




Custodian

Portable Gas Detector

User's Manual

Quick Operating Guide

To switch instrument on:	Press main button. Intermittent beep and green LED flash indicates unit operational.
Alarm:	Fast flashing red LEDs and wailing sounder indicates gas hazard.
To reset (accept) alarms:	Press main button
To switch on backlight:	Press any button
To switch instrument off:	Main button &  key simultaneously
To zero instrument in clean air:	Press lower  key until bar on LCD moves from RUN to ZERO then push main button to accept. If a key symbol appears on the LCD a password is required to zero the instrument - section 5.5.

A finger guard is available which only permits access to the main button &  key. This restricts access to instrument functions but does allow the unit to be switched on and off.

Issue 1.

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2. Introduction to Custodian

The Crowcon Custodian is a portable gas detector which can monitor up to four gases simultaneously. It is designed to be carried or worn by individuals working in hazardous environments such as confined spaces, and will give a loud audible and bright visual alarm warning when preset concentrations of gas are detected.

Detailed mechanical design features have resulted in an easy to service instrument with sealing to IP65.

The user interface has been designed to combine the best features of 'one button operation' for routine applications, with simple multi-button operation for advanced functions. The shape of the instrument has been designed to fit comfortably against the body and pose the least restriction on movement. It can fit in a pocket, on a belt or a chest harness.

The detachable battery pack can be replaced in a hazardous zone for round the clock operation. Rechargeable packs utilise environmentally friendly nickel hydride batteries with a life of up to 1000 charge cycles. These will power an instrument with one flammable sensor and three electrochemical sensors for 16 hours. Dry cell (disposable) packs are also available.

The sensor module can be detached and replaced for easy field maintenance.

Unique to an instrument of its size, there is an optional integral pump for remote sampling or 'forced diffusion'.

3. Operation

3.1 Switch-on Sequence

To switch on the instrument, press the main button.



The instrument tests all LCD segments, red alarm LEDs and sounder before entering **Run** mode. The green 'confidence' LED will flash and the speaker bleeps every few seconds to reassure users that the instrument is working and the environment is safe. It is now ready to be used. Note the

audible bleep may be turned off using the SetCustodian program (section 14.4).

What if the display shows a message like 'E1'?

E numbers indicate that the diagnostic routines have found an error, such as Calibration Expired. Section 10 gives further details.

3.2 **Run Mode**

The instrument displays each gas reading in turn for several seconds, cycling back to the first. The channel displayed is indicated by a bar on the LCD under the gas name on the label. To hold on a particular channel, press the upper  key to select the channel of interest. Note that the **Run** indication disappears. Press the lower  key to return to **Run** mode.

The display may be blanked by a selection in the SetCustodian configuration program (section 14.4).

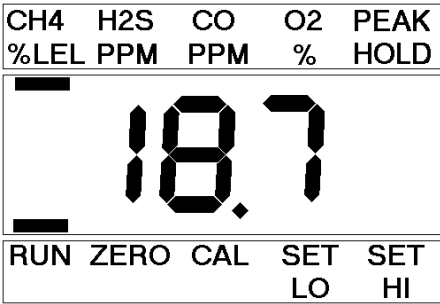


fig 3.1

The display panel shown in figure 3.1 is for an instrument with 4 sensors fitted. The sensor 1 reading is displayed first, indicated by the upper cursor, showing 18.7% LEL CH4 (methane) present. After a few seconds the cursor moves to the next position, and H2S (hydrogen sulphide) ppm (parts per million) is displayed. A few seconds later it switches to sensor 3 which reads ppm CO (carbon monoxide) then to

sensor 4 which displays % by volume oxygen. After completing this cycle, it returns to sensor 1 and repeats.

3.3 **Display Symbol Guide**



Battery Low

Accompanied by faster confidence bleeps. Indicates that there is less than 20 minutes battery life remaining. If switched off, the instrument will not allow itself to be switched on again in this condition.



Pump blocked

Accompanied by a ticking noise. Indicates that the built-in pump or airway is blocked. Check that the flow adaptor and sample lines are free from water or dirt. Also check the sensor filter behind the baffle plate (fig 8.1).

This can occur if a sampling pipe is lowered into a flooded cavity, as the pipe may then suck up water. It can also be triggered if the air intake is blocked with a finger, clothing etc. Once blocked, the pump will not be restarted unless the flow adaptor is removed and re-attached, or the instrument is switched off and on again.



Password protection

Indicates that the function being selected cannot be accessed without a password. This may be encountered when attempting to Zero, Calibrate, Set Alarm levels or turn the instrument off. Password entry is described in section 5.5.



Peak hold

Indicates that the reading displayed is the highest level recorded since the instrument was switched on or reset. For oxygen, Peak Hold records the lowest value encountered. Peak Hold works for all gases simultaneously. Selection is described in section 5.1.



TWA alarm

Sometimes appears during alarms (section 4).

4. Alarm types

For each gas channel, there are three instantaneous alarms; level 1, 2 and 3. For toxic gas channels, there are also two time weighted average (TWA) alarms which operate at short term (15 minute) and long term (8 hour) exposure limits.

Level 1 and 2 instantaneous alarms (referred to as LO and HI on the display label) may have their thresholds adjusted from the instrument keypad (section 5.4).

All alarms may have their thresholds set via the computer interface (section 14.4) and the following parameters may be set for instantaneous alarms:

- Normally triggered on a rising level, alarms may be set to trigger on a falling level as with oxygen deficiency alarms.
- Alarms may be latching, requiring manual reset, or self clearing when the hazard has passed.
- Normal alarms cannot be cleared whilst the gas hazard persists. It is possible to set them so they may be silenced (the red LEDs will continue to flash). This allows the user to set a 'pre-alarm' warning at a low gas level and a non-silenceable alarm at a higher level.
- Unused alarms may be deactivated.

If any alarm event is triggered, the red LEDs will flash and the sounder will emit a loud tone. This tone is selected from a menu available to the SetCustodian user (section 14.4).

The gas channel which has detected an alarm condition will be indicated by a flashing LCD bar below the gas name. The gas value of a channel in alarm will flash whilst it is being displayed.

If the TWA (Time Weighted Average) symbol appears on the display, this indicates that the total cumulative exposure to a toxic gas has been reached for an 8-hour shift or a 15-minute 'window'. Health & Safety regulations require that workers

should leave the hazardous area once they have exceeded this dose. A TWA alarm cannot be manually reset. The main button may be used to silence or clear certain instantaneous alarms as the configuration permits.

5. Keypad Functions

5.1 Peak Hold

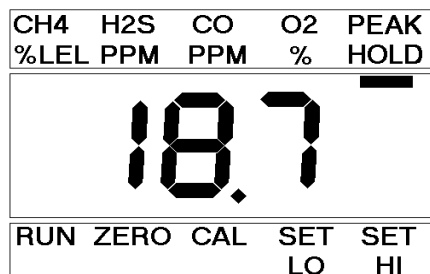


fig 5.1

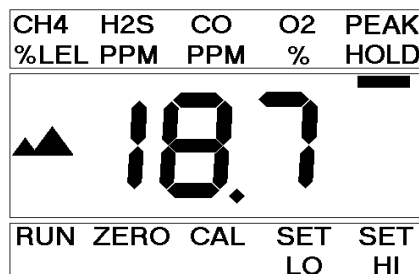






fig 5.2

Peak Hold mode can be selected from **Run** mode by pressing the upper  button until the bar appears under the PEAK HOLD label legend (fig 5.1). Press the main button to make the double-peak symbol appear (fig 5.2). (Pressing the main button again at this stage restores normal display and removes the symbol.) Return to **Run** mode or a specific channel with the cursor keys  .

The instrument will now display the peak reading of any sensor (lowest oxygen reading) since the instrument was switched on. Press the main button to clear the peak readings to current levels.

5.2 Zeroing instrument in clean air

Press the lower  key until the bar on the LCD moves from RUN to ZERO. Press the main button to accept.

The instrument will zero its gas readings. *The instrument must be in fresh air before performing this operation.*


If a key symbol appears on the LCD, a password is required to zero the instrument - see section 5.5.





If **E2** appears (section 10), the zero offset is too great to be adjusted, such as would occur with an oxygen channel in air. In this case, the channel should be **calibrated** to read 20.9 (section 5.3)

5.3 Calibrating instrument

Ensure the instrument reads zero (except oxygen) in fresh air. Fit the flow adaptor as described in section 6.

From RUN mode press the  key to progress the bar on the LCD to the CAL position.



Press the  key to select the gas channel to be calibrated. Pass calibration gas through the flow adaptor as described in section 6.3.

Press the  or  keys to adjust the reading to match the known gas concentration. (Pressing either cursor key   at this stage will result in the adjustment being scrapped.)

Press the main button to accept the new value.


A key symbol may appear indicating that this value cannot be changed without a password. If so, enter the password as described in section 5.5.



If **E3** appears (section 10) and the display does not achieve the desired value, the gain is being set out of range indicating probable sensor failure or incorrect calibration gas.



Press the  key to select another channel for calibration or the  key to step via the alarm view/change options back to **Run** mode.



5.4 Viewing/Altering Alarm levels

Press the  key until the **SET LO** function is indicated.

Press the  key to select the channel.

The low alarm level for that channel is now displayed and may be adjusted with the  /  keys. (Pressing either cursor

key   at this stage will result in the adjustment being scrapped.) Press the main button to accept the adjustment. A key symbol may appear indicating that this value cannot be changed without a password. If so, enter the password as described in section 5.5.

Press the  key to select another channel or the  key to step via the **SET HI** option back to **Run** mode.





The **SET HI** function is identical in operation to the **SET LO** function except that it operates on the level 2 alarm.

5.5 **Password Entry**

Access to the functions zero, calibrate, set lo and set hi may be restricted by the assignment of two passwords within the SetCustodian configuration program (section 14.4). The default configuration is as follows:-

Password 1    : **ZERO**

Password 2    : **ZERO, CAL, SET LO, SET HI, OFF**

If a protected function (eg zero, fig 5.3) is selected with the main button, the display is cleared and the key symbol appears (fig 5.4) to prompt the user to key in the relevant password. Enter the correct sequence of the     keys. As each key is pressed, a small 'o' appears (fig 5.5). After four key entries, press the main button. The selected function will operate if the correct password was entered, otherwise a question mark appears (fig 5.6). Acknowledge the error by pressing the main button.

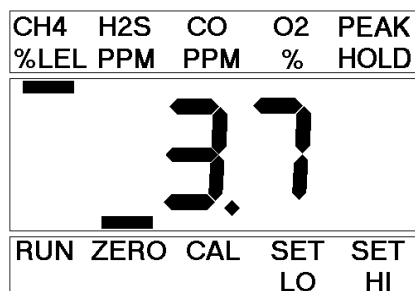


fig 5.3

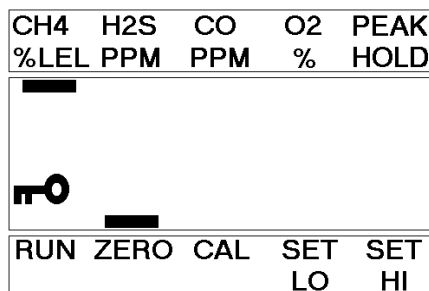


fig 5.4

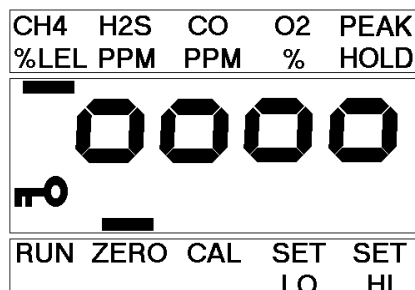


fig 5.5

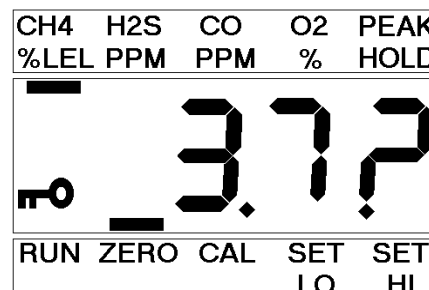


fig 5.6

Once a password has been successfully entered, it remains valid until the instrument is returned to **Run** mode. All functions protected by this password now take immediate effect when they are selected.

6. Remote Sampling & Calibrating

It is often desirable to take samples from a remote location, such as when testing a confined space before entering. Also, it is necessary to sample a source of known gas for calibration purposes.

Two Flow Adaptors are available which attach over the sensor grille, to allow the internal pump or a hand-held aspirator bulb to be used to draw remote air samples. The adaptor is secured with two finger screws.

6.1 Pumped Instruments

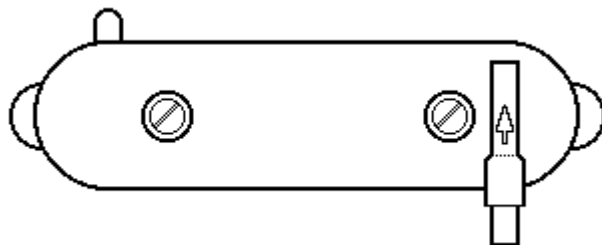


fig 6.1

The internal pump switches on automatically when the Pump Flow Adaptor is fitted over the grille. Air is drawn in through the nozzle on the adaptor and exhausted through the small nozzle below the sensor grille. In this configuration, the instrument continuously samples air in its immediate vicinity. A sample tube may be connected to the inlet nozzle for remote sampling.

Warning: *the instrument senses the presence of the flow adaptor using a magnet moulded into the adaptor. Keep the flow adaptor away from cassette tapes, floppy disks etc.*

6.2 Diffusion Instruments

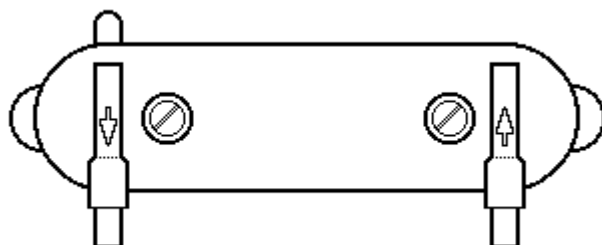


fig 6.2

The Calibration Flow Adaptor has an inlet and outlet nozzle marked by air flow direction arrows. Inlet connections are as for pumped instruments but the outlet must be connected to a hand aspirator bulb or other suitable pumping device. A consistent style must be adopted when using hand aspirators - Crowcon recommend squeezing once per second to achieve a flowrate of approximately 0.5 - 1 litre/min.

This adaptor may also be used on pumped instruments in which case the internal pump will not run.

6.3 **Calibration Method**

Pass calibration gas through the flow adaptor from a regulated cylinder. Use a flowmeter and needle valve set after the regulator to set a flow rate of 0.5 - 1 litre/min. Pumped units should ideally be fed gas from an unpressurised gas bag. *When the calibration gas may represent a toxic risk, it is advisable to connect the outlet to an exhaust bag or fume extractor.*

Typically, calibration gas must be applied for 30 seconds or more before the reading stabilises to its final level. This reading may then be adjusted to the desired level using the keypad (section 5.3) or computer interface (section 14.3).

An automatic calibrator is available to streamline batch calibration.

7. **Battery pack**

7.1 **Changing the battery pack**

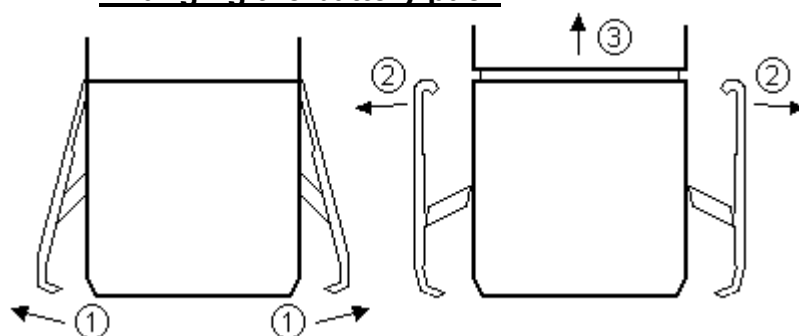


fig 7.1

1. Prise the clips away from the bottom of the battery pack.
 2. Push the clips up towards the instrument to detach the hooks and release them from the main body.
 3. Pull the battery pack away from the instrument.
- Refit a charged pack by reversing the above procedure.
A CommsPod may be fitted in the same way.

Battery packs may be replaced in a hazardous area, but CommsPods may only be fitted and used in a safe area.

7.2 **Recharging**

Do not use the charger in a hazardous area!

Switch the charger on.

Place the instrument in the charger with the charging contacts towards the rear.

The red LED will light whilst the instrument is undergoing fast charge. Full recharge from flat takes about 6 hours, during which it is normal for the batteries to become warm. After fast charging, the red LED goes out and the green LED comes back on: the batteries are now charged and receiving a trickle current. The instrument can be used immediately or left on charge indefinitely.

Battery packs can be recharged on their own without being connected to the main instrument.

No damage will occur if dry cell packs (7.3) are inadvertently placed in the charger, as no charging current will flow.

7.3 **Dry cell packs (non-rechargeable)**

Dry cells come in a distinctly marked battery pack to avoid confusion. To change batteries, detach the battery pack from the instrument. Using the Allen key provided, remove the bolts securing the battery retaining plate. Replace the spent cells taking note of polarity indications.

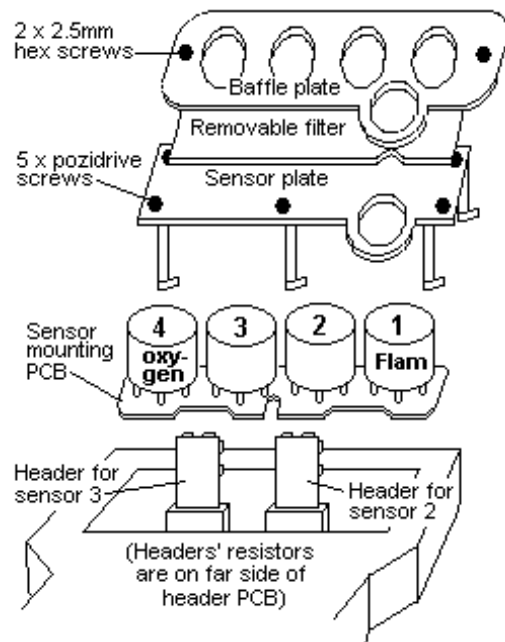
Cells may only be replaced in a safe area!

Use only the following battery types:

Duracell	MN1500	LR6
Ever Ready	Energizer	LR6BA
Varta		4006

The use of alternative types will invalidate intrinsic safety approvals.

8. **Sensor Replacement**

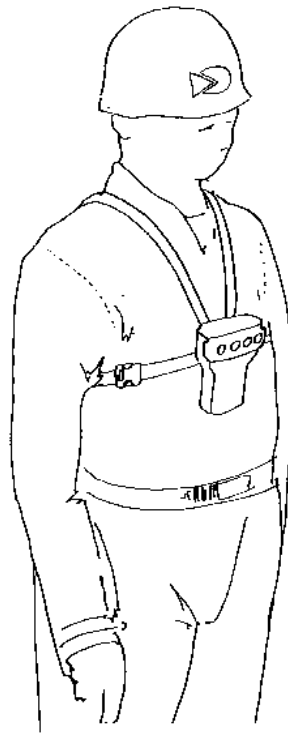


Remove the flow adaptor if fitted (section 6). Remove the baffle plate which is secured by two screws. The removable filter may come away with this component. Remove the five screws securing the sensor plate assembly and withdraw it from the instrument.

fig 8.1

Rotate the quick release fixings which retain the sensor mounting pcb and detach it from the sensor plate. Individual plug-in sensors may now be replaced as required. If replacing a toxic sensor, it is necessary to replace the associated header pcb. This is supplied with the spare sensor and should be fitted to the socket on the marshalling pcb nearest to the sensor in question. When reassembling, ensure that all gaskets and filters are in good condition and correctly fitted.

9. Fixing Attachments



A number of options are available when it comes to wearing or carrying the instrument.

The standard attachment is the transparent belt bracket fitted to the rear of the instrument through which a normal trouser belt may be fed.

In place of the belt bracket, the chest harness bracket may be attached. The chest harness is worn as shown in figure 9.1

fig 9.1 Chest Harness

A pocket clip is available for the front of the instrument which enables it to be worn as shown in figure 9.2. The battery pack fits inside the pocket so that the sensors face outwards.

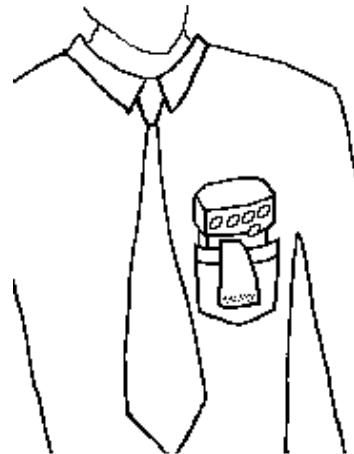


fig 9.2 Pocket Clip

10. Troubleshooting guide

<i>Symptom</i>	<i>Diagnosis</i>	<i>Remedy / check</i>
Does not switch on	battery flat	recharge or replace battery
Does not switch off	password required	alter configuration *
Display blank	display disabled	alter configuration *
No confidence bleep	function disabled	alter configuration *
Reading when no gas present	zero drifted	zero instrument in clean air
Unstable / inaccurate reading	sensor failure	recalibrate or replace sensor
Does not talk with PC	CommsPod unpowered	connect power

* section 14.4

The instrument may display the following warning codes:

E1: Calibration Expired: indicates that the period between regular calibrations has elapsed.

E2: Zero Failed: results from attempting to zero a channel exposed to gas (including an oxygen channel in air). The function request is aborted without effect.

E3: Calibration Failed: the gain is being set out of range indicating probable sensor failure or incorrect calibration gas. The gas reading is set as close to the desired level as the gain limiting software will allow.

E4: Sensor Overrange (displayed in place of a legal sensor reading)

E5: High/low Temperature: - gas readings may not be reliable at these extremes.

E6: Electronic Hardware Failure: - the instrument should be sent for repair.

Most of these warning codes can be acknowledged (cleared) by pressing the main button.

11. Limitations of Use

Gas readings may not be reliable at temperatures above 50C or below -20C. In this case the E5 error message is displayed.

Flammable gas sensors will respond to many flammable gases and vapours, although the calibration will be specific to one type. Readings may be reduced if the atmosphere is oxygen deficient.

Substances containing lead, silicones or halogens may permanently reduce the sensitivity of flammable gas detectors.

Toxic gas sensors may respond in varying degrees to gases for which the sensor is not calibrated. Cross sensitivity data is available from Crowcon's Sales Department.

Reactive gases such as chlorine are adsorbed onto the surfaces of most materials, including sensor apertures and sampling equipment. This will delay the response to the gas. Use inert tubing such as PTFE and keep sample lines short. If hand aspirating, ensure that the minimum flowrate of 1l/min is maintained.

Do not replace disposable cells in a hazardous area. Exchange the battery pack instead.

Do not use a CommsPod in a hazardous area.

12. Accessories

Auto calibrator

DC0 103 Charger

DC0 105	CommsPod
DC0 101	Rechargeable battery pack
DC0 102	Dry cell battery pack
DC0 114	Chest harness
DC0 104	Carry case
	Pocket clip
	Belt bracket
	Carry strap
DM0 421	Finger guard
DC0 107	Flow adaptor - pumped
DC0 108	Flow adaptor - diffusion
	Water float
	Aspirator
	Aspirator probe

13. Spares

DM0 428	Goretex filter (5 pack)
DM0 420	Sensor blanking plug
	Electric pump
DM0 403	Battery pack clip
DE0 108	Switch membrane
DE0 110	Flammable sensor
DE0 111	Oxygen sensor
DE0 112	Carbon monoxide sensor
DE0 113	Hydrogen sulphide sensor
DE0 114	Sulphur dioxide sensor
DE0 115	Nitrogen dioxide sensor
DE0 116	Chlorine sensor

14. SetCustodian Computer interface

14.1 Introduction

SetCust is a Microsoft Windows based utility program for interfacing with a Custodian gas detector. Using industry standard RS232 from the PC serial port, the program allows full access to the instrument for routine operations such as calibrating and advanced functions such as altering passwords. Functions and configuration options are presented with Windows menus and dialog boxes.

14.2 Installation

The minimum hardware requirement for SetCustodian is a 386SX PC running Windows 3.0 or later.

To install SetCustodian on the hard disk, insert the disk in drive a, click on the **File** menu in Program Manager, select **Run**, and type **a:setup** as the Command Line. Setup will create a directory and program group called Custodian (fig 14.1).

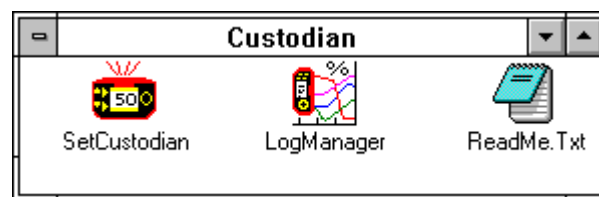


fig 14.1

By default, SetCustodian uses serial port COM1. If using port COM2, the win.ini file may be edited with Notepad such that the lines:

```
[CUSTODIAN]  
PORT=2
```

are included. Be sure to create a backup of win.ini before editing it!

To run SetCustodian:

Run Windows.

Double click on the SetCustodian icon which can be found in the Custodian program group (fig 14.1).

Ensure that the instrument is fitted with a CommsPod in place of the battery pack (see section 7.1 on battery pack removal). The CommsPod must be powered from a 12V supply such as the Custodian charger, and the serial lead must be plugged in to the computer serial port. *The intrinsic safety certification does not permit this operation in a hazardous area.* Switch on the instrument.

14.3 Routine Functions



Select **Upload** from the **Datalink** menu - this reads the configuration from the instrument which is necessary to identify various parameters such as gas types. A table appears on the screen.

Select **Read Gas** from the **Datalink** menu - current gas values are inserted into the table.

To zero the instrument, select **Zero** from the **Adjust** menu - there is the option to zero one or all channels simultaneously. Ensure the instrument is in fresh air.

To calibrate the instrument, select **Calibrate** from the **Adjust** menu.

Connect a supply of calibration gas as described in section 6.3.

Select the gas channel and type in the known value of the calibration gas. Click **OK** when the instrument reading has stabilised.

14.4 Configuration

FILE	EDIT	Custodian
------	------	-----------

fig 14.2 Status Bar

The **Status Bar** (fig 14.2) indicates the relative state of three editions of the configuration file. The **FILE** version is that stored on computer disk, the **EDIT** version is that stored in computer RAM and the **Custodian** version is that stored in the instrument. When the program is first started, all three are portrayed in yellow indicating that no valid configuration exists.

Upload the configuration from the **Datalink** menu to load all instrument parameters into computer RAM. (**EDIT** and **Custodian** items on the **Status Bar** turn green.) Before editing this configuration it is wise to save the current one to disk: from the **Files** menu select **Save As...** and name the file anyname.set. The **FILE** item on the **Status Bar** turns green indicating that all three editions are now the same.

Set Parameters

Display mode: Full

Alarm sound: Two tone [Test]

Logging period: 60 Seconds

Passwords

Password 1	Password 2
<input checked="" type="checkbox"/> Zero	<input checked="" type="checkbox"/> Zero
<input type="checkbox"/> Calibrate	<input checked="" type="checkbox"/> Calibrate
<input type="checkbox"/> Alarms	<input checked="" type="checkbox"/> Alarms
<input type="checkbox"/> Off	<input type="checkbox"/> Off

☐ Functions timeout

☒ Confidence Blip

Next calibrate: 26 Weeks

[Channels] [Finished]

fig 14.3

This configuration may be viewed or edited by clicking on the **Edit** menu to bring up the Set Parameters dialog box fig 14.3. Within this box, it is possible to alter the following parameters:

- **Display mode** - full or blank display
- **Alarm sound** - a menu of alarm tones is available for the instrument's gas alarm. Click **Test** for a preview of the sound.
- **Logging period** - see Datalogging.
- **Functions timeout** - if this option is selected, instrument keypad functions (zero, cal, set lo, set hi) will be disabled 30 seconds after switch-on.
- **Confidence blip** - on or off (shown on).
- **Next calibrate** - this option defines the period between a full instrument calibration, and generation of the E1 (section 10) Calibration Expired warning.
- **Passwords** - two passwords are assigned for the restriction of user access to instrument keypad functions. The default password protection shown in fig 14.3 indicates that:
 - no password is required to turn the instrument off
 - password 2 must be entered in order to calibrate or change alarm levels
 - either password 1 or 2 must be entered in order to zero the instrument

Click the check boxes if it is required to change this pattern of protection.

Click the Password 1 or Password 2 button if it is required to change either key sequence. The Set Password dialog box appears (fig 14.4).

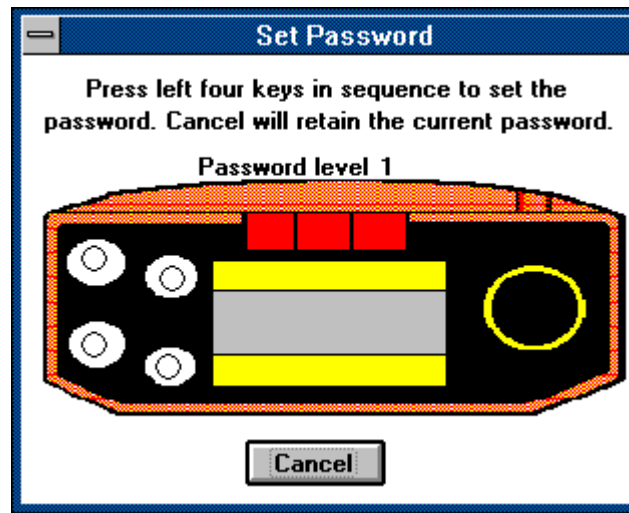


fig 14.4

- **Setup channels** - Click the **Channels** button to bring up the **Setup channels** dialog box (fig 14.5)

Setup Channels

Editing Channel Number 2 **Previous** **Next**

Gas: H2S Range: 0-25 Units: ppm

Finished

Time Weighted Averages

Short term level: 15.0 Long term level: 10.0

Alarm 1	Alarm 2	Alarm 3
<input checked="" type="checkbox"/> Active	<input checked="" type="checkbox"/> Active	<input type="checkbox"/> Active
<input checked="" type="checkbox"/> Rising Alarm	<input checked="" type="checkbox"/> Rising Alarm	<input type="checkbox"/> Rising Alarm
<input type="checkbox"/> Latching	<input checked="" type="checkbox"/> Latching	<input type="checkbox"/> Latching
<input checked="" type="checkbox"/> Can Mute	<input type="checkbox"/> Can Mute	<input type="checkbox"/> Can Mute
5.0	10.0	0.0
Value	Value	Value

fig 14.5

Channel 2 setup is shown - click **Next** or **Previous** for other channels.

Gas type, **Range** and **Units** are selected from pull down menus.

Time Weighted Average (TWA) alarm levels for **Short term** (15 minutes) and **Long term** (8 hour) may be edited. These values only apply to toxic gas channels.

Three instantaneous alarms are configured as shown (fig 14.5)

Alarm 1 is a non **Latching** alarm triggered by the gas level **Rising** above 5 ppm which may be silenced.

Alarm 2 is a **Latching** alarm triggered by the gas level **Rising** above 10 ppm which may not be silenced.

Alarm 3 is not **Active**.

Click **Finished** to close the **Setup Channels** box and again to close the **Set Parameters** box.

If any changes have been made to the configuration, the **FILE** and **Custodian** items on the **Status Bar** turn red, indicating that they are now different to the current RAM edits. To download the new configuration to the instrument, select **Download** from the **Datalink** menu (**Custodian** item on **Status Bar** turns green). Saving the configuration to disk as newname.set will turn the **FILE** item green also.

A printout of the configuration is available by selecting **Print** from the **Files** menu.

14.5 Datalogging

To access logged data from an instrument, select **Upload Log** from the **Datalink** menu. Save file as anyname.log. See LogManager section for analysis of log files.

After uploading, select **Clear Log** from the **Adjust** menu to make room for new reports in the instrument.

Set the **Logging period** in seconds by entering a value in the **Set Parameters** dialog box from the **Edit** menu. The default value is 60 seconds.

15. LogManager Program

Once a logged data file has been saved on disk, it may be analysed using LogManager.

Launch the program by double clicking on the LogManager icon.



Select **Open Log...** from the **File** menu.

Select the file of interest (anyname.log) by typing the filename or clicking on a name from the list. Click **OK**.

Data is presented graphically with an individual coloured trace for each gas. As the mouse pointer is moved around the screen, the gas level and event time are displayed in the upper left corner.

Use the horizontal scroll bar to move along the time axis.

Gas values are scaled according to the maximum range on any channel shown. In order to see detail on a low range channel (eg 25ppm H₂S), it may be advantageous to turn off the traces of any high range channels (eg 500ppm CO). This is achieved by selecting the **View** menu and clicking on channels to turn traces on or off.

A tabular listing of the current log file is available by selecting **Print** from the **File** menu. The listing is directed to the resident printer.

15.1 **Spreadsheet Files**

For detailed analysis and presentation of logged data, files should be converted to comma separated variable (c.s.v.) format and then imported into a proprietary spreadsheet program (eg Microsoft Excel, Lotus 123).

Select **Save as...** from the **File** menu and save the current logged data as anyname.csv. By default, this selection converts the entire file to csv format. In some countries, spreadsheets have been standardised to use semi-colon delimited data files. In this case, select the **Convert** menu and click the semi-colon data separator check box **before** saving the file. This dialog box also enables a user to convert just a part of the data file by entering the start and end reading numbers. By default, the complete file is selected.