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USER MANUAL

Model	615 Water Quality Analyser For firmware V1.27
Version	3.4
Date	1/3/2017

Contents

Introduction

The YK615 comes already assembled. The only construction required is to connect the probe assembly to the Reader Unit and, if necessary, connect the external power supply.

General Description

The model 615 Water Quality Analyser is a robust multi-parameter field instrument which can be used for real time water quality measurements or for remote operation using a built in data logger.

The instrument consists of a multi-sensor probe and a reader unit which can store and display data. Additional auxiliary analog probe inputs can be facilitated on the reader unit. The probe and reader unit have been designed to be compact, durable and easy to use. Data is transferred to the reader unit using serial communications giving reliable, interference free measurements. The Reader Unit controls the operation of the instrument, provides easy access to the data, control, memory and calibration functions. The Reader Unit contains a real time clock and all stored data includes the date and time of measurement. Both stored data and calibration information can be easily down loaded to a computer using the data transfer program, YK Quick Terminal.

The YK615 comes with storage container to protect the sensors while the instrument is in storage.

The battery charging port can also function as an external power supply during extended periods of remote logging.

Specifications

Reader Unit:

Display: LCD with four lines of 20 alphanumeric characters.

Memory: Remote logging – 2425 samples. Real time (STORE key) 840 samples. All samples include date, time, GPS and data tag if assigned. Memory is backed up by lithium battery to guard against main battery failure.

Data tags: 75 for STORE key data, 25 for logged data. Note: each data tag is limited to 18 characters long.

Sample Rate: 1 per 2 minutes to 1 per day in Standard Logging Mode. 1 per second in Fast Logging Mode. Display updates every 2 seconds.

ADC: 16bit ADC and old model s having 13bit ADC

Communications: Baud rate 9600, 8 data bits, 0 parity, 2 stop bits.

Power: Battery pack containing 8 "C" size Nickel Metal Hydride cells connected as a pack. Memory backup voltage supplied by ½ AA lithium cell.

Case: Impact resistance polycarbonate; waterproof display, keypad, connectors and case.

Dimensions: 130 mm X 95 mm X 190 mm

Weight: 1.6 kg

Sensors:
Temperature
Range: -2 - 50ºC

Accuracy: ±0.05ºC

Resolution: 0.01ºC

Type: pt 100 platinum element

Conductivity
High Range: 0 - 80 ms/cm

Accuracy: ±0.05 ms/cm

Resolution: 0.02 ms/cm

Low Range: 0-8000 us/cm

Accuracy: ±5 us/cm

Resolution: 3 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:	±3 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

Two auxiliary inputs

Input:	0-5 volts each input

Physical

Cable length:	3 m or 10 m. Other lengths made to order.
Dimensions:	50 mm diameter, 320 mm long

Description of Reader Unit

The Reader Unit is housed in a tough, durable, high impact polycarbonate case with a keypad and alpha-numeric display mounted on the front panel. The side of the case has five connectors. The top connector is used for data output, the second for connecting external power supply and the third is the sensor connector. Each connector is provided with a protective cap which screws over the connector ensuring full waterproof sealing. The connectors also have a polarising pin so that incorrect connection cannot be made. Inside the Reader Unit a CPU controls the operation of the instrument, memory stores data and 8 C size rechargeable batteries power the instrument.

Connector Pins
The connector pins on the Reader Unit connectors are numbered in clockwise order from the polarising pin (see figure 1). The following table lists the purpose of each pin on the connectors.

	Communications	Auxiliary Power	Sensor
Pin 1	Ground	Negative	Ground
Pin 2	RS232 out	Positive	Data
Pin 3	RS232 in	n/a	+12V

Auxiliary Sensor 2

Pin 1	Ground	Ground
Pin 2	Signal 0-5V	Signal 0-5V
Pin 3	+12V	+12V

alpha-numeric display

MODEL 615
WATER QUALITY ANALYSER

YEO-KAL

arrow keys

key pad

Manufactured by Yeo-Kal Electronics Pty Ltd

| ON OFF | TIME 0 1 ABCD | MENU 2 3 GHIJKL | CAL 4 5 MNOPQR | LIGHT 6 7 STUVW | STORE 8 9 XYZ0 | ESC |

ENTER

(a)

connector cap

front panel gasket

COMMS

AUX BATT

SENSOR

front panel retaining screws

pin 1
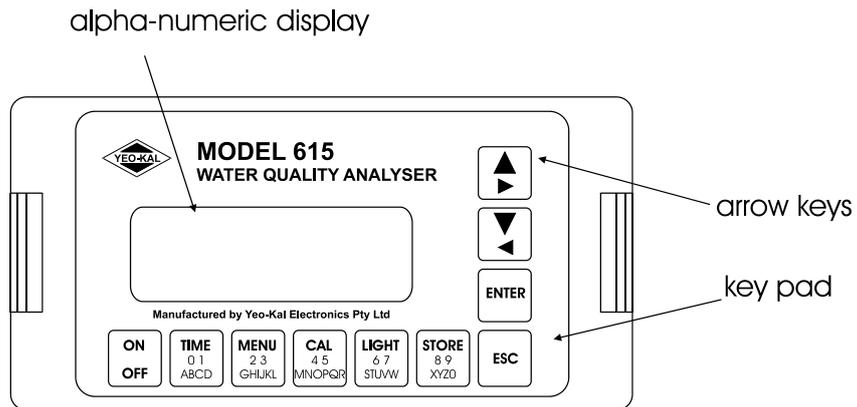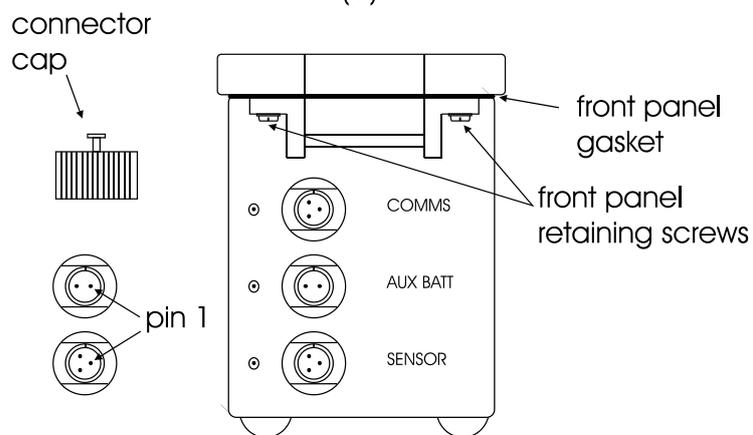
(b)

Figure 1: Reader unit for the YK615 : a) Top view showing key pad and alphanumeric display b) End view showing connectors. Note auxiliary connectors not shown.

Description of Probe

The probe assembly consists of sensor, cable and connectors. The body of the probe is made of PVC with a PVC sensor guard. The interface cable is permanently connected to the probe body to eliminate the need for underwater connectors. In the event of the cable being cut, the probe has a waterproof seal between the cable connection and the internal electronics package. At the other end of the cable is a corrosion and water resistant connector for connection to the Reader Unit.

The sensors can easily be accessed by sliding the sensor guard up and rotating the bottom section of the probe. (see fig 2b)

The conductivity and dissolved oxygen sensors can be removed for servicing. However, the whole unit must be **thoroughly dry** before these sensors are removed. A cotton bud can be used to dry the spaces in between the sensors.
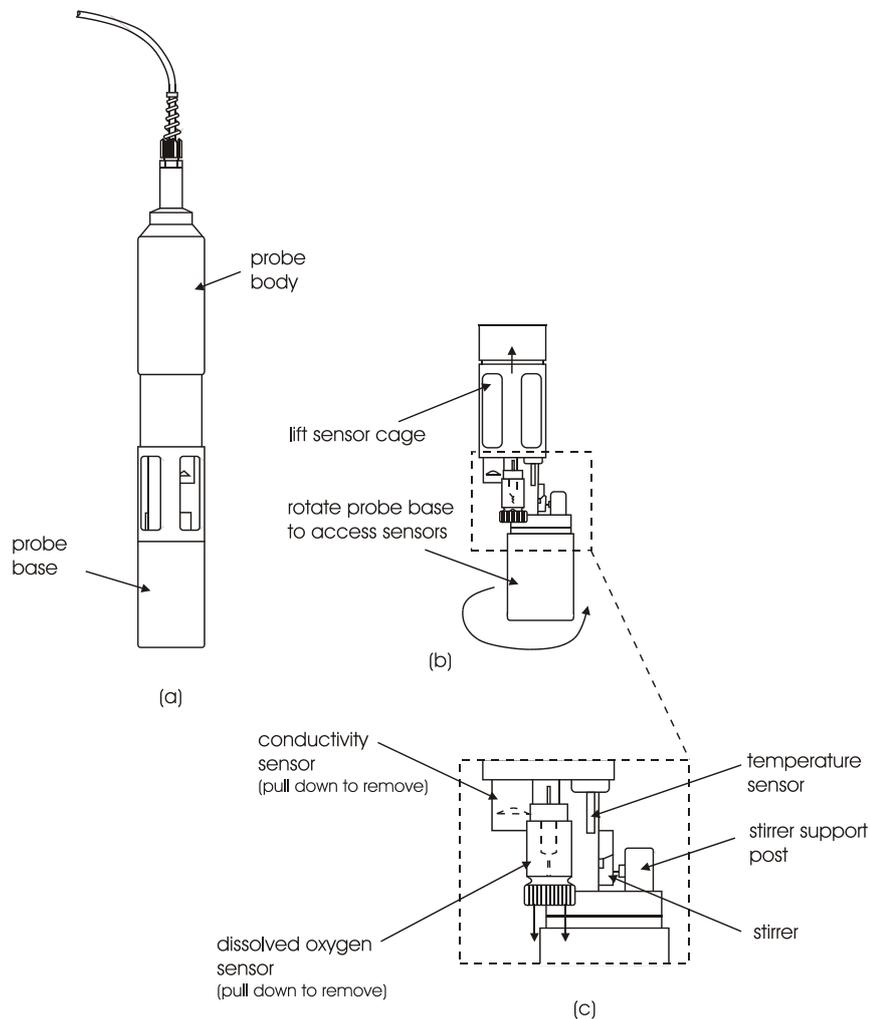
Figure 2: a) Complete probe assembly b) Sensor cluster exposed by lifting sensor cage and rotating probe base C) Expanded view of sensor cluster with dissolved oxygen sensor detached.
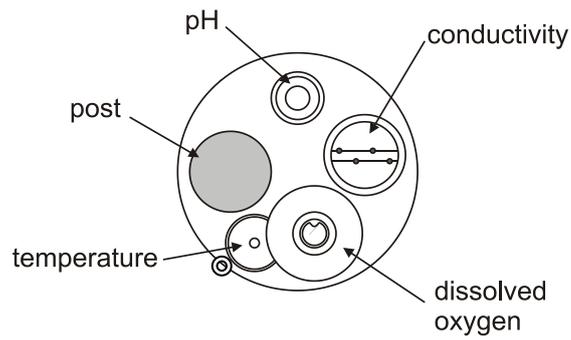
Figure 3: End view of probe
(without bottom section)
showing position of sensors.

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 using the optional platiniser or 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.

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. This sensors has a refillable secondary junction for sensor maintenance. This sensor with maintenance helps combat accumulation of internal contamination.

pH Meter
Primary Reference Electrolyte
Ag/AgCl Elements
Porous Wick Primary Reference
Internal Filling Solution
Sleeve Electrolyte (renewable)
Ground Surface
Intermediate Junction (secondary reference electrolyte)
pH Membrane
Sample
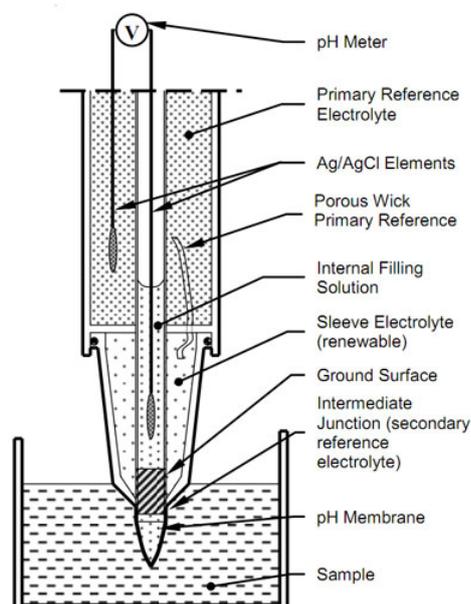
Assembly

The YK615 comes already assembled. The only construction required is to connect the probe assembly to the Reader Unit and, if necessary, connecting the external power supply.

Connecting the Probe Assembly

To attach the probe assembly, first unscrew the knurled connector cap from the SENSOR connector of the Reader Unit. The connector cap is attached to the Reader Unit by a chain so that it can be replaced whenever the probe assembly is disconnected. To connect the probe assembly, align the locating pin on the Reader Unit with the slot on the cable connector and push the cable connector into the Reader Unit sensor connector then screw home the retaining ring.

Connecting an External Power Supply

Extended remote logging, and charging the internal Reader Unit batteries can be achieved by connecting the unit to an external power dc power supply such as 240V/18VDC switched power supply, a car battery or solar panel. To connect the external power, first attach the external power supply lead to the Reader Unit. To do this, unscrew the knurled connector cap from the AUX BATT connector of the Reader Unit. Align the locating pin on the Reader Unit with the slot on the cable connector and push the cable connector into the Reader Unit connector then screw home the retaining ring. The connector cap is attached to the Reader Unit by a chain so that it can be replaced whenever the external power is disconnected. Connect the red terminal clamp to the positive terminal of your power supply and the black clamp to the negative terminal.

Operation

The YK615 comes already assembled. The only construction required is to connect the probe assembly to the Reader Unit and, if necessary, connecting the external power supply.

If the pH sensor has a cap over it, the cap should be removed **(SLIDE THE CAP OFF, DO NOT UNSCREW)** prior to operation. **See section 6 for IMPORTANT INFORMATION.**

Operating Instructions

The following is provided as a quick reference for operation of the instrument. To gain maximum performance and reliability from the YK615, make sure that you read and understand the entire user manual before operating the instrument.

The instrument is switched on or off by pressing the centre of the ON/OFF key.

ON
OFF
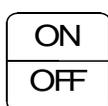
When the unit is switched on, the display will briefly show the serial number of the instrument and the version number of the software loaded in the Reader Unit. If the probe is connected, the display will then automatically begin to show the value of readings from the probe. The parameters displayed will be four parameters at one time. Press the **arrow** keys to scroll the display through the other parameters.

From here, the main menu is entered by pressing the **MENU** key. If the sensor is not connected, the LCD display will show no sensors have been used. Press main menu to scroll through the menu options, press the **arrow** keys to select a menu items as indicated by the arrows on the LCD display. Press the **ENTER** key to select Main Menu or Set Up Menu. You can back out of any point in the menu without changing the current settings by pressing the **ESC** key.

Key Pad Description

Time: Hold down key to observe the date and time on the LCD

Menu: Select Main menu OR Setup menu

Cal: Calibrate any of the sensors, See Chapter 0.

Light: Press light key to illuminate LCD display

Store: Store data in real time and by holding down the key, a data tag can be entered.

ESC: To exit a particular routine.

Enter: To accept a particular routine

Arrows: Up, Down, Back or Forward used in the main menu and tagging data.

The menu options are as follows:

Main Menu

1.	STORE DAT OUT	Down load store data to computer
2.	CLEAR STORE MEM	Erase data entered using the **STORE** key
3.	START LOGGER	Enter a logging program
4.	LOGGED DAT OUT	Down load logged data to computer
5.	CHECK BATTERY	Display Battery Voltage

Set up Menu

1.	SENS S/N	If available, serial number of probe is displayed.
2.	SET CLOCK	Adjust date & time
3.	TURB AVERAGE	Integrate turbidity readings
4.	SET PRECISION	Sensor resolution on display
5.	ASGN\DEL SENS	Select assign or delete sensor
6.	CONFIG DISP	Assign sensors on LCD display
7.	AUTO OFF	Power off timer for battery save function
8.	LCD CONTRAST	Alter display contrast
9.	LIVE COMMS	Displayed data is output through COMMS Port
10.	BEEPER	Audible keyboard indicator
11.	ALT CORRECT	Enter altitude for correcting D.O. readings
12.	IN CAL CONST	Allows the input of calibration constants by COMMS port.
13.	OUT CAL CONST	Outputs the calibration constants to the COMMS port

Note that main menu option 3 (START LOGGER) requires that all data be cleared from memory. You will be asked for conformation before memory is cleared.

The Reader Unit can be turned off without losing any of the instrument settings. If the logger is activated, the unit will continue to record measurements even if the Reader Unit is turned off.

Store Data Out (1)

The Reader Unit has two separate memories: the store memory and the logger memory. The logger memory can hold up to 2135 readings and the store memory can hold up to 600 readings. Once stored, the data can then be down loaded into a computer via the YEO-KAL software or printed at a later date.

The store memory is used to hold spot measurements. To store a reading while in the field simply press the **STORE** key. The data will be down loaded in the order in which it is stored so keep a

record of the site at which each measurement was made so that the data can be easily analysed. The operator will be asked to connect the serial data cable to the PC. Press ENTER and the operator will asked to include the calibration constants in the download.

Clear Store Memory (2)

From the main menu press the ENTER after selecting Erase Store Mem, the operator will be asked press ENTER or ESC. Press ENTER to proceed and clear memory.

Start Logger (3)

The YK615 can also be programmed to take measurements at regular intervals and store the results in the logger memory.

The fastest sample rate in Standard Logging Mode is one per two minutes, the stirrer is activated one minute before the sample is to be taken and will switch off immediately after the data has been recorded.

In Fast Logging Mode the sample rate is approximately 1 per second.

Programming the Reader Unit

To program the logger for a measurement routine, perform the following steps:

1. Enter the main menu, select (3) START LOGGER and press **ENTER**. If the logger memory is empty the operator will go to the set up routine, if there is data in memory the operator will be asked to press ENTER to clear memory or ESC to log data contiguously from the last data point.
2. Press ENTER to program logging, the start date will be displayed. To change the start date use the arrow keys and ENTER to accept the required flashing start date. Note; the time is displayed in 24 hour time format. The cursor will automatically go from day DD to month MM and year YYYY, then start time HH:MM, press ENTER to go to stop time settings. This is set up the same way.
3. When the desired sample rate is displayed press **ENTER**. The message Enter Data Tag #1 will appear use alpha-numeric and arrow keys to make a tag or ESC for no tag. Arm logger? will be displayed then press ENTER to arm or ESC to restart and the instrument then automatically returns to displayed data.

The instrument is now programmed and can be switched off. The logger will automatically switch on the stirrer 1 minute before the programmed measurement time and the message AUTO LOGGER,

Sensor warm up time, please wait will be displayed. When the sample has been taken, the instrument will automatically shut down again until the next sample time has arrived.

To halt the logging process, select MENU key You will then see the message Disarm logger (ENT/ESC) press **ESC** to continue logging or **ENTER** to stop the logging routine.

Logged Data Out (4)

Data stored in the YK615 can be down loaded to a computer and then stored, graphed or printed out using most popular applications. The data can also be sent directly to a compatible serial printer. When the data is down loaded, it includes a header, as shown in figure 4 below, indicating whether the data is from the logger or store memory.

In order to download the data stored in memory to a computer, you will need terminal software ie YK Quick Terminal or similar and the communications cable. To transfer data, perform the following operations:

1. Connect the 3 pin connector of the communications cable to the COMMS connector of the Reader Unit, (see figure 1). Connect the other end of the cable to an RS232 (serial communications) port on your computer or adapter.
2. Start your data transfer program, select the correct comms port and prepare it for receiving data.
3. Switch on the YK615 and select (4) LOGGED DAT OUT or (1) STORE DAT OUT to down load data from the memory, then press **ENTER**. The unit will then display the message DOWNLOADING DATA and down load data to your computer. When the operation is finished, the instrument will automatically return to the main menu.

```
$H
Ver: 1.27
$H
YEO-KAL MODEL 615
SERIAL NUMBER:  625
DATE OF DOWNLOAD: 13/04/17 11:08
DATE FORMAT: DD/MoMo/YY HH:MM:SS


Port     Param      Date   Time  lo dat  lo sp  lo temp  hi dat  hi sp  hi temp  offset    slope
----------------------------------------------------------------------------------------------$D
Ser4 Phyco (ppb) 24/03/17 12:57    111       0    0.00   30613   4500    0.00  -111.000     6.778
Ser0 E.C (uscm)  23/03/17 13:26      8       0    0.00    2367   1413   26.34     8.000     1.626
Ser1 Sal (ppt)   23/03/17 13:29      9    0.00    0.00    8969  35.00   26.82     9.000 162934.43
Ser2 Temp (C)    23/03/17 13:25  -5605   14.60    0.00   12818  35.50    0.00 18474.656   881.483
Ser3 Turb (ntu)  23/03/17 13:50   -611     0.0    0.00    4840  200.0    0.00   611.000    27.255
Ser5 pH (pH)     23/03/17 13:38  13855    4.00   26.15  -14074  10.00   26.49 32440.386 -4629.346
Ser6 ORP (mv)    23/03/17 13:41   6120     295    0.00    7284    472    0.00 -4178.687     6.576
Ser7 D.O.(%sat)  23/03/17 13:46   -125     0.0    0.00   10449  100.0   25.06  -125.000    49.568
Aux0 Aux chan 0  Not calibrated.
Aux1 Aux chan 1  Not calibrated.
Aux2 Aux chan 2  Not calibrated.
Aux3 Aux chan 3  Not calibrated.
Aux4 Aux chan 4  Not calibrated.
$H----------------------------------------------------------------------------------------

Samples in memory: 0027
ID,Tag,Date/Time,Phyco (ppb),Temp (C),E.C (uscm),E.C (mscm),Sal (ppt),Dens(g/cm3),S.G. (sg),TDS (g/l),D.O.(%sat),D.O.(mg/l),pH (pH),ORP (mv),Turb (ntu),GPS
Latitude,GPS Longitude
1,A36,24/03/17 14:48:37,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
2,A36,24/03/17 14:48:39,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
3,A36,24/03/17 14:48:40,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
4,A36,24/03/17 14:48:41,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
5,A36,24/03/17 14:48:43,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
6,A36,24/03/17 14:48:44,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
7,A36,24/03/17 14:48:45,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
8,A36,24/03/17 14:48:47,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
9,A36,24/03/17 14:48:48,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
10,A36,24/03/17 14:48:49,-15,26.25,0,0,0,6.17,-900,40,95.8,7.73,0,0.9967,996.56,000 00.0000',000 00.0000'
11,A36,31/03/17 09:22:16,-15,21.64,0,0,0,7.45,900,75.8,69.6,6.13,0,0.9979,997.7,000 00.0000',000 00.0000'
12,A36,31/03/17 09:22:18,-15,21.64,0,0,0,7.45,900,75.8,69.6,6.13,0,0.9979,997.7,000 00.0000',000 00.0000'
13,A36,31/03/17 09:22:21,-15,21.64,0,0,0,7.45,900,75.9,69.6,6.13,0,0.9979,997.7,000 00.0000',000 00.0000'
14,A34,31/03/17 09:22:46,-15,21.66,0,0,0,7.45,900,76,69.6,6.13,0,0.9978,997.69,000 00.0000',000 00.0000'
15,A34,31/03/17 09:22:49,-15,21.66,0,0,0,7.45,900,76.1,69.6,6.13,0,0.9978,997.69,000 00.0000',000 00.0000'
16,E26,31/03/17 09:23:14,-15,21.67,0,0,0,7.45,900,76.1,69.6,6.12,0,0.9978,997.69,000 00.0000',000 00.0000'
17,E26,13/04/17 11:06:51,-15,20.84,0,0,0,6.43,768,134.5,49.1,4.39,0,0.998,997.87,000 00.0000',000 00.0000'
18,E26,31/03/17 09:23:14,-15,21.67,0,0,0,7.45,900,76.1,69.6,6.12,0,0.9978,997.69,000 00.0000',000 00.0000'
19,E26,13/04/17 11:06:51,-15,20.84,0,0,0,6.43,768,134.5,49.1,4.39,0,0.998,997.87,000 00.0000',000 00.0000'
20,E26,31/03/17 09:23:14,-15,21.67,0,0,0,7.45,900,76.1,69.6,6.12,0,0.9978,997.69,000 00.0000',000 00.0000'
21,A36,31/03/17 09:22:16,-15,21.64,0,0,0,7.45,900,75.8,69.6,6.13,0,0.9979,997.7,000 00.0000',000 00.0000'
22,A36,31/03/17 09:22:18,-15,21.64,0,0,0,7.45,900,75.8,69.6,6.13,0,0.9979,997.7,000 00.0000',000 00.0000'
23,A36,31/03/17 09:22:21,-15,21.64,0,0,0,7.45,900,75.9,69.6,6.13,0,0.9979,997.7,000 00.0000',000 00.0000'
24,A34,31/03/17 09:22:46,-15,21.66,0,0,0,7.45,900,76,69.6,6.13,0,0.9978,997.69,000 00.0000',000 00.0000'
25,A34,31/03/17 09:22:49,-15,21.66,0,0,0,7.45,900,76.1,69.6,6.13,0,0.9978,997.69,000 00.0000',000 00.0000'
26,E26,31/03/17 09:23:14,-15,21.67,0,0,0,7.45,900,76.1,69.6,6.12,0,0.9978,997.69,000 00.0000',000 00.0000'
27,E26,13/04/17 11:06:51,-15,20.84,0,0,0,6.43,768,134.5,49.1,4.39,0,0.998,997.87,000 00.0000',000 00.0000'
```

Figure 4b: Sample of comma separated data output from the YK615 (date format: dd/mm/yy).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
25	Samples in memory: 0027																			
26	ID	Tag	Date/Time	Phyco (pp	Temp (C)	E.C (uscm	E.C (mscm	Sal (ppt)	Dens(g/cn	S.G. (sg)	TDS (g/l)	D.O.(%sat	D.O.(mg/l	pH (pH)	ORP (mv)	Turb (ntu)	GPS Latitu	GPS Longitude		
27	1	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
28	2	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
29	3	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
30	4	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
31	5	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
32	6	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
33	7	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
34	8	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
35	9	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
36	10	A36	24/03/2017 14:48	-15	26.25	0	0	0	6.17	-900	40	95.8	7.73	0	0.9967	996.56	000 00.000	000 00.0000'		
37	11	A36	31/03/2017 9:22	-15	21.64	0	0	0	7.45	900	75.8	69.6	6.13	0	0.9979	997.7	000 00.000	000 00.0000'		
38	12	A36	31/03/2017 9:22	-15	21.64	0	0	0	7.45	900	75.8	69.6	6.13	0	0.9979	997.7	000 00.000	000 00.0000'		
39	13	A36	31/03/2017 9:22	-15	21.64	0	0	0	7.45	900	75.9	69.6	6.13	0	0.9979	997.7	000 00.000	000 00.0000'		
40	14	A34	31/03/2017 9:22	-15	21.66	0	0	0	7.45	900	76	69.6	6.13	0	0.9978	997.69	000 00.000	000 00.0000'		
41	15	A34	31/03/2017 9:22	-15	21.66	0	0	0	7.45	900	76.1	69.6	6.13	0	0.9978	997.69	000 00.000	000 00.0000'		
42	16	E26	31/03/2017 9:23	-15	21.67	0	0	0	7.45	900	76.1	69.6	6.12	0	0.9978	997.69	000 00.000	000 00.0000'		
43	17	E26	13/04/2017 11:06	-15	20.84	0	0	0	6.43	768	134.5	49.1	4.39	0	0.998	997.87	000 00.000	000 00.0000'		
44	18	E26	31/03/2017 9:23	-15	21.67	0	0	0	7.45	900	76.1	69.6	6.12	0	0.9978	997.69	000 00.000	000 00.0000'		
45	19	E26	13/04/2017 11:06	-15	20.84	0	0	0	6.43	768	134.5	49.1	4.39	0	0.998	997.87	000 00.000	000 00.0000'		
46	20	E26	31/03/2017 9:23	-15	21.67	0	0	0	7.45	900	76.1	69.6	6.12	0	0.9978	997.69	000 00.000	000 00.0000'		
47	21	A36	31/03/2017 9:22	-15	21.64	0	0	0	7.45	900	75.8	69.6	6.13	0	0.9979	997.7	000 00.000	000 00.0000'		
48	22	A36	31/03/2017 9:22	-15	21.64	0	0	0	7.45	900	75.8	69.6	6.13	0	0.9979	997.7	000 00.000	000 00.0000'		
49	23	A36	31/03/2017 9:22	-15	21.64	0	0	0	7.45	900	75.9	69.6	6.13	0	0.9979	997.7	000 00.000	000 00.0000'		

S625

Ready   100%

Figure 4c: Sample of comma separated data opened in MS Excel ®

Check Battery (5)

From the main menu select check battery and press ENTER. The battery voltage will be displayed and if the battery state is till acceptable the message OK will appear. Push the ESC to go back to the main menu. If the battery fall below 9.8 volts the display will show Batt Low and the beeper will sound.

If the battery is not recharged and operator continues to use the unit the battery voltage will fall rapidly until the unit shuts down. RECHARGE THE BATTERY AS SOON AS POSSIBLE after the message appears.

Before charging, be sure the unit is switched off. Plug the power pack unit into mains power outlet and then plug the battery charger connector into the Aux batt/Charger input on the Reader Unit. The 615 can now be switched ON and act as an auxiliary power supply and charge the batteries at the same time. The battery charger is an intelligent system that takes care of NI-cad and NI-MHO Type rechargeable batteries and adjusts itself for best charging.

Set Up Menu

Sensor Serial Number (1)

The reader reads the serial number of the probe attached to the 615. If more than one unit is used it identifies the correct probe to be used with the Reader Unit.

Set Clock (2)

The clock uses 24 hour format DD/MM/YYYY HH:MM:SS

After selecting Set Clock press the ENTER key and the Day start flashing, use the arrow keys to change the day and press ENTER when correct then go through the same procedure for Month, Year and Time.

Turbidity Average (3)

Press Enter and the operator will be asked to enter the average. The turbidity readings will be averaged over 0 to 99 readings. Use the arrow keys to select the required numerals then use aux number keypad to select the actual value. Press ENTER to accept. Note the default is 5.

Set Precision (4)

Press ENTER and select the parameter to be measured and then press ENTER and use arrow keys to select the precision of reading eg XXX.XXX

Press ENTER or ESC to go to next parameter or ESC to the set up menu.

Assign/Del Sensors (5)

When a channels is assigned, the user may change its default parameter name to whatever best describes the parameter being measured.

The default parameter name is an indicator of the channel name. Eg Aux1, Aux2----etc.

This function allows the operator to identify which channel has been assigned to the parameter name which has been set to the operator's specification.

The user specified parameter name for any channel may be reset to the default parameter name by pressing the ENTER key.

When assigning a GPS use the arrow keys to find Assn: GPS and press **ENTER**. Follow instructions on the LCD display and press **ENTER**. The next step is to go to Configure Display (4)

Configure Display (6)

The display may be set up to the operator's preferences ie each parameter may be displayed on the LCD in the order of the operator's preference. There are four pages or screens consisting of four lines of selected parameters. The selected parameter may be placed on the desired page and line.

If the unit has been initialised to function with the probe attached, and the operator needs to add extra sensors, it is necessary to go to the Set Up menu and go to Config Disp then press ENTER. The operator will be asked to Select page: 0-3. Pages 0-2 will already be allocated with 611 sensors so go to page 3. Note: The previously allocated sensors can be reallocated to other pages and lines.

To add a GPS to the display Select page 3 if the probe is already allocated. Then select the line you wish to allocate GPS to. Press ENTER then use arrow keys to select the correct parameter (LATITUDE) and press ENTER. Use the same procedure for (LONGITUDE) and select the next line for longitude.

Auto Off (7)

To save battery power the 615 will shutdown if no key is pressed after X minutes. Use arrow keys to adjust the time out from) minutes to 120 minutes. Press ENTER to accept. If the operator does not require this function set the time out to zero minutes to disable.

Adjust Contrast (8)

When the instrument is used in the field, variations in ambient light and temperature may make the display difficult to read. This can be remedied by adjusting the display contrast.

To make this adjustment, go to main menu. Use the arrow keys to until the message 1) ADJ CONTRAST appears then press ENTER. Now press the up or down **arrow** keys until the display is easier to read then press **ENTER** or **ESC** to return to the main menu.

Live Comms (9)

When Data Port is ON, storage of data directly into its memory while outputting to the COMMS port is enabled. This can be directly linked to a computer where data can be displayed and/or stored onto a disk.

Beeper (10)

The operator is able turn the audible beeper ON or OFF. Use arrow keys to select and press ENTER.

Altitude and Salinity Corrections (11)

The solubility of oxygen in water is less in brackish or sea water than in fresh water and also decreases with increasing altitude. For dissolved oxygen concentration measurements to be accurate, they must be compensated for the salinity of the water being tested and for the atmospheric pressure. The YK615 will calculate the correct value of dissolved oxygen concentration and percent saturation once you have entered the altitude for the particular sample being tested, salinity corrections are made automatically.

1. With the instrument deployed, select 1) ALT CORRECTION from the main menu and press **ENTER**.
2. Press the **number** keys until the display shows the correct altitude in meters. Press **ENTER**. The altitude which you have entered will remain until it is changed, even if you turn the instrument off.

In Cal Constants (12)

This allows a file with calibration constants to be uploaded into the reader unit

Connect the Reader Unit to a PC serial port and start YK Quick Terminal. Establish comms port connection and press Upload 615 Calibration. A dialog box will prompt for path and file of (.cal) calibration file. Select file up a previously stored calibration constants.

On the reader unit press ENTER and WAITING FOR FILE WILL appear on the LCD display. On the software press OK to commence upload from PC.

Calibration

Calibration order to ensure the accuracy of the YK615, the instrument needs to be calibrated on a regular basis as well as after any maintenance has been performed on the probe. The frequency at which calibration is required will depend on the specific application for which the instrument is to be used. The optimum time between calibrations can be established by regularly checking the performance of the instrument in standard solutions. If the YK615 is kept well maintained and calibrated on a regular basis, a single point calibration is sufficient to keep the instrument performing to specification. However, two point calibrations whenever a sensor has had any maintenance.

The calibration procedures require that the probe be immersed in standard solutions. The probe storage container which is supplied with the YK615 is ideal for this purpose as it provides a water tight seal on the probe and minimizes the volume of standard solution required (about 150 ml). Make sure that you rinse both the probe and container before each calibration and between each calibration solution. The standard solutions are available from YEO-KAL Electronics Pty Ltd or most major scientific suppliers.

Both dissolved oxygen and conductivity measurements require a correction for temperature (this correction is automatically made by the instrument) hence the temperature sensor must be correctly calibrated before you can calibrate either the dissolved oxygen or salinity / conductivity sensors.

To enter the calibration menu, press the **CAL** key. If there is any data in the Reader Unit memory, the message CLEAR ALL MEM? will appear on the display. Press **ENTER** to clear memory or **ESC** to return to the main menu. Once you have entered the calibration menu, use the **arrow** keys to scroll through the menu and select the sensor which you wish to calibrate by pressing **ENTER**.

If the user mistakenly places the probe into the incorrect solution ie high standard instead of a low standard the message will appear on the LCD display "CALIBRATION ERROR RECAL HIGH & LOW". To remove the message recalibrate the sensor correctly. Note: This does not ensure that the unit is calibrated accurately, but does ensure that a major mistake or error does not occur.

During calibration, the display shows a D number ("D = "). These are the raw numbers from the analogue to digital converter prior to conversion to real units (such as °C temperature or mS/cm conductivity or %sat dissolved oxygen, etc). Calibration coefficients are used to convert the D number to the real units.

Expected Sensor Raw Values

Note 1: The raw sensor values are specific to the 13 bit ADC (analogue to digital converter) where the values range from -4095 to +4095.

Note 2: When a value is railing (the raw sensor output is either -4095 or +4095 this is a sign of an electronic issue.

The following table shows the range of expected values from different parameters.

Parameter	Low Set Point		High Set Point	
	Raw (D) value	Value	Raw (D) value	Value
Conductivity	-5 to 5	0 uS/cm	300 to 600	1413 uS/cm
Salinity	-5 to 5	0 ppt	800 to 1100	35 ppt
Dissolved Oxygen	-20 to 5	0 %	700 to 1100	100 %
Turbidity	-20 to 100	0 NTU	700 to 1100	200 NTU
pH*	1000 to 1800	4	-1400 to -2200	10

- Note pH 7 value should be close to 0 however please note that an offset at pH 7 can develop as the sensor ages (contamination/dilution of reference cell) resulting in a non-linear output between pH 4 and 10.

If the values are outside the suggested range this could indicate that the particular sensor needs attention. Modified or older units have different signal conditioning which will change the output.

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 or salinity sensors.

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

1. Select TEMPERATURE from the calibration key. The message CAL TEMP ^{o}C will appear, press **ENTER** to calibrate or **ESC** to main menu. The message Cal high set point or cal low set point (ENT/ESC) will appear. Press the ARROW keys to make the selection then press **ENTER** to calibrate the low temperature range 0-20°C press **ENTER** to proceed. Place the probe into stirred water bath. After pressing **ENTER,** Raw Data from the temperature sensor will appear, wait until the readings are stable and make a note of the reading on the calibration thermometer and press **ENTER.** Press the number arrow keys to change the displayed temperature then press **ENTER**.
2. If you proceed with the high range calibration, Select Cal high set point by using the arrow keys. The message place probe into 25- 50°C water bath. Press **ENTER**, the raw data D is

displayed. Immerse the probe in a stirred water bath held at a constant temperature between 25 and 50 C and wait for the probe to reach a constant temperature. Make a note of the temperature on the calibration thermometer and press ENTER. Use the silver **numbered** keys to change the displayed temperature and press ENTER. The temperature calibration is now complete.

High Conductivity/Salinity Calibration

The conductivity/salinity sensor is calibrated using solutions with a salinity of 0 ppt (air calibration) and 35 ppt. Conductivity is a parameter derived from the salinity measurement and so calibrating salinity simultaneously calibrates the conductivity measurements. 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 calibrate Inst use arrow keys an select SAL (ppt) press ENTER use arrow keys to select high or low calibration set points press (ENTER/ESC) will be displayed. Press **ESC** to exit without changing the calibration.
3. If you wish to continue for low calibration, leave the probe in air, a visual display of the raw data is seen on the LCD display. When the raw data D is stable press **ENTER**, the salinity calibration coefficient will then be automatically updated. You will be asked if you wish to calibrate high set point **ENTER** or **ESC.**
4. If you wish to continue for an upper calibration, immerse the probe in a solution with a salinity of 30-40 ppt, Press **ENTER**; a visual display of the raw data D is seen on the LCD display. When the data is stable press **ENTER**, then use the UP/DOWN arrows keys to set the salinity value of the solution that was used and then the calibration coefficient will be automatically updated and the instrument will return to the calibration menu.

Low Conductivity calibration

1. Select CAL C25 us/cm from the Cal Key and using ARROW Keys select Calibrate instrument press ENTER after reading warning and use arrow keys to select E.C. (us/cm) and press **ENTER** to continue or **ESC** and go to Cal High set point or Cal Low set point. Follow the instructions on the LCD display and be sure that the raw data "D" is stable before accepting the data.
2. Leave the probe in air and press **ENTER** for zero conductivity calibration. You will be asked if you wish to calibrate high set point **ENTER** or **ESC.**
3. If you wish to continue for an upper calibration, immerse -the probe in a KCl solution. To prepare the solution, dissolve 0.7459 grams anhydrous KCl in distilled water and make up the solution to 1 litre. This has an electrical conductivity of 1413 umhos/cm. The raw data will be displayed on the display. When the raw data D is stable press **ENTER**. Then use the UP/DOWN arrows keys to set the conductivity value of the solution that was used and then

the calibration coefficient will be automatically updated and the instrument will return to the calibration menu.

Other conductivities can be selected 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 using solutions with zero % or 100% oxygen saturation. To prepare a sample with zero % saturation, dissolve 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 by pressing the calibration key, use the arrow keys and select calibrate Inst. Press ENTER and use ARROW keys to select D.O. % Press ENTER and use arrow keys to select high or low set points Press **ESC** to exit without changing the instruments calibration.
3. If you wish to continue, immerse the probe in the 0% oxygen solution, a visual display of the raw data for zero can be seen on LCD display. When the data is stable press **ENTER**, the dissolved oxygen calibration coefficients will then be automatically updated. You will be asked if you wish to calibrate high set point **ENTER** or **ESC**
4. Select Cal high set point and press ENTER Immerse the probe in the aerated solution, a visual display of the raw data is seen on the LCD display. When the data is stable press **ENTER**, the dissolved oxygen calibration coefficients will then be automatically updated and the instrument will return to the calibration menu.

pH Calibration

The pH sensor is calibrated using buffer solutions with a pH of 3 – 9.0 and 6-12. 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. Select pH from the calibration key, the message CAL High or Low set point will appear (ENTER/ESC) will be displayed. Press **ESC** to exit without changing the instruments calibration.
2. If you wish to continue, Select low set point and immerse the probe in a solution of the desired pH between 3 and 9, Press **ENTER** and the raw data will appear press ENTER when stable press ENTER and then use the numbered keys to enter the value of the standard used press **ENTER,** the pH calibration coefficients will then be automatically updated.
3. Rinse the probe in distilled water to remove all traces of the low buffer solution. Immerse the probe in a buffer solution with pH between 6.0 and 12.0, Select Cal high set point and press **ENTER** and a visual display of the raw data is seen on the LCD display. When the data is stable press **ENTER.** Press the **arrow and number keys** to change the displayed pH to the correct value (whichever was selected between 6.0 and 12.0) then press **ENTER,** the pH calibration coefficients will then be automatically updated and the instrument will return to the calibration menu.

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 after pressing the Calibration key, the message High or Low CAL set point ORP mv (ENTER/ESC) will be displayed. Press **ESC** to exit without changing the ORP calibration.
2. If you wish to continue, immerse the probe in 295.2 mV solution, a visual display of the raw data is seen on the LCD display. When the data is stable press **ENTER**, the ORP calibration coefficients will then be automatically updated.
3. Select Cal high set point and immerse the probe in solution 472.2 mV solution, press **ENTER** a visual display of the raw data is seen on the LCD display. When the data is stable press **ENTER** the ORP calibration coefficients will then be automatically updated and the instrument will return to the menu.

Turbidity Calibration

The turbidity sensor is calibrated using solutions with a turbidity of 0 ntu (distilled water) and a high value between 100 – 600NTU. 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. To calibrate the turbidity sensor, proceed as follows:

1. Select TURBIDITY from the calibration key, the message CAL high or low set point TURB ntu (ENTER/ESC) will be displayed. Press **ESC** to exit without changing the turbidity calibration.
2. If you wish to continue, immerse the probe in distilled water press **ENTER** or ESC the raw data is seen on the LCD display. When the data is stable press **ENTER.** The turbidity calibration coefficients will then be automatically updated.
3. Immerse the probe in solution with turbidity between 100 and 600ntu's,Select Cal high set point and press **ENTER** a visual display of the raw data is seen on the LCD display. When the data is stable press **ENTER.** Press the **number** keys to change the displayed value to the correct value (whichever was selected between 10 and 600) then press **ENTER,** the turbidity calibration coefficients will then be automatically updated and the instrument will return to the calibration menu.

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 from the calibration key, the message CAL high or low set point (ENTER/ESC) will be displayed. Press **ESC** to exit without changing the depth calibration.
2. If you wish to continue, select Cal low set point and make sure that the probe is above the surface of the water and press **ENTER**, the raw data will be displayed on the LCD display press ENTER to accept this point the coefficients will then be automatically updated. Select cal high set point and submerge the probe to your pre measured depth and make sure that the cable is vertical. Press the **ENTER key** keys to from 1 to 100 meter points. Press **ENTER** the raw data will be displayed on the display. When stable press **ENTER** and use the number keys to change the display to the correct value then press **ENTER**. The depth calibration is now complete.

Internal Bluetooth and GPS

The 615 reader unit has been fitted with internal Bluetooth and GPS.

Bluetooth

This method can be used to communicate to a PC. Calibration, real time and logged data can be transmitted from the 615 to the PC and calibration constants from the PC to the 615.

To use Bluetooth communication a Bluetooth enabled PC is required.

One off Pairing:
1. Power on PC and ensure PC Bluetooth is activated
2. Power on 615 reader unit
3. On PC, search for Bluetooth devices – The device name is YK615_S### where ### is the serial number.
4. Pair Bluetooth device using pass code 0000.

Once paired it is possible to access the allocated Bluetooth serial port by the YK Quick Terminal software. For the specific communication port allocated by Bluetooth please check your Bluetooth documentation.

It is generally possible to find the serial port assigned by going to the properties of the Bluetooth device and locating services.

As the communication port can be handled differently by different computers. On some computers the communication port will need to be re-established if the 615 reader unit is powered down and up again – this is possible by pressing the Open/Close Port button in the software. If the reader unit is powered off, it is not possible to communicate with Bluetooth on the 615.

GPS

GPS co-ordinates appear on page 3 of the reader unit. They appear on screen, in stored data and logged data.

The first time the GPS is used or if the GPS has not been used for a while it may take up to 5 minutes for the satellites to lock in. On subsequent uses the GPS is quicker to get a lock and position.

Bluetooth and GPS Power

The reader unit by default activates power to these devices upon reset. Follow reset procedure if power to these deactivates for any reason.

Maintenance

Reader Unit Maintenance

The Reader Unit requires little maintenance except to charge the batteries as necessary and the connectors are kept clean and dry. When the voltage from the battery pack falls below 9.8 volts, the Reader Unit will display the message BATTERY low on the LCD display If the unit is not recharged the voltage will still drop and the instrument will then automatically shut down, although any data stored in the memory will be retained. When this occurs, the only way to restart the instrument is to recharge the batteries. Ensure that the connector caps are secured onto any connectors which are not in use.

Reset

If the reader unit behaves erratically:

- The Reader Unit will not switch ON or OFF
- LCD display will not display all the characters
- Press keys will not operate reliably
- Down loaded data out of sequence

It is necessary to reset the reader unit PCB for the above behaviour. If the unit will not switch off by pressing the **ON/OFF** key, the front panel should be unscrewed and the battery lead to the main PCB will need to be disconnected and then re-connected. Once the reader is switched off use the following procedure:

The RESET function is initiated by keeping the **ESC** key depressed while pressing the **ON/OFF** key. The message on the LCD display will ask you if you wish to continue or escape. Press the **ENTER** key for yes. It will then ask you want to set **YK Ser Probe** Yes Enter, No ESC. After pressing Enter it will ask if the unit is fitted with a depth sensor. If there is no depth sensor fitted on the probe press the **ESC** key, if there is a depth sensor then press the **ENTER** key.

It is important to now restart the reader unit (and not press any other key) by powering it off by pressing the ON/OFF key and powering it up again.

If the reader unit is fitted with an internal Bluetooth and GPS module go to **Establishing Bluetooth and GPS Power** in section **Internal Bluetooth and GPS** above.

The **RESET** function will not change or clear the calibration constants from the Reader Unit's memory. However it will remove stored or logged data. It will be necessary to reconfigure the display if any customization has been done to the display order.

Battery Replacement

The model 615 batteries are a battery pack and not user changeable. Contact Yeo-Kal Electronics.

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

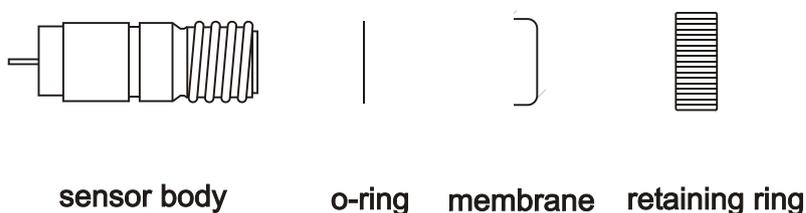sensor body   o-ring   membrane   retaining ring

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 to dry the area between the sensors. Using pliers, lever the dissolved oxygen sensor out of the probe.
2. 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.
4. To refill with electrolyte (1.0 M KOH), hold the probe vertical and place the nozzle of the squeeze bottle beside the silver electrode. Squeeze the bottle to fill the probe with electrolyte until it flows over the top of the probe.
5. Be sure that there are no bubbles inside the sensor.
6. Take a new membrane and centralise it on top of the electrode and let it float on the surface.
7. Place the retaining nut over the membrane and screw down firmly so that the membrane is well tensioned.
8. Check that there are no bubbles in the electrolyte. If bubbles are found, repeat the above procedure.

9. Apply a smear of O-ring grease to the body 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 clicks into place

10. **Wait at least 2 hours for the sensor to stabilise** then recalibrate the dissolved oxygen readings.

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. Loosen the two retaining screws in the stirrer support posts, (refer to figure 3), do not remove them.
2. Remove the stainless steel pin on which the paddle is held by pushing it from one end. Be very careful to not lose the spacers which are between the paddle and support posts.
3. Clean the paddle and replace it in the reverse order. Do not over tighten the retaining screws or you will strip the thread in the support post.

pH/ORP Sensor Maintenance

PH/ORP Sensors

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: These optional pH sensors have 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.

It is important to not get a single drop of water on the back of the ph sensor socket or in the ph socket on the probe. Even finger prints on the back of the ph sensor socket can affect ph
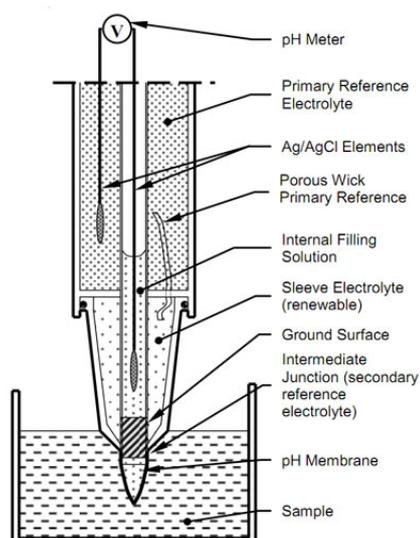
values and stability. Inspect and ensure these critical areas are wiped clean and dry before assembly.

Carefully and firmly pull the transparent forked junction from the dark grey barrel. It may help to twist the transparent forked junction to loosen the o-ring seal while pulling out.

Attach supplied needle to pH gel electrolyte and aim needle to the bottom of the gap between glass centre and dark grey barrel. The objective is to displace the old electrolyte gel with the new. It may be easier to flush the old gel and contaminants out with warm water or by using a wash bottle with the aid of a paper towel.

When re-gelling is complete, reattach the transparent forked junction and slowly push into the dark grey barrel till it will not go any more. As it is pushed, excess gel will be forced up between the glass centre and the transparent forked junction.

Note: Once the sensor has been serviced the pH sensor will need to be calibrated.

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

The above maintenance procedure is recommended prior to calibration. Follow the 2 point calibration procedure for your water quality analyser. In some 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 glass tube is kept clean. Do not use an abrasive cleaner. Clean the tube with a soft rag and, if required, detergent. Make sure that you rinse the probe so that there is no residual detergent film to interfere with the sensor optics. Make sure that you recalibrate turbidity after cleaning the sensor.

The model 615 comes with a black acetyl screen. This is inserted into the glass tube to reduce stray infra-red from causing errors in clear water. At the end of the tube are two holes/slots (apertures) that allow the infra-red light source to pass which is then detected at 90 deg to the source. Mud

and residue can accumulate and the holes/slots may become blocked and obscure the light source affecting the value. They can be cleaned by either using a small bottle brush or remove the screen to clean it.

Remove the screen by unscrewing two retaining screws at the bottom of the probe, situated on the flange. Pull the tube out and wash it and also clean the glass tube. Reinsert the screen and do up the two retaining screws.

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.

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.

This solution may be contained in either the small pH sensor cap

- If the YK615 pH sensor has a small cap around it, this simply pushes into place. The solution can be put into this cap for storage of the pH sensor. If this method is used, a drop of clean water should be put into the storage container to keep air around the DO sensor damp.

  CARE SHOULD BE TAKEN when removing or replacing this cap. **DO NOT UNSCREW THE CAP, (SLIDE THE CAP OFF)** The glass sensor is EXTREMELY DELICATE and should not be bumped or touched.

- The YK615 comes with a storage canister which clamps onto the probe providing a waterproof seal. To maintain enough moisture add 2-5mL of water to keep the pH sensor from drying out.

Appendix 1 - Conversions Used

The YK615 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

CE for probe

N 10255

Appendix 3 - Part Numbers

Part Number	Description
YK615-001	Probe assembly
YK615-002	Cable assembly
YK615-003	Dissolved oxygen sensor
YK615-004	pH/ORP sensor
YK615-005	Conductivity sensor
YK615-006	Depth sensor
YK615-007	Dissolved oxygen membrane
YK615-008	Dissolved oxygen O-ring
YK615-009	Dissolved oxygen membrane retaining ring
YK615-010	Dissolved oxygen electrolyte
YK615-012	Platinising solution
YK615-013	Sensor storage solution
YK615-014	pH buffer 4.0 1 litre
YK615-015	pH buffer 10.0 1 litre
YK615-016	Salinity standard 35.00 ppt 1 litre
YK615-017	Formazin solution 1 litre
YK615-018	Battery pack
YK615-019	Battery pack c/w batteries
YK615-020	Front panel membrane
YK615-021	Circuit board
YK615-022	Communications cable
YK615-023	Auxiliary 12V supply cable
YK615-024	Auxiliary 12V Bulk head connector
YK615-025	Communications bulk head connector
YK615-026	Sensor bulk head connector
YK615-027	YEO-KALGraph graphics software