

# Water level Recording

## Product Summary

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WaterLevelSensV103.pdf updated: May 2014

The following data sheet shows the range of liquid level sensors manufactured by Keynes Controls Ltd. The company produces a range of products to suit many different recording and reporting applications. The AquaBAT range of stand-alone loggers can be installed into boreholes and water ways for un-attended operations. The PIEZO-RM range of intelligent sensors are used with most 3rd party manufactures data loggers, automatic reporting solutions and SCADA applications and transmit data digitally over local networks. The company also manufactures a range of interfaces for use with vibrating wire piezometers. OEM interfaces for third party systems can be obtained. All parts shown are designed and manufactured at the Keynes Controls facility.

### AquaBat Loggers

The AquaBat is used as a stand-alone level recorder into bore holes and free flowing water such as rivers, aquifers and reservoirs. It can be deployed directly into the water and results downloaded in-situ without having removing the instrument. The long battery life ensures that the AquaBat can be deployed for long periods without any need for operator on site visits and support This action saves costs by reducing maintenance visits. Low cost plastic optical fibre can be fitted by the User for different applications.

### Features:

User Installed low cost plastic fibre for communication and deployment - No training required to fit the fibre cable as it is a simple operation requiring the use of sharp scissors and a hex key only.

In-situ Downloads :- Download the data with the sensor in place with no requirement to remove the sensor after deployment.

Sensor Operation Test :- The AquaBAT is unique in that the cable flashes green when data is being transmitted. All a User requires to do to observe that a sensor is still operational is to view the green flash at the end of the fibre. No test equipment or special hardware is required.



**Fibre-Optic Cable** 0 - 120 m User Defined length

**Features**

- User Set cable length - simply adjust to suit application
- 17.5 mm and 22 mm diameter options - fits any bore hole
- lightning Protected By Design - Safe from any transients
- Self Powered > 10 yr battery life - depends on use and downloads
- 200K Readings Storage - 1 sec to 6 Hrs logging periods
- In-situ Fibre Optic communications - Immune from Electro-magnetic Interference
- Totally Encapsulated Design - Free from any seals and welds that can leak.
- Measurement Ranges 10m, 20m, 50m, 100m B
- Battery Replacement Service
- Temperature - 20 to + 60 Deg C

**Part Numbers**

AquaBAT-Bar	Barometer sensor
AquaBAT-17-RM	17.5 mm diameter RM=range 1,2,5,10 m
AquaBAT-22-RM	22 mm diameter RM=range 1,2,5,10 m
HDR-Bluetooth	Fibre-to-Bluetooth Interface



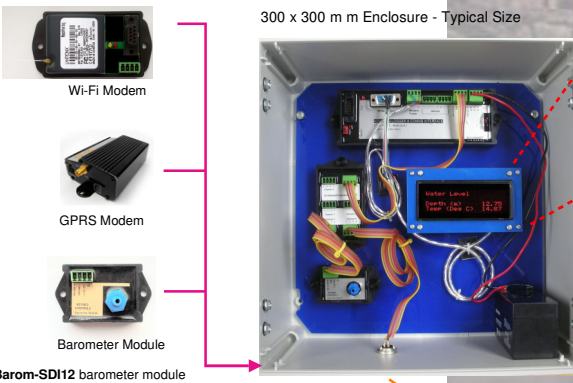
**Bluetooth Cable Free Network**

NP-HDR-Bluetooth Fibre Header unit



Windows Mobile

See further details at <http://www.aquabat.net/Summary/AquaSummary.html>



300 x 300 mm Enclosure - Typical Size

Wi-Fi Modem

GPRS Modem

Barometer Module

Barom-SDI12 barometer module  
Optional Precision Barometer for barometric correction.

### Intelligent Reporting Systems


The image opposite shows one of the modular data logging solutions that are available. The instrumentation can be expanded to take a range of environmental sensors enabling projects to be updated when required.

The logger systems can communicate using GPRS or satellite modems for direct connection to the Internet.

For an exact quotation for your requirements please contact Keynes Controls directly.

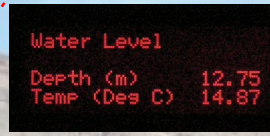
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**SDI-12 Liquid Level Sensors**

Keynes Controls SDI-12 digital network encapsulated water level sensor.



Water Level

Depth (m) 12.75

TEMP (Deg C) 14.87

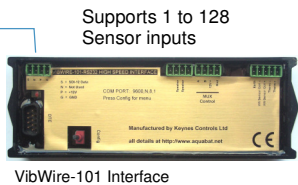
Regional Display Unit



# Vibrating Wire Piezometer

Keynes Controls manufactures and supplies a range of vibrating wire interfaces from single channel, 8 channel or 16/32 channel building blocks. There is an interface that will suit any application or budget.

No of Channels	Interface
1	VibWire-101
1 - 8	VibWire-108
16 / 32	VibWire-101 with MUX-32 expansion
32 - 128	VibWire-101 with upto 4 x MUX-32 expansion units



Vibrating wire piezometers can be supplied in many ranges and will suit nearly every water level recording application. The sensors give absolute readings and need to be used with a local 1 bar sensor or barometer to record barometric conditions. Keynes Controls can supply the sensors, sensor interfaces and data recording solutions. Only a single local barometer is all that is needed to record barometric levels for a 20 Km<sup>2</sup> area.

The **Barom-SDI12 module** is a fully encapsulated barometer module that is used with the vibrating wire piezometers to provide barometric correction for local atmospheric conditions.

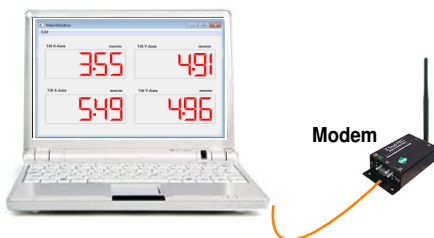
## Remote Systems

### Ezi-Log Web Interface



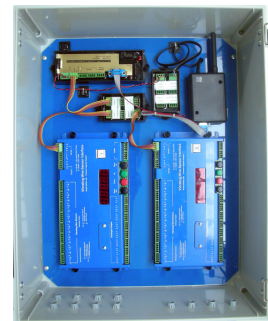
Data can be remotely accessed and reported across the GPRS mobile phone network or for very remote outstations via a satellite modem. The Ezi-Log Web Interface is used remote access from a Internet connected device.

### Q-Log Applications Software



The free Q-Log applications software is used to display results for direct connection between a Microsoft Windows laptop and the different sensor interfaces.

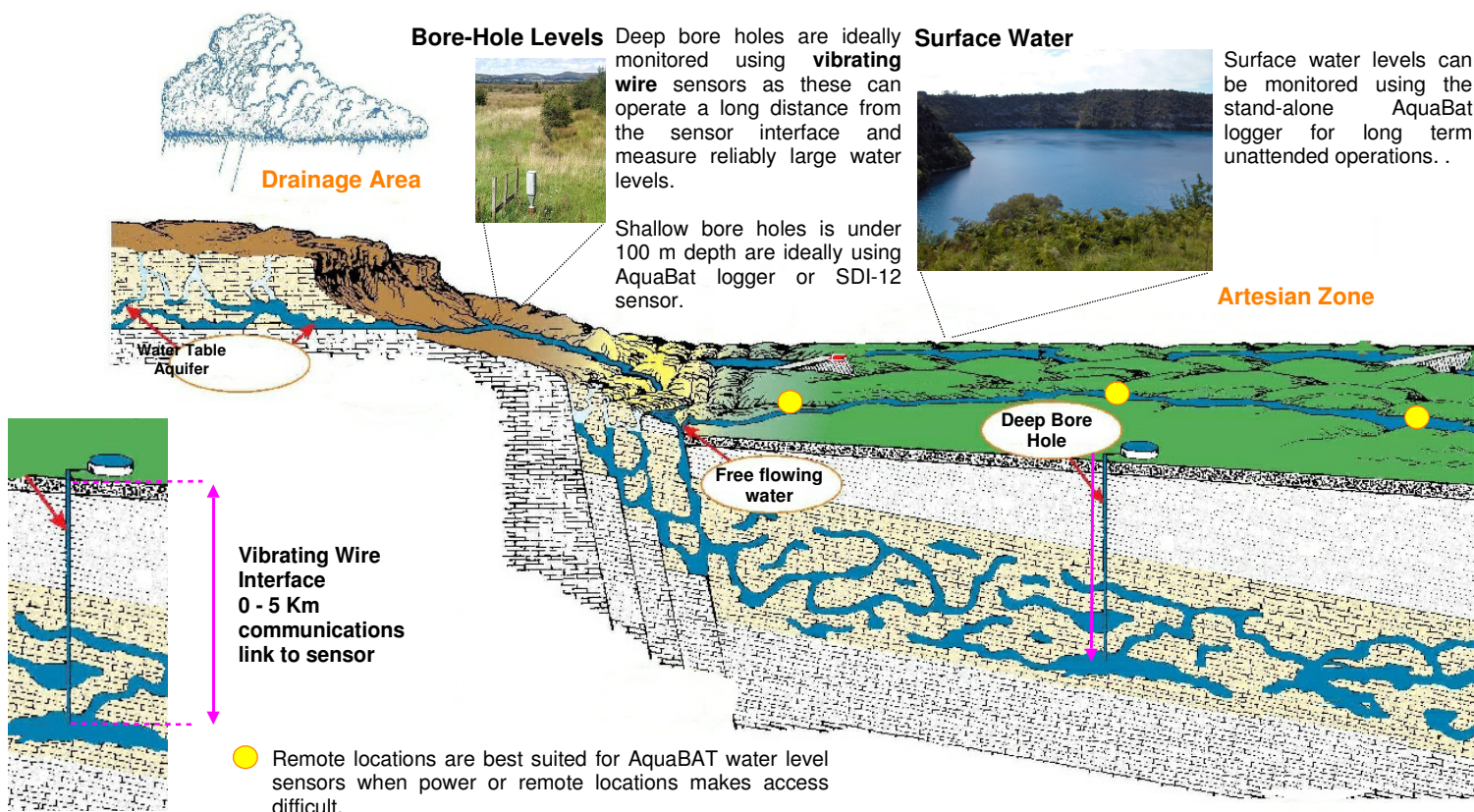
### Remote Outstation



The images above shows a typical remote outstation for use with vibrating wire piezometer's.

For further details and free Q-Log software download see: <http://www.aquabat.net/QLOGFree/qlogv2.html>

Download additional details at: <http://www.aquabat.net/downloads/EZi-LOGv5-marketing.pdf>





## PIEZO-RM Intelligent Water Level Sensor

The company manufactures the PIEZO-RM range of intelligent sensors for use with data loggers, automatic reporting systems and SCADA applications.

All of the PIEZO-RM range of sensors are fully encapsulated devices and are offered with SDI-12 or RS485 digital network support.

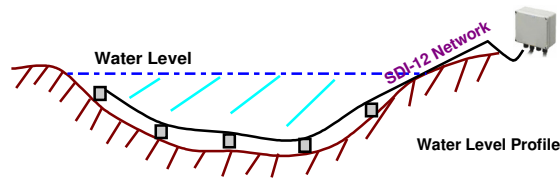
Level measurements are all made internally with the data acquisition electronics being mounted adjacent to the pressure sensor element. This removes the chance for noise degradation and pickup due to signal transmission over current loops and long wires to the acquisition unit. A precision temperature sensor is used for internal temperature compensation or to give the water temperature for post process compensation.

All of the PIEZO-RM range of sensors return water level and temperature values in a choice engineering units to suit most applications. Units supported are mmH2O, cmH2O, ftH2O, bar, PSI, mH2O.

Expanded ID Address support is available enabling up to 36 sensors to be deployed onto a single network.

The PIEZO-RM sensors can be supplied in a range of materials. The standard enclosure is 316 stainless steel. Options for Titanium and marine bronze are available.

### PIEZO-RM Dimensions



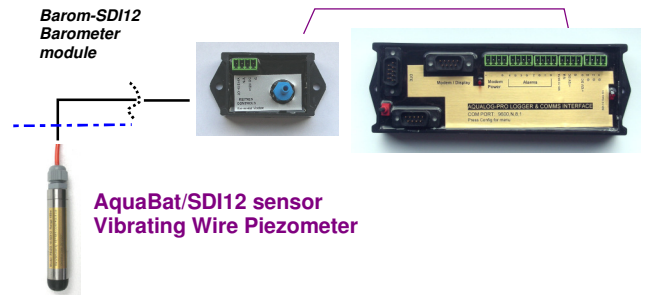
### River Level Profiles

Both the PIEZO-RM range of sensors can be networked together and deployed to form a chain across a river or out into a section of the water flow. The information gathered can be used to form a water level profile.

Part no. **PIEZO-RM-SDI12** where RM = range 1,2,5, 10 bar  
**PIEZO-RM-485** range = 1,2 5,10, 20 bar

**Barometric Corrections** can be undertaken using the Barom-SDI12 barometer module using a second SDI-12 channel on a logger. The **barometer** module is set to make a measurement at the same time as the water level sensor. Barometric correct is made by simply subtracting the Barometric value from the water level sensor since the two sensors give results in the same engineering units.

**AquaBat-Bar** is a 1 bar version of the of the AquaBat logger and is deployed for recording barometric values when a number of dispersed sites are in operation. A single **AquaBat-Bar** will provide satisfactory information for a 20 Km<sup>2</sup> area.

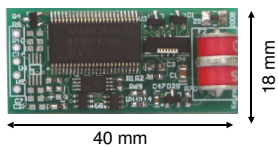


## OEM Applications

The **NP\_PAN-SDI12/RS485** interfaces are general purpose devices used to manufacture intelligent pressure sensors. The cards support most manufactures pressure sensor elements and comes complete with a on-board temperature sensor for internal and post process temperature compensation.

The cards support User selectable engineering and raw data units.

The cards are fully integrated into the free Q-Log applications software.



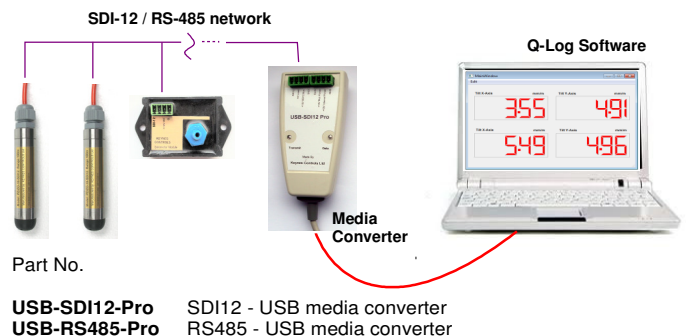
<b>Specifications</b>	125 mm x 22 mm with pressure cap
<b>Power Supply</b>	10-18V DC 4mA Active < 200uA Idle
<b>Lightning Protection</b>	Gas Discharge (standard)
<b>Analogue Input</b>	16 bit ADC with over sampling programmable gain amplifier.
<b>Calibration</b>	6 point calibration
<b>Operating Temp</b>	-30 deg to + 60 Deg C
<b>SDI-12 Specification</b>	V1.3
<b>Output</b>	mmH2O, cmH2O, mH2O, User Defined
<b>Measurement Time</b>	0.2 to 20 secs

## PC based Water Level Recording Systems

The image below demonstrates the hardware necessary to create a PC based water level recording system.

The sensors are powered directly from the USB port of the host PC so no external power supplies are required.

The water height can be displayed directly in Engineering units





## AquaLOG Logger & Communications Interface

The AquaLOG is a fully encapsulated SDI-12 data logger and communications interface and has been designed for low power stand-alone operations. It is fully immersion proof, and User programmable using only a terminal program. There is no dedicated software required for this product.

The AquaLOG offers options for unlimited data storage via USB flash drives, Communications for automatic download applications can be undertaken via GPRS mobile phone network, or via satellite modems.

### PIEZO-RM / SDI-12 & RS-485 Supported Commands

Command	Response	Description
aM!	a0tt2	2 values in time tt given by stats
aD0!	a+0.123+25.5	Pressure and temperature values
aD1!	a+0.1299+0.1201+25.9+25.0	Statistical values max P, min P, max T, Min T
a!	a13KEYNES COPRESR001	Identification string
aXUTu!	au	Temperature units u=0 → Celsius, u=1 → Fahrenheit with read back
aMMn!	an	Reset statistics n=1 → Max Pressure n=2 → Min Pressure n=3 → Max temperature n=4 → Min temperature
aXCn,xxxx	an,xxxx	Calibration data (No temp compensation - default) E = [0] + [1]*s with read back. s is in mV/V E is in mmH2O
aXFt,nn,xxxx!	at,nn,xxxx	Ensemble Averaging Command t → filter type (should be 0 - mean only) nn → number of filtered values 1 to 12 xxxx → interval between measurement * 200ms

The commands shown opposite are supported on the PIEZO-RM range of sensors and are identical between the SDI-12 and RS-485 versions of the instruments.

The commands below are an example of the instructions used by the AquaLOG data logger to record data from 2 x PIEZO-RM level sensors.

See further details at <http://www.aquabat.net>

### Example AquaLOG SDI-12 Commands

The following commands

[D] 0M! 0D0! - get data ID=0 returns 2 values  
Pressure, temp

In-built statistics

[F] 0M! 0D1! - get Max pressure and temp values  
returns 4 values into cells F .. I

0MM1! reset max pressure for sensor ID=0

### Default Test Commands

The following command can be used for factory supplied sensors. Default ID=0 unless specified.

Start measurement: 0M! returns 012 - 1 sec response 2 values  
0D0! returns 0+pressure+temp

### Barometer Module



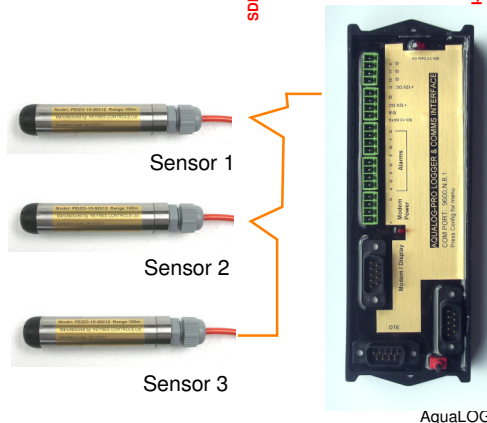
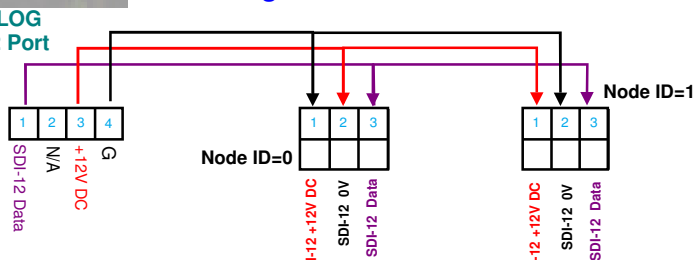
Barom-SDI12 is the standard sensor used by the AquaLOG instrumentation for barometric correction for liquid level measurements.

This sensor is available as a RS-485 network device.

See <http://www.aquabat.net/Barometer/barometersdi12.html>

Description	
Operating Range	600 to 1200 m bar
Pressure Accuracy	± 0.5 m bar
Resolution	0.03 m bar
Temp Range	-20 to + 70 Deg C
Resolution (Typical)	0.2 Deg C
Accuracy	± 1 Deg C
Power Supply	+12V DC @ 5 mA During a reading Switched off when not in use
Operating Temp	- 20 to 70 Deg C
Output Variables	Pressure Temp
Network Type	SDI-12 v103
Vent Tube Attachment	4 mm plastic tube.
Mounting Holes	4.1 mm

### SDI-12 Digital Network Connection



Optional Calibration formulae including temperature compensation is supported but not used by default. This function has to be set by the User.

$$E = [0] + [1]*s + [2]*s*s + [3]*t + [4]*t*s + [5]*t*s*s$$

## Technical Specifications & Part Numbers

### PEIZO-RM SDI-12/RS485 Sensors

The **PEIZO-RM** of sensors provide an absolute output ie. the water level above the sensor without any consideration for barometric conditions. This range of sensors are fully encapsulated and have no seals where water or moisture can leak into the chamber containing the electronics. A solid 3 core cable is fitted that is used for both communications and deployment. The communications cable is isolated from the electronics using custom glass metal seals. The PIEZO-RM sensors do not use expensive vented cable and so are easy to transport, handle and install. The Barom-SDI12 unit is used when barometric corrections is required.

Description	AquaBat Water Level Logger		
<b>Measurement ranges</b>	1 bar	0 - 10 m	used for barometric level recording
	2 bar	0 - 20 m	
	5 bar	0 - 50 m	
	10 bar	0 - 100 m	
<b>Accuracy</b>	±0.05% Full Scale - 17.5 mm (Typical)		
	± 0.05% Full Scale - 22 mm (Typical)		
<b>Dimensions</b>			
<b>17.5 mm Unit</b>	170 x 17.5 mm Body	Fibre Cap Length = 10 mm	End Cap = 20 mm
<b>22 mm Unit</b>	170 x 22 mm Body	Fibre Cap Length = 10 mm	End Cap = 20 mm
<b>Operational life</b>	Greater than 10 yrs depending upon number of downloads and sample rates		
<b>Sensors</b>	Pressure Temperature -20 to + 60 Deg C		
<b>Instrument Diameter</b>	Options for 17.5 mm & 22 mm		
<b>Number of Records</b>	200,000		

### AquaBAT Level Logger

The AquaBat operates as a stand-alone data recorder and is ideal for long term projects without any user intervention.

These sensor are supplied in marine quality 316 stainless steel as standard and are offered in Titanium or marine bronze.

Contact [sales@keynes-controls.com](mailto:sales@keynes-controls.com)

for pricing and further details.

### In-House Calibration

All sensors and systems manufactured by Keynes Controls are all calibrated in-house.

External calibration can be arranged. Contact us for details.

### Vibrating Wire Sensor Interfaces

Description	VibWire-108	VibWire-101
<b>Number Vibrating Wire Inputs</b>	8	1 - Expands to 128 channels
<b>Number Analogue Inputs</b>	8 x Thermistor inputs or 8 x 0 - 2.5V DC single ended input jumper selectable	1 x Thermistor input
<b>Distance to Sensor</b>	Depends upon sensor output level 0 - 5 Km typical	0 - 5 Km typical
<b>Network Interfaces</b>	SDI-12 / RS485 / Analogue Output	1 x SDI-12
<b>Power Supply</b>	10 - 18 V DC 80 mA for 3 Secs/Channel scanning 1 mA stand-by	10 - 18V DC
<b>Excitation Method</b>	Continuous ping - auto resonant	Auto-resonance
<b>Response time</b>	30 seconds for 8 channels 2 seconds for 1 channel	3 Secs / Channel
<b>Frequency Range</b>	400 - 6 KHz	400 - 6 KHz
<b>MUX Expansion</b>	No	4 x MUX16/62 units

Vibrating Wire Piezometers available from Keynes Controls Ltd

Range	Part Number
2 bar	EPP-30-2
3 bar	EPP-30-3
5 bar	EPP-30-5
7 bar	EPP-30-7
10 bar	EPP-30-10
15 bar	EPP-30-15
20 bar	EPP-30-20
35 bar	EPP-30-35
50 bar	EPP-30-50

**Accuracy** 0.1 % fs  
**Resolution** 0.025 % fs  
where 1 bar = 10m water

### PIEZO-RM range of intelligent sensors.

Description	SDI-12 sensors	RS-485 Sensor
<b>Network Options</b>	SDI-12	SDI-12 & 4-20 mA software selectable
<b>Number of nodes</b>	36	36
<b>Measurement type</b>	Absolute - Units Bar / m water Temperature Deg C / Deg F	Absolute - Units Bar / m water Temperature Deg C / Deg F
<b>Measurement ranges</b>	1 bar 0 - 10 m 2 bar 0 - 20 m 5 bar 0 - 50 m 10 bar 0 - 100 m	1 bar 0 - 10 m 2 bar 0 - 20 m 5 bar 0 - 50 m 10 bar 0 - 100 m
<b>Comments</b>	<i>Barom-SDI12</i> module is ideally suited to measure barometric levels on an SDI-12 network.	This series of sensors enables users to deploy the instruments and provide an easy upgrade path to a digital solution.
<b>Dimensions</b>	115 x 20 mm	115 x 20 mm
<b>Resolution</b>	0.002 to 0.0006% FS	0.002 to 0.0006% FS
<b>Accuracy</b>	0.05% net FS	0.05% net FS

### Part Numbers

#### OEM Interface Board

#### Sensors

**PIEZO-RM-SDI12** RM=1,2,5,10 range in meters  
**PIEZO-RM-RS485** RM=1,2,5,10,20 range in meters

**Barom-SDI12** SDI-12 barometer Module

#### Stand-alone Level Logger

**AquaBAT-Bar** Barometer sensor  
**AquaBAT-17-RM** 17.5 mm diameter RM=range 1,2,5,10 m  
**AquaBAT-22-RM** 22 mm diameter RM=range 1,2,5,10 m  
**HDR-Bluetooth** Fibre-to-Bluetooth Interface

**Q-Log Software - download**  
<http://www.aquabat.net/QLOGFree/qlogv2.html>

**Ezi-Log Web Interface:**  
<http://www.aquabat.net/downloads/EZI-LOGv5-marketing.pdf>

Additional details can be obtained

<http://www.aquabat.net> or [sales@keynes-controls.com](mailto:sales@keynes-controls.com)