aeroQUAL

IQM 60

Indoor Air Quality Monitor

User Guide

version 2.0

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Foreword

Statements of Compliance

1. The Aeroqual IQM Monitor complies with EN 61000-6-1:2001
2. The Aeroqual IQM Monitor complies with EN 61000-6-3:2001
3. The Aeroqual IQM Monitor complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) these devices may not cause harmful interference, and (2) these devices must accept any interference received, including interference that may cause undesired operation.

   NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

   - Reorient or relocate the receiving antenna.
   - Increase the separation between the equipment and receiver.
   - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
   - Consult the dealer or an experienced radio/TV technician for help.

Warranty

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.
    - Save your original receipt. You will need it for warranty repair claims. Should your Aeroqual product need warranty service, you should return it to the dealer from whom it was purchased or contact Aeroqual.

Our Warranty

Aeroqual warrants this product to be free from defects in material and workmanship at the time of its original purchase by a consumer, and for a subsequent period as stated in the following table:

Products	Warranty Period
IQM 60	One year from the date of purchase
Sensor Components	Six months from date of purchase
Other Accessories	One year from the date of purchase

This warranty is expressly limited to the original owner who purchases the equipment directly from Aeroqual or from an authorized Aeroqual dealer.

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.

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 monitor in or near volatile fuel or chemicals.
- **HEALTH AND SAFETY IN THE WORKPLACE**
  Aeroqual Monitors 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 monitor 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 Monitor and System Components

1.1 IQM 60

The Aeroqual IQM 60 Environmental Monitor is a custom-built indoor air quality instrument which can be configured with up to six gas sensor modules as well as options such as a particle monitor. The configuration of the instrument supplied is determined by the sensor modules and options that were ordered.

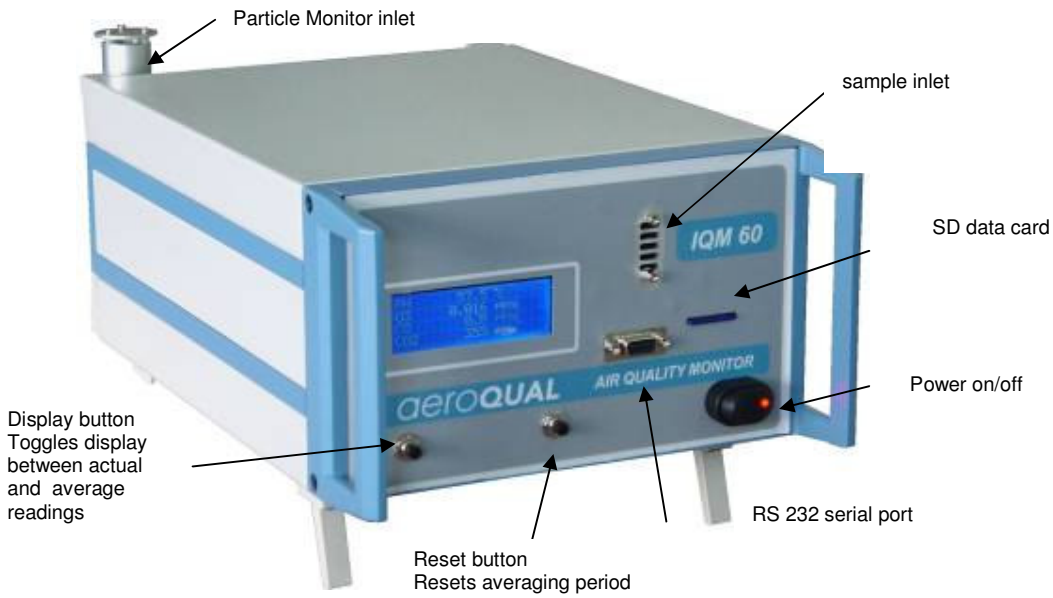
This manual describes the general use and operation of the AQM Environmental Monitor. The Product Information Sheet supplied at the front of the folder will specify the "as-built" monitors and the packing list of shipped items. Please check that all the components have been supplied as per your order and contact your dealer or Aeroqual on email at: sales@aeroqual.com if any of the components are missing.

Calibration certificates for each gas module are attached with the Product Information Sheet. The AQM monitor performance has been checked and is presented in the AQM Instrument Performance Report (also attached with Product Information Sheet).

1.2 System Components include:

- IQM 60 Monitor
- 12VDC Regulated Power Supply
- Temperature and humidity sensor extension cable
- Computer CD containing software for data logging and calibrating IQM
- Data Card (1GB)
- Data card reader
- Serial Cable

2.0 Description of Controls



NOTE 1. **Insert the data card by pressing in gently until the card latches in place. To remove the data card gently press inwards and then let go to release the latch. Always turn off the IQM 60 before removing or inserting the data card.**

NOTE 2. **The temperature and humidity sensor is housed in a gland located on the back panel.**

3.0 Operating Instructions

3.1 Getting Started

The IQM 60 is simple to operate:

- Ensure that the 12VDC power supply to the IQM 60 is connected (rear panel).
- Ensure the datacard is correctly inserted in the slot.
- Turn on the power switch (front panel).

Note: The IQM 60 should be allowed to run for 30 minutes so that it is fully warmed up before taking readings.

3.1.1 Button/Switch Control Description

Front Panel	*Power on/off* turns the IQM 60 on and off.
	Display button switches between current reading and average reading.
	Reset button starts a new average period.
Rear Panel	*Sensor fan on/off* switches the inlet fan on or off, off for calibration (see below).
	PM Span on/off this switches on the fibre span check on the particle monitor. The value shown on the display should match that given in the Particle Monitor certificate. If not, then adjust the PM gain factor.

3.2 Temperature and humidity sensor extension

The temperature and humidity sensor can be removed from its port at the rear of the instrument and connected by the supplied extension cable to the instrument. This enables the temperature and humidity to be measured away from the instrument. Pull out to remove the sensor. Do not attempt to screw out the sensor.

3.3 Connecting a computer

The connection of a computer to the IQM 60, the installation of the software and its use are described in Appendix A.

3.4 Reading the Datacard

Data is stored on the data card as a daily file. The format of the data is a tab delineated file which can be opened with standard graphical software such as MS Excel. Always turn off the IQM 60 before removing or inserting the data card. To remove the data card gently press inwards and then let go to release the latch.

3.5 Testing

Zero and span checks should be performed with humidified air. If the IQM is to be deployed in environments with low or high absolute humidity it is recommended that the sensors be zero and span calibrated under those conditions, since the sensors are slightly sensitive to changes in absolute humidity.

3.6 Zero Calibration

The sensors can be manually zero calibrated by introducing humidified zero air into the instrument and using the PC software to initiate the zero calibration routine. Please note the Zero Air should be free of CO_2, O_3, CO and hydrocarbons. The sensor fan should be turned off, switch located on rear panel.
CONTACT AEROQUAL FOR FULL DETAILS OF THIS PROCEDURE.

3.7 Span Calibration

The sensors can be manually span calibrated by modifying the individual gain factors for each sensor. Introduce a known concentration of span gas into the instrument and adjust the gain factor to set the correct concentration reading. The relative humidity of the span gas should be at a minimum of 20% RH, but set to the level normally encountered at the installation site. The sensor fan should be turned off, switch located on rear panel.
CONTACT AEROQUAL FOR FULL DETAILS OF THIS PROCEDURE.

3.8 Particle Monitor Span Calibration

PM Span on/off Switch (on back panel) - this switches on the fibre span check on the particle monitor. The value shown on the display should match that given in the Particle Monitor certificate. If not, then adjust the PM gain factor.

3.9 Maintenance

The IQM is designed to operate without maintenance for extended periods. It is recommended that it be returned to Aeroqual for re-calibration on an annual basis. The calibration process may also include a new scrubber, refurbished sensors, software upgrades and leak testing. See your Aeroqual representative for further details.

3.10 Care and Cleaning

- Keep the IQM dry. Avoid water and/or condensation as humidity and liquids containing minerals may corrode electronic circuits.
- Do not use or store in dusty, dirty areas.
- Do not store or turn off the monitor in temperatures below 5°C.
- This unit is designed for use at temperatures between 5°C and +45°C. If you wish to use the monitor outside this range you will need an additional environmental enclosure. Sudden changes in temperature will cause condensation that may damage the electronic components.
- Do not drop, knock or shake as this could lead to internal damage.
- Do not use harsh chemicals, cleaning solvents or strong detergents for cleaning. Wipe with a soft cloth slightly dampened with a mild soap-and-water solution.

4.0 Troubleshooting

Symptom	Possible Cause	Fault isolation/Solution
Gas sensor readings incorrect	Insufficient warm up	Allow the sensors to fully warm up after power down.
	Incorrect zero calibration	Repeat zero calibration with clean air. Check media in Gas Treatment module.
	Incorrect span calibration	Perform span check.
"NR" in Data table (No response)	Computer too slow	Test with a faster computer.
Occasional NR shows	RF noise in environment.	Try to reduce RF noise
COMMUNICATION		
No communication over RS232	RS232 cable disconnected	Reconnect cable
PC Datalogging stopped	IQM power blackout interrupted datalogging.	Close and restart IQM software.
No data on SD card	Card not correctly installed in slot.	Turn off IQM and install card in slot correctly.
	Datalogging interval set too large.	Set logging interval in configuration to a lower interval.

Appendix A: IQM V2.0 Software Instructions

Description

The IQM V2.0 Software is designed to be a simple interface for communicating with the IQM monitor via a PC and RS232 cable (supplied). It can be used to configure the IQM, 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 VM1.6 (supplied with software) and the database is an open source HSQLDB Java database. Data can be easily exported to a spreadsheet for manipulation.

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

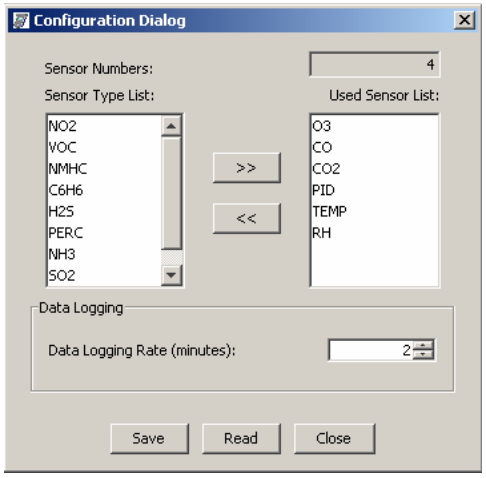
Setting Up

1. Install IQM CD into drive and run IQM_V2.0.exe if you haven't already installed the software. The software self-extracts and loads.

2. Connect the PC to the IQM60 RS232 port via the RS232 cable.

3. Launch software
   - Click *Setup---> COM Port*.
   - Select correct COM port settings *Port, 19200, 8, 1, N, N*
   - Click *OK*

4. Configure Software
   - Click *Setup--> Configuration.*



   - Enter Sensor Numbers (eg 5)
   - Enter *Sensor Type List* (eg O3, CO, CO2, Temp, RH)
   - Select *Data Logging Rate.* Enter the logging interval between data points.
   - *Save* and *Close* to exit configuration

Datalogging

1. To start logging data
   - Click *File--> Start Data Logging*

   (Data will then be logged into the database and is visible in the Real Time Table and Real Time Graph windows).

2. Data logging can be stopped by:

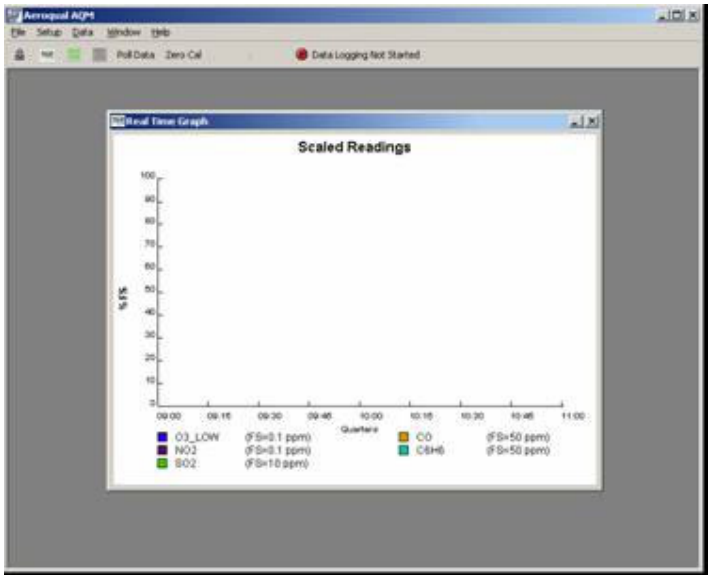
   - Click *File--> Stop Data Logging*

Viewing Logged Data

Real time and logged data are viewed in separate windows in either table of graphical format.

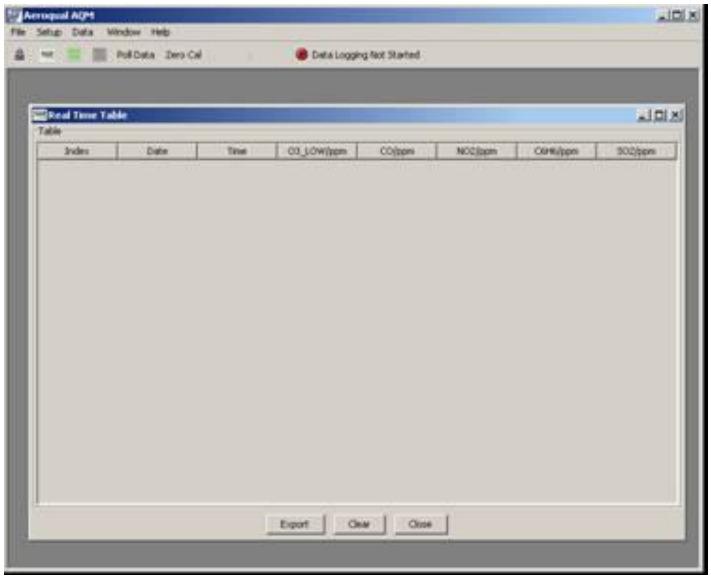
1. Real time data can be viewed in graphical format by

   - Click *Data--> Graph--> Real time*
     (Note: This window opens automatically on launching the software.)



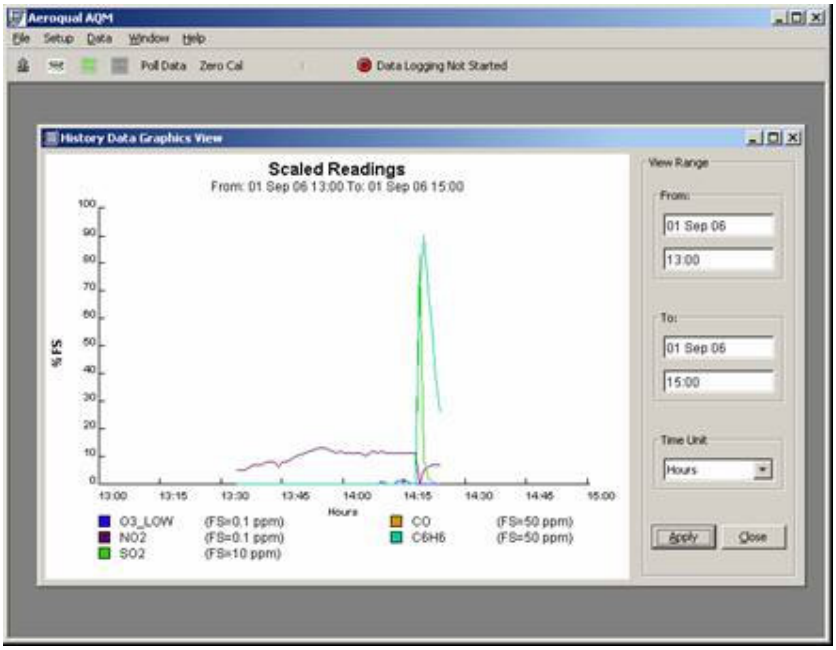
The Y-scale is given as percent full scale. The full scale reading is given beside the sensor name (eg CO2 FS=2000 ppm) The Full scale can be changed for each sensor by clicking on 2000

2. Real time data can be viewed in table format by
   - Click *Data--> Table--> Real Time*
     Note: This window opens automatically on launching the software.



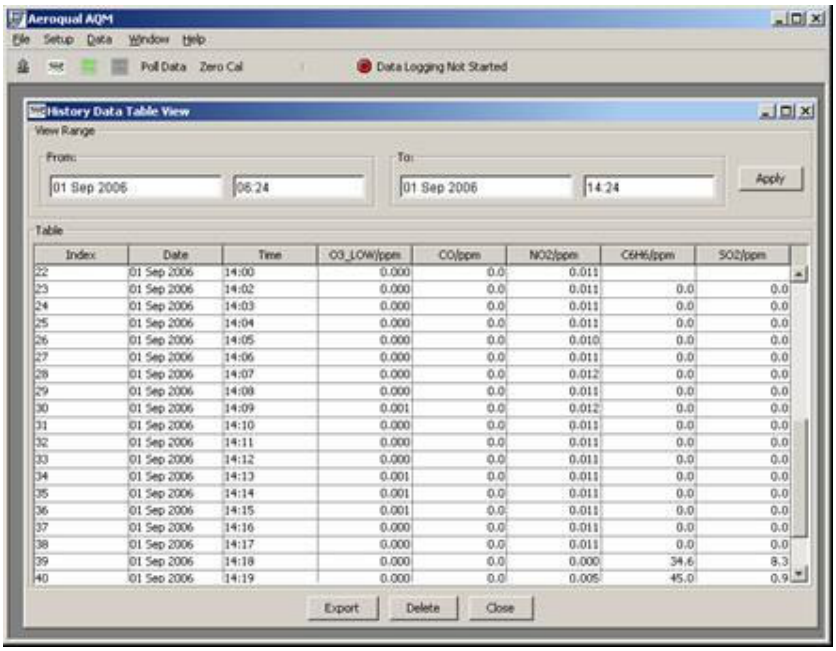
3. Logged data can be viewed in graphical format by

- Click *Data--> Graph--> History*
- Enter date and time for log
- Click *Apply*



4. Logged data can be viewed in table format by

- Click *Data--> Table--> History*
- Enter date and time for log
- Click *Apply*



Exporting Data

The Logged data can be exported to an xls file (see diagram in View Data section above).

- Click *Data--> Table--> History*
- Click on *Export* on the History Data Table View window.

The data can also be deleted from the database by:

- Clicking on *Delete*.

Tools

IQM tools can be accessed directly from the toolbar (e.g. Zero Cal, Polling Data) or by

- Click Tools

Polling data

The IQM unit can be manually polled at any time by:

- Click *Poll Data* (button on the menu).

Zero Calibration

The IQM unit can be manually zero calibrated at any time by:

- Click *Zero Cal* (button on the menu).

This activates the zero calibration sequence straight away. The fan in the IQM needs to be turned off so that zero air can be pumped into the sample inlet port. *Do not touch the unit during this process*.

View Gain Factors
Each sensor has a gain factor that adjusts the sensor span. The gain factors for each sensor is given by

- Click View Gain Factor

Calibrate Gain Factor
You need to enter a password for this section. The factory default password is *password*. The gain factors for each individual sensor can be automatically calculated by entering this selection. You need to specify the concentration of gas given to the sensor.

Modify Gain Factors
The gain factors can be manually adjusted via this menu. You need to enter a password to enter.

Change Password
This allows you to change the password.

Updating the Real Time Clock (RTC)
This function allows the user to synchronize the RTC on the IQM with the user's PC clock. The IQM RTC can be viewed by clicking on "Test Connection".

Backing up Database

The database can be backed up and saved as a zip file by:

- Click *File--> Zip Database*

Deleting Data from Database

- Click *Data--> Table--> History*
- Select data.
- Click Delete.

----------Caution: this will delete the data and it cannot be recovered----------

Updating Sensor List

Aeroqual may develop new sensors which can be added to the list of IQM connectable sensors. If this occurs, Aeroqual will release a new sensor list which can be integrated by:

- Click *File-->Update Sensor List*
- Enter new file location.
-

Diagnostics

If a sensor fails, an alarm window will appear to alert the user and no data for that sensor will be logged (blank space in the database). If data is lost due to a communication error a "NR" will appear in the database.

Appendix B: Communication Protocol

The IQM monitor information output is based on RS232 protocol. These command protocols are specified by Aeroqual Limited. Aeroqual reserves the right to change the protocol without notification.

Version 2.0, extended based on AQM V3.7.
** Added Sensor name and display format decimal number set commands.
** Changed RS232 port baud rate to 19200bps.

Date: 20-9-2007

The IQM controller master can only take max of 8 sensors, which include temperature and relative humidities sensors as well.

Section 1. General descriptions of communication commands:

Command streams are binary, and uses hexadecimal bytes as representation. Comma and spaces are not applied for every command and reply data stream, they are just used for clearly specifying data stream:

1. Sensor reading request command sent out from PC or other data receiver, its format is a 4 bytes stream:

BASE, SENSOR_TYPE, RESERVED, CHECKSUM

* BASE - information request command header, its value is 0x55.
* SENSOR_TYPE - gas concentration request command, please refer section 2 for details.
* RESERVED - may be used to extend functions later, its value is 0x00 for now
* CHECKSUM - the data stream's check sum - that makes the command stream total bytes sum to be zero. Its value should be 0x9B for this command.

Example (To poll ozone reading): 0x55 0x30 0x00 0x7B

2. Sensor reading request command reply or auto data report command data stream, 16 bytes:

SENSOR, SENSOR_TYPE, DATA, RESERVED_4, SENSOR_STATUS, RESERVED_4, CHECKSUM

* SENSOR - 1 byte monitor reply data stream header, its value is 0xAA.
* SENSOR_TYPE - 1 byte gas type, its value will be same as the request command value, see section 2 for details.
* DATA - 4 bytes floating point data value. If the SENSOR_TYPE is gas sensor,
  the value is concentration in ppm. If the value is 9999, this means the corresponding sensor didn't give reading. Please refer to Section 2 for detail.
* RESERVED_4 - 4 bytes reserved space.
* SENSOR_STATUS - 1 byte sensor status indication, refer section 3 for details.
* CHECKSUM - 1 byte the data stream's check sum - that makes the command stream total bytes sum be zero.

3. AQM Monitor property configuration command, 4 bytes,

BASE, CONFIGURING, RESERVED, CHECKSUM

Followed by 21 bytes configuration data stream:

SENSOR, SENSOR_NUM, SENSOR_1, SENSOR_2, SENSOR_3, SENSOR_4, SENSOR_5, SENSOR_6, SENSOR_7, SENSOR_8, SENSOR_9, SENSOR_10, SENSOR_11, SENSOR_12, SENSOR_13, SENSOR_14, AUTO_REPORT_RATE, ZERO_CAL_INTERVAL, AUTO_ZERO_READ_FREQ, AQM_STATUS, CHECKSUM

* SENSOR_NUM - 1 byte, specify the valid numbers of sensor has been used by the AQM box.
* SENSOR_1, SENSOR_2, SENSOR_3, SENSOR_4, SENSOR_5, SENSOR_6, SENSOR_7, SENSOR_8, SENSOR_9, SENSOR_10, SENSOR_11, SENSOR_12, SENSOR_13, SENSOR_14, - Specifies the sensor type has been used for the AQM box. The value will be any of Sensor type value.
* AUTO_REPORT_RATE - 1 byte, specify the auto data report rate in minutes maximum 255 minutes. It's only valid, when AQM_STATUS bit 0 is 1.
* ZERO_CAL_INTERVAL - 1 byte, specify the auto zero calibration interval in hours maximum 255 hours. It's only valid, when AQM_STATUS bit 1 is 1.
* AUTO_ZERO_READ_FREQ - 1 byte, specify the auto zero reading frequency in hours, max 255 hours. It's only valid, when AQM_STATUS bit 2 is 1.
* AQM_STATUS - 1 byte, used specify AQM auto report data and auto zero calibration, see section 2 for details.

Example: 0x55 0x19 0x00 0x92
//Followed by: 0x55 05 30 40 50 65 B0 00 00 00 02 01 01 03 CA

4. Request AQM Monitor property configuration command, 4 bytes,

BASE, REQUEST_CONFIGURE, RESERVED, CHECKSUM

* REQUEST_CONFIGURE - 1 byte configuration request command, its value please see section 2.

Example: 0x55 0x18 0x00 0x93

5. Request AQM Monitor configuration command reply, 21 bytes,

SENSOR, SENSOR_NUM, SENSOR_1, SENSOR_2, SENSOR_3, SENSOR_4, SENSOR_5, SENSOR_6, SENSOR_7, SENSOR_8, SENSOR_9, SENSOR_10, SENSOR_11, SENSOR_12, SENSOR_13, SENSOR_14, AUTO_REPORT_RATE, ZERO_CAL_INTERVAL, AUTO_ZERO_READ_FREQ, AQM_STATUS, CHECKSUM

* SENSOR_NUM - 1 byte, specify the valid numbers of sensor has been used by the AQM box, max number is 14.
* SENSOR_1, SENSOR_2, SENSOR_3, SENSOR_4, SENSOR_5, SENSOR_6, SENSOR_7, SENSOR_8, SENSOR_9, SENSOR_10, SENSOR_11, SENSOR_12, SENSOR_13, SENSOR_14, - Specifies the sensor type has been used for the AQM box. The value will be any of Sensor type value.
* AUTO_REPORT_RATE - 1 byte, specify the auto data report rate in minutes maximum 255 minutes. It's only valid, when AQM_STATUS bit 0 is 1.
* ZERO_CAL_INTERVAL - 1 byte, specify the auto zero calibration interval in hours maximum 255 hours. It's only valid, when AQM_STATUS bit 1 is 1.
* AUTO_ZERO_READ_FREQ - 1 byte, specify the auto zero reading frequency in hours, max 255 hours. It's only valid, when AQM_STATUS bit 2 is 1.
* AQM_STATUS - 1 byte, used specify AQM auto report data and auto zero calibration, see section 2 for details.

6. AQM Monitor information request command, 4 bytes:

BASE, AQM_INFO, RESERVED, CHECKSUM

Example: 0x55 0xFB 0x00 0xB0

* AQM_INFO - 1 byte AQM information request command.

7*. AQM monitor information reply command, 17 bytes, (since V4.0):

SENSOR, AQM_INFO, AQM_ID, VERSION, NAME, RTC, CHECKSUM

* AQM_INFO - 1 byte sensor information request command, see section 2 for its value.
* AQM_ID - 4 bytes, long integer values, indicate the AQM serial number. 1-100, reserved by Aqeroqual, 101 - 4294967295 used for production
* VERSION - 1 byte, its decimal value divided by 10 gives you the AQM box version number.
* NAME - 3 bytes, the monitor name ASCII code (AQM/IQM).
* RTC - 6 bytes, the monitors Real Time Clock (each field is one byte), ss:mm:hh DD/MM/YY, the year is since 1900+YY
* User could use this command to test communications.

8. AQM Monitor zero calibration command, 4 bytes:

BASE, ZERO_CAL, RESERVED, CHECKSUM

Example 0x55 0x12 0x00 0x99

9. AQM monitor zero calibration reply command, 16 bytes:

SENSOR, ZERO_CAL, RESERVED, RESERVED_4, RESERVED_4, RESERVED_4, CHECKSUM

* The reply just inform user that the AQM is started to perform the action.

10. Turn on Zero Scrubber command, 4 bytes:

BASE, ZERO_SCRUBBER_ON, RESERVED, CHECKSUM

Example 0x55 0x14 0x00 0x97

11. Reply command of turn on zero scrubber, 16 bytes:

SENSOR, ZERO_SCRUBBER_ON, RESERVED, RESERVED_4, RESERVED_4, RESERVED_4, CHECKSUM

* The reply just inform user that the AQM is started to perform the action.

12. Turn off Zero Scrubber command, 4 bytes:

BASE, ZERO_SCRUBBER_OFF, RESERVED, CHECKSUM

Example 0x55 0x15 0x00 0x96

13. Reply command of turn off zero scrubber, 16 bytes:

SENSOR, ZERO_SCRUBBER_OFF, RESERVED, RESERVED_4, RESERVED_4, RESERVED_4, CHECKSUM

* The reply just inform user that the AQM is started to perform the action.

14. Span calibration command, 4 bytes command followed by 7 bytes calibration details:

BASE, SPAN_CALIBRATION, RESERVED, CHECKSUM
BASE, SENSOR_TYPE, CALIBRATION_POINT, CHECKSUM

* CALIBRATION_POINT - 4 bytes floating point data, specified the sensor span calibration point

Example: 0x55 16 00 95
0x55 30 CD CC CC 3D 09

* Start span calibration for O3 Low sensor at 0.1 ppm

15. Span calibration started confirm reply 4 bytes:

SENSOR, SPANE_CALIBRATION, SENSOR_TYPE, CHECKSUM

16. Get span gain value, 4 bytes:

BASE, GET_SPAN_GAIN, RESERVED, CHECKSUM

Example: 0x55 17 00 94

17. Replied Span gain value for all configured sensors, total 73 bytes (14 sensors):

SENSOR, GET_SPAN_GAIN, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, SENSOR_SPAN_VALUE, CHECKSUM

* SENSOR_SPAN_VALUE - 5 bytes, 1 byte SENSOR_TYPE, 4 bytes floating point span calibration factor value.
* Example: 0x30 00 00 80 3F, this is O3 Low sensor with span factor of 1.0

18. Set Span gain value command, 4 bytes command followed by 7 bytes span calibration value details:

BASE, SET_SPAN_GAIN, RESERVED, CHECKSUM
BASE, SENSOR_TYPE, GAIN_VALUE, CHECKSUM

* GAIN_VALUE - 4 bytes floating point data, specified the sensor span calibration point

Example: 0x55 1B 00 90
0x55 30 00 00 80 3F BC

* Set gain factor 1.0 for O3 Low sensor

19. Set Span gain value success reply 4 bytes:

SENSOR, SET_SPANE_GAIN, SENSOR_TYPE, CHECKSUM

20. Set sensor names for data logging and monitors with displays.
4 bytes command followed with 114 bytes sensor code and name ASCII.

BASE, SET_SENSOR_NAMES, RESERVED, CHECKSUM

BASE, SENSOR_1, NAME_1, SENSOR_2, NAME_2, SENSOR_3, NAME_3, SENSOR_4, NAME_4, SENSOR_5, NAME_5,
SENSOR_6, NAME_6, SENSOR_7, NAME_7, SENSOR_8, NAME_8, SENSOR_9, NAME_9, SENSOR_10, NAME_10,
SENSOR_11, NAME_11, SENSOR_12, NAME_12, SENSOR_13, NAME_13, SENSOR_14, NAME_14, CHECKSUM

* SENSOR_1 ~ SENSOR_14 - 1 byte Specified sensor type has been used for the monitor.
* NAME_1 ~ NAME_14 - are the names of sensors. They are in ASCII format 7 char each, less than 7 USE blank char instead.

21. Set concentration valid decimal numbers for monitors with display.
4 bytes command followed with 30 bytes sensor code and decimal numbers.

BASE, SET_DECIMAL_NUMS, RESERVED, CHECKSUM

BASE, SENSOR_1, DECIMAL_1, SENSOR_2, DECIMAL_2, SENSOR_3, DECIMAL_3, SENSOR_4, DECIMAL_4, SENSOR_5, DECIMAL_5,
SENSOR_6, DECIMAL_6, SENSOR_7, DECIMAL_7, SENSOR_8, DECIMAL_8, SENSOR_9, DECIMAL_9, SENSOR_10, DECIMAL_10,

SENSOR_11, DECIMAL_11, SENSOR_12, DECIMAL_12, SENSOR_13, DECIMAL_13, SENSOR_14, DECIMAL_14, CHECKSUM

* SENSOR_1 ~ SENSOR_14, - 1 byte each, sensor type code has been used for the monitor.
* DECIMAL_1 ~ DECIMAL_14 - 1 byte each, which is the values of decimal numbers for the sensor valid concentration.

Section 2. Protocol command values:

BASE = 0x55 header command used for receiver command
SENSOR = 0xAA header command used for monitor reply
ZERO_CAL = 0x12 Zero calibration command
ZERO_SCRUBBER_ON = 0x14 Turn on zero scrubber
ZERO_SCRUBBER_OFF = 0x15 Turn off zero scrubber
SPAN_CALIBRATION = 0x16 do span calibration
GET_SPAN_GAIN = 0x17 request span calibration values
REQUEST_CONFIGURE = 0x18 Request configure of AQM box command
CONFIGURING = 0x19 Configure AQM box command
SET_SPAN_GAIN = 0x1B Set sensor gain factor
SET_SENSOR_NAMES = 0x1C Set sensor names
SET_DECIMAL_NUMS = 0x1D Set sensor concentration display decimal points number
AQM_INFO = 0xFB AQM monitor information request command.

SENSOR_TYPE These values defined a sensor type respectively. Some type of sensors can be extended up to 4 more subtypes, such as, NO2 can extend to 0x51, 0x52, 0x53. Some of can one only extend 1 subtype for reserving. However, every extended sensor type need a special program. Therefore the value can be any of the following and their extensions (Aeroqual may update the sensor coding):

= 0x30 //High, Low, Ultra Low Ozone concentration data request command - can extend
= 0x40 //CO concentration data request command - can extend
= 0x50 //NO2 concentration data request command - can extend
= 0x60 //VOC concentration data request command - can extend
= 0x61 //NMHC concentration data request command
= 0x62 //VOC LOW concentration data request command
= 0x65 //C6H6 BENZ concentration data request command - can extend
= 0x70 //H2S concentration data request command - can extend
= 0x80 //PERC concentration data request command - can extend
= 0x82 //CH4 methane concentration data request command - can extend
= 0x90 //NH3 concentration data request command - can extend
= 0x91 //NH3 LOW (0-100) concentration data request command.
= 0xA0 //HC12 concentration data request command - can extend
= 0xB0 //SO2 concentration data request command - can extend
= 0xB2 //SO2 HIGH concentration data request command - can extend
= 0xB5 //CO2 concentration data request command - can extend
= 0xBA //IPA concentration data request command - can extend
= 0xC0 //H2O2 concentration data request command - can extend
= 0xC5 //ETAC concentration data request command - can extend
= 0xCA //H2 concentration data request command - can extend
= 0xD0 //PROP concentration data request command - can extend
= 0xD5 //PID gas sensor concentration data request command - can extend
= 0xD9 //PM10 ug/m3, Particle monitor reading request command
//used for auxiliary module, analogue ADC are 10 bits resolution
= 0xDA //WS - Wind Speed, data request command, sin wave signal input(max 32kHz), result is wind speed in meter/second or can be frequency in Hz(require special program).
= 0xDB //WD - Wind Direction, data request command, analogue input 0-5V, result is degree angles relative to zero point or voltage (require special program).
= 0xDC //SR/AX1, data request command, analogue input 0-34mV with gain of 144, result is voltage in mV.
= 0xDD //AX2, data request command, analogue input 0-450mV with gain of 11, result is voltage in mV.
= 0xDE //AX3, data request command, analogue input 0-5V without gain, result is voltage in Volts.
= 0xDF //AX4, data request command, sin wave signal input(max 32kHz), result is frequency in Hz.

From below the gas type can only extend 1 subtype
= 0xE0 Reserved gas concentration data request command - can extend 1
= 0xE2 Reserved gas concentration data request command - can extend 1
= 0xE4 Reserved gas concentration data request command - can extend 1
= 0xE6 Reserved gas concentration data request command - can extend 1
= 0xE8 Reserved gas concentration data request command - can extend 1
.....
= 0xF0 - 0xF5 are reserved command space
= 0xF6 Temperature data request command - can extend 1
= 0xF8 Relative humidity data request command - can extend 1

from 0xFA are reserved for other commands, not for gas sensor type.

RESERVED 1 byte reserved not been used for information transfer, can be 0x00
RESERVED_2 2 bytes reserved
RESERVED_3 3 bytes reserved
RESERVED_4 4 bytes reserved

CHECKSUM a data stream's check sum - that makes the command stream total bytes sum is zero.

SENSOR_STATUS * 8 bits monitor and sensor status information

SensorStatus * b0 = 1 sensor failure
* b0 = 0 sensor working fine
Reserved * b1 reserved no meaning at all
Reserved * b2 reserved no meaning at all
Reserved * b3 reserved no meaning at all
Reserved * b4 reserved no meaning at all
Reserved * b5 reserved no meaning at all
Reserved * b6 reserved no meaning at all
Reserved * b7 reserved no meaning at all

AQM_STATUS * b0 = 0, means the AQM will only report data by polling individual sensor
* b0 = 1, means the AQM will auto report all sensor concentration at specified rate.

* b1 = 0, means the AQM will only do zero calibration by user command
* b1 = 1, means the AQM will auto do zero calibration at specified ZERO_CAL_INTERVAL.

* b2 = 0, means the AQM will not do auto zero readings.
* b2 = 1, means the AQM will do auto zero readings at specified AUTO_ZERO_READ_FREQ time intervals. The zero reading time is fixed 15 minutes long.

Section 3. Data value format representation:

The floating point data values use standard IEEE754 32 bits floating point little endian representation, like DATA field.

Section 4. Data transfer mechanism

1. Due to the monitor main chips feature, 2 byte int and 4 bytes float data send sequence are low byte first, high byte last.

2. For regular data report:

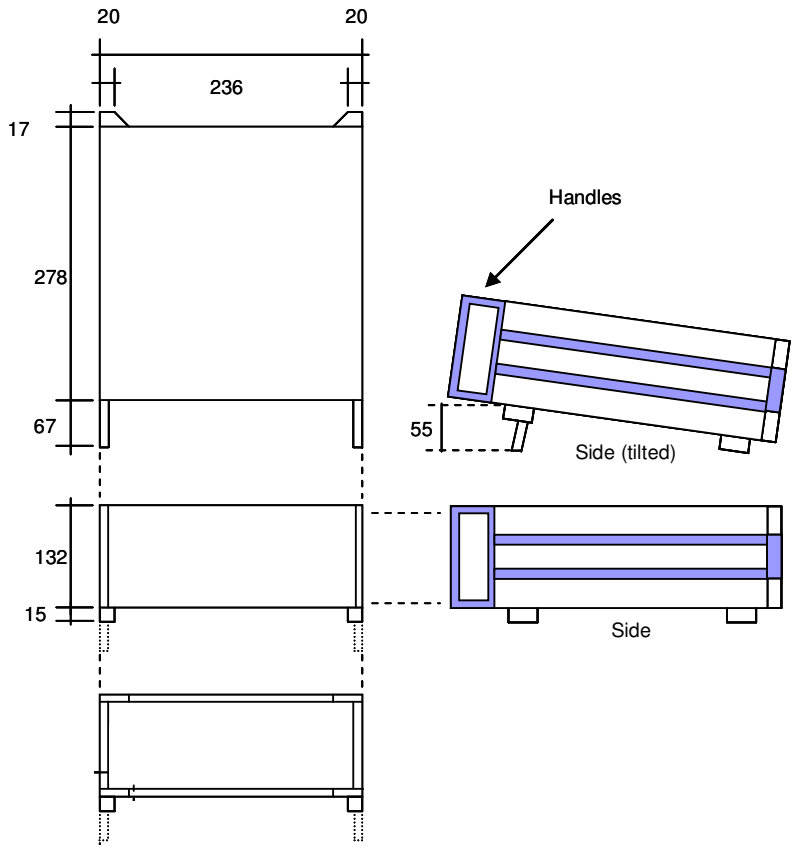
Once the monitor power on and after warming up (1 minute), it will regularly report measured result to RS232 serial port by default.

Section 5. RS232 communication port settings:

Baud rate:	19200
Data bits:	8
Stop bits:	1
Parity:	none
Flow control:	none

Enclosure

External View



Description

Cast aluminum and pressed steel powder coated enclosure.

Dimensions

Basic enclosure size is:

236 mm W x 132 mm H x 278 mm D

The padded feet add 15mm to the depth and together with the two carry handles give the product an overall size of:

236 mm W x 148 mm H x 362 mm D

Front View

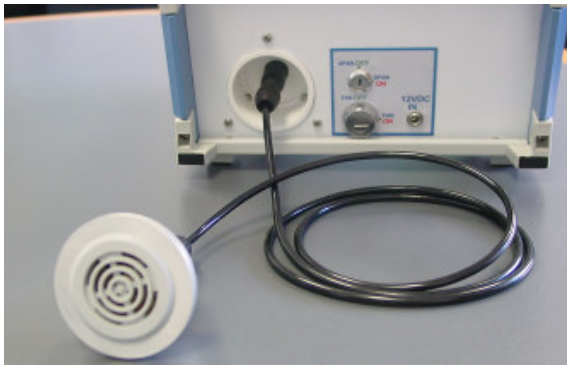
Rear View (Note: the layout of the back panel can vary slightly depending on the product configuration)

Temperature and Humidity sensor **(pull out to remove)**

12V DC power jack

Key switch for sensor fan on/off

Particle Monitor span switch on/off



Extension cable for Temperature and Humidity sensor