aeroQUAL

UV-H
UV Ozone Photometer

User Guide

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Foreword

Warranty

Aeroqual warrants this product to be free from defects in materials and workmanship for a period of 1 (one) year from the date of shipment from the factory. Consumable items such as pumps, filters and gas scrubber media are excluded from this warranty. This warranty is expressly limited to the original owner who purchases the equipment directly from Aeroqual or from an authorized Aeroqual dealer. Should your Aeroqual product need warranty service, you should return it to the dealer from whom it was purchased or contact Aeroqual.

What we will do

If, during the warranty period, this product fails to operate under normal use and service, due to improper materials or workmanship, Aeroqual subsidiaries, authorized distributors or authorized service partners will, at their option, either repair or replace the product in accordance with the terms and conditions stipulated herein.

Conditions

1. The warranty is valid only if the original receipt issued to the original purchaser by the dealer, specifying the date of purchase, is presented with the product to be repaired or replaced. Aeroqual reserves the right to refuse warranty service if this information has been removed or changed after the original purchase of the product from the dealer.

2. If Aeroqual repairs or replaces the product, the repaired or replaced product shall be warranted for the remaining time of the original warranty period or for ninety (90) days from the date of repair, whichever is longer. Repair or replacement may be via functionally equivalent reconditioned units. Replaced faulty parts or components will become the property of Aeroqual.

3. This warranty does not cover any failure of the product due to normal wear and tear, damage, misuse, including but not limited to use in any other than the normal and customary manner, in accordance with Aeroqual's user guide for use, faulty installation, calibration and maintenance of the product, accident, modification or adjustment, events beyond human control, improper ventilation and damage resulting from liquid or corrosion.

4. This warranty does not cover product failures due to repairs, modifications or improper service performed by a non-Aeroqual authorized service workshop or opening of the product by non-Aeroqual authorized persons.

5. The warranty does not cover product failures which have been caused by use of non-Aeroqual original accessories.

6. This warranty becomes void if a non-Aeroqual approved power supply is used.

7. Tampering with any part of the product will void the warranty.

8. Damage to the sensors can occur through exposure to certain sensor poisons such as silicones, tetraethyl lead, paints and adhesives. Use of Aeroqual sensors in these environments containing these materials may (at the discretion of Aeroqual) void the warranty on the sensor head. Exposure to gas concentrations outside of the design range of a specific Aeroqual sensor head can adversely affect the calibration of that sensor head and will also void this warranty as it applies to the replacement of sensor heads.

9. Aeroqual makes no other express warranties, whether written or oral, other than contained within this printed limited warranty. To the fullest extent allowable by law all warranties implied by law, including without limitation the implied warranties of merchantability and fitness for a particular purpose, are expressly excluded, and in no event shall Aeroqual be liable for incidental or consequential damages of any nature whatsoever, however they arise, from the purchase or use of the product, and including but not limited to lost profits or business loss.

10. Some countries restrict or do not allow the exclusion or limitation of incidental or consequential damage, or limitation of the duration of implied warranties, so the preceding limitations or exclusions may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which may vary from country to country.

Thank you for purchasing this Aeroqual product. To get maximum use of the features of your new product we recommend that you follow a few simple steps:

- Read the guidelines for safe and efficient use.
- Read all the terms and conditions of your Aeroqual Warranty.

For Your Safety

Read these simple guidelines. Ignoring these guidelines may be hazardous.

▪ **USE SENSIBLY**
Use only as per this user guide.

▪ **USE AEROQUAL APPROVED SERVICE**
Only approved service personnel must work on this product.

▪ **ACCESSORIES**
Use only approved accessories. Do not connect incompatible products.

▪ **CONNECTING TO OTHER DEVICES**
When connecting to any other device, read the appropriate user guide for detailed safety instructions. Do not connect incompatible products.

▪ **HAZARDOUS ENVIRONMENTS**
Do not use the UV-H Photometer in or near volatile fuel or chemicals.

▪ **HEALTH AND SAFETY IN THE WORKPLACE**
Aeroqual UV-H Photometers and Sensor Heads are used to monitor ambient gas concentrations. Aeroqual does not guarantee user safety. In hazardous environments, an appropriate Health and Safety plan should be in place.

WARNING *Do not* **switch the UV-H Photometer on before reading the User Guide.**

Technical Support

Technical information, service and spare parts are available through your distributor. In addition, world wide technical support is available from Aeroqual Ltd.

Please contact:

Aeroqual Limited
109 Valley Road, Mt Eden, Auckland 1024, New Zealand
Phone: +64 9 623 3013
Fax: +64 9 623 3012
Email: technical@aeroqual.com

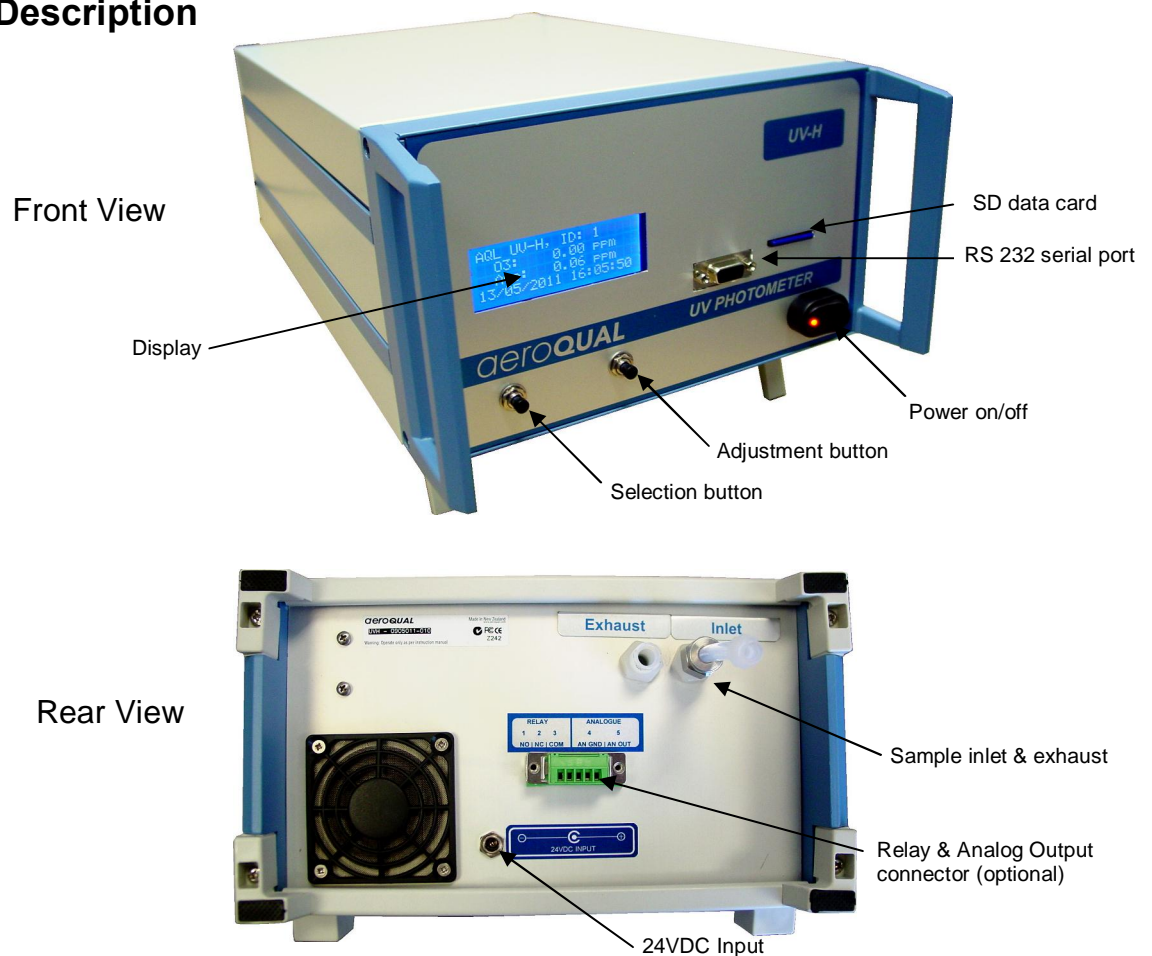# 1.0 UV-H Photometer and System Components

1.1 UV-H

The Aeroqual UV-H Ozone Photometer is a non-dispersive ultraviolet (UV) photometer which alternatiely switches a selective MnO_2 ozone scrubber in and out of the measuring stream and computes the ratio of transmitted light to give a reliable measure of ozone concentration. A mercury vapor lamp with a line at 254 nm is used as the light source. A solar blind photodiode is used as the detector. The relationship between transmitted light and ozone concentration is defined by the well known Beers/Lambert Law. The optical bench is maintained at a temperature of 55 ^{o}C to avoid condensation.

Data is logged to a removable Secure Digital (SD) card or logged directly to a PC using the supplied software. Optional analog and relay control outputs are available for control applications.

1.2 System Components

- UV-H Ozone Photometer
- 24VDC Regulated Power Supply
- Computer CD containing software for data logging and configuring the UV-H
- Data Card (2GB)
- Serial Cable

2.0   Description

Front View

Display

SD data card

RS 232 serial port

Power on/off

Adjustment button

Selection button

Rear View

Sample inlet & exhaust

Relay & Analog Output connector (optional)

24VDC Input

3.0 Operating Instructions

3.1 Getting Started

1. Unpack unit
2. Install SD card into slot on front panel
3. Plug 24VDC power supply pack into rear socket on UV-H and connect to mains power.
4. Connect inlet and exhaust tubing (1/4 "OD)
    ****SAFETY: vent the exhaust safely to avoid personal exposure to elevated ozone levels.*****
5. Turn on the power switch on front panel. The instrument will showing "warming up: for 2 minutes and then start reading.

Note: The UV-H Photometer should be allowed to run for 60 minutes to acheive ultimate accuracy.

3.2 Operating the UV-H Photometer

Display

When first powering on the Photometer the display will show "Warming up...+for 2 minutes.
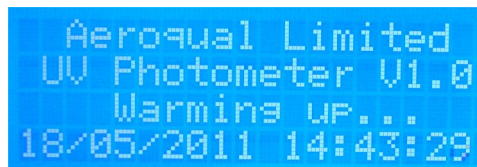
After warm up the displays shows:

Front Panel Push Buttons

There are two buttons on the front panel "selection+ and "adjustment+. Pushing the "selection+ button for 2 seconds enters configuration mode. Repeat pushes enable the user to scroll through a list of parameters whose values can be changed. The "adjustment+button enables the value to be selected for each parameters. Holding down the "adjustment+ button will scroll through the values.

Parameter	Values
ID	1 to 99
display units	ppm or mg/m3
logging rate	1 to 60 minutes
averaging time	5, 10, 15 or 60 minutes
relay output mode (only functional with optional relay output board)	alarm above (NO closed, NC open, above setpoint) alarm below (NO closed, NC open, below setpoint) control mode (5% band)
relay setpoint (only functional with optional relay output board)	0.00 to 200.00 ppm
exit	

SD Card log

The information logged on the SD card is:

Date, Time, O3 ppm, Ave O3 ppm.

The data files are stored as a daily file in a tab delimited file with the filename YYYYMMDD.aql. Note: the ozone SD card data is always logged in ppm even if the display units are mg/m3.

There is also an EVENTLOG.aql file on the SD card which logs a variety of events for diagnostic analysis.

Optional Relay Board

If the optional relay board has been fitted the user can use the UV-H for control or alarm purposes and also obtain a 0-5V (0-200 ppm) analogue output. These outputs are available on conector located at the rear of the UV-H Photometer. Please note the specifications for these outputs are given in Appendix B.

Connecting a computer

The connection of a computer to the UV-H via the RS232 serial data port, the installation of the software and its use are described in Appendix A.

Maintenance

The UV-H is designed to operate without maintenance for extended periods. The following table outlines a periodic maintenance schedule for the UV-H. This schedule is based on experience under normal operating conditions and may need to be modified to suit specific operating conditions.

Interval	Item	Procedure
3 months	Inlet filter	check/replace
6 months	pump flow	check
12 months	span calibration	perform against a calibrated ozone source
12 months	zero scrubber	replace filters
12-18 months	check lamp	check lamp output in diagnostics screen and replace if below 1 V output.

4.0 Troubleshooting

4.1 Troubleshooting Guide

Symptom	Possible Cause	Fault isolation/Solution
Gas sensor readings incorrect	Insufficient warm up	Allow the UV-H Photometer to fully warm up after power down. This may require 60 minutes or more.
	Incorrect zero calibration	Repeat zero calibration with clean air.
	Incorrect span calibration	Perform span check.
	Sensor module leaking	Check for leaks
	Sensor pump failed	Measure flow. If pump has failed replace.
	Inlet filter dirty	Replace
Gas Sensor readings noisy or unstable	Leaks	Leaks dilute the sample stream and can cause low span readings and incorrect zero readings. Perform a leak test.
	Inlet filter dirty	Replace
	Lamp faulty	Replace
	Pump faulty	Check flow. Replace
No communication over RS232	RS232 cable disconnected	Reconnect cable
PC Data logging stopped	UV-H power blackout interrupted data logging.	Close and restart UV-H software.
	USB to serial hub not working	Check USB connectors. Check the Moxa serial hub is present on the device hardware menu in the PC. If not reload driver software and re-install.
No data on SD card	Card not correctly installed in slot.	Turn off UV-H and install card in slot correctly.
	Data logging interval set too large.	Set logging interval in configuration to a lower interval.
	Data card module fault	Send control module to factory for replacement module.

4.2 Diagnostics

The UV-H has a number of sources for diagnostic information if a problem arises. These are described below:

Event log   A large number of UV-H Photometer events are logged on the event log file which is located on the SD data card.

Event Code Examples	Meaning
O3 :S.F. 2008/11/12 23:45	Lamp failure on 12 Nov 2008 at 23:45
Power on: 2008/11/12 10:12	Power turned on at 10:12 am on 12 November 2008
Config at 2008/11/12 13:12 D:1, Ave Time: 15, Log Rate:1, Status: 0x01, Setpoint=1.50	Configuration saved at 1:12 pm on 12 November 2008

Messages

This is located on the PC software tool bar. If the UV-H is connected to the computer then event messages will be written to the Messages window in real-time.

Diagnostics

This is located in the PC software. If the UV-H is connected to the computer then the sensor module can be interrogated to determine if there is a problem not picked up by normal fault detection as well as fine tune the sensor performance. Only qualified personnel should use this menu as incorrect use may result in sensor malfunction. Please consult Aeroqual Technical Support to understand how to use this feature.

5.0 Calibration

The UV-H can be calibrated by applying a certified concentration of ozone gas to the UV-H inlet. Span adjustments on the UV-H are performed by adjusting GAIN value via the PC software under the Calibration menu. Always use PTFE or fluorcarbon tubing for all sample lines. Always allow the instrument to warm up for at least 2 hours before calibration.

5.1   Zero calibration

The UV-H can be re-zeroed via the PC software using a zero air source.
1. Connect a PC to the UV-H and run the UV-H photometer software.
2. Connect a source of zero air to the UV-H through the sample port using ¼ inch Teflon tubing. Use a T fitting to ensure the UV-H is sampling the gas flow at atmospheric pressure. The zero air should be at least 1.0 LPM (check there is excess flow at the exhaust of the T fitting).
3. Allow the UV-H to sample until stable readings are obtained (about 10 minutes).
4. Start zero calibration by clicking %Calibration . Zero calibration+

5.2   Span calibration

The UV-H can be manually span calibrated by modifying the gain factor for the sensor. Introduce a known concentration of ozone gas into the UV-H Photometer and adjust the gain factor to set the correct concentration reading. Note: a sensor zero point calibration should always be performed before undertaking a span calibration.

Span calibration procedure

1. Perform zero calibration.
2. Connect a calibrated source of ozone gas to the UV-H through the inlet port . Use a T fitting to ensure the UV-H is sampling the gas flow at atmospheric pressure. The span gas flow should be at least 1.5 LPM (check there is excess flow at the exhaust of the T fitting).
3. Allow the UV-H to sample the gas until a stable reading is obtained (about 10 minutes).
4. Adjust the UV-H sensor gain factor to set the correct concentration reading
   Calibration -->Calibrate Gain-->enter password %password+-> select gas--->enter new gain factor

   new Gain factor = old Gain factor   x   Span gas concentration / UV-H gas reading

Note: the GAIN change is logged in the EVENTLOG file on the SD card.

Appendix A   UV-Photometer V1.0 Software Instructions

Description

The UV-H Software is designed to be a simple interface for communicating with the UV-H photometer via a PC. It can be used to configure the UV-H, initiate the zero calibration routine, modify gain factors, poll data and display the data in either table or graphical format. The software runs in Java VM1.5 (supplied with software) and the database is an open source HSQLDB Java database. Data can be easily exported to a spreadsheet for manipulation. The software also incorporates a GSM modem connection which can be used to connect to a UV-H unit remotely.

Computer Requirements

- CD-ROM Drive
- RS232 port
- Windows OS version 2000 or later
- 100 Mb of spare hard drive space
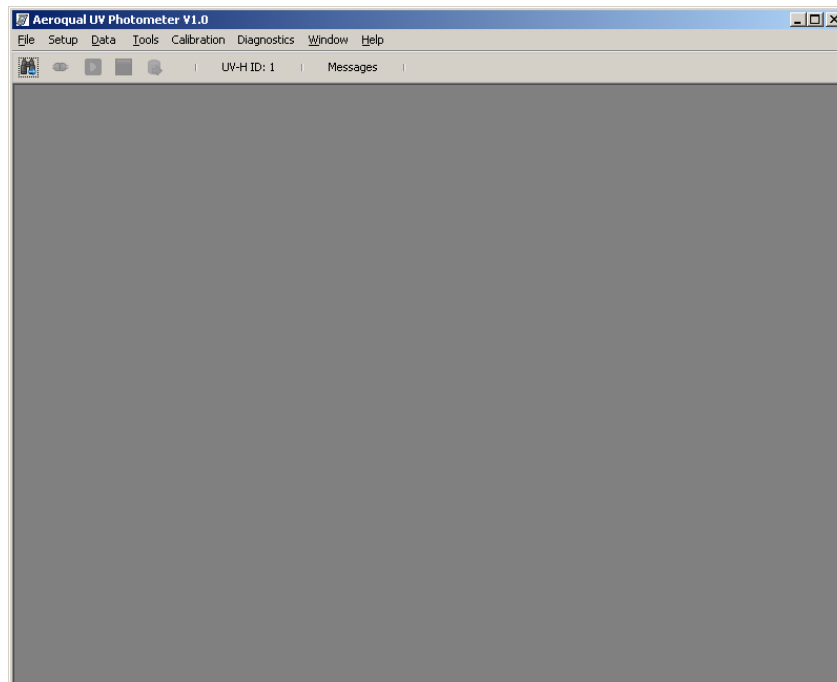- recommended 256 Mb RAM
- recommended 1 GHz processor speed

Setting up

1. Install UV-H CD into drive and extract the ‰Aeroqual UV Photometer v1.0.zip

2. Launch software
   - Click Setup---> *COM Port.*
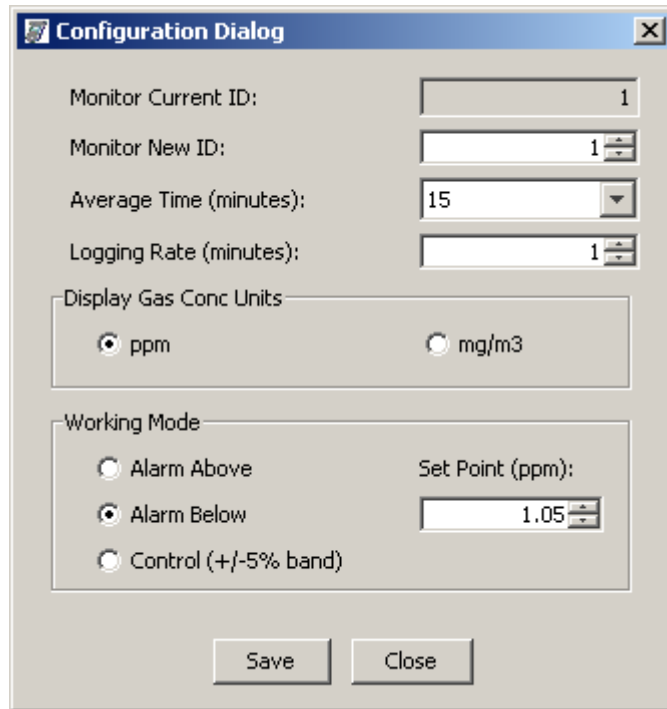   - Select correct COM port settings *Port, 38400, 8, 1, N, N*
   - Click *OK*
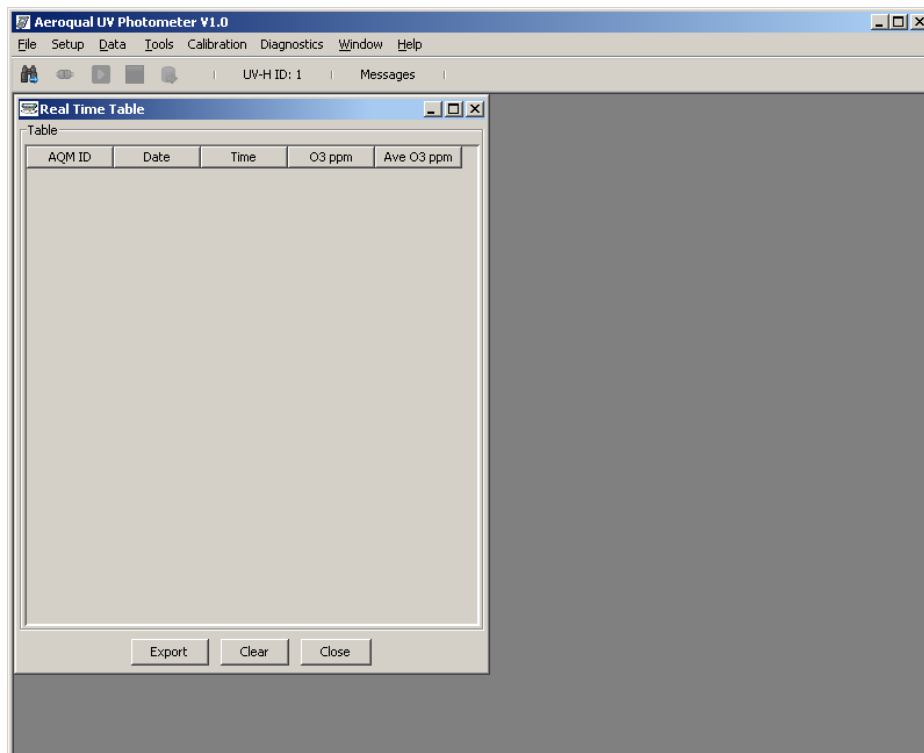
Passwords

The factory set passwords for the UV-H are:

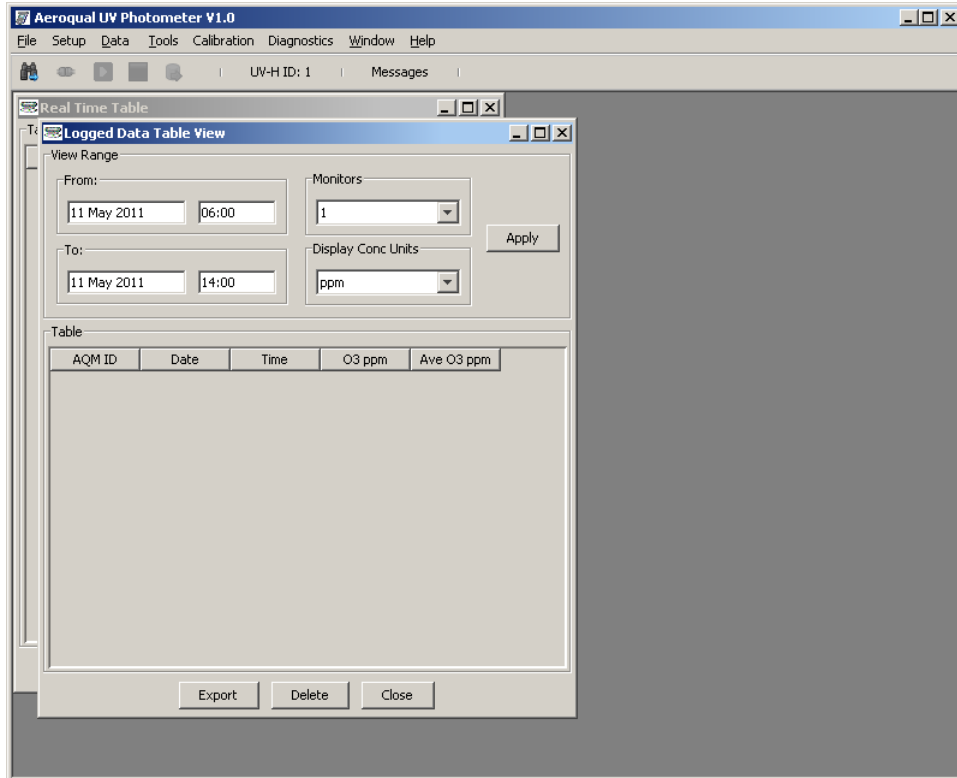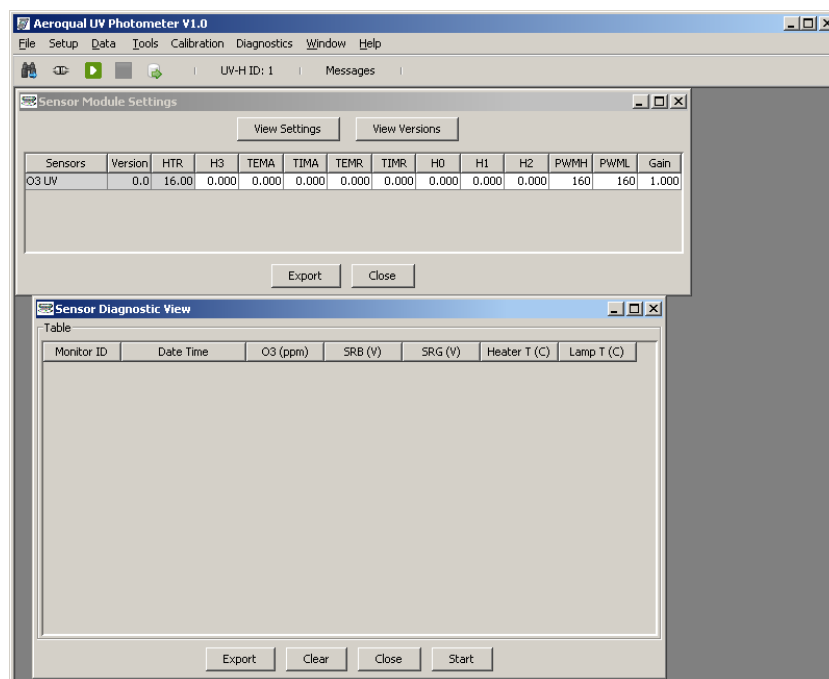|		
System password:		password
Diagnostic password:		george

Software main window

Configuration dialog

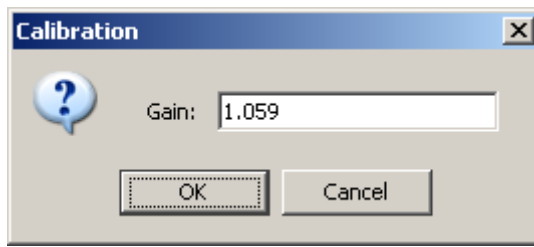

Real Time Table view window

Logged Data Table view window
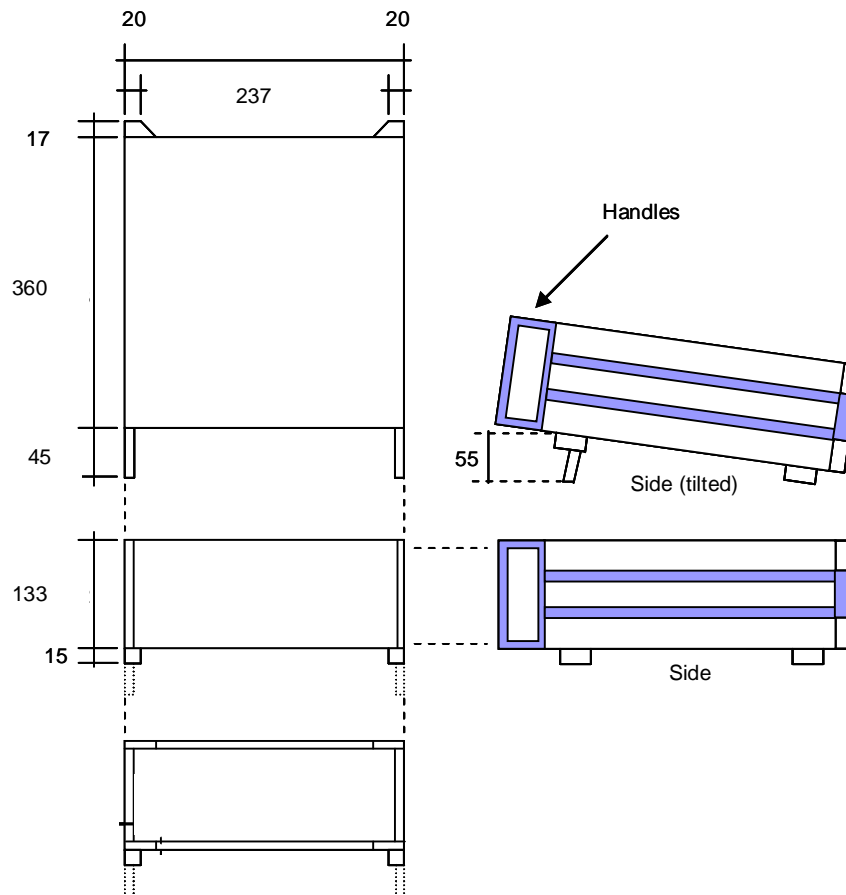

Sensor setting and Diagnostics view window

Gain Calibration dialog

Appendix B   Specifications

Enclosure

(Note: the layout of the back panel can vary slightly depending on the product configuration)
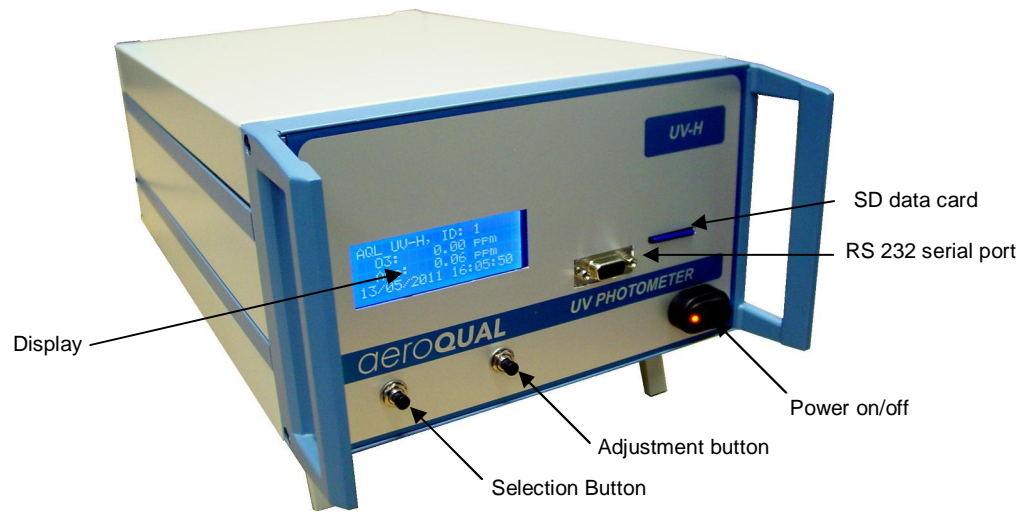
External View

Description
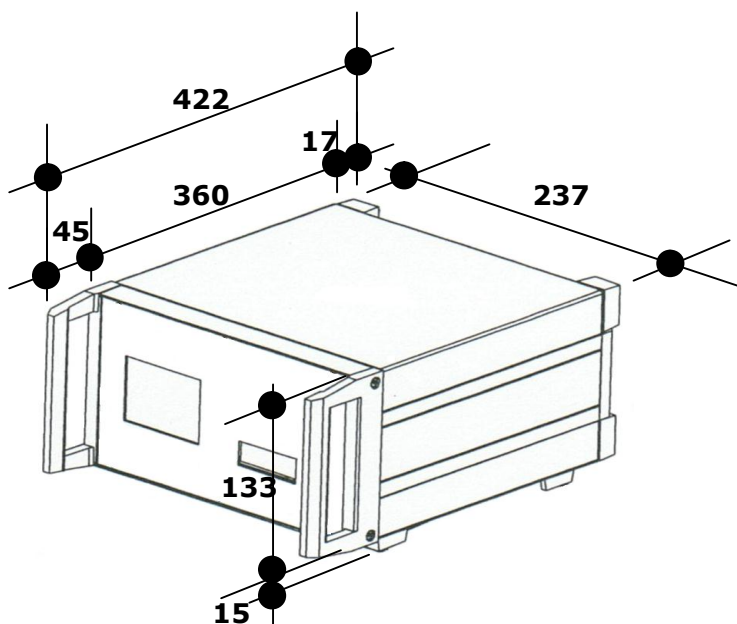Cast aluminum and pressed steel powder coated enclosure.

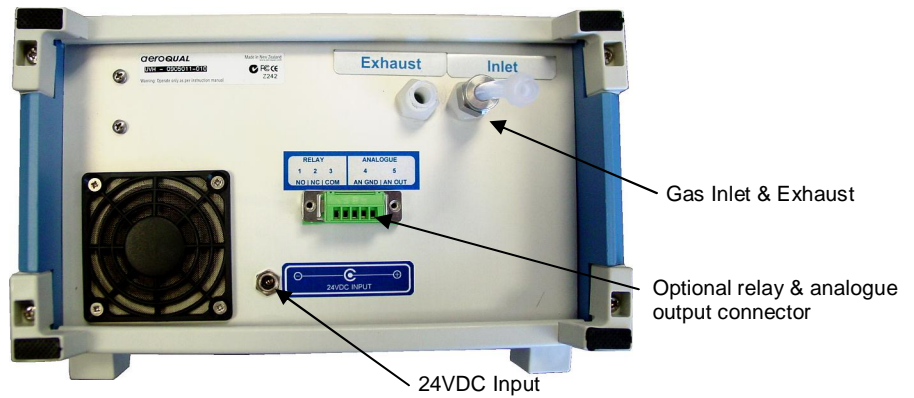## Dimensions

The padded feet add 15mm to the depth and together with the two carry handles give the product an overall size of:
422 mm W x 148 mm H x 422 mm D

Front View

SD data card

RS 232 serial port

Display

Power on/off

Adjustment button

Selection Button

Rear View

Gas Inlet & Exhaust

Optional relay & analogue output connector

24VDC Input

422

17

360

237

45

133

15

Specifications

Calibrated Range	0-200 ppm or 0-400 mg/m3 Ozone
Precision	<±5% of reading above 0.2 ppm
	±0.01 ppm below 0.2 ppm
Resolution	0.01 ppm
T90	< 60s
Sampling method	Brushless DC diaphragm pump
Sample flow rate	0.4 ±0.05 LPM
Inlet filter	5 µm pore size, 37 mm PTFE filter
Pneumatic connections	Kynar ¼+compression fittings
Wetted Materials	Kynar, Teflon PFA, quartz, aluminium, viton
Environmental operating conditions	
Temperature	0-40°C
RH	0-95% RH (non-condensating)
Display	4-line digital display
Digital interface	RS232
ID	1 (default) user configurable from 1 to 99
Data logging	2 Gb SD card
Enclosure	Metal Instrument Case
	378 x 236 x 132 mm
Power supply	Switch mode power supply 24 VDC
	Input 90-260V AC; 47-63Hz
Software	PC data logging software
Options	RS232 to USB convertor (R53)
	Spare inlet filters (25 pack) (R12)
	10m x 6.25 mm OD PFA tubing (R66)
	Relay and analog output board with 0-5V 12 bit (0-200ppm) and setpoint controlled 30V DC 2A relay