

# PPM Formaldemeter™ *htV-m*

3 Parameter IAQ Monitor  
with built-in Memory

## Operation Manual



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## 1 INTRODUCTION

The PPM Formaldemeter™ *htV-m* is a precise 3 parameter indoor air quality monitor suitable for monitoring low level concentrations of hazardous formaldehyde vapours under extremes of temperature and humidity, in parts per million (ppm) and mg/m<sup>3</sup>. Fast and easy to use, pressing a single button gives an immediate indication of concentration levels.

The *htV-m* has a built in non-volatile memory and real time clock. It can be used as a manual hand held device or a continuous data logger capable of a month of continuous monitoring and thus has the option of being mains or battery powered.

The supplied *Download Software* can be installed on a PC and used to retrieve samples from the non-volatile memory and to manage the instrument settings using the USB interface on the Formaldemeter™ *htV-m*.

Please read these instructions carefully and familiarise yourself with the instrument before use. The operating manual will provide you with all the necessary information for the correct use of your Formaldemeter™ *htV-m*.

Please note that PPM Technology Limited shall not be liable for errors that may appear herein or for incidental or consequential damages in connection with or arising from the use of this material.

## 1.1 INITIAL RECEIPT OF YOUR FORMALDEMETETER™ *ktV-m* KIT

Your PPM Formaldemeter™ *ktV-m* kit has been packaged carefully and includes all the components necessary for full operation. Immediately upon receipt, please examine the kit contents carefully to ensure that you have received the following items in good condition.

### **KIT CONTENTS**

The Formaldemeter™ *ktV-m* kit contains:

- Formaldemeter™ *ktV-m* instrument with Stand
- Formaldehyde *Calibration Standard* and *Material Safety Data Sheet* (MSDS)
- USB cable and *Download Software* CD
- DC Mains adaptor with Universal Input Plugs
- Vial of filters (10)
- PPM Technology pen
- Certificate of Calibration
- Quick set-up Guide

### **DAMAGE**

Inspect all items carefully for damaged or missing items, these ought to be reported to your dealer. Any damage should immediately be reported to the carrier.

## 1.2 GENERAL DESCRIPTION

Unlike other formaldehyde monitoring devices such as colour stain tubes and badges, the Formaldemeter™ *ktV-m* is capable of measuring many samples consecutively without the need for inconvenient ancillary equipment. Being ultra compact and battery operated, the instrument is truly field portable. It can also be mains powered suitable for continuous monitoring and a USB interface for data download and configuration from a PC.

The Formaldemeter™ *ktV-m* is extremely simple to use and provides immediate, semi-quantitative readings of atmospheric formaldehyde concentration displayed on a digital read-out, in both ppm and mg/m<sup>3</sup>.

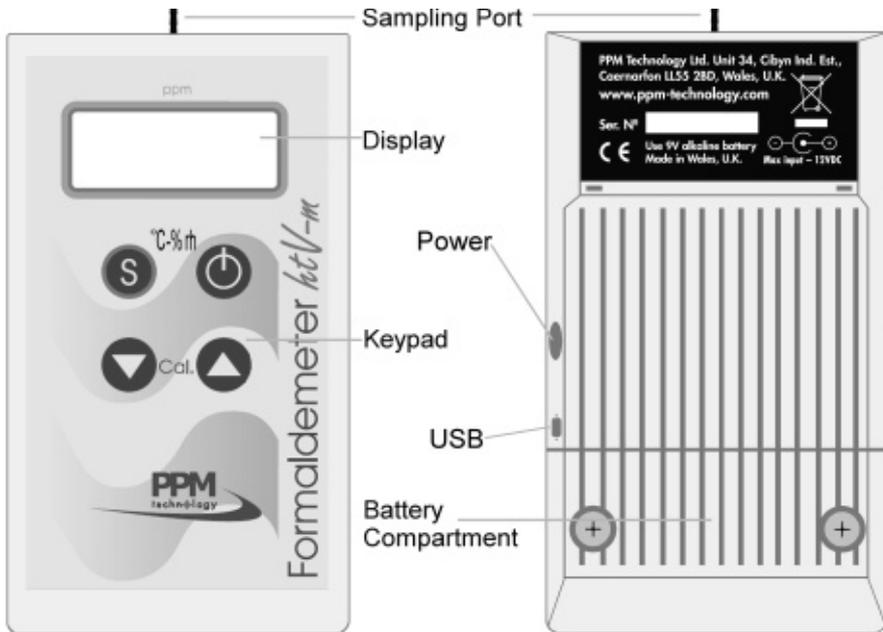
The Formaldemeter™ *ktV-m* is designed to measure the concentration of formaldehyde in snatch (discrete) samples of air and should be employed primarily as a screening device.

## IMPORTANT POINTS

It is important that you are aware of the following points when using the instrument:

- The Formaldemeter™ *ktV-m* is temperature compensated to operate most accurately in the range 15 – 29°C and 25 – 85%RH.
- The results obtained with the PPM Formaldemeter™ *ktV-m* are instantaneous spot readings. A single reading is not necessarily representative of long-term personal exposure. A series of readings taken at short intervals is preferable to infrequent tests.
- Smoking in the environment to be analysed should be avoided as tobacco smoke contains aldehydes, a potential interferent.
- Care must be taken to ensure that fluid or dust is not drawn into the instrument. This could permanently damage the sensor.
- The Formaldemeter™ *ktV-m* has been designed to be sufficiently robust for everyday field use. However, should the unit sustain a severe physical shock, the operation and calibration of the instrument should be checked using the supplied formaldehyde *Calibration Standard*.

## 1.3 INSTRUMENT FEATURES



*Instrument Diagram*

- **SAMPLING PORT**  
The brass sampling port is the inlet through which the sample is drawn into the sensor.
- **KEYPAD**  
Four buttons operate the instrument; some of which have multiple functions. The button switches are located beneath the membrane and are operated by pressing firmly where indicated.
- **USB PORT**  
The USB interface allows direct connection to PC to be used with *Download Software*.
- **DC POWER PORT**  
The DC Power Port gives the option of the instrument to be externally powered.
- **DISPLAY**  
The liquid crystal display (LCD) shows the formaldehyde concentration of the sample in 0.01ppm increments.

The display also shows messages during certain operations.

**DISPLAY KEY:**

Sensor Recovering	----
Sensor Ready	0.00
Instrument Sampling	run
Taking a Calibration Sample	CAL
Set Calibration Level	SEt
Replace Battery	bAt
Fuel Cell needs Hydrating	EtP → Lo
Instrument Not Calibrated	SEt → CAL
Instrument Memory is Full	FULL
Instrument Schedule Running	Schd

- **BATTERY COMPARTMENT**

The battery compartment is located beneath a cover at the bottom rear of the instrument. To gain access to the battery, simply remove the cover by unscrewing the two screws. A flat battery is indicated by the display flashing: "bAt ". See Section 7.4 for further details on battery replacement.

## 2 TECHNICAL INFORMATION

### 2.1 PRINCIPLE OF OPERATION

#### ELECTROCHEMICAL FORMALDEHYDE SENSOR

The PPM Formaldemeter™ *htV-m* uses proven electrochemical sensing technology for determining the concentration of formaldehyde in air samples. The instrument contains an electrochemical formaldehyde sensor comprising two noble metal electrodes and a suitable electrolyte.

When air is drawn into the sensor by means of the internal sampling system, a small voltage is generated which is directly proportional in magnitude to the concentration of formaldehyde in the sample.

This voltage is produced as a result of the electro-oxidation of formaldehyde at one of the catalytically active electrodes.

The signal is fed to a precision electronic amplifier and then to a signal processor before being output on the instrument's display, when calibrated, as formaldehyde concentration in ppm (parts-per-million by volume).

All the electronic systems are based on modern integrated circuitry employing the latest surface mount technology to ensure that the Formaldemeter™ *htV-m* is an exceptionally robust and reliable instrument.

### 2.2 INTERFERENTS

A short list of common chemicals that can cause interference is included in Appendix B.

#### ALCOHOLS AND ALDEHYDES

As is found with other portable detection equipment using electrochemical sensors, the meter is not totally specific to formaldehyde alone, being susceptible to a degree of interference from a small range of other chemicals. Other aldehydes and alcohols such as methanol and ethanol in the atmosphere can cause cross-interference effects.

#### PHENOL AND RESORCINOL

The presence of phenol in the air can give a reading on the Formaldemeter™ *htV-m*. When monitoring formaldehyde in situations where phenolic resins are also present, one of the supplied *Phenol Filters* should be fitted onto the sampling port of the instrument (see Appendix B and Section 8.3).

## **SENSOR BACKGROUND READING**

Due to the high sensitivity of the sensor a background reading can often be produced even when sampling in an atmosphere considered to be free of interference. Background interference can be reduced using the new features on the Formaldemeter™ *htV-m*, please contact *PPM Technology Ltd.* for details.

## **HUMIDITY EXTREMES**

As the sensor is very sensitive, it is possible that extremes of humidity (generally, anything outside 40–60%RH) may cause a background reading on Formaldemeter instruments. The Formaldemeter™ *htV-m* is specially designed to reduce this effect.

## **2.3 ACCURACY AND PRECISION**

The Formaldemeter™ *htV-m* has a measuring range of 0–10ppm (equivalent to 0–12.3mg/m<sup>3</sup> at 25°C, see Section 4.2) with a precision of 2%. The accuracy over this range is ±5%, given an accurate calibration (see Section 6.4) at 2.000ppm.

Measurements are displayed to a 0.01ppm resolution (reduced to 0.1ppm in Limit 4 — see Section 4.5) but are saved to FRAM memory with a 0.001ppm resolution.

The instrument meets the NIOSH criteria for an acceptable method for measuring 0.300ppm formaldehyde over a 25–70%RH range, a full report on this is available from *PPM Technology Ltd.*

## **2.4 DECLARATION OF CONFORMITY**

Within the E.U., the instrument and accessories conform to the *RoHS 2 Directive* concerning hazardous substances (2011/65/EU), contact *PPM Technology Ltd.* for more details.

Also, within the U.K., *PPM Technology Ltd.* is registered with a *WEEE Compliance Scheme* and the instrument and it's accessories should be returned to *PPM Technology Ltd.* for disposal at the end of it's life as outlined by the *WEEE Directive* (2012/19/EU) for a member of *EEE Category 9*. Elsewhere in the E.U. please contact your distributor for further details — note that the instrument is marked with the "crossed out wheelie-bin" symbol and should not be disposed in the normal household waste stream.

### 3 USING THE FORMALDEMETER™ *htV-m* AS A HANDHELD DEVICE

Upon receipt of your *htV-m*, it is set to function as a handheld device.

#### 3.1 TAKING A SAMPLE

##### POWER ON

Press the  power button once. The display will show "----" followed by " 0.00". This indicates that the instrument is ready to take a sample.

##### POWER OFF

Switch the instrument off by pressing and holding down the  power button for 3 seconds until display shows " OFF" then release. A click is heard, your instrument is now off.

##### SAMPLING

Turn instrument on, hold the instrument in the atmosphere to be sampled. Press and release the  sample button. The display will show "r.u.n ". The internal pump should be heard running for a short period as it samples the air.

The display will next switch between the " -.-" and " 0.00" screens for 10 seconds and then stay on " -.-" for the remainder of the sample. After 60 seconds, the display will show the final reading until the instrument is switched off. This indicates the formaldehyde concentration in parts-per-million (ppm).

By holding down the  button the instrument will show the reading in mg/m<sup>3</sup> alternating with "RLT=".

By holding down the  button, the display will show the time taken to reach the displayed concentration in seconds.

##### ALTERNATIVE SETTINGS

The sample durations listed above (10 and 60 seconds), may vary depending on the specifications of the supplier or customer. These values are the default set by the instruments manufacturer. For further details please contact your local distributor.

#### 3.2 SENSOR RECOVERY PERIOD

Between samples, the instrument should be left switched off for a few minutes to allow the sensor to clear of any residual formaldehyde. As a general rule, the higher the reading obtained, the longer it takes for the sensor to clear.

If the instrument is switched on before the sensor has cleared, the display will flash "----" and no sample can be taken. The cell is clear and ready to sample only when the display shows " 0.00" for three seconds without interruption.

If the instrument does not clear after approximately 5 minutes, then refer to troubleshooting section of the manual.

### **3.3 CALIBRATION AND THE CALIBRATION STANDARD**

Sensor sensitivity will change very gradually with time so periodic recalibration will be required. It is advisable to check calibration regularly to ensure that the instrument is functioning correctly.

A quick calibration check can be carried out by drawing a formaldehyde sample of known concentration from a *Calibration Standard* into the instrument's sensor and noting whether the displayed reading agrees with the expected concentration value.

The PPM Formaldemeter™ *htV-m* is supplied with a formaldehyde *Calibration Standard* for calibrating the instrument. It is recommended that calibration check or adjustment be carried out at the approximate operational temperature.

Refer to Section 6.4 for more details on how to check and adjust the instrument calibration.

#### **THE FORMALDEMETER CALIBRATION STANDARD**

The *PPM Formaldehyde Calibration Standard* consists of formaldehyde absorbed on a substrate in a glass tube from which a head-space vapour sample can be drawn. Each *Calibration Standard* is carefully manufactured to a high tolerance and is supplied with a *Material Safety Data Sheet* (MSDS) and advice on safe disposal.

#### **EFFECT OF TEMPERATURE**

The concentration of formaldehyde vapour generated in the *Calibration Standard* varies with temperature, the instrument has a built in thermometer and a temperature/concentration table is supplied with each *Calibration Standard* for this reason.

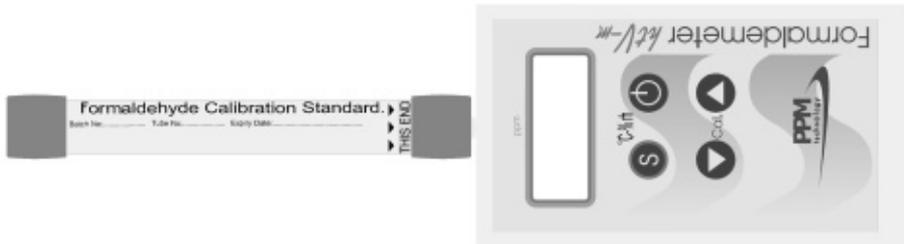
Due to the effect of body temperature, handle the *Calibration Standard* only by the yellow end caps, to ensure temperature equilibrium.

#### **TEMPERATURE EQUILIBRIUM**

The calibration standard should always be allowed to stabilise within the recommended temperature range of 15–29°C for at least 1 hour before use.

### **CALIBRATION STANDARD EXPIRY**

Each *Calibration Standard* may be used for a maximum of 6 months (as indicated by the expiry date given on each *Calibration Standard*), or a maximum of 100 samples. New *Calibration Standards* can be ordered from *PPM Technology Ltd.* or through your local distributor, see Section 8.3.



*Correct way to sample from a Calibration Standard.*

## 4 ADDITIONAL FEATURES

### 4.1 TEMPERATURE & HUMIDITY SENSOR

- 1 Hold down the **S** button and press the **⌚** button once.
- 2 The Instrument will briefly display "HEAT". Release the **S** button.
- 3 The instrument will then show the temperature reading (in °C), followed by "°C".
- 4 The instrument will then display the humidity (in % Rh), followed by "%RH".
- 5 The instrument will cycle through these four screens until it is either switched off manually, or it will switch itself off after 30 seconds.

The Sensor used for the temperature and humidity readings is accurate to within  $\pm 3.0\%$  Rh for humidity, and  $\pm 0.4^\circ\text{C}$  for temperature, within the operational limits for the instrument. To ensure the accuracy of the instrument the temperature & humidity sensor is inspected and may be replaced as part of the instruments annual service.

### 4.2 CONVERSION TO $\text{MG}/\text{M}^3$

The *htV-m* converts each sample from the normal parts-per-million (ppm) units to the alternative milligrammes-per-cubic-meter ( $\text{mg}/\text{m}^3$ ) (see Sections 3.1 and 4.1). The equation used to convert the concentration is as follows:

$$\text{mg}/\text{m}^3 = \left( \frac{P \times M}{R \times T} \right) \times C$$

Where

$C$  is the concentration in **ppm**.

$T$  is the temperature in **K**.

$P$  is the atmospheric pressure in **kPa** (101.325kPa at Sea Level).

$M$  is the molar mass of the gas in **g/mol** (30.01g/mol for HCHO).

$R$  is the Ideal Gas Constant (**8.3144621 JK<sup>-1</sup>mol<sup>-1</sup>**).

Note that  $\text{mg}/\text{m}^3$  is equivalent to  $\mu\text{g}/\text{l}$  but  $\text{mg}/\text{m}^3$  is the preferred unit when discussing gasses.

#### DYNAMIC CONVERSION

By default the instrument will use the temperature sensor to convert each sample to  $\text{mg}/\text{m}^3$  and will assume that the remaining variables are fixed and as indicated above. The measured temperature is

converted from °C to Kelvin by adding 273.15K to the reading.

Because the conversion depends on temperature the same reading in ppm may well give different mg/m<sup>3</sup> results because the temperature has changed.

#### FIXED CONVERSION AT STANDARD CONDITIONS

In some circumstances it may be advantageous to convert a reading to mg/m<sup>3</sup> using some accepted *Standard Conditions* (such as IUPAC, ISMC or NIST) rather than those under which the sample was taken. This can be done by changing the instrument to use a fixed conversion factor.

To do this, the equation used is replaced by:

$$mg/m^3 = \left( \frac{c_{\bullet}}{512} \right) \times C$$

Where

$C$  is the concentration in **ppm**.

$c_{\bullet}$  is a constant conversion factor.

The value of  $c_{\bullet}$  can be calculated from the desired *Standard Condition* parameters to be used by the instrument to convert the sample into mg/m<sup>3</sup>. A short table of common *Standard Conditions* and the equivalent value of  $c_{\bullet}$  follows:

Temperature	Pressure	$c_{\bullet}$	Body
0°C	100.000 kPa	677	IUPAC (STP)
0°C	101.325 kPa	686	ISO 10780, NIST, IUPAC
15°C	101.325 kPa	650	ISO 13443, EEA, EGIA
20°C	101.325 kPa	639	NIST, EPA
25°C	101.325 kPa	628	GOST 2939-63, EPA
25°C	100.000 kPa	620	SATP
20°C	100.000 kPa	630	CAGI
15°C	100.000 kPa	641	SPE
20°C	101.3 kPa	638	ISO 5011

*Values of  $c_{\bullet}$  for some common Standard Conditions*

To use *Fixed Conversion* and set a new factor on the instrument press and hold the ▲, ▼ and Ⓢ buttons whilst pressing ⓪ to enter the *Operational Settings* menu. The instrument display will flash "OPER", release the buttons.

Note that changing other settings in this menu can be harmful and could prevent your instrument from working, if you accidentally change a setting then **turn the instrument off immediately** by holding down the ⓪ button. Do not press the Ⓢ button as this will save your changes. If you did press Ⓢ then turn the instrument off and contact your dealer for instructions on how to revert to the correct settings.

Once you are in the *Operational Settings* menu press the Ⓢ button to step through the items 'till you reach the "SEd..." entry. Use the ▲ button to use *Fixed Conversion* ("SEdY") and press Ⓢ to enter a new factor. The display will show, for example, "c.686" where 686 is the current c. value. Use the ▲ or ▼ buttons to change this to the required value for c.. Once set, press Ⓢ to save the new settings and then press and hold the ⓪ button to turn the instrument off. The *Fixed Conversion* factor will now be used to convert from ppm to mg/m<sup>3</sup>.

### 4.3 ALARM SOUNDER

Each Formaldemeter™ *htV-m* is fitted with an internal sounder to alert the user when a sample exceeds some predefined level. The "ALr" group of settings in the *Configuration Menu* enable and configure this feature (see Section 5.1 and Appendix C). When the alarm is enabled, by changing the "ALrA" setting to "ALrY", a new sub-menu is enabled to allow further configuration:

- "ALrS" : The threshold, in ppm, above (or below) which the alarm is triggered.
- "ALrd" : The duration of the alarm condition, in seconds.
- "ALrG" or "ALrL" : The logic applied between the threshold and the reading. "ALrG" triggers the alarm if the reading is greater than the threshold (reading > threshold). "ALrL" triggers the alarm if the reading is less than the threshold (reading < threshold).

### 4.4 SAMPLING MODE

There are three sampling modes available, which can be selected from the *Configuration Menu* (see Section 5.1 and Appendix C):

- *Peak Mode* ("S=P ") — the maximum sensor output is used to give the reading.

- *Time Mode* ("5=5 ") — the sensor value at the calibration time-to-peak is used to give the reading.
- *Area Mode* ("5=8 ") — the sensor output is integrated between two given times, usually 15 and 60 seconds.

Most of the time *Area Mode* is the best choice and is the default setting, the various *Area Gate* settings allow the instrument to change between the three sampling modes when certain sampling conditions are met. *For further details contact PPM Technology Ltd.*

## 4.5 LIMIT SELECTION

This setting governs the amount of activity permitted in the sensor when taking a new sample. In essence it controls how long the instrument takes to clear before another sample can be taken. The default limit for the Formaldemeter™ is "L=1", which means that the fuel cell must be very stable before the instrument allows the user to take another sample. The settings are available in the *Configuration Menu* (see Section 5.1 and Appendix C):

- "L=1" — The normal Formaldemeter™ setting (**up to 2ppm**).
- "L=2" — **not for use on the Formaldemeter™**.
- "L=3" — The medium concentration Formaldemeter™ setting. If the Formaldemeter™ *htV-m* is used regularly in atmospheres where the concentration of formaldehyde is **often over 2ppm or in excess of 5ppm**, it is advised to use this setting. This will allow the instrument to sample at more frequent and regular intervals. Please note that when using this Limit, the readings at very low concentration are less accurate, due to the fact that some residual formaldehyde from the previous sample may still be present in the sensor.
- "L=4" — The high concentration Formaldemeter™ setting. If the Formaldemeter™ *htV-m* is used regularly in atmospheres where the concentration of formaldehyde is **in excess of 10ppm**. Please contact the manufacturers regarding this Limit as it's use may require additional changes to both instrument settings and possibly hardware

Note that to change the Limit setting the instrument must first be Re-Set (see Section 6.3) and then calibrated with the new settings (see Section 6.4).

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## 4.6 NON-FRAM DATA RETRIEVAL

As with the older *letV* model, the *letV-m* has sufficient memory capacity to log the last 10 samples as well as the FRAM memory. This function enables the user to view the last 10 manual samples on the instrument. Use the *Download Software* provided to retrieve the FRAM data.

### ACCESSING THE DATA

- 1 Hold down the  button and press the  button: The instrument will display "HEAt". Release both buttons.
- 2 The instrument will then toggle between the temperature ("°C") and humidity ("RH") displays.
- 3 Once the instrument is in this mode press both the  and the  buttons at the same time. The display will show "dAtA". Release the buttons.
- 4 The display will then alternate between two screens showing previous sample results. For example:



The first screen indicates which previous sample is being displayed, from "run0" (most recent), to "run9" (the oldest). The second screen shows the reading. Use the  or  buttons to change which reading is being shown.

When the  button is pressed the instrument will display the reading in mg/m<sup>3</sup>, as shown below:



Press the  button when done to turn the instrument off.

## 4.7 CLEARING THE NON-FRAM MEMORY

While viewing the data, hold down both  and  buttons at the same time, until the display has run through all the following screens:



The non-FRAM memory will now be clear.

## 4.8 FRAM MEMORY FULL

Since the *htV-m* has a built in FRAM memory every sample taken either manually or continuously will be recorded. After many samples have been taken (minimum 2000) the FRAM memory will eventually become full and the instrument will start to overwrite older readings with new readings so as to continue sampling.

This is also true for remote samples when the Remote FRAM Save setting is enabled. The default instrument will have Remote FRAM Save disabled and it is only required and enabled in a small number of specialised situations but can be changed in the *Operational Settings* menu (see Appendix D) or by using the *Download Software*.

To prevent older readings being overwritten when the FRAM memory is full, the Stop On Full setting can be enabled either with the *Download Software* or manually from the *Configuration Menu*. When Stop On Full is enabled the instrument display will show "FULL" when the FRAM memory reaches it's capacity and will prevent any further manual or continuous samples from being taken. The instrument will continue to show "FULL" and prevent non-remote sampling until the FRAM memory is cleared using the *Download Software* included with your *htV-m* kit.

To change the current setting enter the *Configuration Menu* (as described in Section 5.1 and Appendix C) and go to the "SoF..." entry in the menu.

Pressing the ▼ button will disable Stop On Full mode ("SoFn"), this is the default state.

Pressing the ▲ button will enable Stop On Full mode ("SoFy").

Press the Ⓢ button to save your choice and then press and hold the ⓪ button to exit the menu and turn the instrument off.

## 5 USING THE FORMALDEMETER *htV-m* AS A CONTINUOUS MONITOR

The built in memory and real time clock enables the instrument to log all three parameters at corresponding times, allowing improved monitoring and analysis opportunities.

### REAL TIME CLOCK

The Real Time Clock is an internal clock that can only be set up and viewed via a USB link and using the *Download Software*. The clock cannot be displayed on the instrument screen, it is used internally.

### SCHEDULE MODE

In order for continuous monitoring to take place a *Schedule* must be set up. A schedule allows the user to control every aspect of the monitoring e.g. set start time, how often you want to sample, for how long and on which days.

A schedule can only be set up via a PC using the provided *Download Software* and USB cable to transfer the information to the instrument. However, once schedule has been programmed into the instrument, it can be started at any time without using a PC.

### 5.1 SWITCHING THE FORMALDEMETER *htV-m* FROM A HANDHELD DEVICE TO A CONTINUOUS MONITOR.

Press down both the Ⓞ and ▲ buttons whilst you turn the instrument on with the ⌚ button. The screen will display "CONF": You can now release the buttons. This is the *Configuration* menu, you can move through the items in the menu with the Ⓞ button.

One of the first items in the menu is "SCH..." and, when in handheld mode, will be "SCHN" (Schedule No). To enable the schedule, set by the *Download Software*, use the ▲ button to change this setting to "SCHY" (Schedule Yes). Press the Ⓞ button to enter your changes and move on to the next menu item.

Once you've changed the setting, press and hold the ⌚ button to exit the menu and turn the instrument off. The schedule has now been activated and the *htV-m* can be used as a continuous monitor.

### 5.2 STARTING A SCHEDULE

Switching the *htV-m* on again, after activating a schedule (as described previously), will start the schedule but the instrument will

behave as normal until a schedule begins. Please note that if the active schedule is not due to start within the instrument's five minute Auto Off period then the instrument will turn off before the schedule begins to run and no samples will be collected. To alter this behaviour it's necessary to use the *Download Software* to disable the Auto Off setting. The Auto Off setting is inhibited when a schedule is active and running but will revert to the previous setting when the schedule stops running.

When a schedule is running the instrument will attempt to sample according to the settings uploaded from the *Download Software* and the display will toggle between "Schd" and the last sample result (or, while the first result in a schedule is being analysed, "Schd" and ". . . .").

Once a schedule is running, all buttons on the *htV-m* are disabled apart from the  button and the instrument will stay turned on.

The instrument can be scheduled to sample at intervals between once a minute and once an hour. It is also possible to enable a special mode where samples are taken as often as possible (i.e. as soon as the previous sample has cleared, the next one is taken). The schedule can be constrained to start at a specific time of day and to last for a specific duration or to only run on certain days of the week.

If no schedule has been uploaded to the instrument since purchase then a default schedule will run. The default schedule is set to sample continuously for as long as the instrument is turned on, at intervals of 2 minutes.

### 5.3 ENDING A SCHEDULE

To stop a running schedule turn the instrument off (using the  button). To return to handheld mode and prevent the schedule from running, follow the procedure from Section 5.1 but select "Schn" instead of "Schd".

### 5.4 HOW TO USE DATA MODE

**NOTE: READ AND UNDERSTAND THIS SECTION IF YOU DO NOT INTEND TO USE THE SUPPLIED DOWNLOAD SOFTWARE WITH YOUR KIT. IF YOU DO INTEND TO USE THE DOWNLOAD SOFTWARE THEN YOU MAY IGNORE THIS SECTION BUT SHOULD READ THE SEPARATE MANUAL WITH THE SOFTWARE INSTEAD.**

To download saved readings from the *htV-m* without using the supplied *Download Software* you will need a spare USB port; the

appropriate USB drivers installed on your machine (installers for Microsoft® Windows® are supplied on the CD in your kit) and a USB cable connected between your machine and your *htV-m* (one is supplied in your kit). It is also advisable to power your *htV-m* from a mains adaptor to prevent data loss due to battery failure during the transfer.

In addition to the above you will need a piece of software, known as a “Terminal Emulator” or “Serial Capture”, to receive the downloaded data – there are many available applications such as *RealTerm*, *PuTTY*, *Hyper Terminal*, *ProComm*, *WinComm* & *Minicom*. Older versions of the Windows® operating system came with *HyperTerminal* already installed but on more recent releases you will need to install your own software.

### ENABLE DATA MODE

By default the *htV-m* will be set up to use the *Download Software* only. In order to use other software to retrieve the data *Data Mode* will need to be enabled. This only needs to be done once and is persistent, if you need to use the *Download Software* at a later date you will need to revert to the original settings and disable *Data Mode* first.

- 1 Press and hold the ▲, ▼ and Ⓢ buttons while pressing ○ to enter the *Operational Settings* menu. The instrument will flash "ⓈPEr", release the buttons.
- 2 Press the Ⓢ button to move through the menu items until the "dRE..." item is selected.
- 3 To enable *Data Mode*, press ▲ to choose "dREY". To disable *Data Mode* press, ▼ to choose "dREr".
- 4 Press the Ⓢ button to confirm the new setting, as this is the last entry in the menu the instrument will turn off (otherwise press the ○ button).

### CONNECTION SETTINGS

When you connect the instrument to your machine with a USB cable it will appear as a new serial port, if the correct drivers are loaded on your machine. Connect to the instrument with your software at 9600 baud with 8 data bits and 1 stop bit and no parity (often indicated as "9600,8N1") and no handshaking (or, sometimes called "flow control"). You will also need to know the name of the new serial port, this will be "COM..." followed by a number on Microsoft® Windows® operating systems; "/dev/tty.usbserial..." followed by a number on Apple® OS X® and "/dev/ttyUSB..." followed by a number on GNU/Linux® operating systems: refer to your operating system manuals on how to determine this correctly.

## DOWNLOADING DATA

Once connected, make sure that the instrument is turned on and is behaving correctly. If not then turn off immediately and disconnect the USB cable before seeking more help. Also, note that it's not recommended to be sampling or running a schedule whilst downloading data from the instrument. To start the download you need to send a single "X" to the instrument (capital X, decimal ASCII character 88) — the instrument should then immediately start sending the entire contents of the FRAM memory to your software, depending on the capacity this can take up to 10 minutes. You can cancel an active download by sending any other character, apart from "X", to the instrument.

If your software has a logging or capture function then you can use this to save the data to a CSV file for safe keeping or for use in your own reports. For example, you can use a spreadsheet package such as *LibreOffice*<sup>®</sup> "Calc" or *Microsoft*<sup>®</sup> *Excel*<sup>®</sup> to open the CSV file and generate charts from the data.

## EXAMPLE

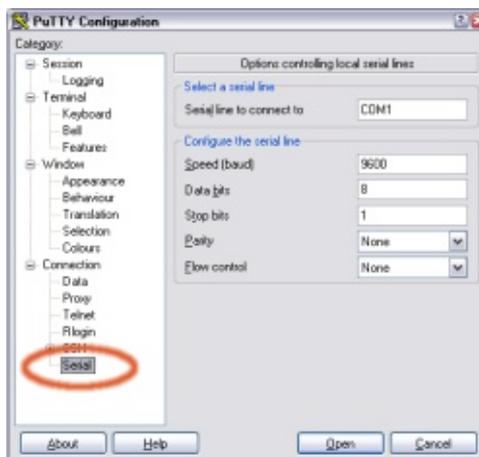
As an example, here's how to set up and use the *PuTTY* software to download data from the instrument — this is no way an endorsement of any particular software over another by *PPM Technology Ltd.* or their agents and distributors. You can download and use *PuTTY* for free, please refer to the *PuTTY* website for more details:

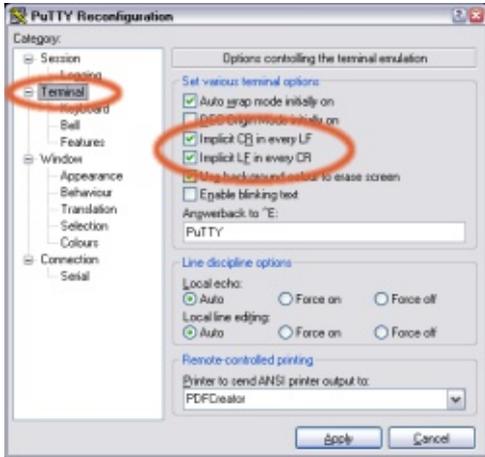
<http://www.chiark.greenend.org.uk/~sgtatham/putty/>

Using the *PuTTY* software with the instrument connected and turned on, select *Connection* » *Serial* in the side bar. Enter the correct port in the first box and the correct configuration underneath it.

Next select the root *Terminal* entry in the side bar and ensure that the "Implicit CR in every LF" and "Implicit LF in every CR" check boxes are selected.

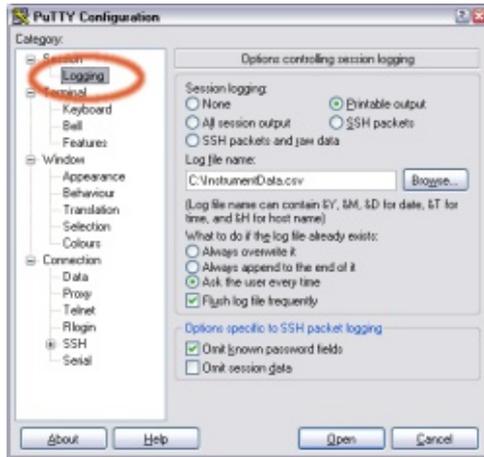
Next select *Session* » *Logging* in the side bar and select the "Printable output" radio button and enter a location for the filename, ensuring to use the ".csv" extension.





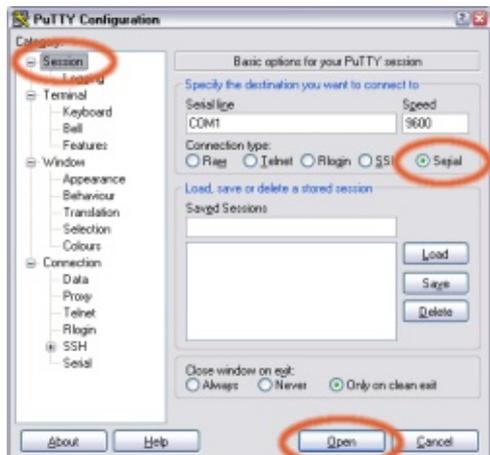
In the root *Session* entry in the side bar select the "Serial" radio button and confirm that the correct port and baud rate is shown before clicking on "Open" at the foot of the window.

If you get an error or the black terminal screen does not appear then refer to the *PuTTY* documentation; check your settings; check your connection and try again. Once the terminal screen appears make sure that it's focused and type a capital **X** on the



keyboard. Data from the instrument should appear in the window and you will be asked to confirm that you wish to log the data, if not or if the data appears to be garbled then close the window and check your settings and connection again.

Once the data has stopped (depending on the amount of data and the memory capacity of your instrument this can take up to 10 minutes) you can close the black

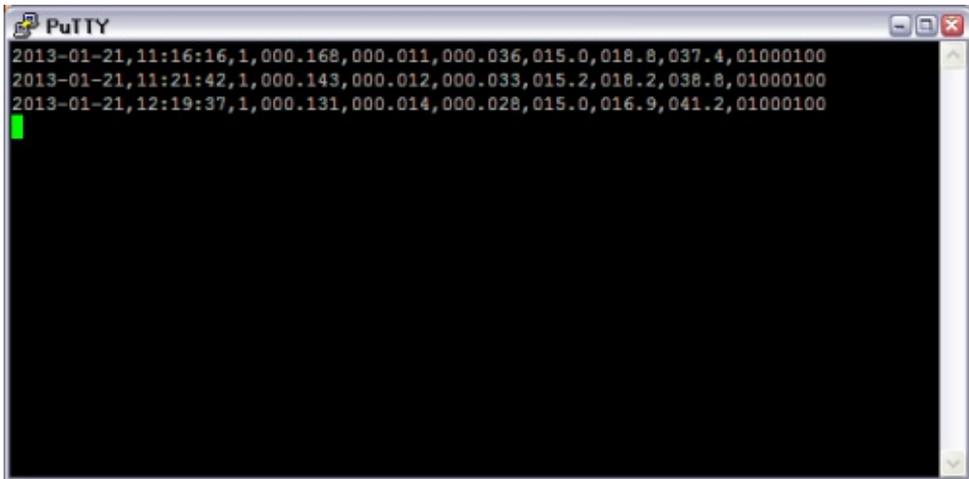


terminal window and inspect the data which should have been saved to the location selected earlier.

The downloaded data, briefly, comprises of the following columns:

- A Sample Date (*returned as "YYYY-MM-DD"*);
- B Sample Time (*returned as "HH:MM:SS"*);
- C Sample Limit (see Section 4.5);
- D Peak Reading (in *ppm*);
- E Time Reading (in *ppm*);
- F Area Reading (in *ppm*);
- G Time-To-Peak (in *seconds*);
- H Temperature (in  $^{\circ}\text{C}$ );
- I Humidity (in  $\%Rh$ ) and
- J Sample Status Flags.

Refer to the separate *Download Software* manual for more details.



```
PuTTY
2013-01-21,11:16:16,1,000.168,000.011,000.036,015.0,018.8,037.4,01000100
2013-01-21,11:21:42,1,000.143,000.012,000.033,015.2,018.2,038.8,01000100
2013-01-21,12:19:37,1,000.131,000.014,000.028,015.0,016.9,041.2,01000100
```

*Example instrument download output in PuTTY.*

## 6 TROUBLESHOOTING

The most common problem is when the display flashes "----" constantly and the instrument will not sample, even after being left turned off for several hours. The three main reasons for this problem are:

- 1 The instrument has been accidentally calibrated when no calibration standard was present.
- 2 The calibration standard used for calibration has expired.
- 3 The instrument has been damaged and will need to be repaired.

To determine which of the reasons applies to your case follow the procedures shown below (note that quoted values are for tests performed at 25°C).

### 6.1 CHECK THE SAMPLING SYSTEM

- 1 Make sure that the instrument has been turned off for about 5 minutes.
- 2 Press and hold the ▼ button whilst pressing the ☉ button to turn the instrument on. The display will show "tESEt", release all the buttons.
- 3 A four digit value will appear on the display ("0.123", for example). Give the instrument a few seconds to stabilise.
- 5 Note the initial value and the approximate rate of change over a minute: If either the initial value **or** the rate of change **exceeds 0.300** then it is likely that your sensor has been damaged — contact your service centre or *PPM Technology Ltd.* for further details. If the values indicated are less than 0.300 then continue with the procedure.
- 6 With the sample nozzle inserted into a valid *Calibration Standard*, take a sample (see Section 3.4 for instructions on handling the *Calibration Standard*).
- 7 The display should be set to "0.000" as the pump starts to run and then rise up to a maximum as the sample is drawn in.
- 8 Press and hold the ▼ button to display the test peak time value. Make a note of this value ("t 5.5", for example). If this value is **less than 5.0 seconds** there may be a problem with the sampling system or your sensor — contact your service centre or *PPM Technology Ltd.* for further details. Otherwise, continue with the procedure.

- 9 Press and hold the ▲ button to display the test peak value. Make a note of this value ("5.578", for example). If this value is **less than 5.000** then there may be a problem with the sampling system or your sensor — contact your service centre or *PPM Technology Ltd.* for further details. Otherwise, continue with the procedure.

- 10 Turn the instrument off by holding down the ☉ button.

Leave the instrument off for at least five minutes before repeating this part of the troubleshooting test. These steps rule out damage to your instrument or sensor, check the instrument calibration gain next.

## 6.2 CHECKING THE CALIBRATION GAIN

The calibration gain is used to convert the sensor output into the ppm value shown on the screen when sampling, it is calculated by the instrument when it's being calibrated (see Section 3.4.5). If the calibration is incorrect (by calibrating without a *Calibration Standard* or with an expired *Calibration Standard*, for example) then the instrument will calculate a value for the calibration gain which is too high and will cause problems with sampling. To check the calibration gain proceed as follows:

- 1 Press and hold the ▲ button whilst pressing the ☉ button to turn the instrument on. "ER 17" should appear on the display, release the buttons.
- 2 A four digit value will alternate with a two digit exponent value on the display (the exponent will be prefixed with "...E: "). Make a note of the exponent value (18 in "E: 18", for example).
- 3 The instrument will power down after a few seconds. Or you may hold down the ☉ button.

If the exponent value was **between 15 and 13** then you may have used an expired *Calibration Standard* — check your *Calibration Standard* expiry date and acquire a new one if needed. When you are ready, carry out a Re-Set (see Section 6.3) followed by a new calibration attempt (see Section 3.4).

If the exponent value was **less than 13** then you may have accidentally calibrated without a calibration standard being present. Acquire a *Calibration Standard*; carry out a Re-Set (see Section 6.3) followed by a fresh calibration attempt (see Section 3.4).

If the exponent value was normal then some other fault is causing the instrument to not settle, contact your service centre or *PPM Technology Ltd.* to arrange for inspection of your faulty instrument.

## 6.3 PERFORMING AN INSTRUMENT RE-SET

Make sure that you have a valid *Calibration Standard* to hand before performing this procedure as your current calibration will be deleted, and there is no way of "undoing" the Re-Set procedure once it has been performed.

- 1 Make sure that the instrument is turned off.
- 2 Press and hold both ▲ and ▼ buttons whilst turning the instrument on with the ⏻ button. "rSEt" will appear on the display. Release all the buttons.
- 3 When "-rSEt-" appears on the display press the ▲ button to change it to "YES". To complete the Re-Set press the Ⓢ button.
- 4 "rSEt" will appear on the display as the instrument clears the calibration to a safe, default value.
- 5 "SEt" and then "CAL" will now appear on the display followed by the normal "0.00" display. This will occur each time until the instrument is calibrated correctly (see Section 3.4).

If, after a Re-Set, you are still experiencing problems then contact your service centre or *PPM Technology Ltd.* to arrange an inspection of your instrument.

## 6.4 CALIBRATION

Please read this section thoroughly before attempting to check or adjust calibration. Users are strongly advised to familiarise themselves with the instrument before attempting to adjust the calibration and should follow the instructions carefully.

### 6.4.1 CALIBRATION CHECK PROCEDURE

Place the instrument and *Calibration Standard* together in a place where the temperature is stable for at least one hour before commencing the calibration check to allow thermal equilibration.

Before carrying out a calibration check, the sensor must be clear of formaldehyde vapour from any previous samples. An accurate temperature measurement is also required as this is vital for the calibration check procedure. You can use the built in temperature sensor on the instrument (as described in Section 4.1) or any other thermometer for this.

#### PROCEDURE

- 1 Place the *Calibration Standard* and the instrument on a flat work

surface. Handle the *Calibration Standard* as little as possible to avoid heating the tube, holding it by the yellow caps. Remove both end plugs.

- 2 Switch the instrument on by pressing the  $\odot$  button once. Wait for the LCD to show a steady "0.00" display.
- 3 Insert the nozzle into the sampling end of the tube. Ensure a good seal around the instrument nozzle by pushing the *Calibration Standard* tube firmly against the instrument when taking a sample.
- 4 Press the  $\odot$  button and wait until the internal sampling pump stops before removing the *Standard* from the instrument. Replace the end plugs in the *Calibration Standard* securely.
- 5 The display will flash between "----" and "0.00" for 10 seconds.
- 6 The display will then show a flashing "-.-" as the sample is analysed. After 60 seconds, the display will show a non-flashing value, which is held until the instrument is switched off. This indicates the formaldehyde concentration in ppm.
- 7 Refer to the Temperature/Concentration look-up table on the *Calibration Standard*: If the reading is within 5% of the value shown in the table, then no re-calibration is required. A detailed look-up table is also included in Appendix A of this manual.
- 8 If re-calibration is required, follow the calibration adjustment procedure that follows.

Leave the instrument switched off for approximately 5 minutes to recover before commencing another calibration check, adjustment or taking a sample.

#### **6.4.2 CALIBRATION ADJUSTMENT PROCEDURE**

Please read this section thoroughly before attempting to check or adjust calibration. Users are strongly advised to familiarise themselves with the instrument before attempting to adjust the calibration and should follow the instructions carefully.

Under normal operating conditions, instrument calibration should require only minimal periodic adjustment. To see whether a full recalibration is required, perform a calibration check first (see Section 6.4.1).

Place the instrument and *Calibration Standard* together in a place where the temperature is stable for at least one hour before commencing the calibration adjustment to allow thermal equilibration.

Before carrying out a calibration adjustment, the sensor must be clear of formaldehyde vapour from any previous samples. An accurate temperature measurement is also required as this is vital for the calibration check procedure. You can use the built in temperature sensor on the instrument (as described in Section 4.1) or any other thermometer for this.

#### PROCEDURE

- 1 Place the *Calibration Standard* and the instrument on a flat work surface. Handle the *Calibration Standard* as little as possible to avoid heating the tube, holding it by the yellow caps. Remove both end plugs.
- 2 Switch the instrument on by pressing the  button once. Wait for the LCD to show a steady "  " display.
- 3 Insert the nozzle into the sampling end of the tube. Ensure a good seal around the instrument nozzle by pushing the *Calibration Standard* tube firmly against the instrument when taking a sample.
- 4 Simultaneously depress both  and  buttons. The pump will be heard drawing a vapour sample and the screen will briefly show "CAL ". Release the two buttons. When the pump stops, remove the *Calibration Standard* and replace both yellow end plugs.
- 6 The display will show an increasing, flashing value for 60 seconds, followed by "SEt " and then the default value of " 1.750".
- 7 Refer to the Temperature/Concentration look-up table on the *Calibration Standard* to find the calibration value. For example, at **22°C** the calibration value is **2.30ppm**. A look-up table is also included in Appendix A of this manual.
- 8 Now use the  or  buttons to adjust the value on the display to the required concentration. Press the  button to store this calibration value.
- 9 The display will show "CAL " followed by " End". The instrument will then switch off automatically.

The instrument has now been re-calibrated. Leave the instrument switched off for approximately 5 minutes to recover before commencing another *Calibration Adjustment*; a *Calibration Check* or taking a new sample. It's recommended that you run through the *Calibration Check* procedure again after performing a *Calibration Adjustment* to confirm that the new calibration is correct.

## 6.5 HYDRATING THE FUEL CELL

Another common problem is when the display shows "LEP" followed by "Lo" each time it's turned on ("Time-to-peak Low" message). This is due to the internal electrochemical fuel cell having dried out. This problem can occur if the unit is being used to sample in a very dry climate or environment. The fuel cell will need to be hydrated to clear this message.

To hydrate the fuel cell, you will need to use a *Sensor Refresh Standard* (available from PPM Technology and some distributors) and the *Download Software* supplied with the your instrument. If the software is not available then you can also manually alter the instrument settings to perform the fuel cell hydration as follows.

### 6.5.1 MANUAL FUEL CELL HYDRATION

The pump run time of the instrument will need to be increased (to 10 to 20 seconds, depending on instrument and firmware version) by following the steps detailed below:

1. Reset the instrument. This is detailed above in Section 6.3.
2. Turn the instrument off. Once off, hold down both ▲ and ▼ buttons and the Ⓢ button and switch the unit on. If done correctly, you should see "OPER" displayed on screen.
3. Press the Ⓢ button to navigate down to the setting listed as "SP:RL", note the value (e.g. 1.9 seconds) and change it to 20 seconds (you may only be able to select 10 seconds depending on the age of the instrument).
4. Continue to press Ⓢ to navigate through the rest of the menu system until the instrument switches off.

Now that the pump run time has been increased, simply place the *Sensor Refresh Standard* over the brass nozzle of the instrument and take several long samples. You may need to repeat this procedure depending on how low the Time-to-Peak Value is.

Once completed you will need to return the instrument pump setting back to the original value noted in Step 3 above and recalibrate it (see Section 6.4 above).

If the instrument is still displaying this message, please contact PPM Technology for further help.

## 7 MAINTENANCE

With the exception of the battery, your Formaldemeter™ *htV-m* has no user-serviceable components. It is important that no attempt is made to open the instrument other than to replace the battery. Any evidence of tampering with the instrument will invalidate the warranty.

If you find that your instrument requires service or repair, please return it to *PPM Technology Ltd.* or an authorised service centre.

### 7.1 CLEANING THE INSTRUMENT

On no account should the Formaldemeter™ *htV-m* be immersed in liquid. Any fluid entering the instrument will destroy the sensor and the electronic circuitry.

If the instrument's enclosure requires cleaning, it should be wiped with a damp cloth. Never use abrasive or solvent based cleaning agents.

### 7.2 STORAGE

When not in use, your Formaldemeter™ *htV-m* should be stored in the supplied carrying case in a clean, dry environment and away from extremes of temperature.

### 7.3 INSTRUMENT BATTERY

When the instrument battery voltage becomes too low for reliable measurements to be taken, the battery needs replacing. When this is about to occur the instrument display will flash the "bAt" warning message.

### 7.4 BATTERY REPLACEMENT

The instrument requires a **9V PP3 type alkaline battery**. To replace the battery, simply remove the battery compartment cover at the bottom of the instrument by unscrewing the two screws at the rear and place the battery in the compartment. Be sure to observe the indicated polarity on the instrument and the battery.

Take care when disposing of spent batteries and observe any warnings shown on the battery packaging and any local regulations (such as 2006/66/EC in the EU). If battery recycling facilities are available in your area then please make use of them.

## 8 ACCESSORIES AND CONSUMABLES

A wide range of accessories and consumables are available for your new instrument, some of which are detailed here and are available from your distributor. Modifications, bespoke design, advice and spare parts are also available directly from the manufacturer.

### 8.1 RUBBER SLEEVE ("BLUE BOOT")

Protect your instrument from spills, drops and knocks with this soft and durable rubberised cover. The brightly coloured "boot" allows access to the instrument controls but protects the sampling nozzle and connectors. Contact *PPM Technology Ltd.* for more details.

### 8.2 WALL MOUNT

Wall mounting bracket for semi-permanent continuous monitoring installations. Contact *PPM Technology Ltd.* for more details.

### 8.3 CALIBRATION STANDARD AND FILTERS

Formaldehyde *Calibration Standards* can be obtained from either your distributor or directly from *PPM Technology Ltd.* using the order number **514-001**. You may also be interested in setting up an annual standing order for *Calibration Standards* so that a valid one is always available: A new *Calibration Standard* will be dispatched automatically when your current one approaches its expiry date.

Packs of 100 *Filters* (order number **510-001**) and Spare *PPM Technology Ltd.* pens (order number **510-002**) can also be obtained from the same source.

### 8.4 DATA CABLES AND POWER SUPPLY

The instrument data cable is a standard A-to-miniB USB cable; replacements can be obtained from *PPM Technology Ltd.* using the order number **520-015** (users with the older "RS232" version should use the order number **520-005** instead). If you need a new copy of the *Download Software* the latest version and documentation is available as a free download from the *PPM Technology Ltd.* website, those wishing to order a physical CD of the software should use order number **520-008**.

Replacement 12v/1A power supplies with international plug heads for the instrument are available with either 2.1mm or 2.5mm connectors (order number **520-006**). Please provide your instrument serial number when ordering to ensure that the correct connector size is supplied for your instrument. Power supplies should be replaced as

soon as any damage or faults are noticed, please note the connector polarity marked on the instrument and the power requirements when replacing the original power supply with your own model.

## 8.5 BYPASS VALVE

A miniature bypass valve can be installed inside the instrument to bypass the sensor when not sampling. This is useful if the instrument is used in either high pressure environments, where air could be forced through the sensor even when the sample pump is not sampling, or for use in high concentration environments, to minimise background ingress into the sensor by sealing the inlet.

The bypass valve can also be used in conjunction with the sampling pump to allow for sampling through lengths of tubing: the "dead volume" in the pipe is discarded before the valve directs the air from the end of the pipe into the sensor at the last moment. Inert tubing of the correct diameter to fit the instrument nozzle is available in various lengths, contact *PPM Technology Ltd.* for more details.

**NOTE:** *Installing the bypass valve requires hardware modification by manufacturer. Your instrument will need to be returned to the factory for this.*

## 8.6 WiFi MODULE

As an alternative to the USB socket the instrument can be fitted with an internal WiFi module. Once configured, the module allows data to be downloaded from the instrument's memory through the WiFi network — potentially from anywhere around the world through the internet. The module supports IEEE802.11b/g/n 2.4GHz WiFi networks as both a station and access point (or both) and is fitted with an internal 2.6dBi antenna. The module can be configured with the network settings and security via a web browser.

The WiFi module is installed in the battery compartment and so the instrument will no longer be able to be powered by batteries and must be powered with the mains power supply. Using the USB and the WiFi module at the same time is not recommended and, due to the nature of the WiFi connection, transfer speed will be reduced and is dependant on the network signal strength.

**NOTE:** *Installing the module and requires some hardware modification. Your instrument will need to be returned to the factory for this.*

## 9 WARRANTY

The Formaldemeter™ *htV-m* is warranted to be free of defects in materials and workmanship under proper and normal use and service for a period of one year from the date of purchase (invoice or receipt date). This warranty is limited to repair or replacement (at our option) of any part that proves defective in material or workmanship under normal use and service, provided the product is returned to *PPM Technology Limited*, shipment charges prepaid.

Damage due to defacement, misuse, tampering, lack of prescribed maintenance or use in violation of the instructions furnished by *PPM Technology Limited* is not covered. This warranty is in lieu of all other warranties, express or implied, including but not limited to merchantability or fitness for a particular purpose. In no event shall we be liable for any incidental or consequential damages of any nature.

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## A DETAILED CALIBRATION TABLE

A detailed *Calibration Adjustment* table for the formaldehyde *Calibration Standards* with  $\pm 5\%$  *Calibration Check* values shown.

Temperature °C (°F)	Target Concentration / ppm		
	-5%		+5%
15.0 (59.0)	1.258	1.324	1.390
15.5 (59.9)	1.308	1.377	1.446
16.0 (60.8)	1.361	1.433	1.504
16.5 (61.7)	1.416	1.490	1.565
17.0 (62.6)	1.473	1.550	1.628
17.5 (63.5)	1.532	1.613	1.693
18.0 (64.4)	1.594	1.678	1.761
18.5 (65.3)	1.658	1.745	1.832
19.0 (66.2)	1.724	1.815	1.906
19.5 (67.1)	1.794	1.888	1.983
20.0 (68.0)	1.866	1.964	2.062
20.5 (68.9)	1.941	2.043	2.145
21.0 (69.8)	2.019	2.126	2.232
21.5 (70.7)	2.101	2.211	2.322
22.0 (71.6)	2.185	2.300	2.415
22.5 (72.5)	2.273	2.393	2.512
23.0 (73.4)	2.364	2.489	2.613
23.5 (74.3)	2.460	2.589	2.718
24.0 (75.2)	2.559	2.693	2.828
24.5 (76.1)	2.661	2.802	2.942
25.0 (77.0)	2.769	2.914	3.060
25.5 (77.9)	2.880	3.032	3.183
26.0 (78.8)	2.996	3.154	3.311
26.5 (79.7)	3.116	3.280	3.444
27.0 (80.6)	3.242	3.412	3.583
27.5 (81.5)	3.372	3.550	3.727
28.0 (82.4)	3.508	3.693	3.877
28.5 (83.3)	3.649	3.841	4.033
29.0 (84.2)	3.796	3.996	4.195
29.5 (85.1)	3.949	4.156	4.364

## B INTERFERENCE TABLE

The results shown are from research carried out under controlled conditions in an incubator set at 25°C. A wide range of suspected interfering gases have been tested including NH<sub>3</sub>, CO, CO<sub>2</sub>, NO<sub>2</sub>, acetone and isobutylene. The table only shows those which caused interference below LEL levels.

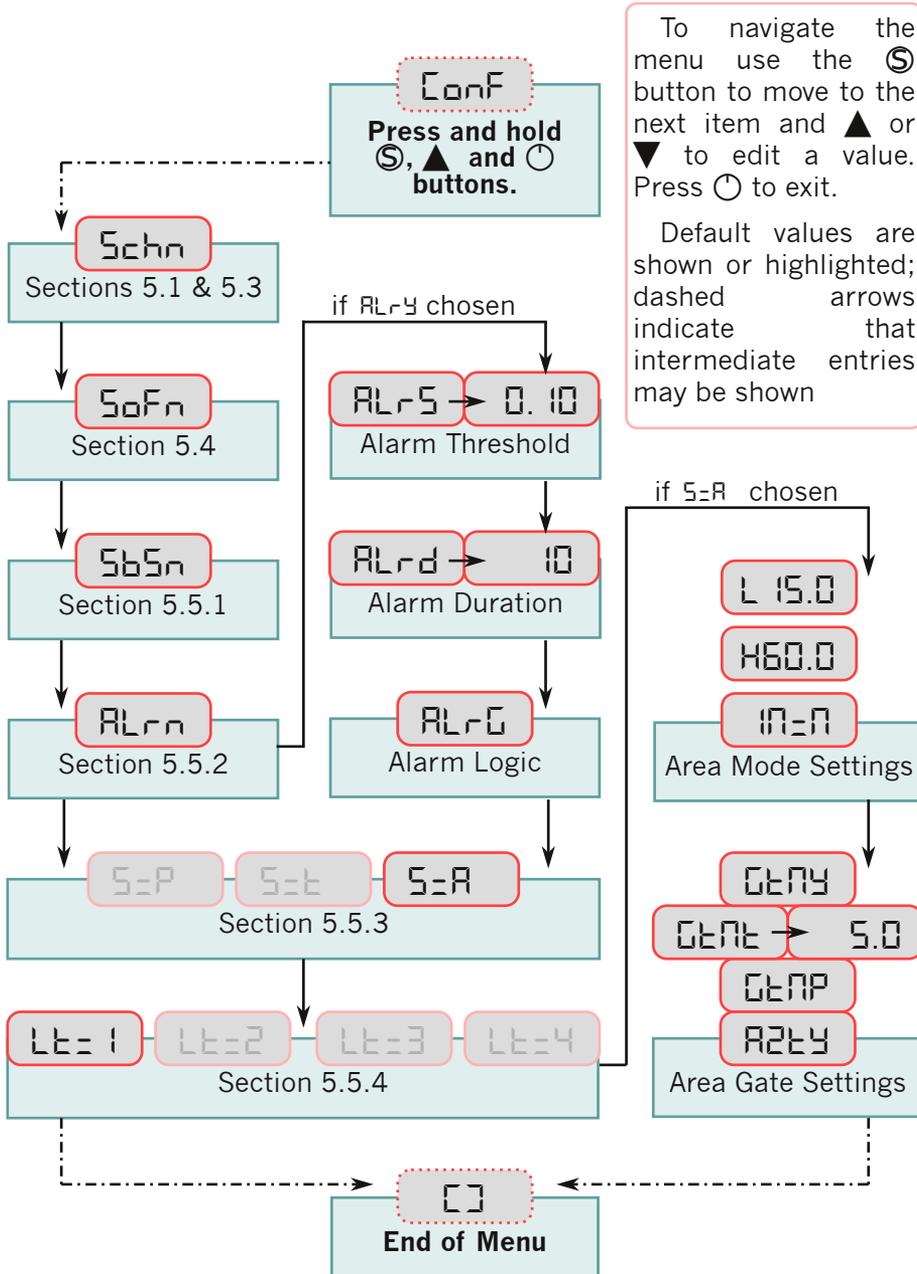
Gas	Concentration Required to Give a 1ppm Reading	Response	Removal of Interfering Gas Using a Phenol Filter
Acetaldehyde	12	Linear	60%
Ethanol	24	Linear	45%
Formic Acid	26	Linear	100%
Formaldehyde	1	Linear	15%
Glutaraldehyde	7	Linear	70%
Methanol	60	Linear	30%
Phenol	7	Linear	100%
Resorcinol	250	Linear	100%

*Phenol Filters* are extremely efficient at removing phenol and other alcohols and aldehydes from the air. These filters can be fitted over the sampling port of the instrument prior to taking a sample. It's recommended that the filter be disposed of after ten samples as they can become saturated and less efficient: do not store used and unused filters together to avoid cross contamination.

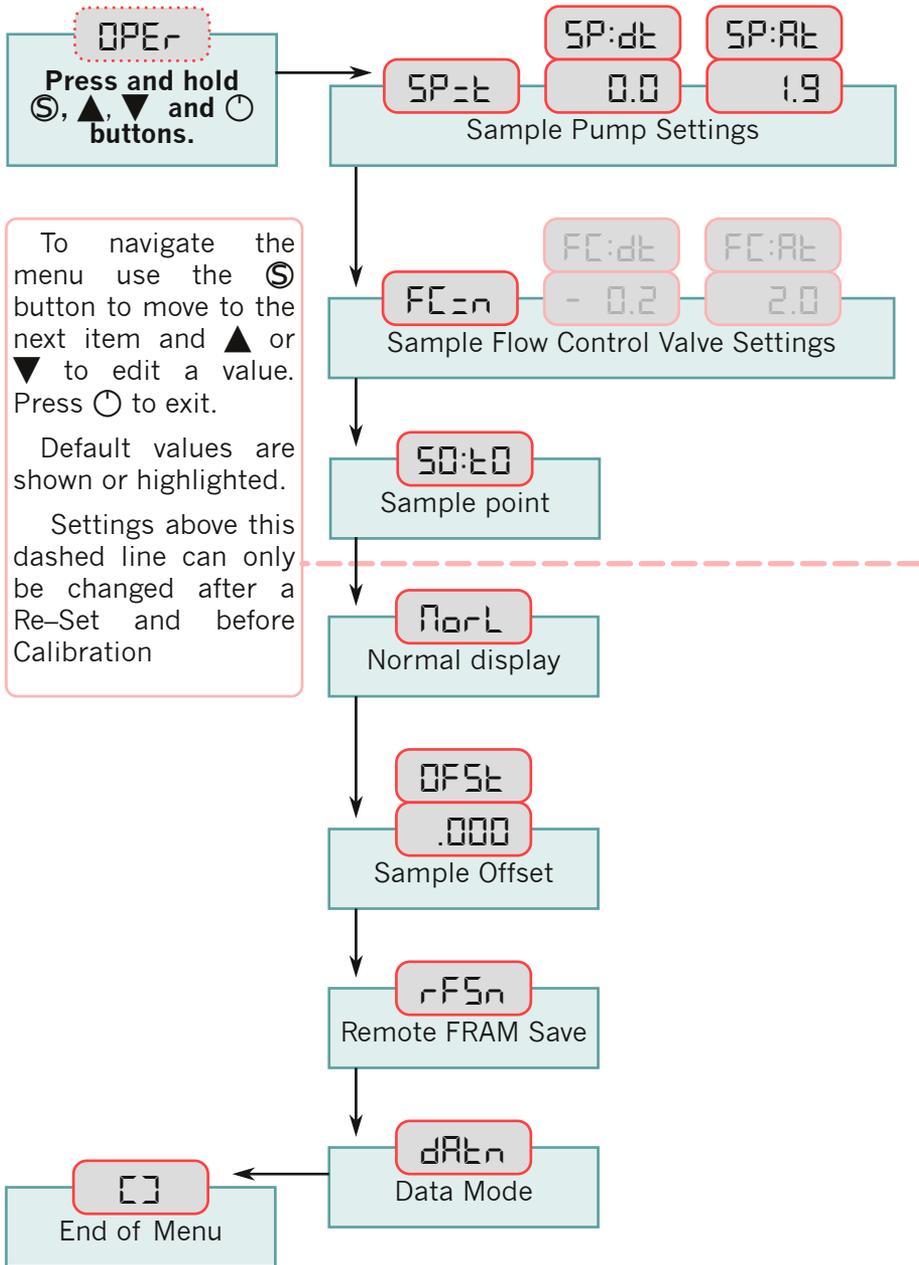
Important information:

- Never calibrate the instrument using interference gases.
- Ozone causes formaldehyde to be broken down into CO<sub>2</sub>, H<sub>2</sub>O and oxygen causing measured levels to be reduced.
- *Phenol Filters* also reduce the formaldehyde concentration by 15% and should only be used in conditions where interferences are present or suspected.
- The interference ratio and filter efficiency quoted in the table are derived from several readings across many sensors. Actual results may vary from instrument to instrument.

## C CONFIGURATION MENU LAYOUT



## D OPERATIONAL SETTINGS MENU



## E RECORD OF SETTINGS

Use this table to record your original settings upon receipt or when you adjust them so that you can return to them later.

SETTING	Original		
CONF S <sub>1</sub>	A    t    P	A    t    P	A    t    P
L <sub>1</sub>			
H <sub>1</sub>			
IN <sub>1</sub>	y    n	y    n	y    n
GtN <sub>1</sub>	y    n	y    n	y    n
GtNt			
GtN <sub>2</sub>	A    P	A    P	A    P
R2t <sub>1</sub>	y    n	y    n	y    n
CONF L <sub>1</sub>	1    3    4	1    3    4	1    3    4
OPER SP <sub>1</sub>	n    t    A	n    t    A	n    t    A
SP:dt			
SP:Rt			
OPER FC <sub>1</sub>	n    t    A	n    t    A	n    t    A
FC:dt			
FC:Rt			
OPER OFSt			
OPER rFS <sub>1</sub>	y    n	y    n	y    n
Misc.			
Date			
Initials			

## F SUMMARY OF NIOSH REPORT

The Formaldemeter™ *ktV-m* is an improved version of the Formaldemeter™ *ktV*. NIOSH has carried out studies upon the Formaldemeter™ *ktV* and another leading direct-reading formaldehyde monitor and compared the two instruments with the fully evaluated *NIOSH Method 2016, Issue 2 (2003) for Formaldehyde in Air*. The null hypothesis for the study was that the mean formaldehyde concentration for the direct-reading instrument would be equal to the mean concentration measured by *NIOSH Method 2016*.

Before use in the experiment, the Formaldemeter™ *ktV* was calibrated using a *Formaldehyde Calibration Standard*.

	NIOSH Method 2016	PPM Technology Ltd. Formaldemeter™ <i>ktV</i>
Analytical Technique	HPLC, UV Detection	Electrochemical
Range	0.23—37 µg/sample	0—10 ppm
Accuracy	±19%	Within NIOSH criteria
Interferents	Ozone, Ketones & Other aldehydes	Phenol, Resorcinol, Alcohols, Aldehydes, Humidity at >60%
Flow Rate	0.030—1.5 L/min	0.353 L/min
Sample Period	60 min	60 sec

*Comparison of the NIOSH and PPM Formaldehyde Methods.*

	N	Mean* (SD)	ΔMean* (SD)	Median*	Min* Max*	Min-Max *	Mean Squared Error
NIOSH 2016	47	0.37 (0.35)	— [vs.NIOSH]	0.22	0.026 1.5	1.5	— [vs.NIOSH]
PPM <i>ktV</i>	47	0.341 (0.240)	0.030 (0.140)	0.246	0.032 1.220	1.188	0.019

*Summary of statistics from the NIOSH and PPM Formaldehyde Methods.*

*\*Units are in ppm.*

- The *PPM Technology Formaldemeter™ ktV* calibrated with the *Calibration Standard* passed the comparison with the *NIOSH Method 2016, Issue 2 (2003)*.
- The 1-hour integrated sample collected with the *PPM Technology Formaldemeter™ ktV* had no statistically significant differences from those obtained by the *NIOSH Method 2016*.
- A 1-hour integrated sample collected with the *PPM Technology Formaldemeter™ ktV* instrument is useful as a screening tool and precludes the need for timely and expensive laboratory analysis if low concentrations are measured.

The full *NIOSH Method 2016, Issue 2* can be found on the NIOSH/CDC website (<http://www.cdc.gov/niosh/docs/2003-154/pdfs/2016.pdf>) and a full copy of the report can be obtained from *PPM Technology Ltd.* on request.