



# AQUAlogger 110

## User Manual

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# 1 Introduction

This manual describes the operation of the AQ620 2-Channel Fluorometer logger. The logger is designed to interface directly to 2 Seapoint fluorimeters and provide real-time data to a surface computer. Data collected from the logging unit is displayed in real-time and stored on the host computer for off-line viewing.

## 1.1 About This Manual

This User Manual provides a detailed guide to the AQ620 hardware and the control software package. Topics covered include:

- System description
- Hardware interfacing
- Logging and control software description
- Installation of software
- Operation of software
- Maintenance, Handling, Parts Data, Safety, Fault Finding

Technical details, including system specification are described in appendixes.

## 2 The AQ620 System

### 2.1 Block Diagram

The system diagram is shown in Figure 1.

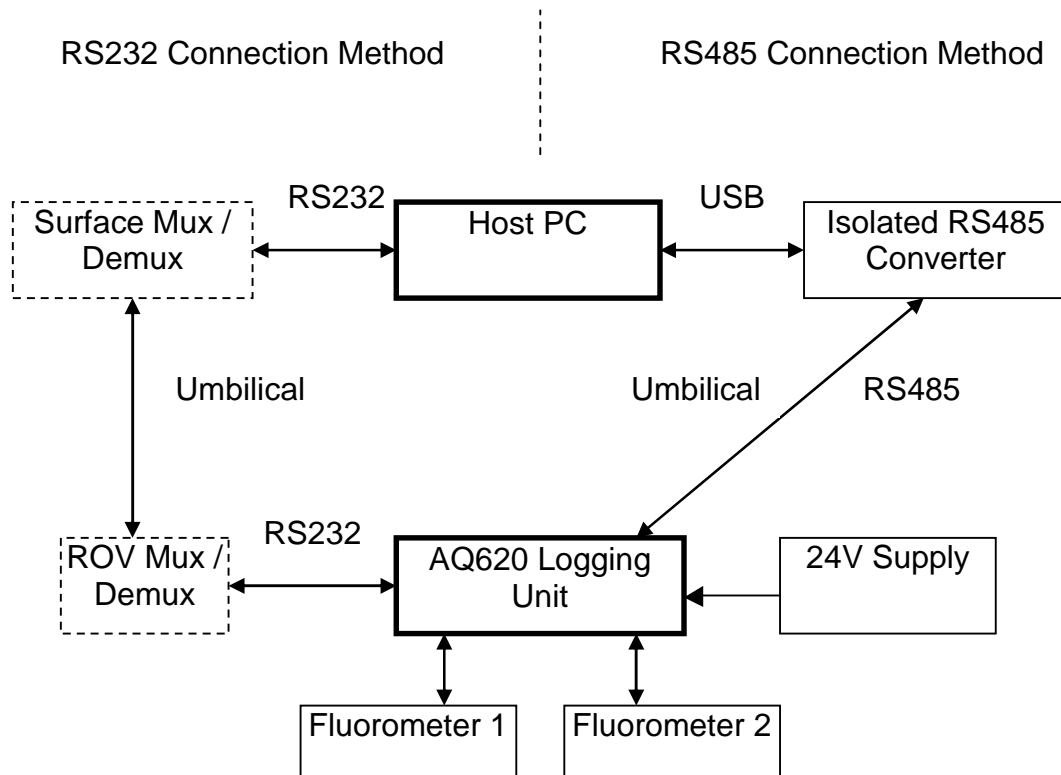


Figure 1 AQ345 System Diagram

The logger has two methods of connection – RS232 and RS485. Both methods of connection are available on the communications connector on the logger housing and either can be used – however only one interface can be used at a time.

### 2.2 RS232 Connection

For short range connections the RS232 link can be used. When the logger is being used in an ROV application the serial connection can be used to connect to the ROV multiplexer and the data can be transmitted to the surface via the ROV umbilical.

### 2.3 RS485 Connection

The RS485 interface is isolated and intended to directly drive signals to the surface over a long cable. To interface to most computers a converter is required to translate the RS485 signals

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before going into the PC. The supplied RS485 converter plugs into the PC via the USB interface and provides an additional COM port to the computer.

## 2.4 The host PC

This is required to run the *AQUAtalk* application to communicate between the user and the logger. The Windows based application controls the operation of the logger and the displaying and storage of the data fed back. The host PC should be capable of running the Windows 98SE or later operating system and have an available serial port (or USB interface with a USB to serial converter).

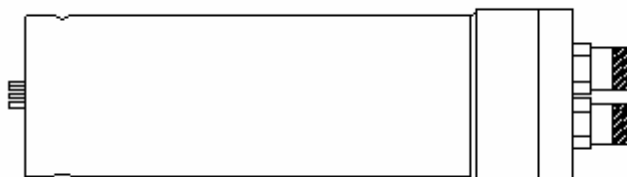
## 2.5 AQ620 Logging Unit

The AQ620 logging unit is a self-contained unit requiring only an external 24V-power supply. The logger has all required hardware to directly interface to the Seapoint Fluorometers and feed the data back to a surface computer. See the appendix for the specification on the power supply requirements.

## 3 Making Connections to the AQ620 System

### 3.1 Instrument and Logger Housing

The AQ620 electronics is packaged in a single housing with a single 8-way connectors at one end (for power and communications) and two 6-way connectors at the other end (to connect to the fluorometer cables). The connectors used are illustrated in the following diagram.



*Logger and Instrument Connectors*

### 3.2 Fluorometer connections

The fluorometers are connected to the AQ620 logger via the 6 way Impulse MCBH-6-FS connectors. Both connectors have an identical pin configuration. The two channels on the logger are identified by blue paint dots on the connectors – one dot for channel one and two dots for channel two.

Pin Number	Pin Function	Notes
1	Power ground	
2	Signal input	[0..5]V signal return from logger
3	Signal ground	
4	Power output	Power supply to sensor – this is always powered when the logger is powered
5	Gain control A	
6	Gain control B	

### 3.3 System connections

The system interface to the logger is via the 8 way Impulse MCBH-8-MP connector. This connector carries both power and data to the logger. The colour denotes the core colour on the supplied 8-way MCIL to free-end cable.

Pin	Pin Function	Notes	Colour
1	24V supply	See Appendix A - Technical Specification for details	Black
2	Supply ground		White
3	RS485-A	Communication data line A	Red
4	RS485-B	Communication data line B	Green
5	RS485-GND	DO NOT CONNECT	Blue
6	RS232-TX	RS232 transmit from logger	Brown
7	RS232-RX	RS232 receive to logger	Yellow
8	RS232-GND	RS232 signal ground	Orange

## 3.4 Communication connections

### 3.4.1 RS485

The RS485 lines should be connected to the PC via the supplied Adam-4561 Isolated USB to RS-232/422/485 Converter. The RS485 data lines on the output of the logger should be connected as follows:

<i>Logger Signal</i>	<i>Converter Unit Signal</i>
RS485-A	TX+ (DATA+) (RS485)
RS485-B	TX- (DATA-) (RS485)

NOTE: When RS485 is being used with the supplied cable, the free wires for the RS232 signals MUST be insulated from each other and any other signals – failure to do this could destroy the RS232 communications channel.

### 3.4.2 RS232

The RS232 output from the logger can be connected to a PC directly via an RS232 serial port, or via the supplied Adam-4561 Isolated USB to RS-232/422/485 Converter. The RS232 signals defined in Section 3.3 are with respect to the logger (i.e. RS232-TX is data OUT from the logger and RS232-RX is data INTO the logger) – these signals must be crossed over before being connected to the PC or ROV multiplexer as below:

<i>Logger Signal</i>	<i>PC / ROV Multiplexer Signal</i>
RS232-TX	RS232-RX
RS232-RX	RS232-TX
RS232-GND	RS232-GND

If the supplied Adam-4561 converter is used (recommended) the connections should be made as follows:

<i>Logger Signal</i>	<i>Converter Unit Signal</i>
RS232-TX	RX (RS232)
RS232-RX	TX (RS232)
RS232-GND	GND (RS232)

If the logger is to be connected to a standard 9-way male ‘D’ connector on a PC serial port the connections should be as follows:

<i>Logger Signal</i>	<i>9-way ‘D’ connection pin</i>
RS232-TX	2
RS232-RX	3
RS232-GND	5

NOTE: When RS232 is being used with the supplied cable, the free RS485 wires MUST be insulated from each other and any other wires – failure to do this could damage the logger.

## 4 Logging Control

The AQ620 system is designed for real-time monitoring of the two fluorometer channels. Each channel has an independent gain control which can set the Seapoint fluorometers into one of four gain modes. This is the only control the user has over the sensors.

### 4.1 Gain Range

To get detailed information about the concentration of fluorescein or other tracer appropriate to the attached sensor, the gain of the sensors can be increased or decreased. The gain can be manually fixed or automatically controlled as described below.

#### 4.1.1 Automatic Gain

When the logger starts logging and is configured in AUTO gain mode it takes the first sample in the lowest gain mode for the sensor. If this value is below the gain threshold for the channel (which by default is set to 20% of full-scale for that gain) the gain is increased to the next gain. On the next sample the sensor is sampled using the new gain and once again the value is compared to the threshold level and if the sample is below this the gain is increased. If the signal is very low the gain will increase to the maximum gain for the sensor.

Once the appropriate gain has been reached for the current conditions the sensor will keep the current gain until one of the two conditions are met:

- The sample falls below the threshold level for the current gain. If this is true (and the sensor is not already in the maximum gain) the gain will be increased and the next sample will be sampled with the new, higher gain.
- The sample rises above the saturation threshold for the sensor. When the sensor is saturated any increase in the input (the concentration of tracer in this case) will not produce the corresponding increase in the output of the sensor as the output is already at its maximum level. In this case the sample acquired by the sensor is not valid (as the concentration could actually be significantly higher than the output of the sensor will indicate). When this occurs the gain will be reduced for the next sample (unless the sensor is already in the minimum gain mode, in which case the tracer concentration is too high for the sensor to measure).

#### 4.1.2 Manual gain

In auto gain the PC will determine the best gain mode for the current conditions – therefore in low concentration conditions (measuring background levels before any tracer is detected) the sensor is likely to be configured in the highest gain mode. In the highest gain mode the sensor will be at its maximum sensitivity, so any fluctuations in background measurements could give a widely changing (noisy) output signal. To reduce the sensitivity in this situation it may be desirable to fix the gain of the sensor to a value other than the maximum gain and once a leak has been detected switch the system into AUTO gain to pinpoint the leak location.

Typically it is recommended to leave the system in AUTO gain mode.

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## 5 Software and Hardware Installation

### 5.1 Introduction

This chapter describes the procedure for installing the AQUA*talk* software packages on to a computer. It addresses:

- Hardware and software environments
- Description of the package contents
- Backup routine
- Installation routine
- Preliminary check routine
- System customisation

### 5.2 Hardware Requirements

#### 5.2.1 Computer Compatibility

The AQUA*talk* package has been written for use with an IBM PC or upwardly compatible machine, running a 32-bit version of Windows (98SE or later). The software is supplied on a CDROM.

#### 5.2.2 Serial Communications

Serial communications with the logger is via a two wire RS485 or three wire RS232 connection. RS485 is not provided as standard on most machines, so an isolated protocol converter has been provided to connect the logger to the PC via a USB port. When using the RS232 interface on the logger the user can either plug it directly into a serial port on the PC (recommended) or use the USB protocol converter supplied and wire in the RS232 lines to the terminals on the converter. The supplied converter will appear as a new COM port on the PC once connected.

On plugging the converter into the PC for the first time a driver will be requested. The driver can be found on the installation CDROM in the \Drivers directory. Just follow the Windows prompts to install the driver.

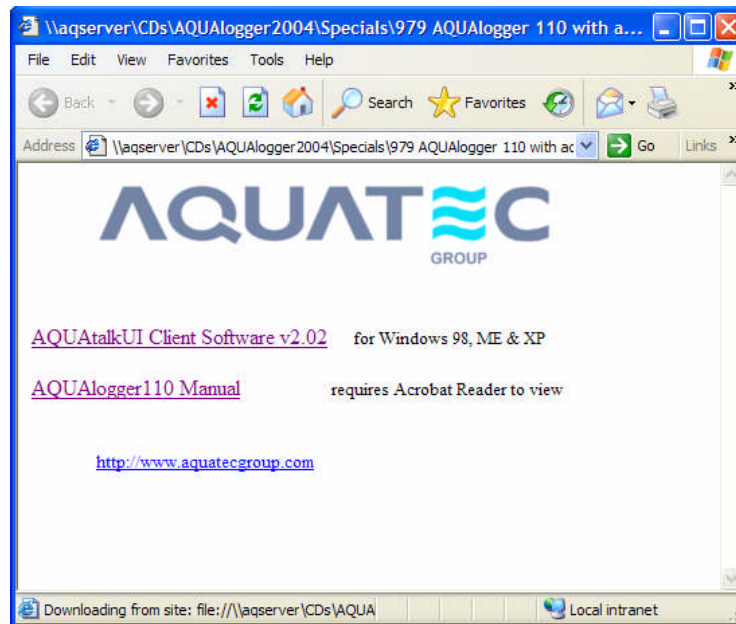
When a logger is connected via any COM port on startup the AQUA*talk* application will scan though any available ports on the PC to identify a logger. This process will typically take around 20 seconds.

### 5.3 The AQUA*talk* Software Package

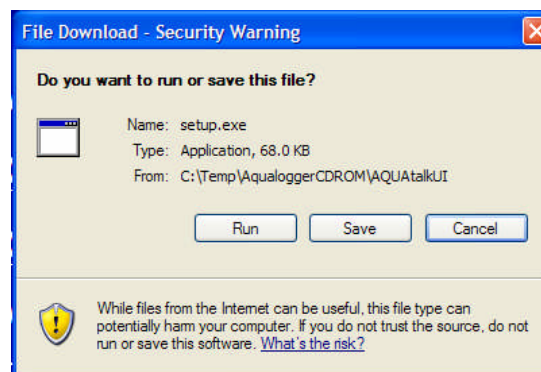
The AQUA*talk* application supplied with the logger is used for everyday communications and real-time data logging. All control of the logger is via this application.

### 5.3.1 Installation Procedure

The supplied CDROM has been configured to 'Autorun' and will produce a Webpage similar to that shown below:



Click on the 'Install' link on the page. A popup will then appear as below – select 'Run' and follow the onscreen instructions.



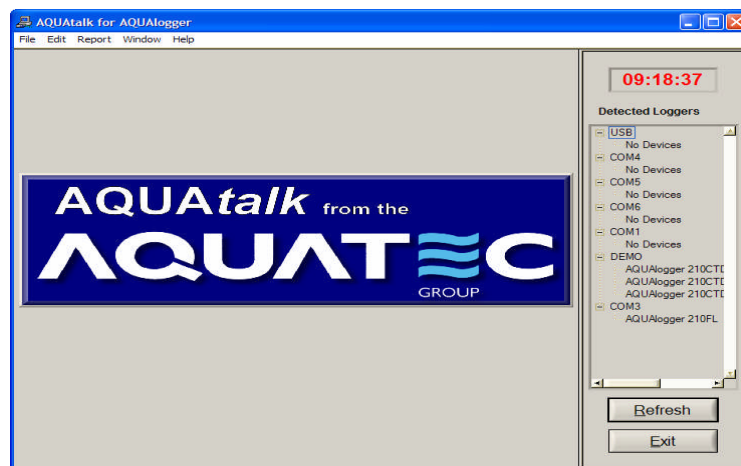
### 5.3.2 RS232/RS422/RS485 Device installation

When plugging the isolated USB to RS232/RS422/RS485 into a USB port on the computer running the AQUAtalk application Windows will prompt for a driver for the device. The drive can be found on the AQUAtalk CDROM in the \Drivers directory.

## 5.4 System Setup

The AQ620 system can be installed via a number of different methods depending on which interface (RS232 / RS485) is being used and how the unit is connected to the host computer (directly or via an ROV multiplexer). The setup sequence below describes a typical installation sequence for RS485 connection using the supplied Adam-4561 converter. It is assumed that both the AQUAtalk application and the driver for the Adam-4561 adaptor have been installed.

1. The 8-way cable supplied with the logger should be plugged into the logger and secured in place with the locking sleeve. For short range control (e.g. in a lab) the 2-meter cable supplied should be used directly – for longer range control the user should attach their extension cable.
2. Plug in the fluorometer(s) being used. **If only one is being used the supplied dummy connector *MUST* be fitted to the unused channel prior to deployment.**
3. The RS485 wires should now be attached to the Adam-4561 converter – the table in Section 3.3 shows the pin out of the 8-way connector. The connection to the logger RS485-A should be attached to the TX+(DATA+) input on the converter and the RS485-B should be attached to the TX-(DATA-) input. The connections to the converter are via a terminal block so a small flat blade or cross-head screw driver is required.
4. The power supply should be connected to the logger. The supply range is shown in Appendix A – a 24V supply capable of supplying at least 0.5A is recommended for driving the logger. Section 3.3 shows which pins of the 8-way connector to connect the power supply to. If a very long cable is being used, the resistance of the cable should be considered to ensure the voltage drop along the cable does not take voltage at the logger below the minimum specified input voltage. Always observe the **correct polarity**.
5. The RS485 converter should be plugged into the computer. The driver should be already installed so the computer should automatically detect the device. The converter is powered directly from the USB port so it requires no external power supplies. Note that if a recent version of Windows is being used (e.g. Windows XP) the computer will ask for the driver once again if the converter is plugged into a different USB port to the one originally used when the driver was installed.
6. Turn on the power supply to the logger. Depending on the fluorometer type being used the fluorometers should appear to dimly glow.
7. Start the AQUAtalk application. It can be found on the Windows ‘Start’ menu in the ‘Aquatec’ folder as ‘AQUAtalk for AQUAlogger’.
8. On startup the AQUAtalk application will scan all of the available COM ports on the computer and ‘ping’ for a logger. This can take approximately 20 seconds. Once complete the screen should appear as below:



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In the above example the logger has been found on COM3. On left clicking on the logger in the 'Detected Loggers' box the software will prompt to connect to the logger – select 'Yes' and the program will launch and operate as described in Section 6.

If there is a problem connecting to the logger, Section 11 describes a number of checks which may help to identify the problem.

## 6 Operation of AQUAtalk Software

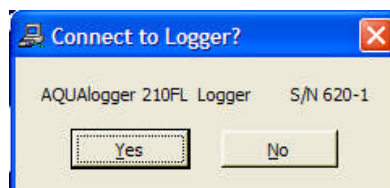
The AQUAtalk software will now be described. This section works through the software screen by screen.

### 6.1 Starting the application

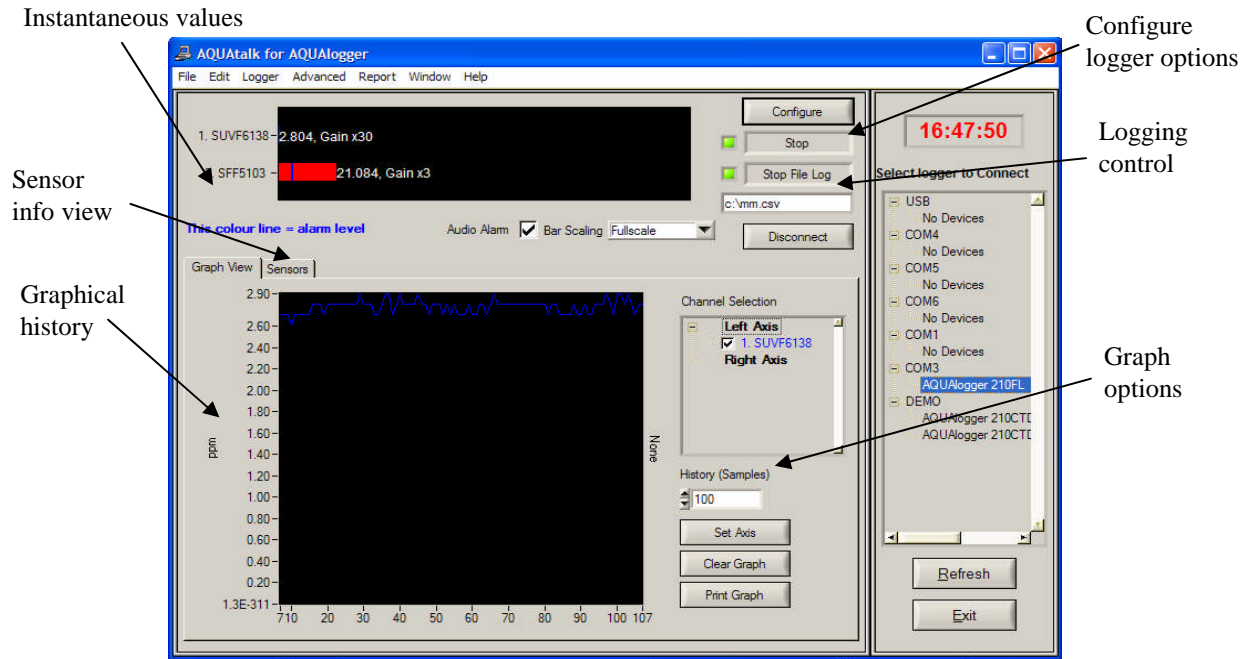
On startup the AQUAtalk application will ‘ping’ each of the COM ports on the computer to detect a logger. Therefore the logger should be powered up before opening the program. If the logger is not powered before starting the program, turn the power on and click on the ‘Refresh’ button below the ‘Detected Loggers’ box as shown below:



When the logger has been detected left click on the logger in the ‘Detected Loggers’ list and the prompt will appear:



Click ‘Yes’ and the main program screen will appear:



The main elements of the program are shown in the above figure. Each of the functions will now be described.

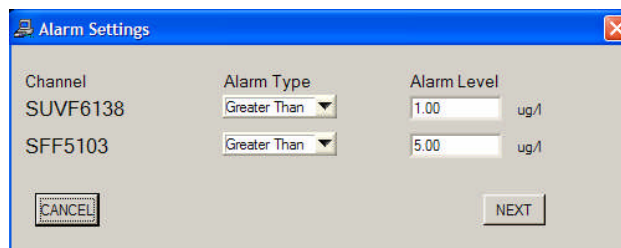
## 6.2 AQUAtalk functions

### 6.2.1 Configure logger options

The first operation is to setup the logger channels. The options that are configured are for the sensor gain, the alarm levels and the data file to log to. The options are selected by pressing the 'Configure'.

#### 6.2.1.1 Alarm setup

Each of the channels in the logger has an alarm levels which can be configured by the user. If the sensor detects a signal exceeding the alarm threshold the software will change the colour of the instantaneous values shown on the user interface from green to red. If the 'Audio Alarm' box is checked the computer will periodically beep when the alarm has been tripped.

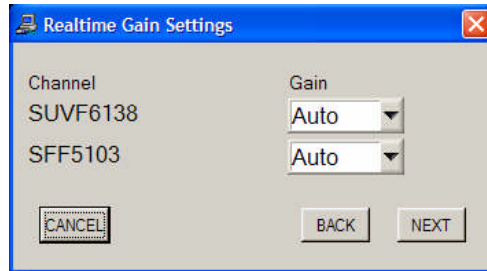


The alarm setting is shown above. The channel will be configured typically as a sensor type – e.g. Fluorometer or with a name corresponding to the sensor serial number (as shown). The alarm type can be used to specify whether the alarm is enabled and whether it is activated above

or below the specified alarm level. Set the alarm to an appropriate type and level for each channel and click 'NEXT'.

### 6.2.1.2 Gain settings

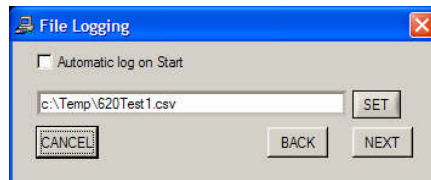
The gain setting for each of the logger channels can be independently configured. The selection of the appropriate gain mode is described in Section 4.1. Select the appropriate gain mode and click 'NEXT'.



### 6.2.1.3 Data file

All of the data acquired by the AQ620 is displayed in real-time on the screen and can also be logged to a file on the computer to view later. The format of the file is compatible for direct import into any spreadsheet program.

If no filename is supplied no logging will take place. The 'Automatic log on Start' checkbox forces disk logging to occur whenever data is being collected by the AQ620. If it is not checked logging to file can be independently enabled and disabled so once the display shows something interesting occurring logging to file can be enabled to capture the event thus reducing the amount of data to go through after deployment.

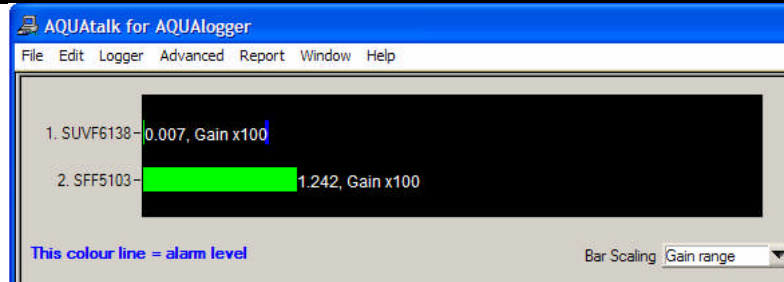


## 6.2.2 Logging control

The logging controls are 'Start' and 'Start File Log'. Once pressed the light on the display next to the button will be on or off to show the current state and the text on the button will change to 'Stop' and 'Stop File Log' respectively. To start acquisition the top button must be first clicked so it changes to 'Stop' – the instantaneous values and graph will start to update. If the 'Automatic log on Start' has been checked (as described in Section 6.2.1.3) the 'Start File Log' will be greyed out and not selectable – logging to disk is controlled by the 'Start' and 'Stop' button, so whenever the logger is acquiring the data is also always being logged to disk. The control below the 'Start File Log' button indicates the pathname of the file the data is being written to.

### 6.2.3 Instantaneous Values

The instantaneous values of the two logger channels are shown in the form of a bar chart in this section. On every sample these values are updated – a zoomed in section is shown below:



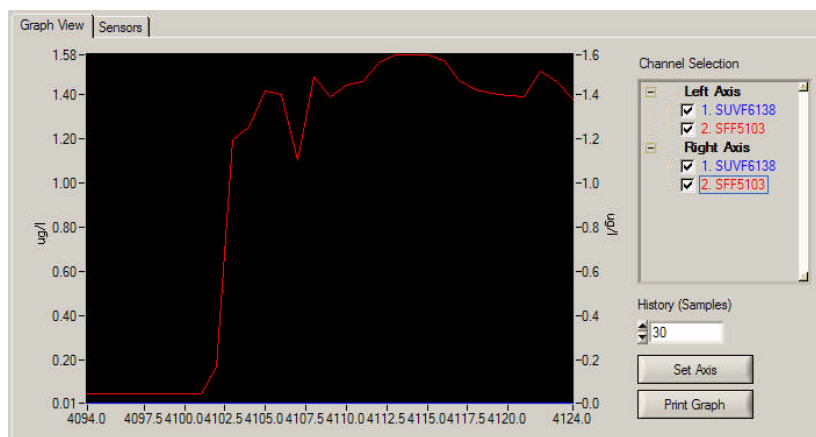
The text on the axis next to the bar shows the sensor on the channel – in this case it is setup for the sensor serial number. The bar will be green (as shown) while the alarm is inactive for a the channel. If a channel alarm becomes active, the bar will change to red to indicate this state. The alarm level for the channel is indicated by the small blue line on the display.

The ‘Bar Scaling’ has 3 options of how to display the data on the bar:

- ‘Fullscale’ – this scales the bar to be at a maximum at the maximum level the sensor can detect (maximum output on the minimum gain). As in most situations the tracer concentration will be well below the maximum for the sensor, this view will typically show very small levels for most of the time unless.
- ‘Alarm centred’ – this scales the bar so the level at which the alarm has been set is in the centre of the display. Therefore the user can quickly determine whether a channel is close to the triggering an alarm.
- ‘Gain range’ – this scales the bar to have a maximum corresponding to the maximum for the current gain of the sensor. If the sensor is in AUTO gain mode when the software switches the gain setting the scale will change so the bar will appear to ‘bounce around’ if the gain is changing often (which could be the case if the sensor is detecting tracer levels close to the maximum for one of the gain ranges). This view provides the most detailed view of the current values.

## 6.2.4 Graphical History

The graph on the display allows viewing of the history of the AQ620 output. There are various options to control the view. The display is shown below:



### 6.2.4.1 History (Samples)

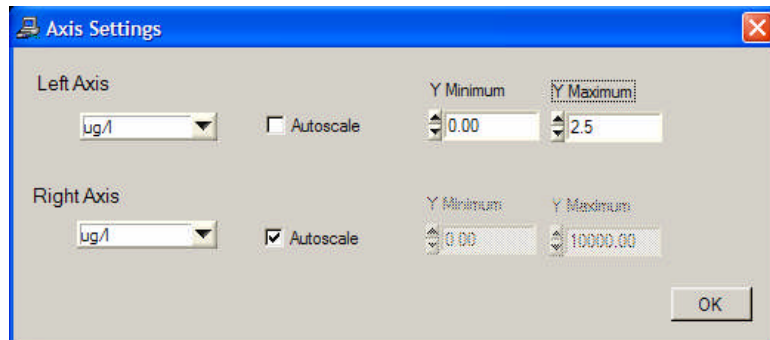
This defines the number of samples to plot on the graph – in this case the last 30 samples are plotted. The sampling updates at a 1Hz rate (1 seconds between samples) so the 30 sample window corresponds to 30 seconds in time.

### 6.2.4.2 Print Graph

This button allows the graph to be printed. As the graph will continuously update the ‘Stop’ button should be pressed on the main user interface to stop the graph from updating before pressing the print button.

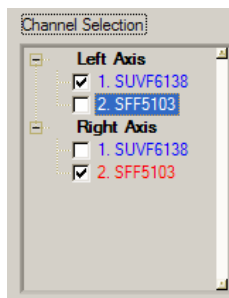
### 6.2.4.3 Set Axis

The scale on the graph can be configured to either ‘Autoscale’ to the minimum and maximum for the dataset or can be fixed to user specified minimum and maximum. If the two sensors being used on the AQ620 are different types (or sensors of the same type but fixed into different gain modes) it can be useful to plot the two channels onto different axes – the left and right y-axis on the graph can have different scales and so the ranges can be independently configured.



### 6.2.4.4 Channel Selection

The channel selection check boxes allow definition of which channel to plot on which (left or right) y-axis. In the example below the sensor ‘SUVF6138’ will be plotted on the left-axis and ‘SFF5103’ will be plotted on the right axis.



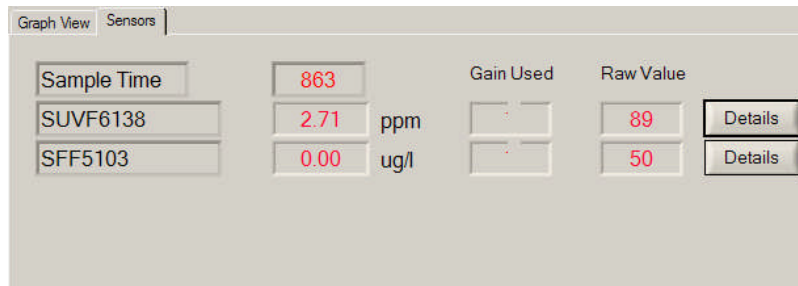
### 6.2.4.5 Graph Trace Colours

From the Edit menu the ‘Customise Colours’ option can be used to set the colours for the graph traces.

## 6.2.5 Sensor Info View

The 'Sensor' tab on the main display allows viewing of the details of the sensor on the logger channels. Additionally the raw ADC (analogue-to-digital converter) values from the logger are displayed to help with diagnosis in the event of any problems with the unit.

The information on the Sensors view is shown below. Clicking on the 'Details' button on the display shows all of the information the logger holds on the channel – gain settings, calibration values, range values etc. The raw ADC values will range from 0 to 65535.



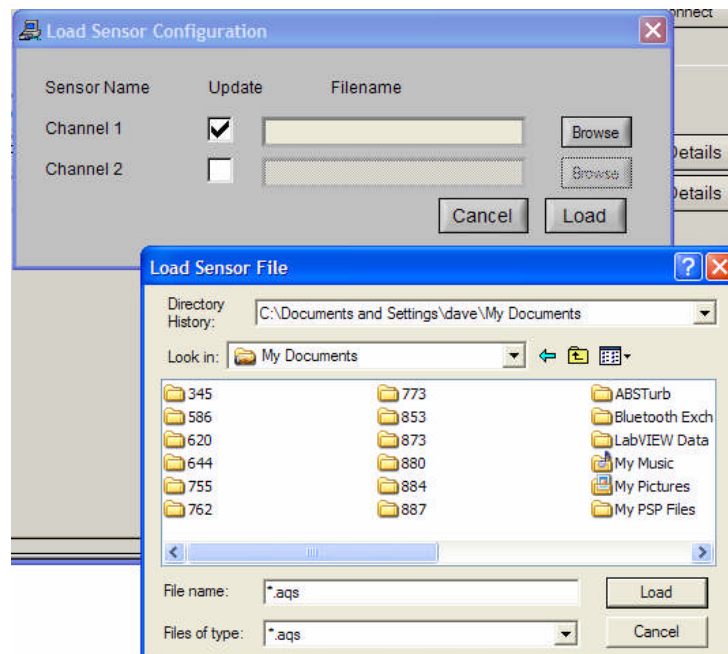
## 6.2.6 Advanced Menu

### 6.2.6.1 Update Firmware

The 'Update Firmware' option on the 'Advanced' menu allows downloading of new software to the logger. **This should only be used under the direction of Aquatec.**

### 6.2.6.2 Load User Sensor

This option allows the user to load pre-defined descriptions of sensors that can be plugged into the AQ620 logger. If a particular sensor is plugged into a channel on the logger the information defining it can be loaded from a file. Selecting the menu option displays the panel shown below – the 'Load' button brings up a dialogue box to select the .aqs file.



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## 7 AQ620 System Maintenance

### 7.1 Introduction

This section covers the routine maintenance required for the AQ620 System.

### 7.2 Maintenance

The only maintainable items are the 'O' rings and underwater connectors. See the following sections for details.

### 7.3 Opening the Housing

There are **NO** user serviceable parts within the logger housing and therefore it should **NEVER** be opened by the user, unless under specific instruction from Aquatec.

**CAUTION:** Always take care when opening a housing. Always point the endcap to be removed away from any people or equipment. Release screws gradually to check whether there is internal pressure.

### 7.4 'O' Rings

The 'O' rings should be lubricated prior to any deployment. Clean the 'O' rings and apply silicone grease such as Molykote 111 sparingly. Make sure that the face seal does not drop out of its groove during assembly.

### 7.5 Underwater Connectors

The underwater connectors should be lubricated prior to use. Lubricate the mating surfaces with 3M Silicone Spray or equivalent. **Do not use silicone grease**, as this will cause clogging.

### 7.6 Aluminium Endcap Screws

To minimise corrosion risks, the endcap is held in place with high tensile aluminium alloy screws. However, these may still be snapped by excessive tightening.

Before fitting them, apply an anti-seize compound such as Rocol J166. Then tighten until they just touch the endcap. Apply pressure centrally to the endcap to compress the internal trapped air and the face seal, and tighten each screw gently to take up the slack, working on the four screws in a 12/6/3/9 O'clock order. **DO NOT OVERTIGHTEN.**

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## 8 AQ620 System Packing, Handling, and Storage

### 8.1 Introduction

This section covers the requirements for packing, handling, and storing the AQ620 System.

### 8.2 Packing

When the AQ620 System is to be transported, it should be packed in such a way as to protect it from heavy impacts and sharp objects.

### 8.3 Handling

The AQ620 system comprises delicate electronics. It should be handled with care. The pressure case should only be opened by suitably qualified personnel, observing the warning and instructions detailed in the following section. When using the supplied 8-way cable with free-end wires, any unused wires should be insulated from each other and from other signals. Connecting them together or to other signals could damage the logger - if in doubt cut any unused wires back so the conductors are not exposed.

### 8.4 Storage

The instrument may be stored in most environments, since it is waterproof. Care should be taken to allow it to acclimatise from cold or warm storage before opening in a laboratory environment.

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## 9 Parts Data

### 9.1 Introduction

This section provides information on spare parts that are available for the AQ620.

### 9.2 Changeable Parts

#### 9.2.1 O rings

Should replacements be required these are available from Aquatec or any O-ring supplier. The two 'O' ring types are:

- Face seal: 51.6mm x 2.4mm Nitrile
- Piston seal: 41.6mm x 2.4mm Nitrile with PTFE spiral backup ring

#### 9.2.2 Screws

If any significant corrosion is observed on the housing screws they should be replaced while the housing can still be opened. The screws **MUST** be **anodized aluminium** M4 x 35mm socket cap screws.

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## 10 Safety and the Environment

### 10.1 Introduction

This section highlights aspects of safety and effects on the environment.

### 10.2 Electrostatic Discharge

Components within the pressure housing are highly sensitive to damage from electrostatic discharge. Work should only be carried out on the open instrument in a static protected environment.

### 10.3 Pressure Cases

#### WARNING

- If a case leaks, it can prove hazardous when brought to the surface.
- If a hissing noise is heard, wait for it to cease before carefully opening the case.
- If the endcap moves away from the case when the securing screws are removed, assume the case is pressurised. Slacken the screws evenly until the piston seal is exposed when the pressure will be released.
- It is advisable to allow the cases to reach ambient temperature before opening.
- A cold case may have an internal pressure below the outside pressure which can cause water to be sucked in. Carefully dry the area near the endcap to be opened.

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## 11 Fault Finding / Correction

If the logger is not found when the AQUA*talk* program starts the following describes the checks that may identify the problem:

1. Ensure the wet pluggable connector at the logger is firmly pushed in. These can be stiff. Never use silicone grease to lubricate the connectors as these can coat the contacts of the connector and make the connections fail.
2. Ensure the power supply driving the logger is capable of driving the logger. With the logger connected place a volt meter over the power supply and ensure the output is within the range specified in Appendix A.
3. Check the polarity of both the RS485 and power connection.
4. Ensure that any wires from the 8-way connector that are not being used are insulated from each other and any surrounding signals / metallic objects.

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## Appendix A - Technical Specification

### A.1 Logger Details

Logger type	Aquatec AQ620 logger based on AQUAlogger 110 core
Sampling resolution	16 bits
Analogue input range	[0..5]V

### A.2 Communications

Communication protocol	RS485 (isolated at host computer and logger)
Communications speed	19200 bit per second
Communication format	8:1:N

### A.3 Power Requirements

Logger external supply	24V DC (Range 19V to 36V)
Logger power consumption	150mA typ.
Fluorometers	27mA (max) – 15mA (typ.) each

### A.4 Housing Details

Material	AL Alloy
Finish	Hard Anodised and Dyed Black
Dimensions	76mm diameter x 240mm long + connectors
Pressure Rating	3000m sea water depth

## Appendix B - Summary of Data File Format

Data produced by the AQ620 is output in a comma-separated file format (.csv) and can be imported into any spreadsheet application. Below is an example file showing the headed and data values.

Time	SampleNum	SUVF6138 ug/l	SFF5103 ug/l
12:35:30	1	0.199127	0.187683
12:35:30	2	0.067139	0.062561
12:35:30	3	0.020142	0.018768
12:35:31	4	0.006638	0.006256
12:35:31	5	0.006714	0.006256
12:35:32	6	0.006714	0.006332
12:35:32	7	0.006714	0.006256
12:35:33	8	0.006714	0.006256
12:35:33	9	0.006638	0.006332
12:35:34	10	0.006714	0.006256
12:35:34	11	0.006714	0.006256
12:35:35	12	0.00679	0.006256
12:35:35	13	0.00679	0.006332