

**NEP50xx RS485/RS232/SDI12/USB & Analogue option**

Sensor calibrations and output configurations.



**Environmental Compliance for Dredging Operations**





## 1.0 Prerequisites

- Please find the provided USB or download latest software from <http://download.observator.com/files>.

**The Main site.**

<http://download.observator.com/files/>

**Software**

<http://download.observator.com/files/?dir=Software/NEP50xx>

**For CFGs**

<http://download.observator.com/files/?dir=NEP50XX%20calibration%20da>

To download a single CFG single file from the list.

Please right click and press "**Save link as**"

*To help locate files please use the "find or search" tool in your browser.*

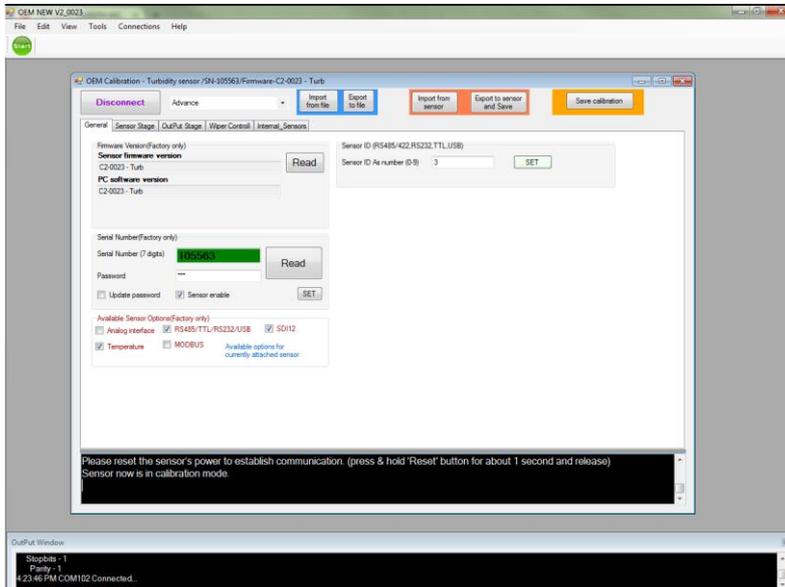
**Important** – Please make sure that to use matching revision of sensor’s firmware and PC software.

Folder view

Name	Date modified	Type
Calibration	30/06/2016 12:47 ...	File fol
Device_CPU	6/06/2016 9:09 PM	File fol
Devices	6/06/2016 9:21 PM	File fol
Hex	6/06/2016 9:21 PM	File fol
Prerequisites & Drivers	6/06/2016 9:09 PM	File fol
 Nephlo <span style="font-size: small;">meter</span> OEM.exe	6/06/2016 9:09 PM	Applic
 USB NEP5000 V3.exe	31/03/2016 7:25 PM	Applic
usb_config.txt	5/07/2016 4:22 PM	Text D
Docs	13/07/2016 9:57 AM	File fol

- “Nephlometer OEM.exe” calibration software installed PC.  
User may run this exe directly from USB or copy contains to a local drive (When coping please copy all the supporting folders to same location).



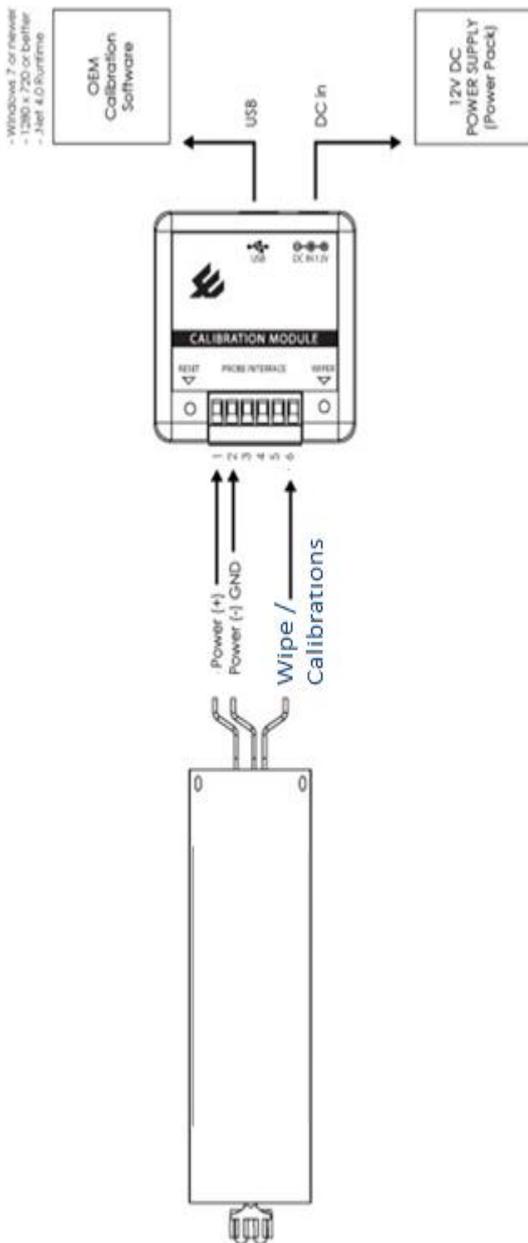


- Observator Instruments NEP50xx OEM calibration module, USB cable and supplied installation disk or USB drive.



## 2.0 Calibration Hardware Setup

Please setup your probe as follows. Note that the 12V power pack is not required if your USB port can deliver more than 200mA.



( Glanded cable )NEP500x RS485 & analogue option wire colours and its functions.

Wire colour	NEPOEM Voltage option.
Brown	DC+10Vto30V
Green	GND
Grey	Wipe / Calibrations
White	Voltage out reference to GND OR 4-20mA Loop driver out to GND.
Blue	RS485 (-)
PINK	RS485 (+)

(Glanded cable 6m maximum length )NEP500x, RS232 & analogue option wire colours and its functions.

Wire colour	NEPOEM Voltage option.
Brown	DC+10Vto30V
Green	GND and RS232 GND
Grey	Wipe / Calibrations
White	Voltage out reference to GND OR 4-20mA Loop driver out to GND.
RED	RS232 TX
Yellow	RS232 RX



## Subconn connector Option

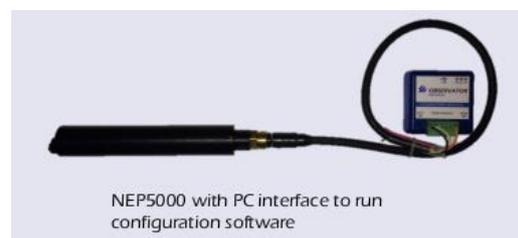
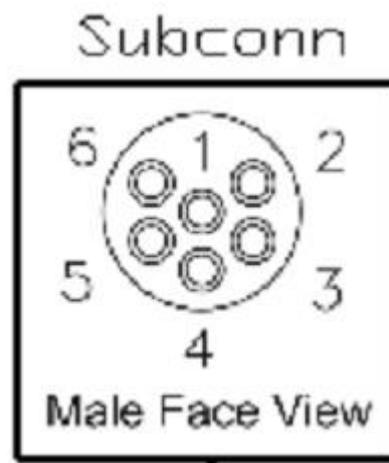
### NEP50xx with 4-20mA current option. Subconn pins

pin 1	Power(+)12V to 24V
pin 2	GND and RS232 GND
pin 3	RS485+ OR RS232 TX
Pin 4	RS485- OR RS232 RX
Pin 5	Calibration wire turbidity.
Pin 6	4-20mA current out through GND.

### NEP5000 with pressure option (RS485 only). Subconn pins

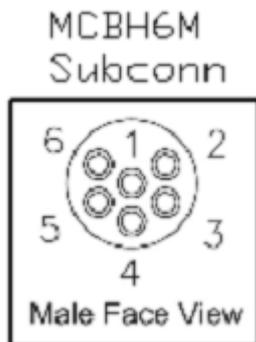
pin 1	Power (+) 12V to 24V
pin 2	GND
pin 3	RS485+
Pin 4	RS485-
Pin 5	Calibration wire turbidity.
Pin 6	Calibration pressure.

Subconn Pin number	Subconn standard matching connector's Default wire colours.
Pin 1	Black
Pin 2	White
Pin 3	RED
Pin 4	Green
Pin 5	Orange
Pin 6	Blue



## NEP5008 Sensor Pinouts OR wire colours.

### SubConn connector SDI12 Option.



- Pin1- = Power GND, SDI12 GND and Voltage output GND.
- Pin2- =SDI12 Data.
- Pin3- =10 to 30V DC power (+ve).
- Pin4- =4-20mA loop to power GND via 100ohms
- Pin5- =Voltage Out.
- Pin6- =Calibration Communication Data.

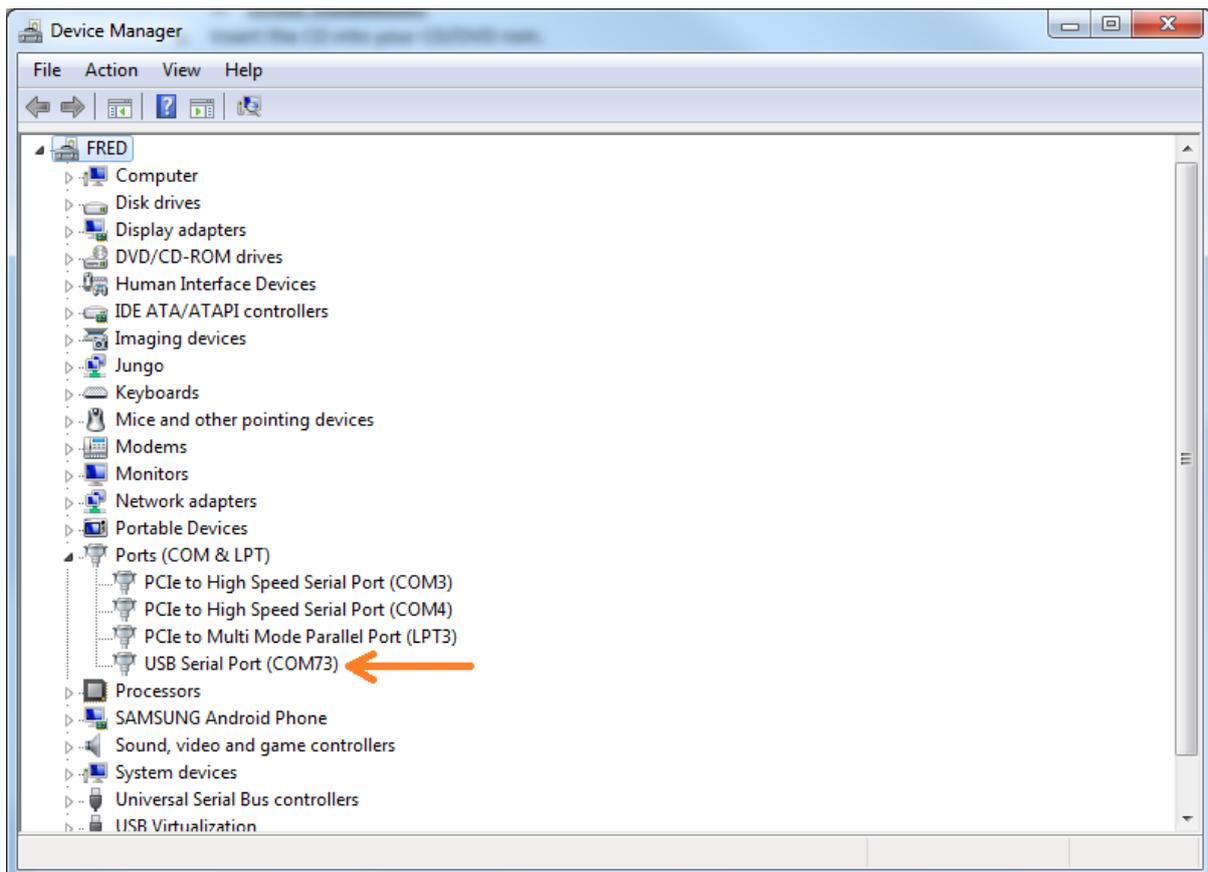
### SDI12 Glanded option

- Green- = Power GND, SDI12 GND and Voltage output GND.
- White- =SDI12 Data.
- Brown - =10 to 30V DC power (+ve).
- Blue - 4-20mA loop to power GND via 100ohms
- Yellow- =Voltage Out.
- Gray- =Calibration Communication Data.



## 3.0 Driver Installation

- Insert the CD into your CD/DVD rom or Insert provided USB.
- Connect Calibration module to PC via supplied USB cable.
- Open “Windows device manager” and select the newly connected device.
- Right click and click “Update device software” and then click “driver software from your computer” option.
- Using the “Browse” button select optic diver when prompt and OK.
- Wait for completion of driver installation.
- After successful installation “Windows device manager” should display a com port in “Ports (COM & LPT)” Category.

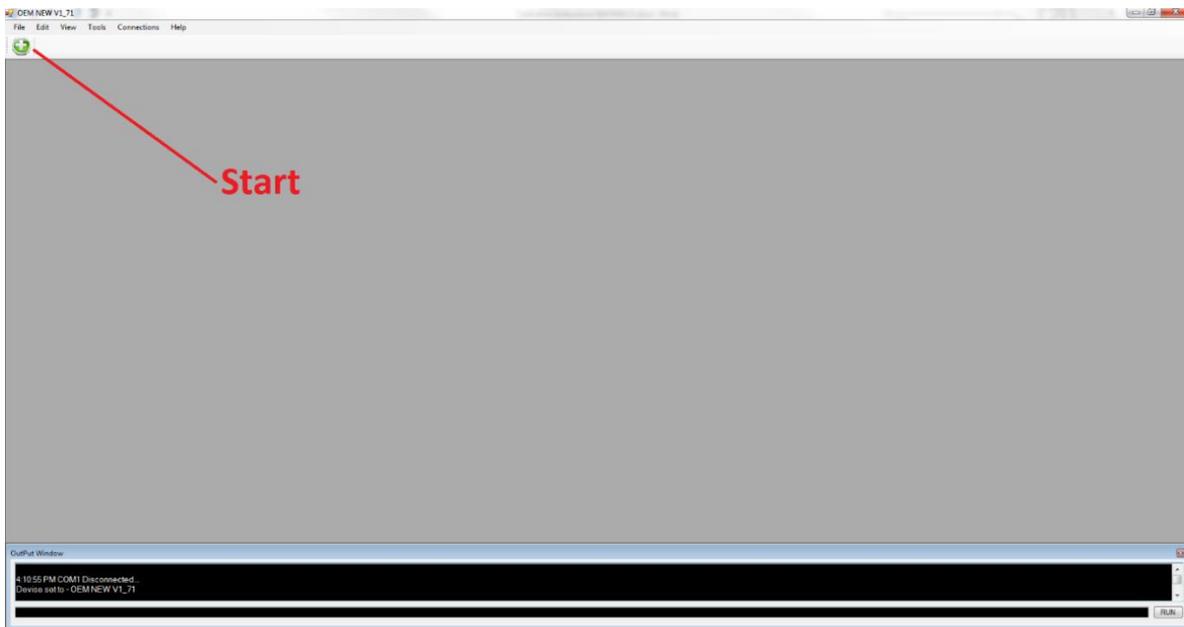


- Note the new port number.

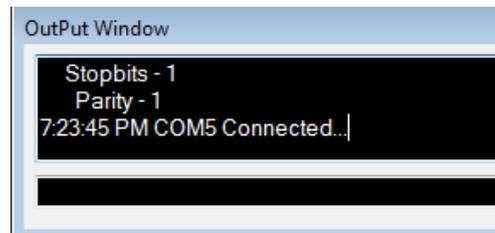
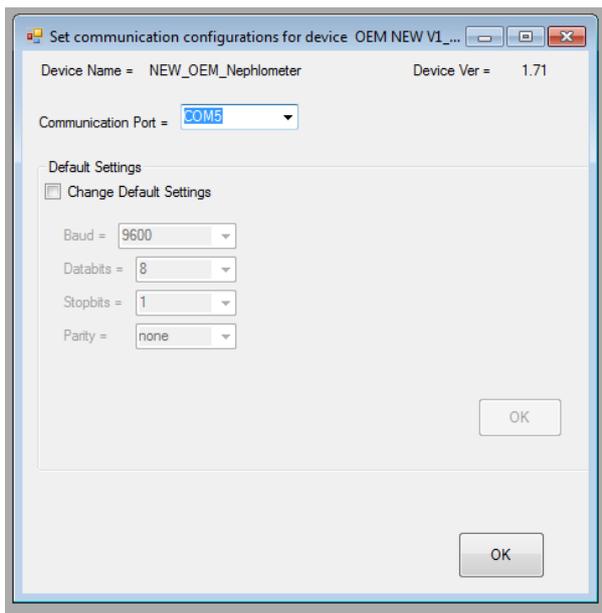


## 4.0 Software Connection Setup

- a. Run calibration software and press “Start” Button.



- b. Select the correct COM port from dropdown box and press OK.

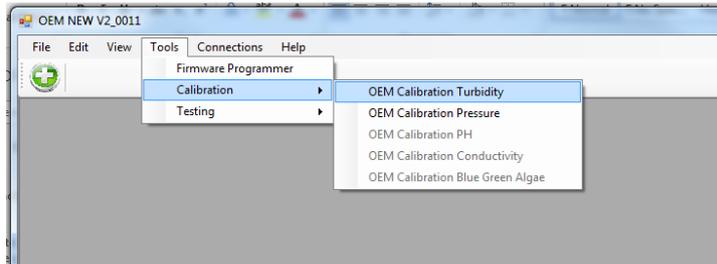


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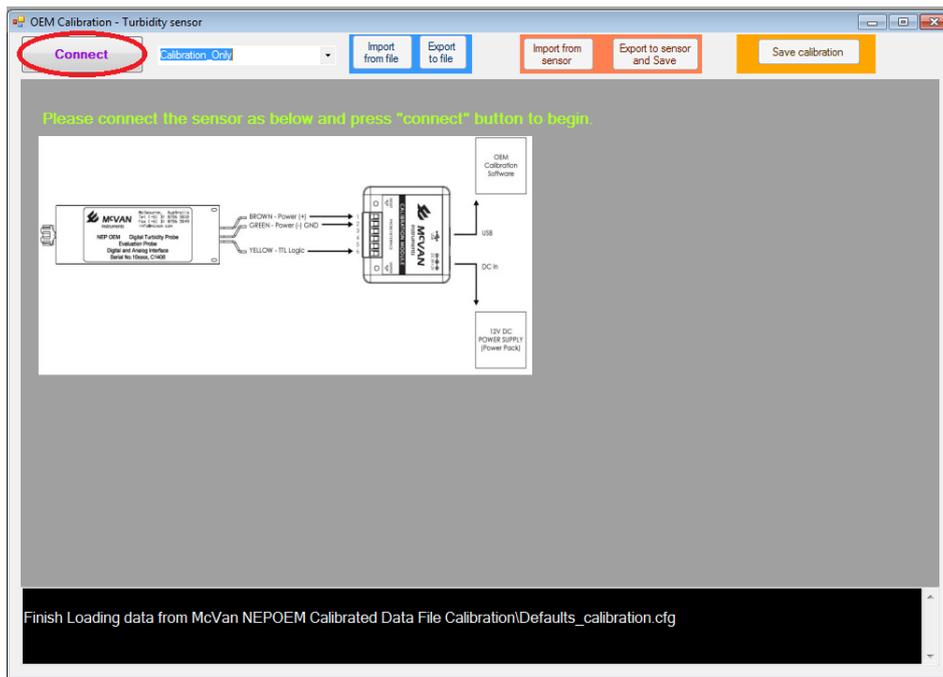


Note – Output Window should show following when correct communications port is select

- c. Go to “Tools”, “Calibration” and select “OEM Calibration Turbidity”.

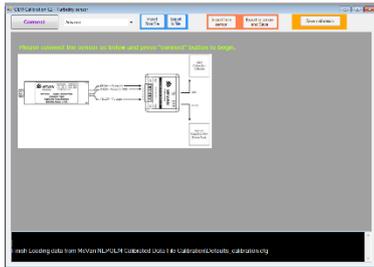


Note – Step 3.d will run the Calibration Window. Pressing the maximise button (top right) will enable a larger view.

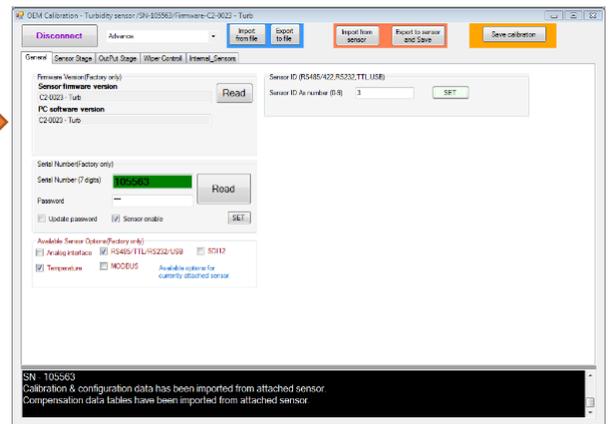
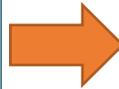


To establish a calibration connection with the sensor please follow the following procedure.

1. Press connect button “Connect Button” on the software.



2. Press “Reset” button on Calibration Module.



Output Window should show following when successful.

“SN -xxxxx

Calibration & configuration data has been imported from attached sensor.

Compensation data tables have been imported from attached sensor.”

Note 1 – First line showing that all the calibration data displaying are defaults values.

Note 2 – Select “Advance” in top left drop down window to display all Available Options.



## 5.0 Practices & Principles

### A. Abstract

Chapter 5.0 outlines the strict guidelines that an operator should follow during the operation of the turbidity sensors. It is highly recommended that all operation staff read this chapter thoroughly independent of prior background knowledge. **Failure to do so may result in undesired measurement discrepancies.**

### B. Laboratory Equipment

Quality laboratory equipment is essential during the calibration stages to minimise errors that may arise in the laboratory. Essential lab equipment includes: in-date reference solutions, infrared absorbent containers, wash solution, compressed air and a vice and stand.

Zero NTU reference (Amco Clear) & 'Top End'

Reference solutions



Figure 5.1

Stand and Vice



Figure 5.2

Infrared Absorbent Container

Wash Solution



Figure 5.3



Figure 5.4

Compressed Air



Figure 5.5

Page



All reference solutions should be replaced after expiry.  
Infrared absorbent containers should be thoroughly washed after usage.  
Wash solutions replaced regularly.

### C. Probe Cleaning

Turbidity probe heads should always be cleaned before immersion into a reference solution. This process consists of rinsing the probe head with a Zero '0' NTU wash solution (distilled water is acceptable) then removing the moisture with compressed air.

Stains or other foreign matter may be removed with a lint free cloth. However, the probe should again be blown with a compressed air if a cloth is applied.

### D. Probe Immersion

For accurate readings, the reference solution should be poured into an infrared absorbent container. This will minimise ambient radiation from disrupting the probe reading. Furthermore, there should be a minimum of 70mm height from the reference solution's surface to the container bottom.

Turbidity probe in 0 NTU solution  
Probe is clamped in place



Figure 5.6

Turbidity probes should be inserted into the reference solution at a non-perpendicular angle with respect to the liquid surface. This will minimise the likelihood of bubble formation upon the optic head.



Once the conditions listed above have been satisfied, fix the probe into position with a clamp and stand. Figure 5.6 illustrates an appropriately configured measurement apparatus.

#### **E. Wiping**

Before logging data, the operator should always perform at least one wipe. The operator should note the raw NTU value before and after the wipe. If the raw NTU value changes significantly, it is likely that air bubbles have formed on the optic head. In this case, Section D should be repeated. Otherwise, proceed to Section F.

#### **F. Measuring & Stabilisation**

Provided Section E & D were performed without error, the turbidity probe is now ready to acquire data. Set the probe into data acquisition mode and observe the behaviour of the raw NTU value. Probe data will be valid once the raw NTU stabilises. Stabilisation typically takes anywhere between 5 to 10 seconds. However more time may be required for low NTU solutions (less than 100 NTU).

#### **G. Post Measurement Cleaning**

Turbidity probes should be cleaned immediately after usage. Failure to do so may result in the formation of stains that could pollute reference solutions.



## 6.0 General Settings

### A. Firmware Version

The current firmware revision running on the connected probe. Please make sure that both probe and PC versions are in same revision.

### B. Serial Number

Unique serial number assigned to the running probe during manufacturing. Serial numbers cannot be changed.

### C. Password

Factory usage only.

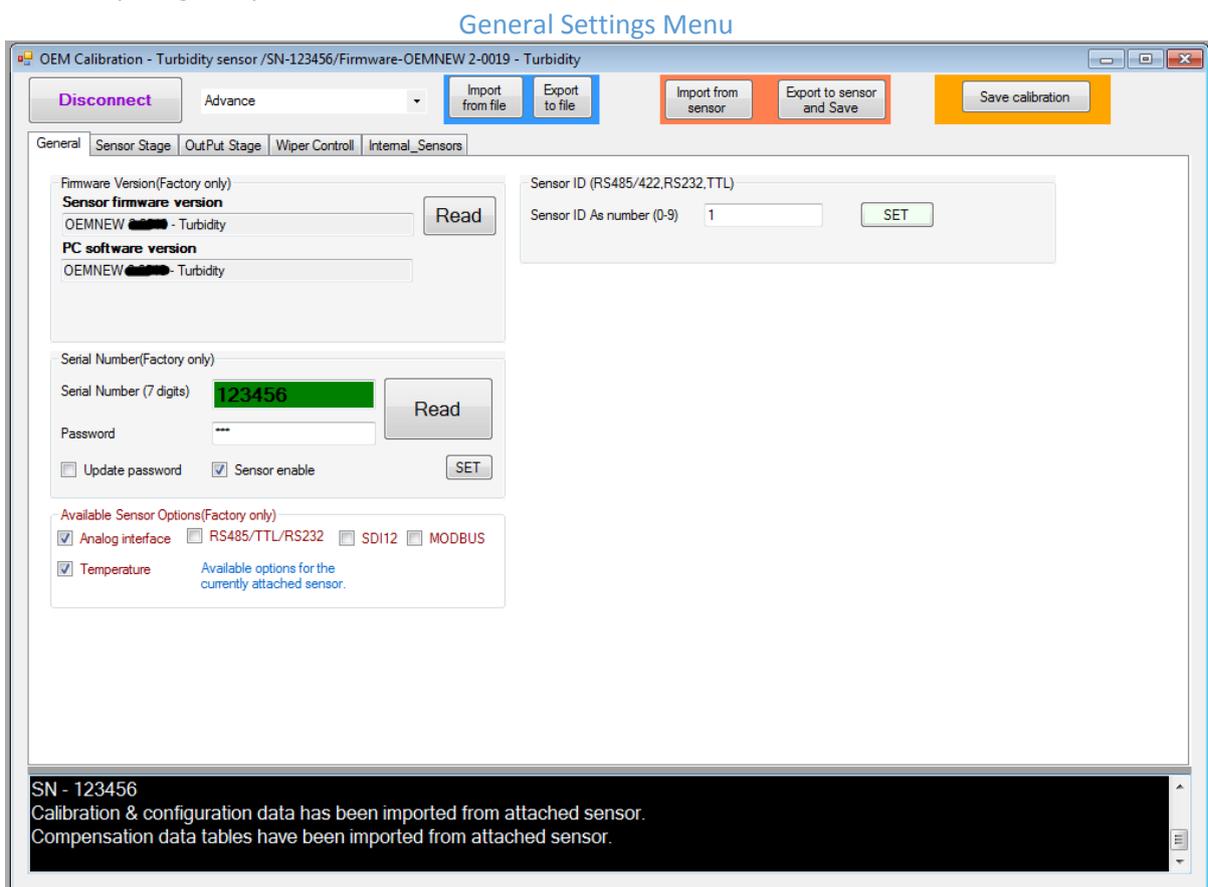


Figure 6.1

### D. Sensor ID

Current ID of running sensor. Sensor ID can range from 0 to 9. Sensor ID is used for serial output.

### E. Available Sensor Options

A list of output interfaces available to the probe. Corresponding hardware must be physically installed into the probe for outputs to be available.





## 7.0 Turbidity Sensor Calibration

*Please read Chapter 5.0 Practices & Principles before attempting calibration instructions outlined in chapter 7.*

### A. Equipment

Before attempting calibration, please ensure that you have the following equipment:  
 Zero '0' NTU reference solution (Amco Clear), one 'top end' reference solution per each range, a vice stand, wash solution (Distilled water or Amco Clear), one infrared absorbent container per reference solution, compressed air.

0 NTU reference (Amco Clear) & 'Top End'

Reference solutions



Figure 7.1

Stand and Vice



Figure 7.2

Wash Solution



Figure 7.3

Infrared Absorbent Container



Figure 7.4

Compressed Air



Figure 7.5

### B. Preparation

Please thoroughly read Chapter 6.0 Section X before attempting subsequent steps!



### C. Navigation

The turbidity range and sensitivity calibration options are located under the 'Sensor Stage' primary tab and 'Sensor Calibrations' secondary tab.

### D. Range Selection

The turbidity sensor probe comprises three turbidity ranges; low, medium and high. Each range is optimised for measuring specific levels of turbidity (**Check order information for target ranges**).

*NOTE: The 'Auto' option is not a discrete range, but rather a mechanism for the probe to dynamically adjust the range settings during data acquisition, thus automatically selecting appropriate range for the current sample. This is covered in section G.*

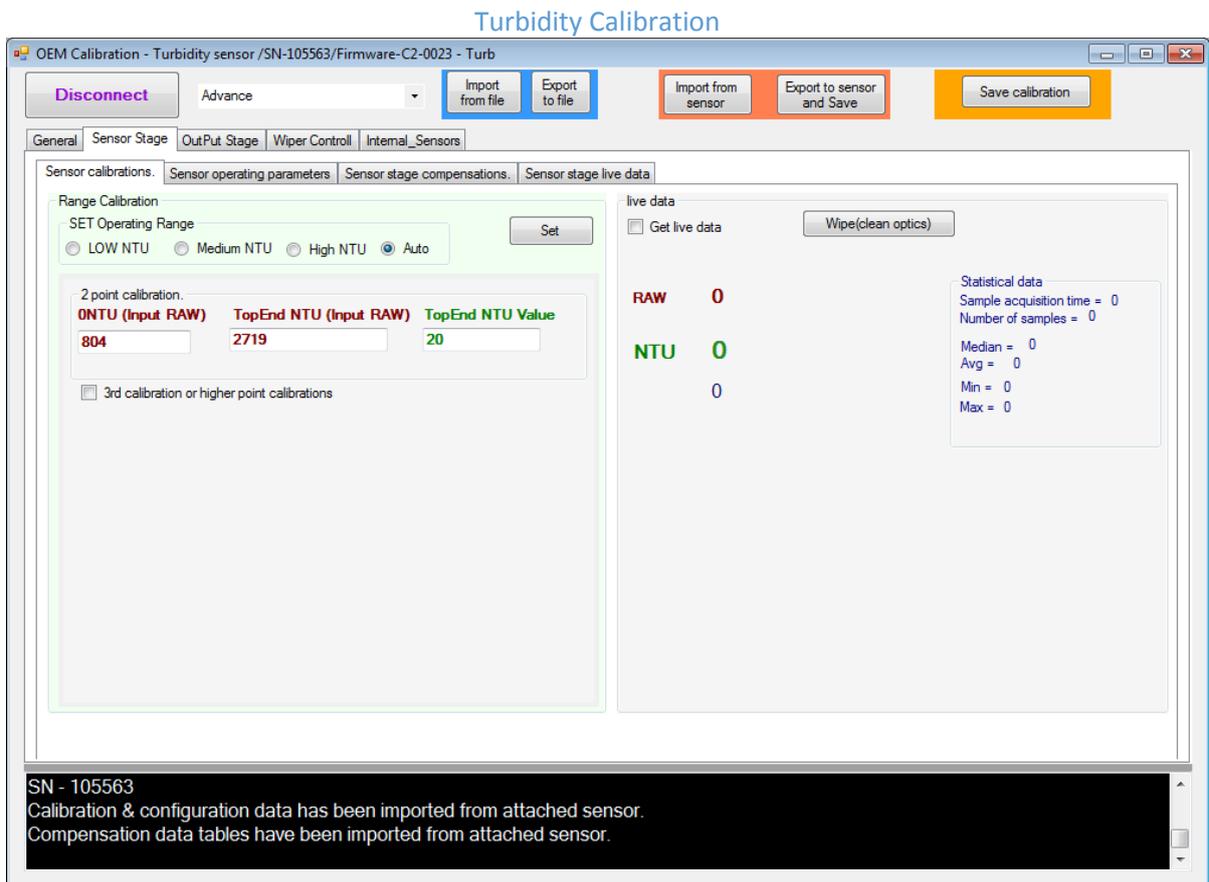


Figure 7.1



## E. 2-Point Calibration

This is the process of normalising measured data between two reference points; 'low end' (Zero '0' NTU reference) and 'top end'.

### a. Turbidity Value

To commence calibration of a particular range, the target 'top end' turbidity rating must first be specified. In the example illustrated in figure 7.1, the 'top end' solution has a turbidity rating of 1000 NTU. Thus, in this case we input the integer value of 1000 into the 'TopEnd NTU Value' text field (field in green).

### b. Low End

Secondly, we must acquire the zero NTU offset of the turbidity sensor. (*NOTE: The offset is specific to each individual sensor*). This is achieved by measuring the turbidity of a Zero '0' NTU reference solution.

Start by first placing the probe in the reference Zero '0' NTU solution. Next, tick the 'Get Live Data' check box. Subsequently, the probe will commence measuring the solution. Allow the turbidity sensor a few seconds to stabilise (**Please refer to Chapter 6 Section X for recommended turbidity measuring practices**). The turbidity sensor's raw measurement (value in red) should stabilise between 100 and 200. (*Ignore the NTU reading for now*).

Once stabilised, un-tick the 'Get Live Data' check box. Next, copy the raw measurement integer into the Zero '0' NTU (Input RAW) text field.

### c. Top End

Place the probe into the 'top end' solution. Next tick the 'Get Live Data' check box. Allow the probe time to stabilise (**Please refer to Chapter 6 Section X for recommended turbidity measuring practices**). Once stabilised, un-tick the 'Get Live Data' check box. Next, either click on the 'TopEnd NTU (Input Raw)' label or in the adjacent text field, manually input the raw NTU value. Finally click the 'Set' button.

To clarify results, replace the probe into known turbidity solutions ranging between zero and the 'top end' solution.

### d. Committing to Memory

Once satisfied with results, click the 'Save Calibration' button in the top right hand corner of the working window (**the button on the orange background**). This will instruct the probe to retain the calibration settings even after power down.



## F. Auto-Ranging

### a. Abstract

The Auto-Ranging feature is a mechanism for the probe to dynamically adjust the range settings during data acquisition. Thus, ensuring that the probe always operates in the range that will give the finest available resolution.

To enable the auto-ranging feature, the probe must first be calibrated for all three ranges.

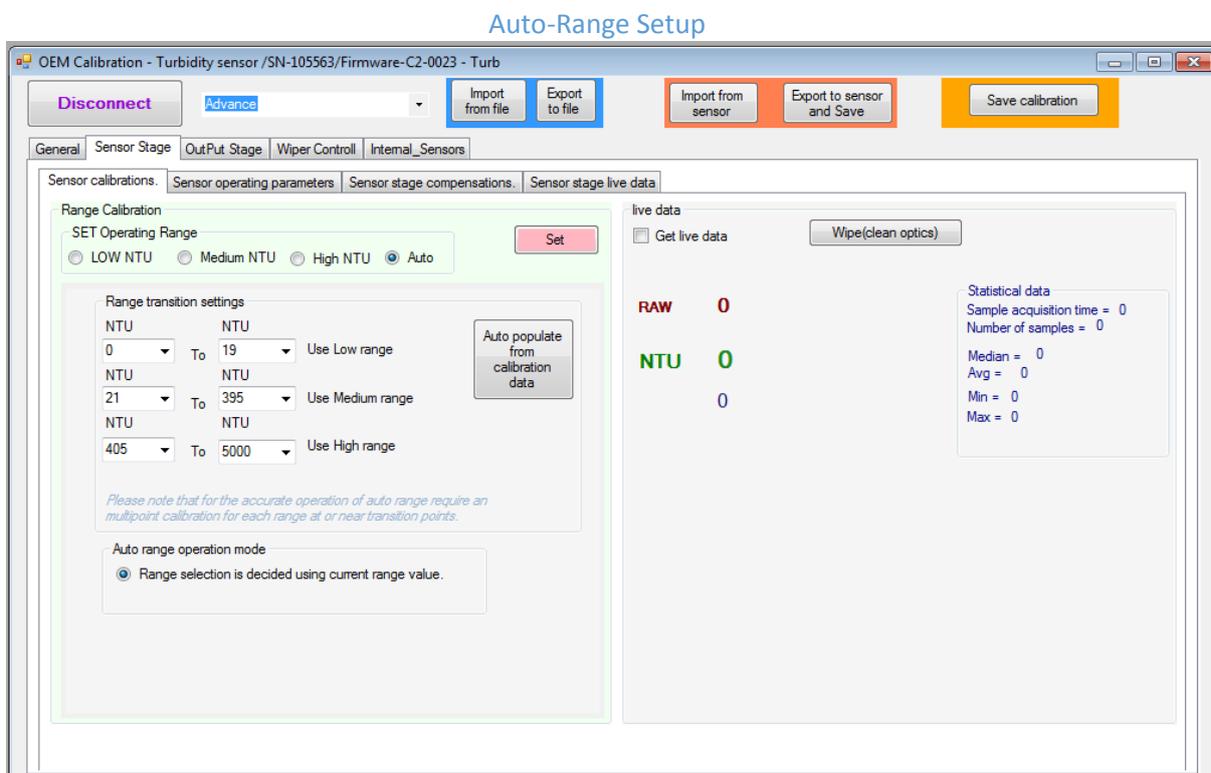


Figure 7.3

### b. Navigation

The Auto-Range feature can be accessed by clicking on the 'Sensor Stage' tab, 'Sensor Calibrations' tab and finally selecting the 'Auto' radio button.

### c. Enabling

The Auto-Range feature is enabled by clicking the 'Auto populate from calibration data' button. This will setup the overlapping turbidity values by extracting the results from the three ranges. Next, click the 'Set' button. Finally, click the 'Save calibration' button.

### d. Verification

Verify the auto-ranging feature by sampling differing solutions that fall into the low, medium and high ranges. If setup correctly, the probe will automatically change its operating range to best suit the current solution.



## 9.0 Analogue Voltage Output Calibration

### **A. Navigation**

The analogue voltage output configuration settings are located under the 'Output Stage' primary tab and 'Analogue Out\_RAW\_setup' secondary tabs (Figure 8.2).

### **B. Enabling Analogue Voltage Output**

The voltage output is enabled by checking the 'Analogue' tick box. The sample rate can be adjusted by changing the integer value of the field box located next to the tick box. The integer value expresses the sample period in milliseconds.

### **C. Physical Calibration Setup**

The voltage output can be measured with a laboratory grade multimeter (or voltmeter). All voltage enabled probes are calibrated in factory with digital multimeter.

### **D. Adjusting Bottom Limit**

Select the 'Set 0 NTU Offset' radio button. Click 'Apply/Test' and the probe will output the voltage associated with the Zero '0' NTU offset.

The Zero '0' NTU voltage offset can be adjusted by moving the range slider. To increase the offset voltage, move the slider to the right. To decrease the offset voltage, move the slider to the left. Offset changes take effect after pressing the 'Apply/Test' button.

### **E. Adjusting Top Limit**

Repeat step D procedure, but with the 'Set Top end Limit' radio control selected.



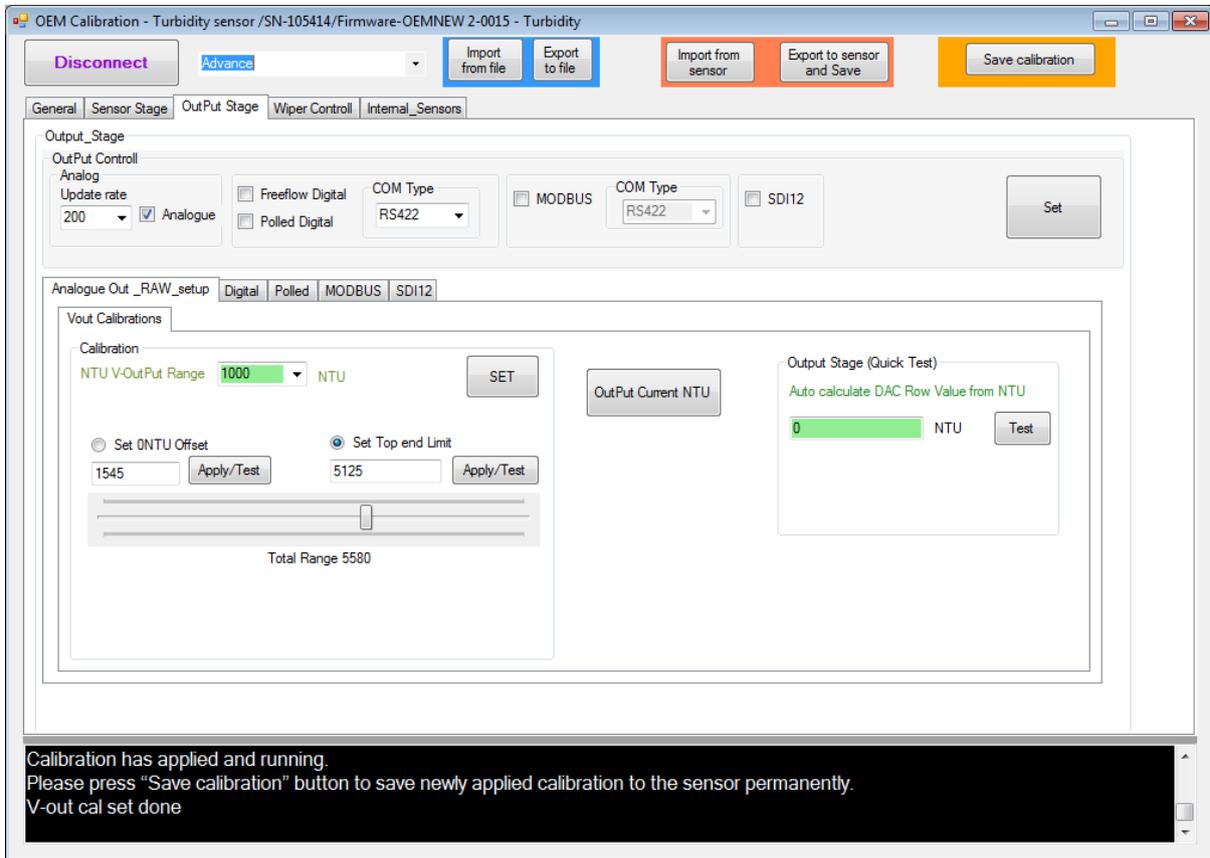


Figure 9.2

### F. Setting Target Turbidity Upper Limit

The target turbidity upper limit can be set by specifying the turbidity level in the 'NTU V-Out Range' text box on the 'Vout Calibrations' tab.

For example, in figure 9.2 it can be observed that the target turbidity upper limit is set to 1000 NTU. In the case the probe measure a solution of 1000 NTU, the voltage induced on the output will be equal to the voltage specified by the 'Top Limit' (Section E). Similarly, if the probe measures a 0 NTU solution, the voltage on the output will be equal to the voltage specified by the 'Bottom Limit' (Section D).



### **G. Committing Calibration to Memory**

Once satisfied with the settings, click the 'Set' button in the top right hand corner of the Calibration tab. Next click the 'Set' button on the 'Output Stage' tab. Finally, click the 'Save Calibration' button in the top right hand corner of the active window.

### **H. Verification**

Analogue voltage outputs for turbidity levels may be simulated using the 'Output Stage (Quick Test)' feature. To do this, input an expectant turbidity level into the 'Auto calculate DAC Raw Value from NTU' value field. Next click the 'Test' button. The probe will subsequently output the corresponding voltage.



## 10.0 Analogue Current Loop

### **A. Abstract**

The Analogue Current Loop output facilitates a milli-ampere current output interface. The current loop has a specified bottom limit of 4mA and an upper limit of 20mA.

### **B. Navigation**

The analogue current output configuration settings are located under the 'Output Stage' primary tab and 'Analogue Out\_RAW\_setup' secondary tab (Figure 10.2).

### **C. Enabling Analogue Current Loop Output**

The current loop output is enabled by checking the 'Analogue' tick box. The sample rate can be adjusted by changing the integer value of the field box located next to the tick box. The integer value expresses the sample period in milli-seconds.

### **D. Physical Calibration Setup**

The current loop output can be measured with a laboratory grade multimeter (or ammeter).

A load resistance must be placed in series with the ammeter. The recommended load resistance is 100 ohms, however load resistance may vary between 50 to 270 ohms. All current loop enabled probes are calibrated in factory with Fluke 15B digital multimeters.

### **E. Adjusting Bottom Limit**

Select the 'Set 0 NTU Offset' radio button. Click 'Apply/Test' and the probe will output the current associated with the 0 NTU offset. The 0 NTU current offset can be adjusted by moving the range slider. To increase the offset current, move the slider to the right. To decrease the offset current, move the slider to the left. Offset changes take effect after pressing the 'Apply/Test' button.

### **F. Adjusting Top Limit**

Repeat step D procedure, but with the 'Set Top end Limit' radio control selected.



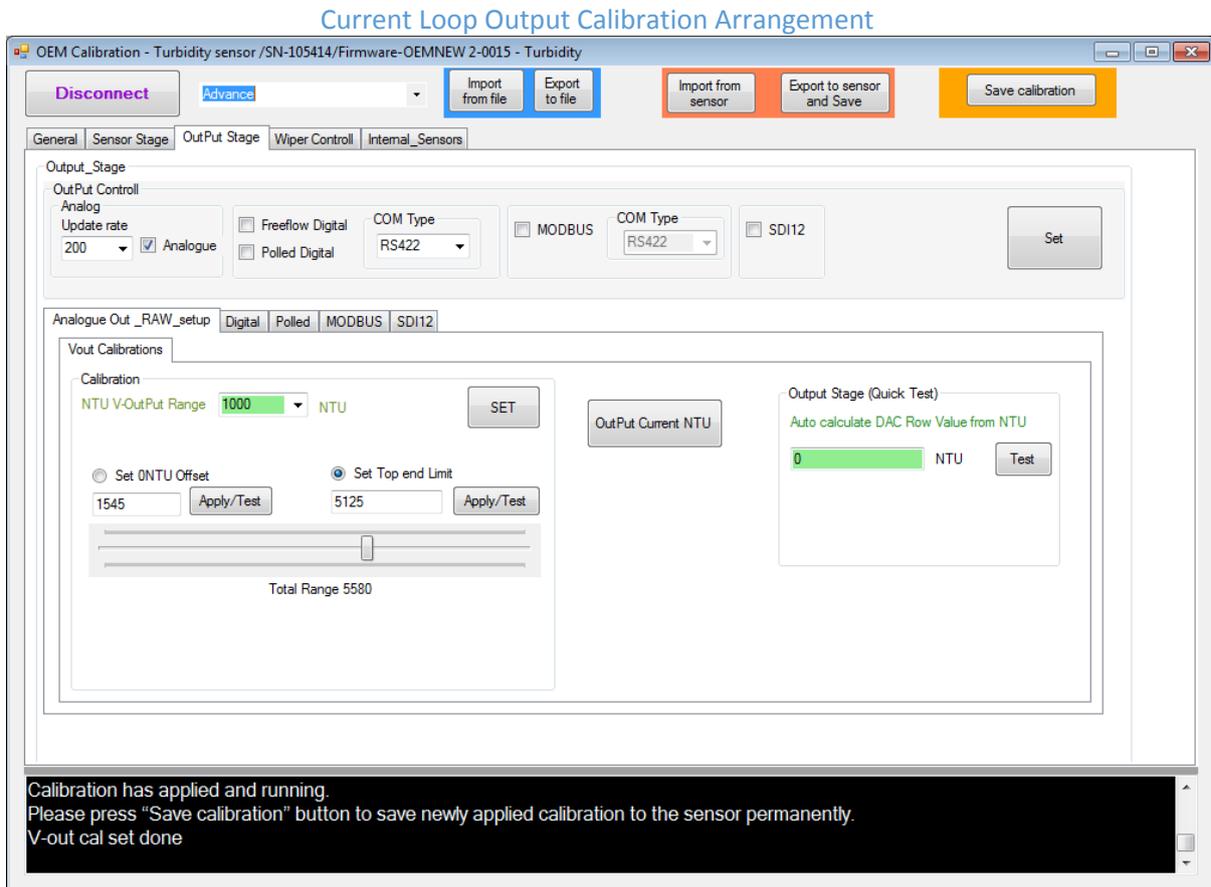


Figure 10.2

### G. Setting Target Turbidity Upper Limit

The target turbidity upper limit can be set by specifying the turbidity level in the 'NTU V-Out Range' text box on the 'Vout Calibrations' tab.

For example, in figure 10.2 it can be observed that the target turbidity upper limit is set to 1000 NTU. In the case the probe measure a solution of 1000 NTU, the voltage induced on the output will be equal to the voltage specified by the 'Top Limit' (Section E). Similarly, if the probe measures a 0 NTU solution, the voltage on the output will be equal to the voltage specified by the 'Bottom Limit' (Section D).

Note that the Target Turbidity Upper Limit may be adjusted without having to repeat Section E & F.



### H. Committing Calibration to Memory

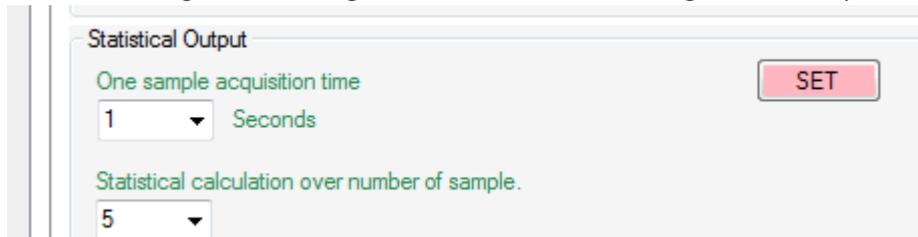
Once satisfied with the settings, click the 'Set' button in the top right hand corner of the Calibration tab. Next click the 'Set' button on the 'Output Stage' tab. Finally, click the 'Save Calibration' button in the top right hand corner of the active window.

### I. Verification

Analogue voltage outputs for turbidity levels may be simulated using the 'Output Stage (Quick Test)' feature. To do this, input an expectant turbidity level into the 'Auto calculate DAC Raw Value from NTU' value field. Next click the 'Test' button. The probe will subsequently output the corresponding voltage.

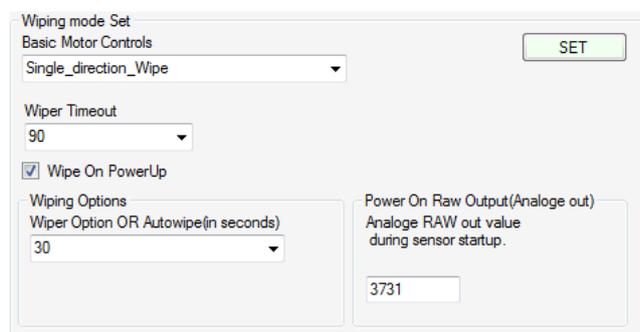
### Statistical measurement's configurations.

This user configurable settings are located in "Sensor stage > Sensor operating parameters"



### Wiper settings.

This user configurable settings are located in "Wiper control"



User may select how the wiper should operate when initiated by a logger or in auto wipe mode.



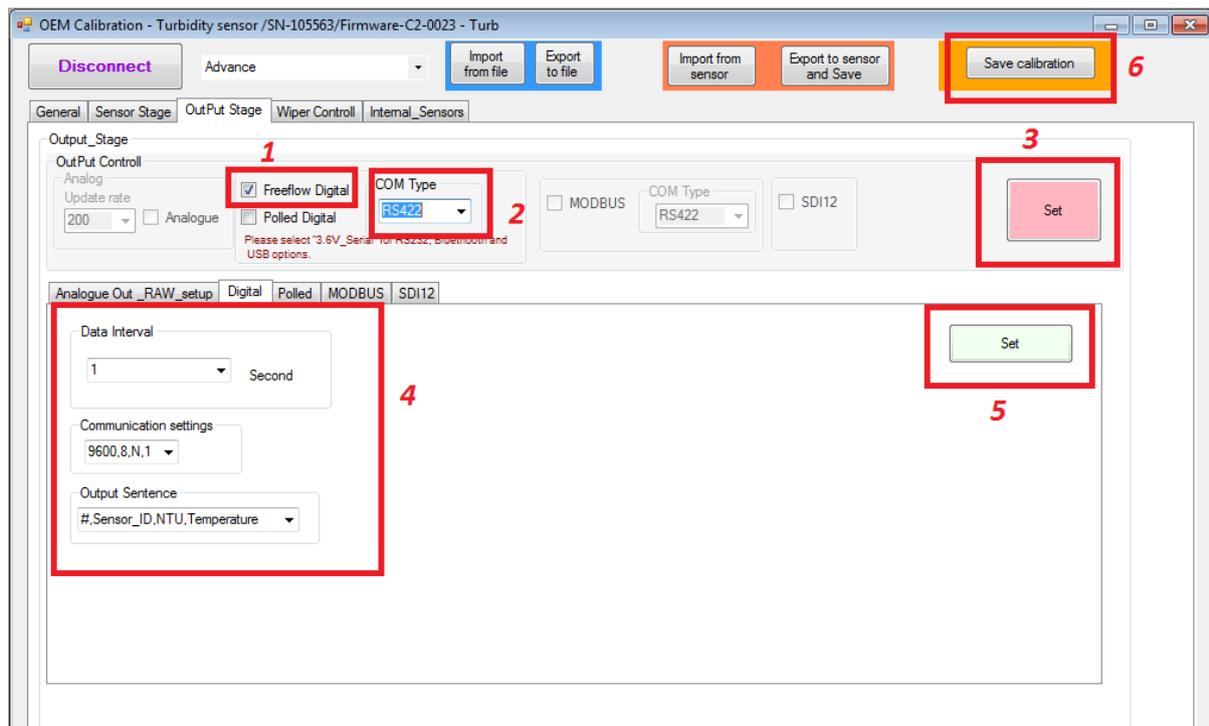
## 11.0 Serial output using RS485

The sensor can operate in two modes using Rs422/RS485 electrical data output.

1. Continuous free flow.
2. Rs485 Poled.

### Continuous free flow.

Please use the following settings and press buttons 3, 5 and 6 in sequence after selecting settings 1, 2 and 4.

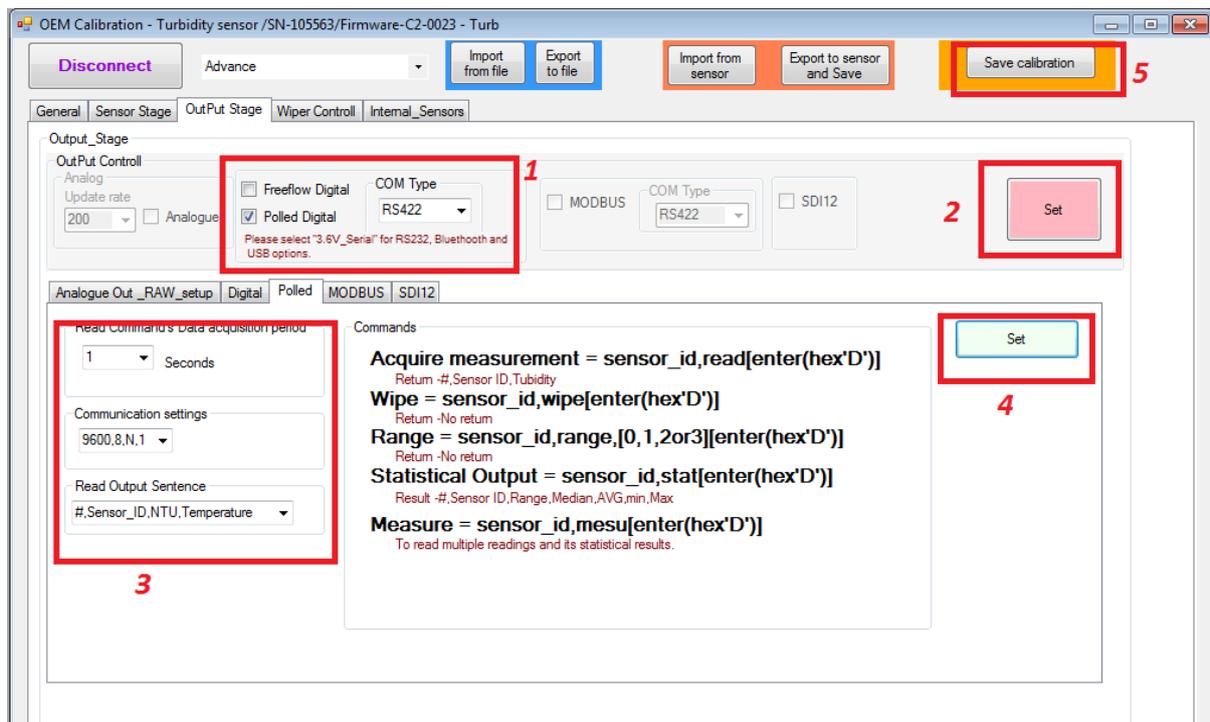


This will output Continuous RS422 data every 1 second Baud 9600, 8, n, 1.



**RS485 polled.**

Please use the following settings and press buttons 4, 2 and 5 in sequence after selecting settings 1 and 3.



OEM Calibration - Turbidity sensor /SN-105563/Firmware-C2-0023 - Turb

Disconnect Advance Import from file Export to file Import from sensor Export to sensor and Save Save calibration 5

General Sensor Stage OutPut Stage Wiper Control Internal\_Sensors

Output\_Stage

OutPut Control

Analog Update rate 200 Analogue

Freeflow Digital COM Type RS422 1

Polled Digital

MODBUS COM Type RS422 2

SDI12

Set

Analogue Out\_RAW\_setup Digital Polled MODBUS SDI12

Read Commands data acquisition period 1 Seconds

Communication settings 9600,8,N,1

Read Output Sentence #.Sensor\_ID,NTU,Temperature 3

Commands

Acquire measurement = sensor\_id,read[enter(hex'D')]  
Return -#,Sensor ID,Turbidity

Wipe = sensor\_id,wipe[enter(hex'D')]  
Return -No return

Range = sensor\_id,range,[0,1,2or3][enter(hex'D')]  
Return -No return

Statistical Output = sensor\_id,stat[enter(hex'D')]  
Result -#,Sensor ID,Range,Median,AVG,min,Max

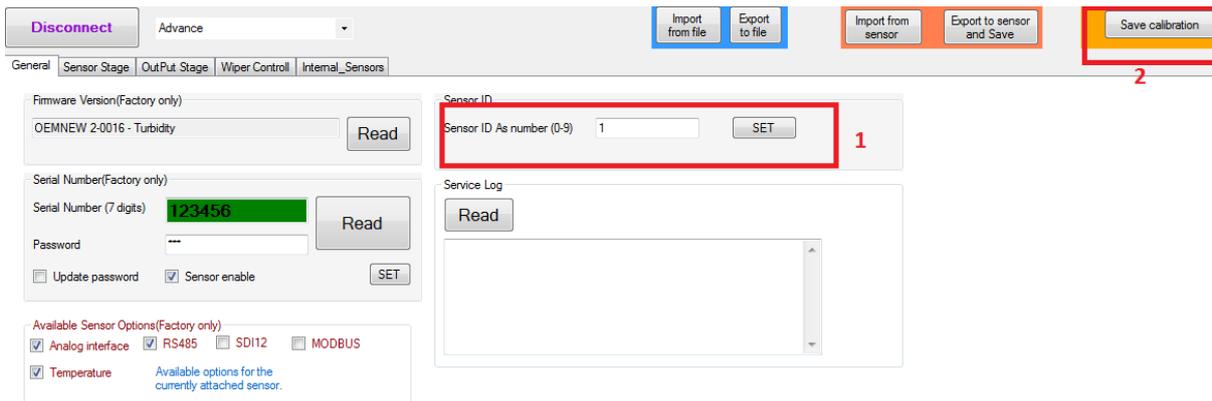
Measure = sensor\_id,mesu[enter(hex'D')]  
To read multiple readings and its statistical results.

Set 4



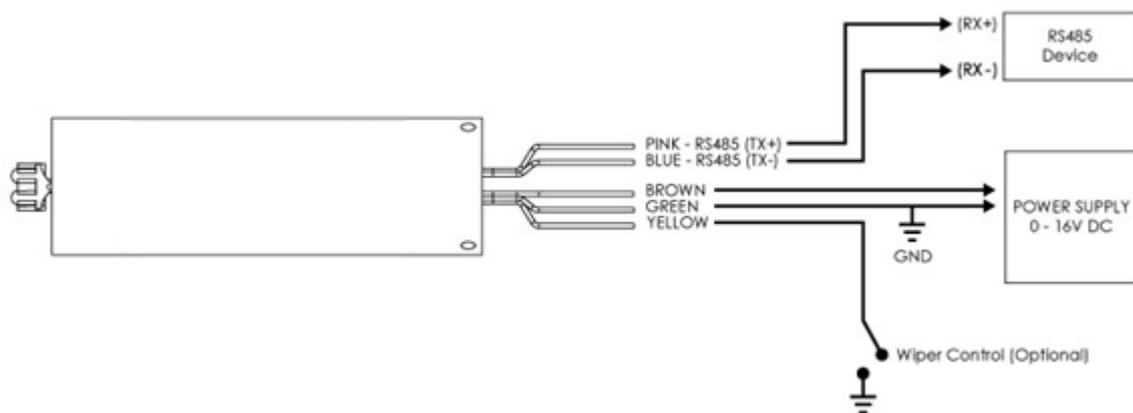
### Set Sensor ID.

Please do step 1 and 2 in sequence.



With above settings the sensor will wait for following RS485 commands and responds accordingly.

### Recommended RS485 and RS422 test setup.



Page:



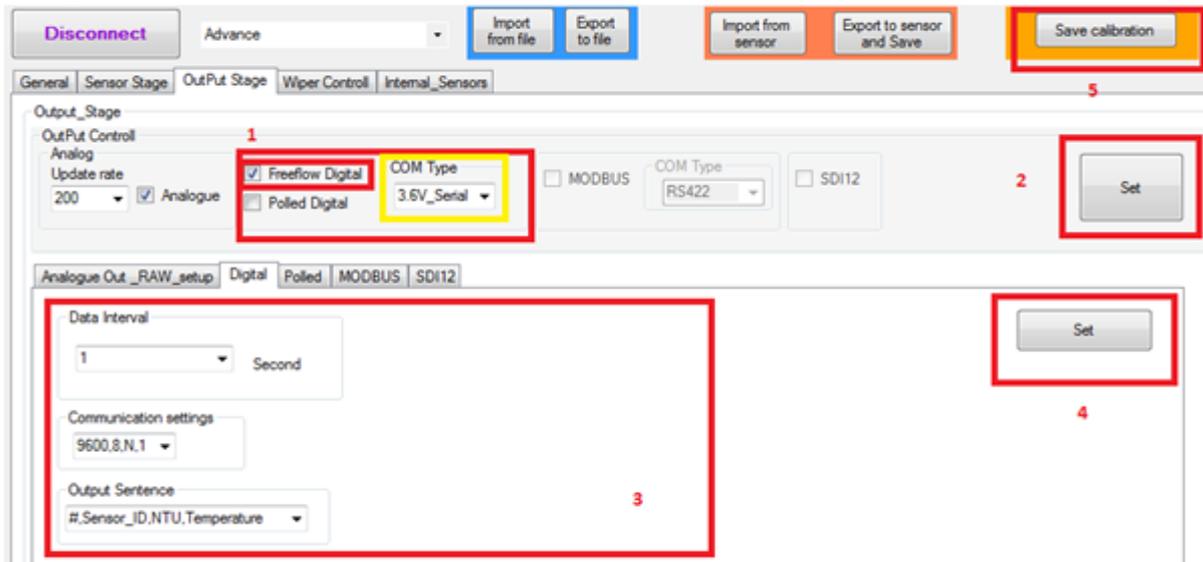
## Serial output using RS232 (When RS232 hardware available on-board).

The sensor can operate in three modes when RS232 is available electrical data output.

1. Continuous free flow.
2. RS232 Poled.
3. RS232 calibration mode.

### Continuous free flow.

Please use the following settings and press buttons 4, 2 and 5 in sequence after selecting settings 1 and 3. Please note that when using RS232 hardware the option “COM Type” should be selected as “3.6V\_Serial”.



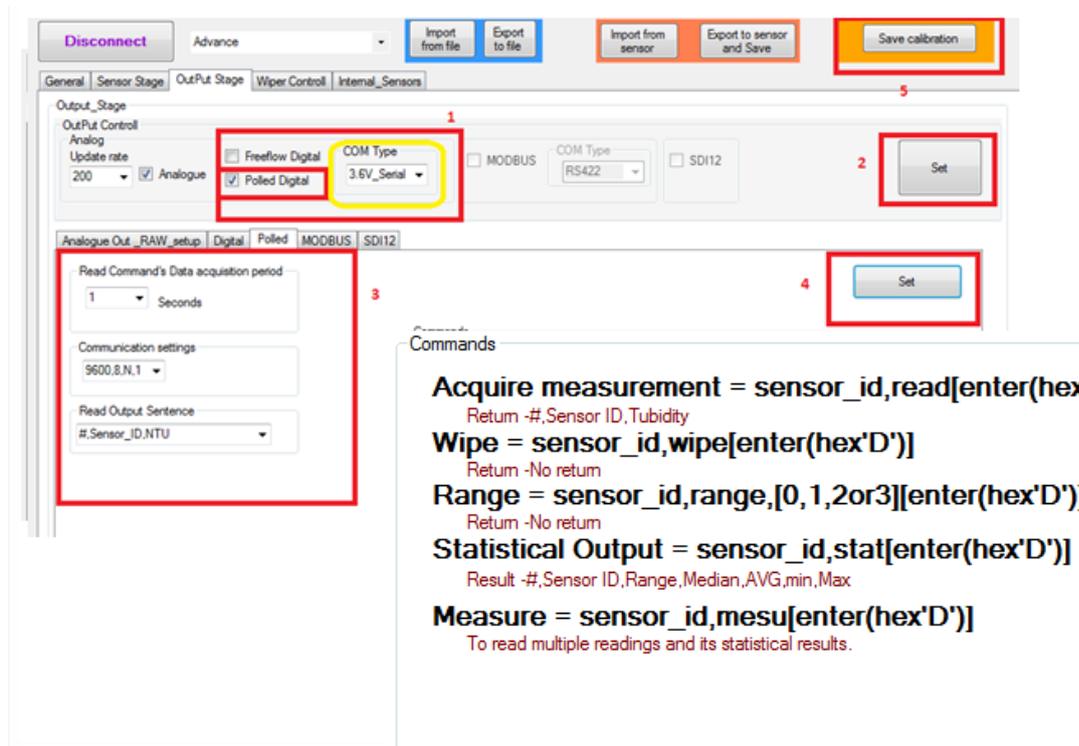
The screenshot shows the 'OutPut Stage' configuration window. At the top, there are buttons for 'Disconnect', 'Advance', 'Import from file', 'Export to file', 'Import from sensor', 'Export to sensor and Save', and 'Save calibration'. The 'OutPut Stage' tab is selected, showing 'Output\_Stage' settings. Under 'OutPut Control', 'Freeflow Digital' is checked (1), and 'COM Type' is set to '3.6V\_Serial' (2). Below this, the 'Analogue Out\_RAW\_setup' section is visible, with 'Data Interval' set to 1 Second (3), 'Communication settings' set to 9600,8,N,1 (3), and 'Output Sentence' set to #.Sensor\_ID,NTU,Temperature (3). A 'Set' button (4) is located to the right of these settings. The 'Save calibration' button (5) is highlighted at the top right.

This will output Continuous RS232 data every 1 second Baud 9600, 8, n, 1 and auto wipe every 60 seconds.



### RS232 polled.

Please use the following settings and press buttons 4, 2 and 5 in sequence after selecting settings 1 and 3.



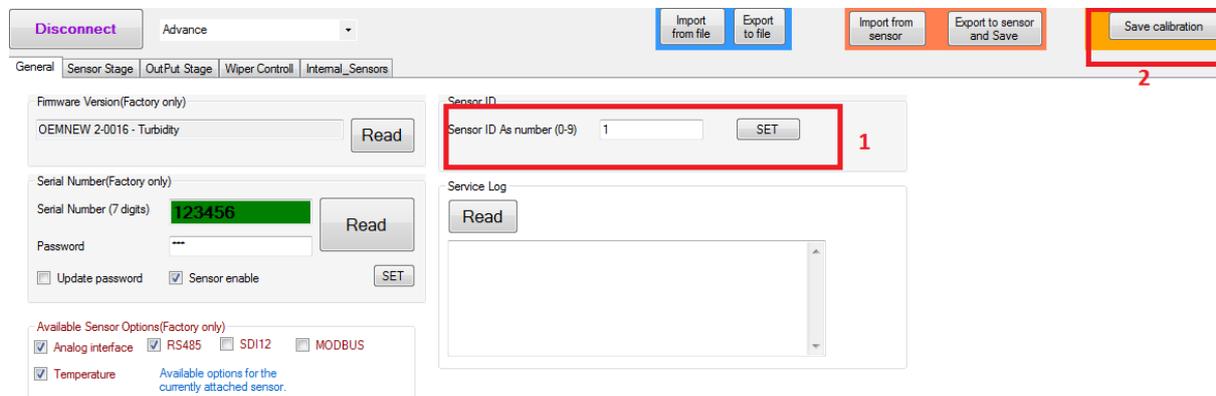
**Commands**

```

Acquire measurement = sensor_id,read[enter(hex'
Return -#,Sensor ID,Turbidity
Wipe = sensor_id,wipe[enter(hex'D')]
Return -No return
Range = sensor_id,range,[0,1,2or3][enter(hex'D')]
Return -No return
Statistical Output = sensor_id,stat[enter(hex'D')]
Result -#,Sensor ID,Range,Median,AVG,min,Max
Measure = sensor_id,mesu[enter(hex'D')]
To read multiple readings and its statistical results.
    
```

Please note that when using polled mode in RS232 hardware will echo all the transmit characters. Will echo all the commands.

### Set Sensor ID. Please do step 1 and 2 in sequence.



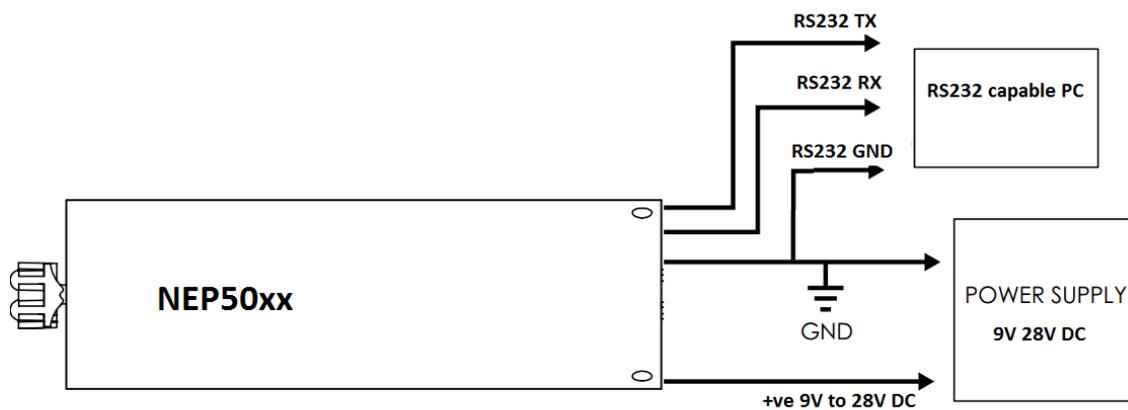
With above settings the sensor will wait for following RS485 commands and responds accordingly.

Page 1



## Access calibration mode using RS232 hardware (When available on-board).

Calibration mode of the sensor can be access using the RS232 hardware. RS232 capable PC or RS232 to usb converter will be required with stable DC power supply.

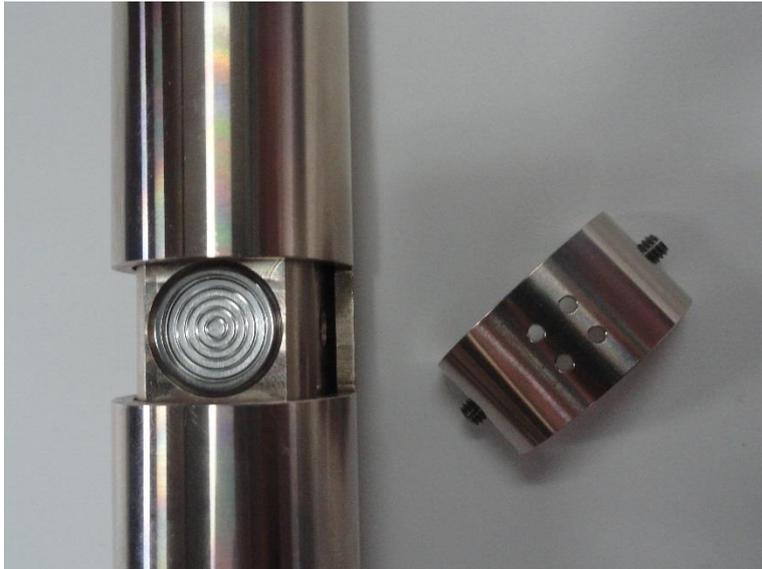


Please refer to “4.0 Software Connection Setup” for further information regarding use of the calibration software and its procedures.

**Please note that the Calibration module (Blue box) still can also be used for all the calibrations and configurations.**



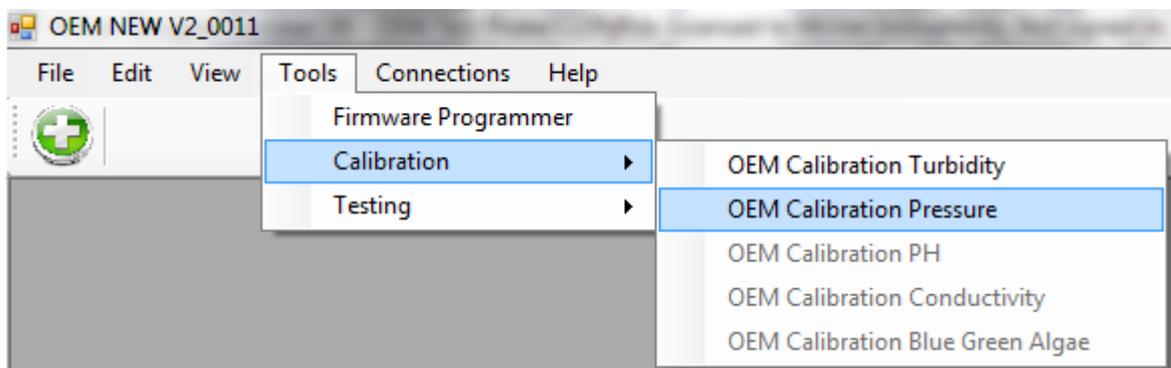
## 12.0 Pressure Sensor calibration.



### Communication information.

Please plug appropriate calibration plug in to calibration module and follow step 3 through 5C.

8.a To calibrate temperature sensor please click “Tools” menu item then Press “OEM Calibration Pressure”



Press “Connect button” and then press “Reset” button in the Calibration module. Output Window should show following when successful.

**Sensor now is in calibration mode.**

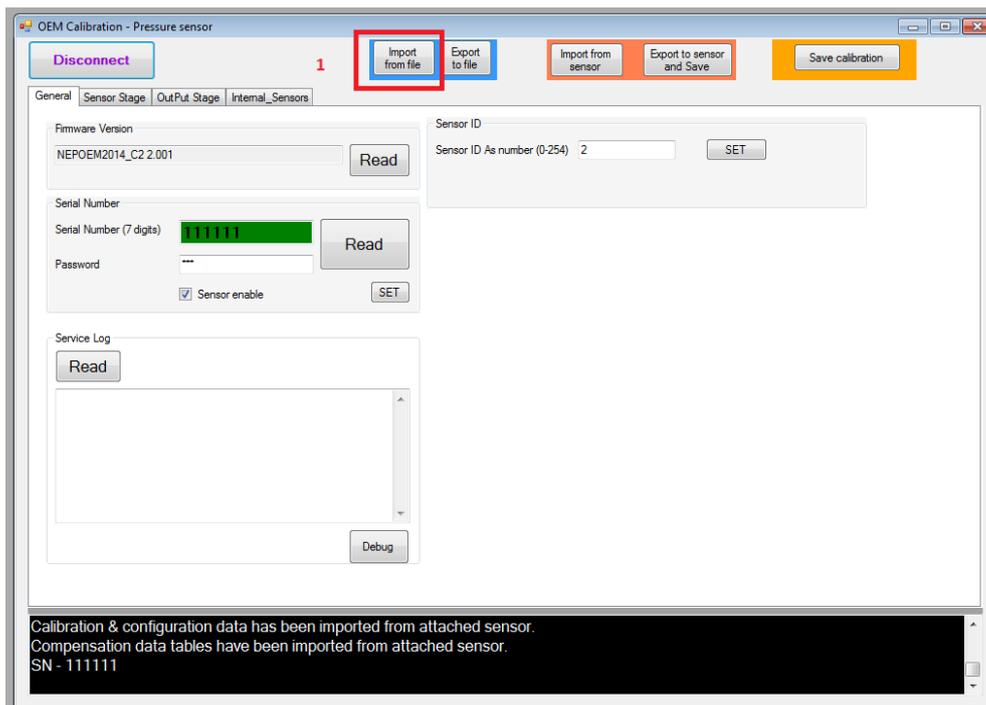
**SN - 111111**

**Calibration & configuration data has been imported from attached sensor.**

**Compensation data tables have been imported from attached sensor.**

When the sensor establishes the connection to the pc software, software will then attempt to synchronize with the sensor. This will transfer all the calibration and configuration data to PC software.

**Load Supplied Calibration & Configuration file supplied by the factory calibration.**



Press “Import Config Data” button and select and open correct calibration file [Serial Number].cfg file.

*Note1 – Factory will supply this unique [Serial Number].cfg file with each probe and this contains the factory calibration data and configuration data specific to each probe.*

*Note2- Please select “Advance” in top left drop down window to display all Available Options.*

*Note3- Press “Read” button under Serial number group in “General” to read attached probes serial number.*

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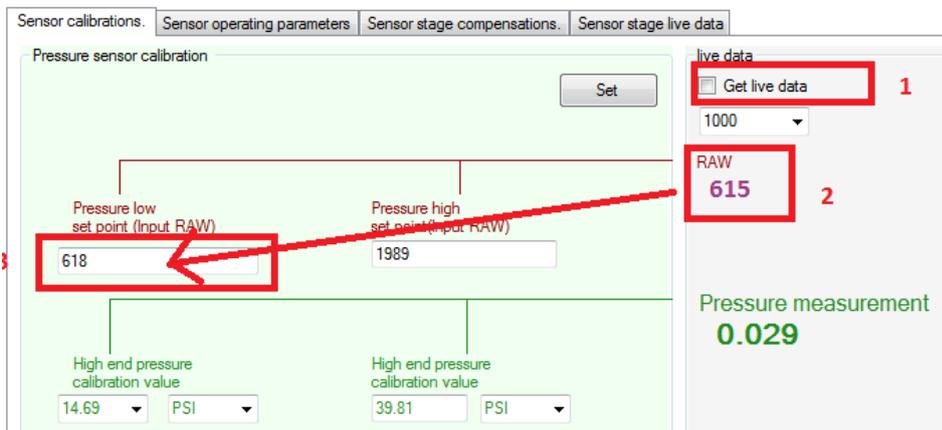
**Requirements before the pressure calibration begin.**

- Pressure sensor calibration is required a constant pressure chamber which to apply various air or hydraulic pressures to the sensor while it’s in calibration mode.
- A reference pressure sensor is required to monitor and to get calibration data.

**Pressure sensor calibration.**

After establishing the calibration connection with the PC software please open the “sensor calibration” tab to begin calibration.

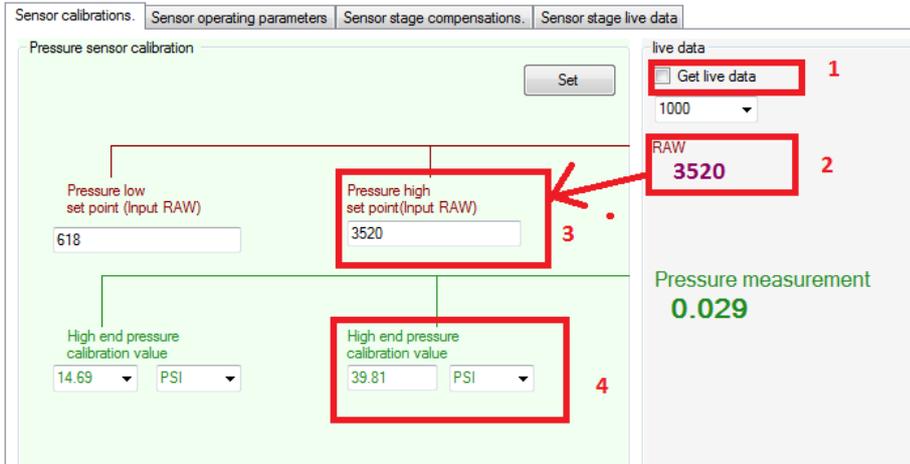
**Calibration step#1 (low end pressure calibration)** = Expose the pressure sensor to normal sea level pressure(~14.3PSI) and press get live data check box and allow 1 minute settling time. If RAW value appear to be stable enter the RAW data to “*pressure low set point*” Text box.



**Calibration step#2 (High end pressure calibration)** = Expose the pressure sensor to maximum pressure point and press get live data check box and allow 1 minute settling time. If RAW value

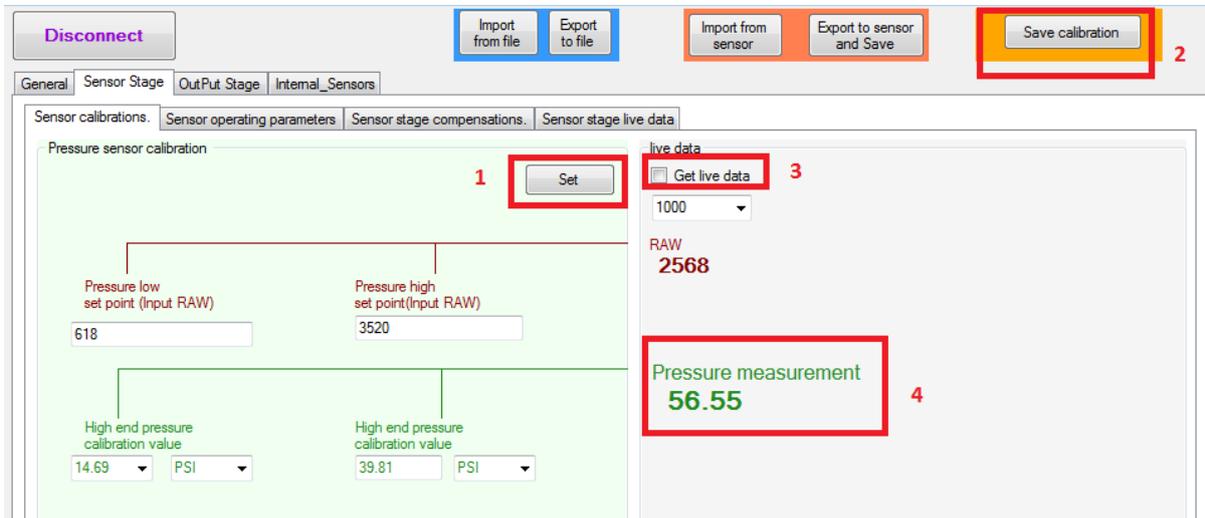


appear to be stable enter the RAW data to “pressure high set point” Text box.



Then type reference pressure sensor value in “high end pressure calibration value” text box (step 4)

**Calibration step#2(apply pressure calibration)** = Press “Set” button in “pressure sensor calibration” window to apply to above values to the sensor. After completion of the setup press “live data” checkbox again to check pressure measurement “in green” shows as same as reference probe



Please note at this point applied data is saved in probes temporary memory and press “Save calibration” button to store calibration permanently.

**Calibration step#3** = If sensor readout is within 0.02 FSO from the reference then the probe is assume to be calibrated. Press “Save Calibration” button and exit.

Probe 6



## 13 SDI12 Option

**NEP50xx SDI12 option** offers a comprehensive sensor operation through a wide range of SDI12 commands and its related internal configurations.

SDI12 option communicates in fixed communication setting of 1200,7,E,1.

**Some of key operations.**

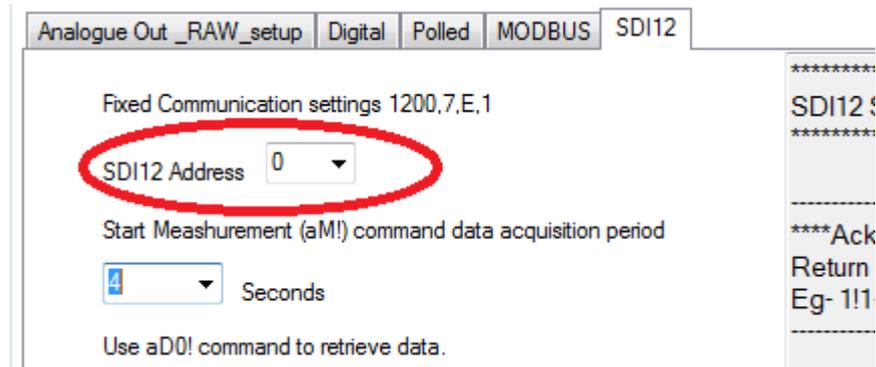
- Initiate single turbidity measurement and read.
- Initiate multiple turbidity measurements and read its statistical results.
- Initiate wipe (Clean optics) operation.
- Change appropriate measurement range and “Auto range”.
- Basic SDI12 command set.

### 2.0 User configurable settings using that aid SDI12 measurements.

Some of the SDI12 operational parameters and sensor’s operational configurations that can be changed using PC configuration software.

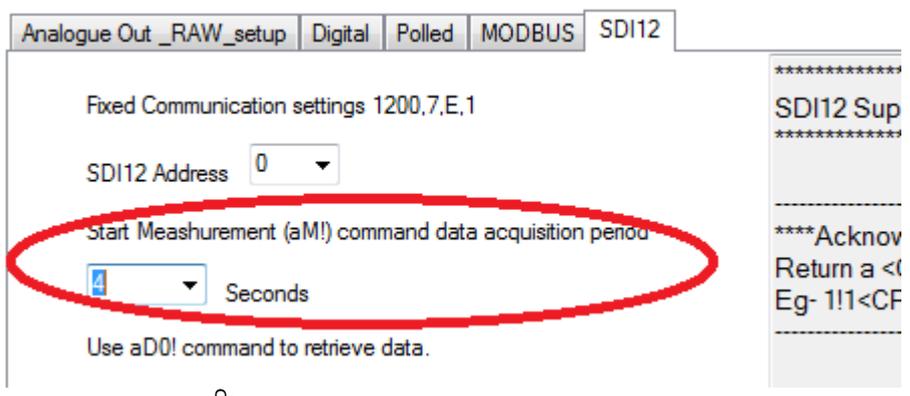
#### 2.1 SDI12 address.

SDI12 network address can be changed using “Output stage > SDI12” settings page in the configuration tool.



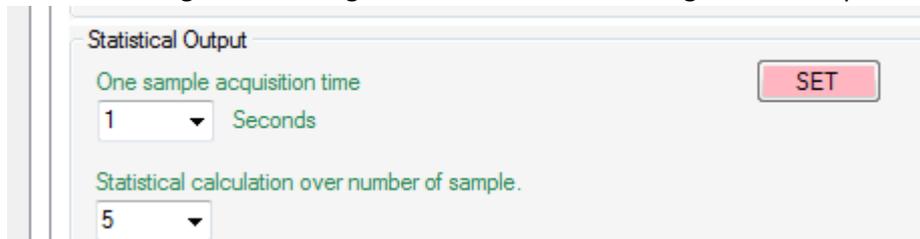
#### 2.2 Measurement duration.

This option allows user to select between quick and stable measurement when using a single turbidity measurement command (aM!).



### 2.3 Statistical measurement's configurations.

This user configurable settings are located in "Sensor stage > Sensor operating parameters"



Statistical Output

One sample acquisition time SET

1 ▾ Seconds

Statistical calculation over number of sample.

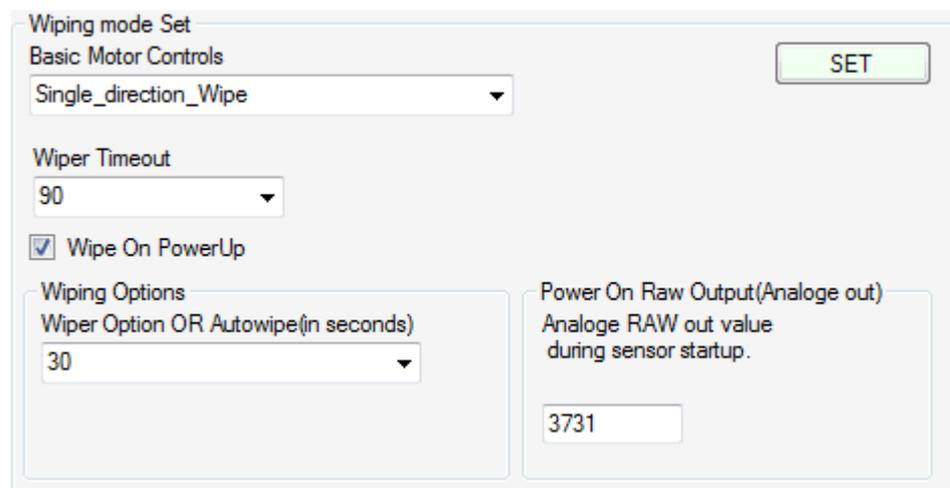
5 ▾

When using "Start statistical measurement (aM6!)" command the sensor may takes one second measurements and add to length of 5 data array. End of measuring its last measurement (5th) the sensor will calculate a statistical results from its most reason 5 measurements.

User may adjust these settings as desired.

### 2.4 Wiper settings.

This user configurable settings are located in "Wiper control"



Wiping mode Set

Basic Motor Controls SET

Single\_direction\_Wipe ▾

Wiper Timeout

90 ▾

Wipe On PowerUp

Wiping Options

Wiper Option OR Autowipe(in seconds)

30 ▾

Power On Raw Output(Analoge out)

Analoge RAW out value during sensor startup.

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### 3.0 Initiate single turbidity measurement and read.

User may issue Measure command (aM!) then wait appropriate delay and then use single measurement read(aD0!) command to read data.

#### **Step #1**

-----  
**\*\*\*Take single measurement \*\*\***

Start measurement (aM!)

Return 20011<CR><LF>

aM! atttn<CR><LF>

*a - the sensor address a - the sensor address*

*M - the start measurement ttt - the specified time, in seconds, until the sensor will have the measurement(s) ready*

*! - terminates the command n - the number of measurement values the sensor will make and return*

*in one or more subsequent D commands; n is a single digit integer with a valid range of 0 to 9*

*Note that the measurement period is set to 2seconds*

#### **Step #2**

Logger should wait's(delay) more than aM! Command's requested operational delay.

#### **Step #3**

-----  
**\*\*\*Single measurement read\*\*\***

Send data command (aD0!)

Return a+NTU<CR><LF>

Eg- 2+2.75<CR><LF>

Note that 2.75 is the measured NTU value.



#### 4.0 Initiate multiple turbidity measurements and read its statistical results.

User may issue “statistical measurement” command (aM6!) then wait appropriate delay and then use “statistical measurement read” (aD6!)command to read data.

##### **Step #1**

-----  
 \*\*\*\*Take full statistical measurement\*\*\*\*  
 Start statistical measurement (aM6!)  
 Return 20061<CR><LF>  
 aM6! atttn<CR><LF>  
 a - the sensor address  
 M6 - the start measurement ttt - the specified time, in seconds, until the sensor will have the measurement(s) ready  
 ! - terminates the command n - the number of measurement values the sensor will make and return  
 in one or more subsequent D commands; n is a single digit integer with a valid range of 0 to 9  
 Note that the measurement period is set to 6 seconds  
 -----

##### **Step #2**

Logger should wait’s(delay) more than aM6! Command’s requested operational delay.

##### **Step #3**

-----  
 \*\*\*\* Full statistical measurement read\*\*\*\*  
 Send data command (aD6!)  
 Return a+TT.TT+MMMM.MM+AAAA.AA+LLLL.LL+SSSS.SS<CR><LF>  
 Eg- 1+23.58+714.53+714.52+714.24+714.85<CR><LF>  
 Note that.  
 TT.TT= Temperature  
 MMMM.MM = Median  
 AAAA.AA=Average  
 LLLL.LL = Minimum value  
 SSSS.SS = Maximum Value  
 -----



Statistical Output

One sample acquisition time SET

1 ▾ Seconds

Statistical calculation over number of sample.

5 ▾

When using “Start statistical measurement (aM6!)” command the sensor may takes one second measurements and add to length of 5 data array. End of measuring its last measurement (5th) the sensor will calculate a statistical results from its most reason 5 measurements.

### 5.0 Initiate wipe (Clean optics) operation.

#### Step #1

\*\*\*\*\*Wiper Control\*\*\*\*\*

Wipe command (aM1!) Wipe action will be completed in 12s

Return a0121<CR><LF>

Eg- 20121<CR><LF>

Note that 12 is requesting of 12 seconds of delay.

#### Step #2

Logger should wait’s(delay) more than aM1! Command’s requested operational delay.

Wiping mode Set

Basic Motor Controls SET

Single\_direction\_Wipe ▾

Wiper Timeout

90 ▾

Wipe On PowerUp

Wiping Options

Wiper Option OR Autowipe(in seconds)

30 ▾

Power On Raw Output(Analoge out)

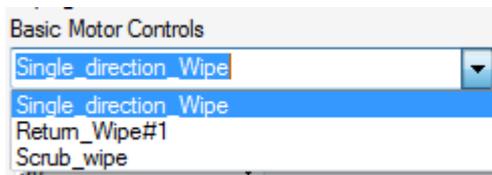
Analoge RAW out value during sensor startup.

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**Some Important points.**

- If power on wipe is selected the SDI12 logger may wait more than 12s to finish its operation.
- “Auto wipe” feature is not available in SDI12 mode.
- User may select how the wiper should operate when SDI12 logger issues aM! Command.



**6.0 Change appropriate measurement range and “Auto range”.**

During normal sensor operations the logger may issue any of the following to change the current measurement command.

**Note that** this is a temporary range change and when the sensor’s power resets the sensor range will restore to its default range that selected by the PC configuration software.

-----  
 \*\*\*\*Change NTU range\*\*\*\*

High Range (5000NTU)

\*\*Command (aM2!)

Return a0001<CR><LF>

Medium Range (3000NTU)

\*\*Command (aM3!)

Return a0001<CR><LF>

Low Range (1000NTU)

\*\*Command (aM4!)

Return a0001<CR><LF>

**OR**

-----  
 \*\*\*\*Auto Range (Probe’s software selects appropriate range) \*\*\*\*

Command (aM5!)

Return a0001<CR><LF>

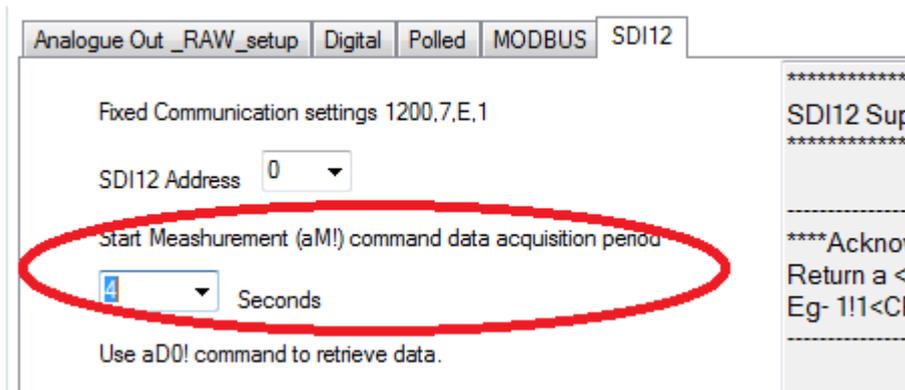
Please note that auto range requires about 5 seconds to select appropriate range and take a measurement. So in order to use this setting first need to use the

Page 2



calibration software and select 5 second or more (Data actuation period) in the SDI12 configuration window.

**Note that** auto range is selected by the configuration software or by the SDI12 logger the single measurement's **"Measurement duration"** time **must** be set to a value higher than 4 seconds.



## 7.0 Basic SDI12 command set.

\*\*\*\*\*Acknowledge Active Command (a!) \*\*\*\*\*

Return a <CR><LF>

Eg- 1!1<CR><LF>

\*\*\*\*\*Change Address Command (aAb!) \*\*\*\*\*

Return b<CR><LF>

Eg- 1A2!2<CR><LF>

\*\*\*\*\*Address query command (?!)\*\*\*\*\*

Return a<CR><LF>

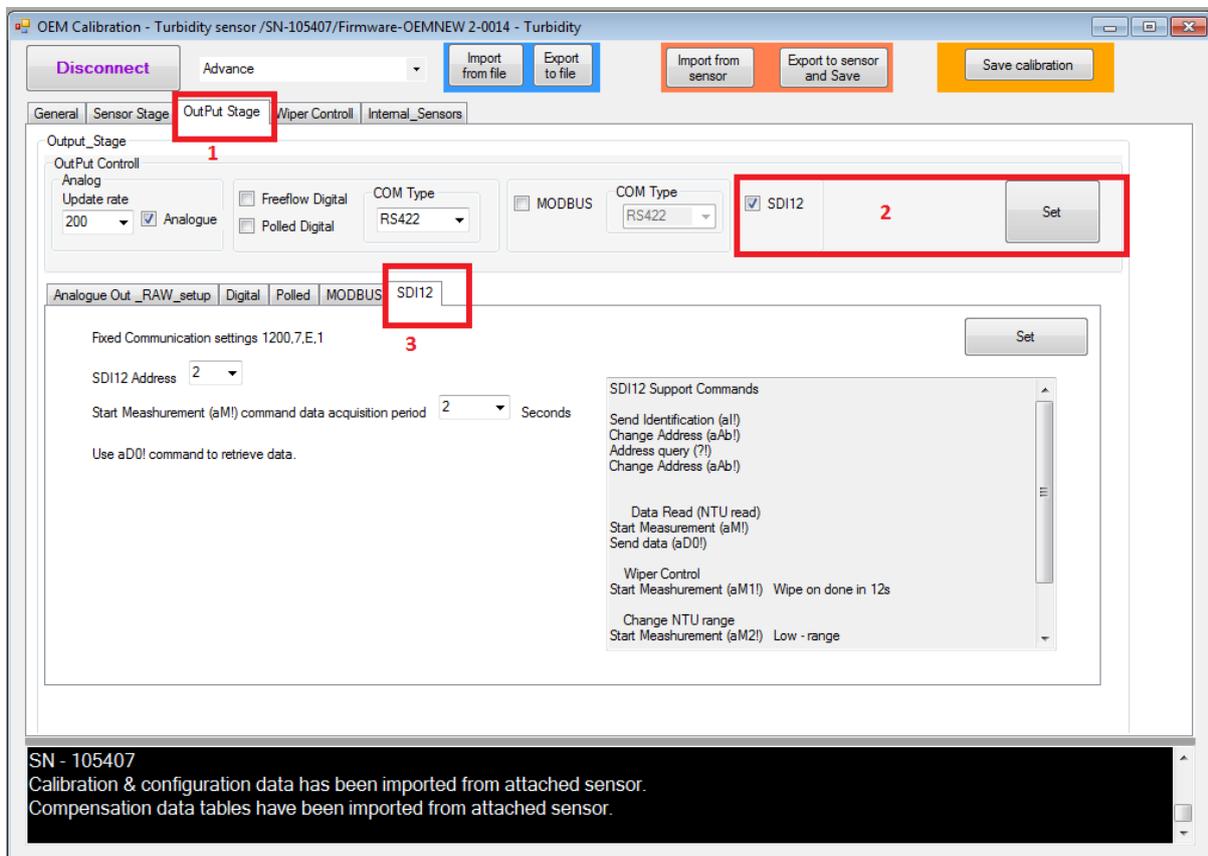
Eg- ?!2<CR><LF>



## Recommended logger's scripting guide.

It is recommended that to use following sequence of actions to obtain an accurate measurement from NEP50xx.

1. NEP50xx **power on** and allow **2 seconds** or more for boot up to be completed.
2. Issue command "aM1!" to **Initiates a wipe** (clean optics) and **wait 12 seconds**.
3. Issue command "aM2!, aM3! Or aM4!" to select appropriate **measurement range**.
4. Issue command "Start Measurement (aM!)" to **initiate measurement** and **wait 2 seconds** to complete the measurement.
5. Issue a "Send data command (aD0!)" to **read data**.



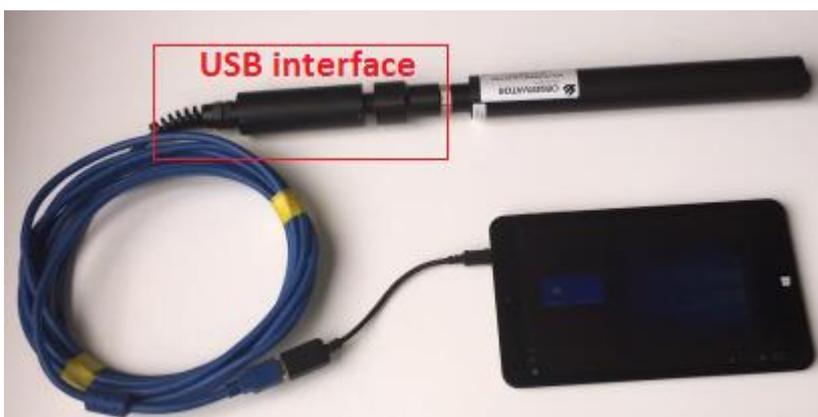
## USB option.

This option must be specify at time-of-the-order and there are two types of configurations.

**USB Type 1** = USB interface hardware is built inside of the NEP50XX body with glanded 5m USB cable. This option is ideal for the lab use or spot check type use.



**USB Type 2**= USB interface hardware is built in to a second detachable housing where any new or old (If you have already purchased a NEP50xxx) NEP50XX sensor can be used.



**Impotent note if using with an existing probe – Due to various wiring arrangements and pinouts differences between RS485, RS232, analogue option and SDI12 option the Type 2 USB interface female connector's wiring must be matched to your existing probe. Please consider this at the time of the order.**



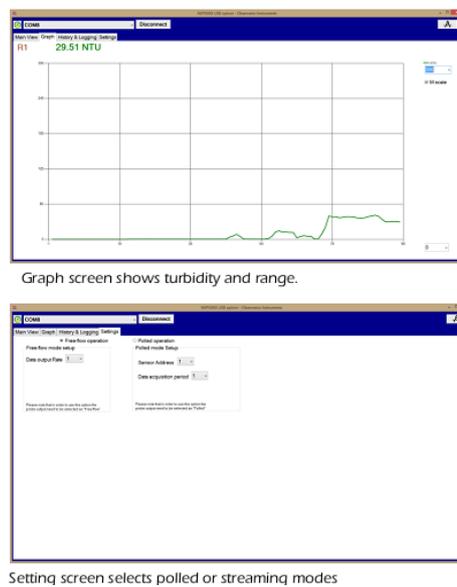
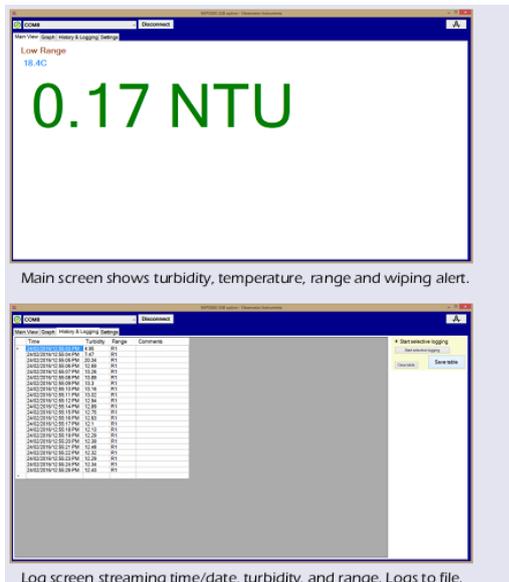
## Available visualisation software for USB option

This software visualization is available for Windows and Android.

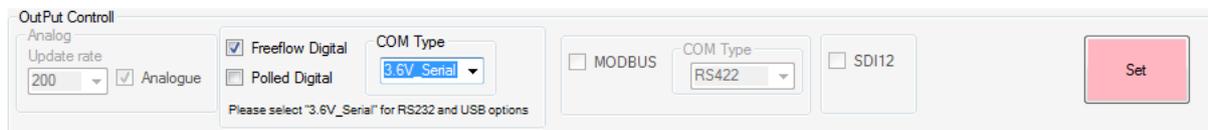
### Windows APP

This app can run on windows 7, 8 and 10 in any tablet, laptop or desktop. USB OTG is required on the device.

Please run “USB NEP5000 VX.exe”. Select correct windows assigned COM port and press “Connect button”



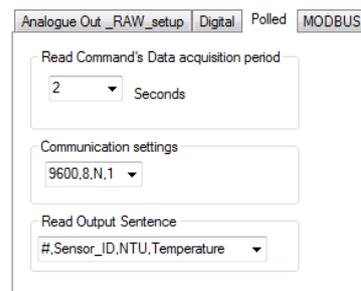
Impotent note – USB option require that you select output stage of the NEP50xx set to following.



Then select control format.



OR



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## Android APP

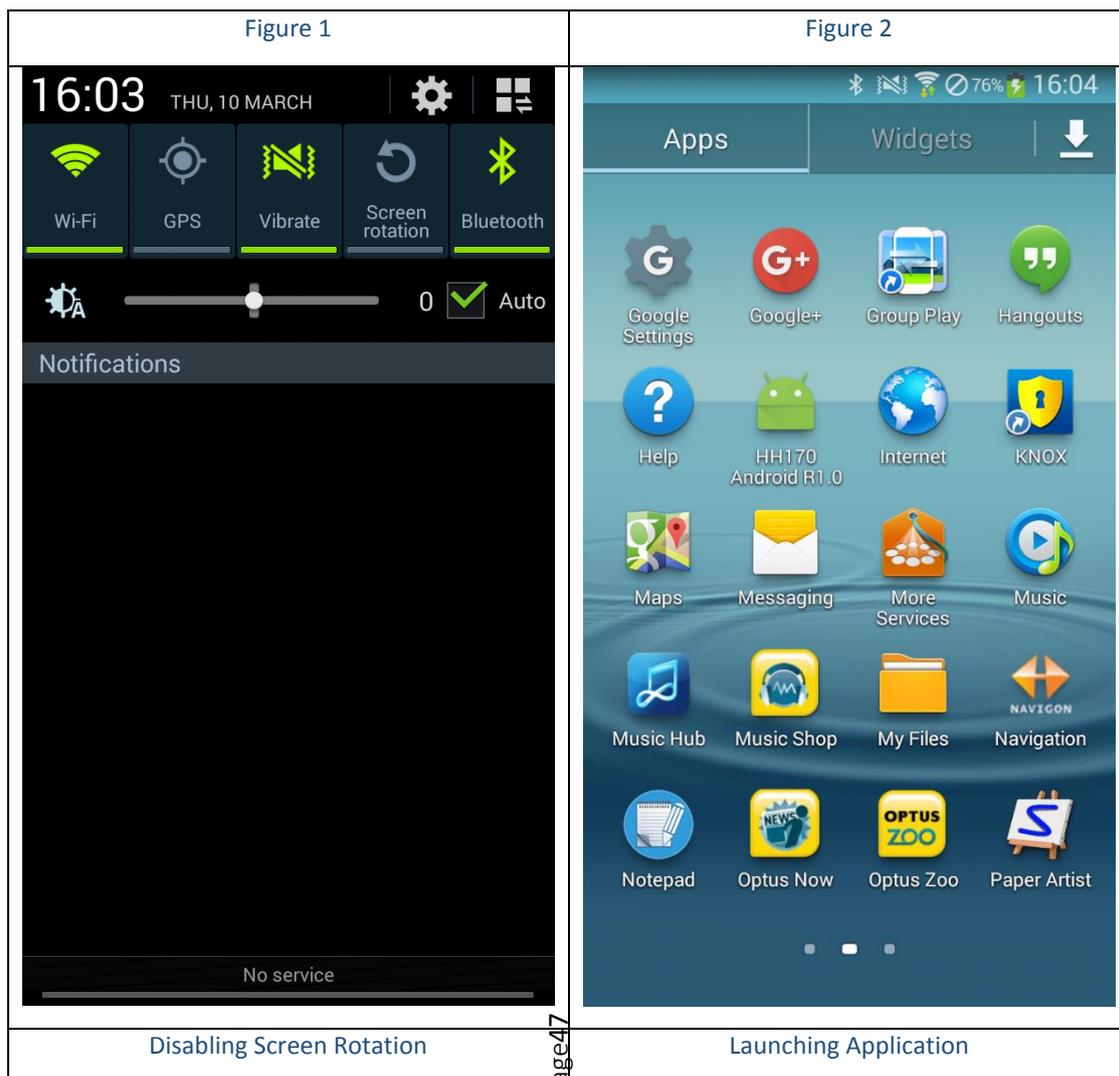
### 1. Getting Started

HH170 Android Companion Software is only compatible with Android 4.0 “Ice Cream Sandwich” and later.

Before launching the HH170 software, **you must first disable the screen auto rotation feature within the Android Operating System.**

**NOTE: The Bluetooth radio must be enabled in the Android Operating System if connecting to a HH170 Handheld.**

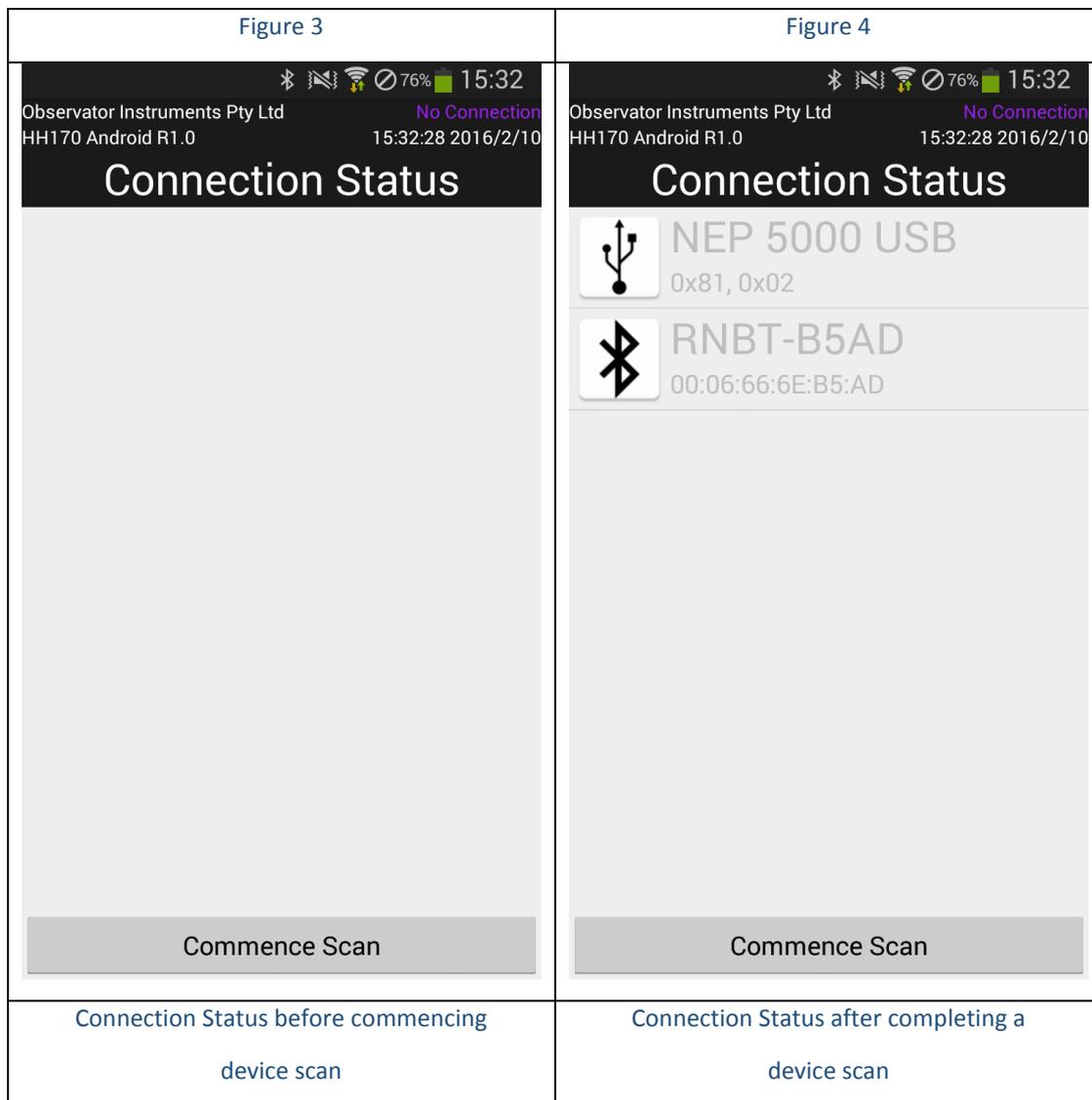
Navigate to the applications panel and search for the application called “HH170 Android R1.0”. Launch the application.



## 2. Connecting to Devices

HH170 Android Companion can connect with devices via the Bluetooth and USB OTG protocols.

Currently, the only connectable devices are the Observator Instruments HH170 Handheld and NEP 5000 USB Nephelometer.



After start up, the user will be taken to the connection page (Figure 3). To begin, the user must press the “Commence Scan” button located at the bottom of the page. The software will scan for any compatible devices. (Note that programme activity can be followed by the notification in the top right hand corner.)

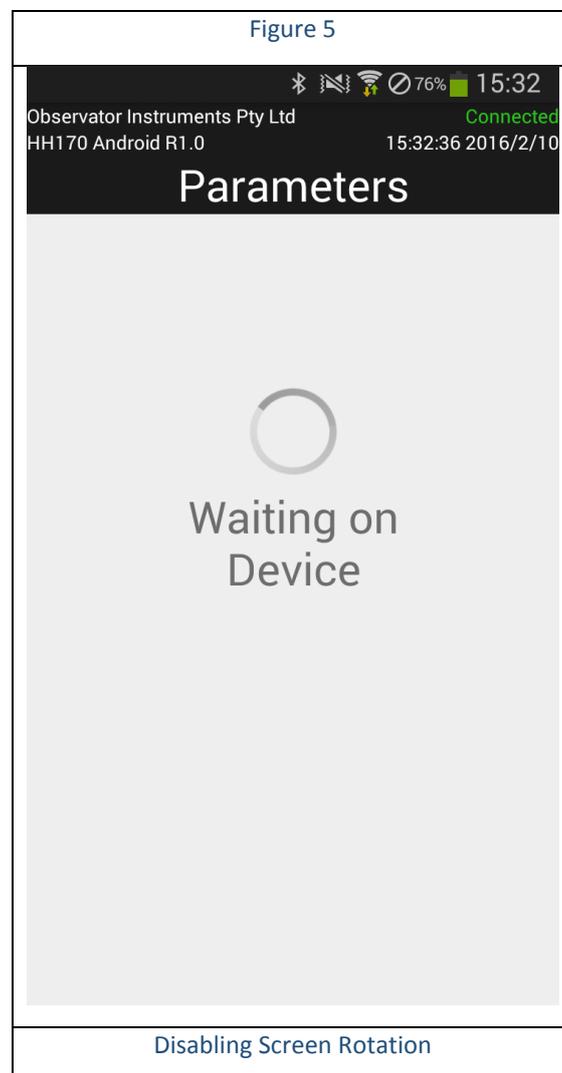
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Upon scan completion, a list of available devices will populate the screen.

It can be seen in Figure 4 that the running instance is able to connect to either a NEP 5000 USB nephelometer via USB OTG or a HH170 Handheld via Bluetooth.

To start a connection and obtain runtime data, tap on the desired device in the list. This will initiate a connection handshake.



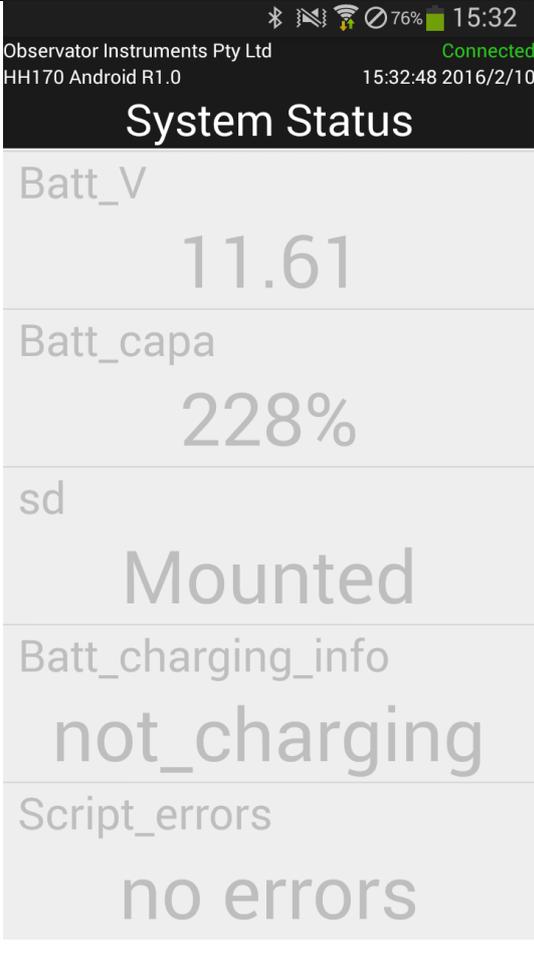
After a successfully handshaking, the software will wait for the connected device to transmit data. During this time, the device will display a “Waiting on Device” message.



### 3. Acquiring Data

After a successful connection has been established and data from the connected device has arrived, the Parameters and System Status screens will be populated in a similar manner to Figures 6 and 7.

It can be seen that parameters and system status information can be added the data list dynamically as they are received from the connected device.

Figure 6	Figure 7
 <p>Parameters</p> <p>Turbidity 0.63 NTU 10/2/2016 15:31:51 R1</p> <p>Temperature 30.79 C 10/2/2016 15:31:51</p>	 <p>System Status</p> <p>Batt_V 11.61</p> <p>Batt_capa 228%</p> <p>sd Mounted</p> <p>Batt_charging_info not_charging</p> <p>Script_errors no errors</p>
<p>Parameters screen displaying data from a NEP 5000 USB nephelometer with the temperature sensor enabled</p>	<p>System Status screen displaying system data from a HH170 Handheld</p>



## Accessing calibrations and configuration in USB option.

Please follow the instructions subjected in section 4.0 “Software Connection Setup” to page 9 and then when the pc software prompt to press the reset button, instead pass the supplied magnet over the marked area of the USB’s probe body.



## I Document History

### **Revision 3.6**

28th October 2015  
Edit by: Niran Pelpola  
Ver 2.019 updates with SDI12.

### **Revision 3.7**

24th February 2016  
Edit by: Niran Pelpola  
Ver 2.021  
Auto range enhancements.

### **Revision 3.8**

11h March 2016  
Edit by: Niran Pelpola  
Ver 2.021  
Subconn wire colours & USB option.

### **Revision 3.9**

13h July 2016  
Edit by: Niran Pelpola  
Ver 2.023  
SDI12 update.  
Statistical package update.

### **Revision 4.0**

1<sup>st</sup> Aug 2016  
Edit by: Niran Pelpola  
Ver 2.024  
Graphics update.

### **Revision 4.1**

1<sup>st</sup> Aug 2016  
Edit by: Niran Pelpola  
Ver 2.024  
Wiring table modified.

### **Revision 3.5**

9<sup>th</sup> October 2015  
Edit by: Haydn Kearsey

### **Revision 3.4**

13<sup>th</sup> July 2015  
Edit by:  
Niran Pelpola

### **Revision 3.3**

30<sup>th</sup> June 2015  
Edit by:  
Niran Pelpola

### **Revision 3.2**

19<sup>th</sup> March 2015  
Edit by:  
Niran Pelpola

### **Revision 3.1**

4<sup>th</sup> March 2015  
Edit by:  
Niran Pelpola  
Changes:

### **Revision 3.0**

26<sup>th</sup> February 2015  
Edit by:  
Niran Pelpola  
Changes:

### **Revision 2.0**

20<sup>th</sup> February 2015  
Edit by:  
Craig Anderson  
Changes:  
Document Creation

### **Revision 1.0**

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Craig Anderson  
Changes:  
Document Creation



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