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# USER MANUAL

Model 620 Water Quality Data Logger

Version 1.3

Date 1/5/2019

# WARNINGS

## DEPLOYMENT WARNING:

***Always remember to tighten the cap on the top before deployment otherwise the model 620 is not be water tight!***

## EXPLOSION WARNING:

***In a particular combination of circumstances where salt water comes into contact with batteries an explosion may result. If the probe is damage and water ingress is possible the probe should be kept dry and returned to Yeo-Kal Electronics to be repaired.***

## SCREW CAPS:

***When/if deploying the probe with the cable disconnected it is important to install the screw cap on the top connector. Tighten firmly for o-ring seal- over tightening will not improve the seal and may weaken it and make it hard to unscrew!***

***If the probe is fitted with auxiliary sensors ensure the cable from the external sensor is screwed tight.***

# Contents

# Introduction

The model 620 comes already assembled. The only assembly is connecting the logger to the battery charger or to the PC by cable supplied.

## General Description

The model 620 is a fully submersible water quality data logger designed for unattended deployment. The unit is an ideal tool for long term deployment where accuracy and reliability are required - can be used in a wide variety of application including water ways, bore holes, sea, dams and ponds. The machined PVC and stainless steel assembly makes this data logger tough and durable.

The instrument consists of a multi-sensor probe which has internal memory and batteries so it can both store data and output in real time.Communication to and from the probe is in half duplex serial where data is transferred to the PC using serial communications giving reliable, interference free measurements and also commands are sent to the logger using the same interface. Commands sent and data received are handled by the accompanying PC Windows® software. The calibration routine is also handled with the software.

The model 620 comes with storage container to protect the sensors while the instrument is in storage.

## Specifications

| | |
|---|---|
| Memory: | Non volatile memory for full capacity of 20800 samples. |
| ADC bits: | 18bit |
| Sample Rate: | Logging from 1 per 10 seconds |
| | Real time: 8 sensors - 1 per second or 12 sensors 1 per 2 seconds (approximate times) |
| Communications: | Baud rate 9600, 8 data bits, No parity, 1 stop bits (8-N-1) (baud of 4800 available in settings) |
| Power: | Nickel metal hydride pack with 4500mAH or |
| | Lithium ion battery pack with capacity of 3520mAH |
| Material: | Machined grey PVC and stainless steel |
| Dimensions: | 511mm X 68mm diameter. Suspension bracket makes diameter 82mm. |
| Weight: | 2 kg |

**Sensors:**
**Temperature**
Range: -2 – 50°C

Accuracy: ±0.05°C

Resolution: 0.01°C (0.001°C possible through settings)

Type: pt 100 platinum element

**Conductivity**
High Range: 0 - 80 ms/cm (note use low range for low values)

Accuracy: ±0.05 ms/cm

Resolution: 0.02 ms/cm

Low Range: 0-8000 us/cm

Accuracy: ±5 us/cm

Resolution: 1 us/cm

Type: Four electrode cell

**Salinity**
Range: 0 - 60 ppt

Accuracy: ±0.05 ppt

Resolution: 0.02 ppt

Type: See Appendix 1 - Conversions Used

**Dissolved Oxygen**
Range: 0 - 200% saturation
0 - 20 mg/l

Accuracy: ±0.5%

Resolution: 0.1%

Type: Active silver and lead electrode sensor with PTFE* membrane and built-in stirrer

**Turbidity**
Range: 0 - 600 ntu

Accuracy: ±0.5 ntu (0 - 300 ntu range)
±5 ntu (300 - 600 ntu range)

Resolution: 0.3 ntu

Type: Nephelometric measurement from a 90° sensor with pulsed infra-red light source

**pH**

Range: 0 - 14

Accuracy: ±0.03

Resolution: 0.01

Type: Combination silver/silver chloride type with sintered Teflon* junction

**ORP**

Range: -700 mV to +1100 mV

Accuracy: ±10 mV

Resolution: 1 mV

Type: Combination bare metal electrode common reference junction with pH electrode (see Appendix 1 - Conversions Used)

**Depth (optional)**

Range: 0 - 100 m or
0 - 150 m

Accuracy: ±0.5% of full scale

Resolution: 0.1 m

Type: Dual active silicone strain gauge

**Auxiliary inputs**

Input: 4 X 0-5 volts each input

**Physical**

Cable length: 5m. Other lengths made to order.

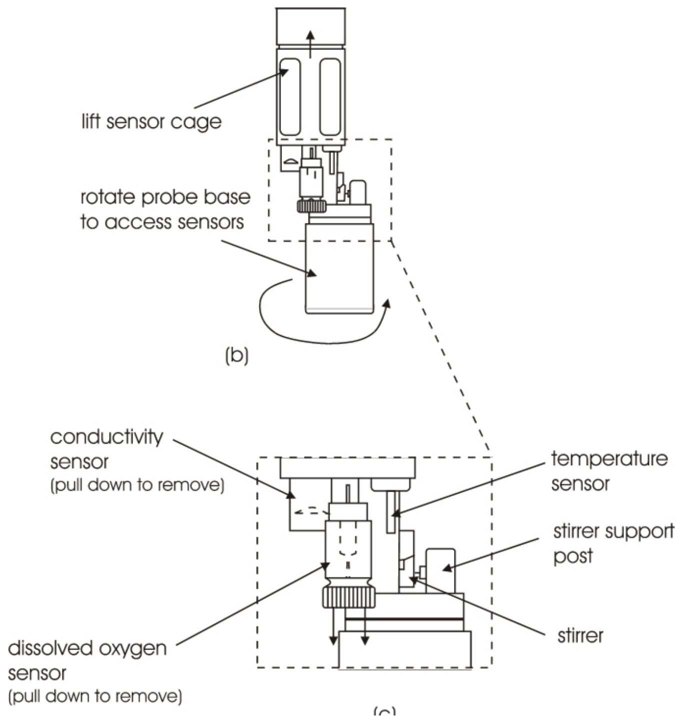
# Description of Sensors

The probe assembly consists of the pivoting suspension bracket, cable connector, probe body, top sensor housing, sliding sensor guard and bottom sensor housing. The body of the probe is made of PVC with a PVC sensor guard.

The sensors can easily be accessed by sliding the sensor guard up and rotating the bottom section of the probe.

The conductivity and dissolved oxygen sensors can be removed for servicing. However, the whole unit must be **thoroughly dry** before these sensors are removed to strictly avoid getting moister in the sockets. A cotton bud or paper towel can be used to dry the spaces in between the sensors.

Expanded view of sensors with dissolved oxygen sensor detached.



**Temperature Sensor**
The temperature sensor consists of a pt 100 platinum element, housed in a stainless steel sheath for robustness and corrosion resistance. The temperature sensor requires little maintenance, however the temperature measurement is used for calculating the dissolved oxygen in mg/l and for temperature correction of the conductivity sensor, so it is important that the temperature sensor is properly calibrated.

**Dissolved Oxygen Sensor**
Dissolved Oxygen is measured using an active type membrane covered sensor. The sensor itself consists of silver and lead electrodes and a 25um PTFE membrane and is filled with a 1.0M potassium hydroxide. A constant flow of water passes the sensor, maintained by a stirrer located on the bottom section of the probe.

When the silver and lead electrodes are connected through the external circuit, electrons pass from the lead electrode to the silver electrode. When oxygen is present at the surface of the silver electrode, it reacts with electrons to produce hydroxyl ions.

At the lead electrode the loss of electrons produces lead ions. The lead's electrons combine with hydroxyl to precipitate lead hydroxide on the lead electrode.

The rate of transference of electrons via the external circuit from the lead to silver electrode ie that is the current flowing in the external circuit, is the measure of the rate of cell reaction and thus the rate at which oxygen reaches the silver electrode. The current flowing in the external circuit is directly related to the oxygen concentration in the sample being measured by the electrodes.

The Dissolved Oxygen sensor may periodically require a new membrane and electrolyte. A unique knurled nut is used to hold the sensor membrane in position without overstressing the membrane. This gives long term stability and allows easy replacement. The sensor can be removed from the probe for servicing. A replacement probe is ready for use immediately after installation and calibration.

**Conductivity Sensor**
The conductivity is measured using a 4 electrode bridge. The four electrode system uses automatic compensation to overcome any build up of contamination on the electrodes. The electrodes are made from fine platinum and are coated with platinum black to enhance the long term stability and sensitivity of the sensor. The coating should last for a long period of time if it is not mechanically removed, however, the coating can be replaced by returning the sensor to YEO-KAL Electronics Pty Ltd.

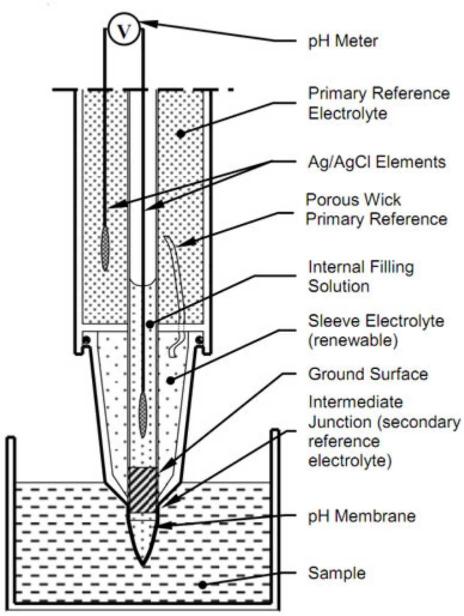
**Turbidity Sensor**
The turbidity sensor is located in the hole which runs through the bottom section of the probe and is lined with a glass tube. Turbidity is measured by the nephelometric method which uses a light source and a detector measuring the light scattered at 90 degrees to the incident light beam. A pulsed infra-red light source is used. A Turbidity screen has also been installed which has apertures to reduce bounce off the glass wall and remove refraction from samples high density (sea water).

**PH/ORP Sensor**

The pH and oxidation reduction potential (ORP) are measured using separate pH sensor and bare metal platinum electrode for ORP. They both share an internal reference electrode in the pH sensor.

**pH - Standard non-fill able:**These pH sensors require the least maintenance, only to be stored clean 3 MOL KCL. Their design is a double junction type to protect the primary junction from dilution and contamination.

**pH - Optional refillable:**Theseoptional pH sensorshave a refillable secondary junction for sensor maintenance. As the electrolyte has a higher flow it requires regular electrolyte top up and calibration. This type of sensor is faster in responding and helps combat accumulation of internal contamination.




**Auxiliary Sensors**

The probe would be fitted with an expansion housing usually featuring an external sensor clamp and bulk head connector for power and communications/sensor voltage.

**Auxiliary Sensor Electrical Characteristics:** Signal voltage required is 0 to 5 volts. The output voltage can either be wired for battery voltage (7 -8.4V) or 5 volts regulated.

**Auxiliary Sensor water proof cap:**If the external sensor is removed it is important to use the supplied screw cap which will keep water out of the connector.

# Maintenance

## D.O. Sensor Maintenance

To maintain the performance and accuracy of the dissolved oxygen sensor, the membrane should also be replaced if it becomes damaged or contaminated with organic matter. Clean the membrane with cotton wool saturated with alcohol

**Changing the Membrane**

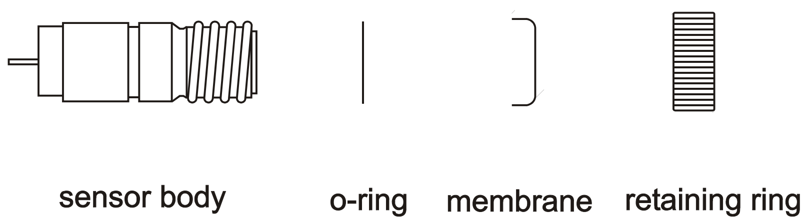



Figure 5: Exploded view of dissolved oxygen sensor.

To change the membrane, perform the following steps, refer to figure 5.

1. Remove the dissolved oxygen sensor from the probe. To do this, lift the sensor guard and rotate the bottom section of the probe to expose the sensors. Ensure that the probe and sensors are completely dry. Use a cotton bud or paper towel to dry the area between the sensors. Using a flat screw driver, lever the dissolved oxygen sensor out of the probe.
2. With the sensor removed, unscrew the retaining ring and remove the old membrane.
3. Check the O-ring and discard if it is damaged then flush out the old electrolyte with distilled water.
4. To refill with electrolyte (1.0 M KOH), hold the probe vertical and place the nozzle of the squeeze bottle above and beside the silver electrode. Squeeze the bottle to fill the probe with electrolyte until it flows over the top of the sensor.
5. Be sure that there are no bubbles inside the sensor. Tapping the side of the sensor (with a ruler) can help dislodge any trapped bubbles.
6. Again add more electrolyte to form a meniscus.
7. Take a new membrane in hand and centralise it on top of the electrode and let it float on the surface.
8. Place the retaining nut over the membrane and screw down firmly so that the membrane is well tensioned.
9. Check that there are no bubbles in the electrolyte. If bubbles are found, repeat the above procedure from step 5.
10. Apply a smear of O-ring grease to the o-ring of the sensor and push it back into the probe. Be sure not to damage the membrane and be sure to push the sensor in until it cannot go any further.

11. **Wait at least 2 hours for the sensor to stabilise** then recalibrate the dissolved oxygen readings. This step is vital as the oxygen inside the sensor needs to be fully used before a reading can be taken.

**Dissolved Oxygen Stirrer Maintenance**
The Stirrer for the dissolved oxygen sensor is a magnetically operated paddle which oscillates and forces water past the sensor membrane. This stirrer may occasionally become clogged, particularly if the water you are testing contains a large amount of magnetic particles. To remove the stirrer paddle for cleaning, proceed as follows:

1. Lift the wire clip off the post and push to the opposite side.
2. Again lift the wire clip and rotate the paddle towards you so the clip may pass by. A small black spacer will be dislodged and will need to be retained for reassembly.
3. Pull the wire clip out. As this happens the stirrer and the opposite small black spacer will come free.
4. Clean the paddle and replace it in the reverse order.

## pH/ORP Sensor Maintenance

Before use:

- Always remember to remove the protector cap (cream in colour).
- Electrochemical sensors change over time so calibration before field use will provide the best accuracy.

After use:

- Always rinse the probe and sensors of dirt, debris and sample liquid.
- Replace protector cap (cream in colour) filled with a bit of ph probe keeper.

**Standard non-refillable sensor:**This sensors requires maintenance if there is a build up of contamination on the glass membrane. A clean damp paper towel carefully wiped over the glass will clean this sensors glass membrane. If the electrolyte becomes contaminated or depleted of electrolyte the sensor will require replacement.

**Optional refillable:** This optional sensor type has a refillable secondary junction. Also as the electrolyte has a higher flow rate it requires regular electrolyte top up and calibration. By refilling the electrolyte from the bottom this will displace the old electrolyte which will help slow contamination from occurring.

**Warning: Abrasive damage (including scratches) to the pH glass will reduce the sensor performance.**

The above maintenance is recommended prior to calibration. Follow a 2 point calibration procedure for your water quality analyser. In some clean circumstances it is feasible to calibrate without maintenance. A prolonged period of no maintenance will affect the reference and may cause the centre offset to drift – meaning mid values may read high or low.

**Storing**

Do not store pH sensor in water as it will deplete the ions.

Do not let the pH sensor dry up.

Always rinse of contaminates and store clean.

Ensure there is some pH probe keeper in the protector cap before replacing on the ph sensor.

## Turbidity Sensor Maintenance

The turbidity sensor requires little maintenance except ensuring that the turbidity screen (a black acetyl optical screen) be kept free of accumulated grit and mud and every so often it should be removed and cleaned. The glass tube should also be cleaned with a damp paper towel or a small bottle brush. Recalibration of this sensor after cleaning is required.

Removing the screen is achieved by unscrewing the two retaining screws at the bottom of the probe, situated on the flange. Pull the black screen out and wash it and also clean the glass tube. Reinsert the screen and do up the two retaining screws – an orientation mark exists which should face the centre of the probe.

## Conductivity Sensor Maintenance

To maintain the performance and accuracy of the conductivity / salinity sensor, the electrodes need to be periodically cleaned and if the platinum black coating is damaged, the electrodes will need to be re-platinised.

Inspect the sensor on a regular basis. If there is any evidence of a build up of contamination on the electrodes, then the sensor should be removed and cleaned using the platiniser unit as described below. If the platinum black coating is damaged, the electrodes should be cleaned and then re-platinised. To perform these operations, proceed as follows:

1. To remove the sensor, lift the sensor guard and rotate the bottom section of the probe to expose the sensors. Ensure that the probe and sensors are completely dry. Use a cotton bud to dry the area between the sensors. Pull the conductivity sensor down out of the probe by hand. Do not twist the sensor. Ensure that the vacant sensor socket is kept completely dry.
2. To clean the electrodes, plug the sensor into the platiniser unit. Connect the unit to a 6V power supply (such as a lantern battery). Fill the platiniser with 0.1M HCl and switch on the platiniser for 5 minutes. Switch off the platiniser and rinse with distilled water. Now inspect the electrodes. If the platinum black coating is intact, replace the sensor in the probe assembly as described in step 5 below. If the electrodes need to be re-platinised, proceed as follows.
3. To strip the old platinum black coating from the electrodes, plug the sensor into the platiniser unit fill with 5M HCl. Connect the unit to a 6V power supply and switch the unit on. The old platinum black will be stripped off the electrodes. Once completed, switch the platiniser off and rinse with distilled water.
4. To replace the electrode coating, plug the sensor into the platiniser unit and connect to a 6V power supply. To make the platinising solution, mix 3g of chloroplatinic acid with 0.3g of lead acetate and top up to 100ml with distilled water. Fill the platiniser with platinising solution and switch the unit on for 10 minutes. The electrodes will be plated with a sooty black coating. When complete, rinse the unit and electrodes with distilled water then fill the unit with 0.1M HCl and switch on for 2 minutes to remove any occluded platinum black solution remaining on the electrodes. Rinse the sensor and platiniser with distilled water and install the sensor in the probe assembly.
5. Before installing the conductivity sensor into the probe assembly, make sure that both the sensor and probe assembly are dry. Apply a smear of vacuum grease to the sensor body to

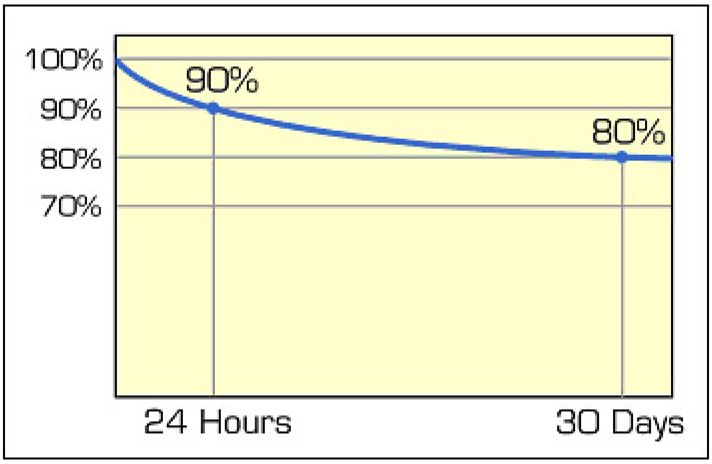
ensure that a water tight seal is achieved. The sensor can only be installed with the connector pins aligned. Align the sensor and push it into the probe assembly. Be sure to recalibrate the salinity and low conductivity.

# Battery

## Alkaline Batteries 6 off C size

The battery voltage may be checked in the software by pressing the Check Logger button. The nominal battery voltage is 9.0 volts however the actual voltage will range from 9.6volts down to the cut off of 7.5 volts.

It is important to note that these batteries have a self-discharge effect and also use less than 1ma of current when stored. The batteries will last at least 6 months while connected. However if the unit is going to stored for long periods disconnect the battery.




| Battery Life for various logging sample rates<br>When logger is fitted with fresh batteries | For 6AH Battery as 6000*60=360000mA Mins<br>1 min 1 sample; real time<br>80mA\6000*60/80=4500 samples |
|---|---|
| 1 sample per day | 6 months |
| 1 sample per hour | 6 months |
| 2 samples per hour | 3 months |
| 3 samples per hour | 2 months |
| 4 samples per hour | 1 month |

## Alkaline Batteries

**WARNINGS:**
**All care should be taken when removing batteries**

**Short circuiting:** Ensure the battery pack cannot short circuit. Batteries are dangerous when under short circuit.

**Peirce or puncture:**The batteries are dangerous if pierced or punctured.

**Over tightening:** This will make it difficult to unscrew and is not necessary for a good o-ring seal!

**Under tightening:**If too loose and no seal then the probe will be flooded.

**Cross threading:**Ensure thread is correctly engaged before screwing tight. If not correctly engaged the thread will be cross threaded and damaged.

**Connectors:** Connector wires are small and can be damaged. Always pull the connector apart by holding the connector not the wires.

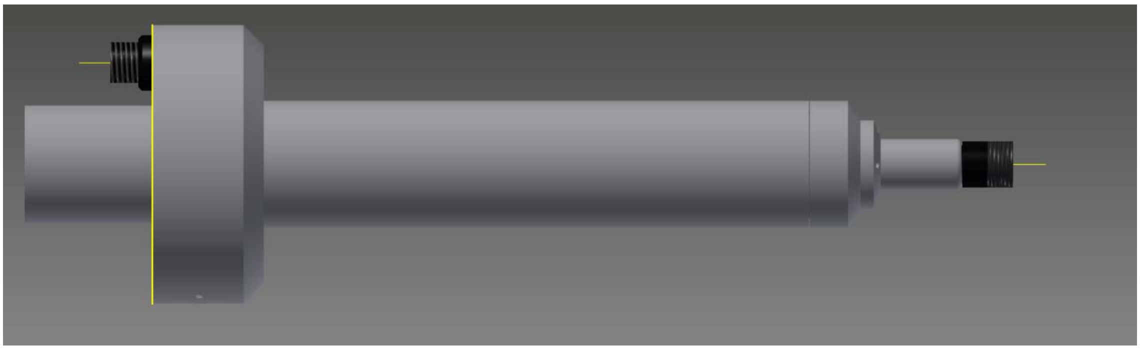
The battery voltage may be checked in the software by pressing the Check Logger button. The nominal battery voltage is 9.0 volts however the actual voltage will range from 9.6volts down to the cut off of 7.5 volts.

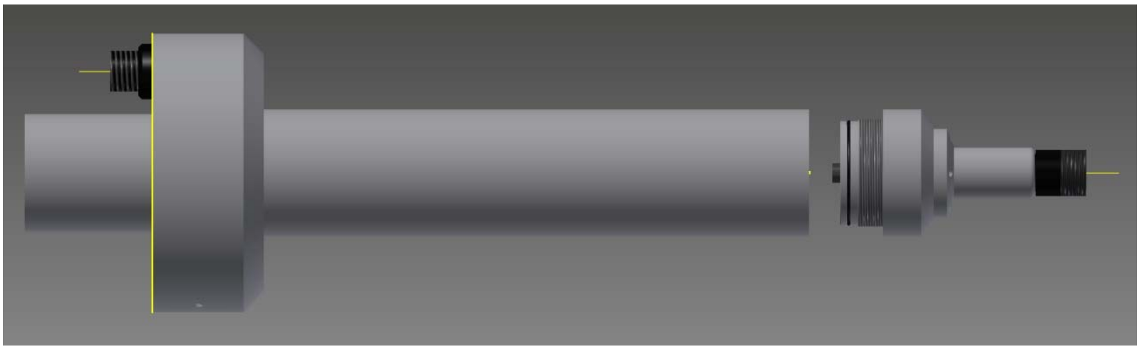
The battery chemistry is alkaline which have some specific qualities

- When not using the probe disconnect the battery.  6 months life when connected
- Do not leave discharged batteries installed in logger for extended periods

**Getting to the battery pack:**

1. Remove cable from top connector.
2. *CAREFULLY UNSCREW* top of probe exposing connectors for battery, main power for probe and communication. Internal wires are small and will not support the weight of the probe or top housing.





3. Track wires from battery and carefully disconnect at the connector. Pull the connector apart when holding the connector not the wires.
4. At this point the battery pack can be pulled out and swapped
5. Install Battery:

1. Collect/bundle wires from inside probe cavity together.
2. Push battery pack into cavity guiding the probe wires to one side of the battery pack.
3. Push connector from battery pack down one side between the battery and the cavity wall to get it out of the way.
4. Push top cover into position and screw round knurled nut down
5. It is a good idea to rotate counter clockwise till the thread gets to the start of the thread (can be a small click felt or heard). Rotate in the clockwise direction to tighten thread.

Ensure thread is engaged to avoid damage from cross threading. If the thread becomes tight just as engaging then unscrew to avoid damage and retry.

6. There are 2 o-ring seals in this connection. The amount of torsion required to correctly tighten is till the top and probe body are flush. Not loose but just bit more!

# Connecting

The model 620 will communicate with the PC with the communication software, however it has a number of commands which be used to create a non standard /customized deployment.

## Connecting to the PC

Connect the USB adapter to the Windows PC. If available, a driver will be activated and a COMS (communication) port number will be assigned. If a driver installation is required an computer administrator is required to install the driver. The driver can be downloaded from www.yeokal.com.au > Manual/Downloads >Drivers & Software>Prolific USB Adapter Driver.

http://yeokal.com.au/downloads/software/PL2303_Prolific_DriverInstaller_v110.exe

Note: Each USB port assigns a different COMS port number.

Connect the communication cable to the probe and tighten the knurled ring (not too tightly!). Connect the other end to the USB adapter into the computer.

## Communication specification:

Baud: 9600

Data bits: 8

Parity: N

Stop bits: 1

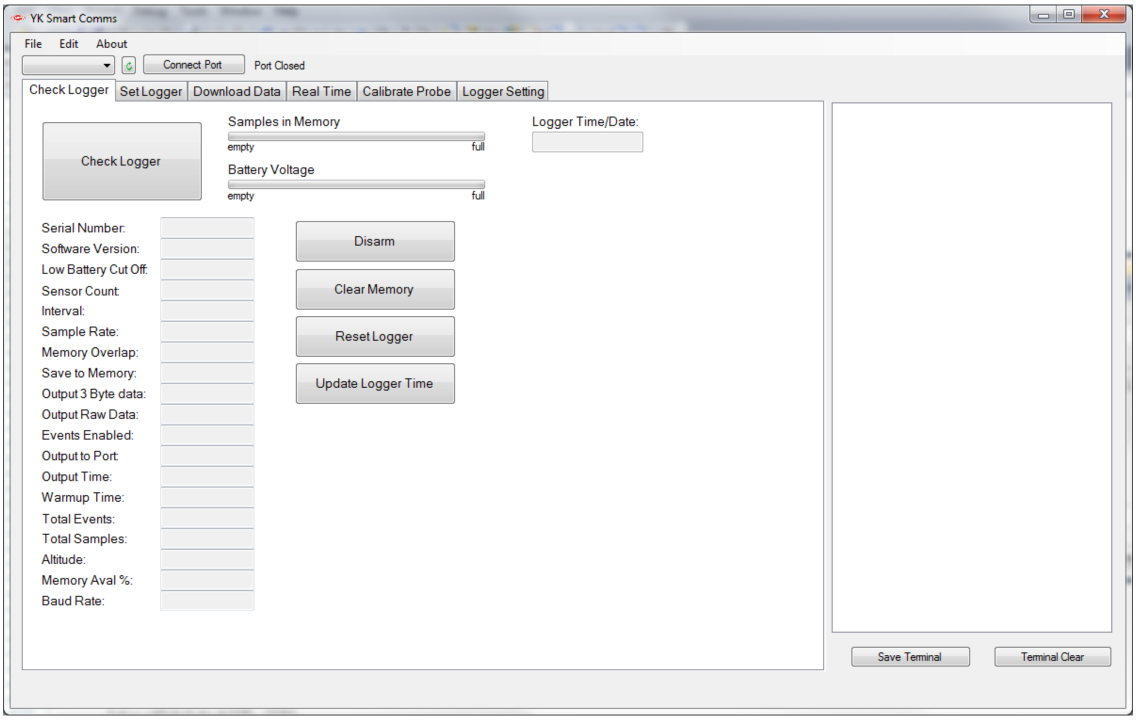
Advanced command list available on application.

## Communication Software

Once the USB driver is installed, start the communication software YK Smart Comms. YK Smart Comms is a program that will run from the single file (no installation is necessary) which is best copied and run from the Desktop. It is not recommended to run from the CD or flash drive as the software saves settings to the computer and requires a writable destination.

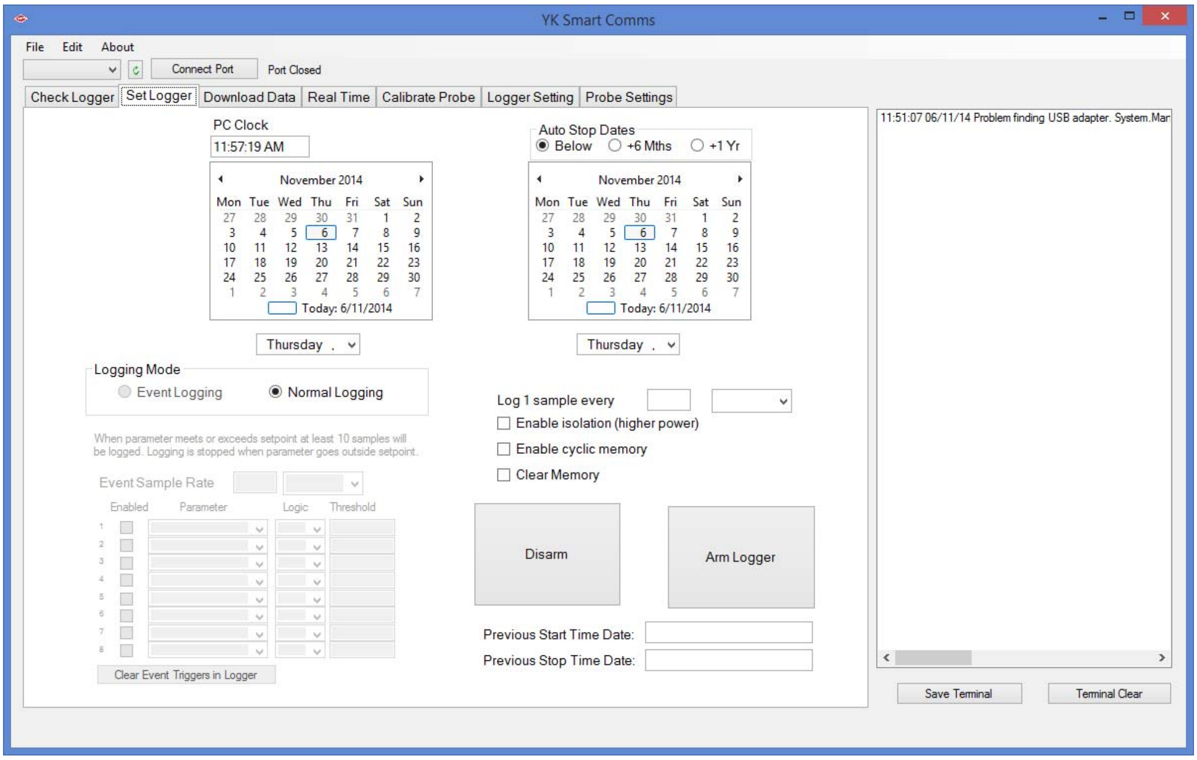
When the software starts and the USB cable is connected; the COMS port will be automatically selected and opened and the ready to communicate with the 620.

# Check Logger:




Press check logger button to check battery and the status of the 620.

# Set Logger:




Used to arm the model 620 data logging features for deployment. Choose start and stops times and dates and select the sample rate.

**Enable isolation:** Usually off unless being deployed with cable attached. Uses high battery power.

**Enable cyclic memory:** When disabled and the memory goes full the logging will stop. When enabled the memory will act like a circular buffer.

**Clear memory:** When the armed the memory will be cleared.

**Arm Logger button:** This will arm the 620 with the selected settings.

**Disarm button:** When armed the only way to communicate with the 620 is by first disarming.

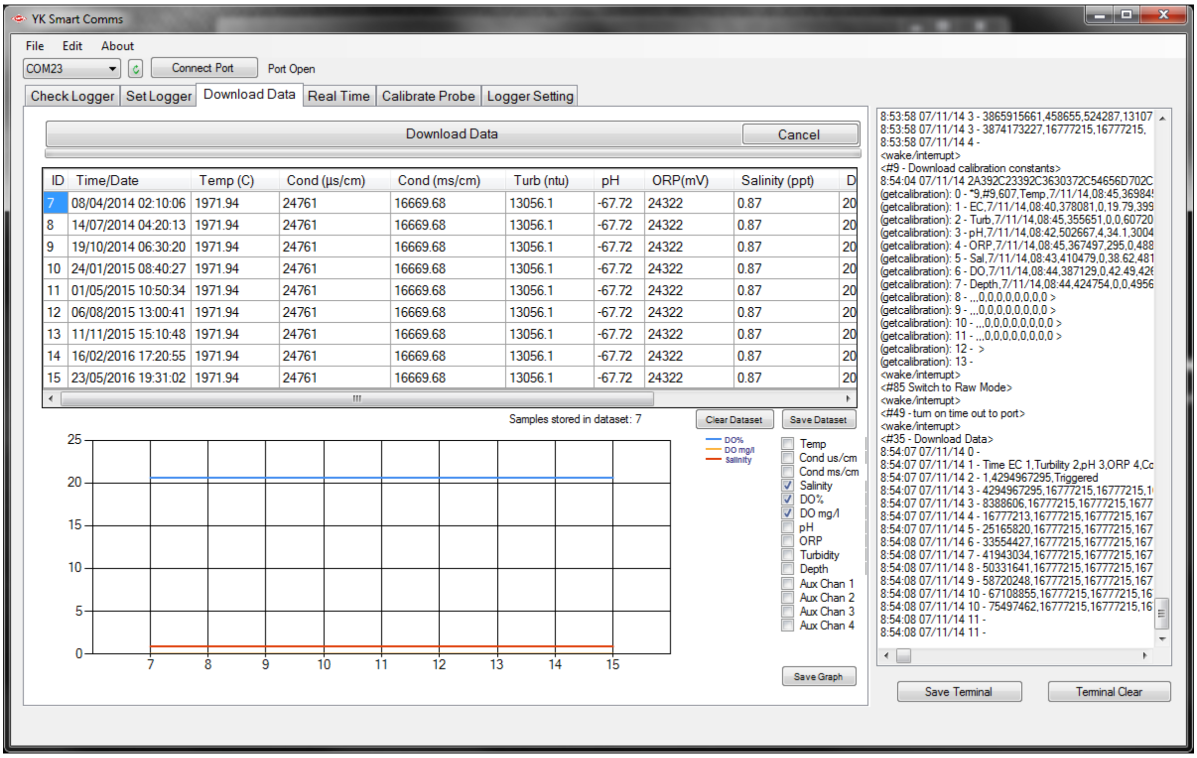
***Note: Before arming logger it is best to untick "Enable isolation" to save battery power while logging unless an external power supply cable is used!***

**Procedure:**

Click on start and stop dates then click onto sample rates (seconds, Minutes or Hours. The faster the sample rate the faster the battery will be depleted and unit will shut down.

Click Arm Logger and follow instructions

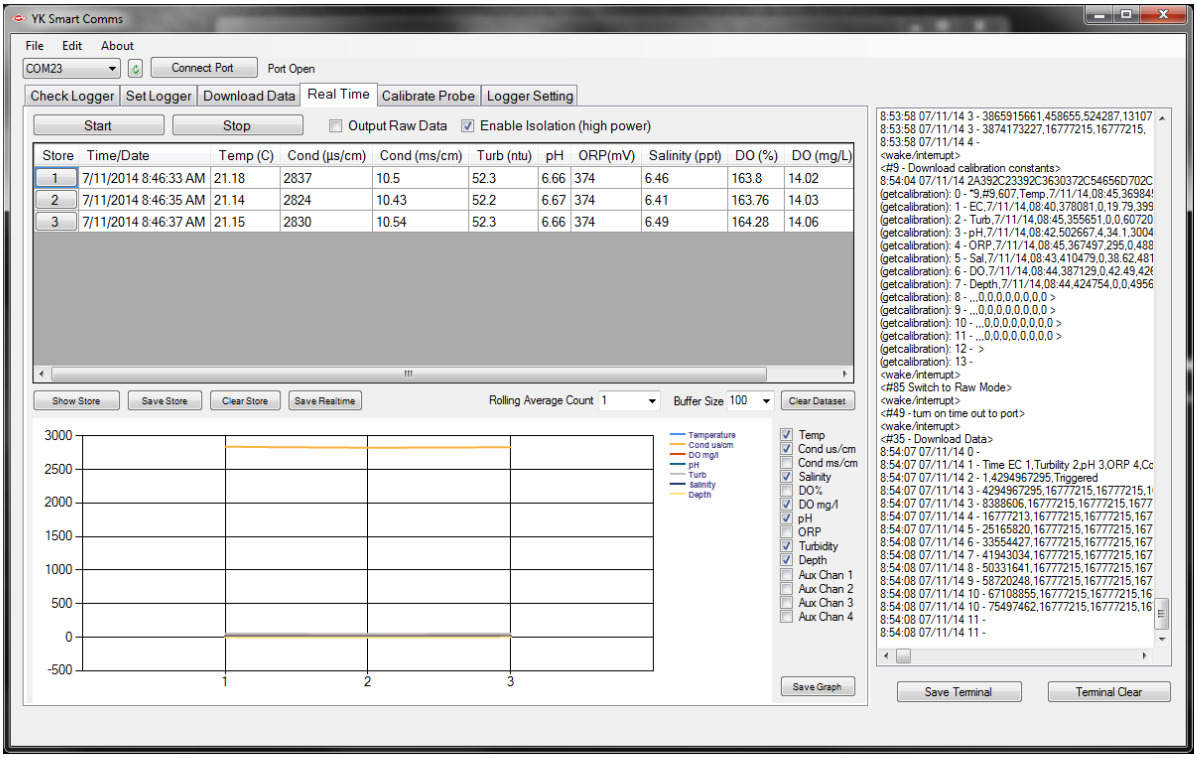
# Download Data:




**Download Data button:** Press to download the data from the logger. 1st logger status is queries, 2nd calibration constants are downloaded, 3rd data is downloaded.

**Cancel button:** to interrupt the data download.

# Real Time:



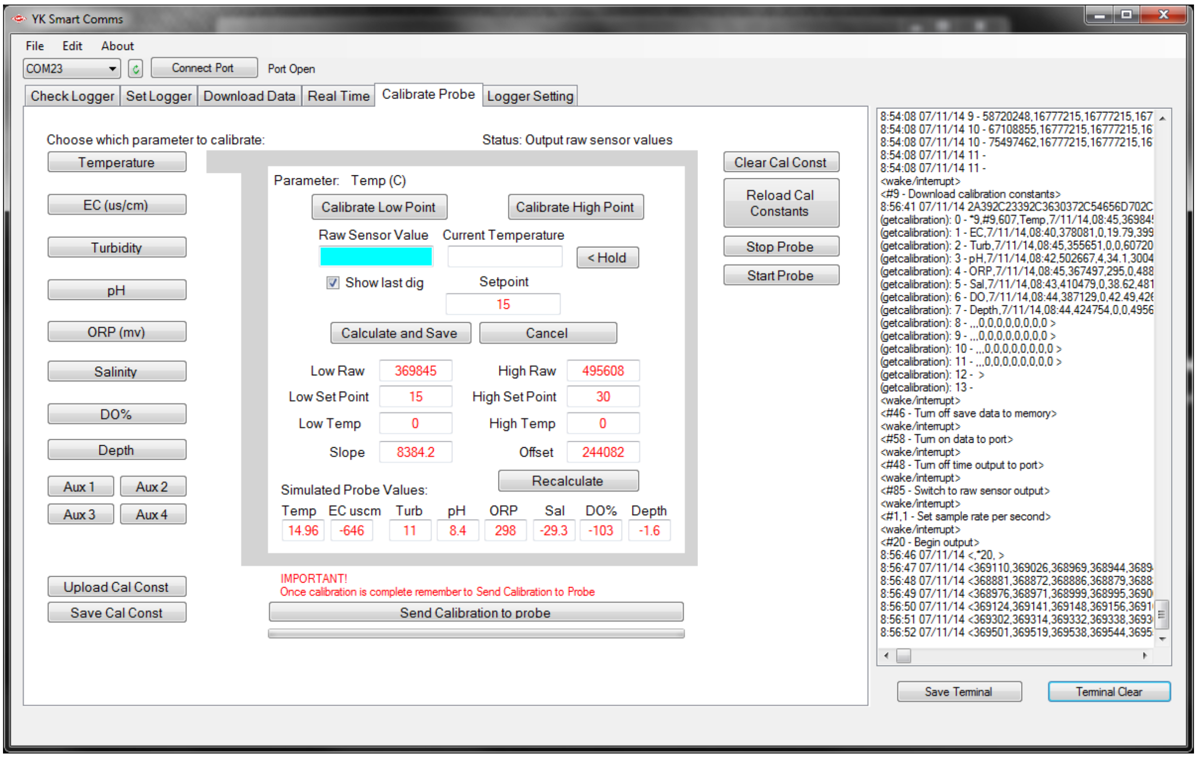

**Start button:** Configures and starts the real time data stream from the probe. The DO stirrer will be started confirming the commands have been received.

**Stop button:** Stops the real time data stream. The DO stirrer will stop confirming the command has been received.

**Output Raw Data:** With this selected it is possible to see the sensor raw values. Change check then press start to send.

**Enable Isolation:** As the cable is connected in real time this should checked and enabled. This will stop spurious electronic interference affecting the sensitive electronics.

# Calibration:




When this tab is selected the calibration constants will be downloaded from the 620 – this will take a short time. After the calibration constants are downloaded the DO stirrer will be started and raw sensor values are being sent out from the probe in real time. The terminal screen on the right will show populating values as they are received by the PC.

**Parameter button:** Selects the parameter to calibrate and loads the constants from memory to the display.

**Calibrate Low / High Point:** Used to select which set point to calibrate – low or high.

**Show last dig:**As the electronic analogue to digital converter in the probe is very sensitive it is useful to ignore the last raw sensor value digit. The last digit has no effect on the output value and it likely not stable due to background noise.

**Hold:** This button is used to hold the Raw Sensor Value and stop it from changing. Pressing this allows the set point to be changed and then Calculate and Save button pressed.

**Calibrate and Save:** This button takes the Raw Sensor Value and set point values and adds them to the calibration constants table with newly calculated Offset and Slope.

**Cancel:** If the Calibrate Low or high point button is pressed not intentionally then this button will cancel from that selection.

**Recalculate:** It is possible to change the calibration values in the calibration table then recalculate. This may be useful to estimate a change in calibration and recalculate the slope and offset.

**Send Calibration to probe:** When calibration is complete the constants need to be uploaded to the probe.

**Clear Cal Const:** This will clear the constants loaded into the PC (not the probe). *Any changes made to the constants not sent to the probe will be lost.*

**Reload Cal Constants:** This will re download the calibration constants from the probe. *Any changes made to the constants not sent to the probe will be lost.*

**Stop Probe:** This will stop the probe from outputting raw sensor values.

**Start Probe:** This will start the probe from outputting raw sensor values.

**Upload Cal Const:** If calibration constants are located in a file they can be uploaded into calibration table on PC and into the probe. Calibration constants in the PC and the probe will be overwritten.

**Save Cal Const:** This will save the calibration constants in the calibration constants table in the PC to a ".cal" file.

## Calibration Overview

To calibrate, choose the parameter on the left and then the Calibrate Low Point or Calibrate High Point buttons. The raw sensor value will populate to the Raw Sensor Value text box and the temperature will also populate if it is required for the calibration (ie automatic temperature compensation).

Press Hold when the raw value stabilizes. Note that as the raw values are very sensitive at 18bit resolution the last 1 or 2 digits may not stabilize. This is okay and is likely background noise.

While calibrating the sensors, the constants will be changed in the PC.When SEND CALIBRATION TO PROBE button is pressed, the constants sent and loaded into the probe. Bearing in mind that the constants are not loaded till sent, but it is possible to check the calibrated values which are simulated at the bottom of the screen under Simulated probe values.

**IMPORTANT NOTE: The calibration is not loaded in the probe till the SEND CALIBRATION TO PROBE button is pressed and the probe accepts the new constants!**

**Temperature Calibration**
The temperature calibration should vary very little over the lifetime of the instrument however it is worth checking on the accuracy of your temperature measurements before calibrating the dissolved oxygen, conductivity or salinity sensors as they are very sensitive to temperature.

Temperature calibration is performed at two temperatures. The low temperature must be between 0 and 20$^{o}$C and the high temperature must be between 30 and 50$^{o}$C. A thermometer to at least 0.1$^{o}$C accuracy and resolution must be used.  To calibrate temperature, proceed as follows:

Select TEMPERATURE button from the list of parameters. The press Low or High button to start the raw sensor values populating to the screen. Immerse the probe in a stirred water bath held at a constant temperature– note thermal inertia will occur to the sensor so a period of waiting for the probe to reach a constant temperature is required. Make a note of the temperature on the calibration thermometer and press HOLD. Enter the set point value and press CALIBRATE AND SAVE BUTTON. The temperature calibration is now complete for that set point.

NOTE: If a thermometer accuracy is less than 0.1$^{o}$C it is best to only check the temperature and not calibrate as the accuracy is not high enough.

**Salinity/High Conductivity Range (ms/cm) Calibration**

The conductivity/salinity sensor is calibrated using solutions with a salinity of 0 ppt (air calibration) and 35ppt. Conductivity ms/cm is a parameter derived from the salinity measurement and so calibrating salinity simultaneously calibrates the conductivity ms/cm measurement. To calibrate the sensor, proceed as follows:

1. First, ensure that the temperature sensor is reading accurately and if necessary, perform the temperature calibration described previously.
2. Select SALINITY parameter the Low or High calibration point. Press **Cancel**to exit without changing the calibration.
3. Calibrate Low point 0ppt in Air. Dry and blow excess water off sensor (take care not to tough black electrode pins) and start Low Point calibration, when raw sensor value has stabilized the press HOLD. Leave set point at 0 and then press CALCULATE AND SAVE.
4. Calibrate High point:Immerse the probe in a solution with a salinity of 30-40 ppt, when temperature and raw sensor value have stabilized the press HOLD. Enter set point and then CALCULATE AND SAVE.

**Low Conductivity Range (us/cm) Calibration**

1. First, ensure that the temperature sensor is reading accurately and if necessary, perform the temperature calibration described previously.
2. Select EC (us/cm) parameter then Low or High calibration point. Press **Cancel**to exit without changing the calibration.
3. Calibrate Low point 0us/cm in Air. Dry and blow excess water off sensor (take care not to tough black electrode pins) and start Low Point calibration, when raw sensor value has stabilized the press HOLD. Leave set point at 0 and then press CALCULATE AND SAVE.
4. Calibrate High point: Immerse the probe in a solution with a conductivity of 1413us/cm, when temperature and raw sensor value have stabilized the press HOLD. Enter set point and then CALCULATE AND SAVE.

Other conductivities can be entered between 500 to 8000 us/cm. It is advisable to use the solution of KCl which has the conductivity of 1413us/cm. The calculation for temperature correction is at its optimum when this value is used. If other standards are used the temperature changes in the sample will cause small changes in the displayed conductivity.

**Dissolved Oxygen calibration**

Dissolved oxygen calibration is performed at points zero % and 100%. For zero % prepare a solutions by dissolving 26 grams of sodium sulphite in 500 ml of water and add 0.2 grams of cobalt chloride.  Stir the solution until the crystals are dissolved. Discard the solution after 30 minutes as it will begin to absorb oxygen. Alternatively an optional zero dummy probe may be used to obtain a zero point. To make a solution with 100% saturation, aerate a sample of fresh water for about two hours. A fish tank air pump and bubbler is ideal for this purpose. When you have the calibration standards ready, perform the following steps:

1. Before calibrating dissolved oxygen, ensure that the temperature sensor is reading accurately and, if necessary, perform the temperature calibration described above. If you have replaced the membrane on the dissolved oxygen sensor, you must wait for 2 hours after replacing the sensor membrane `before the calibration can be performed. You should also check that the stirrer is operating correctly. The paddle should oscillate freely when the instrument is performing measurements.
2. Select DISSOLVED OXYGEN button and CALIBRATE LOW POINT. Either place probe in DO 0% solution or install zero % plug. Press HOLD when readings are stable then confirm set point then CALIBRATE AND SAVE button. Note: zero point rarely changes and only needs to done once and checked occasionally.
3. Select CALIBRATE HIGH POINT. Place probe in DO 100% saturated solution. Press HOLD when readings are stable then confirm set point then CALIBRATE AND SAVE button.

**pH Calibration**

The pH sensor is calibrated using buffer solutions with a pH of 3 – 9.0 for low and 6-12 high. If the probe is fitted with a refillable pH sensor, it is good practice to refill prior to calibration (see **pH/ORP Sensor Maintenance)**. To calibrate the pH sensor, proceed as follows:

1. First, ensure that the temperature sensor is reading accurately and if necessary, perform the temperature calibration described previously.
2. Select pH parameter and CALIBRATE LOW POINT button and place in buffer solution usually between 4 and 7. Press HOLD when readings are stable then confirm set point then CALIBRATE AND SAVE button.
3. Press CALIBRATE HIGH POINT button and place probe in buffer solution (usually between 7 and 10). Press HOLD when readings are stable then confirm set point then CALIBRATE AND SAVE button.

**ORP Calibration**

Oxidation reduction potential is calibrated using standard solutions producing ORP of 295.2 mV and 472.2 mV.

To prepare the 295.2 mV solution, measure out enough pH 7 buffer to cover the ORP sensor and saturate the solution with quinhydrone. This will only require a small amount of quinhydrone and is best done by adding a pinch and then stirring for 30 seconds. There should still be solid, undissolved quinhydrone in the solution. If no solid is seen, add an additional amount and repeat stirring until solid quinhydrone is seen. To prepare the 472.2 mV standard, repeat the above except use pH 4 buffer instead of pH 7. Perform the calibration as follows:

1. Select ORP parameter and CALIBRATE LOW POINT button and place in ORP solution default setpoint 295mV. Press HOLD when readings are stable then confirm setpoint then CALIBRATE AND SAVE button.

2. Press CALIBRATE HIGH POINT button and place probe in high ORP solution. Default high setpoint is 472mV. Press HOLD when readings are stable then confirm setpoint then CALIBRATE AND SAVE button.

**Turbidity Calibration**
The turbidity sensor is calibrated using solutions with a turbidity of 0 ntu (distilled water) and a high value between 100 - 300 ntu's. These solutions can be prepared by diluting a concentrated formazin solution. Beware, formazin is a suspected carcinogen. Always wear rubber gloves when handling formazin solutions. Note: Always clean the glass tube before calibration – see maintenance. To calibrate the turbidity sensor, proceed as follows:

1. Select TURBIDITY parameter and CALIBRATE LOW POINT button and place in distilled water default setpoint 0ntu. Press HOLD when readings are stable then confirm setpoint then CALIBRATE AND SAVE button.
2. Press CALIBRATE HIGH POINT button and place probe in high Turbidity solution from 10 – 600NTU. Default high setpoint is 200NTU. Press HOLD when readings are stable then confirm setpoint then CALIBRATE AND SAVE button.

**Depth calibration**
If the optional depth sensor is fitted then it will also require calibration. To perform the depth calibration you need to lower the probe to a known depth in the water. This can be done by placing a mark on the probe cable at a measured distance from the bottom of the probe assembly then, making sure that the probe cable is vertical, lower the probe until the mark is at the surface of the water.

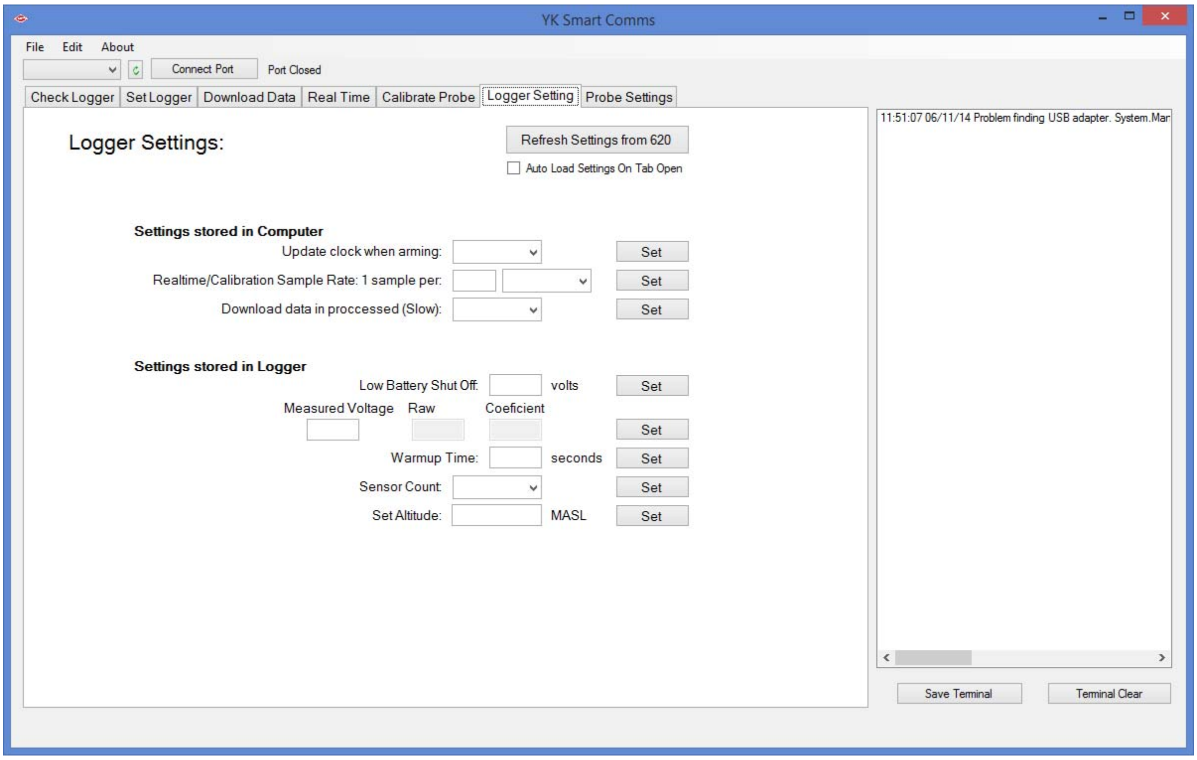
1. Select DEPTH parameter and CALIBRATE LOW POINT button and leave in air, default setpoint 0 M. Press HOLD when readings are stable then confirm setpoint then CALIBRATE AND SAVE button.
2. Press CALIBRATE HIGH POINT button and place probe to a known depth. Default high setpoint is 2 meters. Press HOLD when readings are stable then confirm setpoint then CALIBRATE AND SAVE button.

**Auxiliary Channel Calibration**
If the probe is fitted with auxiliary sensor/s then they may be calibrated by pressing the Aux #. The # is the auxiliary channel number - where with one additional sensor channel 1 would be connected.

The calibration applies a straight line equation to the sensor output. To calibrate an auxiliary channel, proceed as follows:

Press Low or High button to start the raw sensor values populating to the screen. Immerse the probe in a calibration solution and once the reading has stabilized press HOLD. Enter the setpoint value and press CALIBRATE AND SAVE BUTTON. 2 point calibration is required.

# Logger Settings




**Update clock when arming:** Default “Yes”. When arming the logger clock will be updated to the PC time.

**Realtime sample rate:** 1 per second the default value will sample as fast as possible. This can be changed and will affect the sample rate for the real time tab.

**Download data in processed:** The model 620 can output in processed values, but for large volumes of data this can make the download take 8 times longer than downloading the calibration constants and raw sensor values then post processing on the PC.

**Low battery shut off:** This can be set at 6.5v lowest and helps protect the lithium ion batteries from over discharge.

**Battery voltage calibration:** When check logger is run, the raw battery voltage will be populated here. By entering the real voltage a coefficient will be generated and can be passed to the logger. This value has been set at the factory with accurate measuring equipment and is important so the battery shut off operates correctly – protecting the batteries.

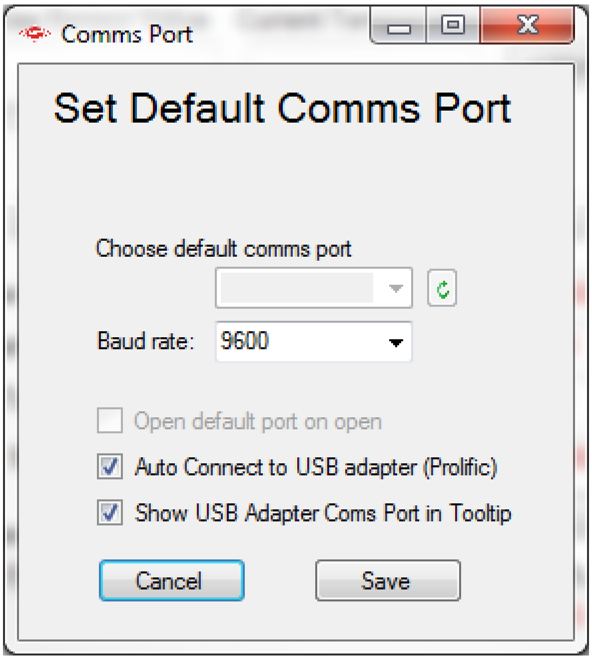
**Warm up time:** This time determines how long before a sample the electronics is powered before a sample is recorded. While this can be reduced to save battery, ample time for sensor stabilization may not be achieved. 60 seconds is default.

**Sensor Count:**The standard probe comes with 8 sensors. By changing this value the memory structure will be altered and the ADC will read 12 sensors instead of 8 (i.e. memory capacity will be reduced and sample rate period extended).

**Set Altitude:** This stores the altitude in the logger memory for a more accurate DO mg/L calculation.

## Advanced Settings:

**Edit >Comms port setting:** Used to configure automatic communication port settings.




Baud rate: 9600 default. If the baud rate in the Logger Settings is changed the PC must match.

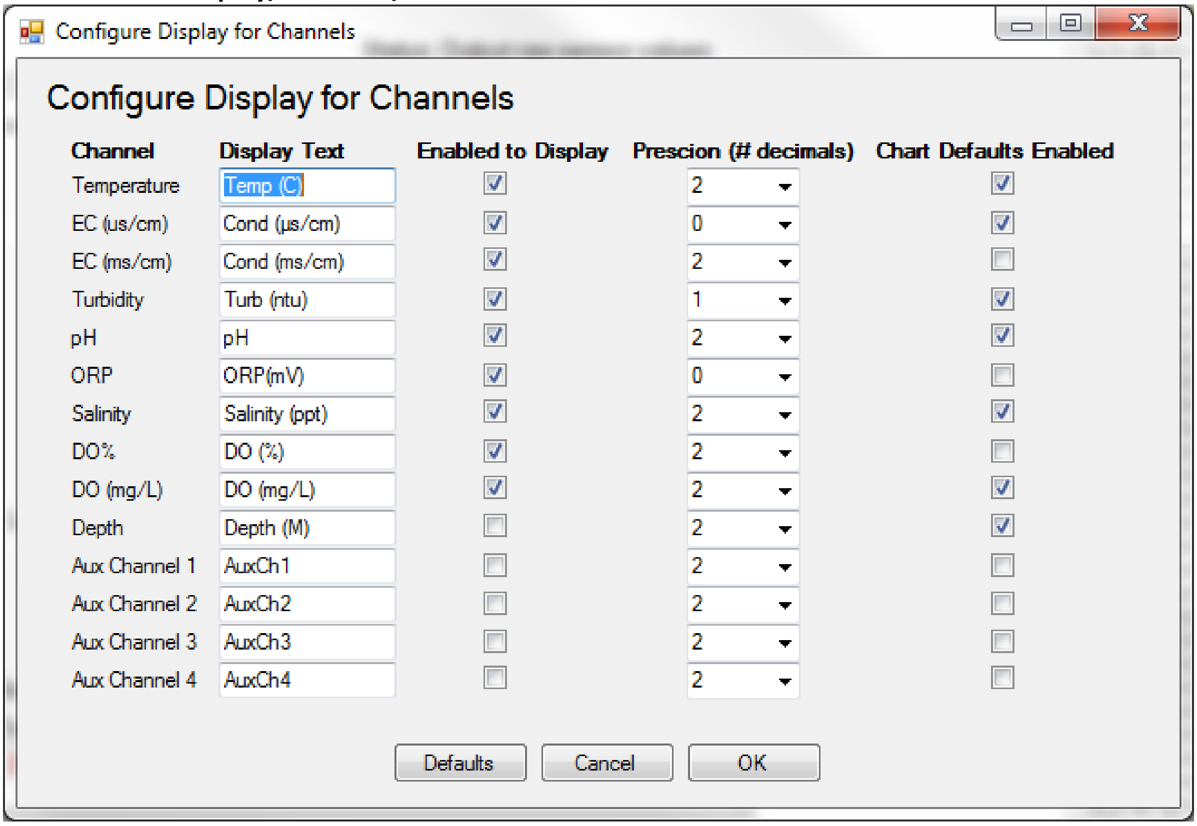
Open default port on open: Available when Auto connect to USB adapter disabled. This will attempt to connect to the same coms port number each time the program is opened.

Auto connect to USB adapter (prolific): on start the program will search for the connected USB adapter supplied. The prolific reference refers to the chipset used in the electronics of the adapter.

Show USB Adapter coms port in tooltip: If USB adapter attached the tooltip showing the port number will display when hovering over the coms port selection on main screen.

**Edit > Windows Device Manager:** An easy way to access the Windows device manager.

**Edit > Channel Display/Precision/Chart:**




Used to set the name of the parameters, which parameters display values and charting and what precision they are.

# Storage

When storing the instrument, the pH electrode should be kept moist in a solution of 3M KCl (approximately 22 grams of KCl dissolved in water to make 100 ml of solution). It is advisable to buffer this solution to bring it to approximately pH 5 or 6. A small amount of this solution is best put in the small pH sensor cap

The sensor section of the probe should be stored in the storage canister which clamps onto the probe providing a waterproof seal. To maintain enough moisture add 2 - 5mL of water to keep the sensors from drying out.

# Appendix 1 - Conversions Used

This unit measures dissolved oxygen as % saturation and then automatically converts the reading to milligrams per litre. This conversion is calculated from the dissolved oxygen solubility tables found in International Oceanographic Tables vol.2. National Institute of Oceanography 1972.

The conversion between conductivity and salinity is performed using the Practical Salinity Scale. UNESCO Technical Papers in Marine Science 1983.

The conversion of low conductivity raw data to conductivity referenced to 25 Deg C is performed using constants derived from HANDBOOK OF CHEMISTRY AND PHYSICS, 1963, Chemical Rubber Publishing Company, Page 2691, Conductivity of Standard Solutions using KCl, 0.001 M solution.

Redox potential (ORP) conforms to International Standard IEC 746-5, “Expressions of Performance of Electrochemical Analysers, Part 5: Oxidation-Reduction potential”. In accordance with this standard, the Redox potential is referred to the standard (“normal”) hydrogen electrode (NHE) and is expressed in mV.

# Appendix 2 - Compliance

Probe: CE

N 10255

Cable: AS/NZS 3013-2005 ELECTRICAL INSTALLATIONS CLASSIFICATION OF THE FIRE AND MECHANICAL PERFORMANCE OF WIRING SYSTEM ELEMENTS, APPENDIX E: MECHANICAL TEST METHOD - CUTTING TEST at -40°C and 110°C.

Calibration: This unit can be calibrated in a NATA or certified laboratory.