ARGES Nitrite Sensor Manual

Product Overview

The ARGES Nitrite sensor is an intelligent submersible selective ion sensor manufactured by Keynes Controls and is manufactured using high grade PVC (Polyvinyl Chloride) tube and is fitted with a high performance wet mate network connector. The sensor is purely digital in operation and offers high performance measurements. The advanced power saving design ensures the sensor is ideal for remote operations. The sensor can be used as a standalone sensor or as part of a multiparameter system. All ARGES selective ion sensors have built-in temperature sensors that can be used to record the sample temperature.

The sensor is fully user configurable and supports the advanced SDI12 V1.4 protocol. The SI Units for the measurements can be automatically assigned by the sensor.

Product Images

This is a photograph of the Nitrite Sensor, featuring a sleek black finish with its name prominently displayed for easy identification.

These photographs showcase the Nitrite Sensor in action, being used to test river quality in Abingdon, Oxfordshire.

Figure 1

Figure 2

Figure 3

Figure 4

QLOG Applications Software

The ARGES Nitrite sensor is supplied with a copy of the QLOG applications software. QLOG gives the user the ability to make configuration changes, take measurements, display real-time measurements and store results in spreadsheet format CSV text files for easy analysis.

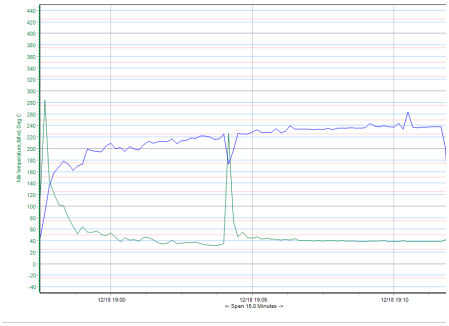


Figure 5

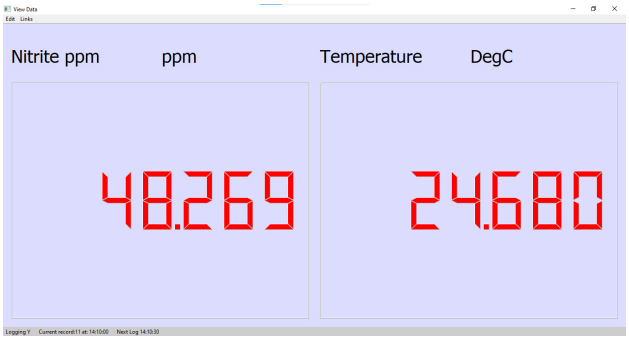


Figure 6

The images above show real-time measurements of Nitrite in a series of panel meters and charts.

Nitrite Sensor Technical Features

TYPE	RANGE (Typical levels)
Solid state ISE sensor.	
Measurement range:	0.5 - 460 mg/L - Auto-ranging - other ranges on request
Nitrite Resolution:	0.01 ppm
Nitrite Accuracy:	+/- 9% of Reading
Built-in Digital Networks	SDI12 / RS485 / MODBUS (16 & 32 Bit Registers)
Sensor life:	Re-calibrate after 720 hours measurement time
pH Range	4.6 - 8
Temperature Range	5 - 50 °C
Isolated Electrodes	Between measurements / standby mode.
Sensor Element	Solid State
Interference IONS	CN−
SI Units	ppm, °C
Standby Current	1mA - Typical

The calibration procedure used with the Nitrite sensors follows the same procedures as described on page 9 for all of the ARGES range of selective ion sensors. The easiest way to calibrate a selective ion sensor is to use the free QLOG software and set the sensor to calibration mode.

Measurement Integrity

A solid state sensor makes measurements using reference and selective ion half cells and as such has to be deployed into the correct environment. The sensor measures the potential across the selective-ion-sensor and the reference when deployed into the test sample. Under ideal conditions the test sample should be slow flowing.

The ARGES Nitriite sensor is factory calibrated at 2 points. Typical high value calibration is at 100 ppm, and the low calibration point is 10 ppm. The sensor is capable of higher concentration readings but operates most accurately when calibrated over the range into which it is to be deployed.

The ARGES Nitrite sensor can supply temperature compensated readings .

Measurement Variables

The following variables are available for use with the Nitrite sensor.

The user can adjust the order and measurement variables being sent out from the sensor.

Letter	Description	Name	Units
	Main Sensor Readings		
A	Raw Concentration Output	sraw	ppm
B	Base Concentration Output (Nitrite)	btp	ppm
C	Not used		
D	Not used		
M	Temperature Sensor	TempD	Degree Celsius

Table 1

Communications with Windows PCs

Equipment Required:

1.	USB-SDI12-AG1	Figures 9-12, USB to SDI12 media converter for use with the ARGES chemical sensors
2.	USB Cable	Figure 13, Type 2.0 Male A to Type Male B cable
3.	ARGES Network cable	Figure 16
4.	ARGES Extension cable	Figure 15

Software

Use the Keynes Controls QLOG software

Download a copy from the www.keynes-controls.co.uk website and install onto a Windows Operating system computer.
The software should run on Windows XP, 10 and 11 operating systems.

The software can be used without restriction. Any similar software that supports SDI12 network operations can be used instead.

Figure 7

Figure 8

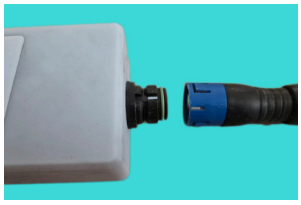


Figure 9

Figure 10

Figures 13 and 16 show the network cables used with all ARGES chemical sensors.

Figure 11 USB 2.0 Type A Male to Type B Male

Figure 12

Figure 13 - ARGES Sensor network extension cable

Figure 14 - ARGES Network Cable

Figure 15

Figure 15 opposite shows the ARGES network cable attached to the Nitrite sensor.

Secure the sensor to the network cable using the red locking cap.

Hardware Installation

The cables used with the ARGES Nitrite sensor, media converter and network cables can only be fitted together in a single combination. It is not possible to connect the instrumentation together incorrectly.

1. Connect the USB cable into the base of the USB-SDI12-AG1 media converter. See Figures 10 and 13 on page 3 above.

2. Connect the orange extension cable or ARGES network cable to the blue binder connector on the USB-SDI12-AG1 media converter. See Figures 11 and 12 on page 3, or 18 and 19 below.

Figure 16

Figure 17

Network cable connection to the USB-SDI12-AGI media converter.

Figure 16 shows the network cable alignment to the USB-SDI12-AG1 media cable.

A white marker on the Blue Binder connectors has to line-up for the cable to push onto the media converter.

Figure 19 shows the network cable terminated onto the media converter.

3. The black ARGES network cable shown in figure 16 above, is waterproof and safe for submergence with the Nitrite sensor. It is terminated with a moulded 5-pin connector that fastens to the sensor and a blue IP68 rated Binder connector.

   The 5-pin sensor terminating socket on the network cable is moulded into the cable end and ensures high integrity and reliable connection. The moulded socket is wet mate capable.

   The orange extension cable is terminated with Binder IP68 plugs.

4. Terminate the ARGES network cable to Nitrite sensor. It only fits one way onto the gold connector at the rear of the sensor. See Figure 20 below.. Lock into place on the sensor using the red securing ring.

5. Using the USB interface cable, Plug the USB type A socket into a standard USB port on the Windows PC. See Figures 9 and 13 on page 3 for more details.

   As long as the Windows PC is powered on, and the USB port is operating to the correct technical specification then the blue status LED on the USBSDI12-AG1 media converter will illuminate. See Figure 12 on page 3.

Figure 18 - ARGES Network Cable

Figure 19 - ARGES Network Extension cable

Powering the ARGES Nitrite Sensor

The ARGES Nitrite sensor is powered directly from the PC USB port via the USB-SDI12-AG1 media converter.

The USB-SDI12-AG1 media converter can power single sensors and multiparameter systems directly from the PC USB Port.

Figure 20

USB-SDI12-AG1 Device Drivers

The device driver software for the usb media converter automatically loads into the PC so long as an Internet connection is made. The media converter uses the FTDI chipset and the driver software is frequently already part of the Microsoft Windows operating systems.

Further Information

All items shown in this document are available from the Keynes Controls online shop.

See keynes-controls.co.uk for details, or E-mail sales@keynes-controls.com

Pin-outs

The pin-out is standard on all of the ARGES range of chemical sensors.

View looking into the sensor connector.

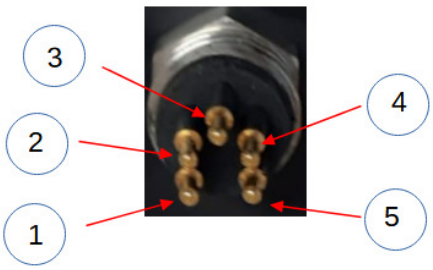


Figure 21

1 = - RS485 2 = + RS485 3 = SDI12 Data 4 = Gnd 5 = + 12V DC

QLOG Software Quick User Guide

The ARGES Nitrite sensor supports multiple digital communication networks. This manual only considers using the SDI12 network for communications using the USB media converter and QLOG software.

Required Information:

1. COM Port used by the USB-SDI12-AG1 media converter.

Use the Device Manager feature of the operating system to locate the USB-SDI12-AG1 COM port number.

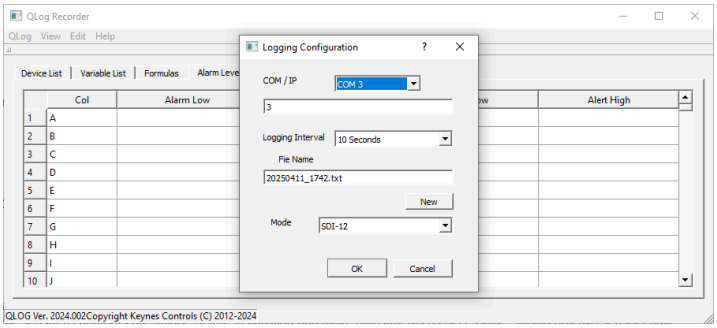


Figure 22 - QLOG Configuration Window

Enter the USB media converter COM port number into the QLOG Software Configuration Window.

The QLOG software has to identify the media converter so the sensor measurements can be read.

Select **QLOG - Configuration menu option**

The Window opposite will appear. Select the COM port number from the pull down list. In the example COM port 3 has been selected.

Network Selection

The ARGEs Nitrite automatically detects the network on which has been connected by reading the network traffic.

The **USB-SDI12-AG1** media converter used with the ARGERS Nitrite sensor only supports the SDI12 network. Upon connecting the media converter to the instrument then the SDI12 network will be activated.

Select **SDI-12** menu option from the pull down list. See Figure 22 above.

Recommended Sample Rate

1. A single sensor connected directly to a PC or similar data acquisition system

   Maximum sample rate **1 Second**

   Recommended sample rate **5 Seconds**

   Once all the configuration settings have been assigned press the ‘OK’ button to store.

Multiparameter Housing Sample Rate

2. The fastest sample rate for a fully populated 7 Port SONDE is **10 Seconds**

   Recommended sample rate is **30 Seconds**.

   It is now possible to scan the network and identify the sensor

Scanning the SDI12 Network

Select **F9** on the PC keyboard, or select ‘Scan for Devices’ from the QLOG menu system

Figure 23

The USB-SDI12-AG1 media converter status indicators will flash on and off, see Figure 23 above.

Identify Nitrite Sensor in the network.

The SDI12 network supports 10 sensors each with an individual ID number for identification. The SDI12 ID number is an integer ranging from 0 to 9. Each sensor has a unique ID address.

Each sensor also has an Product Description string, in the case of the Nitrite sensor this is currently

a14KEYNESCOISELEC106Nitrite

This has been assigned by Keynes Controls Ltd and is a standard feature of the SDI12 protocol.

where **a = ID number of the sensor** **n = Number of sensor type on a network.**

Factory Default settings : **ID = 0** for all sensor types

Once the Nitrite sensor has been identified on the network then it will appear under the Device list tab in the QLOG Software

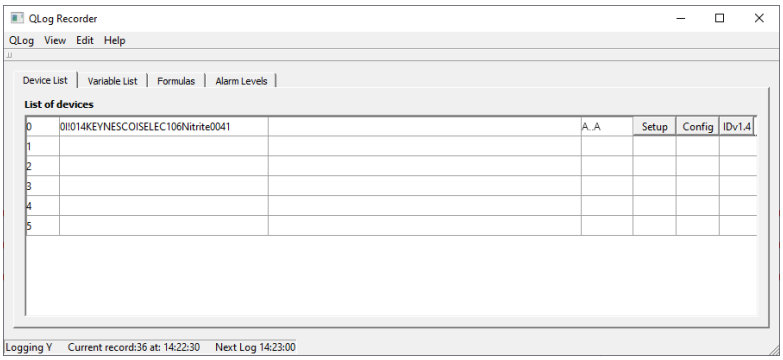


Figure 24 - Device List after a network scan

Figure 24 opposite shows a Nitrite sensor with **ID 0** on the SDI12 network.

Figure 24 shows a typical network scan when multiple sensors are being used and has identified a Nitrite sensor. The QLOG software does not yet understand what has to be done with the measurements that will be returned from the sensor or sensors.

Note. The 4th column shown in Figure 24 shows the cell locations where the measurements will be stored in the results file.
The QLOG software uses the same cell references as common spreadsheets.

The Nitrite sensor above is shown storing measurements into cells A .. A. This is not possible and so no readings will make sense.

The first three cells reference A..D are reserved and cannot be used by the User.

The first cell that can be used to store measurements is ‘D’.

Understanding the Sensor Parameters

An SDI12 sensor can return multiple measurements back to the PC or any other data acquisition system controlling the network.

The QLOG software has to be told which measurements the ARGES Nitrite sensor will be sending to the PC in order to make sense of the results.

The ARGEs Nitrite sensor returns the following values:

Base Concentration Nitrite	**ppm**
Temperature Corrected Nitrite	**ppm**
Sample Temperature	**°C**

Nitrite Measurements

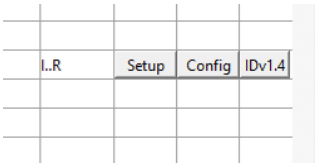


Figure 25

Select the '**Setup**' Button. See column 2 in Figure 24 (page 7).

The Device Setup Window shown in Figure 24 will appear.

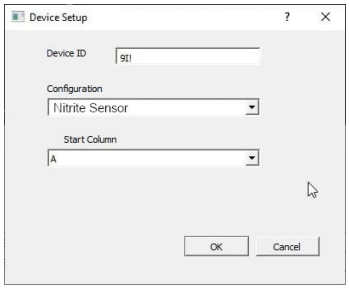


Figure 26 - Nitrite Device Setup Window

Figure 26 opposite shows the QLOG device setup window for the current Nitrite sensor.

Select the '**OK'** button.

Ensure the '**Nitrite Sensor**' option is shown in the Window. Adjust with the pull down menu options as necessary.

The Start column into which the measurements are to be stored is defined under the 'Start Column' tab. In the example the cell location is shown as 'A'. This can be adjusted. Any cell after D required.

The **Auto Assign** function will assign the correct cell location for measurement storage automatically.

Once all the sensors on a network have been identified and set the cell locations for the measurements can be automatically assigned.

Repeat for all sensors on the network.

Once the Typtophan sensor has been identified then the measurements can be stored into the results file

Using the menu system shown below

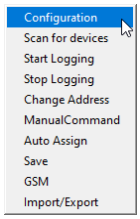


Figure 27

Select '**Auto Assign**' menu option.

The menu is also used to start and stop the data acquisition operations, change the sensor ID etc ..

The QLOG sensor can now be used to make measurements. Everything is configured.

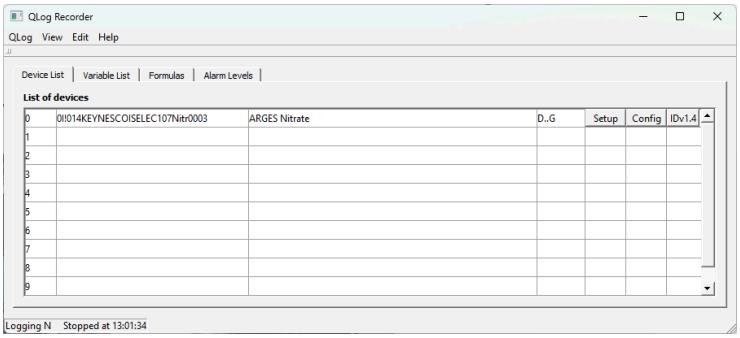


Figure 28

Once the **Auto Assign** function has been activated then the cell references used by the different sensors are automatically assigned.

Figure 28 opposite shows a Device List for a 7 Port multiparameter SONDE with a Nitrite sensor set as ID 0.

Real-time Measurements

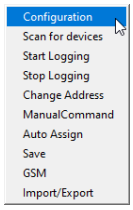


Figure 29

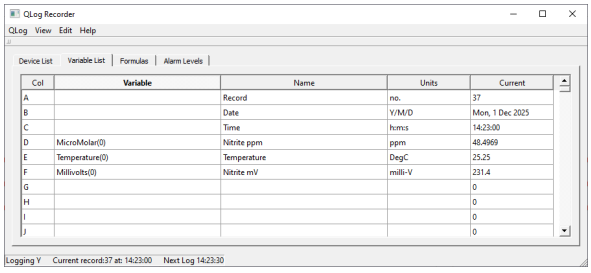


Figure 30 Real-time measurements

In order to observe measurements from the Nitrite sensor, select the '**Start Logging**' option.

The status indicators on the USB-SDI12-AG1 indicator will flash as measurements are sent from the sensor.

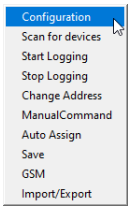
The light level shown is the background level at the time of measurements.

Changing the sensor ID number

It is possible to change the sensor ID number using the QLOG software.

The simplest way is to use the Change Address option from the QLOG software.

Select the 'Change Address' option as shown below.



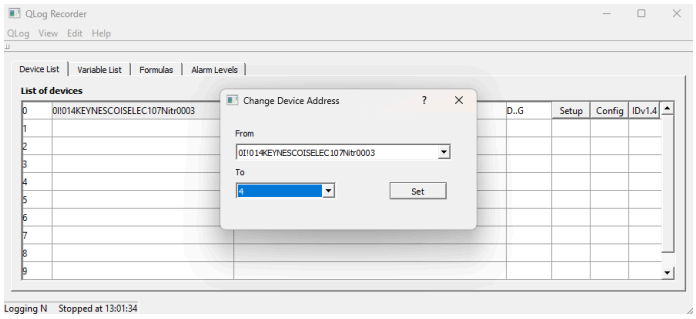


Figure 31 - Change Address Window

The example shows the Change Window configure to adjust a sensor with original ID of 0 to a new ID of 4

Press the 'Set' button to store the new ID.

The QLOG software will scan the network to identify the sensor.

Ensure each sensor has a unique ID number.

Calibration Solutions

Calibrating the ARGES Nitrite sensor requires two calibration solutions, one of 1000 ppm and one of 50 ppm. These solutions are most easily made from a base solution of 1000 ppm.

To produce a 1000 ppm base solution, mix ion salts and deionised water in the following ratios. Masses are provided to make 1 kg of solution.

Chemicals		Ratio	Mass for 1kg	
Ion	Solute		Solute	Water
Nitrite	Sodium Nitrite	1:667	0.15 g	999.85 g

Using these values will provide a solution with a concentration of 1000±1 ppm.

To produce a solution of 1000 ppm, mix 1 gram of the above base solution into 999 grams of deionised water (you may find it easier to mix 10 grams of base solution into 990 grams of water for a 10,000 ppm solution, then mix 100 grams of that into 900 of de-ionised water.

To produce a solution of 50 ppm, dilute a 1000 ppm solution with deionised water in a 1 : 19 ratio.

Sensor Calibration

The calibration procedure used with the Nitrite sensors follows the same procedures as described on page YY for all of the ARGES range of selective ion sensors. The easiest way to calibrate a selective ion sensor is to use the free QLOG software and to set the sensor into configuration mode.

Make test measurements at the 2 calibration points. Record the raw values and sample temperature.
For normal river monitoring the calibration points mentioned above will be satisfactory for many applications. Once some idea as to the levels of Nitrite in the water source is known then the sensor calibration factors can be adjusted to be closer in range and higher accuracy results.

Clean the sensor in deionised water before sampling with the second calibration solution. Make sure the sensor is clean.

Use the temperature sensor built into the ARGES Nitrite sensor to give the sample temperature. When possible, calibrate the sensor at the temperature into which it will be deployed.

Enter the raw Nitrite level as measured by the instrument at the known calibration level (ppm). In the example above this will be for 50 and 1000 ppm calibration points.

To enter configuration mode, press the **Config** button adjacent to the sensor requiring configuration changes as shown in Figure 32.

Figure 32

Sample ARGES Nitrite sensor configuration.

Saving Calibration Information into the sensor.

To store new parameters into the ARGES Nitrite sensor simply enter the new parameter into the table and press the adjacent ‘Set’ button.

If using a Keynes Controls USB-SDI12-AG1 interface then the status indicators will flash briefly indicating that the new parameter has been sent to the instrument.

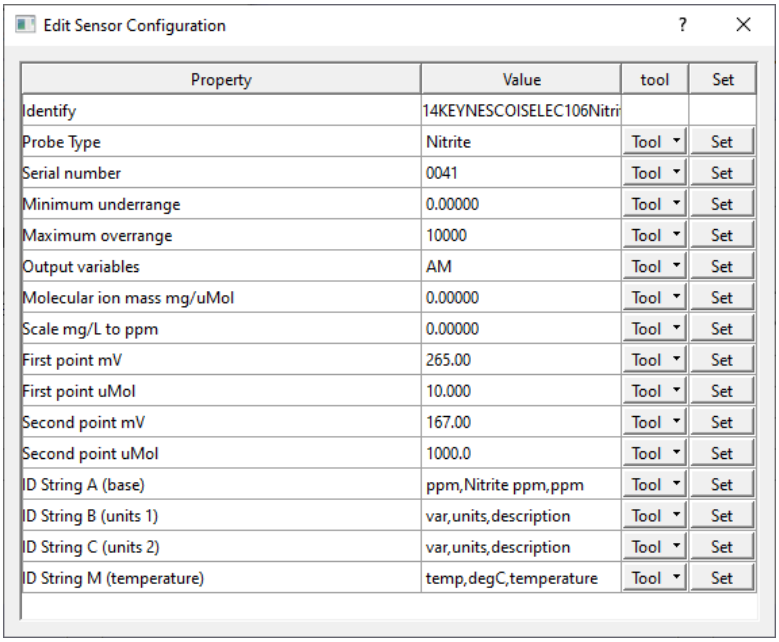


Figure 33 Nitrite Sensor Configuration Window

ARGES Nitrite Sensor Configuration Settings

The ARGEs Nitrite sensor is fully user configurable. Figure33 above shows the Configuration Window for the sensor.

Setting the Nitrite Calibration Parameters

The sensor uses a 2 point calibration system to report measured concentration levels.

First Calibration Point : 50 ppm calibration solution 215.00 mV
Second Point FLR (raw) : 10 ppm calibration solution 22.56 mV

The value of 209 mv is the measurement reported from the ARGES Nitrite sensor in Manufacturer Setup Mode using a 50 ppm test solution. To store new parameters into the instrument configuration select the '**Set**' button.

The ISE sensor requires two calibration points - a high concentration value and a low concentration value. It does not matter if the values are entered high then low or low then high. It is not possible to use a 0 ppm solution for calibration, a nonzero low value must be used.

Maximum Concentration Level

Maximum Overange: Sets the maximum level of measurement that the sensor can return
Maximum Overange: 10000 ppm See Figure 33 above. - this parameter can be adjusted on demand

In this example a ARGES Nitrite sensor has a maximum range of 62,000 ppm before an out of range error message is returned.

The sensor will not return a value greater than 62,000 ppm.

Minimum Concentration Level

Minimum underrange: Sets the minimum level of measurement that the sensor can return
Minimum underrange: 2 ppm - Do not zero calibrate this sensor.

Note - Nitrite sensor will be set to operate from 0 to 10000 ppm only. Should the sensor be calibrated over the range 0 to 100 ppm then the out of range message can be set to operate over the 0 to 100 ppm range.

In practice the sensor operates over a much lower range - 2 - 450 ppm.

Output Variables

The ARGES Nitrite sensor can be configured to return any of the variables listed in Table 1 above. The user has the facility to adjust the measurement parameters being sent out by the sensor..

Figure 34 below shows a sample of the Nitrite sensor Configuration Window where the output variables are assigned.

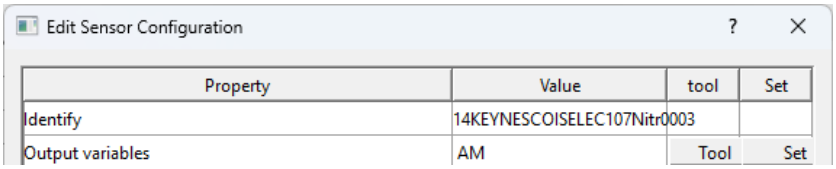


Figure 34 ARGES Nitrite Configuration Window - Return Parameters

aM!aD0! **AM** - returns 4 values for the D0 command.

A = Raw Concentration Output
M = Base Concentration Nitrite

aM!aD1! Command - returns 4 values for the D1 measurement command

Set the output variables to be returned from the sensor using the D1 command Sensor Serial Number.

The sensors have a factory set serial number.

Maximum data type: 16 x alpha-numeric characters.

Additional User Defined Output Variables

The aM!aD1! Command can be used to set additional parameters to be sent out by the sensor

4 user assigned variables are used with this command.

Assign the variables from the Table 1 shown in page 2.

The ability to set the variables.

Calibration Temperature

This is the temperature for which the calibration operations for the sensor were carried out. Under ideal conditions the calibration temperature should be close to the deployment temperature for the chosen water source.

Units : **°C**
Calibration temperature : 18.850 °C

Figure 35 Calibration Temperature Setting - Nitrite Sensor Configuration

Enter the calibration temperature and press ‘Set’ to store the new value into the sensor.

Manufactures Probe Type ID

This is a sensor type as shown on the device list Window.

Caring for the ARGES selective ion sensor

The ARGES selective ion sensors are precision instruments and should be treated with care. It is important that no trace of a previous sample is left on the instrument as it can affect future readings.

1. Clean the sensor using distilled / de-ionised water and dry with a soft cloth.
   Make sure the channel between the nitrite half cell and the reference is clean before deployment.

2. Check that the 5 way connection fitted onto the top of the sensor is clean and free of debris/
   Remove any debris found between the pins and wash with distilled water. Tap water can be used if required.

Should the sensor have been deployed into a heavily contaminated water source then soak the sensor in Isopropanol Alcohol. This will kill any bacteria left on the sensor housing.

Figure 36

Figure 36 shows the head of the nitrite sensor head.

Figure 37

Figure 38

Figure 37 shows the 5-Pin connector fitted onto the selective ion sensors.

Figure 38 shows the sensor fitted inside a multiparameter housing. A brush unit can be used to clean the sensor heads between measure operations.

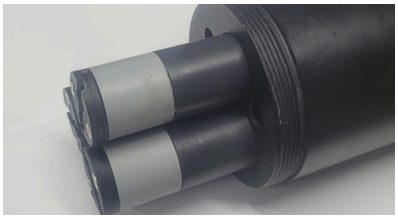


Figure 39 - 3 x selective ion sensors inside a multiparameter housing.

Remove the shade cap and clean the sensors fitted into a multiparameter housing.

Use deionised water when possible. Dry with a soft cloth

Remove any contamination and detritus before redeployment.

Dimensions

Figure 39 shows the dimensions of the sensor, which are the same for all ARGES selective ion sensors.

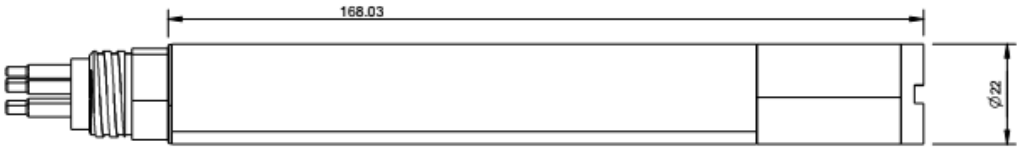


Figure 39

Sensor Deployment

Figures JJ to LL show the ARGES Nitrite sensor prepared for direct deployment into the water source. Make sure the network cable is attached and secured onto the instrument. The sensor can be directly connected to the USB media converter for use with a Windows computer system. The sensor can be directly into a data logger using the SDI12, or RS485 communication networks.

Fig JJ

Fig KK

Fig LL

Multiparameter Sensor Deployment

The ARGES Nitrite sensor can be fitted into a multiparameter housing. Use silicone grease on the 5 pin connector to ease the installation onto the housing socket.

The sensor can be fitted into any spare port in the housing. Secure the protective housing shade cap to the base unit Once the network cable is attached the multiparameter sensor system can be deployed.

Fit the shade cap supplied with the housing when deploying as a multiparameter system into a water source in order to protect the sensor heads from damage and debris.

Charts and Panel Meters

The QLOG software can be configured to show real-time measurements on panel meters and charts as shown below

Select the '**View**' tab from the main QLOG window to select the panel meter and chart options.
The charts support up to 2 Y axis parameters, so Nitrite and temperature values can be shown on the same plot.

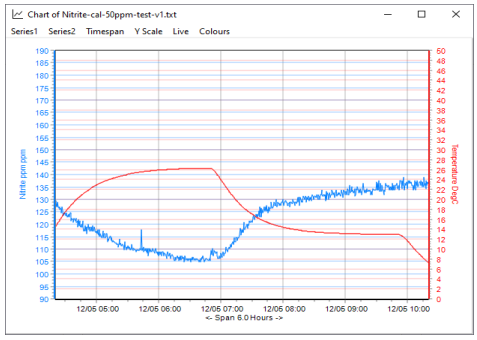


Figure 40

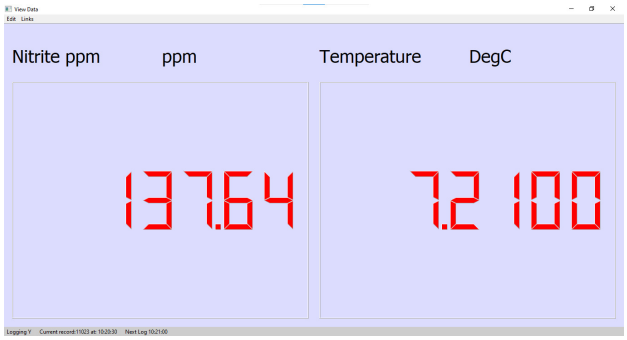


Figure 41

SDI12 V 1.4 Features

In order to use the SDI12 V1.4 for any sensor they have to be already identified on the network and setup. See page 9 Figure 28 above.

Figure 42

The Window in Figure 41 will appear. Let all the parameters in the table be downloaded from the sensor then press the 'Update' button. The status LED indicators on a USB-SDI12-AG1 media converter will stop flashing once all of the parameters have been sent.

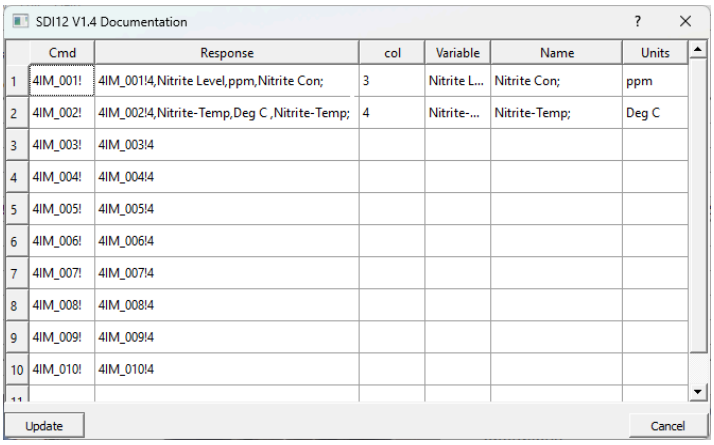
The ARGES Nitrite sensor will report the measurements into QLOG with the SI units for area measurement automatically defined.

SDI12 V1.4 assigned SI Units

The ARGEs Nitrite sensor supports the SDI12 V1.4 protocol and as such supplies measurements directly in SI units.

The SI units for the Nitrite sensor are shown in Figure 41 opposite.

To store any changes into the sensor select and press the 'Update' button.



	Cmd	Response	col	Variable	Name	Units
1	4IM_001!	4IM_001!4,Nitrite Level,ppm,Nitrite Con;	3	Nitrite L...	Nitrite Con;	ppm
2	4IM_002!	4IM_002!4,Nitrite-Temp,Deg C ,Nitrite-Temp;	4	Nitrite-...	Nitrite-Temp;	Deg C
3	4IM_003!	4IM_003!4				
4	4IM_004!	4IM_004!4				
5	4IM_005!	4IM_005!4				
6	4IM_006!	4IM_006!4				
7	4IM_007!	4IM_007!4				
8	4IM_008!	4IM_008!4				
9	4IM_009!	4IM_009!4				
10	4IM_010!	4IM_010!4				

Figure 43

Figure 41 is the SDI12 V1.4 configuration for the Nitrite sensor.

Supported Commands

Table 22 below lists the commands supported by the Nitrite Sensor

Start measurement	aM!	a05\r\n where 05 = time delay before measurement sent
Send ID	aI!	a14KEYNESCOISO000014\r\n Part description assigned by Keynes
Address Query	?!	Where a = ID number - 0 - 9 (standard) / (a..z) Enhanced SDI-12 0 - 9 / a - z for RS485
Change Address	aAb!	where a = Initial address and b = Final address
Start Measurement	aM!	Make a measurement - a = address of sensor Example 1M! starts a measurement for sensor with ID=1
Set Output Variables	XCSTR0	Sets the parameter order for measurements sent from the sensor - factory set BCDM
Read Serial Number	aXSN!	Instrument Response a+Serial-number
Calibration Date	aXCD!	Instrument Response a+date
First Calibration point (ppm)	XCA0	Typical value = 1000 ppm
First point uncompensated (mV)	XCA1	Typical Value = 132.65
Second point electrical (ppm)	XCA2	Typical Value = 50 ppm
Second point uncompensated mV)	XCA3	Typical Value = 23.56 mV
Temperature Compensation % per Deg-C	XCA20	Typical 0.25 % per/Degree C
SDI12 V1.14 (Default factory settings)		
String ID = A	XVIDS0	Nitrite-level,ppm, Nitrite Concentration!
String ID = B	XVIDS1	Nitrite-temp, Temperature Nitrite Deg C

Device List

Figure 44 shows the ‘Device List’ Tab.

All sensors identified on a network are listed here.

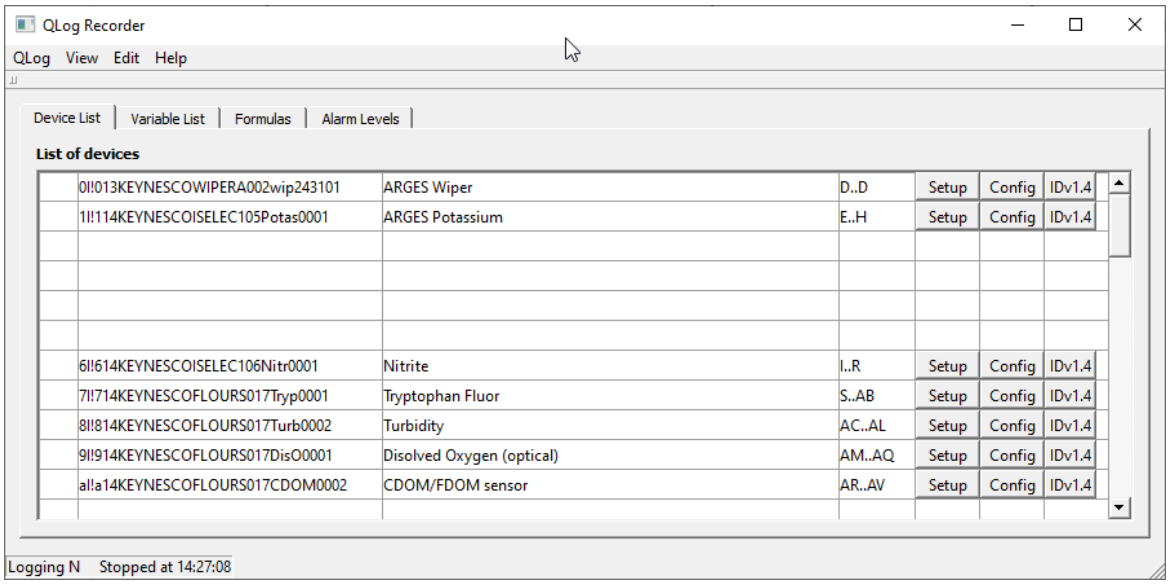


Figure 44

QLOG Charts & Panel Meters

Use the ‘View’ Tab to select and configure the real-time charts and panel meters.
The QLOG software supports up to 4 x dual Y axis real-time charts.

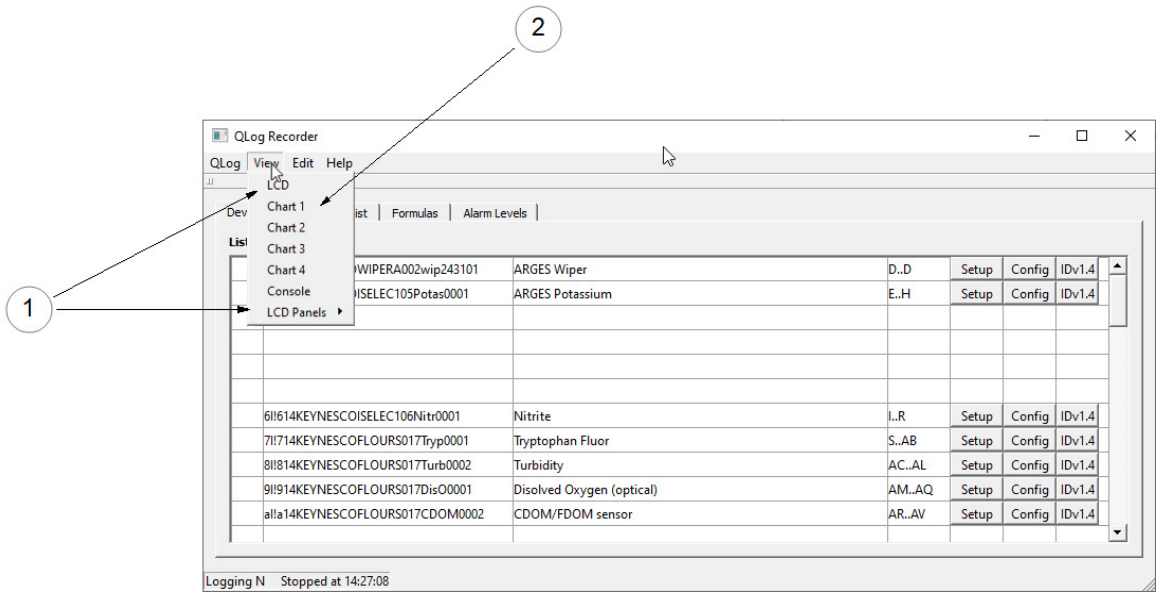
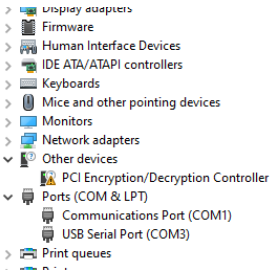


Figure 45

1 = Panel Meter Selection
2 = Charts Selection

Windows 10 Device Manager Window



The USB-SDI12-AG1 media converter used in the examples above is shown identified as

USB Serial Port (COM 3)

as shown in the image opposite.

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