 8
- **Stopbits:** 1


*\*other parameters as default*

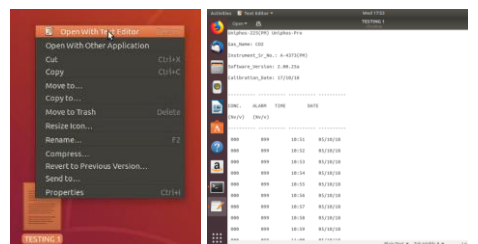
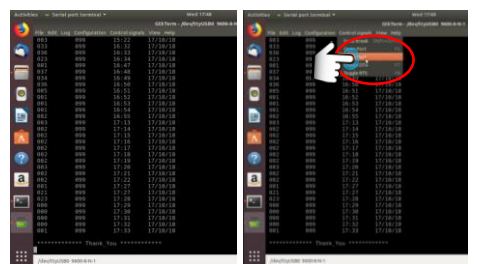
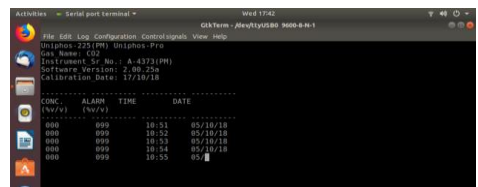
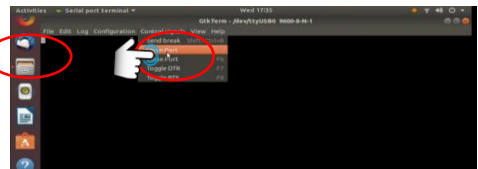
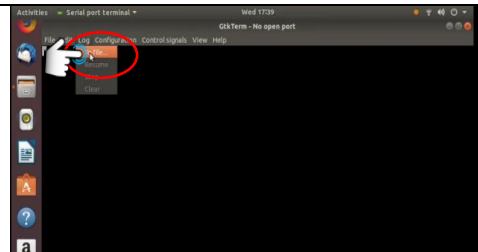
Click OK after.

h) Next, click on **Log** from the menu and choose **to file...**

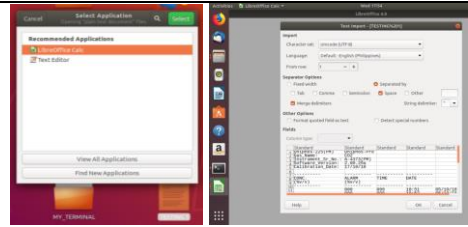
i) Window for saving files will appear. Create a file and Save.

j) After setting up Configurations and Log, go to **"Control signals"** in the menu and click **"Open Port"** in the drop down list.

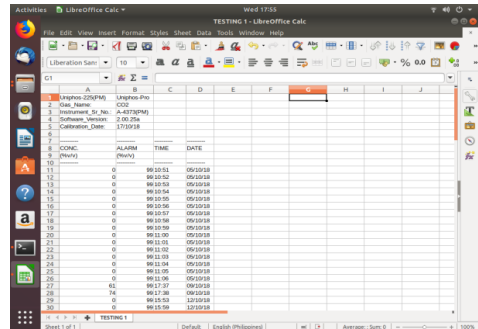
k) Download data from CO<sub>2</sub> Analyzer. Press Enter Key  in the Menu page to enter the Download / Reset Mode.



l) Readings should show on the terminal.



m) After the downloading of the data to the terminal software is done, go back to “Control Signals” and click “Close Port”.



n) Check on the Log file data. You can open either with **Text Editor** or any **spreadsheet app on Linux**.



#### NOTE:

For troubleshooting serial port connection refer to TROUBLESHOOTING GUIDE (8) > Problem on Serial Port Connection for Linux (8.6).



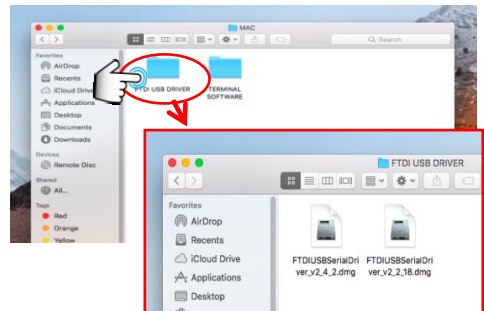
## 5.5.3 INSTALLATION AND DOWNLOADING FOR MAC

### 5.5.3.1 Software Installation for MAC

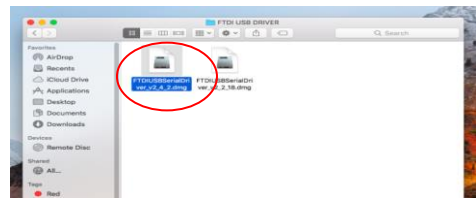
a) Open MAC Folder from USB Flash Drive provided along with the CO<sub>2</sub> Analyzer.



b) Open FTDI USB DRIVER folder.



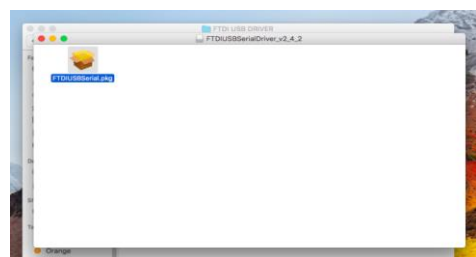
c) Choose driver matching your MAC OS version.



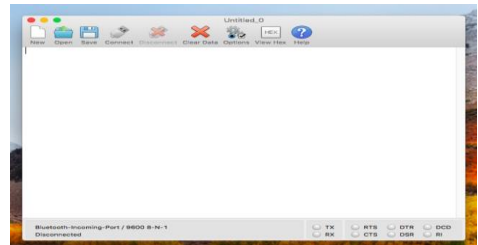
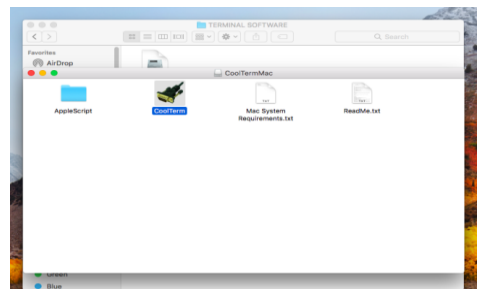
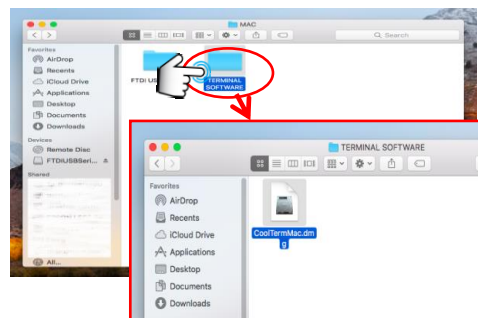
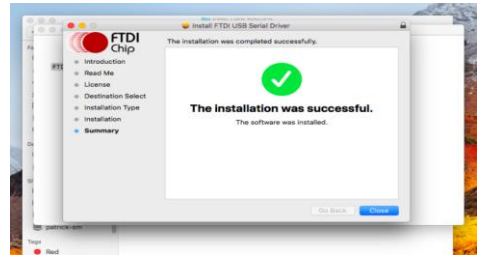
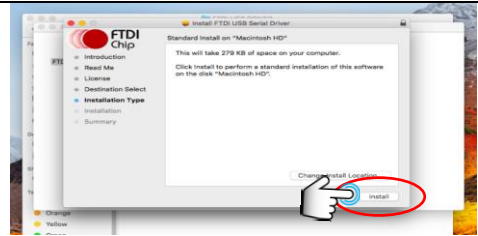
Currently Supported VCP Drivers:

Operating System	Release Date	Processor Architecture						Comments
		x86 (32-bit)	x86_64 (64-bit)	PPC	ARM	MIPS	SH4	
Mac OS X 10.3 to 10.8	2010-08-10	2.2.18	2.2.18	2.2.18	-	-	-	Refer to TN-108 if you need a custom VCP VDDP in MAC OS
Mac OS X 10.9 and above	2017-05-12	-	2.4.2	-	-	-	-	This driver is signed by Apple

d) Click on the .pkg file from the window that will appear.



e) Installation window will appear after. Just click on “**continue**” and “**install**”.



f) Go Back to MAC folder and choose TERMINAL SOFTWARE.

g) Open .dmg file

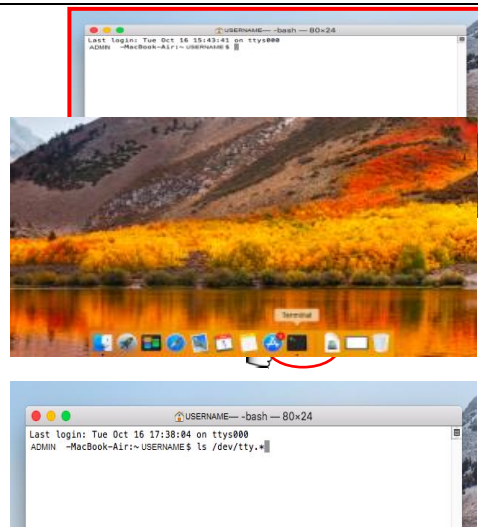
h) Window from .dmg file will appear. Click on “CoolTerm” after.

i) “CoolTerm” software will appear.

#### 5.5.3.2 Download Data for MAC

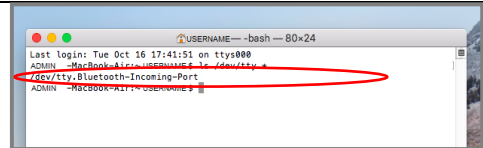
a) Open MAC's Terminal to check USB Serial port connection.

b) While the CO2 Analyzer is not connected type the command, “*ls /dev/tty.\**” on the terminal.

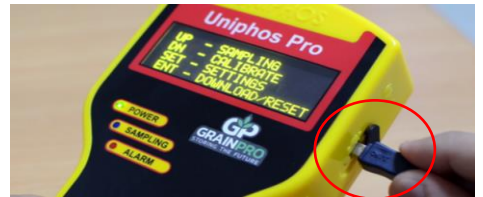




c) No USB connection will appear.

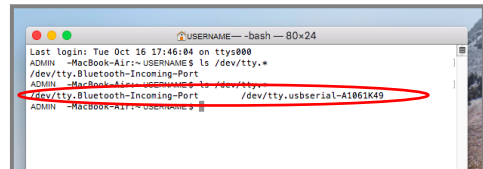


d) Connect the CO<sub>2</sub> Analyzer with your computer via USB Cable provided.

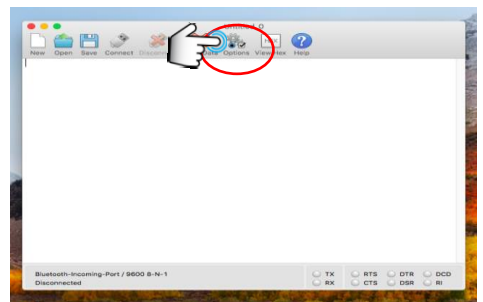


e) In the terminal, type again the command, ***ls /dev/tty.\****

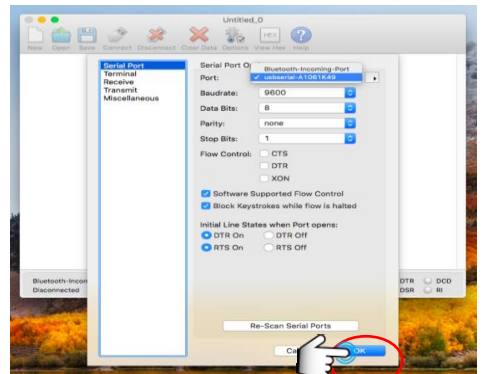
USB connection shall appear on the terminal.



f) Open “CoolTerm” software again.

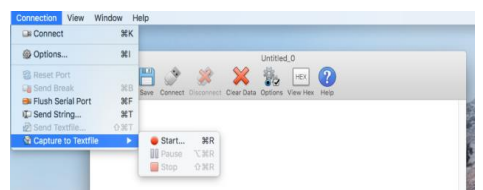
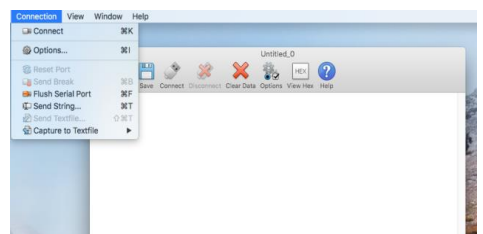


g) From the menu click **Options**.



h) From the Serial Port Options, choose parameters as follows:

- **Port:** usbserial-\*\*\*\*\* (usb serial connection of your CO<sub>2</sub> Analyzer)
- **Baudrate:** 9600
- **Data Bits:** 8
- **Parity:** none
- **Stop Bits:** 1



\*other parameters as default


Click OK after.

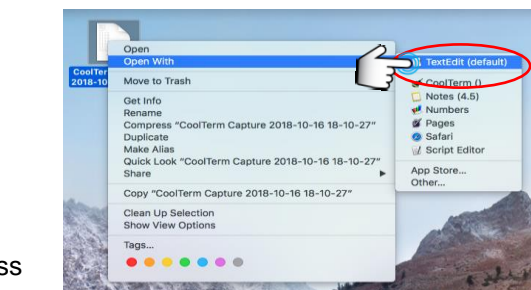
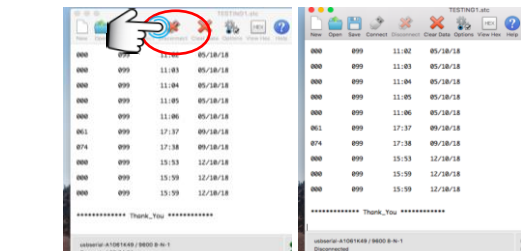
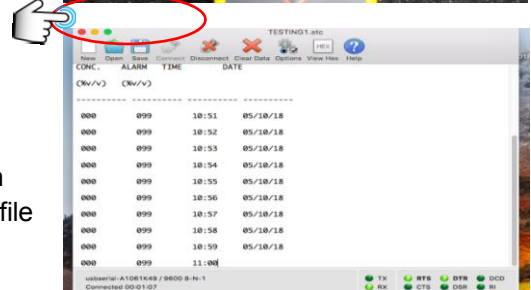
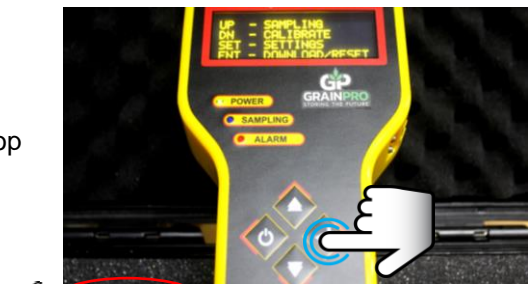
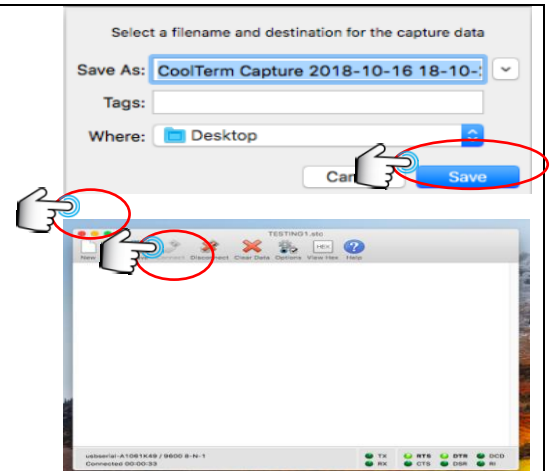
i) Click **“Connection”** from the Main Menu.

j) Choose **“Capture to Textfile”** from the drop down list and click **Start...**

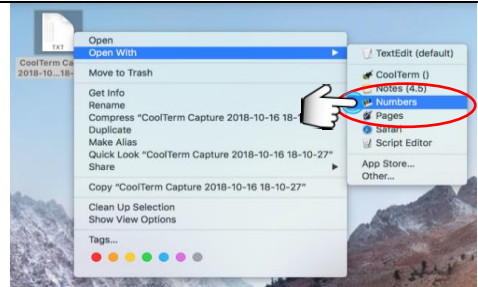
k) Window **“Select a filename and destination for the capture data”** will appear. Create a file and **Save**.

l) After setting up Options and Capture, click **“Connect”**.

m) Download data from CO<sub>2</sub> Analyzer. Press Enter Key  in the Menu page to enter the Download / Reset Mode.



n) Readings should show on the terminal software.

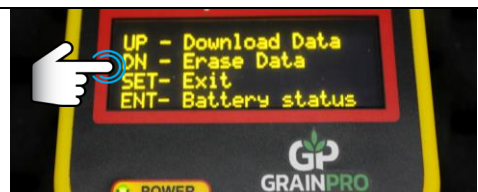


o) After the downloading of the data to the terminal software is done, disconnect and close “CoolTerm”.

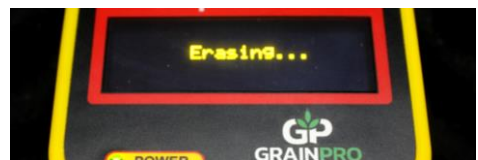
p) Check on the saved capture data. You can open either with **TextEdit** or **MAC iWork’s Numbers** or other file viewing app.

#### 5.5.4 Erase Data on CO<sub>2</sub> Analyzer

a) Press the Down Key ▼ to erase all the data stored in the CO<sub>2</sub> Analyzer.




b) Erasing prompt will appear on the display.



**NOTE:** Selecting “Erase Data” will result in permanent loss of current internal data.

c) After erasing, page will return to Main Menu.

### 5.5.5 Battery Status

- Press the Enter Key  to determine the battery percentage.
- Battery status prompt will appear on the display.
- After 2 seconds, page will return to main Menu.



## 5.6. Monitoring Battery Charge

### 5.6.1 Battery Status

Battery status can only be monitored when the CO<sub>2</sub> Analyzer is in the Data downloading page.



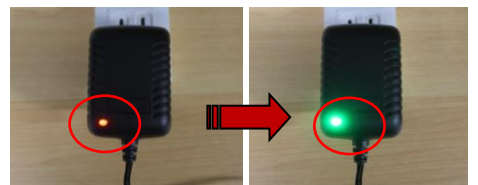
### 5.6.2 Battery Low

When the battery capacity goes below 25%, the LOW BATTERY prompt will be displayed and will prompt the Main Menu page only after charging the battery.



### 5.6.3 Battery Charging

Battery should be charged until Red LED on the charger turns to Green LED.



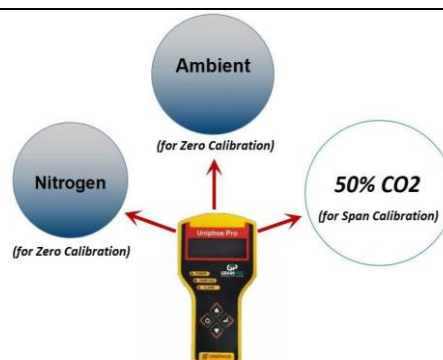
## 5.7. Calibration Mode

### 5.7.1 Calibration


- Zero Calibration shall be done using ambient condition (CO<sub>2</sub> concentration at ambient is about 0.03% to 0.04%) or by using pure Nitrogen.
- Span Calibration shall be done using 50% CO<sub>2</sub> concentration. See section 5.7.2 Calibration process, h.

**NOTE:**

If 50% CO<sub>2</sub> is unavailable, use only Zero calibration. See section 5.7.2 Calibration Process (g).

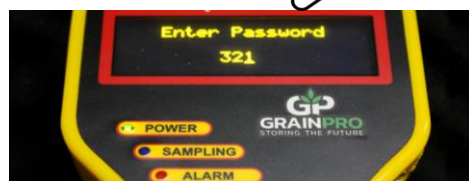


### 5.7.2 Calibration Process

- In the Main Menu page, press Down Key  to enter the Calibration mode.
- Enter the Password (321) and expose to ambient air or connect to pure nitrogen.



- Press Enter Key  to confirm, then the CO<sub>2</sub> Analyzer is ready for Zero calibration.



- The “Apply Zero Gas” prompt will be displayed and the CO<sub>2</sub> Analyzer will take samples for 30 seconds (displayed on the screen).




- CO<sub>2</sub> Analyzer will be set to zero, only if count value is in between 50 to 999, ideally 500.



- After taking the samples, “Zero Cal Done” prompt will appear otherwise “Zero Cal Fail” prompt will be displayed.




**NOTE:** In case of Zero Cal Fail, refer to the TROUBLESHOOTING GUIDE (8) >Zero Calibration (8.1).

- After Zero calibration, “Span Gas” will be displayed. To discontinue the Span Calibration, press “SET” Key  to exit. However, enter gas






concentration values for which instrument is to be calibrated (Ideally 50) to continue the Span Calibration.

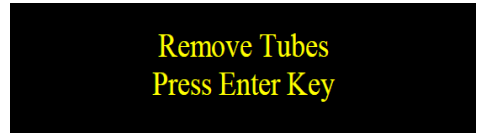
- h) Connect the CO<sub>2</sub> Analyzer to 50% CO<sub>2</sub> bag/tank using available calibrated instrument as reference.
- i) Press Enter Key  to start and the “Apply Span Gas” prompt will appear. CO<sub>2</sub> Analyzer will take samples of target gas for 120 seconds (displayed on the screen).

**NOTE:** Span Gas Value should be equal to 20% to 80% (ideally 50%) of full range of the CO<sub>2</sub> Analyzer, otherwise “Invalid Span Gas” prompt will appear on screen and will ask for Span Gas Value.

- j) CO<sub>2</sub> Analyzer will be calibrated, only if counts value for applied span gas is within valid range (i.e. from 1000 to 4030 display counts, ideally 3000).
- k) After Span calibration process, “Span Cal Done” prompt will be displayed otherwise “Span Cal Fail” prompt will be displayed.

**NOTE:** In case of Span Cal Fail, refer to the TROUBLESHOOTING GUIDE (8) >Span Calibration (8.2).

- l) CO<sub>2</sub> analyzer will display prompt “Remove tubes”. Press Enter Key  then proceed to “Purging Air” (about 1 minute).
- m) Upon successful Span Calibration, last calibration date of the CO<sub>2</sub> Analyzer will be updated automatically to the current date.



## 6. USING CARBON DIOXIDE ANALYZER FOR MONITORING CO<sub>2</sub> LEVEL (INTENDED FOR GRAINPRO TRANSAFELINER (TSL) USERS)

- 6.1. The GrainPro® TranSafeliner™ (TSL) protects and preserves the quality of dry agricultural commodities during transit.
- 6.2. Monitoring of carbon dioxide level is recommended to ensure control of insect infestation
- 6.3. To ensure gas-tightness, the container with TSL can be checked using the CO<sub>2</sub> analyzer.
- 6.4. Using an analyzer, the carbon dioxide level can be checked through the TSL's plastic valve before unloading.



- 6.5. Insert the flexible adapter hose (black) to the inlet dust filter of CO<sub>2</sub> Analyzer, then connect the plastic valve into the TSL.



*Insert*




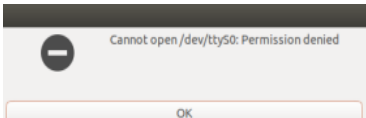
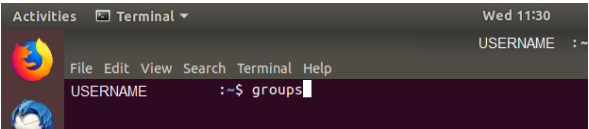


- 6.6. Take the CO<sub>2</sub> reading.
- 6.7. Increased carbon dioxide level indicates absence of any source of leaks from punctures, holes or damages. CO<sub>2</sub> level of ambient air is 0.03% to 0.04%.

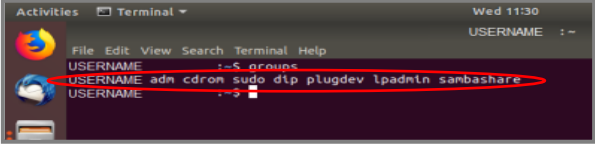
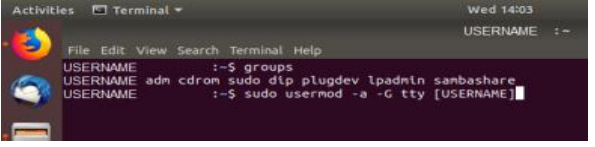
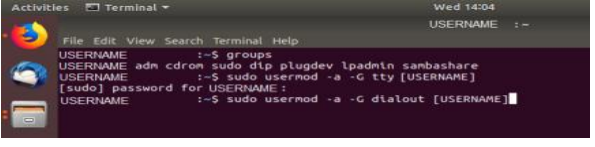
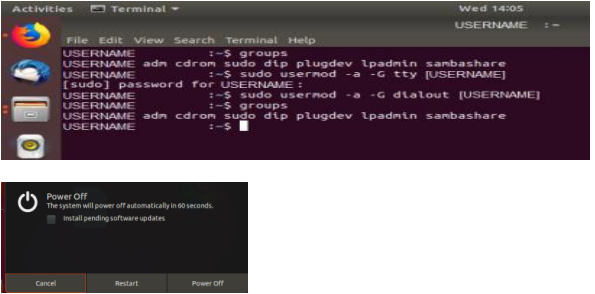
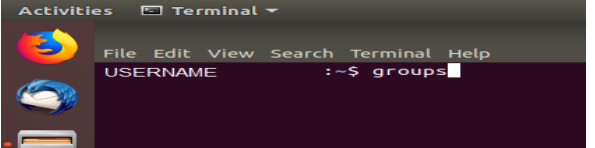
## 7. MAINTENANCE AND CARE

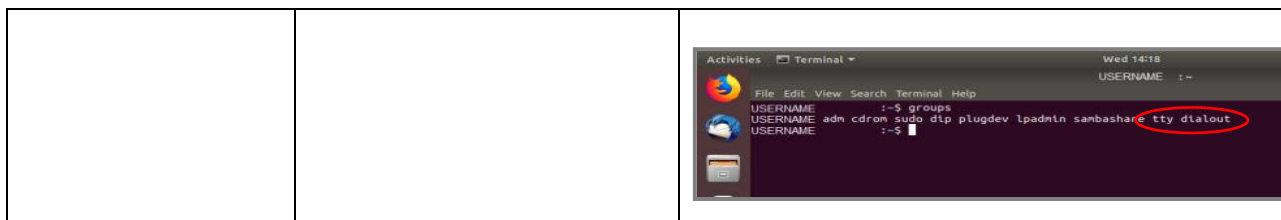
- 7.1. Do a regular (monthly) battery checkup and recharge it fully before use. Charge the instrument until Red LED on charger turns to Green.
- 7.2. Do not keep the Analyzer without using for more than 3 months (from the date of shipment). Li-Ion battery performance may be affected.
- 7.3. Perform the calibration check once in a month as this will ensure the accuracy of readings throughout the life of the instrument.
- 7.4. Avoid using the analyzer in direct sunlight. Provide shade while using the CO<sub>2</sub> Analyzer in the field.
- 7.5. Do not expose the CO<sub>2</sub> Analyzer to excessive positive or negative pressure. It affects the accuracy of the measurement.
- 7.6. Occasionally, the casing of the CO<sub>2</sub> Analyzer may be cleaned with a slightly damp lint free cloth. Wipe the CO<sub>2</sub> Analyzer thoroughly but care should be taken not to allow any water or moisture to enter.

## 8. TROUBLESHOOTING GUIDE

Parameters	Possible Cause	Solution
8.1. Zero Calibration	Zero Cal Fail	<p>Exit from the calibration mode by pressing Set Key . Re-enter into calibration mode and immediately after “Apply Zero Gas” prompt, manually set zero count in between 50 to 999, ideally 500 by adjusting Zero Pot (within 30 seconds of zero calibration time).</p>  <p>ZERO POT (FZ)</p>
8.2. Span Calibration	Span Cal Fail	<p>Re-enter into the calibration mode, zero the instrument (optional in case of last successful zero calibration &amp; can be skipped by pressing Set Key ) and repeat the same procedure as explained in 5.8.2 Calibration Process, (f) or send to factory.</p>
8.3. Pump making abnormal noise	There may be a blockage in the gas sampling tube or in the nozzles	Clear blockage
8.4. The instrument does not turn On	Low battery	Recharge Battery
8.5. Sensor Drift	Count value is lower than 500 which is the ideal value for an open atmosphere.	<ol style="list-style-type: none"> <li>1. Conduct purging twice. If sensor drift still appear, do the next procedure.</li> <li>2. Press Set Key then Up Key for setting. Enter the password, 999 and check the counts (CNTs) value, ideally 500. If it is &lt;500, adjust the zero pot at the back of the instrument. Then press Set Key to go back to the main menu.</li> </ol>
8.6. Problem on Serial Port Connection for Linux	<p>If a message pops up <b>“Cannot open ****: Permission denied”</b> when you open the software or open the port in control signals.</p> 	<p>Open the Ubuntu's terminal software.</p>  <ol style="list-style-type: none"> <li>1. Type in the command <b>groups</b> to check if “tty” and “dialout” is among the user's group.</li> <li>2. If neither is in the groups add both. (If only one</li> </ol>



		<p>is missing, only add that one)</p>  <p>3. To add tty type in the command, <i>sudo usermod -a -G tty [USERNAME]</i> and press enter, password will be asked, just input continuously and press enter again.</p>  <p>4. To add dialout type in the command, <i>sudo usermod -a -G dialout [USERNAME]</i> and press enter.</p>  <p>5. Type in the command <i>group</i> again. Notice if tty and dialout is still not included. For the addition to take effect, restart your computer.</p>  <p>6. Once the computer restarts, open the Ubuntu's terminal software and type in the command <b>groups</b>. See if <b>tty</b> and <b>dialout</b> is added.</p> 
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## 9. FREQUENTLY ASKED QUESTIONS

### 9.1. What is the GrainPro® Carbon Dioxide (CO<sub>2</sub>) Analyzer?

Carbon Dioxide (CO<sub>2</sub>) Analyzer is an instrument used to measure the Carbon Dioxide (CO<sub>2</sub>) concentration.

### 9.2. For what purpose is a CO<sub>2</sub> Analyzer used?

Carbon Dioxide (CO<sub>2</sub>) Analyzer is used to monitor process, enhance safety, increase efficiency and improve quality.

### 9.3. What is the sensing method used in GrainPro® Carbon Dioxide (CO<sub>2</sub>) Analyzer?

The sensing method used in GrainPro® Carbon Dioxide Analyzer is through nondispersive infrared measurements.

### 9.4. What is a micro-processor instrument?

It has a data logging capacity, can store data in real time, and has a provision to download the stored data to a computer.

### 9.5. What kind of sensor is used in GrainPro® Carbon Dioxide (CO<sub>2</sub>) Analyzer?

It uses Nondispersive Infrared (NDIR) sensor which is used to analyze gases.

### 9.6. What is a Nondispersive Infrared (NDIR)?

It is a simple spectroscopic (study of infrared light dispersed according to its wavelength) sensor often used as a gas detector. It is nondispersive in the sense of optical dispersion since the infrared energy is allowed to pass through the atmospheric sampling chamber without deformation.

### 9.7. Does CO<sub>2</sub> Analyzer need maintenance and calibration?

Yes. Maintenance and care are needed to sustain the product life of the instrument (see 6). For the calibration, there are two types: Zero calibration and Span Calibration. Zero Cal shall be done using ambient condition or by using pure nitrogen, while Span Cal shall be done using 50% CO<sub>2</sub> concentration.

### 9.8. What is Calibration?

Calibration verifies that the Analyzer is operating properly and adjusts for any drift or loss of sensitivity. The process involves passing two certified concentrations of the target gas - one for Low/Zero Point and other for High/Span Point - usually from a calibration gas cylinder and allowing the Analyzer to adjust for drift in the reading.

### 9.9. What is Purging Air?

Purging Air is used to flush clean air before the actual reading. This ensures that the functionality of the CO<sub>2</sub> Analyzer is not affected or damaged by the contaminants from the surrounding environment.

## 10. WARRANTY CLAUSE

GrainPro® hereby warrants that products sold to Buyers shall be free of defects in workmanship and materials, for a period as follows, starting from the date of shipment (B/L): One year for the GrainPro® Carbon Dioxide Analyzer.

The warranty liability is limited to replacement of defective products within the warranty period at GrainPro's plant in accordance with the provisions specifically and expressly set forth herein.

The Buyer will pay for Products which need to be replaced under warranty, a percentage of the full list price according to the ratio between the period, which has passed until replacement, and the full warranty period.

The Buyer shall bear shipping costs for shipment of defective Products to GrainPro, and GrainPro shall bear shipping costs of returning good Products to Buyer.

The Warranty does not cover the cost of any service, work, or material required for the replacement of defective Products at the site of installation.

GrainPro shall have no obligation under the warranty to replace defective Products or parts thereof if the defect is a result of any of the following: normal wear and tear; damages occurring after delivery, accidents, acts of God, or catastrophes, fault or negligence, or improper storage installation, maintenance of the Products.

Replacement costs and shipping charges for Products found not to be under warranty as specified above would be paid in full by the Buyer before new/refurbished Products are shipped.

The Buyer agrees that the warranty liabilities of GrainPro shall be and are limited to the express foregoing terms: THE EXPRESS WARRANTIES AND OBLIGATIONS SET FORTH ABOVE, ARE AND SHALL BE IN LIEU OF ALL OTHER WARRANTIES AND OBLIGATIONS OF GRAINPRO, and EXPRESSED OR IMPLIED. EXCEPT TO THE EXTENT HEREIN PROVIDED, GRAINPRO DOES NOT MAKE AND SHALL NOT BE DEEMED TO MAKE ANY WARRANTY WHATSOEVER, TO ANY END USER OR TO ANY OTHER PERSON OR PARTY, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR USE OR PURPOSE. GRAINPRO SHALL NOT BE LIABLE FOR ANY LOSS OF USE, SALES OR PROFIT OR FOR ANY INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES CAUSED BY OR SUFFERED AS A RESULT OF THE SALE OR USE OF THE PRODUCTS.

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