

VOC Pro  
Hand Held  
Photoionisation Air Monitor  
User Guide



**Warning: Limitation of Liability**

The ultimate responsibility of the consequences of use of toxic compounds rests with the user. Casella CEL's role is as a supplier of instrumentation to assist in the early detection of hazardous conditions involving such compounds.

It is vitally important to ensure that the VOC Pro is maintained in accordance with Casella CEL's instructions and that proper calibration is regularly performed.

As with any complex device, the VOC Pro is subject to failure and, while Casella CEL has taken, and continues to take, all possible precautions to (a) reduce the possibility of failure, and (b) warn the user in the event of failure, circumstances may occasionally occur in which there is a failure despite such precautions on Casella CEL's part. Casella CEL regrets that it cannot accept liability for damages of any kind caused as a result of either failure of the user to follow instructions or of the VOC Pro to perform.



**Casella CEL**

**VOC Pro**

**Portable Photo-ionisation Monitor**

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**RELEASE HISTORY****Part Number: G202033****Revision: A****Publication date: January, 2005****User Assistance**

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***Notices and*** **1**  
***Warnings***

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## ***FCC Warning***

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This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Subpart B, Class B of Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

## ***The VOC Pro Intrinsic Safety (I/S) Notice***

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THE VOC Pro IS CLASSIFIED FOR USE IN CLASS I, DIVISION 1, GROUPS A, B, C, D HAZARDOUS LOCATIONS. T4 (135°C) RATING.

It has been listed by MET® to comply with Underwriters Laboratories® Inc. UL® 913 *Standard for Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, Division 1, Groups A, B, C, D Hazardous (Classified) Locations*, Sixth Edition when powered by G202029 Battery Pack. THE VOC Pro IS NOT INTENDED TO DETECT COMBUSTIBLE LEVELS OF GASES. THE VOC Pro IS CLASSIFIED FOR USE IN ATMOSPHERES CONTAINING COMBUSTIBLE LEVELS OF GASES.

These accessories are for use with the VOC Pro in a hazardous location:

G202019	Calibration Regulator
G202037	Wrist Strap
G202018	Belt-Clip Holster
G202020	Carrying Case
G202036	User's Reference Card
G202032	Short Sample Probe

Do not use any other accessories with the VOC Pro in a hazardous location.

Substitution of components may affect safety rating.

<p><b>CAUTION</b></p>	<p><i>To reduce the risk of fire or injury to persons, read and follow these instructions:</i></p> <ol style="list-style-type: none"><li><i>1. All calibration, maintenance and servicing of this device, including battery charging, must be performed in a safe area away from hazardous locations. Disconnect all power before servicing.</i></li><li><i>2. There are no operator replaceable parts inside the VOC Pro except the battery pack, UV lamp and sample inlet filter.</i></li><li><i>3. There are no operator serviceable parts inside the VOC Pro.</i></li></ol>
-----------------------	---



## **WARNING**

1. *For replacement battery pack use only Part No. G202029.*
2. *Do not dispose of the battery pack in a fire. The cells may explode. The battery pack must be disposed of properly. Check with local codes for possible special disposal instructions.*
3. *Do not open or mutilate the battery pack. If the VOC Pro is used in a manner not specified, the protection provided by the VOC Pro may be impaired.*
4. *Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.*
5. *Do not defeat proper polarity orientation between the battery pack and battery charger.*
6. *Charging the battery is only to be done in a non-hazardous area.*
7. *Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For AC adapter use only Part No. G202007 (115 / 220V) When using the AC adapter do not block access to AC outlet in use with adapter. AC adapter is not to be used in a hazardous area.*

## **ATTENTION**

VOC Pro EST CLASSIFIÉ POUR USAGE DANS LES EMPLACEMENTS DANGEREUX DE CLASSE I, DIVISION 1, GROUPES A, B, C, D. ÉVALUATION T4 (135°C).

VOC Pro est conforme à la norme des Underwriters Laboratories Inc. UL 913 *Standard for Intrinsically Safe Apparatus and Associated Apparatus for use in Class I, Division 1, Groups A, B, C, D Hazardous (Classified) Locations*. Quatrième édition.

VOC Pro est conforme à la norme de CSA Standard 22.2 No. 157-92 - *Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations*.

VOC Pro EST NE PAS INTENDER POUR DÉTECTER DES NIVEAUX DE COMBUSTION DES GAZ. CET APPAREIL EST CLASSIFIÉ POUR USAGE DANS DES ATMOSPHÈRES CONTENANT DES NIVEAUX DE COMBUSTION DES GAZ.

Les accessoires suivants peuvent également être utilisés avec l'appareil dans un emplacement dangereux:

G202019	Régulateur de calibration
G202037	Sangle de poignet
G202018	Étui de ceinture
G202020	Étui de transport
G202036	Carte de référence
G202032	Petite Gamme d'échantillons

Ne pas utiliser d'autres accessoires avec cet appareil dans un emplacement dangereux.

La substitution des composantes peut nuire à la sécurité d'emploi.

**ATTENTION**

*Pour réduire le risque de feu ou blessures, lisez attentivement ces directives:*

- 1. Tout étalonnage et entretien, incluant le chargement de la batterie, doit être fait dans un endroit sécuritaire et non-explosif. L'alimentation électrique doit être mis hors-service.*
- 2. Aucune pièce ne peut être changée par l'utilisateur à part la batterie.*
- 3. Aucun entretien ne peut être fait par l'utilisateur.*

## **ATTENTION**

1. *Utilisez seulement des batteries rechargeables de type nickel cadmium avec un chargeur 12 Volts DC (Pièce G202029).*
2. *Ne jetez pas les batteries dans le feu. Elles pourraient exploser Vérifiez avec la réglementation locale avant d'en disposer.*
3. *Ne pas ouvrir ou briser la batterie. La protection offerte par le VOC Pro sera alors inutile.*
4. *La manutention de la batterie nécessite d'éviter les produits conducteurs comme des anneaux, bracelets ou clés pour éviter tout court-circuit La batterie pourrait surchauffer et causer des brûlures.*
6. *Ne pas modifier la polarité entre la batterie et le chargeur.*
7. *Utilisez seulement l'adaptateur AC spécifié dans le manuel. (Pièces G202007 (115 / 220 Volts AC),. Ne pas bloquer la sortie de l'adaptateur AC.*

## **ATEX Directive and EMC Directive**

### **EC Declaration of Conformity**

We **Casella CEL Ltd**  
**Regent House, Wolseley Road**  
**Kempston, Bedford, England MK42 7JU**

declare that:    Equipment:            **Photoionization Monitor**  
                         Model name:            **VOCpro**

In accordance with the following Directives:

**94/9/EEC        ATEX Directive**  
**89/336/EEC    The Electromagnetic Compatibility Directive**

has been designed and manufactured to the following standards:

**Safety:        EN61010-1:2001**  
**EMC:         EN61326:1997:A1:1998 and A2:2001**  
**Explosive**  
**Atmosphere:   EN50014:1998 and EN50020:2002**

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above reference standards and all essential requirements of the Directives.

Signed by:



Name:            Steve Tearle  
Title:            Technical Director  
Done at:        Kempston, Bedford, England  
On:               21<sup>st</sup> January 2005

Model: VOC Pro Photoionisation Air Monitor, Certified Intrinsicly Safe/Sécurité Intrinsèque. Class I, Division 1, Groups A B C and D. Maximum surface temperature 135°C T4. Casella CEL Ltd, Regent House, Wolseley Rd., Kempston, Bedford, England MK42 7JY

Model: VOC Pro  
TRL 03ATEX21022X  
EEx ib IIC T4 (Ta = 0°C to +40°C)



WARNING - Substitution of components may impair intrinsic safety. Avertissement - La substitution de composants peut compromettre la sécurité intrinsèque. To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.

CAUTION - To reduce the risk of explosion, only use AC Adapter and Serial Port or recharge the batteries outside of the hazardous location. Avertissement - Afin de prévenir l'inflammation d'atmosphères dangereuses, ne charger les batteries que dans des emplacements designés non dangereux. Use only Casella battery pack Part No. G202029.

## **WARNING**

1. *All calibration, maintenance and servicing of this device, including battery charging, must be performed in a safe area away from hazardous locations.*
2. *Disconnect all power before servicing.*
3. *Do not open UV Lamp Cap when unit is energized.*
4. *Only use the AC Adapter in a safe area away from hazardous locations*
5. *Only use the Serial Port in a safe area away from hazardous locations.*

## **CAUTION**

*To reduce the risk of fire or injury to persons, read and follow these instructions:*

- 1. There are no operator replaceable parts inside the VOC Pro except the battery pack, UV lamp and sample inlet filter.*
- 2. For replacement battery pack use only Casella CEL Part No. G202029.*
- 3. There are no operator serviceable parts inside the VOC Pro.*
- 4. Do not dispose of the battery pack in a fire. The cells may explode. The battery pack must be disposed of properly. Check with local codes for possible special disposal instructions.*
- 5. Do not open or mutilate the battery pack. If the VOC Pro is used in a manner not specified, the protection provided by the VOC Pro may be impaired.*
- 6. Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.*
- 7. Do not defeat proper polarity orientation between the battery pack and battery charger.*
- 8. Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For AC adapter use only Part No.G202007 (115/220 Volts AC),. When using the AC adapter do not block access to AC outlet in use with adapter. AC adapter is not to be used in a hazardous area.*

These optional accessories may be used with the VOC Pro in a hazardous location:

G202019	Calibration Regulator
G202037	Wrist Strap
G202018	Belt-Clip Holster
G202020	Carrying Case
G202036	User's Reference Card
G202032	Short Sample Probe

Do not use any other accessories with the VOC Pro in a hazardous location.



# ***Introduction* 2**

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## ***About this Manual***

---

This manual provides detailed instructions for setup, operation and maintenance of the VOC Pro Portable Photoionisation Monitor.

Before unpacking the instrument, please read *Warnings and Safety Practices* on page 16. This section describes possible hazards that might injure the user, damage the instrument or compromise its operation. Some general safety information is also provided.

To help you learn to use the VOC Pro quickly, this manual is organized by tasks beginning with Using the VOC Pro in Chapter 3. Accessories are covered in Chapter 4. Routine maintenance is covered in Chapter 5. Troubleshooting techniques are covered in Chapter 6.

The VOC Pro manual uses a few conventions for key names on the keypad and for text that is shown on the display.

UPPERCASE      Fixed key names are denoted by uppercase text.

“Display Text”      Text that appears on the VOC Pro status display is in quotation marks.

Soft key names are also shown in quotation marks.

In the text you will find various warnings and notes.



*A warning indicates an operation that could cause personal injury if precautions are not followed.*

**WARNING**



*A caution indicates an operation that could cause instrument damage if precautions are not followed..*

**CAUTION**

**NOTE:** *A note indicates significant information.*

## ***Warnings and Safety Practices***

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Please read the Notices and Warnings section of this user's manual before operating the VOC Pro.

## ***Approved Models of the VOC Pro***

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This manual provides operational information for all models of the VOC Pro. The VOC Pro is intrinsically safe and approved for use in hazardous locations. Refer to the Notices and Warnings section of this manual for details of each approval.

Throughout the manual, notes are provided to inform you of the limitations of usage for the VOC Pro models.



*If the VOC Pro you are using is not specifically identified as intrinsically safe with a label on the VOC Pro, do not use it in a location where flammable concentrations of gases and vapours may exist.*

WARNING

## ***Excessive Heat and Cold***

---

Do not expose the instrument to intense sunlight for prolonged periods.

Exposure to excessive heat or cold may result in erroneous readings.

## VOC Pro Overview



**Figure 1. The VOC Pro Instrument**

The VOC Pro measures the concentration of airborne gases and vapours that can be ionised by a photoionisation detector. The VOC Pro automatically

displays and can record these concentrations. **The VOC Pro does not distinguish among individual compounds.** The reading displayed represents the total concentration of all photoionisable chemicals present in the sample. The VOC Pro is factory-set to display concentration in units of ppm.

The VOC Pro operates automatically. The VOC Pro display updates itself once per second. You can read concentrations directly from the display. If you are using the dilution probe (Part No. G202023), you must multiply the displayed reading by the dilution factor.

The VOC Pro will perform short-term exposure limit (STEL), time-weighted average (TWA) and PEAK calculations when it is in INTERVAL mode. You can view any of these results in INTERVAL mode.

The VOC Pro has two data logging options, Tag and Interval mode. Tag mode allows the user to manually tag and store readings during a walkthrough. Interval mode allows the user to datalog at selectable intervals of 15 seconds, 1 minute, 2 minutes, 5 minutes, and 10 minutes. In Interval mode, the STEL, PEAK and TWA are calculated. If you select Interval mode, these values are automatically recorded in the VOC Pro's memory. The VOC Pro can log up to 15,000 entries.

In Tag mode operation, the VOC Pro prompts you to locate a site and then to record a background and sample reading for the site. You can record up to 15,000 manual entries. There is no averaging of data in Tag mode. Tags are set via the PC using the VOC Pro Comm software.

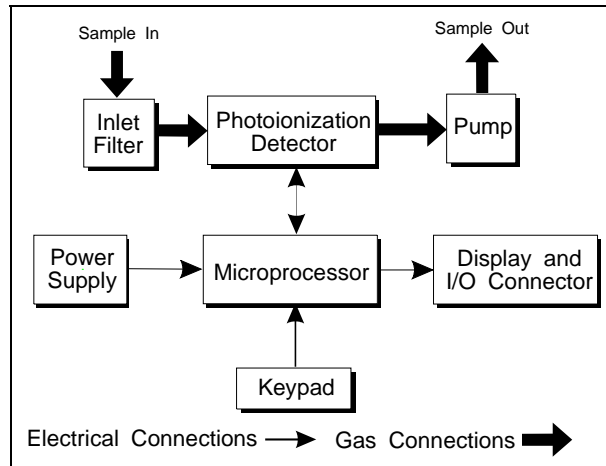
Recorded data can be reviewed on the display or downloaded to a computer. Data are recorded by date and time.

The VOC Pro has 5 keys for instrument operation. The keys are used to set up and calibrate the VOC Pro. All information entered with the keys and stored in the VOC Pro's memory is retained when the instrument is switched off. The clock and calendar continue to operate and do not need to be reset when the VOC Pro is turned on.

## ***General Operation***

---

The VOC Pro is a microprocessor-controlled air monitor for measuring the presence of photoionisable compounds in air at parts-per-million levels. The block diagram in *Figure 2* shows the main components of the VOC Pro.



**Figure 2. The VOC Pro Block Diagram**

The microprocessor controls the components of the instrument and interprets and records the signal generated by the photoionisation detector (PID). Recorded data and setup information entered into the microprocessor's memory are retained when the VOC Pro is turned off.

A pump continuously pulls the air under test through the VOC Pro's PID. The PID converts the concentration of photoionisable compounds in the sample into an electrical signal. The microprocessor subtracts any background from the signal and divides this signal by a sensitivity obtained by calibrating with a standard gas of known concentration. This concentration appears on the VOC Pro's display and, depending on the values entered through the VOC Pro's keypad, an alarm status may be displayed and an audio signal may be heard.



The VOC Pro can detect thousands of different types of airborne gases and vapours and its response depends on the characteristics as well as the concentration of each compound. **The VOC Pro does not distinguish one type of compound from another, but displays a number indicating the total concentration of all photoionisable compounds in the sample.**

A standard of isobutylene at a known concentration may be used for setting the sensitivity. If the VOC Pro is calibrated with isobutylene, it displays concentrations in units equivalent to ppm of isobutylene. If isobutylene were the only photoionisable chemical in the sample, then the VOC Pro would display its concentration directly.

The VOC Pro responds more or less readily to other chemicals than it does to isobutylene. Because it has a medium sensitivity to isobutylene, this gas has been chosen as a reliable means of reporting an average concentration of total ionisable compounds present.

Gases other than isobutylene can be used to calibrate the VOC Pro. However, all response factors are based on an isobutylene calibration.

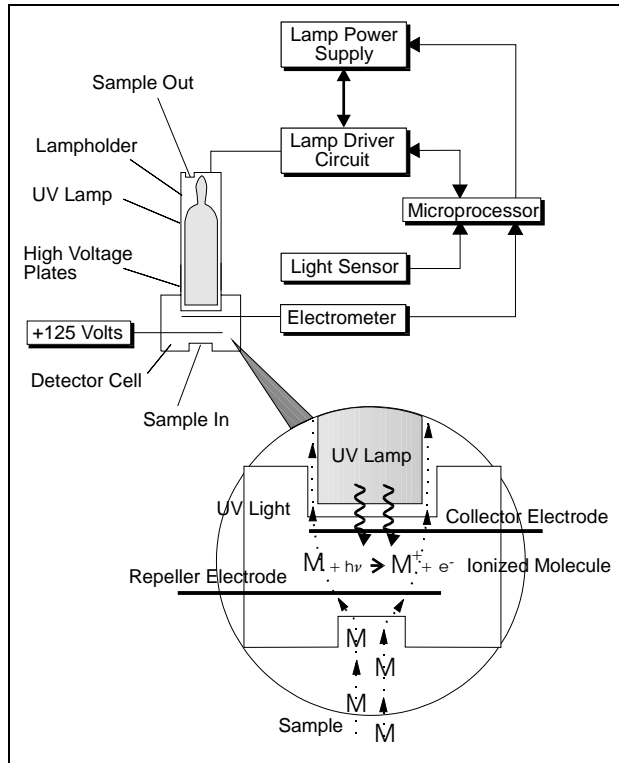
## ***Photoionisation Detector***

---

The VOC Pro's PID is shown in *Figure 3*. The PID measures the concentration of photoionisable chemicals in the gas stream from the sample inlet and produces an electrical signal for the microprocessor.

A UV lamp generates photons which ionise specific molecules in the gas stream. The permanent air gases (argon, carbon dioxide, nitrogen, oxygen, water vapour, etc.) require a relatively high energy for ionisation, and are not ionised by the UV photons. Many of the compounds considered pollutants, including most hydrocarbons, are ionised.

The gas stream is directed into the PID through a small port at the center of the UV lamp window and through a series of larger ports around the perimeter of the lamp window. This arrangement permits a high sample flow rate and short response time.



**Figure 3. Photoionisation Detector**

The ionised molecules in the detector cell are subjected to a continuous electric field between the repeller electrode and the collector electrode. The ions move in the electric field, generating a current which is proportional to the concentration of the ionised molecules in the detector cell. An electrometer circuit converts the current to a voltage which is then fed to the microprocessor.

The UV lamp is operated by a high voltage lamp driver circuit which delivers high voltage energy to the lamp through plates in the lamp holder. The lamp driver power supply is controlled by the microprocessor based on a feedback signal from a light sensor on the driver circuit board.

## ***Unpacking Instrument***

---

Remove the VOC Pro from its shipping box. The following accessories are included with the VOC Pro:

1. Sample Probe
2. Instrument Manual
3. Multi-Tool
4. AC Adapter or AC Adapter with AC Line Cord
5. Wrist Strap
6. Replacement Sample Inlet Filters (10 pieces)
7. Reference Card

Ensure that all of these accessories have been included with the instrument. If any items are missing or damaged, contact Casella CEL immediately.

## ***Support Equipment and Consumables***

---

### ***Calibration***

For normal operation these items are required:

1. Calibration Gas Regulator (Part No. G202019).
2. Calibration gas containing 100 ppm isobutylene (Part No. G202006). Other concentrations of the calibration gas may be required. This will depend on your application.
3. Zero air. Clean, ambient air is suitable for calibration.

Alternatively, you can use a gas sampling bag and a source of hydrocarbon free air. Air should not have more than 0.1 ppm total hydrocarbons (THC).

If you will be using large tanks of gas, specify a single stage, high purity regulator with a CGA 590 connection at the inlet. The regulator should also have a 1/8" parallel, compression fitting with which to connect the regulator to the gas bag adapter. The delivery pressure must be adjustable to between 5 psig (34.5 kPa). You may require a gas bag and gas bag adapter (Part No. G202004).

4. If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder.

## ***Field Operation***

For field operation, the VOC Pro Field Kit (Part No. G202041) is available. The field kit includes a cable kit, a carrying case and a calibration regulator, a spare battery pack and a cylinder of 100 ppm isobutylene calibration gas.

Refer to the check list in on page 65 to ensure you have all the necessary accessories and equipment before beginning field operation.

## ***Computer***

The VOC Pro may also be connected to a computer. The computer must be a Windows<sup>TM</sup>-based PC. Use the cable kit (Part No. G202028) to connect the VOC Pro to the computer.

**NOTE:** *The VOC Pro is not classified for use in hazardous locations when connected to a computer*

## ***Using the VOC Pro* 3**

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## ***Battery Charging***

---

Before beginning operation of the VOC Pro, the battery pack must be charged. You can also remove the battery pack and replace it with a fully charged spare battery pack (Part No. G202029).

**NOTE:** *You must use the 115 / 220 V battery charger (Part No. G202007) in order to comply with the requirements of the applicable Council Directives.*

## ***Removing and Replacing the Battery Pack***

**NOTE:** *Do not remove or recharge the battery pack in a hazardous location.*

To remove the battery pack

1. If the VOC Pro has been turned on, turn it off by pressing the ON/OFF key for five seconds and then releasing it.

**NOTE:** *If you do not turn the VOC Pro off before removing the battery pack, you will reset the instrument and you will lose all logged data and setup parameters.*

2. Locate the battery hatch on the back of the instrument. See *Figure 4*.
3. Loosen the two Phillips screws in the top of the battery hatch.
4. The battery hatch can now be removed.
5. Lift the battery pack out of the case and carefully disconnect the battery pack connector from the VOC Pro.
6. Attach the connector from the charged battery pack to the VOC Pro.



**Figure 4. Battery Pack Removal and Replacement**

**NOTE:** *The connector is polarized. It will only fit one way. Do not force the connection.*

7. Place the battery pack in the VOC Pro case. Ensure the battery wires are not pinched or strained.
8. Ensure the wrist strap ring is in proper position. This ring holds the wrist strap in place.
9. Replace the battery hatch and then replace the two screws. Do not over-tighten the screws as you will damage the case.



## **Charging the Battery Pack**

**NOTE:** *Only use the AC adapter specified for use with the VOC Pro. Using another AC adapter will result in damage to the battery pack, the VOC Pro or the adapter itself.*

To charge the battery pack:

1. Plug the AC adapter into the jack located on the bottom of the VOC Pro.
2. Plug the AC adapter into an AC outlet. If you are using the European AC adapter, ensure the correct plug is installed on the line cord. If it is not correct for the wall outlet in your area, then it must be replaced.
3. The Charge LED on the VOC Pro indicates the charge state. Red indicates the battery is being charged. Green indicates the battery is fully charged and ready for use.

It is normal for a fully charged battery to indicate it is charging (red light) when first plugged in. The Charge LED will turn green within a few minutes to indicate the battery is fully charged.

4. When the battery pack is fully charged, remove the AC adapter first from the wall outlet and then from the VOC Pro.

Charging a fully discharged battery pack will take approximately 4 hours.

Optionally you can use the off line charger (Part No. G202027) to charge the battery pack when not installed in the VOC Pro.

If you are charging the battery pack in the instrument you can use all the features of the VOC Pro while the battery pack is being charged.

Leaving the AC adapter connected to the VOC Pro will not harm the battery or the AC adapter in any way. If the VOC Pro is to be left unused for an extended period of time, leave it connected to the AC adapter so that the battery will be fully charged and ready for operation.

On average a fully charged battery pack will provide 8 hours of continuous operation. Battery life is shorter if the instrument is turned off and then on again repeatedly, or if the backlighting is turned on.

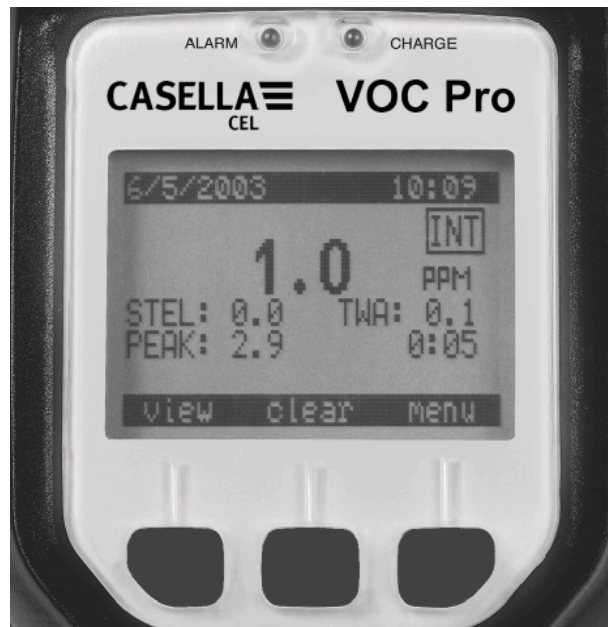
## ***Display***

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The VOC Pro has a graphic display for reporting the detected concentration and to guide you through configuration options. All functions of the VOC Pro will be reported on the display.

### ***Graphic Display***

The VOC Pro uses a 128 by 64 graphic display. The display will always be used for reporting the detected concentration. In order to accommodate the range of concentrations, the VOC Pro can detect the meter reading will be reported using one of 2 resolutions. A resolution of 0.1 will be used for concentrations below 100 ppm, and a resolution of 1 will be used for concentrations above 100 ppm.



**Figure 5. The VOC Pro Display**

The display reports instantaneous concentration at all times when the pump is on. In Interval mode, the display will report instantaneous concentrations as well as PEAK, STEL or TWA.

The VOC Pro is designed for ease of use with a logically organized internal menu structure/user interface. The VOC Pro User Menu is shown in *Figure 6*.

The VOC Pro has three soft keys under the graphic LCD display, which always show the available functions of the soft keys in any screen.

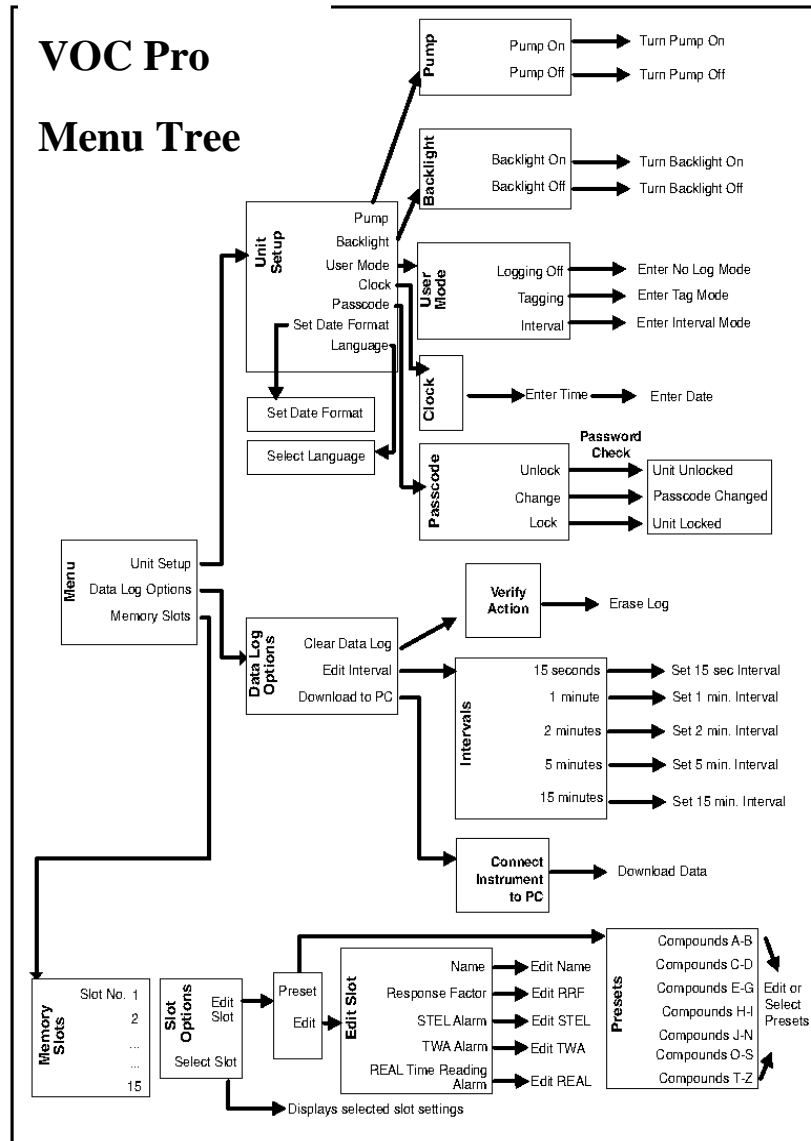


Figure 6. User Menu

## **Keys**

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### **Fixed Keys**

The VOC Pro has two fixed keys. The first fixed key is the ON/OFF key. The second fixed key is the dedicated calibration key. Pressing the CAL key will start calibration in almost any mode.

The ON/OFF key is used to both turn power on to the VOC Pro as well as the turn the power off. To turn on the VOC Pro, press the ON/OFF key. To turn the power off, press the ON/OFF key and hold it down for 5 seconds, and then release it. This is done to prevent accidental power off.

### **Soft Keys**

The three soft keys on the VOC Pro are located directly below the display. Each key has varying functions for configuring the VOC Pro, editing the data, and controlling the display. Since only three soft keys are available, each function is broken down into a path. A map, showing each path and the resulting functions, is shown in Figure 6.

## ***Beginning Operation***

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### ***Turning the VOC Pro On***

1. Turn the VOC Pro on by pressing the ON/OFF key. See *Figure 1* for the location of the ON/OFF key.
2. The VOC Pro will display the instrument's software version number. Next the VOC Pro will proceed to the mode display.
3. The VOC Pro has an instant-on lamp. For maximum accuracy and stability, allow the VOC Pro to warm-up for 10 minutes prior to calibration.

### ***Default Display***

The display shows the last mode in which the VOC Pro was used. The resolution of the display changes with the magnitude of the reading. A reading of 0 to 99.9 will be displayed with a resolution of 0.1 ppm. A reading greater than 99.9 will be shown with a resolution of 1 ppm. The meter will display concentrations up to 2000 ppm.

The VOC Pro can power up in Logging Off, Tag, or Interval mode depending on the mode that was set by the previous user. The current mode is shown in the upper right-hand corner of the display.



**Figure 7. Logging Off Mode Display**



**Figure 8. Tag Mode Display**





**Figure 9. Interval Mode Display**

## **Numeric Value, Duration, Time and Date Entry**

In cases where the system requires the user to enter a number, duration, time, or date, the following mechanism is used. The number of digits to be entered depends on the type of value being entered. Upon entering a value entry screen, a bar icon below the left most digit highlights it as the active digit. The up (middle soft button) and down (left soft button) arrows are used to increase/ decrease the digit. The bar icon is moved to the next digit to the right using the right soft button. Once the user has finished entering the value they use the right soft button to move the bar icon to the far right to highlight the check mark. When the bar is under the check mark, the left soft button changes to 'done'. The user is then able to input the value. Pressing the right soft button while the check mark is highlighted will return the bar icon to the left most digit.

In some cases, units may be specified (e.g., ppm or hh:mm); in others there may be no units.

No cancel option is available to the user. They must input a value.



## Instrument Status

The instrument status is shown on the left of the first line of the status display. Each status has a priority assigned to it. If more than one status is in effect, then the status with the highest priority is displayed until the condition is corrected or until the option is turned off. *Table 1* is a list of the possible system alerts.

**Table 1. System Alerts**

<b>VOC Pro Display</b>	<b>Description</b>
Zero Air Error	Zero gas too high
Span Gas Error	Span gas too low
Pump Error	Pump fault
UV Lamp Error	UV lamp fault
Blocked Filter	Blocked sample inlet filter
Low Battery Icon	Low battery
Data Log Full	Data memory full
Unit is Locked. Enter Passcode to Unlock.	Unit locked by passcode
The Unit is Communicating with the PC	Instrument communicating with PC
Instrument Over Range	Sample concentration over instrument operating range
Alarm + R Icon	Real time concentration alarm
Alarm + T Icon	TWA concentration alarm
Alarm + S Icon	STEL concentration alarm

## **System Alerts and Alarms**

While operating the instrument, system alerts can occur. To accurately identify the source of the alarm, each type of alarm has been given a unique status.

In addition to the status, the VOC Pro also has an audio alarm and an alarm LED. To conserve power, the VOC Pro alternates between the LED and audio. Different alarms are identified by the frequency at which the VOC Pro alternates between the audio and LED; Peak alarm is 5 times per second, STEL alarm is 2.5 times per second, and TWA alarm is 1.25 times per second.

A soft key is used for acknowledging alarms and is named “Accept”. If no alarm exists, then the “Accept” key is not shown. To clear the alarm, press the “Accept” key. Once acknowledged, the alarm indicators are cleared. The alarm status will remain until the alarm condition clears.

The VOC Pro updates the instantaneous concentration once every second. Following every update, the instantaneous concentration is compared to the peak alarm level, and if exceeded, an alarm is triggered.

In Interval mode, if a 15-minute average exceeds the STEL, a STEL alarm is generated. The TWA alarm is generated when the current average of concentration, since the TWA was last cleared, has exceeded the TWA exposure limit.

During calibration, all alarms are disabled. Once the calibration is complete, the alarms are re-enabled.

## ***User Interface – Basic Menu***

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The VOC Pro is designed for ease of use with a logically organized internal menu structure/user interface. The VOC Pro User Menu is shown in *Figure 6*.

The VOC Pro has three soft keys under the graphic LCD display which always show the available functions of the soft keys in any screen.

## ***Operation Modes***

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### ***Logging Off Mode***

Logging Off mode is identified by the word “**LOG**” with a diagonal line through the word “LOG” in the upper right corner of the VOC Pro display. Logging Off will continuously display the concentration of total volatile compounds present that the VOC Pro can ionise. The reading is updated approximately once per second. In Logging Off mode, the only soft key displayed is MENU.

MENU selects the VOC Pro’s internal menu for the instrument setup by the user.

### ***Tag Mode***

Tag mode is identified by the word “**TAG**” in the upper right-hand corner of the VOC Pro display. Tag mode will continuously display the instantaneous concentration of total volatile compounds. Tag mode also allows the user to manually tag and datalog readings. Tag mode allows the user to datalog a background reading, a sample reading and assign Site Codes to readings. Site Codes are set using the VOC Pro Comm software. See Chapter 4, Connecting Accessories, for more information on how to use the VOC Pro Comm software. In Tag mode, the soft keys are VIEW, TAG and MENU.

VIEW selects datalogger review.

TAG selects “No Label”, “Background”, or “Sample”.

MENU selects the VOC Pro’s internal menu for the VOC Pro setup by the user.

## ***Interval Mode***

Interval displays the instantaneous readings as well as STEL, TWA, and PEAK readings. Interval mode is identified by the letters “INT” in the upper right-hand corner of the VOC Pro display. Interval automatically calculates and updates STEL, TWA, and PEAK readings. Interval mode also automatically stores these readings in the VOC Pro’s memory at a preset interval selected by the user. In Interval mode, the soft keys are VIEW, CLEAR and MENU.

VIEW selects datalogger review.

CLEAR selects clearing the values for “TWA”, “PEAK”, “ALL”.

MENU selects the VOC Pro’s internal menu for the VOC Pro setup by the user.

## ***Short-Term Exposure Limit (STEL) Mode***

The Short-Term Exposure Limit (STEL) mode displays the concentration as a 15-minute moving average. The VOC Pro maintains 15 samples, each representing a one-minute averaging interval.

Once every minute, the oldest of the 15 samples is replaced with a new one-minute average. This moving average provides a 15-minute average of the last 15 minutes with a one-minute update rate. Since the average is calculated using 15 one-minute averages, the meter display will only update once every minute.

STEL is set to zero each time the instrument is turned on. Since STEL is a 15-minute moving average, there is no need to clear or reset the STEL.

STEL calculations are always being performed by the VOC Pro. You can display the results of the calculations by selecting Interval Mode.

### ***Time-Weighted Average (TWA) Mode***

The TWA accumulator sums concentrations every second until 8 hours of data have been combined. If this value exceeds the TWA alarm setting, a TWA alarm is generated. The TWA is not calculated using a moving average. Once 8 hours of data have been summed, the accumulation stops. In order to reset the TWA accumulator, press the “Clear” key, then select “TWA” using the “Down Arrow” key, then press “Clear”.

This sum will only be complete after 8 hours, so the meter displays the current sum divided by 8 hours.

TWA calculations are always being performed by the VOC Pro. You can display the results of the calculations by selecting Interval mode.

### ***PEAK Mode***

The PEAK mode displays the current detected concentration. The reading is updated once a second. In the background, the VOC Pro datalogger is sampling the concentration and measuring minimum, maximum, and average concentrations for the selected averaging interval. At the end of every interval, one entry is placed in the datalogger until the datalogger is full.

In order to reset the PEAK reading, press the “Clear” key then select “PEAK” using the “Down Arrow” key then press “Clear”.

## ***Datalogger***

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### ***Interval Operation***

The microprocessor accumulates all readings in an averaging interval that you select, and determines the minimum, average and maximum readings. It stores these numbers along with the highest priority instrument status and the most recent time and date.

These recorded data can now be reviewed and edited. Recorded data can also be printed using the PC. For each averaging interval, the VOC Pro prints the minimum of all the minima, the average of all the readings for the interval and the maximum of all the maxima.

In PEAK mode, the reading is updated once a second. In the background, the VOC Pro datalogger is sampling the concentration and measuring min, max, and average concentrations for the selected averaging interval. At the end of every interval, one entry is placed in the datalogger until the datalogger is full.

In STEL mode, 15 samples are combined to form a 15-minute average. Once every minute, the oldest of the 15 samples is replaced with a new one-minute average. This moving average provides a 15-minute average with a one-minute update rate so the meter display will only update once every minute. STEL is set to zero each time the instrument is turned on.

STEL calculations are always being performed by the VOC Pro. You can display the results of the calculations by selecting STEL as the Display mode.

TWA mode sums concentrations every second until 8 hours of data have been accumulated. Once 8 hours of data have been summed, the accumulation stops.



This sum will only be complete after 8 hours, so the meter displays the current sum divided by 8 hours. While you are in TWA mode, the time on the status display will show the number of minutes and hours of data that TWA has accumulated. When this reaches 8 hours, the VOC Pro stops accumulating data and the TWA is complete.

TWA calculations are always being performed by the VOC Pro. You can display the results of the calculations by selecting TWA as the Display mode.

Interval mode logs readings at user-selected intervals of 15 seconds, 1 minute, 2 minutes, 5 minutes, and 15 minutes. Interval simultaneously displays the STEL, TWA, and PEAK reading along with the instantaneous reading. The VOC Pro's datalogger can store 15,000 entries. The interval you select will determine the period of operation. At the end of the period, the datalogger will be full and you will see the "Data Log Full" status.

**Table 2. Averaging Intervals and Period STEL, TWA, and PEAK Operation**

<b>Averaging Interval</b>	<b>Hours of Operation to Fill the Datalogger</b>
15 sec	62.5
1 min	250
2 min	500
5 min	1250
15 min	3750

The VOC Pro’s display can show four values in Interval mode: STEL, TWA, and PEAK, plus the instantaneous reading.

### ***Erasing or Downloading Data***

There are two options for data manipulation under the “Erase/Download” Data selection.

“Clear Data Log” deletes all readings in the VOC Pro memory.

**NOTE:** *Deleted information cannot be recovered. You should play back and print or download the contents of the datalogger before deleting any information.*

To empty the data logger in the VOC Pro:

1. Press the MENU key.
2. Use the DOWN ARROW key to choose “Data Logger Options”, and then press the SELECT key.
3. Choose “Clear Data Log”, and then press the SELECT key.
4. Press either the YES or NO key in response to “Are you sure you want to clear all data?”.

“Download to PC” begins download of stored data from the VOC Pro to the PC. The VOC Pro computer cable, G202028, must be connected between the VOC Pro and the PC before beginning the data download. The VOC Pro software package, the VOC Pro Comm, must be installed and running on the PC prior to download.

To download data:

1. Press the MENU key.
2. Use the DOWN ARROW key to choose “Data Log Options” then press the SELECT key.
3. Use the DOWN ARROW key to choose “Download to PC”, then press the SELECT key.
4. Press the NEXT key at the “Connect Instrument to PC” prompt.
5. The display will show “Downloading Data” and data will now download to the PC. Press the DONE key to stop the download at any time.

## Unit Setup Functions

Unit setup functions are used to select the VOC Pro features. There are five functions which can be set on the VOC Pro; **Pump, Backlight, User Mode, Clock and Passcode**. Figure 10 shows a menu detailing the User Setup functions. Press the MENU key in any operating mode to access “Unit Setup”.

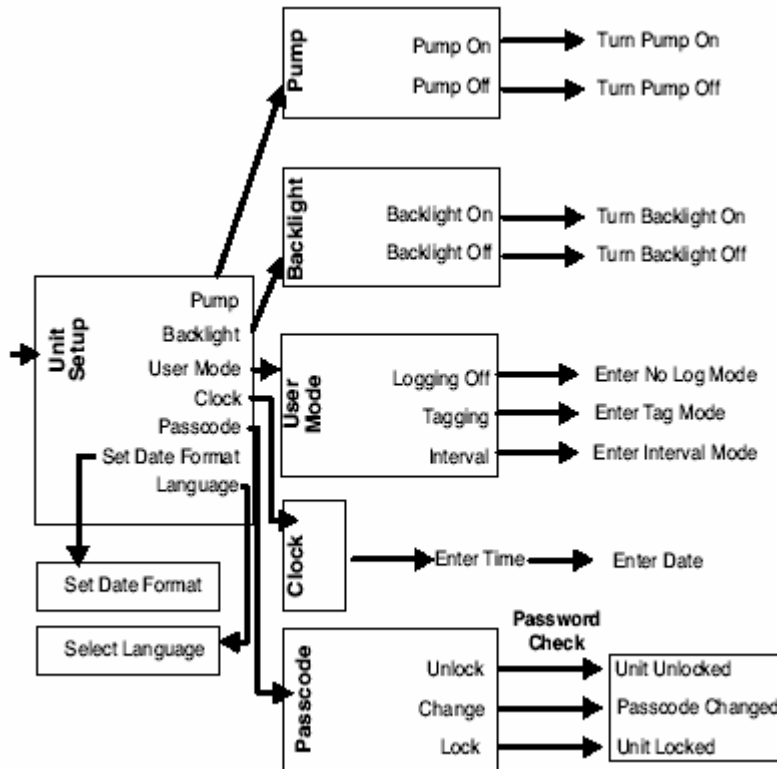


Figure 10. Unit Setup Map

## **Pump**

The Pump function turns the pump on and off.

The detector is turned off when you turn the pump off. This prevents the detector from being damaged when there is no sample flowing through the detector.

When the pump and the detector are off, the meter display will read “Pump Off”. Turn the pump and detector off when concentration measurements are not necessary, and the VOC Pro will only be used for setup or reviewing data. By operating the instrument with the pump and detector off when you do not need them, you will conserve the battery and ultraviolet (UV) lamp.

To turn the pump on:

1. Press the MENU soft key, “Unit Setup”, press SELECT, “Pump”, press SELECT, “On”, then press SELECT.

To turn the pump off:

2. Press the MENU soft key, “Unit Setup”, press SELECT, “Pump”, press SELECT, “Off”, then press SELECT.

## **Backlight**

The backlight function is used to switch the backlighting on and off when there is insufficient light to read the display.

To switch the backlighting on and off:

1. Press the MENU soft key and select “Unit Setup”.
2. Select BACKLIGHT and then press the SELECT soft key. Press the DOWN ARROW soft key to either turn the backlight on or off.
3. Press SELECT soft key to return to the main display.

To extend the operating life of the battery pack, turn the backlighting off when it is not required.

## **User Mode**

User mode selects one of the three logging modes. The three logging modes are Logging Off, Tag and Interval mode.

Logging Off mode displays instantaneous readings only. The display is updated continuously and readings are not datalogged.

Tag mode displays instantaneous readings. The user has the option to manually store the instantaneous reading as either a data point without a tag, a background reading, or a sample reading.

Interval mode displays the instantaneous reading, STEL, TWA and PEAK readings. In interval mode data is logged at a preset interval of 15 seconds, 1 minute, 2 minutes, 5 minutes or 15 minutes selected by the user.

## **Clock**

The Clock function is used to set both the current date and time.

### Entering Numbers with the Soft Keys to Set the Clock

For all information that you must enter, the left, center and right soft keys correspond to the up, down, and right arrow. See *Figure 11*.

The up and down arrows are used to change the character highlighted by the cursor. The right arrow is used to advance the cursor to the next character on the right. When the cursor is advanced past the right most character or symbol ✓, it wraps around to the first character again. To accept the changes, press the DONE soft key when the checkmark is highlighted.



**Figure 11. Setting the Time**

The soft keys are defined on the bottom line of the display.

**To set the time and date:**

1. Press the MENU soft key.
2. With “Unit Setup” highlighted, press the SELECT soft key.
3. Using the DOWN ARROW soft key, highlight “Clock”. Press the SELECT soft key.

The up and down arrow soft keys are used to change the character underlined by the cursor. The right arrow is used to advance the cursor to the next character on the right. When the cursor is advanced past the right most character, it wraps around to the first character again.

Formatting characters, such as the colon (:) in the time, the decimal (.) in a concentration, and the slash (/) in date are skipped when advancing the cursor.

4. Use the “arrow keys” to enter the correct time. The time is formatted as Hour:Minute.
5. Use the RIGHT ARROW soft key until the “Checkmark” on the display is highlighted. Press the DONE soft key to confirm the time and move to the date option.
6. When setting the date, the VOC Pro prompts you for the current date formatted as Month/Day/Year. Use the ARROW KEYS to enter the correct date.
7. Press the DONE soft key to confirm the date and the display will return to the main screen.

## ***Passcode***

The “Lock” key is used to prevent access to the VOC Pro’s sensitive options. Sensitive options are those which can affect the VOC Pro’s readings. If any of these functions is selected when the instrument is locked,



the VOC Pro will prompt you to unlock the instrument before you can access the functions.

To lock the VOC Pro:

1. Press the MENU soft key. Highlight UNIT SETUP and press the SELECT soft key. Use the DOWN ARROW soft key to highlight PASSCODE, then press the SELECT soft key.
2. Choose either UNLOCK, CHANGE or LOCK soft keys. You will be prompted for a passcode. Using the UP, DOWN and RIGHT ARROW soft keys, enter the passcode. Press the RIGHT ARROW soft key until the CHECKMARK is highlighted and select the DONE soft key.

***NOTE:** If you change the passcode, make sure you record the setting. If you cannot remember your passcode once the instrument is locked, there is no way to unlock it without losing all your data log contents.*

## **Date Format**

The Date Format function is used to select one of the two available date formats.

MM/DD/YYYY or

DD/MM/YYYY

Using the DOWN ARROW soft key to move the cursor to the date format you desire then press the SELECT soft key to select that format.

## **Language**

The Language function is used to select one of the available languages. All messages and menus will be displayed in the language selected.

Using the DOWN ARROW soft key move the cursor to the language you desire then press the SELECT soft key to select that language.

## **Response Factor Library**

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The response of a PID to a compound is dependent on its ionisation potential. In certain situations when the user is confident that only a **single specific compound** exists, they can set up the VOC Pro using an isobutylene calibration to mimic the VOC Pro response as if the VOC Pro was calibrated using that specific single compound.

### **General Information**

In situations where only a single pure compound is present in air, the VOC Pro should be calibrated with a standard of that specific compound as span gas. The VOC Pro's 15 memory slots can be used to store calibration information for 15 different span gases.

The VOC Pro will always detect all ionisable compounds present in a sample regardless of the response factor (RF) selected.

**NOTE:** *Even if the VOC Pro has been calibrated with a specific compound, its response is not specific and the presence of another ionisable impurity may render the numerical result invalid.*

It is often impractical to carry a range of different standards into the field. Approximate results can be obtained by calibrating the VOC Pro with the recommended span gas and entering the appropriate response factor. The response factor is based on the ratio of the response of the specific compound to the response of the span gas. The response factor multiplies the VOC Pro's reading, then displays and records it.

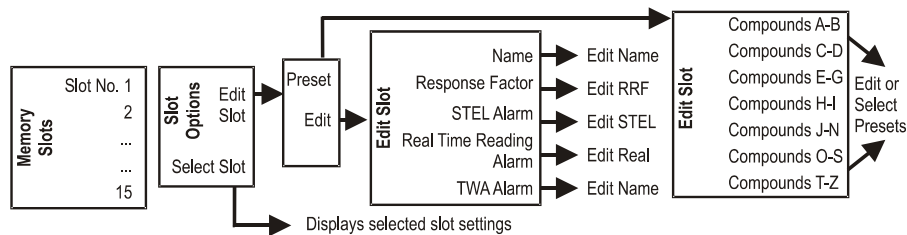
Table 7 on page 110 provides a list of response factors. This list should be used only for concentrations up to 500 ppm of the specific compound, as response factors change with concentration.



WARNING

The VOC Pro is a total VOC instrument and will **ALWAYS** respond to all ionisable compounds present in a sample. The VOC Pro will **NEVER** respond only to a specific compound if an RF is programmed. It is the responsibility of the user to be aware of the limitations of PID instruments.

## Response Factors and Memory Slots



Response factors built into the VOC Pro are used to correct for the response of the PID to a specific compound. These correction factors are often called response factors (RF). The VOC Pro has 15 memory slots. Each memory slot can store one preset RF. Library/RF selections simplify Memory Slot programming and provide standard response factors for approximately 100 compounds. CHOOSE FROM PRESETS allows you to select an entry from a pre-programmed Library. The name, response factor and three alarm levels are all set from the library.

To select a preset to program the selected Memory Slot:

Press MENU, choose “Memory Slots”, and then use the DOWN ARROW soft key to highlight “Memory Slots”, then press the SELECT soft key.

To select a memory slot:

Press the DOWN ARROW key until the memory slot you wish to use is highlighted. Press the SELECT key.

The memory slot compound, RF, TWA, STEL, and Real-time Alarm value are displayed. Press the DONE key to return to the main menu.

To edit a memory slot:

1. Press MENU, then the DOWN ARROW key to highlight “Memory Slot”, then press SELECT.
2. Press the SELECT key to view the “Memory Slot” content and then press the DONE key to return to the Main Menu.
3. Press the EDIT key to change the value for Relative Response Factors (RRF) or the REAL, STEL and TWA alarms.
4. Press the EDIT soft key, highlight either Name, RRF, STEL, TWA, or REAL using the DOWN ARROW key, then press the SELECT soft key.
5. Use the up, down and right arrows soft keys to enter the desired number.
6. Highlight the CHECKMARK and press the DONE soft key.
7. Press the DONE soft key to return to the main display or press the SELECT soft key to edit another value.
8. To return to the Main Menu, press SELECT then DONE.

To select a pre-programmed compound stored in the VOC Pro's Preset RF library:

1. Press the MENU key.
2. Choose "Memory Slots", then press the SELECT key.
3. Press the EDIT key.
4. Press the PRESET key.
5. Use the DOWN ARROW key to choose the alpha range of the compound of interest, then press the SELECT key.
6. Choose the compound of interest using the DOWN ARROW key and press the SELECT key.
7. Press the SELECT key to accept the choice or press EDIT to modify the preset values for STEL, TWA and real time alarm as shown above.

## ***Calibration Technical Description***

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Periodic calibration is required to compensate for the VOC Pro output changes due to inlet filter restriction, ionisation chamber contamination, lamp cleanliness, pump wear and other factors.

During calibration, the VOC Pro is first exposed to zero air. A small (zero) signal is generated. This zero signal is stored by the microprocessor.

The VOC Pro is next exposed to span gas. This span gas signal is stored by the microprocessor. The microprocessor subtracts the zero signal from the span gas signal and divides the difference by the user-entered span gas concentration. The resulting sensitivity is stored in the selected Memory Slots with the zero signal and the alarm levels. This number is then multiplied by the response factor and displayed.

The VOC Pro readings are always relative to the calibration gas. After calibration with isobutylene, the VOC Pro will respond directly in units equivalent to isobutylene. Most volatile organic compounds will be detected by the VOC Pro. It cannot distinguish between isobutylene and other ionisable compounds. A reading of 10 ppm indicates all ionisable compounds that are present have generated an ion current proportional to 10 ppm of isobutylene. The reading is actually 10 ppm isobutylene equivalent units. The VOC Pro readings give an indication of the total ionisables present and their concentration relative to the calibration gas.

## ***Calibration Introduction***

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The VOC Pro must be calibrated in order to display concentration in ppm units equivalent to the calibration gas. First, a supply of zero air, which contains no ionisable gases or vapours, is used to set the VOC Pro's zero point. Then, a calibration gas, containing a known concentration of a photoionisable gas or vapour, is used to set the sensitivity.

Clean indoor ambient air may be substituted for a cylinder of zero air. Due to the VOC Pro's sensitivity, outdoor air is usually unsuitable for

calibration. For best accuracy, use a commercial source of zero grade air and a second regulator. Zero air should have not more than 0.1 ppm total hydrocarbons (THC).

If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder.

**NOTE:** *Disconnect the VOC Pro from the AC adapter before beginning calibration.*

## **Compressed Gases**

Cylinders of compressed gas, such as calibration gas, must be handled with extreme care. For safety, the calibration gas cylinders must be secured before use.

Please observe the following handling procedures:

- Mark each new regulator with its intended gas service and never use a regulator for more than one service. To ensure safety and avoid contamination, regulators should be dedicated to one service. Do not change gas service or adapt equipment without consulting your gas supplier.
- Do not heat or expose cylinders or regulators to temperatures above 52°C (125°F). The cylinders may rupture at high temperatures.
- Use only the specified regulator for the calibration gas. Confirm regulator type and material with your specialty gas supplier.
- Always secure cylinders before removing the cylinder valve protection cap.
- Do not drag or roll cylinders. Large cylinders should only be moved on carts designed for compressed gas cylinders. Do not move cylinders without the valve protection cap in place.
- Wear safety glasses when working with compressed gases.

- Do not store cylinders in a hazardous location. Store cylinders in an upright position away from possible sources of heat or sparks.
- Never plug, obstruct or tamper with safety relief devices.

## **Regulators for Compressed Gases**

When connecting a regulator to a large cylinder:

- Ensure cylinder valve and regulator connection match.
- Ensure regulator construction materials are compatible with the gas, and that the cylinder pressure gauge will withstand the cylinder pressure.
- Never use the regulator as a shut-off valve. Close the cylinder when it is not in use.
- Do not subject the regulator to an inlet pressure greater than recommended.
- Do not move or detach the regulator when it is pressurised or when it is in use.
- Before connection, ensure the gas cylinder valve and the regulator CGA connection are clean.
- Turn the pressure control valve on the cylinder all the way off (close the cylinder). Turn the regulator outlet to off. Open the gas cylinder valve slowly and check for leaks. Adjust the delivery pressure and then open the regulator outlet valve.

## **Calibration Gas**

Adequate ventilation must be provided when the VOC Pro is being calibrated.

If compound threshold limit values (TLV) are exceeded, you should use a gas bag for sampling and calibration.

*To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder*



## **Calibration Using the Regulator**

### **Connecting the Regulator to the Cylinder**



*Observe proper handling procedure for all gases!*

**WARNING**

To connect the regulator to the gas cylinder:

1. Connect the regulator to the calibration gas cylinder.
2. If you are using a portable tank of calibration gas (Part No. G202006), connect the regulator (Part No. G202019) directly to the tank.
3. When the regulator is connected properly, you can read the cylinder contents from the regulator gauge.
4. Connect the adapter tubing to the regulator.



Figure 12. Calibration with regulator

## ***Calibrating the VOC Pro with the Regulator***

1. Ensure that the short sample probe is connected to the VOC Pro inlet. If you are using the long probe for sampling, then ensure the long probe is connected to the VOC Pro.

**NOTE:** *Ensure the sample probe is free of any contamination as this will affect the calibration.*

2. Press the CAL key.
3. Follow the instructions on the display and connect the VOC Pro to zero air or leave the instrument unconnected so it can sample clean ambient air. Then press the “Next” key. The VOC Pro will take 60-90 seconds to set the zero point for calibration.

4. The VOC Pro display will show “Zero air calibrated. Continue calibration?” Press the “Next” key.
5. Enter the span gas concentration if the concentration displayed on the VOC Pro is different than the concentration of the span gas cylinder. Press the “New” key and follow the display prompts. For further information see page 38 for numeric value, duration, time, and date entry. If the span concentration matches the span gas cylinder concentration, press the “Next” key. To exit calibration, press the “Cancel” key.
6. Ensure the calibration gas cylinder is upright and open the regulator by turning the valve counter clockwise. Open the regulator until the ball is 1/8” (3mm) from its rest position.
7. The VOC Pro will take 60-90 seconds to set the span set point. When finished with the calibration, the VOC Pro will display “Calibration complete”.

**NOTE:** *If you are not using the Casella CEL Regulator, ensure that the inlet pressure is less than 5 psi when calibrating.*

**NOTE:** *While the Cal status is active, all alarms are deactivated.*

## **Calibrating the VOC Pro with a Gas Bag**

1. Ensure the short sample probe is connected to the VOC Pro inlet. If you are using the long probe for sampling, then ensure the long probe is connected to the VOC Pro.

**NOTE:** *Ensure the sample probe is free of any contamination as this will affect the calibration*

2. Press the CAL key.
3. Follow the instructions on the display and connect the VOC Pro to zero air sample bag or leave the instrument unconnected so it can sample clean ambient air. Then press the “Next” key. The VOC Pro will take 60-90 seconds to set the zero point for calibration.
4. The VOC Pro display will show “Zero air calibrated. Continue calibration?” Press the “Next” key.
5. Enter the span gas concentration if the concentration displayed on the VOC Pro is different than the concentration of the span gas cylinder. Press the “New” key and follow the display prompts. If the span concentration matches the span gas cylinder concentration, press the “Next” key.
6. Connect the VOC Pro to the sample bag containing the span gas. The VOC Pro will take 60-90 seconds to set the span set point. When finished with the calibration, the VOC Pro will display “Calibration complete”.

**NOTE:** *While the Cal status is active, all alarms are deactivated.*

## ***Preparing for Field Operation***

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### ***Field Check List***

When using the VOC Pro for field operation, the following items should be carried into the field to reduce or eliminate down time of the instrument.

If you are going to be in the field for a single 8-10 hour day, then you should include the following accessories:

**Table 3. Check List for Field Operation**

✓ Spare battery pack (Part No. G202029)
✓ Spare 10.6 UV lamp (Part No. G202002)
✓ VOC Pro multi-tool (Part No. G202026)
✓ Short sample probe (Part No. G202032)
✓ Calibration regulator (Part No. G202019)
✓ Tank(s) of calibration gas (Part No. G202006)
✓ Spare inlet filters (Part No. G202030) pack of 25
✓ Carrying case (Part No. G202020)
✓ Instrument manual (Part No. G202033)
✓ DC power cord (Part No. G202021)

If you will be in the field for more than one day, you should include the following additional items:

**Table 4. Additional Field Items**

✓ Switchable 115/ 220 VAC adapter (Part No.G202007 )
✓ Cable kit (Part No. G202028)
✓ Computer and associated cables

## ***Operational Check List***

Before beginning field work, set up and calibrate the VOC Pro for your particular application.

To ensure the instrument is in working order before heading into the field:

1. Ensure the battery pack is fully charged. If you are unsure about the status of the battery, replace the battery pack with one that is fully charged. See *Battery Charging* on page 27.
2. After calibration is complete, sample the calibration gas and the bag of zero air to ensure the VOC Pro has been calibrated correctly.
3. Select the correct operating mode. See Section regarding *Operation Modes* page 41.

# ***Connecting Accessories*** **4**

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## **Computer**

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The VOC Pro will download information stored in its datalogger to a Windows<sup>®</sup> based computer. This option may be used if you need to prepare reports based on the VOC Pro's recorded data. This feature may also be used if you need the recorded data in a format that can be imported into a spreadsheet or database for further calculations.

**NOTE:** *The VOC Pro is not classified for use in hazardous locations when connected to any computer.*

The instructions below will provide you with the basic information for using the VOC Pro with the VOC Pro communications software, the VOC Pro Comm. In order to use these instructions, you must be familiar with Microsoft Windows and it must be installed and running on your computer.

To initiate communications between the VOC Pro and a PC:

1. Turn the VOC Pro off.

**NOTE:** *You must turn the instrument off before connecting or disconnecting the computer cable.*

2. The VOC Pro must be connected to a serial port. Use the computer cable (Part No. G202028) to connect the VOC Pro to one of the computer's serial ports. Remember which serial port you are using as you will need this information when you set up the VOC Pro Communications software. Normally you will use Com1 or Com2.
3. If the VOC Pro printer cable plugs directly into the port on the computer without the gender changer or the 9 to 25-pin adapter, you are most probably connected to a parallel port. You will need at least one of the adapter cables to connect the VOC Pro to a serial port. Once all connections have been made, turn on the VOC Pro instrument.

4. Start the VOC Pro Comm software as you would any Windows<sup>®</sup> program. The VOC Pro Comm splash screen will appear on the PC. Once the VOC Pro Comm software is running, the PC is ready to receive data from the VOC Pro.
5. On the VOC Pro, the number of data bits has been fixed at 8, stop bits has been fixed at 1. Parity has been set at None and the Flow control is Xon/Xoff. These values are set automatically by the VOC Pro Comm software.
6. On the VOC Pro, press the MENU key, choose “Data Log Options”, then press the SELECT key.
7. Choose the “Download to PC” option using the DOWN ARROW key and press the SELECT key.
8. Follow the VOC Pro prompts to start the data download.

For your reference, the pin assignments for all serial port signals are listed below.

**Table 5. Serial Port Signals**

<b>Pin #</b>	<b>Function</b>	<b>VOC Pro</b>
2	RXD	Output to PC
3	TXD	Input from PC
5	GND	Ground
6	CTS	Output to PC
8	DCE	Output to PC

## **Wrist Strap**

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To use the wrist strap:

1. Turn off the VOC Pro and then remove the battery cover. See *Removing and Replacing the Battery Pack* on page 27.
2. Place the metal ring of the wrist strap in the circular notch located on the battery door.
3. Replace the battery cover.
4. Adjust the strap length as necessary.

## **DC Power Cord**

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The VOC Pro can be connected to a car battery through the cigarette lighter with the DC power cord. While the VOC Pro is connected to the car battery, the VOC Pro battery is being charged.

**NOTE:** *The VOC Pro is not classified for use in hazardous locations with a DC power cord.*

To connect the VOC Pro to a DC power supply:

1. Turn the instrument off by pressing the ON/OFF key for five seconds.
2. Connect the DC power cord (Part No. G202021) to the VOC Pro AC adapter jack on the rear of the instrument.
3. Connect the other end of the DC power cord to the cigarette lighter in the car.
4. Turn the instrument on again by pressing the ON/OFF key.

If the vehicle is running, ensure the engine exhaust does not contaminate your samples.

## ***Belt Clip Holster***

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Use the belt clip holster (Part No. G202018) to protect the instrument and to mount the instrument to a belt.

1. Insert the VOC Pro into the holster.

## ***11.7 eV UV Lamp***

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### ***General Information***

The VOC Pro is equipped with a standard 10.6 eV UV lamp. An 11.7 eV UV lamp (Part No. G202003) is available for special applications.

Install this lamp as outlined in Removing and Replacing the UV Lamp on page 83. When you install a UV lamp other than the standard 10.6 eV lamp, all the response factors become invalid. You must set the response factor for the current cal memory to 1. Contact Casella CEL's Applications Department for further information.

**NOTE:** *Do not use the 11.7 eV lamp in conjunction with the dilution probe.*

### ***Limitations of Lithium Fluoride Lamp Window***

This lamp is intended for special applications only. It is not suitable for normal operation, due to limitations of the lamp window material.

The 11.7 eV lamp window material is lithium fluoride (LiF). LiF is composed of two light elements which are easily disrupted within the crystal

lattice by the UV light generated by the lamp. Disruption of the lattice causes the crystal to turn a yellowish color, and performance may decline.

Unlike other lamp windows, LiF readily absorbs water from atmospheric humidity. When contaminated by moisture, the window loses its ability to transmit UV light.

**NOTE:** *Do not touch the lamp window or handle it near water.*

## **Using the 11.7 eV UV Lamp**

With an 11.7 eV lamp installed, your instrument functions as a detector responding to compounds which ionise at 11.7 eV or less. The 11.7 eV lamp may be useful for detecting compounds not ionised by the standard 10.6 eV lamp.

Due to the LiF lamp window limitations, the lifetime of the 11.7 eV lamp may be shortened and it should be used sparingly according to the following instructions.

To use the 11.7 eV lamp in your the VOC Pro:

1. Remove the 11.7 eV lamp from the supplied desiccant bottle and install the lamp as outlined in Removing and Replacing the UV Lamp on page 80.

**NOTE:** *Do not remove or replace any detector lamp in a hazardous location.*

2. Turn the instrument on and wait for the ready status. If the lamp cannot be started, contact Casella CEL's Technical Support Department.
3. Calibrate the VOC Pro. See *Calibration Using the Regulator* on page 61.

4. All response factors are invalid when an 11.7 eV lamp is installed. The response factor must be set to 1.
5. Recalibrate the instrument every 15 minutes of operation.
6. Every hour of operation, switch off the instrument, remove the lamp and examine the window for yellowing. If the window is yellow, then regenerate the window according to the procedure in *Cleaning the Lithium Fluoride Window* on page 87.
7. After use, remove the lamp and store it in the supplied desiccant bottle.

**Do not leave the 11.7 eV lamp in the instrument when you turn it off. Always remove the 11.7 eV lamp and store it in the supplied desiccant bottle.**

## **Off-Line Charger**

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### **General Information**

The off-line charger (Part No. G202027) allows you to charge a battery pack independently of the VOC Pro. To charge a battery pack without removing it from the VOC Pro, see *Battery Charging* on page 27.

The off-line charger requires one of the following the VOC Pro accessories for operation:

- AC Adapter (Part No. G202010 - North America)
- AC Adapter (Part No. G202009 - Europe)
- AC Adapter (Part No G202008- UK)
- DC Power Cord (Part No. G202021)

Use only the AC adapter specified for use with the VOC Pro. Using another AC adapter will result in damage to the battery pack, the off-line charger, or the adapter.

### **Charging from an AC Source**

**NOTE:** *Do not charge the battery pack in a hazardous location.*

To re-charge your battery pack:

1. Remove the battery pack as outlined in *Battery Charging* on page 27.
2. Attach the connector from the battery pack to the socket on the off line charger.

**NOTE:** *The connector is polarized. It will only fit one way. Do not force the connection.*

3. Plug the AC adapter into the jack on the opposite face of the off-line charger.
4. Plug the AC adapter into an AC outlet. If you are using the European AC adapter, ensure the correct plug is installed on the line cord. If it is not correct for the wall outlet in your area, then it must be replaced.
5. The LED on the upper face of the off-line charger indicates the charge state of the battery pack. Red indicates the battery is being charged. Green indicates the battery is fully charged.
6. Charging a fully discharged battery pack will take approximately four hours.
7. It is normal for a fully charged battery pack to indicate it is charging (red light) when first plugged in. The LED will turn green within a few minutes to indicate the battery is fully charged.
8. When the battery pack is fully charged, remove the AC adapter, first from the wall outlet, then from the off line charger.
9. Remove the battery pack connector from the socket on the off-line charger.
10. Replace the battery pack in the VOC Pro as outlined in *Removing and Replacing the Battery Pack* on page 279.

You can keep the battery pack fully charged indefinitely, without overcharging it, by leaving it connected to the off-line charger while the charger is operating.

## ***Charging from a DC Source***

To re-charge your battery pack:

1. Remove the battery pack as outlined in *Removing and Replacing the Battery Pack* on page 27.



2. Attach the connector from the battery pack to the socket on the off-line charger.

**NOTE:** *The connector is polarized. It will only fit one way. Do not force the connection.*

3. Plug the DC power cord into the jack on the opposite face of the off-line charger.
4. Plug the DC power cord into a vehicle auxiliary 12 VDC or cigarette lighter socket.
5. The LED on the upper face of the off line charger indicates the charge state of the battery pack. Red indicates the battery is being charged. Green indicates the battery is fully charged.
6. Charging a fully discharged battery pack will take approximately 4 hours.
7. It is normal for a fully charged battery pack to indicate it is charging (red light) when first plugged in. The LED will turn green within a few minutes to indicate the battery is fully charged.
8. When the battery pack is fully charged, remove the DC power cord, first from the vehicle auxiliary 12 VDC or cigarette lighter socket, then from the off-line charger.
9. Remove the battery pack connector from the socket on the off-line charger.
10. Replace the battery pack in the VOC Pro as outlined in *Battery Charging* on page 27.

You can keep the battery pack fully charged indefinitely, without overcharging it, by leaving it connected to the off line charger while the charger is operating.



***Routine  
Maintenance*** **5**

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## ***Battery Charging***

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A fully charged battery pack powers the VOC Pro for approximately 8 hours. If the instrument is to be used for more than 8 hours, carry a spare battery pack (Part No. G202029). When the first one has been discharged, replace it with the spare.

**NOTE:** *If you do not turn the VOC Pro off before removing the battery pack, you will reset the instrument and you will lose all logged data and setup parameters.*

When the VOC Pro displays the low battery symbol, the battery pack requires charging. When the low battery symbol is displayed, you have 30 minutes of operation left. The VOC Pro will turn itself off before the battery pack becomes critically low.



*Do not remove or recharge the battery pack in a hazardous location.*

### **WARNING**

Upon return from field work, charge the battery packs as outlined in *Battery Charging* on page 27. Use only the AC adapter specified for use with the VOC Pro. Optionally you can use the off-line charger to charge the battery pack independently of the instrument. See *Off-Line Charger* on page 75.

**NOTE:** *You must use the 115 / 220 V battery charger (Part No. G202007) in order to comply with the requirements of the applicable Council Directives.*

If you do not require portable operation, you can use the VOC Pro while it is connected to the AC adapter.



*The VOC Pro is not intrinsically safe when connected to an AC adapter.*

**WARNING**

The AC adapter automatically charges at a high charge rate until the battery pack is fully charged. It then maintains the full charge with a low continuous charge rate indefinitely so there is no danger of over-charging.

When the Charge LED on the top of the VOC Pro is red, the battery is charging. When the Charge LED turns green, the battery is fully charged.

## ***Battery Pack Care***

Leaving the VOC Pro for more than 3 months without charging the batteries may result in the loss of recorded data and setup parameters. If the VOC Pro is not used for long periods of time, recharge the battery for a few hours every 30 days to avoid loss of data. See *Battery Charging* on page 27 for instructions on charging the battery.

Please observe the following:

- For replacement battery pack use only Part No. G202029.
- Do not dispose of the battery pack in a fire. The cell may explode.
- The battery pack is 24% cadmium (Cd) by weight. This battery pack must be disposed of properly. Check with local codes for special disposal instructions.
- Do not open or mutilate the battery pack.
- Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.

- Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For AC adapter use only Part No. G202010 (North America) or G202009 (Europe), or G202008 for UK.

## ***Maintenance of the UV Lamp***

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### ***Removing and Replacing the UV Lamp***

**NOTE:** *Do not remove or replace the UV lamp in a hazardous location.*

To remove the UV lamp from your instrument:

1. Ensure the instrument is turned off.



*You must turn the instrument off before removing the lamp cover.*

**WARNING**

2. Remove the lamp housing cover.
3. Tilt the VOC Pro slightly and remove the UV lamp.



*Do not touch the wire grid inside the detector cell. Any dust or dirt in the detector cell can be blown out with a gentle jet of compressed air.*

**WARNING**

*Do not insert any object, other than the UV lamp, into the lampholder.*

4. Without touching the lamp window, place the new lamp into the VOC Pro lamp holder, window first. See *Figure 13*.



**Figure 13. Removing the UV Lamp**

**NOTE:** *Do not force the lamp into the lampholder.*

5. Replace the lamp housing cover. Tighten the cover down. Do not overtighten.
6. Calibrate the VOC Pro and then continue normal operation.



## ***Cleaning the UV Lamp Window***

During the course of normal operation, a film builds up on the window of the UV lamp. The rate at which the film develops depends on the type and concentration of the gases and vapours being sampled and results from the UV light interacting with them.

Hot gases and vapours may contribute to a decrease in sensitivity because they may condense on the lamp window. Condensation may eventually evaporate off the window, but it will usually leave a residue that must be removed by cleaning the lamp window.

Since some UV inhibiting deposits are invisible to the eye, regular cleaning of the lamp window is strongly recommended. Clean the lamp frequently to prevent a heavy buildup of deposits that may be difficult to remove.



*Do not remove the UV lamp in a hazardous location.*

**WARNING**

The UV lamp cleaning kit (Part No. G202025) includes aluminum oxide powder (3.0-micron powder) and cotton swabs. Additionally, you will require approximately 10 mL of methanol. When ordering methanol, specify purge and trap grade.

The instructions provided below are for 10.6 eV lamps. Refer to *Cleaning the Lithium Fluoride Window* for special instructions to clean the 11.7 eV lamp window.



*Never touch the UV lamp window with your fingers.*

**WARNING**

To clean the UV lamp:

1. Remove the lamp as outlined in Removing and Replacing the UV Lamp on page 83.
2. Allow the lamp to cool to room temperature to avoid thermal shock, which could crack the window.
3. Dampen a cotton swab in methanol and dab it into the cleaning compound. Allow a small amount of the cleaning compound to adhere to the cotton tip.



*Do not use methanol to clean the 11.7 eV lamp window.*

**WARNING**

4. Using small circular motions, rub the cleaning compound onto the lamp window. Do not exert excessive force onto the window, since the window can be permanently damaged by misuse.
5. Continue cleaning for approximately one minute.
6. Dampen a new cotton swab with methanol and remove any trace amounts of the cleaning compound from the lamp window.

7. Wipe the window and the lamp with a dry, lint free tissue to remove any trace amounts of the cleaning compound and methanol. All traces of cleaning compound must be removed.
8. Without touching the lamp window, replace the lamp as outlined in Removing and Replacing the UV Lamp on page 83.

## ***Cleaning the Lithium Fluoride Window***

To clean the 11.7 eV lamp window:

1. Clean the lamp window with dry aluminum oxide powder on a dry cotton swab. Do not use methanol or water.
2. Wipe the window and the lamp with a dry, lint free tissue to remove any trace amounts of the cleaning compound and methanol. All traces of cleaning compound must be removed.
3. The lamp window can also be regenerated by storing the lamp in a desiccant for at least 5 days.

**NOTE:** *You may not be able to fully clean the 11.7 eV lamp window.*

## ***Replacing the Sample Inlet Filter***

---

The VOC Pro is equipped with a combined dust and water filter to reduce detector contamination. As the filter collects dust, the VOC Pro's inlet flow rate and sensitivity decrease. The filter will not allow water to pass through, but the filter will not stop all solvents.

**NOTE:** *Do not aspirate liquid samples with the VOC Pro!*

Replace the filter on a weekly basis, or more frequently if the VOC Pro is used in a dusty or wet environment. You must replace the filter if the VOC Pro has been exposed to water. If you are sampling hot gases or vapours, condensation in the sample line may also affect the filter.



*Do not replace the inlet filter in a hazardous location.*

**WARNING**

To replace the inlet filter:

1. Turn the instrument off. Unscrew the filter housing from the detector housing. Be careful not to lose the O-ring seal.
2. Remove the Teflon/Polypropylene filter and install the new filter (Part No. G202030). Place the filter so that the Teflon side is facing down in the filter housing and the mesh side is facing the VOC Pro.



**Figure 14. Replacing the Inlet Filter**

### *Routine Maintenance*

Handle the filter disk only by the edges. The mesh may be damaged or contaminated by excessive handling. Use forceps if possible.

3. Replace the filter housing.
4. Recalibrate and then continue normal operation.



# ***Troubleshooting* 6**

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## ***General Information***

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If you have a service-related question about the VOC Pro, consult this manual first. If you cannot find the answer in this documentation, contact Casella CEL's Technical Support Department.

When you call, please have the following information ready:

1. A description of what happened and what you were doing when the problem occurred.
2. Any corrective action that you have tried.
3. The exact wording of any messages that appeared on the display.



**WARNING**

*Do not service the VOC Pro in a hazardous location.*

## ***Troubleshooting***

<b>Situation</b>	<b>Cause</b>	<b>Action</b>
Zero Air Error	Contamination of sample lines, sample probe, inlet filter or fittings before the detector	Clean or replace contaminated item
	Span gas and zero air are mixed up.	Ensure that clean air is used to zero the VOC Pro. If you are using gas bags, mark the zero air and span gas bags clearly.
	Ambient air is contaminated.	If you are not sure of the cleanliness of the ambient air, use a commercial zero grade air to zero the VOC Pro.
Span Gas Error	Span gas and zero air are mixed up.	Ensure that clean air is used to zero the VOC Pro. If you are using gas bags, mark the zero air and span gas bags clearly.
	Span gas concentration is too low.	Span gas concentration should be higher than 25 ppm.
	UV lamp window is dirty.	Clean the lamp window. See page 85.
	UV lamp is failing.	Install a new lamp. See Removing and Replacing the UV Lamp on page 83.
	The concentration and sample gas are not compatible with the VOC Pro.	Contact Casella CEL for assistance.

*Troubleshooting*

UV Lamp Error	UV lamp has not started immediately.	This fault may occur momentarily when the VOC Pro is first turned on. Allow 60 seconds for UV lamp to start and fault to clear.
		Turn the VOC Pro off then on again. Wait 60 seconds for UV lamp to start.
	UV lamp is not installed	Install UV lamp. See Removing and Replacing the UV Lamp on page 83.
	Incorrect lamp is installed.	Use only a getterless UV lamp. G202002 or G202003
	Electronic problem	Contact Casella CEL for assistance.
Pump Error	If the pump sounds labored, the pump is operating outside its normal operating range.	Check for obstructions in the sample line.  Verify that the sample line, sample probe and inlet filter are not blocked.
		Ensure that the sample outlet is not blocked.
	The VOC Pro has aspirated a liquid.	Contact Casella CEL for assistance.
	The pump has failed.	Contact Casella CEL for assistance.
Blocked Filter		Replace the inlet filter Casella CEL Part No. G202030.

Instrument over range. Display will read ^^^^.	High concentrations of gases will saturate the detector and electronics.	Wait until the display returns to normal. PIDs are designed to detect relatively low levels of gases.
	The detector has become saturated.	Move the VOC Pro to a location where it can sample clean air. Sample clean air until the readings stabilize at a low level.
	Detector has been short-circuited by foreign matter in the cell.	Contact Casella CEL for assistance.

## **General Questions**

Very low or no instrument response detected, yet compounds are known to be present	The VOC Pro has not been properly calibrated.	Verify the concentration of the span gas. Calibrate the VOC Pro. See page 58.
	Memory slots are not set up correctly.	Program the memory slots. See page 55.
	Response Factor has been set to zero.	Set Response Factor to 1.0 or refer to Table 7 for correct response factor.
	Detector is leaking.	Ensure the UV lamp is correctly installed.
		Ensure the lamp cover is tight. Do not over tighten.
		Ensure the O-ring seal on the lamp cover is positioned correctly.
	UV lamp is the incorrect size.	Contact Casella CEL for correct lamp.
	Sampling environment is extremely humid or it is raining.	Water vapour is not ionised by the PID. Water vapour does scatter and absorb light that causes a higher or lower reading. The VOC Pro has been designed to work in a

		humid environment but you may notice a decreased response.
	UV lamp is failing.	Install a new UV lamp. See page 83.
	High concentrations of non-ionisable compounds.	Chemical compounds with an ionisation potential higher than 10.9 eV or 11.9 eV scatter and absorb UV light. Sensitivity may be decreased. Contact Casella CEL for more information.
Erroneous high readings	Sampling environment is very humid.	Water vapour may contain mineral salts which carry a charge. The water vapour becomes an electrolytic solution which becomes ionised when it enters the detector.
	The VOC Pro is not properly calibrated.	Ensure that the calibration gas is the correct concentration and calibrate the VOC Pro as described on page 58.
	Memory Slots have not been properly programmed.	Program the memory slots. See page 55.
	Detector has been short-circuited by foreign material.	Contact Casella CEL for assistance.
Date and time setting are not retained	The battery pack was removed before the VOC Pro was turned off.	Replace the battery pack and reset the time and date. See page 27.

*Troubleshooting*

	The VOC Pro has not been used for 3 months or more.	Connect the VOC Pro to the battery charger and recharge the battery. Reset the date and time.
Display is blank	Battery pack is critically low.	Recharge or replace the battery pack.
	The battery pack is not connected to the VOC Pro properly.	Ensure the battery pack connector is securely attached to the VOC Pro.
Sample flow is less than 300 ml/min/	Inlet filter is plugged.	Replace the inlet filter. See page 87.
	Inlet filter is incorrectly installed.	Ensure the inlet filter is installed correctly. See page 87.
	Sample outlet is blocked.	Clear blockage from sample outlet.
	Pump has been damaged.	Contact Casella CEL for assistance.
Liquid has been aspirated.	The VOC Pro has been exposed to a solvent that can pass through the inlet filter.	Contact Casella CEL for assistance.
	Very corrosive gases have been sampled.	Contact Casella CEL for assistance.
Cannot download data to PC	Cable is not connected.	Connect the VOC Pro to the PC. See page 69.





# ***Appendices* 7**

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## **Specifications**

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Size:	9" (228.6 mm) long x 3" (76.2 mm) deep x 4.25" (107.9 mm) wide at display tapering to 2.6" (66 mm) at handle
Weight:	1.9 pounds (0.86 kg)
Detector:	Instant on photoionisation detector with standard 10.6eV UV lamp, optional 11.7 eV lamp available
Keypad:	5 keys with tactile feedback.
Display:	128 x 64 LCD display for alphanumeric readouts and soft key display
Datalogger memory:	15,000 entries
Serial output:	RS-232, 9600 baud, 8 data bits with no parity, for connection to a Windows™ compatible computer
Audio output:	80 decibels @ 2048 Hz, on Alarm
Inlet connection:	1/8" (3.175 mm) fitting
Battery type:	Nickel cadmium rechargeable cell with intelligent charger. The battery pack is 24% cadmium (Cd) by weight.
Charge/discharge time:	4 hr/8 hr
Input Power:	12 VDC, 1.0 A
Battery charger:	Automatically charges and maintains full charge in battery pack.

Casella CEL Part No U.S. and Canada – G202010 / G202008 –  
UK / G202009 (Eur)

Input: 120VAC 60 Hz 21W

Output: +12VDC 1000mA

Regulatory Approvals: CSA, UL  
All other Countries – Casella CEL  
Part No. G202007

Input: 100-250VAC 50-60 Hz 0.5-0.3A

Output: +12VDC 2.08A

Regulatory Approvals: CE Mark, CSA, UL

Materials in sample stream: Stainless steel, Teflon,  
Viton®, polypropylene, nitrile  
chorobutadiene rubber, nickel.

Inlet filter: Replaceable Teflon/Polypropylene, 1 µm

Inlet flow rate: Greater than 300 mL/min

Operating temperature range: 0 to 40°C (32 to 105°F)

Operating humidity range: 0 to 95% relative humidity  
(non-condensing)

Operating altitude range: Up to 10,000 ft (3000 m)

Storage temperature range: -10 to 65°C (14 to 149°F)

Storage humidity range: 0 to 100% relative humidity (non-  
condensing)

Storage altitude range:	Up to 15,000 ft (4570 m)
Operating concentration range:	0.5 to 2000 ppm, isobutylene
Accuracy:	+/-10% or +/-2 ppm, whichever is greater
Precision:	1% of calibration (calibrated with 100 ppm isobutylene)
Response time:	Less than 3 seconds to 90%
Detection limit:	0.5 ppm isobutylene
Dilution probe:	Normal calibration: concentrations between 100 to 20,000 ppm +/- 20% High accuracy calibration: concentrations between 100 to 1000 ppm +/- 15%. Concentrations between 1000 to 20,000 ppm +/- 20%

**NOTE:** *Specifications subject to change without notice.*

## **Warranty**

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The VOC Pro is warranted for one year against defects in materials and workmanship.

Casella CEL warranties that its manufactured product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment by Casella CEL. This may be voided if, in the opinion of Casella CEL, the product has been abused or treated in a negligent manner so as to cause damage or failure. Negligent use includes, but is not limited to, exposure of the internal parts of the equipment to water. Damage caused thereby is expressly excluded from this Warranty.

Consumable supplies and parts routinely replaced are not warranted.

Casella CEL and its vendors disclaim any implied warranty of merchantability or fitness for a particular purpose. Casella CEL and its vendors will not be liable for any indirect, special, incidental, or consequential damages, irrespective of whether Casella CEL or the vendor has advance notice of the possibility of such damages.

Casella CEL's sole liability under this warranty is limited to the repair or replacement of the product at Casella CEL's discretion at its Service/Repair facility and return to the Customer.

The customer is responsible for insurance and shipping to the designated Casella CEL Service/Repair facility.

## ***Contacting Casella CEL***

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To place an order, check the status of an order, obtain current pricing and availability	+ 44 (0) 1234 844100
Service and repair of your instrument	
Technical Support Department	+44 (0) 1234 844100
Customer Service	
Worldwide:	Casella CEL Ltd Regent House Wolseley Road Kempston Beds MK42 7Jy England +44 (0) 1234844100 www.casellacel.com info@casellacel.com

**Table 6. Contact Information**

## ***Installing Alternate AC Plug on the Battery Charger***

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In most cases the VOC Pro will be shipped with an AC line cord that will fit the AC wall outlet in your area. If this cannot be done, you may need to obtain an AC line cord suitable for the AC receptacle in your area.

The AC line cord, attached plug and receptacle must be marked with your country's certification mark and the cord must have a Harmonization (HAR) mark.

The line cord must be rated for either 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz. The voltage rating will depend on the voltage in your area.

Contact your Casella CEL representative to obtain more information.

## ***Calibration Gas Supplier***

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The recommended span gas is isobutylene in air. 100 ppm isobutylene in air may be obtained from Casella CEL.

The exact concentration will be determined by your application. Other concentrations and other gases may be obtained from your local gas supplier. If you cannot locate a local gas supplier, contact Casella CEL's Technical Support Department.

## ***Using the Gas Bag***

---

To fill gas bag:

1. Turn the knurled plastic knob counter clockwise to unlock it. Use the knurled collar on the valve tube to gently push the valve tube down, toward the bag.



2. Turn the knurled plastic knob clockwise to lock the valve tube in place.
3. Turn the regulator knob counter clockwise about half a turn to start the flow of gas. Fill the gas bag about half full and then close the regulator.
4. Open the syringe port and empty the bag. Flush the bag a few times with the calibration gas and then fill it.
5. To close the gas bag valve, turn the knurled plastic knob counter-clockwise to unlock it. Gently pull the valve tube up to close the valve. Turn the knurled plastic knob clockwise to tighten it against the valve tube.

Once the bag has been filled, use the bag and sample as soon as possible.

**NOTE:** Do not use gas bags to sample unstable or highly reactive compounds. Do not use Tedlar® bags for storage of hazardous materials.

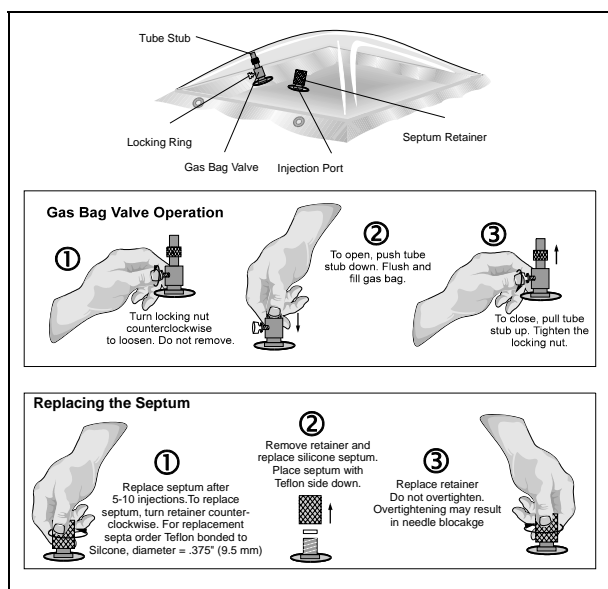


Figure 15. Using the Gas Bag

### System Fuse Values

Module	Fuse	Voltage, Current, Type
Battery Pack	F1	125VDC, 750 mA, Very Fast Acting
Microcontroller Board	F1	125VDC, 1.5 A, Very Fast Acting
Display Board	F1,F2	125VDC, 125 mA, Very Fast Acting
Display Board	F3	125VDC, 100 mA, Very Fast Acting

## Response Factors

The response factors were determined over the range 5 - 500 ppm, based on a 100-ppm isobutylene calibration. Isobutylene RF = 1.0. The following formula was used for calculation of response factors:

$$\text{Response Factor} = \frac{\text{Actual Concentration}}{\text{VOC Pro Response}}$$

A response factor less than 1.0 indicates a compound response better than that of isobutylene. A response factor greater than 1.0 indicates a lower response than that of isobutylene.

**NOTE:** *It does not matter which response factor is entered. The VOC Pro's response is not specific to any one compound. The reading displayed represents the total concentration of all ionisable compounds in the sample.*

When using response factors, results are expected to be accurate to +/- 10 ppm or +/- 25%, whichever is greater.

**Table 7. Response Factors**

<b>Compound</b>	<b>Response Factor</b>
Acetaldehyde	<b>10.5</b>
Acetone	<b>1.2</b>
Acetophenone	<b>2.0</b>
Acrolein (2-Propenal)	<b>4.0</b>
Acrylic Acid	<b>10.9</b>
Acrylonitrile	<b>ND<sup>3</sup></b>
Allyl Chloride (3-Chloro-1-Propene)	<b>3.9</b>
Benzene	<b>0.5</b>
Bromoform (Tribromomethane)	<b>2.0</b>
1,3-Butadiene	<b>0.7</b>
n-Butane	<b>0.2</b>
n-Butanol	<b>3.4</b>
n-Butyl Acetate	<b>2.3</b>
Butyl Acrylate	<b>1.8</b>
Butyl Cellosolve	<b>3.1</b>
n-Butyl Acrylate	<b>1.8</b>
n-Butyl Mercaptan (Butanethiol)	<b>0.6</b>
Carbon Disulfide	<b>1.3</b>
Chlorobenzene	<b>0.4</b>
Crotonaldehyde (2-Butenal)	<b>1.2</b>
Cumene (Isopropylbenzene)	<b>0.6</b>
Cyclohexane	<b>1.3</b>

Cyclohexanol	<b>3.4</b>
Cyclohexanone	<b>0.9</b>
Diacetone alcohol	<b>1.8</b>
1,2-Dichlorobenzene (ortho-)	<b>0.5</b>
cis-1,2-Dichloroethylene	<b>0.8</b>
trans-1,2-Dichloroethylene	<b>0.4</b>
N,N-Dimethylformamide (DMF)	<b>0.8</b>
1,4-Dioxane	<b>1.3</b>
Epichlorohydrin	<b>6.5</b>
Ethanol	<b>8.8</b>
Ethyl Acetate	<b>3.8</b>
Ethyl Acrylate	<b>2.3</b>
Ethylbenzene	<b>0.5</b>
Ethyl Cellosolve (2-Ethoxyethanol)	<b>1.3</b>
Ethylene Glycol	<b>0.1</b>
Ethyl Ether (Diethyl Ether)	<b>1.2</b>
Ethyl Mercaptan (Ethanethiol)	<b>0.6</b>
Ethylene	<b>10.1</b>
n-Heptane	<b>2.4</b>
n-Hexane	<b>4.7</b>
2-Heptanone	<b>2.1</b>
Hydrogen Sulfide	<b>3.3</b>
Isoamyl Acetate	<b>1.8</b>
Isobutyl Acetate	<b>2.6</b>
Isobutyl Alcohol	<b>0.3</b>

Isobutyraldehyde	<b>1.1</b>
Isopentane	<b>8.2</b>
Isoprene (2-Methyl-1,3-Butadiene)	<b>0.6</b>
Isopropanol	<b>4.4</b>
Isopropyl Acetate	<b>2.6</b>
Isopropyl Ether	<b>0.8</b>
Mercaptopropionic Acid	<b>0.1</b>
Methacrylic Acid	<b>000<sup>4</sup></b>
Methyl n-Amyl Ketone (2-heptanone)	<b>2.1</b>
Methyl Bromide (Bromomethane)	<b>1.6</b>
Methyl Chloroform (1,1,1 – TCA)	<b>000<sup>4</sup></b>
Methylene Chloride	<b>000<sup>4</sup></b>
Methyl Ethyl Ketone (2-Butanone)	<b>0.8</b>
Methyl Isobutyl Ketone	<b>1.0</b>
Methyl Mercaptan	<b>0.5</b>
Methyl Methacrylate	<b>1.4</b>
Methyl tert-Butyl Ether (MTBE)	<b>0.8</b>
Monomethylamine	<b>1.3</b>
n-Nonane	<b>1.4</b>
iso-Octane (2,2,4-Trimethylpentane)	<b>1.2</b>
n-Pentane	<b>10.4</b>
Polypropylene	<b>0.8</b>
Propane	<b>000<sup>4</sup></b>
n-Propanol	<b>5.1</b>
Propionaldehyde (Propanal)	<b>14.8</b>

n-Propyl Acetate	<b>3.1</b>
Propylene	<b>1.2</b>
Propylene Oxide	<b>5.8</b>
Styrene	<b>0.4</b>
Syltherm XLT	<b>9.8</b>
Tetrachloroethylene (Perchloroethylene)	<b>0.5</b>
Tetrahydrofuran	<b>1.5</b>
Therminol	<b>000<sup>4</sup></b>
Toluene	<b>0.5</b>
1,1,1 – Trichloroethane	<b>000<sup>4</sup></b>
Triethanolamine	<b>ND<sup>3</sup></b>
Trichloroethylene (TCE)	<b>0.5</b>
Trimethylamine	<b>0.9</b>
1,2,4 – Trimethyl Benzene	<b>2.3</b>
1,3,5 – Trimethyl Benzene	<b>1.7</b>
Vinyl Acetate	<b>1.2</b>
Vinyl Bromide	<b>0.4</b>
Vinyl Chloride (Chloroethylene)	<b>1.7</b>
Vinylidene Chloride (1,1-DCE)	<b>0.8</b>
meta –Xylene	<b>0.5</b>
ortho –Xylene	<b>0.5</b>
para-Xylene	<b>0.5</b>

## Presets

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Presets simplify Memory Slot programming, and provide standard response factors and alarm levels for approximately 100 compounds. The name, response factor and three alarm levels are all set from the preset.

You can change any of the values entered in the Memory Slots. Changes made to the library information that has been loaded into a Preset will have no effect on the original library entry.

**NOTE:** *It does not matter which response factor is entered. The VOC Pro's response is not specific to any one compound. The displayed reading represents the total concentration of all ionisable compounds in the sample.*

**Table 8. Library Entries**

Compound	Code	RF
Acetaldehyde	ACETAL	10.5
Acetone	ACETONE	1.2
Acrolein (2-Propenal) <sub>5</sub>	ACROLEIN	4.0
Allyl Chloride (3-Chloro-1-Propene) <sub>5</sub>	ALLCHLOR	3.9
Benzene	BENZENE	0.5
Bromoform (Tribromomethane) <sub>5</sub>	BROMFORM	2.0
1,3-Butadiene	13BUTADI	0.7
n-Butanol	nBUTANOL	3.4
n-Butyl Acetate	nBUTACET	2.3
n-Butyl Acrylate	nBUTACRY	1.8
n-Butyl Mercaptan (Butanethiol) <sub>6</sub>	nBUTMERC	0.6
Carbon Disulfide	CS2	1.3
Chlorobenzene	CHLOBENZ	0.4
Crotonaldehyde (2-Butenal)	CROTONAL	1.2

Cumene (Isopropylbenzene)	CUMENE	<b>0.6</b>
Cyclohexane	CYCHEXAN	<b>1.3</b>
Cyclohexanone	CYCHEXON	<b>0.9</b>
1,2-Dichlorobenzene (ortho-)	12DCBENZ	<b>0.5</b>
cis-1,2-Dichloroethylene	cis12DCE	<b>0.8</b>
trans-1,2-Dichloroethylene	trn12DCE	<b>0.4</b>
N,N-Dimethylformamide (DMF)	N,N-DMF	<b>0.8</b>
1,4-Dioxane	DIOXANE	<b>1.3</b>
Epichlorohydrin <sup>5</sup>	EPICLHYD	<b>6.5</b>
Ethanol	ETHANOL	<b>8.8</b>
Ethyl Acetate	ETHYACET	<b>3.8</b>
Ethyl Acrylate	ETHYACRY	<b>2.3</b>
Ethylbenzene	ETBENZEN	<b>0.5</b>
Ethyl Cellosolve (2-Ethoxyethanol)	ETHCELLO	<b>1.3</b>
Ethyl Ether (Diethyl Ether)	ETHETHER	<b>1.2</b>
Ethyl Mercaptan (Ethanethiol) <sup>6</sup>	ETHMERC	<b>0.6</b>
Ethylene <sup>7</sup>	ETHYLENE	<b>10.1</b>
n-Heptane	nHEPTANE	<b>2.4</b>
n-Hexane	nHEXANE	<b>4.7</b>
Hydrogen Sulfide	H2S	<b>3.3</b>
Isoamyl Acetate	IAMYACET	<b>1.8</b>
Isobutyl Acetate	IBUTACET	<b>2.6</b>
Isobutylene (Calibration)	ISOBUTYL	<b>1.0</b>
Isobutyraldehyde <sup>6</sup>	IBUTALDE	<b>1.1</b>
Isopentane	IPENTANE	<b>8.2</b>
Isoprene (2-Methyl-1,3-Butadiene) <sup>8</sup>	ISOPRENE	<b>0.6</b>
Isopropanol	IPA	<b>4.4</b>
Isopropyl Acetate	IPACETAT	<b>2.6</b>
Isopropyl Ether	IPROPETH	<b>0.8</b>
Methyl Bromide (Bromomethane)	MeBROM	<b>1.6</b>



Methyl Ethyl Ketone	MEK	<b>0.8</b>
Methyl Isobutyl Ketone	MIBK	<b>1.0</b>
Methyl Mercaptan (Methanethiol) <sup>6</sup>	METHMERC	<b>0.5</b>
Methyl Methacrylate	MeMeACRY	<b>1.4</b>
Methyl tert-Butyl Ether (MTBE)	MTBE	<b>0.8</b>
Monomethylamine	MMeAMINE	<b>1.3</b>
n-Nonane	nNONANE	<b>1.4</b>
iso-Octane (2,2,4-Trimethylpentane)	IOCTANE	<b>1.2</b>
n-Pentane	nPENTANE	<b>10.4</b>
n-Propanol	nPA	<b>5.1</b>
Propionaldehyde (Propanal) <sup>5</sup>	PROPANAL	<b>14.8</b>
n-Propyl Acetate	nPROACET	<b>3.1</b>
Propylene <sup>7</sup>	PROPYLEN	<b>1.2</b>
Propylene Oxide	PROPOXID	<b>5.8</b>
Styrene	STYRENE	<b>0.4</b>
Tetrachloroethylene (PCE)	PCE	<b>0.5</b>
Tetrahydrofuran	THF	<b>1.5</b>
Toluene	TOLUENE	<b>0.5</b>
Trichloroethylene	TCE	<b>0.5</b>
Trimethylamine	TRMeAMIN	<b>0.9</b>
Vinyl Acetate	VINACET	<b>1.2</b>
Vinyl Bromide	VINBROM	<b>0.4</b>
Vinyl Chloride (Chloroethylene)	VINCHLOR	<b>1.7</b>
Vinylidene Chloride (1,1-DCE)	1,1-DCE	<b>0.8</b>
meta-Xylene	mXYLENE	<b>0.5</b>
ortho-Xylene	oXYLENE	<b>0.5</b>
para-Xylene	pXYLENE	<b>0.5</b>

**NOTES:**

1. *Peak alarm levels have been established as the TLV-Ceiling concentration, or the TLV-STEL concentration in those cases where no TLV-Ceiling value exists.*
2. *In those cases where no STEL exists for a compound, the STEL value has been established as equivalent to the TWA value.*
3. *Compound is Not Detectable (ND) by the VOC Pro. Please contact Casella CEL Applications Department for further details.*
4. *Response factor for this compound using the 10.6 eV lamp is equal to 0.00 because the 11.7 eV lamp is required to ionise and detect this compound. Please contact Casella CEL Applications Department for further details.*
5. *In cases where recommended exposure limits are below the detection limit for the compound in question, the estimated lower limit of detection has been substituted for those values.*
6. *The VOC Pro is not suitable for monitoring these compounds at ACGIH recommended levels.*
7. *A 1000-ppm TWA has been established for those compounds which are "Simple Asphyxiants" and for which no exposure value exists.*
8. *For those compounds, which lack established exposure levels, an arbitrary value of 200 ppm has been established for the TWA, STEL and PEAK alarms.*

## **References**

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2. American Conference of Governmental Industrial Hygienists. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1994-1995)*. Reprinted with permission.

**NOTE:** *The TLV/BEI™ publication is revised annually.*

3. National Institute for Occupational Safety and Health (NIOSH). *Recommendations for Occupational Safety and Health, Compendium of Policy Documents and Statements*, January 1992.



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