



Manual

NEP-5000

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Document history

The Observator range is in continuous development and so specifications may be subject to change without prior notice. When in doubt about the accuracy of this document, contact the Observator Group.

Reference documents

Type of document / tool	Product type and name (incl. url)
Software	NEP-5000
CFG files	NEP-5000
Datasheet	NEP-5000
Manual	NEP-5000
Application notes	NEP-5000-SDI-12 option with Campbell logger
	NEP-5000-SDI-12 option for H-522+ & H-500XL loggers
	NEP-5000-SDI-12 option with Hydros spider logger
	NEP-5000-SDI-12, RS485 and analogue: wiper operations
	NEP-5000 multi-point calibration
	NEP-5000 firmware updating procedure
	Pressure calibration
	Shroud installation
	Temperature calibration
	Wiper replacement

Revision history

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2018-04-09	Introduced document control	Observator Australia, Document Controller
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Procedure sign-off:

Date	Company, position	Status
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Distribution list

Date	Company, position

Summary

Thanks for purchasing the new NEP-5000 turbidity probe. It will give you years of service if you install and maintain the probe according to the guidelines set out in this manual.

Our successful NEP-5000 family of Analite turbidity sensors offers enhanced performances in a small and revolutionary design with greater ease of deployment at lower cost. The NEP-5000 turbidity probes are designed for monitoring and process applications where turbidity levels of up to 5,000NTU may be encountered. Standard ranges are 10NTU, 400NTU and 5,000NTU, but custom ranges are available. The NEP-5000 are designed for applications that will not allow bio-fouling to build up, such as short monitoring deployment or placement in fast and cold running water. The NEP-5000 may be submerged to a depth of 100 meters (approximately 328 feet).

The NEP-5000 turbidity probes use 90° optics and employs infra-red light in accordance with international ISO 7027. All probes use a unique modulation technique that ensures almost total rejection of ambient light conditions. It also has a unique microprocessor controlled differential sample and hold circuit for enhanced performance, particularly at low turbidity levels.

This product is ideal for portable application, as well as field and laboratory applications for long term monitoring. Simple to operate, the NEP-5000 can be customized and upgraded. Data logging can also be performed using application on your Windows tablet using Bluetooth communication.

The new NEP-5000 series of turbidity sensors also has the added benefit of a self-cleaning, auto-ranging field instrument. The system can be cabled or directly connected to the wireless module for quick field process reading.

Note: Please refer to manual V4.5 and below for sensor manufactured prior to 2018.

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1 Applications

The NEP-5000 probes typical use includes applications such as:

1. Water quality
2. Food processing
3. Waste treatment
4. Environmental compliance for dredging operations

Which model is best used will be dependent on the application, the measuring environment, the logging equipment and the monitoring period (deployment times) required.

Although advanced digital processing in the Analite NEP-5000 will effectively measure the true turbidity of water when large particles are passing by the optical face, it is recommended to take steps to protect the optical face from possible abrasive effects these particles may cause.

The Analite turbidity probes are not suitable in situations where they may be abraded by large particles such as sand. Under these circumstances, the reading may become erratic due to the large particles passing the optic sensor. Measuring turbidity under such potentially abrasive circumstances may require a stilling well to allow the sand or other hard particles to settle away from the optic sensor in the probe tip.



2 Safety



Always refer to the appropriate wiring diagram and apply appropriate power levels to the sensor to avoid potential destruction of the sensor that may also harm you.



Do not connect anything potentially electrical to the metal body of the sensor as it may result in electrical shocks that could harm you or destroy your instruments.



Do not attempt to force the wiper mechanism while operating or you may harm yourself due to the higher torque level.



When using calibration solutions such as AMCO Clear®, StableCal® or formazin, avoid skin/eye contact and do not consume the solution in any quantity.



Please check with your supplier or material specifications before using the sensor in an unknown chemical.



Take appropriate precaution when handling or servicing pre-deployed sensors; they may be exposed to radioactive and hazardous solutions.

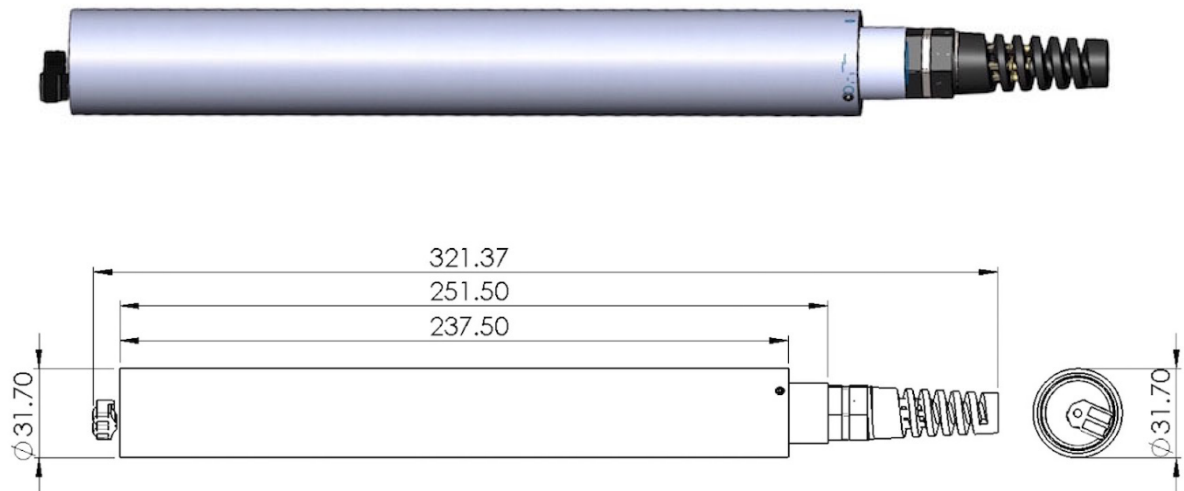


After the end of the life of the product, please dispose of it according to your local regulations or return it to the manufacturer.

3 Specification

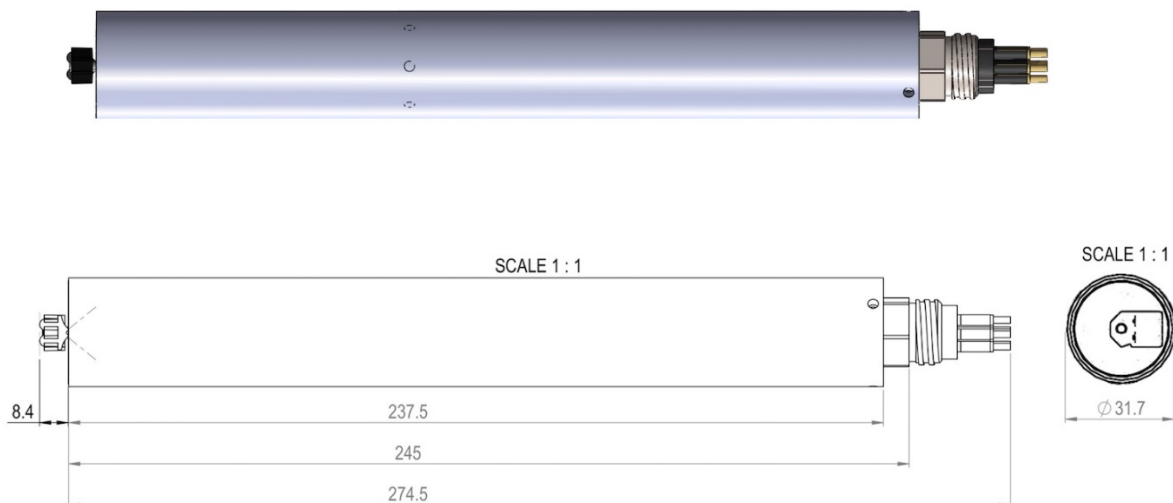
Glanded sensor dimensions

Length	321.37mm
Diameter	31.70mm



SubConn sensor dimensions

Length	274.5mm
Diameter	31.7mm



Mechanical	
Weight	NEP-5000 Delrin models 300 grams – probe only*.
	NEP-5000 metal models 770 grams – probe only*.
	*100gms connector plus 70 grams per meter of cable.
Case construction	Delrin composite casing is standard.
	316 stainless steel
	Titanium
	Anti-biofouling CW352H 70/30% Copper/Nickel.
Cable	Glanded-NEP cable specification: 7 cores + shield, 6mm nominal dia. Polyurethane (PUR) sheath. Conductor resistance 45 ohms per km. Weight - 70 grams per meter.
	SubConn connector cable specification: 6-conductor inline cable, 16 American Wire Gauge (AWG), 1.34mm ² .
Cable length	Standard glanded-NEP cable length to be specified at time of order. Per meter price applies. Maximum cable length is 200m. Length depends on the selected communication protocol.
Depth rating	200m (660ft), non-wiping.
	100m (330ft), wiping.
Operating temperature	-10°C to 40°C
Storage temperature	-20°C to 50°C

Measurement	
Technique	90° modulated infra-red (ISO 7027) is standard.
	180° backscatter modulated infra-red is optional.
Ranges for 90° (3-preset range groups)	Low (example 0-10/20/100NTU).
	Medium (example 0-100/400/1,000NTU).
	High (example 0-1,000/3,000/5,000NTU).
Ranges for 180° (3-preset range groups)	Low (example 0-1,000/5,000NTU).
	Medium (example 0-10,000NTU).
	High (example 0-30,000NTU).
Recommended range versions	V1 NTU ranges: 10, 400, 1,000.
	V2 NTU ranges: 10, 400, 5,000.
	V3 NTU ranges: 100, 1000, 5,000.
	V4 NTU ranges: user specified.
Custom ranges	Available
Range hopping (auto-range)	Available







Specification	
Accuracy including linearity & temperature drift	±1% at 25°C, up to 5,000NTU
Zero drift	Less than ±0.2NTU
Calibration	Factory calibrated using non-toxic AEPA polymer solutions.
Power	8-30V Direct Current (DC) <ul style="list-style-type: none"> • 15mA on • 25mA reading • 60mA wiping
Settling time/measurement acquisition time	Single range (2-4s), auto-range (4-6s)
Wiping	Wiping is configurable via the Personal Computer (PC) configuration tool such as: wiping mode, timeout, power on wipe.
Wipe time	8s in single direction wipe mode. 12s for return wipe mode. 18s for scrubbed wipe mode.

	Range	Resolution
Resolution	Up to 100NTU	±0.01NTU
	Up to 400NTU	±0.1NTU
	Up to 1,000NTU	±1.0NTU
	Up to 5,000NTU	±2.0NTU

4 The box

Depending on what you ordered, the box may contain the following items:



Description	
<p>NEP-5000 Probe NEP-5000 NEP-CBL - Probe cable in meters.</p>	
<p>Blue box calibration module and Universal Serial Bus (USB) cable* Module and PC configuration and calibration software. NEP-CFG</p>	
<p>SubConn female pigtail** NEP-CFG-SF (**) Only included in the shipment when the NEP-5000 has a male SubConn connector. Wiring is different for SDI-12 and RS422/RS485.</p>	
<p>USB key</p>	
<p>Yellow cap</p>	
<p>Wiper replacement kit NEP-WIPER-KIT - comprising of 4 silicon wipers and a hex fastening key.</p>	

5 Accessories

Observer Instruments offers a wide range of accessories for the NEP-5000 range of products directly available from the website:



Accessories

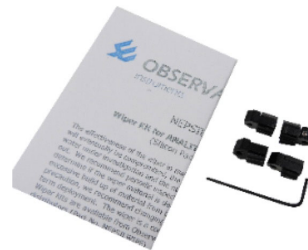
Case

NEP-CASE



Wiper replacement kit

NEP-WIPER-KIT - comprising of 4 silicon wipers and a hex fastening key.



Shroud

NEP-SHRD-D - Delrin protective shroud

NEP-SHRD-C - Copper protective shroud

NEP-SHRD-S - Stainless steel protective shroud

NEP-SHRD-T - Titanium protective shroud



Calibration kit for glanded probes

NEP-CFG - comprising of a blue box calibration module and USB cable.



Accessories

Calibration kit for SubConn probes**
NEP-CFG-SF - comprising of a blue box calibration module, USB cable and a SubConn female pigtail.

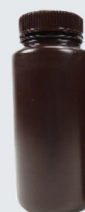
(**) Only for NEP-5000 with male SubConn connector.
Wiring is different for SDI-12 and RS422/RS485.



Calibration solutions
NEP-CAL-GSF



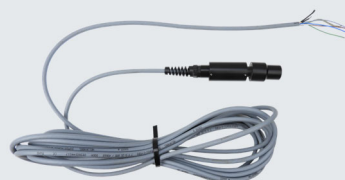
Brown bottle for calibration
NEP-CAL-BTL



NEP-5000 connection cable
NEP-USB-CON



SubConn connector and cable assembly
NEP-CBL-CON



6 How to use this manual (where to begin?)

All NEP-5000 sensors come with default factory settings which are unique to each sensor variation of the NEP-5000. Users may also request desired settings at the time when placing the order.

6.1 Default settings

The default settings for each NEP-5000 glanded & SubConn configuration are as follows:

	SUB-RS232 /Analog	SUB-RS485 /RS422/Analog	SUB-RS485- Pressure	SUB-SDI-12 /Analog
Calibration	Multi-point	Multi-point	Multi-point	Multi-point
Measurement mode	Auto	Auto	Auto	Auto
Statistical package	5 measurement length	5 measurement length	5 measurement length	5 measurement length
Optical-wiper	Single direction	Single direction	Single direction	Single direction
Power on wipe	Yes	Yes	Yes	Yes
Digital data mode	RS232 free-flow	RS422 free-flow	RS485 polled	SDI-12 command mode
Sensor address	1	1	1	
SDI-12 address				0
Analog output	Off	Off		Off

Figure 6.A: Default settings for each NEP-5000 configurations

Note: If satisfied with the current default settings or pre-ordered configurations from the factory, the user does not need to use the calibration software nor do they require to do any changes to the settings.

6.2 Finding the correct wiring diagram for your sensor

To find out the appropriate wiring diagram for calibration and general use, the user may refer to the table on **chapter 8: “Pinout & wiring diagram”**. This selection table also includes reference to the recommended wiring diagrams via tag markers **RS232/Analog_SubConn** connector option (#WD1) to **SDI-12/Analog** glanded-NEP cable option (#WD8).

6.3 How to configure and calibrate your sensor

The NEP-5000 offers easy configuration methodology using single wire (one-wire) communication to the configuration software. Using this configuration, the user only requires to connect 3 wires during the time of the calibration process.

To facilitate trouble free communication with the PC, Observator Instruments provides a module called “calibration module” that converts one wire calibration data to USB and generates 12V DC from available USB 5V.

Note: The calibration module that plugs into the USB port must be able to provide more than 200mA at 5V. If not, the user may provide external power using 12V DC, 500mA plug-pack.

6.4 What is required for your calibration and configuration

NEP-5000 sensors come with SubConn or glanded-NEP cable options. This section describes the equipment required to connect each sensor option to the calibration module.

6.4.1 SubConn with NEP-CBL-CON option

1. Connect your NEP-5000 SubConn option to the NEP-CBL-CON cable provided in your NEP-5000 kit (Figure 6.B: Probe connection to NEP-CBL-CON).

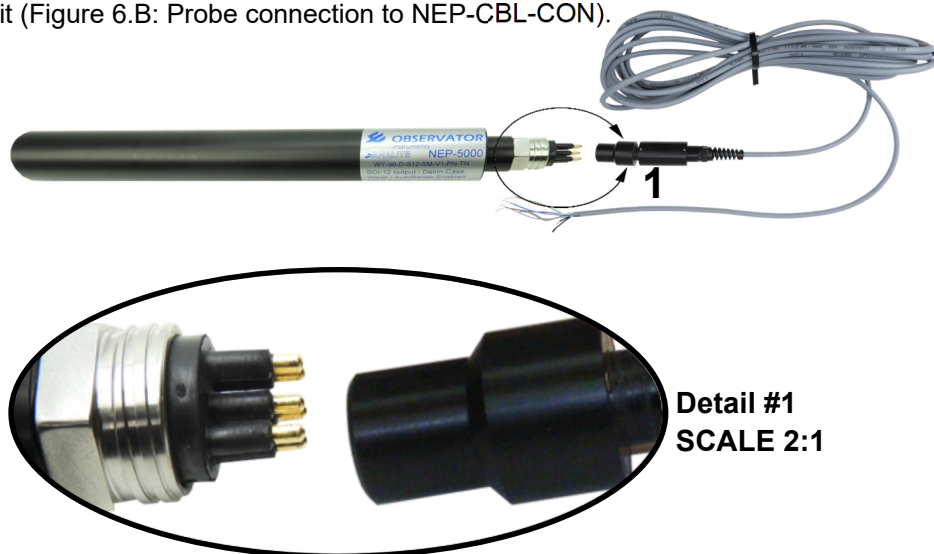


Figure 6.B: Probe connection to NEP-CBL-CON

2. Connect the NEP-CBL-CON to the blue box calibration module (refer to **section 6.5**: “Connect the calibration module”).



Figure 6.C: Example of configuration for SubConn SDI-12 probes

Note: Always be mindful of following the correct pinout which changes based on your probe configuration.

6.4.2 SubConn options only

1. Connect your NEP-5000 SubConn option to the SubConn female pigtail provided in your NEP-5000 kit (Figure 6.D: Probe connection to SubConn female pigtail).

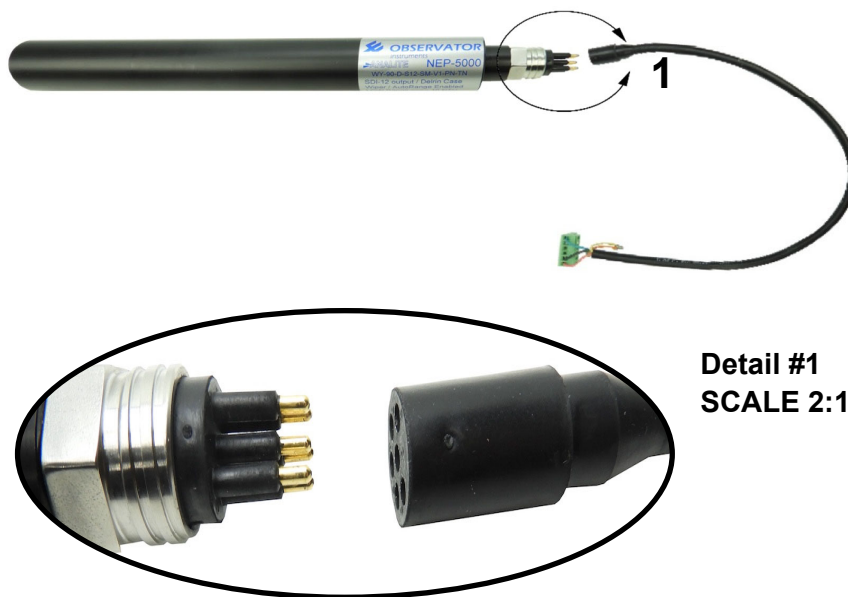


Figure 6.D: Probe connection to SubConn female pigtail

2. Connect the SubConn female pigtail to the blue box calibration module (refer to **section 6.5**: “Connect the calibration module”).



Figure 6.E: Example of configuration for SubConn SDI-12 probes

Note: Always be mindful of following the correct pinout which changes based on your probe configuration.

6.4.3 Glanded-NEP options only

- Connect the SubConn female pigtail to the blue box calibration module (refer to **section 6.5**: “Connect the calibration module”).



Figure 6.F: Example of configuration for SubConn SDI-12 probes

Note: Always be mindful of following the correct pinout which changes based on your probe configuration.

6.5 Connect the calibration module

NEP-5000 probes are calibrated using the “Blue box calibration module” (see Figure 6.G).

1. Connect your sensor(s) to the calibration module according to the “[Pinout & wiring diagram](#)” table on **chapter 8**.

Calibration module pin number	Refer to	Sensor wire to connect
Pin 1	(Figure 6.G: #1)	“PWR”
Pin 2	(Figure 6.G: #2)	“GND”
Pin 6	(Figure 6.G: #6)	“COMMS” (calibration/wiper)

2. Power the calibration module using 12V DC plug pack if your USB port cannot provide more than 200mA off power, otherwise plug pack is not required (Figure 6.G: #5).
3. Connect the provided USB cable to the calibration module (Figure 6.G: #4).

Refer to **chapter 0**, in order to “

4. Connect to the calibration software”. Press reset when required to reset the communication (Figure 6.G: #3) with the sensor.

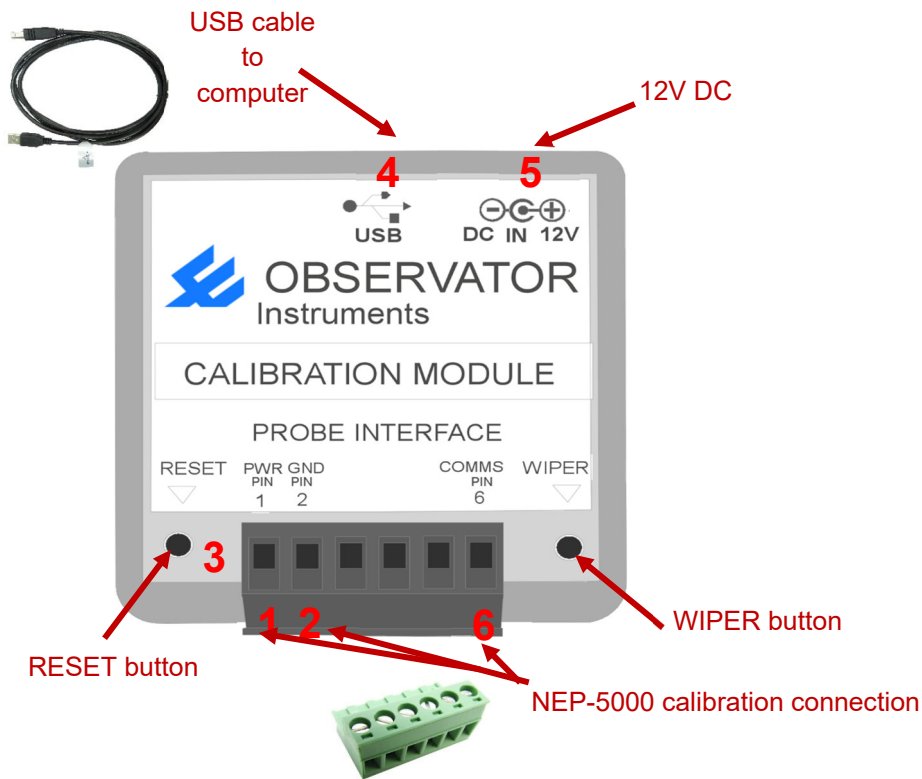


Figure 6.G: Bluebox calibration module

Note: Wiper button allows user to test the wiper when the sensor is in Analog mode.

7 NEP-5000 capabilities

This section will describe all the capabilities of the NEP-5000 sensor and its features available for measuring, communicating, optical cleaning and secondary sensor options.

- In measurement settings, the user may change slew-rate, the behavior of auto-range, and statistical package according to the application requirements.
- In communication settings, the user may select between RS232, RS422, RS485, SDI-12 and Analog and their relevant parameters.
- In optical wiping, the user may select wiper operation mode and their relevant parameters.
- When ordered with secondary sensors, the user may configure and calibrate their parameters according to instructions provided below.

7.1 Features in measuring

The NEP-5000 offers a wide variety of measurement configuration to suit many turbidity applications. Some of the features are:

- The ability to change measurement slew-rate.
- The ability to customize the statistical package.
- An auto-range algorithm which when enabled, automatically selects the appropriate range prior to each measurement.

The NEP-5000 can provide calibration in many turbidity standards using its multi-point calibration scheme, that can adapt to any given turbidity curves.

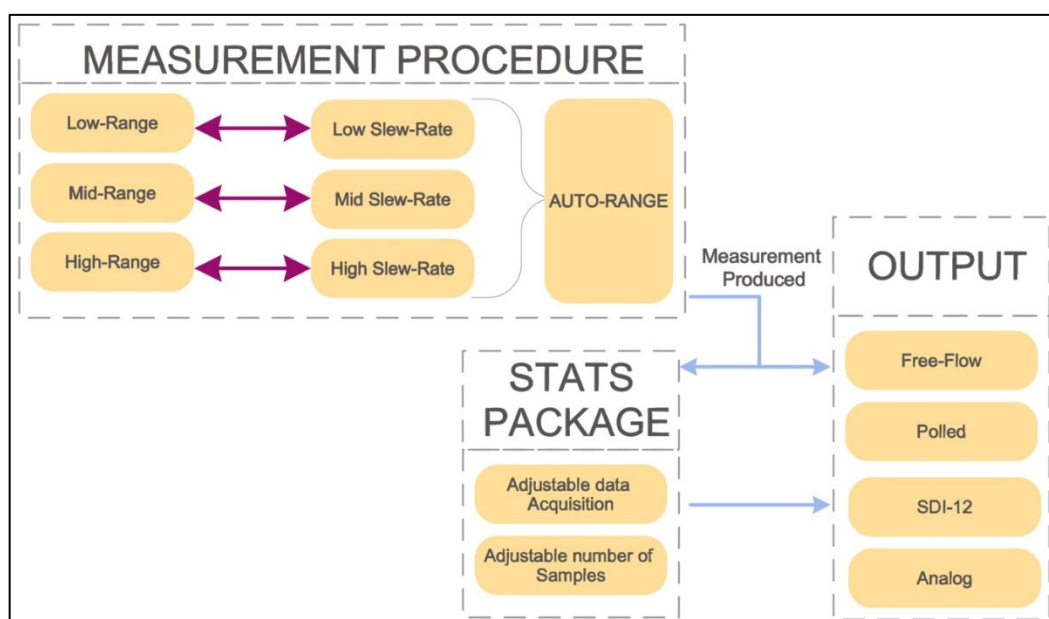


Figure 7.A: Communication features flow-chart

7.1.1 Single-range measurement

When the NEP-5000 is configured as a single-range, the sensor will apply the correct slew-rate during its measurement period. The new-measurement is added to the statistical data-stack for future calculations and passes to the output stage.

Advantages of single-range measurements:

Single-range measurement is ideal for applications that require fast response when constant monitoring is required.

Important: Minimum measurement period must be between one second and onwards.

7.1.2 Auto-range measurement

When the NEP-5000 is configured as auto-range, the sensor starts the measurement procedure by selecting the highest range and taking one single-measurement. Then, according to the first measurement, the sensor will decide the appropriate range to capture series of measurements to calculate final result. To make sure the measured result is within the selected range, the sensor compares the result with the range. If the selected range does not match, it will change the range accordingly and will repeat the measurement in loop until measurement time-out occurs.

Advantages of auto-range measurements:

Auto-range measurement is ideal for applications with unknown measurement ranges where all three ranges are taken for consideration.

Use:

Applications such as river monitoring stations where sediments can read above 1,000NTU and normal turbidity averaging near 10NTU.

Important: Minimum measurement period must be between four seconds and onwards.

7.2 Features in communication

The NEP-5000 consists of a wide variety of communication related features such as:

- Periodic data free-flow.
- Data-request mode (polled-mode).
- SDI-12 mode.
- Measurement via Analog interface.

7.2.1 Periodic data free-flow

The NEP-5000 in data free-flow mode provides periodic data in single-range or auto-range measurements while supporting periodic optical wipe options. Temperature measurement is also available as a secondary parameter.

For related wiring diagram for the free-flow function, please refer to the following drawings:

	SubConn	Glanded
RS232	Refer to #WD1-A RS232 SubConn (not with multiple sensors)	Refer to #WD2-A RS232 glanded #WD2-A RS232 glanded (not with multiple sensors)
RS422	Refer to #WD3-D RS422 SubConn (not with multiple sensors)	Refer to #WD4-D RS422 glanded (not with multiple sensors)
TTL	Special case	

Select the following configurations (Figure 7.B: #1 to Figure 7.B: #3) and click “Set” (Figure 7.B: #4):

1. Periodic data can be obtained between 1 to 1,020 seconds intervals between sentences.
2. Available free-flow mode communication settings are:
 - 1,200, 8, N, 1
 - 4,800, 8, N, 1
 - 9,600, 8, N, 1
 - 1,200, 7, E, 1
 - 4,800, 7, E, 1
 - 9,600, 7, E, 1
3. Available free-flow mode output sentence types are:
 - Sensor ID, turbidity, temperature.
 - Sensor ID, turbidity.
 - Sensor ID, median, average, minimum, maximum.

If auto-range or statistical options are selected, the user must allow appropriate measurement intervals before recording the data as valid.

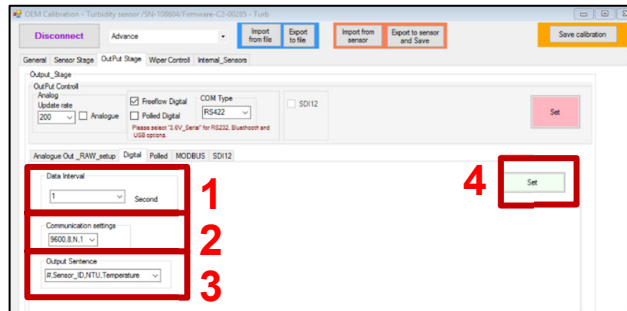


Figure 7.B: Free-flow output sentence

Statistical via free-flow mode:

To obtain a statistical measurement via free-flow mode, the user needs to select the appropriate statistical settings using the PC configuration software.

When selected, the data will be out putted according to the selected free-flow period.

Note: If selected statistical data takes say 40s, the user must wait 40s from start up to receive the first accurate result. After 40s pass, the sensor will output, running statistical measurement as it occurs.

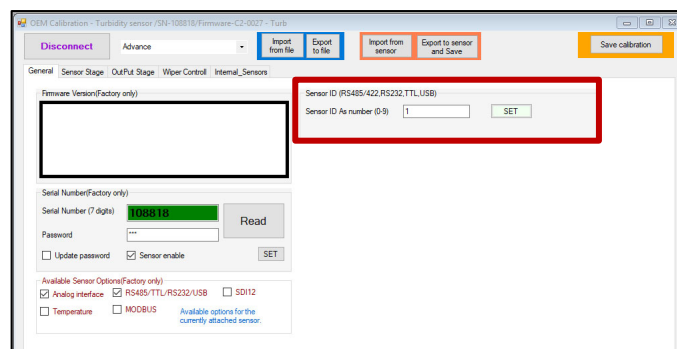


Figure 7.C: Free-flow mode address

The built-in statistical package can provide up to 100 data-point statistical analysis of single auto-range turbidity measurements. The user must decide according to the application, the best configuration.

The user can customize the measurement period and statistical length of the analysis by changing following parameters:

1. The measurement period (
- 2.
3. Figure 7.D: #1).

4. Statistical data-length (
- 5.
6. Figure 7.D: #2).

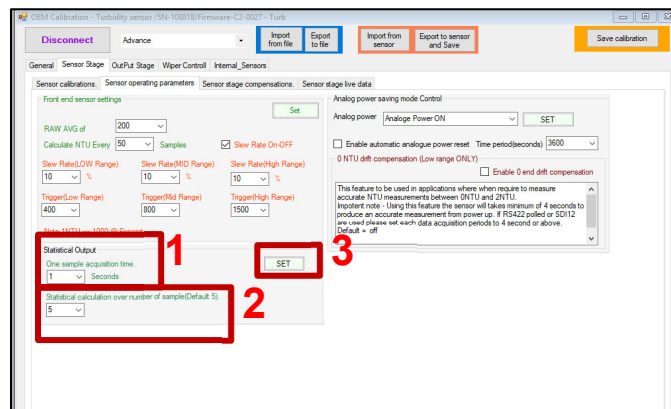


Figure 7.D: Statistical settings

7.2.2 Data-request mode (polled-mode)

The NEP-5000 in data polled-mode provides data on request in single-range or auto-range measurements. Temperature measurement is also available as a secondary parameter.

Functions that can be controlled via polled-mode:

- Optical wiper.
- Turbidity measurement ranges.
- Statistical measurements.

In polled-mode, the sensor or sensors can be addressed using its unique sensor address. The user may connect multiple sensors into the same RS485 bus (up to 10 sensors).

For related wiring diagram for polled-mode function, please refer to the following drawings:

	SubConn	Glanded
RS232	Refer to #WD1-A RS232 SubConn (not with multiple sensors)	Refer to #WD2-A RS232 glanded (not with multiple sensors)
RS485	Refer to #WD3-A RS485 SubConn (not with multiple sensors)	Refer to #WD4-A RS485 glanded (not with multiple sensors)
RS485 with Pressure	Refer to #WD5-A RS485 SubConn (with multiple sensor)	Refer to #WD6-A RS485 glanded (with multiple sensor)
TTL		Special case

Select the following configurations (Figure 7.E: #1 to Figure 7.E: #3) and click “Set” (Figure 7.E: #4):

1. Polled-mode “Read Commands Data acquisition period” allows user to select appropriate measurement time needed for the application.

Note: When using auto-range the data acquisition period must be above 4s and single range must be above 2s.

2. Available polled-mode communication settings are:

- 1,200, 8, N, 1
- 4,800, 8, N, 1
- 9,600, 8, N, 1
- 1,200, 7, E, 1
- 4,800, 7, E, 1
- 9,600, 7, E, 1

3. Available polled-mode output sentence types are:

- Sensor ID, turbidity, temperature.
- Sensor ID, turbidity.
- Sensor ID, median, average, minimum, maximum.

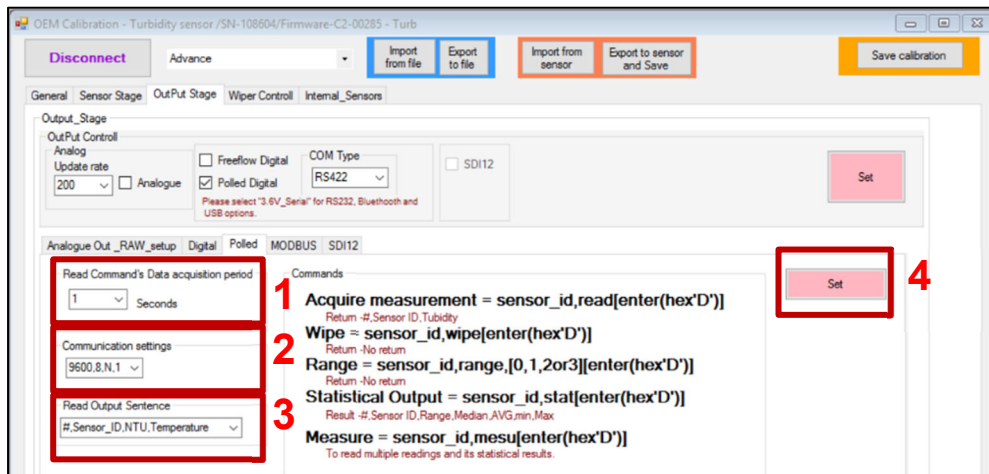


Figure 7.E: Poll-mode output settings

Obtain a measurement:

To obtain a measurement via polled-mode, the logger needs to send “Sensor ID” and “read” followed by carriage return [0x0D]. Please refer to the command below:

```
sensor_id, read[enter(hex'D')]
```

The return response from the sensor is as follows:

- Sensor ID, turbidity, temperature.
- Sensor ID, turbidity.
- Sensor ID, median, average, minimum, maximum.

Note: The desired response can be set using the PC configuration software, please refer to **Figure 7.F: Polled mode address**”.

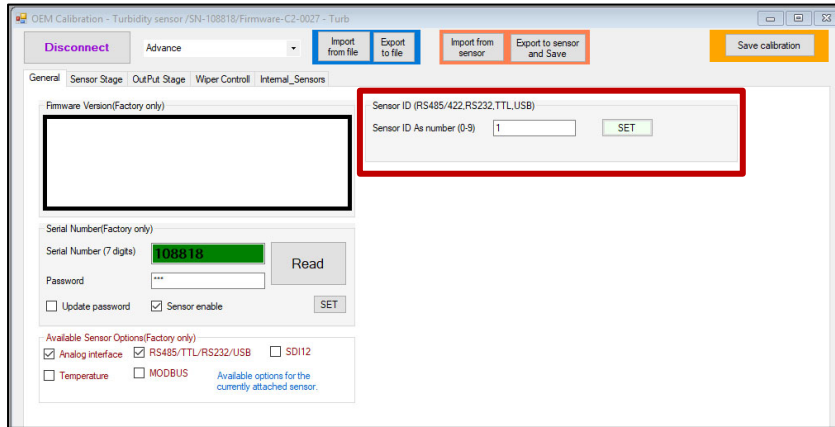


Figure 7.F: Polled mode address

Perform a wipe:

To carry out an optical wipe via polled-mode, the logger needs to send “Sensor ID” and “wipe” followed by carriage return [0x0D]. Please refer to the command below:

sensor_id, wipe[enter(enter(hex'D'))]

Note: The desired wiper response can be set using the PC configuration software, please refer to **section 7.3: “Optical wiper: Features and configurations”**.

Switch range via polled-mode:

To change the measurement range using polled-mode commands, the logger needs to send “Sensor ID”, “range” and “range number” followed by carriage return [0x0D]. Please refer to the command below:

sensor_id, range,[0, 1, 2or3][enter(hex'D'))]

Statistical via polled-mode:

To obtain a statistical measurement via Polled-mode, the logger needs to send “Sensor ID” and “stat” followed by carriage return [0x0D]. Please refer to the command below:

sensor_id, stat[enter(hex'D'))]

To obtain desired statistical output, the user must configure built in statistical package settings using the PC configuration software.

The built-in statistical package can provide up to 100 data-point statistical analysis of single auto-range turbidity measurements. The user must decide the best configuration according to the application.

The user can customize the measurement period and statistical length of the analysis by changing following parameters:

1. The measurement period (Figure 7.G: #1)

Note: When using auto-range, the measurement period must be about 4s and the single range measurement period must be above 2s.

2. Statistical data-length (Figure 7.G: #2)

Note: The final statistical analysis time depends on statistical data-length multiplied by the measurement period.

$$\text{Total statistical analysis time} = (\text{Measurement period} \times \text{Statistical data length}) + \text{Calculation time (4 seconds)}$$

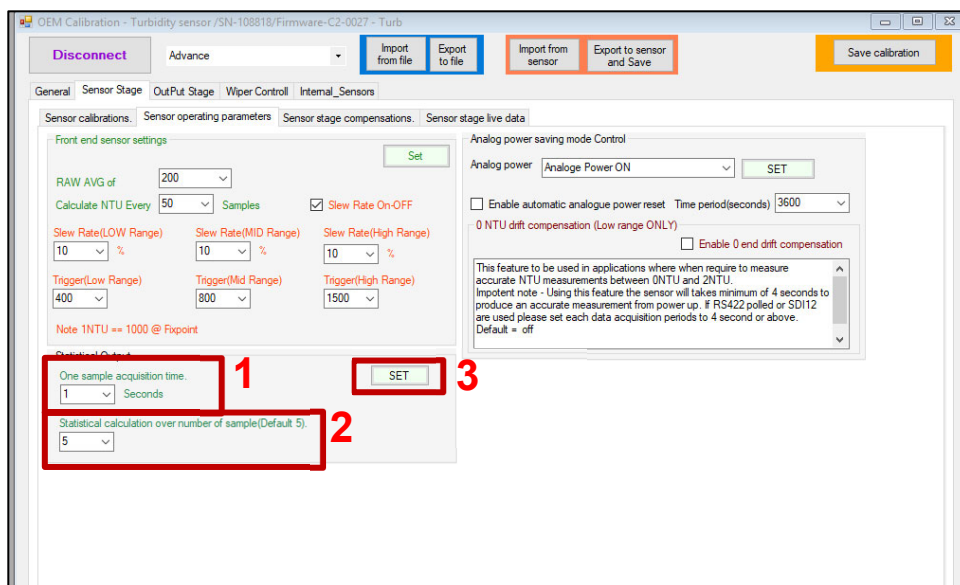


Figure 7.G: Polled mode address

Statistical measurement via polled-mode as legacy NEP-395:

This command may output a series of single reading turbidity measurements and then automatically calculate its statistical output. This is identical to the NEP-395.

Please refer to the command below:

```
sensor_id, mesu[enter(hex'D')]
```


7.2.3 SDI-12 mode

The NEP-5000 in SDI-12 protocol provides a wide variety of parameters and features such as single or auto-range turbidity measurements, optical wipe, range select and statistical measurement.

SDI-12 configuration of the NEP-5000 software provides a variety of selections customized to your application. Some of these configurations are:

- Changing the SDI-12 address: Refer to (Figure 7.H: SDI-12 configuration pages #1).
- Changing the data acquisition time according to desired measurement mode: Refer to (Figure 7.H: SDI-12 configuration pages#2).
- Ability to change the wiper operation to what best suits your application.
- Ability to customize the built-in statistical package.
- Ability to change the mode of measurement when invoked by (aM0!).
- Ability to read the temperature as a secondary measurement (when the option is selected).

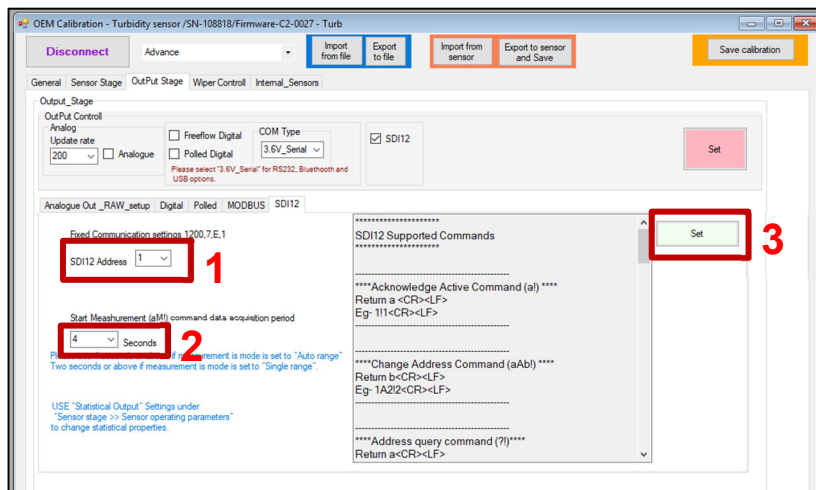


Figure 7.H: SDI-12 configuration pages

For further information regarding customization and SDI-12 use with loggers, please refer to “[NEP-5000-SDI12 option with Campbell logger](#)” application note.

Basic available SDI-12 command set

- SDI-12 acknowledgement command that indicates the presence of the sensor on request.
*****Acknowledge Active Command (a!) *****
Return a <CR><LF>
Eg- 1!1<CR><LF>
- This command allows the user to change the SDI-12 user address via SDI-12 bus.
*****Change Address Command (aAb!) *****
Return b<CR><LF>
Eg- 1A2!2<CR><LF>

Note: This is a temporary modification to the sensor address. It will be restored upon restart (power-cycle) to the pre-configured SDI-12 sensor address set by the PC configuration software.

SDI-12 acknowledgement command returns the sensor address on request:

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

Return a<CR><LF>

Eg- ?!2<CR><LF>

Note: The sensor must not be in a multiple sensor SDI-12 bus when invoked.

Sensor specific command set

- Single measurement of turbidity:
Using single measurement command (aM!) the user may select single range measurement or auto-range measurement.

The return response may change according to the selected measurement typed by the user.

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

- Statistical measurement of turbidity:
Using the statistical measurement command (aM6!), the user can invoke statistical measurement processes. Please refer to “[NEP-5000-SDI12 option with Campbell logger](#)” application note for further information on configuring the built-in statistical package for your application.
The return response to (aM6!) command may change according to the selected measurement typed by the user.

Start statistical measurement (aM6!)

Return 20066<CR><LF>

aM6! atttn<CR><LF>

a - the sensor address 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

- Retrieving measured SDI-12 data:
After initiating a measurement (aM! or aM6!), the logger or SDI-12 master may send read commands (aD0! to aD9!).

To read a single measurement (aD0!)

*****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.

To read a statistical measurement (aD1!).

Note: 6 parameters include with single measurement of turbidity (aD0!) followed by (aD1!).

**** Full statistical measurement read****
Send data command (aD1!)
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

- Optical clean (wiping):

Using measurement command (aM1!) the user may invoke the wiper action.

The wiper status after completion of the wiping action can be read from (aD0!):

1=parking error

0=successful wipe

****Wiper Control****

Wipe command (aM1!) Wipe action will be completed in 16s

Return a0161<CR><LF>

Eg- 20161<CR><LF>

Note that 16 is requesting of 16 seconds of delay.

after 16 seconds has elapsed wiper status can be read using aD0! command.

Note: You can select the appropriate wiper operation by going into the “wiper configuration” tab - refer to **section 7.3.2**: “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

- Changing the measurement range using SDI-12:

Using measurement command (aM2! to aM5!) the user may switch the measurement range.

High Range (5000NTU)

**Command (aM2!)

Return a0010<CR><LF>

Medium Range (400NTU)

**Command (aM3!)

Return a0010<CR><LF>

Low Range (40NTU)

**Command (aM4!)

Return a0010<CR><LF>

Note: When selecting auto-range via SDI-12 the sensor must make sure enough acquisition time is allowed in ‘SDI-12 data acquisition period’ (please refer to [Figure 7.H](#): SDI-12 configuration pages#2).

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

7.2.4 Measurement via Analog interface

Common features for Analog current and voltage configuration

This section explains how to enable and do scaling of the Analog output for both voltage driver option and current driver option.

The NEP-5000 Analog output option can provide a wide variety of different Analog outputs and ranges. Please refer to the calibration of the Analog output section for further information.

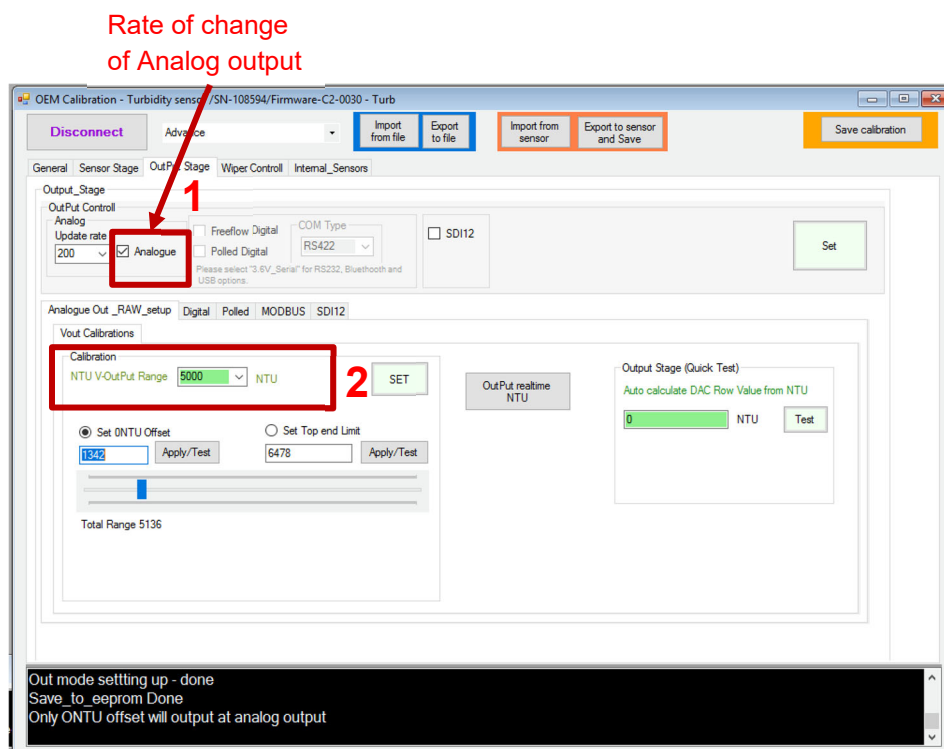


Figure 7.1: Selection of the Analog option

1. Enabling Analog option (Figure 7.1: #1).

When this option is enabled, the sensor will automatically configure to operate as continuous mode and all the digital communications are being turned off.

2. Scaling of the Analog output (Figure 7.1: #1).

This option allows the user to select the scaling factor of the Analog output.

Example: For a 0-2.5V option, the user may decide to have 100NTU or 1,000NTU to represent a 0-2.5V output.

Calibration of current output

This section shows how to set up for the calibration of current output and is a step-by-step instruction procedure for its calibration.

Please wire up your NEP-5000 current output option according to the schematic (Figure 7.J). Use the appropriate wiring colour based on your probe model (see **chapter 8: "Pinout & wiring diagram"**).

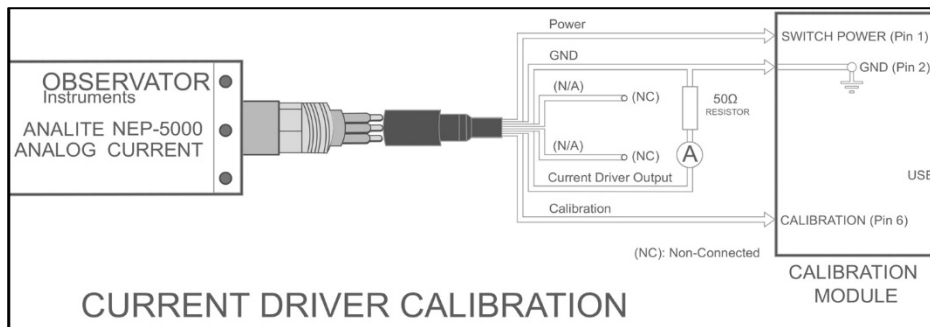


Figure 7.J: Current driver calibration wiring

The following steps detail the calibration component of the output driver that is used to set up the desired limits of the current (e.g. 4-20mA or 0-20mA).

1. Select the option "Set 0NTU Offset" (Figure 7.K: #1).
2. Measure and adjust the current output of the sensor using a multi-meter. Adjust the raw Analog output value (Figure 7.K: #2) based on your low current value (0mA or 4mA).

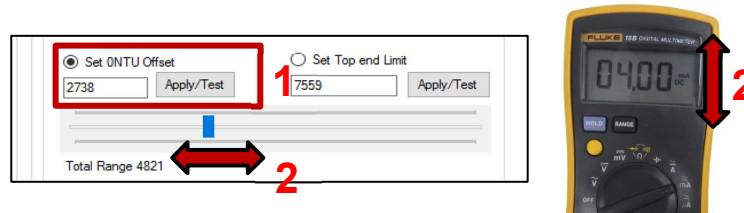


Figure 7.K: Scaling and calibrating 0NTU offset

3. Select the option "Set Top-end Limit" (Figure 7.L: #3).
4. Measure and adjust the current output of the sensor using a multi-meter. Select the raw Analog output value (Figure 7.L: #4) based on your top current value (20mA).

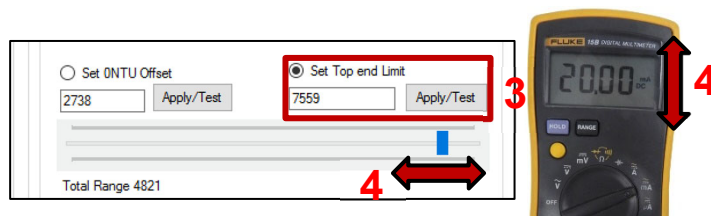


Figure 7.L: Scaling and calibrating top-end limit

Note: Multi-meter instrument specification must be highly accurate.

- To apply the above settings press “Set” and “Save”.

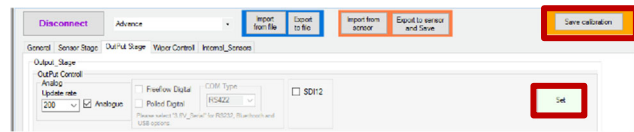


Figure 7.M: Set and save Analog current driver calibration

Calibration of voltage output

This section shows how to set up for the calibration of the voltage output and is a step-by-step instruction procedure for its calibration.

Please wire up your NEP-5000 voltage output option according to the schematic (Figure 7.N). Use the appropriate wiring colour based on your probe model (see **chapter 8**: “Pinout & wiring diagram”).

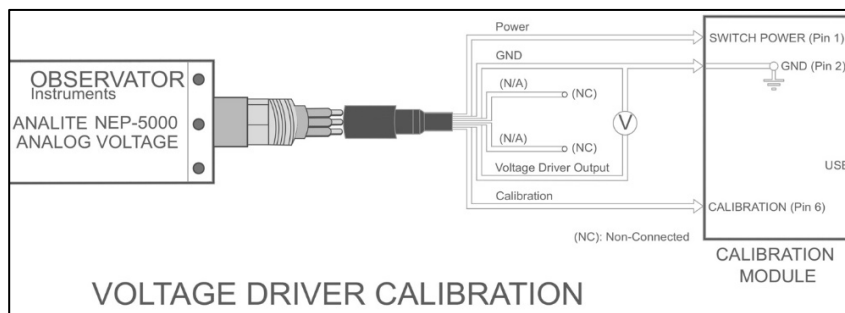


Figure 7.N: Voltage driver calibration wiring

The following steps detail the calibration component of the output driver that is used to set up the desired limits of the voltage (e.g. -2.5V to +2.5V, 0 to 2.5V and 0 to 1V).

- Select the option “Set 0NTU Offset” (Figure 7.O: #1).
- Measure and adjust the current output of the sensor using a multi-meter. Adjust the raw Analog output value (Figure 7.O: #2) based on your low voltage value (-2.5V or 0V).

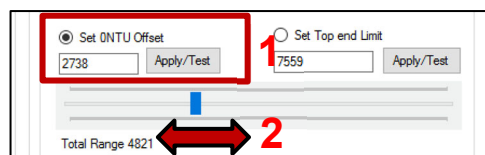


Figure 7.O: Scaling and calibrating 0NTU offset



- Select the option “Set Top-end Limit” (Figure 7.P: #3).
- Measure and adjust the current output of the sensor using a multi-meter. Select the raw Analog output value (Figure 7.P: #4) based on your top current value (20mA).

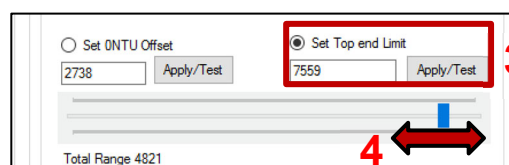


Figure 7.P: Scaling and calibrating top-end limit



Note: Multi-meter instrument specification must be highly accurate.

5. To apply the above settings press “Set” and “Save”.

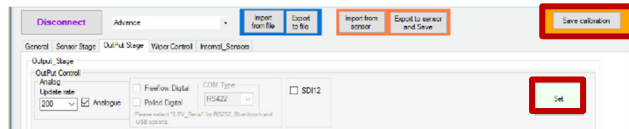


Figure 7.Q: Set and save Analog current driver calibration

7.3 Optical wiper: Features and configurations

The NEP-5000 optical wiping system offers a comprehensive list of wiping solutions to meet the needs of unique applications. Some of the available features are:

- Single direction.
- Return wipe.
- Scrub wipe.
- Automatic periodic wipe.
- Power on wipe.

Note 1: All wiping solutions are available with all output configurations. Please refer to **section 7.3.3:** [“Available optical wiping options for output configurations”](#).

Note 2: For further information regarding application specific use of the optical, please refer to [“NEP5000-SDI-12, RS485 and Analogue: wiper operations”](#) application note.

Note 3: Maintenance and replacement instructions regarding the optical wiper can be found from [“Wiper replacement”](#) application note document.

7.3.1 Basic optical wiper configuration

To configure the optical wiper, select the “wiper control” tab in the NEP-5000 calibration software.

Note: This control tab can also be used to test the wiper system.

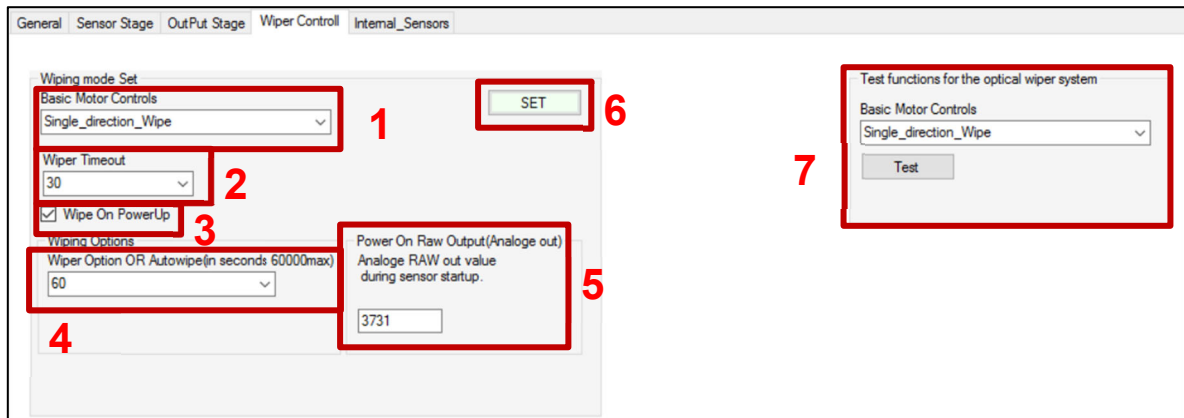


Figure 7.R: Basic wiper configuration tab

1. Select the correct wiper mode (Figure 7.R: #1)
This option allows you to select between single direction, return and scrub wiping options. Please refer to “NEP5000-SDI-12, RS485 and Analogue: wiper operations” application note.
 2. Wiper timeout (Figure 7.R: #2)
This timeout value allows the user to specify the amount of time that the wiper is activated during a wiper jam.
- Note: Timeout value affects differently to each wiper mode.
3. Wipe on powerup (Figure 7.R: #3)
This option allows the user to turn on the optical wiper automatically during the sensor power up.
 4. Wiper option auto-wipe (Figure 7.R: #4)
This option allows the user to set up a periodic optical wipe interval. When auto-wipe is not in-use, please select “OFF”.
 5. Power on raw output (Figure 7.R: #5)
This option is valid for the Analog output option only. During the power-up process, the sensor outputs the set Analog value (may take up to two seconds, twelve seconds when power-on wiping). The value is a raw value related to the Analog section described in **section 7.2.4**: “Measurement via Analog interface”.
 6. Press “SET” (Figure 7.R: #6)
Select “SET” once the wiper configuration is completed.
 7. Test functions for the optical wiper system (Figure 7.R: #7)
This option allows the user to test the optical wiper operation when attached to the calibration software. Some of the operations are: drive forward, backward, break and standby.

7.3.2 Recommended method of triggering the optical wiper using a dedicated wiper wire

This section describes internal electrical characteristics of the wiper wire and recommended methods of triggering the optical wiper action by shorting the wire to the power ground.

- Please refer to **section** (Figure
- Figure 7.S: #1) for internal characteristic for the calibration wire/wiper wire.
- Please refer to **section** (Figure
- Figure 7.S: #2) on recommended use of the wiper activation wire using a relay output or using a Negative Positive Negative (NPN) transistor.

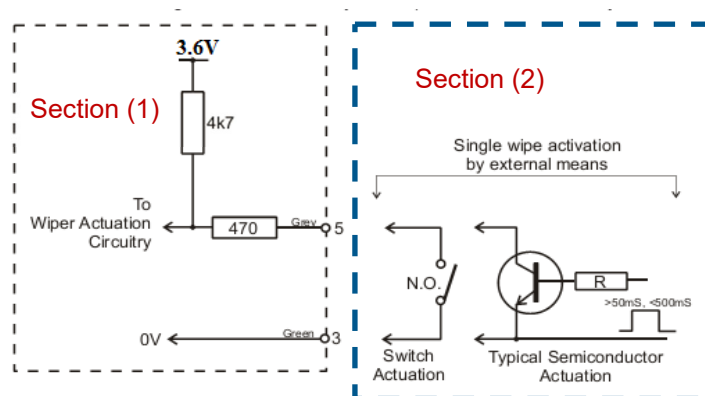


Figure 7.S: Recommended use of triggering optical wiper

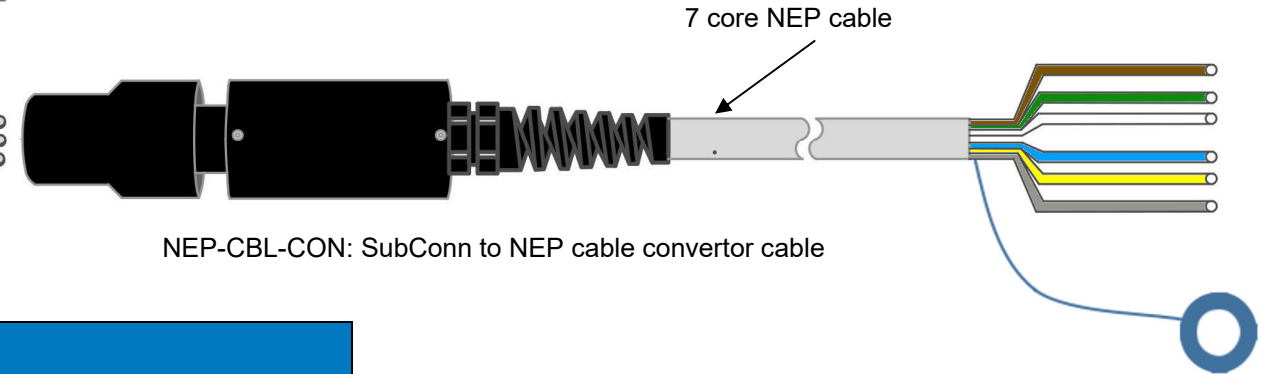
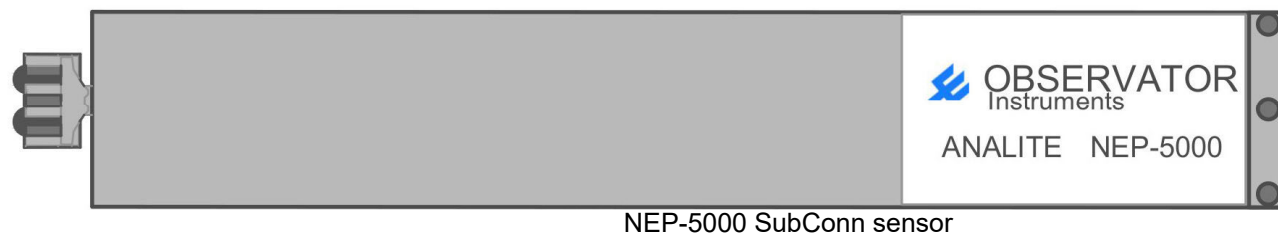
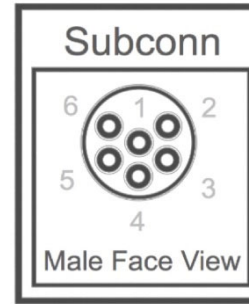
7.3.3 Available optical wiping options for output configurations

Wiping options are unique to each output as described below:

1. Available optical wiping options for “Periodic data free-flow” mode:
 - Periodic optical wiper activation.
 - Power on optical wiper activation.
2. Available optical wiping options for “Data-request mode (polled-mode)” :
 - On-request (using command: sensor address, wipe + Carriage Return (CR)).
 - Power on optical wiper activation.
3. Available optical wiping options for “SDI-12 mode”:
 - Optical wiper activation using command (aM1!), then read wiper status using command (aD0!).
0 = Successful wipe.
1 = Unsuccessful wipe (wiper jammed).
 - Power on optical wiper activation.
4. Available optical wiping options for “Measurement via Analog interface” mode:
 - Optical wiper activation via logic control.
 - Periodic optical wiper activation.
 - Power on optical wiper activation.

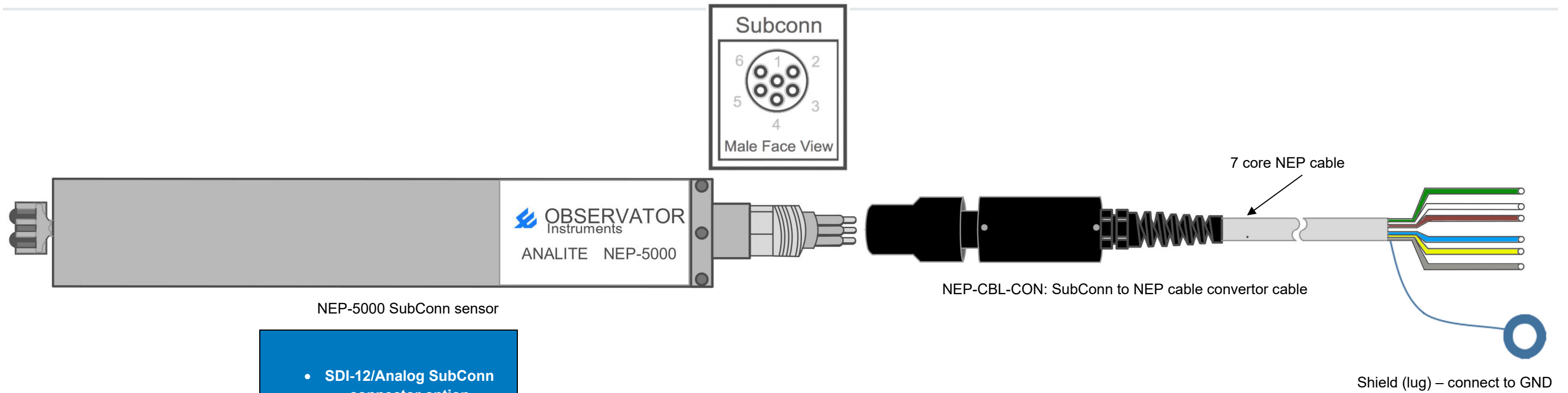
8 Pinout & wiring diagram

- SubConn with NEP-CBL-CON option.



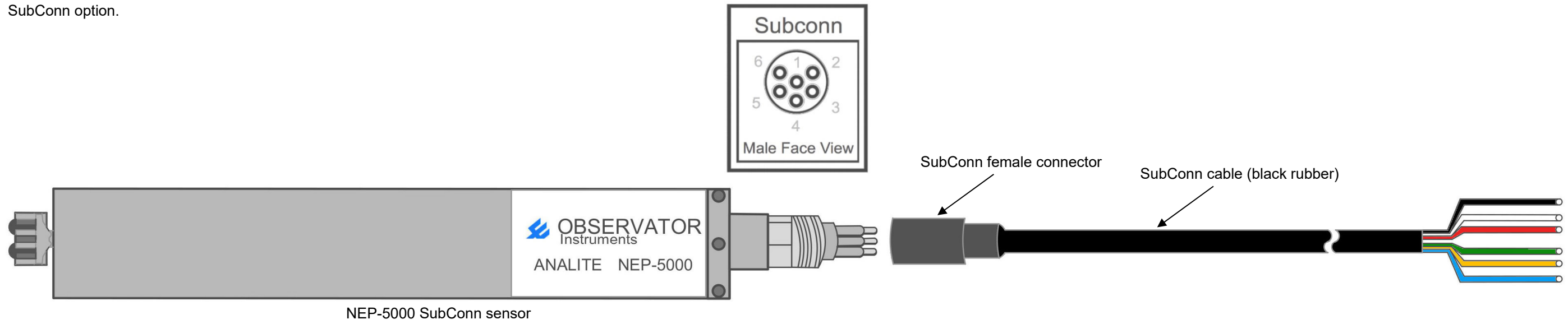
Shield (lug) – connect to GND

SubConn male connector (sensor end)	RS232/Analog SubConn connector option SubConn connector option (#WD1)	RS485/RS422/Analog SubConn connector option SubConn connector option (#WD3)	RS485/Pressure SubConn connector option SubConn connector option (#WD5)	7 core NEP cable colours
Pin 1	Power +12V to +24V	Power +12V to +24V	Power +12V to +24V	Brown
Pin 2	GND / RS232 GND	GND	GND	Green
Pin 3	RS232 (Tx)	RS485 (+)	RS485 (+)	White
Pin 4	RS232 (Rx)	RS485 (-)	RS485 (-)	Blue
Pin 5	Calibration wire turbidity	Calibration wire turbidity	Calibration wire turbidity	Grey
Pin 6	Voltage out reference to GND or 4-20mA loop driver out to GND	Voltage out reference to GND or 4-20mA loop driver out to GND	Calibration pressure	Yellow
	Not used – connected to GND via 1K	Not used – connected to GND via 1K	Not used – connected to GND via 1K	Pink



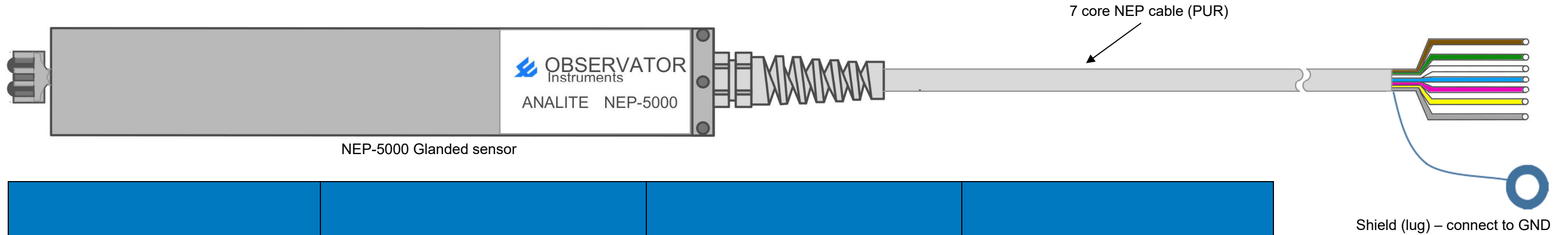
SubConn male connector (sensor end)	<ul style="list-style-type: none"> SDI-12/Analog SubConn connector option SDI-12/Analog SubConn connector option (#WD7)	7 core NEP cable colours
Pin 1	Power GND, SDI12 GND, and voltage output GND	Green
Pin 2	SDI 12 data	White
Pin 3	Power +10V to +24V DC (+Ve)	Brown
Pin 4	4-20mA loop to power GND via 100 ohms	Blue
Pin 5	Voltage out (pin 1 as GND ref)	Yellow
Pin 6	Calibration communication data	Grey
	Not used – connected to GND via 1K	Pink

- SubConn option.



SubConn male connector (sensor end)	RS232/Analog SubConn connector option (#WD1)	RS485/RS422/Analog SubConn connector option (#WD3)	RS485/Pressure SubConn connector option (#WD5)	SDI-12/Analog SubConn connector option (#WD7)	6 core SubConn cable colours
Pin 1	Power +12V to +24V	Power +12V to +24V	Power +12V to +24V	Power GND, SDI12 GND, and voltage output GND	Black
Pin 2	GND / RS232 GND	GND	GND	SDI 12 data	White
Pin 3	RS232 (Tx)	RS485 (+)	RS485 (+)	Power +10V to +24V DC (+Ve)	Red
Pin 4	RS232 (Rx)	RS485 (-)	RS485 (-)	4-20mA loop to power GND via 100 ohms	Green
Pin 5	Calibration wire turbidity	Calibration wire turbidity	Calibration wire turbidity	Voltage out (pin 1 as GND ref)	Orange
Pin 6	Voltage out reference to GND or 4-20mA loop driver out to GND	Voltage out reference to GND or 4-20mA loop driver out to GND	Calibration pressure	Calibration communication data	Blue

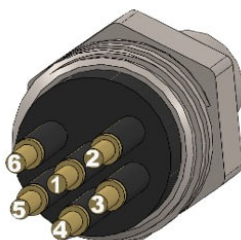
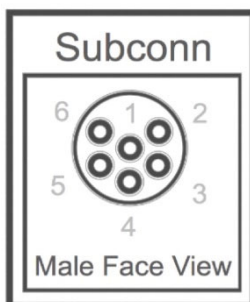
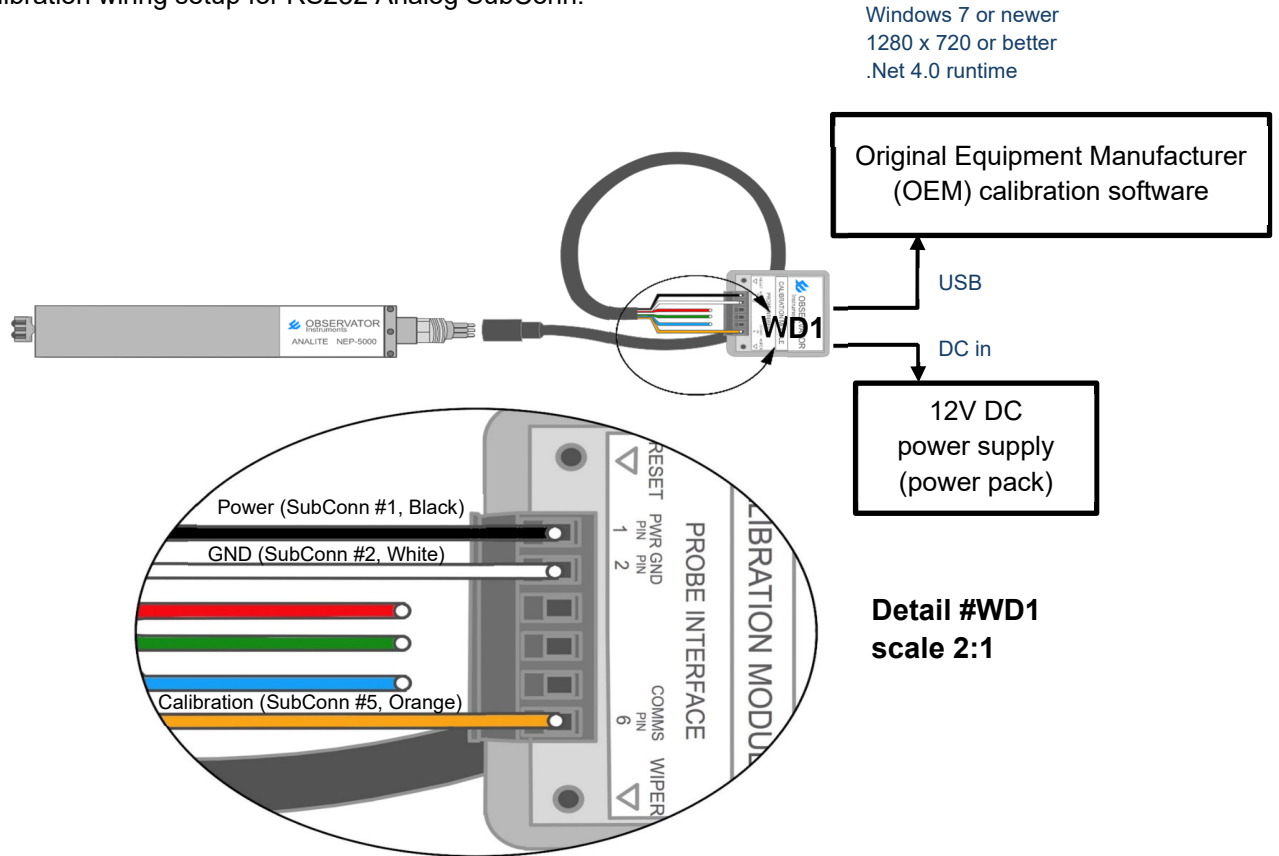
- Glanded-NEP cable option.



RS232/Analog glanded-NEP cable option (#WD2)	RS485/RS422/Analog glanded-NEP cable option (#WD4)	RS485/Pressure glanded-NEP cable option (#WD6)	SDI-12/Analog glanded-NEP cable option (#WD8)	7 core NEP cable colours
Power +10V to +24V DC	Power +10V to +24V DC	Power +10V to +24V DC	Power +10V to +24V DC (+Ve)	Brown
GND / RS232 GND	GND	GND	Power GND, SDI12 GND, and Analog GND	Green
Voltage out reference to GND or 4-20mA loop driver out to GND	Voltage out reference to GND or 4-20mA loop driver out to GND	Not used (1K to GND)	SDI12 data	White
RS232 (Rx)	RS485 (-)	RS485 (-)	4-20mA loop to power GND via 100 ohms	Blue
RS232 (Tx)	RS485 (+)	RS485 (+)	Not used – connected to GND via 1K.	Pink
Analog GND	Not used – connected to GND.	Pressure sensor's calibration	Voltage out (pin 1 as GND ref)	Yellow
Turbidity wipe / calibrations	Turbidity wipe / calibrations	Turbidity sensor's wipe / calibrations	Calibration communication data	Grey

8.1 RS232/Analog SubConn connector option (#WD1)

Calibration wiring setup for RS232 Analog SubConn:



SubConn pin number	Voltage option	SubConn colour	Calibration module pin
#1	Power +12V to +24V (+Ve)	Black	#1
#2	Ground (GND) / RS232 GND	White	#2
#3	RS232 (Tx)	Red	N/A
#4	RS232 (Rx)	Green	N/A
#5	Calibration / wiper	Orange	#6
#6	Voltage out reference to GND or 4-20mA loop driver out to GND	Blue	N/A

Figure 8.A: RS232/Analog SubConn pinout configuration

8.1.1 #WD1-A RS232 SubConn

Connect NEP-5000 to RS232 logger:

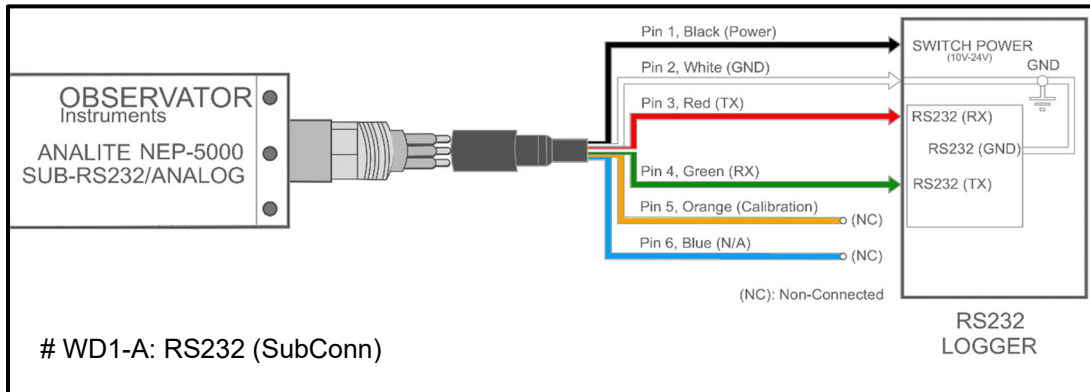


Figure 8.B: RS232 SubConn logger configuration

Description

The NEP-5000 sensor, with RS232 communication option, provides a comprehensive list of functionalities such as:

- Data-streaming (RS232 free-flow) in a variety of desired periods while providing various wiping options.
- Data-request mode (RS232 polled mode) where the control unit sends commands to NEP-5000 to operate.

In data-streaming (RS232 free-flow) mode user may select single range free-flow.

RS232 free-flow selection

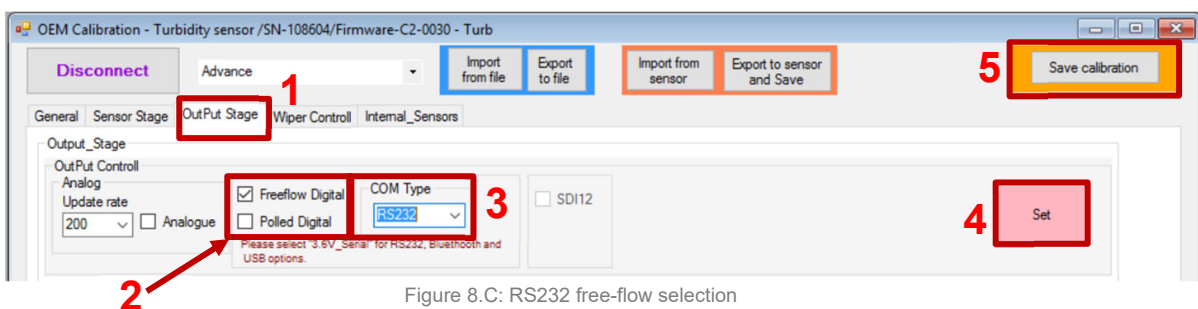


Figure 8.C: RS232 free-flow selection

When RS232 selection is being used with free-flow, the user must select (Figure 8.C: RS232 free-flow selection#2) as “Freeflow Digital”, then select (Figure 8.C: RS232 free-flow selection #3) COM type as “RS232”. Then press, selection (Figure 8.C: RS232 free-flow selection #4) and (Figure 8.C: RS232 free-flow selection #5) to save settings permanently to the sensor memory.

For further information regarding free-flow digital, please refer to **section 7.2.1: “Periodic data free-flow”** of this manual.

RS232 polled-mode selection

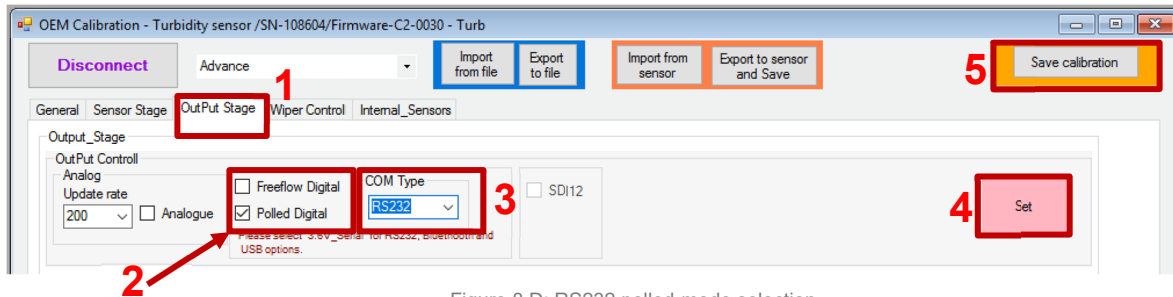


Figure 8.D: RS232 polled-mode selection

When RS232 selection being used with polled-mode, the user must select (Figure 8.D: RS232 polled-mode selection#2) as “Polled Digital”, then select (Figure 8.D: RS232 polled-mode selection#3) COM type as “RS232”. Then press, selection (Figure 8.D: RS232 polled-mode selection#4) and (Figure 8.D: RS232 polled-mode selection#5) to save settings permanently to the sensor memory.

For further information regarding polled-mode digital, please refer to **section 7.2.2: “Data-request mode (polled-mode)”** of this manual.

8.1.2 #WD1-B Analog SubConn

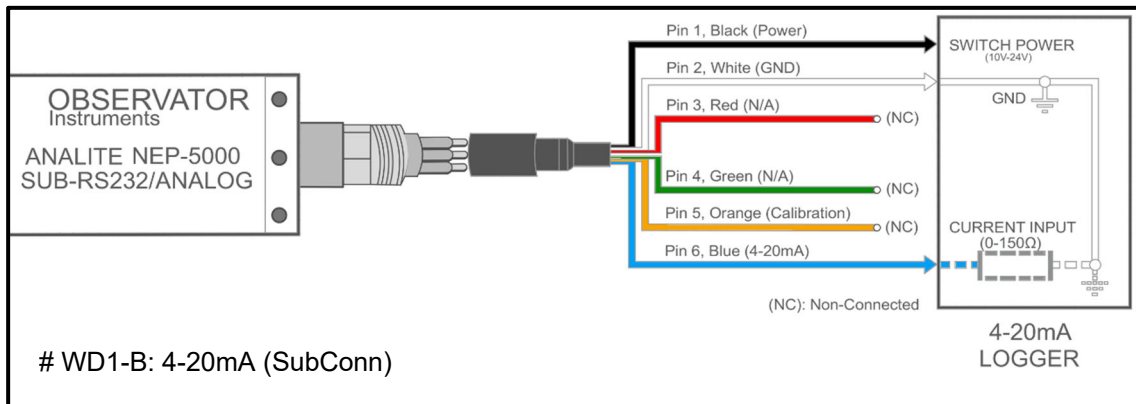


Figure 8.E: Analog SubConn logger configuration

Note: Activate wiper: Short pin 5 to GND. Further information, refer to **section 7.3.2:** “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

Description

The NEP-5000 has current driver option outputs with turbidity is represented as: 4-20mA or 0-20mA. The sensor also allows to control the built-in optical wiper using a control wire or periodic control.

4-20mA selection

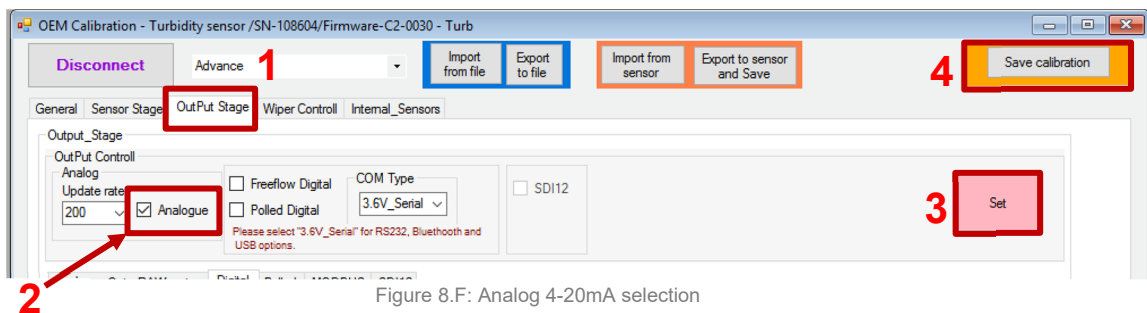


Figure 8.F: Analog 4-20mA selection

To select current option, please follow steps below:

- Select “OutPut Stage” option (Figure 8.F: Analog 4-20mA selection#1).
- Select the “Analog current” option (Figure 8.F: Analog 4-20mA selection#2).
- Then press, selection (Figure 8.F: Analog 4-20mA selection#3) and (Figure 8.F: Analog 4-20mA selection#4) to save settings permanently to the sensor memory.

For further information regarding current output, please refer to **section 7.2.4:** “Measurement via Analog interface” of this manual.

8.1.3 #WD1-C Voltage SubConn

Connect NEP-5000 voltage logger:

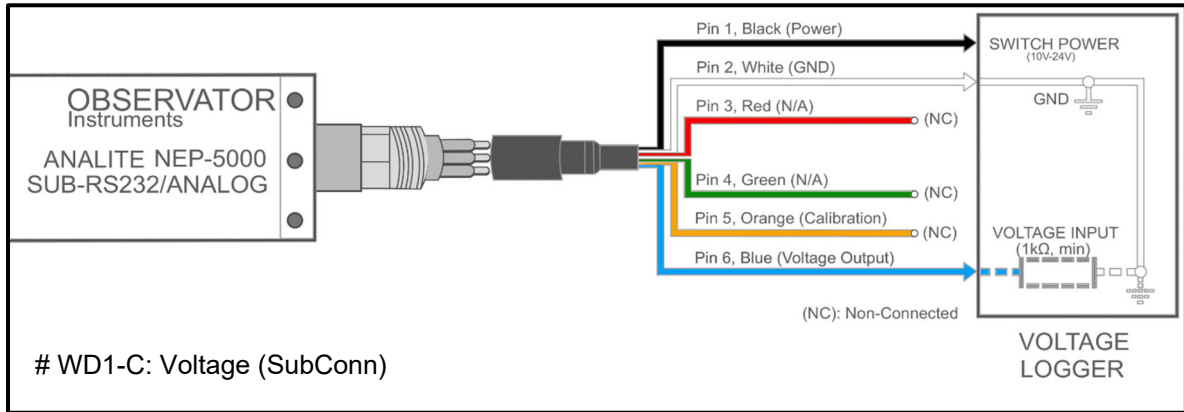


Figure 8.G: Voltage SubConn logger configuration

Note: To activate wiper, short pin 5 to GND (further information, refer to **section 7.3.2:** “Recommended method of triggering the optical wiper using a dedicated wiper wire”).

Description

The NEP-5000 has voltage driver option outputs turbidity is represented as: -2.5V to +2.5V, 0 to 2.5V or 0 to 1V. The sensor also allows to control the built-in optical wiper using a control wire or periodic control.

Voltage selection

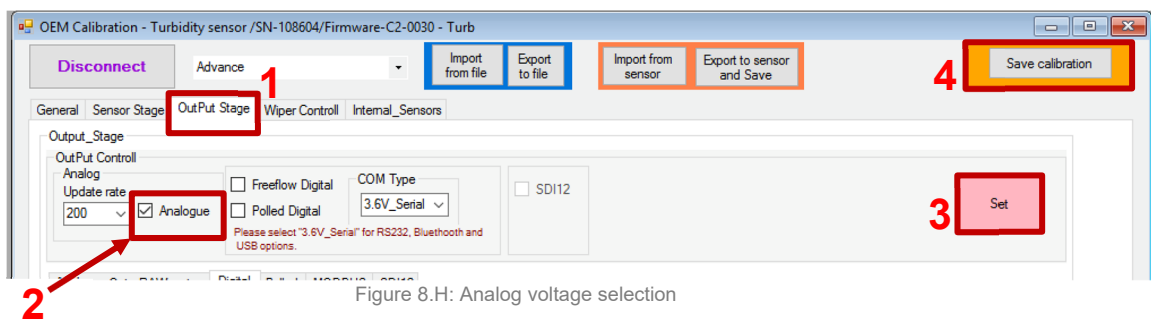


Figure 8.H: Analog voltage selection

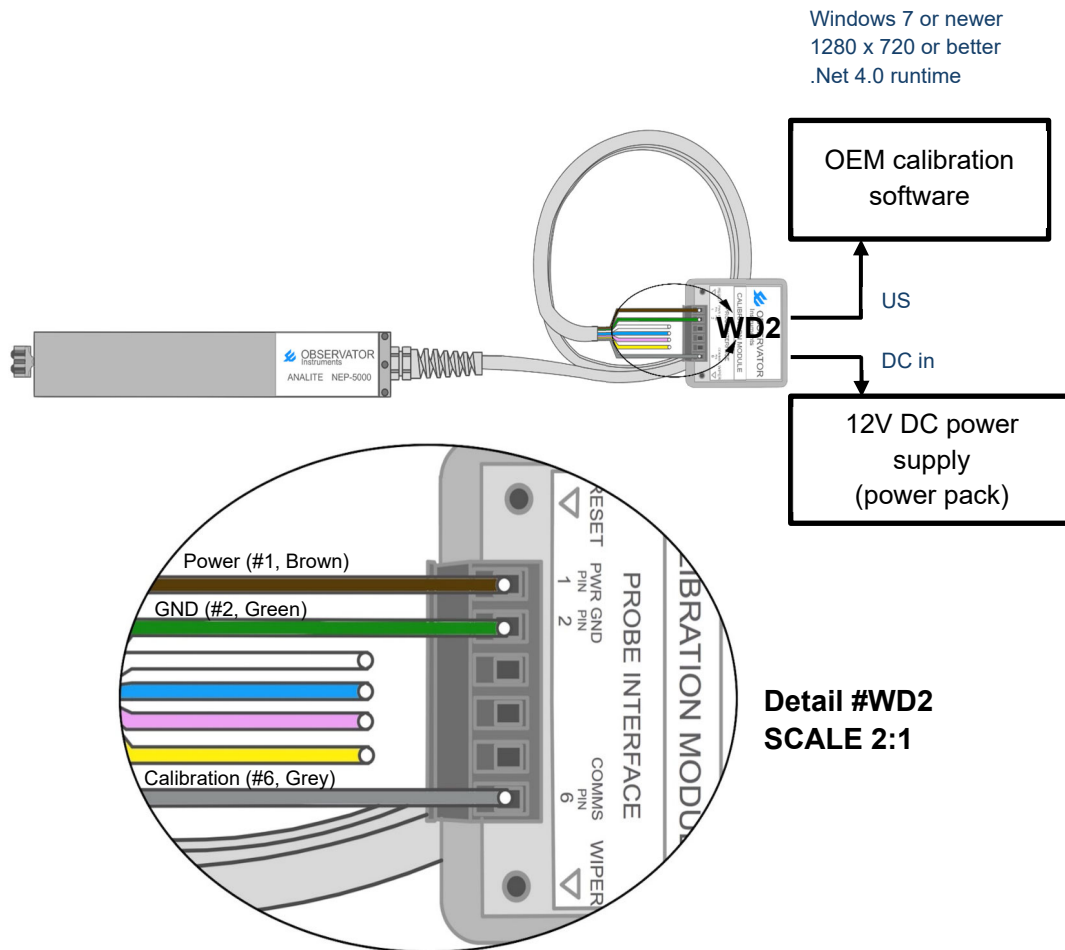
To select voltage option, please follow steps below:

- Select “OutPut Stage” option (Figure 8.H: Analog voltage selection# 1).
- Select the “Analogue” option (Figure 8.H: Analog voltage selection# 2).
- Then press, selection (Figure 8.H: Analog voltage selection# 3) and (Figure 8.H: Analog voltage selection# 4) to save settings permanently to the sensor memory.

For further information regarding voltage output, please refer to **section 7.2.4:** “Measurement via Analog interface” of this manual.

8.2 RS232/Analog glanded-NEP cable option (#WD2)

Calibration wiring setup for RS232 Analog glanded:



NEP-5000 wire colour	Voltage option	Calibration module pin
Brown	Power +10V to +24V DC (+Ve)	#1
Green	GND / RS232 GND	#2
White	Voltage out reference to GND or 4-20mA loop driver out to GND	N/A
Blue	RS232 (Rx)	N/A
Pink	RS232 (Tx)	N/A
Yellow	Analog GND	N/A

Grey	Calibration / wiper	#6
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Figure 8.I: RS232/Analog glanded pinout configuration

8.2.1 #WD2-A RS232 glanded

Connect the NEP-5000 to the RS232 logger:

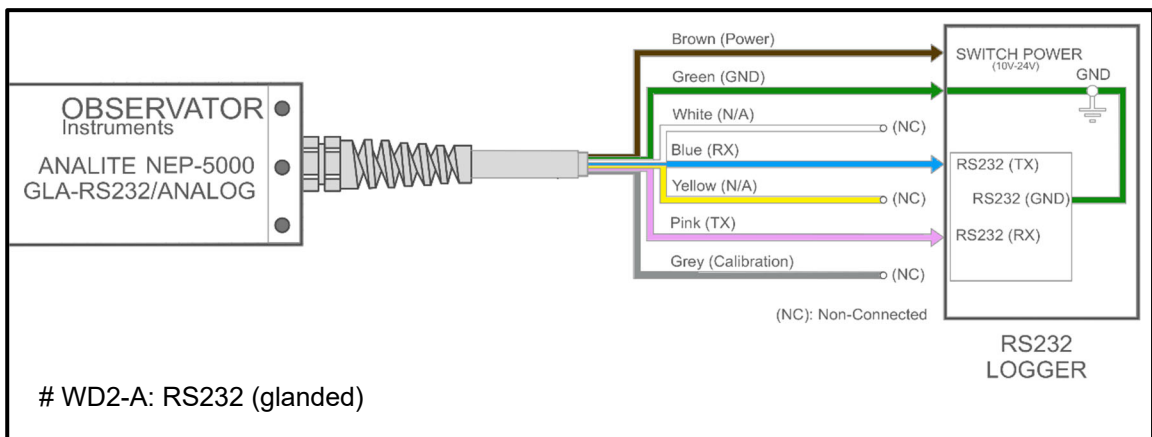


Figure 8.J: RS232 glanded logger configuration

Description

The NEP-5000 sensor with RS232 communication option provides a comprehensive list of functionalities such as:

- Data-streaming (RS232 free-flow) in a variety of desired periods while providing various wiping options.
- Data-request mode (RS232 polled mode) where the control unit sends commands to the NEP-5000 to operate.

In data-streaming (RS232 free-flow) mode the user may select single range free-flow.

RS232 free-flow selection

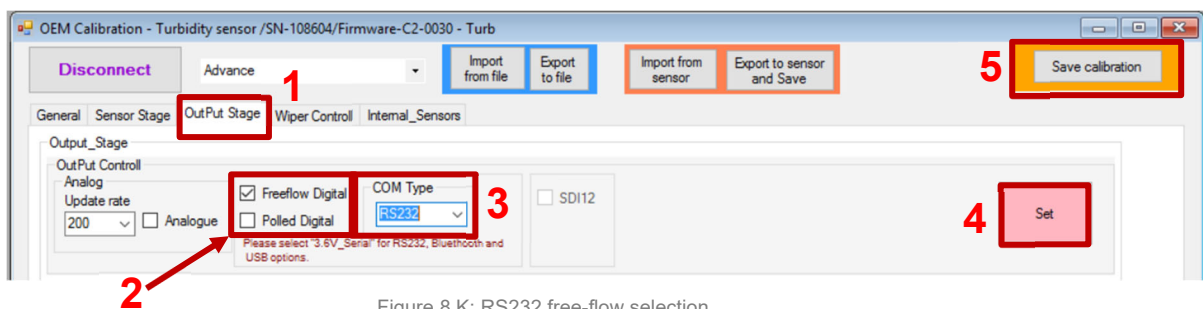


Figure 8.K: RS232 free-flow selection

When the RS232 selection is being used with free-flow, the user must select (Figure 8.K: RS232 free-flow selection#2) as “Freeflow Digital”, then select (Figure 8.K: RS232 free-flow selection #3) COM type as “RS232”. Then press, (Figure 8.K: RS232 free-flow selection #4) and

(Figure 8.K: RS232 free-flow selection#5) to save settings permanently to the sensor memory.

For further information regarding free-flow digital, please refer to **section 7.2.1: “Periodic data free-flow”** of this manual.

RS232 polled-mode selection

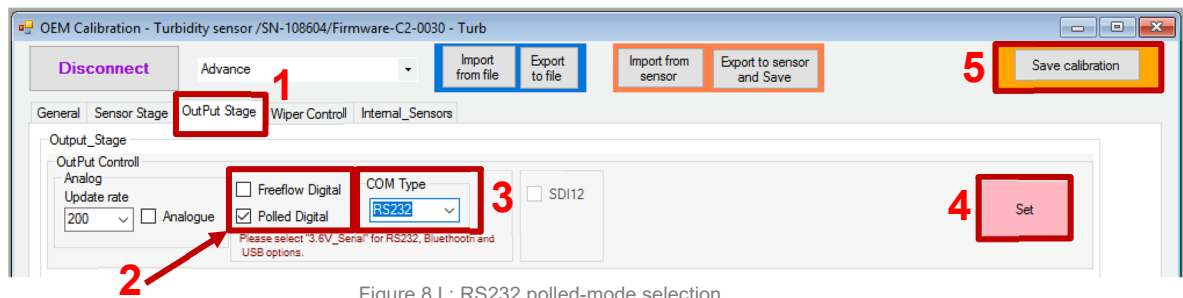


Figure 8.L: RS232 polled-mode selection

When the RS232 selection is being used with polled-mode, the user must select (Figure 8.L: RS232 polled-mode selection#2) as “Polled Digital”, then select (Figure 8.L: RS232 polled-mode selection#3) COM type as “RS232”. Then press, (Figure 8.L: RS232 polled-mode selection #4) and (Figure 8.L: RS232 polled-mode selection#5) to save settings permanently to the sensor memory.

For further information regarding polled-mode digital, please refer to **section 7.2.2: “Data-request mode (polled-mode)”** of this manual.

8.2.2 #WD2-B Analog glanded

Connect the NEP-5000 to the 4-20mA logger:

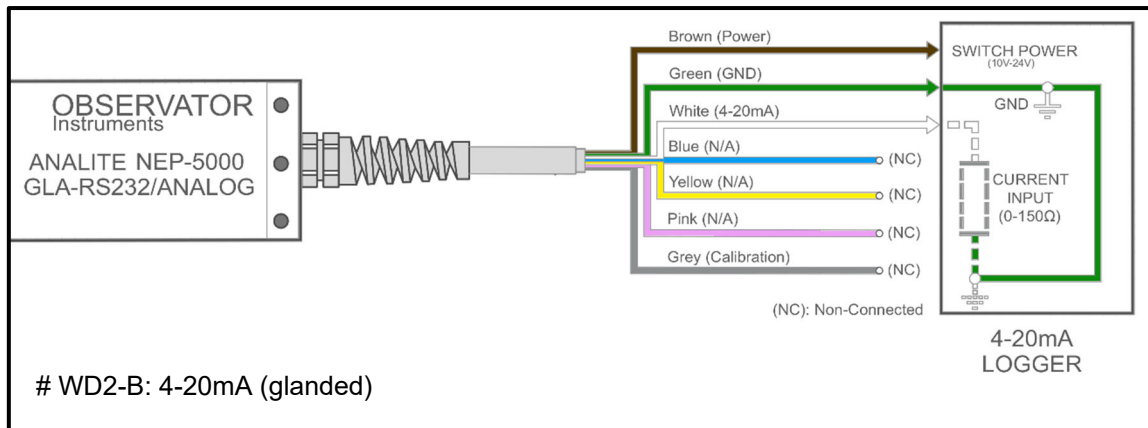


Figure 8.M: Analog glanded logger configuration

Note: Activate wiper: Short grey wire to GND. Further information, refer to **section 7.3.2:** “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

Description

The NEP-5000 with the current driver option outputs turbidity is represented as: 4-20mA or 0-20mA. The sensor also allows to control the built-in optical wiper using a control wire or periodic control.

4-20mA selection

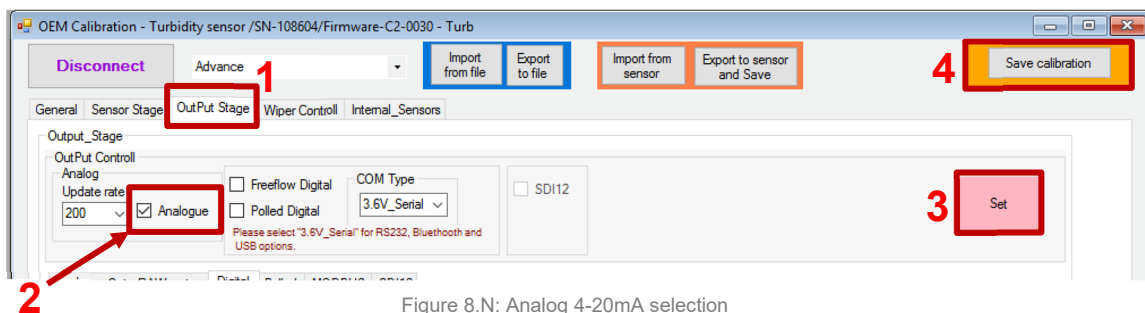


Figure 8.N: Analog 4-20mA selection

To select current option, please follow steps below:

- Select “OutPut Stage” option (Figure 8.N: Analog 4-20mA selection#1).
- Select the “Analog current” option (Figure 8.N: Analog 4-20mA selection#2).

- Then press, (Figure 8.N: Analog 4-20mA selection #3) and (Figure 8.N: Analog 4-20mA selection#4) to save settings permanently to the sensor memory.

For further information regarding current output, please refer to **section 7.2.4: “Measurement via Analog interface”** of this manual.

8.2.3 #WD2-C Voltage glanded

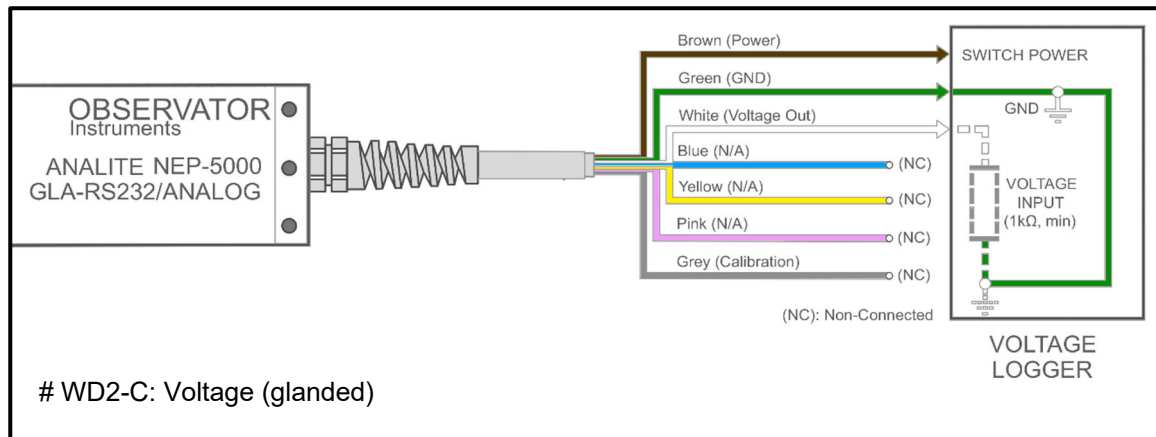


Figure 8.O: Voltage glanded logger configuration

Note: Activate wiper: short grey wire to GND. Further information, refer to **section 7.3.2: “Recommended method of triggering the optical wiper using a dedicated wiper wire”**.

Description

The NEP-5000 with voltage driver option outputs turbidity is represented as: -2.5V to +2.5V, 0 to 2.5V or 0 to 1V. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

Voltage selection

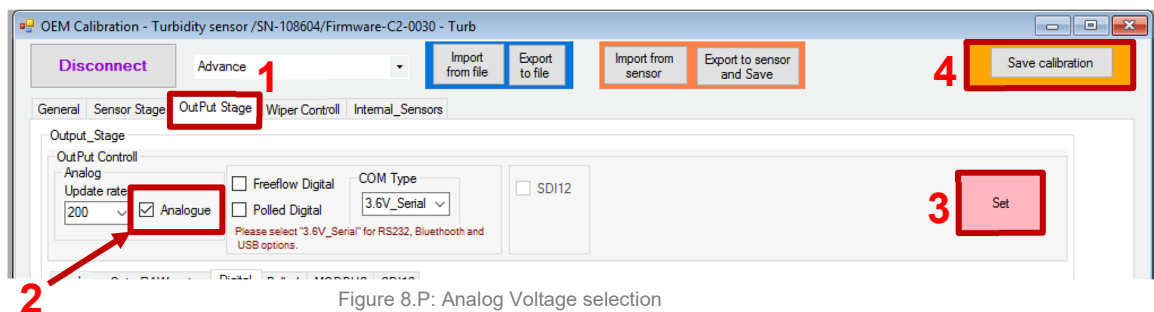


Figure 8.P: Analog Voltage selection

To select voltage option, please follow the steps below:

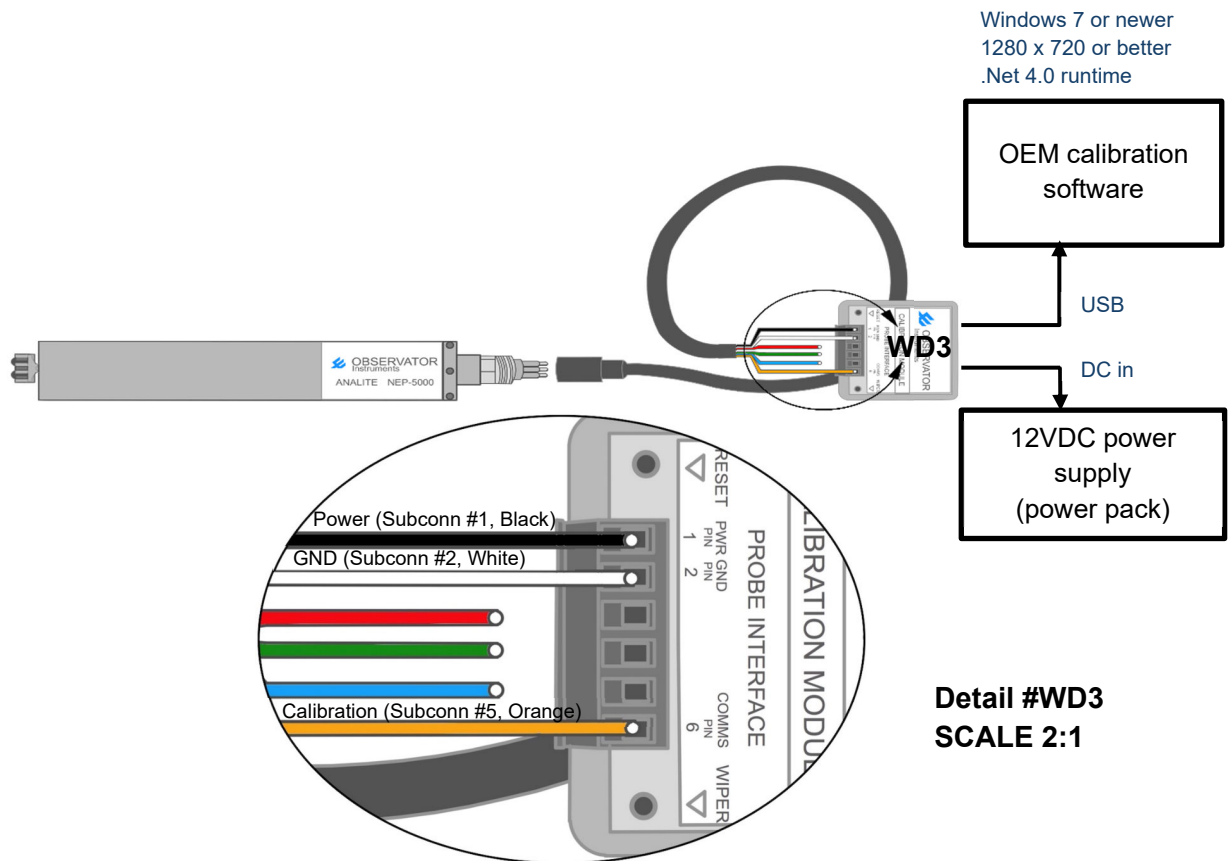
- Select “OutPut Stage” option (Figure 8.P: Analog Voltage selection#1).
- Select the “Analogue voltage” option (Figure 8.P: Analog Voltage selection#2).

- Then press, (Figure 8.P: Analog Voltage selection#3) and (Figure 8.P: Analog Voltage selection #4) to save settings permanently to the sensor memory.

For further information regarding voltage output, please refer to **section 7.2.4**: “Measurement via Analog interface” of this manual.

8.3 RS485/RS422/Analog SubConn connector option (#WD3)

Calibration wiring setup for RS485/RS422 Analog SubConn:



SubConn pin number	Voltage option	SubConn colour	Calibration module pin
#1	Power +12V to +24V (+Ve)	Black	#1
#2	GND	White	#2
#3	RS485 (+)	Red	N/A
#4	RS485 (-)	Green	N/A
#5	Calibration / wiper	Orange	#6
#6	Voltage out reference to GND or 4-20mA loop driver out to GND	Blue	N/A

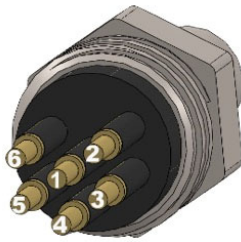
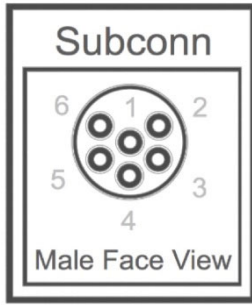


Figure 8.Q: RS485/RS422/Analog SubConn pin configuration

8.3.1 #WD3-A RS485 SubConn

Connect the NEP-5000 to the RS485 logger:

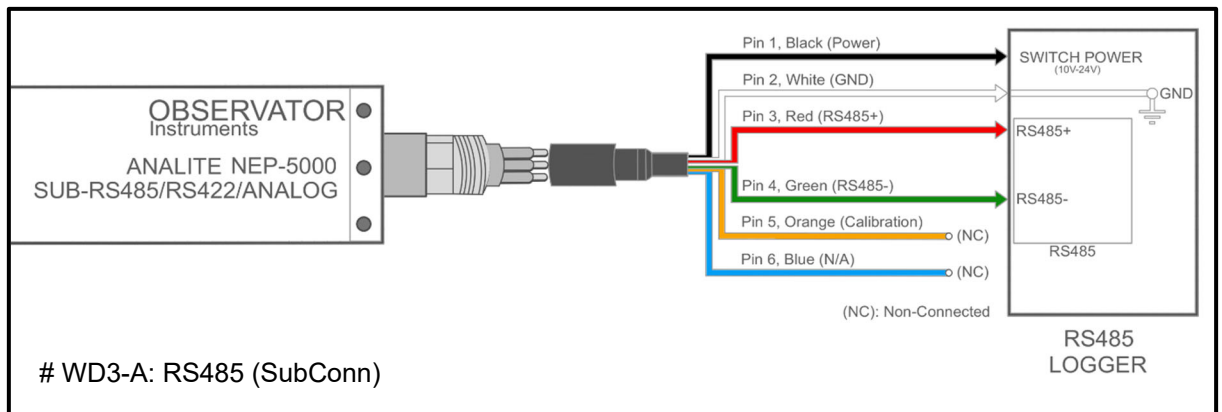


Figure 8.R: RS485 SubConn logger configuration

Description

The NEP-5000 sensor with RS485 communication option provides on-request measurement and control over the sensor. This option also allows to control multiple sensors using the same RS485 bus (e.g. extra turbidity sensors in various heights).

RS485 polled-mode selection

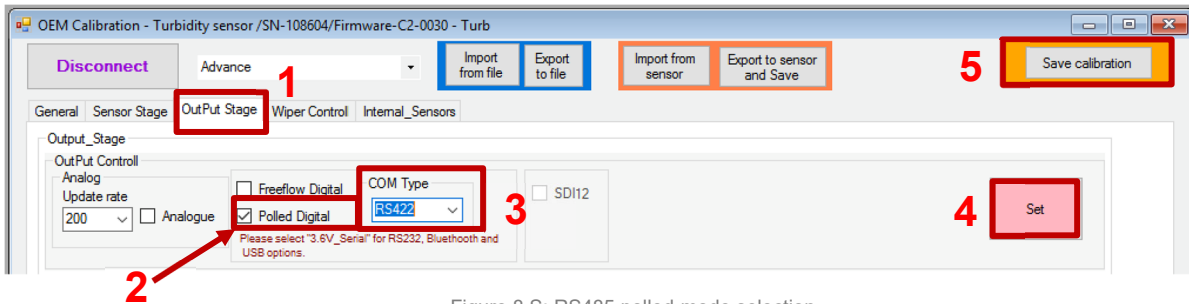


Figure 8.S: RS485 polled-mode selection

When the RS485 has been selected to be used with Polled-mode, user must select (Figure 8.S: RS485 polled-mode selection#2) as “Polled Digital”, then select (Figure 8.S: RS485 polled-mode selection#3) COM type as “RS422”. Then press, selection (Figure 8.S: RS485 polled-mode selection#4) and (Figure 8.S: RS485 polled-mode selection#5) to save settings permanently to the sensor memory.

For further information regarding polled-mode digital, please refer to **section 7.2.2: “Data-request mode (polled-mode)”** of this manual.

8.3.2 #WD3-B Analog SubConn

Connect NEP-5000 to the 4-20mA logger:

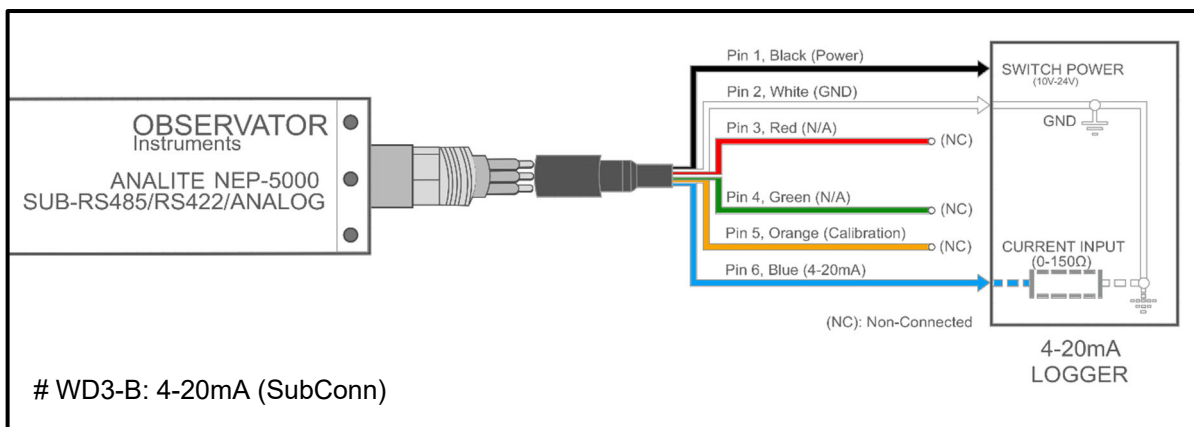


Figure 8.T: Analog SubConn logger configuration

Note: Activate wiper: Short pin 5 to GND. Further information, refer to **section 7.3.2: “Recommended method of triggering the optical wiper using a dedicated wiper wire”**.

Description

The NEP-5000 with current driver option outputs turbidity is represented as: 4-20mA or 0-20mA. The sensor also allows to control the built-in optical wiper using a control wire or periodic control.

4-20mA selection

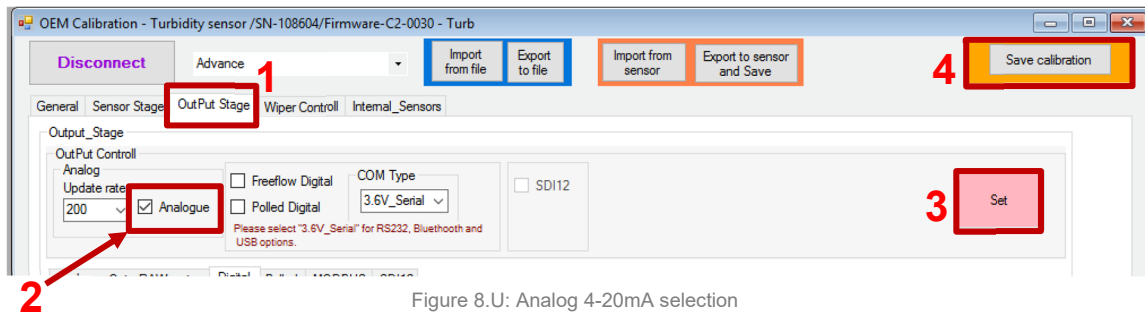


Figure 8.U: Analog 4-20mA selection

To select current option, please follow steps below:

- Select “OutPut Stage” option (Figure 8.U: Analog 4-20mA selection#1).
- Select the “Analogue current” option (Figure 8.U: Analog 4-20mA selection#2).
- Then press, (Figure 8.U: Analog 4-20mA selection#3) and (Figure 8.U: Analog 4-20mA selection#4) to save settings permanently to the sensor memory.

For further information regarding current output, please refer to **section 7.2.4**: “Measurement via Analog interface” of this manual.

8.3.3 #WD3-C Voltage SubConn

Connect NEP-5000 voltage logger:

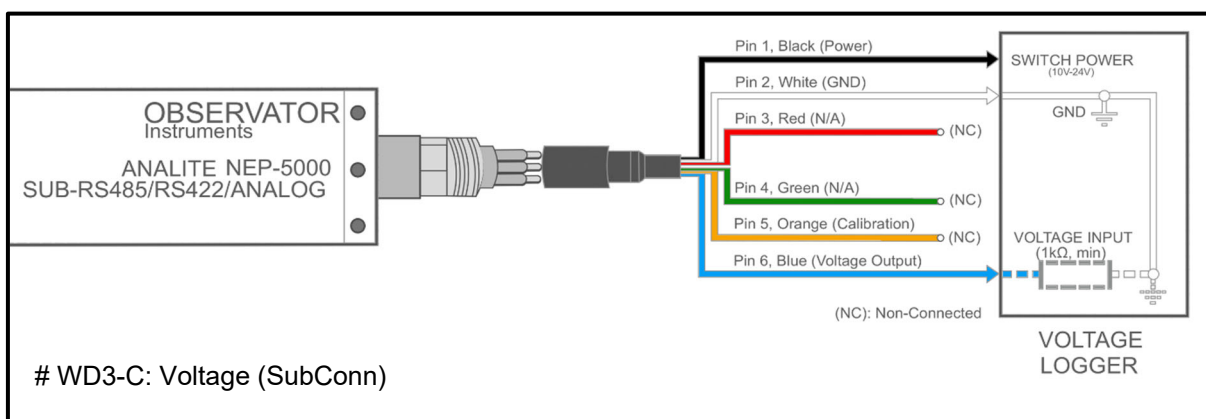


Figure 8.V: Voltage SubConn logger configuration

Note: Activate wiper: Short pin 5 to GND. Further information, refer to **section 7.3.2**: “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

Description

The NEP-5000 with voltage driver option outputs turbidity is represented as: -2.5V to +2.5V, 0 to 2.5V or 0 to 1V. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

Voltage selection

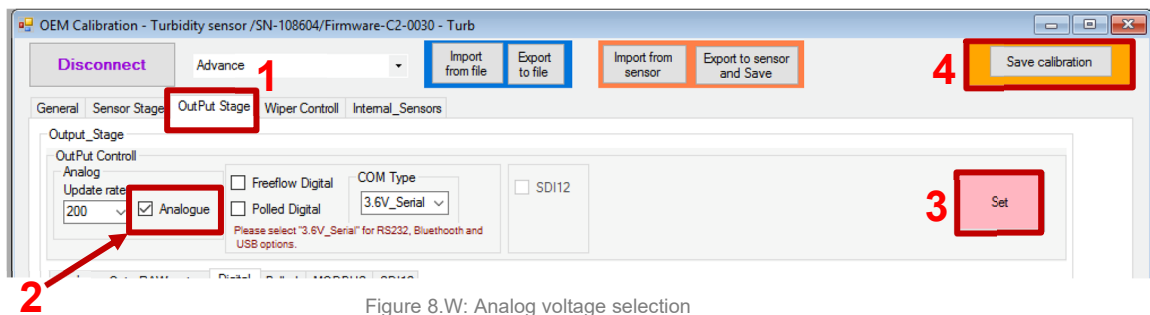


Figure 8.W: Analog voltage selection

To select voltage option, please follow steps below:

- Select “OutPut Stage” option (Figure 8.W: Analog voltage selection#1).
- Select the “Analog voltage” option (Figure 8.W: Analog voltage selection#2).
- Then press, selection (Figure 8.W: Analog voltage selection#3) and (Figure 8.W: Analog voltage selection#4) to save settings permanently to the sensor memory.

For further information regarding voltage output, please refer to **section 7.2.4**: “Measurement via Analog interface” of this manual.

8.3.4 #WD3-D RS422 SubConn

Connect NEP-5000 to RS422 logger:

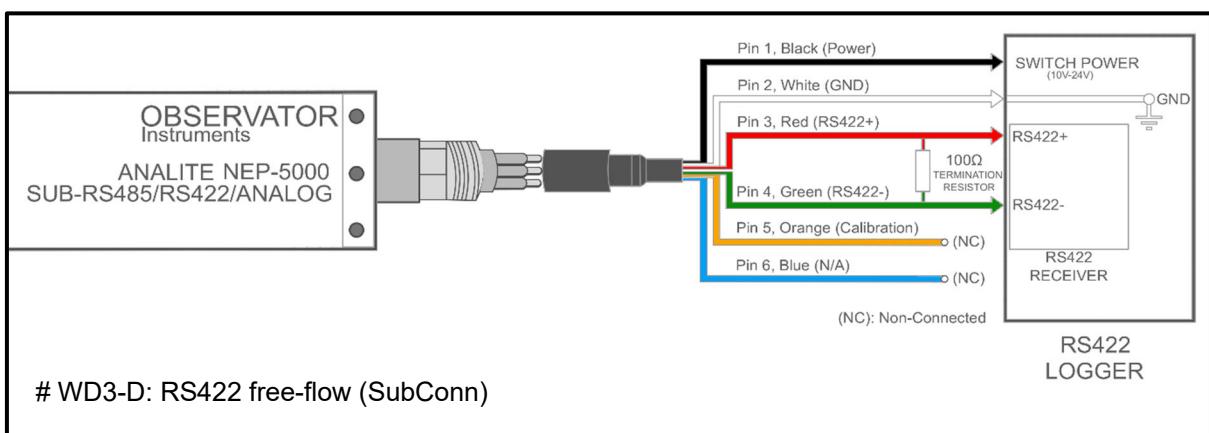


Figure 8.X: RS422 SubConn logger configuration

Description

The NEP-5000 sensor with RS422 communication option provides streaming data over RS422 communication bus. This option allows a variety of desired data output periods while providing various wiping options. The main advantage of this communication type is that it offers up to 1km cable length.

In data-streaming in (RS422 free-flow) mode, the user may select a single range measurement or an auto-range measurement.

RS422 free-flow selection

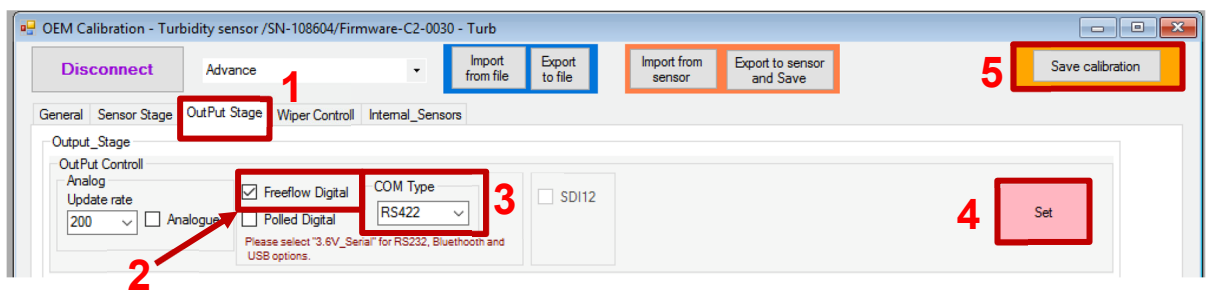


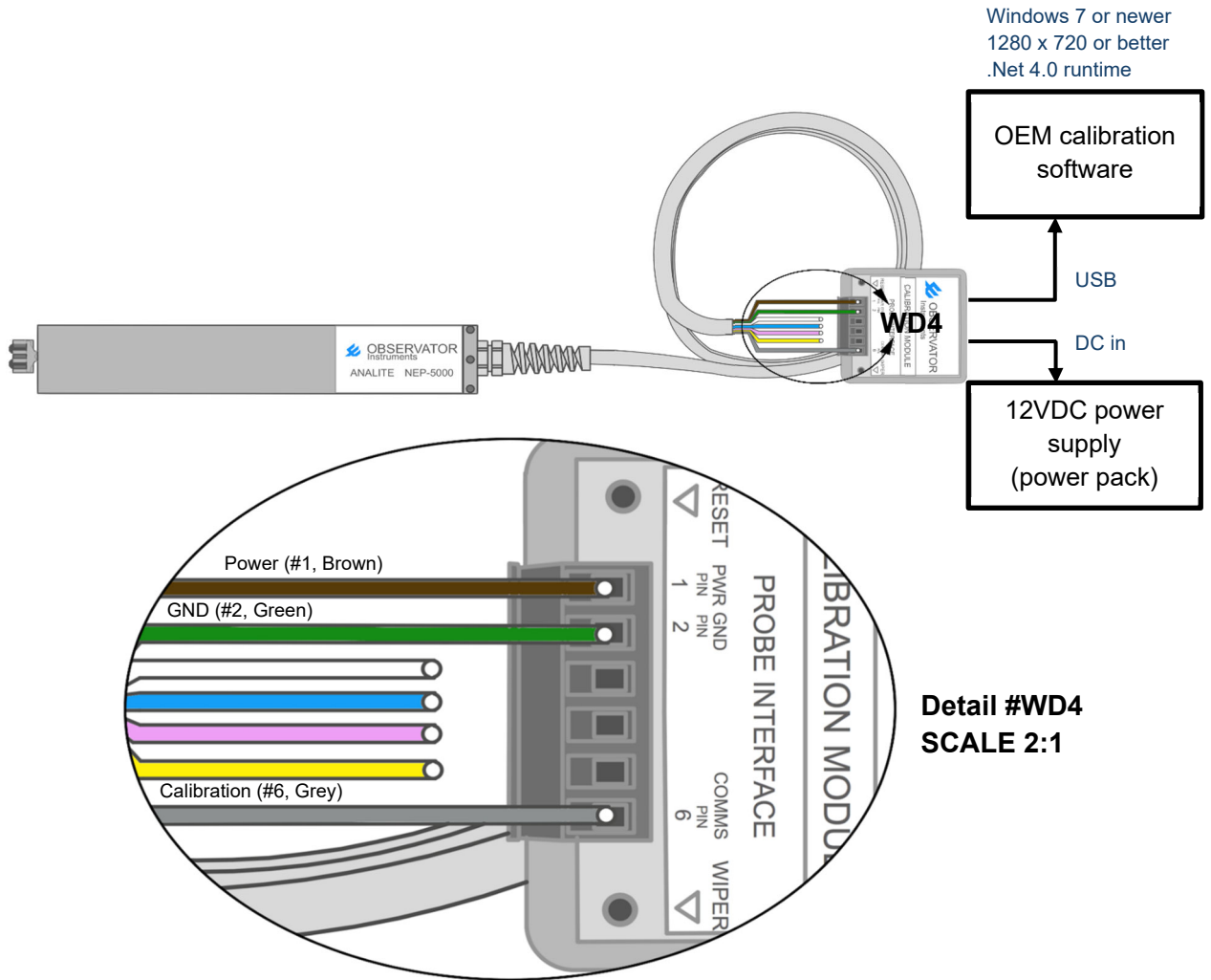
Figure 8.Y: RS422 free-flow selection

When RS422 selection is being used with free-flow, the user must select (Figure 8.W: Analog voltage selection #2) as “Freeflow Digital”, then select (Figure 8.Y: RS422 free-flow selection #3) COM type as “RS422”. Then press (Figure 8.Y: RS422 free-flow selection#4) and (Figure 8.Y: RS422 free-flow selection#5) to save settings permanently to the sensor memory.

For further information regarding free-flow digital, please refer to **section 7.2.1: “Periodic data free-flow”** of this manual.

8.4 RS485/RS422/Analog glanded-NEP cable option (#WD4)

Calibration wiring setup for RS485/RS422 Analog glanded:



NEP-5000 wire colour	Voltage option	Calibration module pin
Brown	Power +10V to +24V DC (+Ve)	#1
Green	GND	#2
White	Voltage out reference to GND or 4-20mA loop driver out to GND	N/A
Blue	RS485 (-)	N/A
Pink	RS485 (+)	N/A
Yellow	N/A	N/A
Grey	Calibration / wiper	#6

Figure 8.Z: RS485/RS422/Analog glanded pinout configuration

8.4.1 #WD4-A RS485 glanded

Connect NEP-5000 to the RS485 logger:

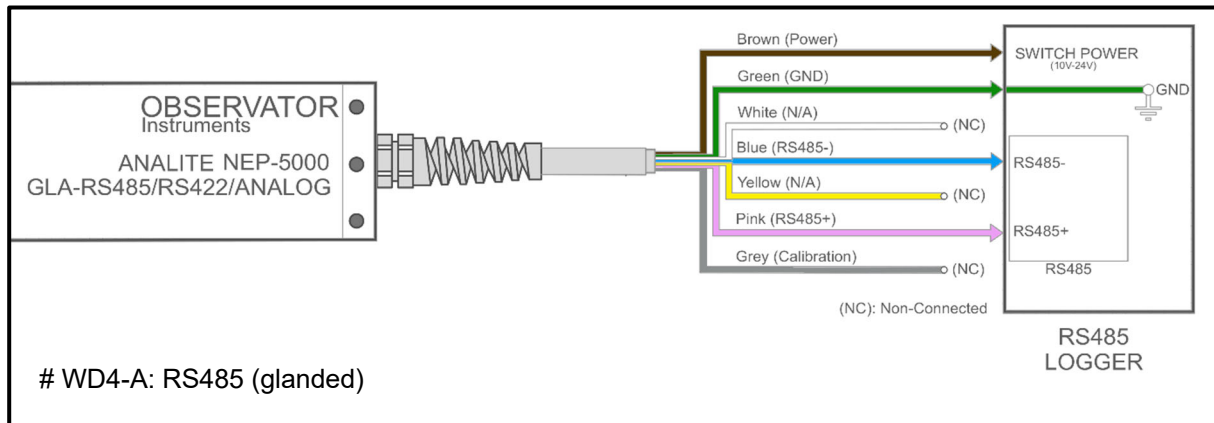


Figure 8.AA: RS485 glanded logger configuration

Description

The NEP-5000 sensor with RS485 communication option provides on-request measurement and control over the sensor. This option also allows to control multiple sensors using the same RS485 bus (e.g. extra turbidity sensors in various heights).

RS485 polled-mode selection

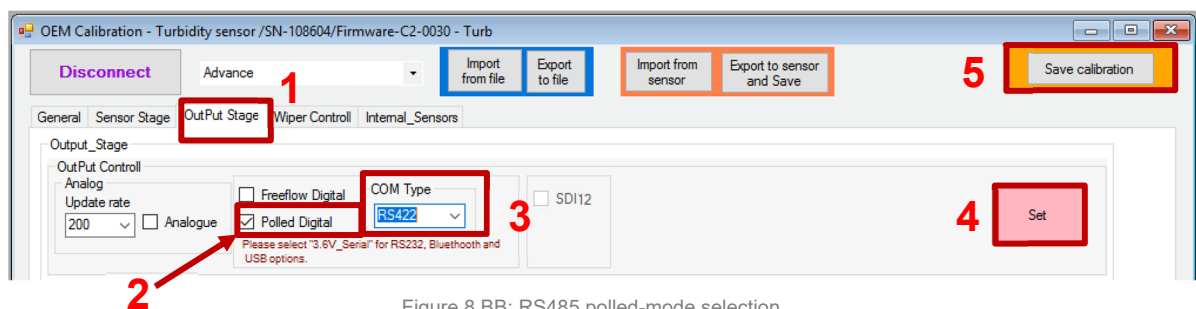


Figure 8.BB: RS485 polled-mode selection

When RS485 selection is being used with polled-mode, the user must select (Figure 8.BB: RS485 polled-mode selection#2) as “Polled Digital”, then select (Figure 8.BB: RS485 polled-mode selection#3) COM type as “RS422”. Then press, (Figure 8.BB: RS485 polled-mode selection#4) and (Figure 8.BB: RS485 polled-mode selection#5) to save settings permanently to the sensor memory.

For further information regarding polled-mode digital, please refer to **section 7.2.2: “Data-request mode (polled-mode)”** of this manual.

8.4.2 #WD4-B Analog glanded

Connect NEP-5000 to the 4-20mA logger:

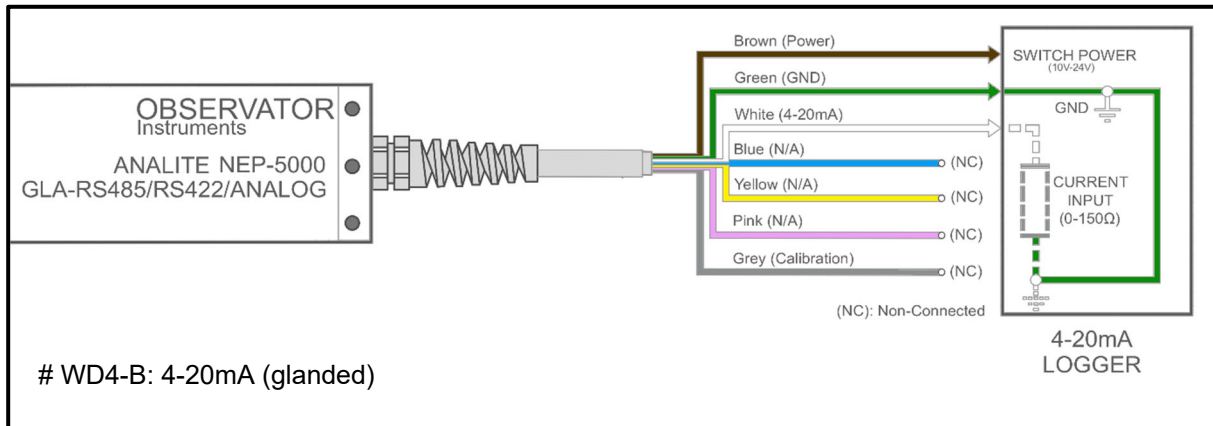


Figure 8.CC: Analog glanded logger configuration

Note: Activate wiper: Short grey wire to GND. Further information, refer to **section 7.3.2:** “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

Description

The NEP-5000 with current driver option outputs turbidity is represented as: 4-20mA or 0-20mA. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

4-20mA selection

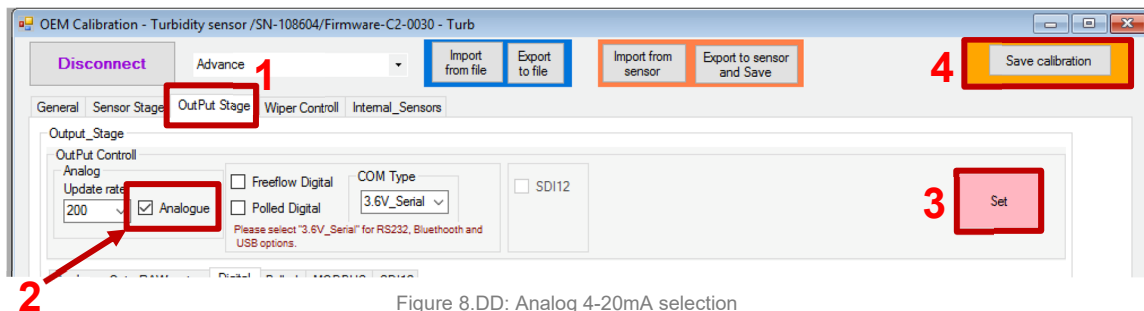


Figure 8.DD: Analog 4-20mA selection

To select current option, please follow steps below:

- Select “OutPut Stage” option (Figure 8.DD: Analog 4-20mA selection#1).
- Select the “Analog current” option (Figure 8.DD: Analog 4-20mA selection#2).

- Then press, (Figure 8.DD: Analog 4-20mA selection#3) and (Figure 8.DD: Analog 4-20mA selection#4) to save settings permanently to the sensor memory.

For further information regarding current output, please refer to **section 7.2.4: “Measurement via Analog interface”** of this manual.

8.4.3 #WD4-C voltage glanded

Connect NEP-5000 voltage logger:

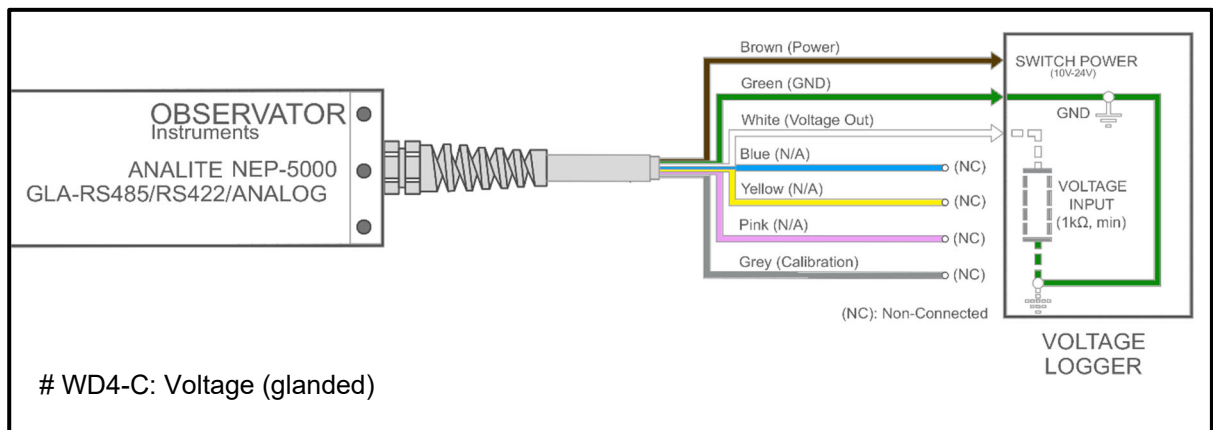


Figure 8.EE: Voltage glanded logger configuration

Note: Activate wiper: Short grey wire to GND. Further information, refer to **section 7.3.2: “Recommended method of triggering the optical wiper using a dedicated wiper wire”**.

Description

The NEP-5000 with voltage driver option outputs turbidity is represented as: -2.5V to +2.5V, 0 to 2.5V or 0 to 1V. The sensor also allows you to control the built-in optical wiper using a control wire or periodic control.

Voltage selection

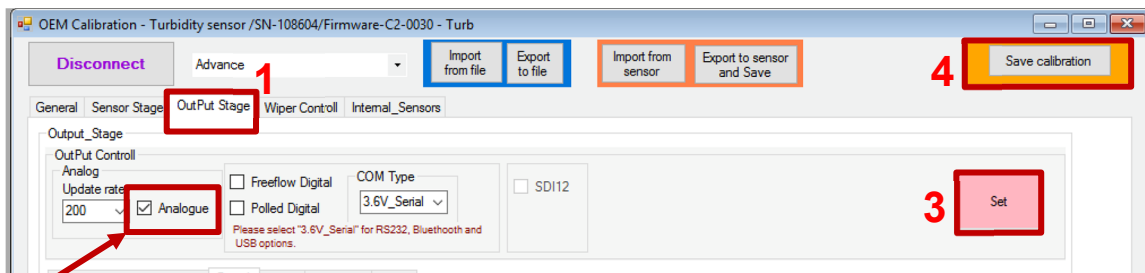


Figure 8.FF: Analog voltage selection

To select voltage option, please follow the steps below:

- Select “OutPut Stage” option (Figure 8.FF: Analog voltage selection#1).

- Select the “Analog voltage” option (Figure 8.FF: Analog voltage selection#2).
- Then press, (Figure 8.FF: Analog voltage selection#3) and (Figure 8.FF: Analog voltage selection#4) to save settings permanently to the sensor memory.

For further information regarding voltage output, please refer to **section 7.2.4**: “Measurement via Analog interface” of this manual.

8.4.4 #WD4-D RS422 glanded

Connect the NEP-5000 to the RS422 logger:

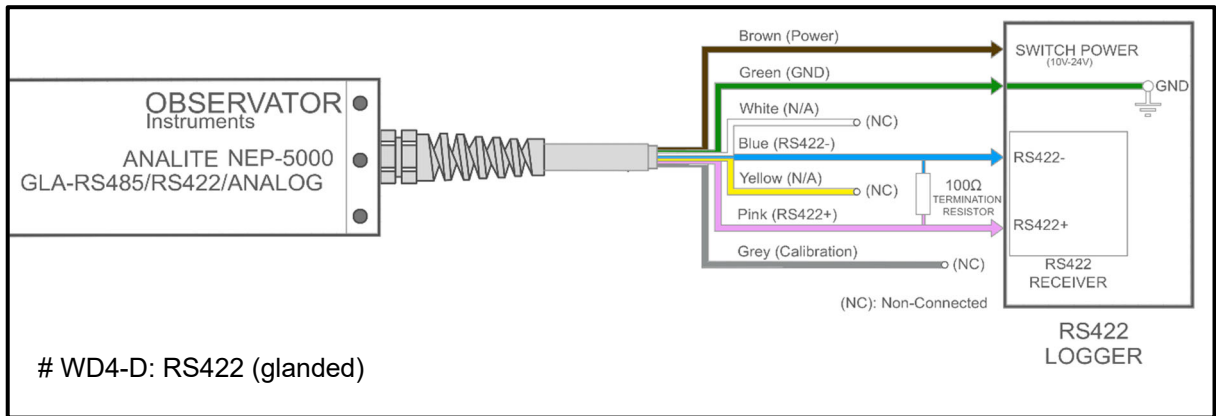


Figure 8.GG: RS422 glanded logger configuration

Description

The NEP-5000 sensor with the RS422 communication option provides streaming data over the RS422 communication bus. This option allows a variety of desired data output periods while providing various wiping options. The main advantage of this communication type is that it offers up to 1km of cable length.

In data-streaming in (RS422 free-flow) mode, the user may select single range measurement or auto-range measurement.

RS422 free-flow selection

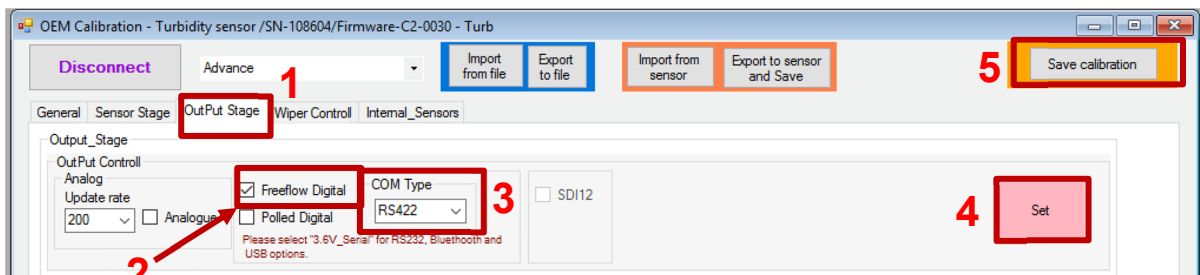


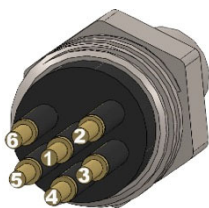
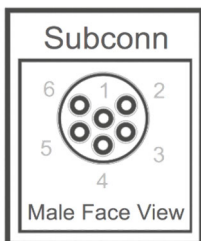
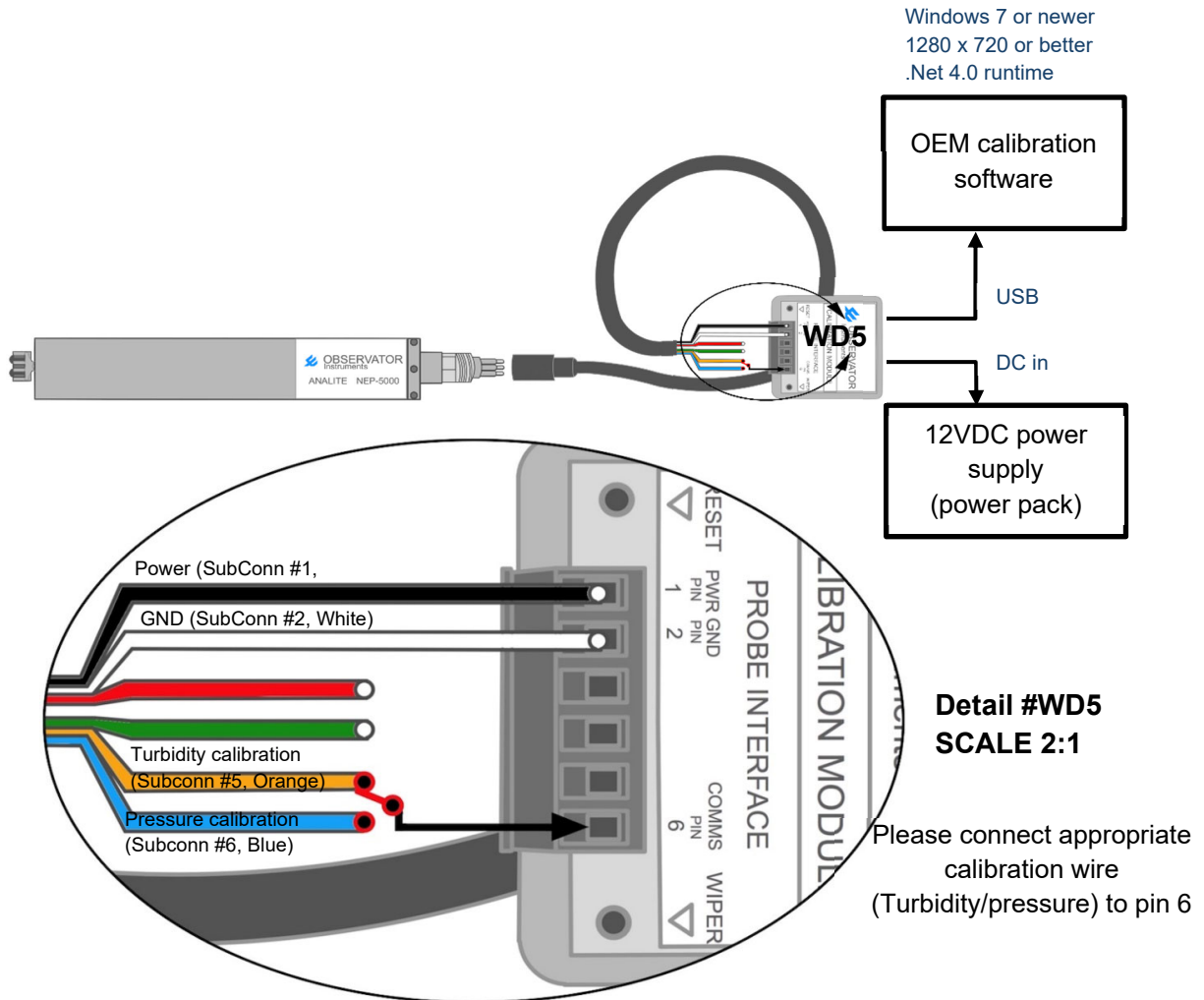
Figure 8.HH: RS422 free-flow selection

When RS422 selection is being used with Free-flow, the user must select ([Figure 8.HH: RS422 free-flow selection#2](#)) as “Freeflow Digital”, then select ([Figure 8.HH: RS422 free-flow selection #3](#)) COM type as “RS422”. Then press, ([Figure 8.HH: RS422 free-flow selection #4](#)) and ([Figure 8.HH: RS422 free-flow selection#5](#)) to save settings permanently to the sensor memory.

For further information regarding free-flow digital, please refer to **section 7.2.1: “Periodic data free-flow”** of this manual.

8.5 RS485/Pressure SubConn connector option (#WD5)

Calibration wiring setup for the RS485 Pressure SubConn:



SubConn pin number	Voltage option	SubConn colour	Calibration module pin
#1	Power +12V to +24V (+Ve)	Black	#1
#2	GND	White	#2
#3	RS485 (+)	Red	N/A
#4	RS485 (-)	Green	N/A
#5	Turbidity calibration	Orange	#6
#6	Pressure calibration	Blue	#6

Figure 8.II: RS485-Pressure SubConn pinout configuration

8.5.1 #WD5-A RS485 SubConn

Connect the NEP-5000 to the RS485 logger:

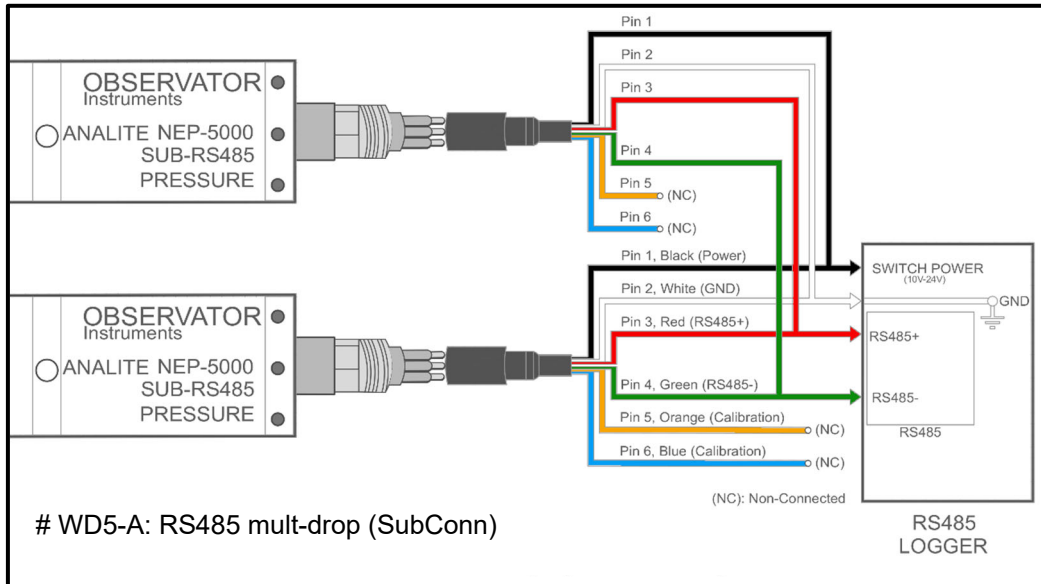


Figure 8.JJ: RS485 SubConn logger configuration

Description

The NEP-5000 sensor with the RS485 communication option provides on-request measurement and control over the built-in multiple sensors. This option also allows to control multiple sensors using the same RS485 bus (e.g. a pressure sensor or extra turbidity sensors in various heights).

The logger or controller that manages the RS485 bus must be aware of each sensor address in order to retrieve data from appropriate sensors (e.g. the built-in pressure sensor in the same body probe must have a different address to the turbidity sensor address).

RS485 polled-mode selection

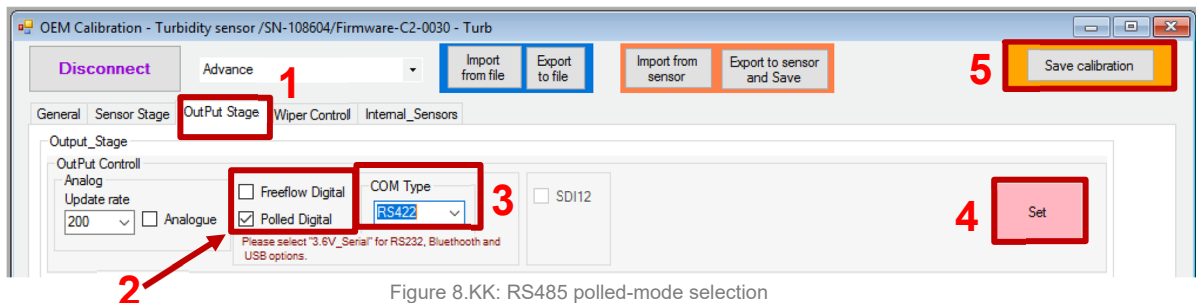


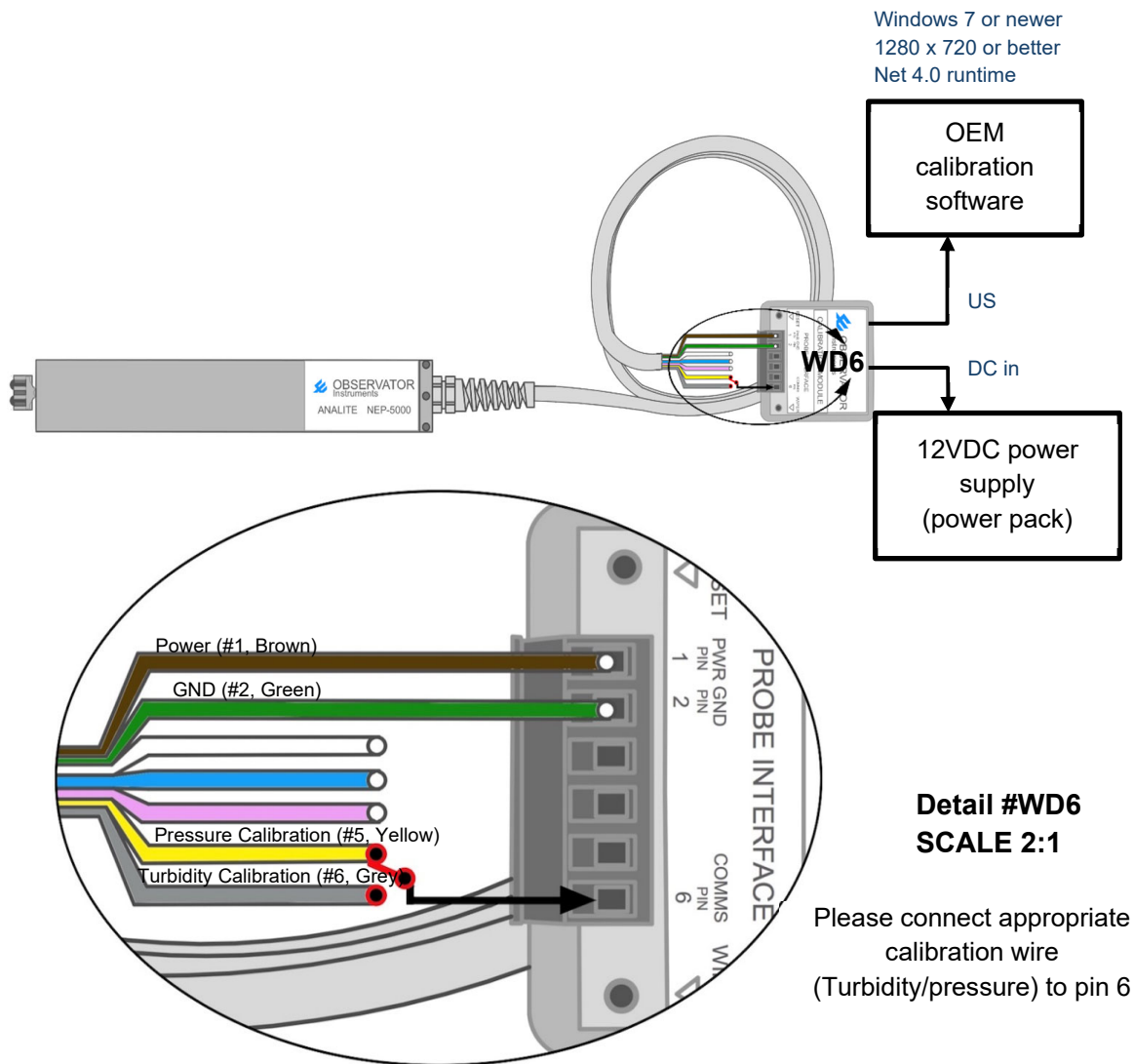
Figure 8.KK: RS485 polled-mode selection

When RS485 selection is being used with polled-mode, the user must select (Figure 8.KK: RS485 polled-mode selection#2) as “Polled Digital”, then select (Figure 8.KK: RS485 polled-mode selection#3) COM type as “RS422”. Then press, selection (Figure 8.KK: RS485 polled-mode selection#4) and (Figure 8.KK: RS485 polled-mode selection#5) to save settings permanently to the sensor memory.

For further information regarding polled-mode digital, please refer to **section 7.2.2: “Data-request mode (polled-mode)”** of this manual.

8.6 RS485/Pressure glanded-NEP cable option (#WD6)

Calibration wiring setup for RS485 pressure glanded:



NEP-5000 wire colour	Voltage option	Calibration module pin
Brown	Power +10V to +24V DC (+Ve)	#1
Green	GND	#2
White	Not used (1K to GND)	N/A
Blue	RS485 (-)	N/A
Pink	RS485 (+)	N/A
Yellow	Pressure calibration	N/A
Grey	Turbidity calibration / wiper	#6

Figure 8.LL: RS485-Pressure glanded pinout configuration

8.6.1 #WD6-A RS485 glanded

Connect the NEP-5000 to the RS485 logger:

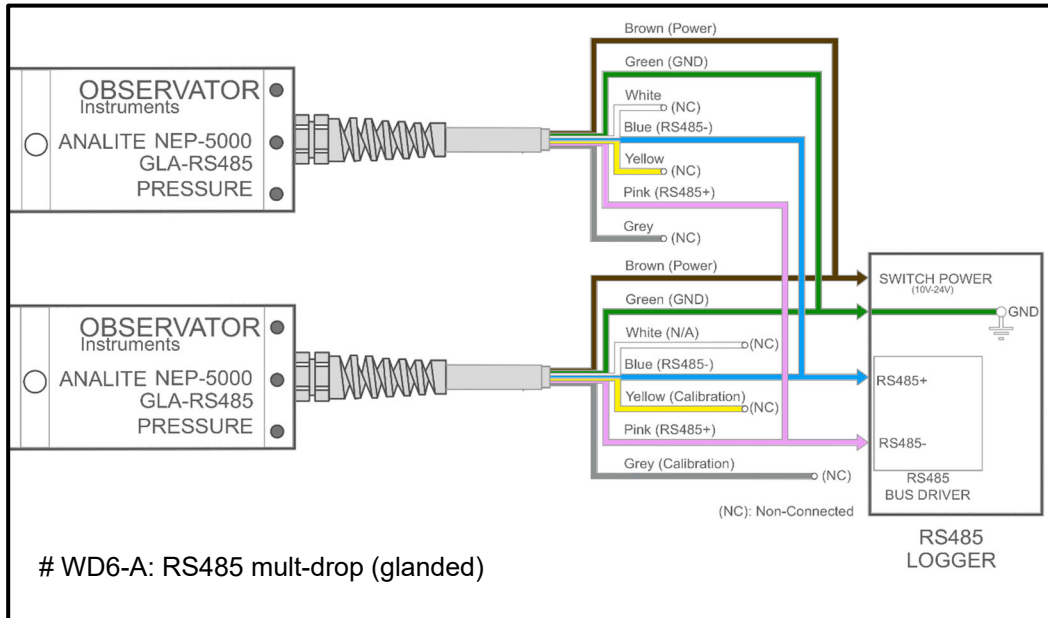


Figure 8.MM: RS485 glanded logger configuration

Description

The NEP-5000 sensor with RS485 communication option provides on-request measurement and control over the built-in multiple sensors. This option also allows to control multiple sensors using the same RS485 bus (e.g. a pressure sensor or extra turbidity sensors in various heights).

The logger or controller that manages the RS485 bus must be aware of each sensor address in order to retrieve data from the appropriate sensor (e.g. the built-in pressure sensor in the same body probe must have different addresses to the turbidity sensor address).

RS485 polled-mode selection



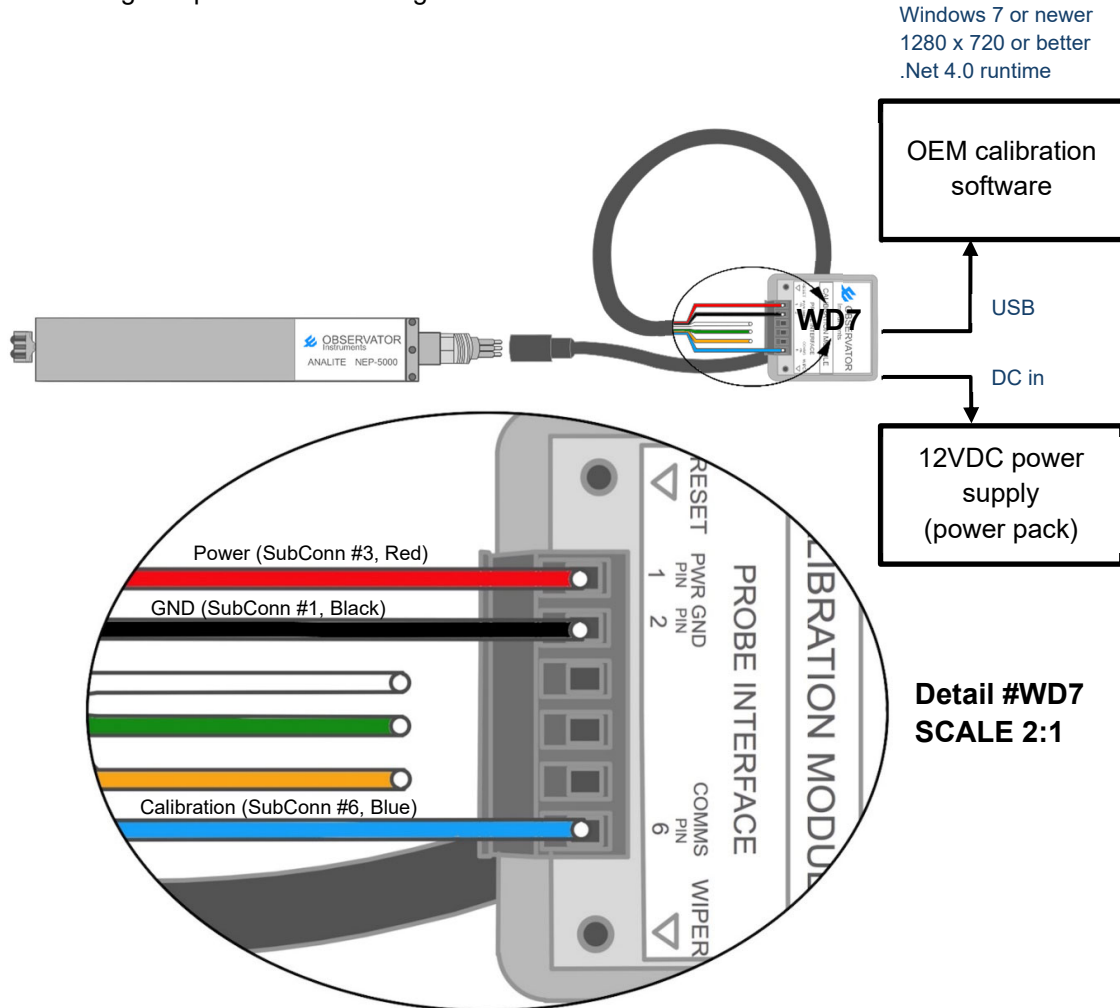
Figure 8.NN: RS485 polled-mode selection

When RS485 selection is being used with Polled-mode, the user must select (Figure 8.NN: RS485 polled-mode selection #2) as “Polled Digital”, then select (Figure 8.NN: RS485 polled-mode selection#3) COM type as “RS422”. Then press, (Figure 8.NN: RS485 polled-mode selection#4) and (Figure 8.NN: RS485 polled-mode selection#5) to save settings permanently to the sensor memory.

For further information regarding polled-mode digital, please refer to **section 7.2.2: “Data-request mode (polled-mode)”** of this manual.

8.7 SDI-12/Analog SubConn connector option (#WD7)

Calibration wiring setup for SDI-12 Analog SubConn:



SubConn pin number	Voltage option	SubConn colour	Calibration module pin
#1	Power GND, SDI-12 GND, and voltage output GND (+Ve)	Black	#2
#2	SDI-12 Data	White	N/A
#3	Power +10V to +24V DC (+Ve)	Red	#1
#4	4-20mA loop to power GND via 100 ohms	Green	N/A
#5	Voltage out (pin 1 as GND ref)	Orange	N/A
#6	Calibration / wiper	Blue	#6

Figure 8.OO: SDI-12/Analog SubConn pinout configuration

8.7.1 #WD7-A SDI-12 SubConn

Connect the NEP-5000 to the SDI-12 logger:

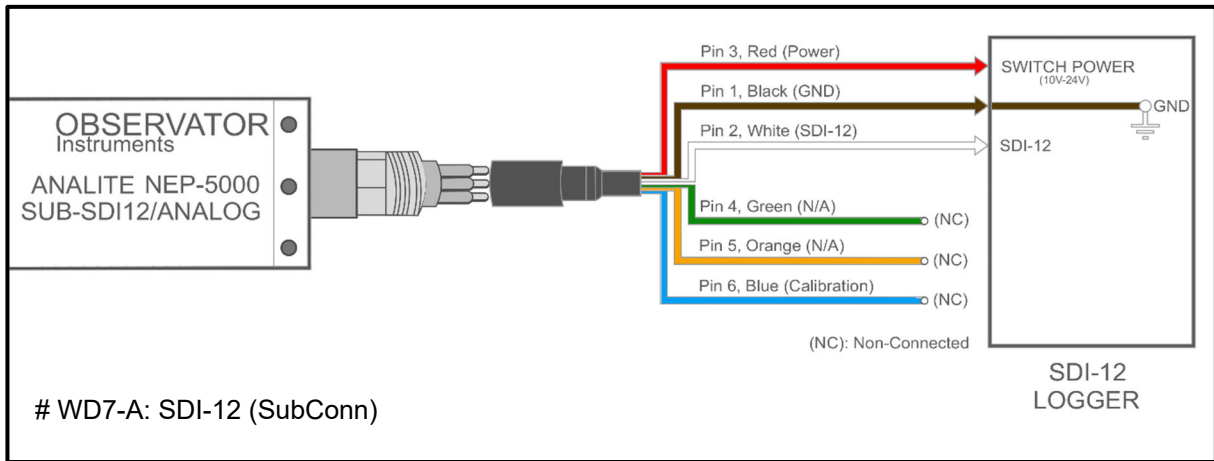


Figure 8.PP: SDI-12 SubConn logger configuration

Description

When the NEP-5000 sensor is configured as SDI-12 communication, it can offer a full range of sensor operations via the SDI-12 bus. Some of these options are initiating and reading turbidity measurements, statistical measurements, changing measurement ranges and operating the optical wiper. The user must select appropriate SDI-12 addresses from the PC-configuration software.

SDI-12 selection

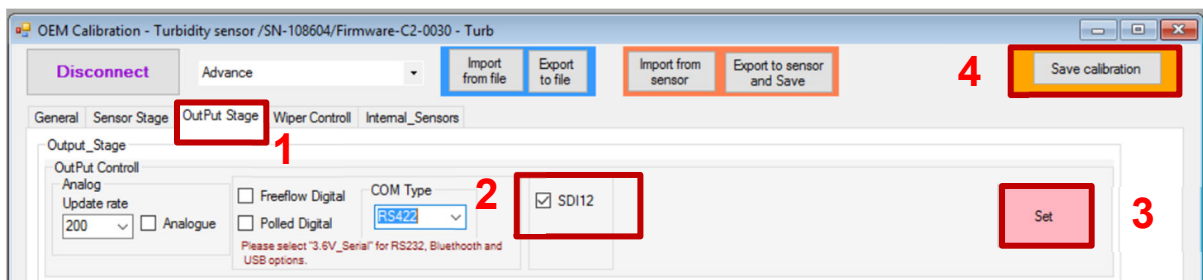


Figure 8.QQ: SDI-12 selection

When SDI-12 selection is being used, the user must tick (Figure 8.QQ: SDI-12 selection#2). Then press, (Figure 8.QQ: SDI-12 selection#3) and (Figure 8.QQ: SDI-12 selection#4) to save settings permanently to the sensor memory.

For further information regarding SDI-12, please refer to **section 7.2.3: "SDI-12 mode"** of this manual.

8.7.2 #WD7-B Analog SubConn

Connect the NEP-5000 to the 4-20mA logger:

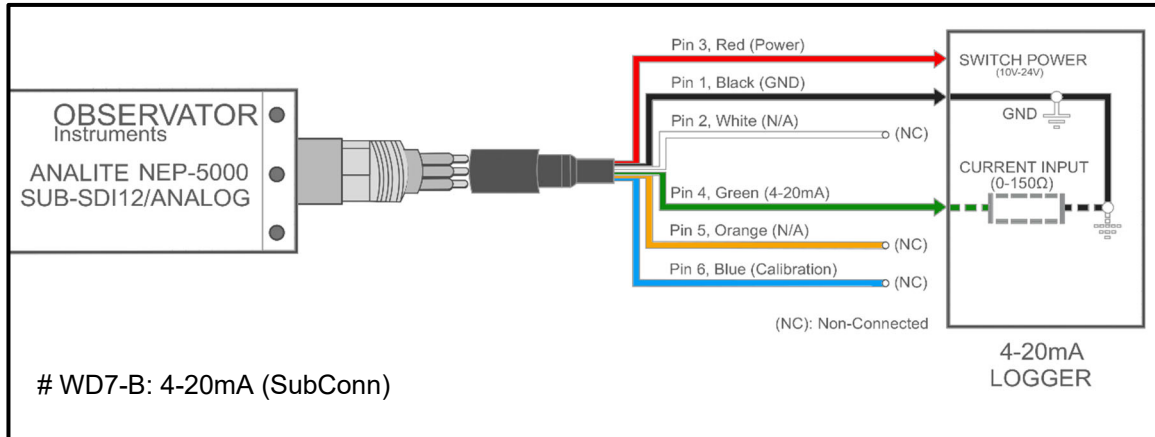


Figure 8.RR: Analog SubConn logger configuration

Note: Activate wiper: Short pin 6 to GND. Further information, refer to **section 7.3.2:** “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

Description

The NEP-5000 with current driver option outputs turbidity is represented as: 4-20mA or 0-20mA. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

4-20mA selection

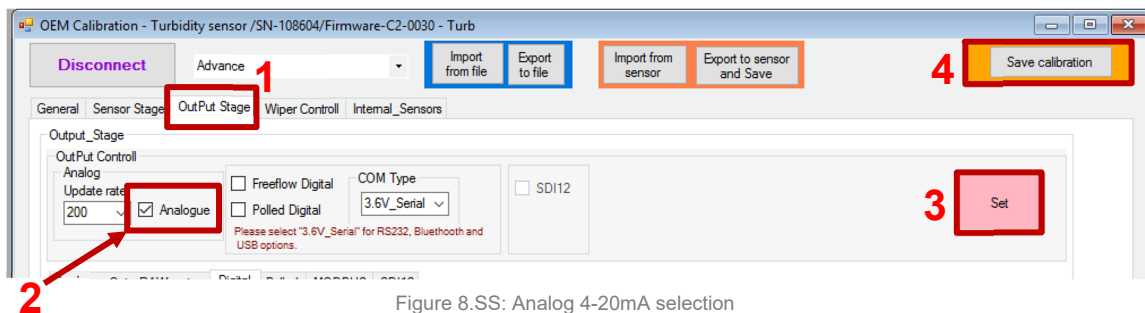


Figure 8.SS: Analog 4-20mA selection

To select current option, please follow the steps below:

- Select “OutPut Stage” option (Figure 8.SS: Analog 4-20mA selection#1).
- Select the “Analogue current” option (Figure 8.SS: Analog 4-20mA selection#2).
- Then press, (Figure 8.SS: Analog 4-20mA selection#3) and (Figure 8.SS: Analog 4-20mA selection#4) to save settings permanently to the sensor memory.

For further information regarding current output, please refer to **section 7.2.4:** “Measurement via Analog interface” of this manual.

8.7.3 #WD7-C voltage SubConn

Connect NEP-5000 voltage logger:

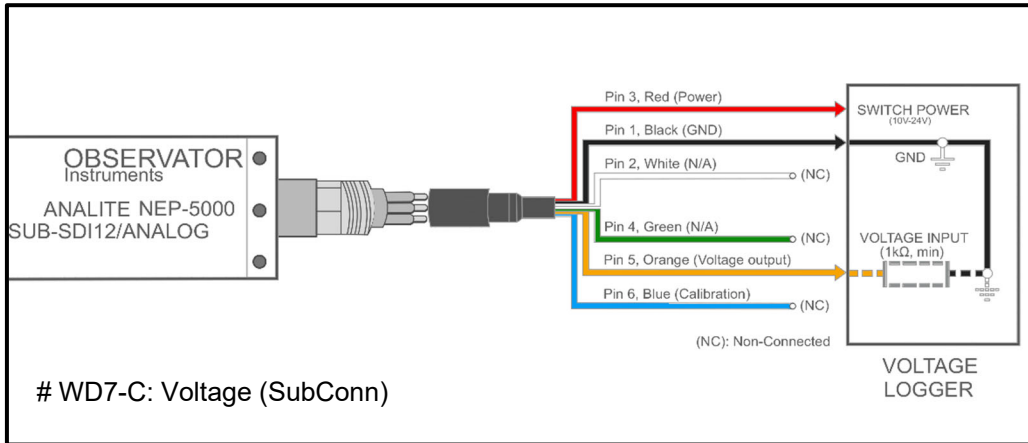


Figure 8.TT: Voltage SubConn logger configuration

Note: Activate wiper: Short pin 6 to GND. Further information, refer to **section 7.3.2:** “Recommended method of triggering the optical wiper using a dedicated wiper wire”.

Description

The NEP-5000 with voltage driver option outputs turbidity is represented as: -2.5V to +2.5V, 0 to 2.5V or 0 to 1V. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

Voltage selection

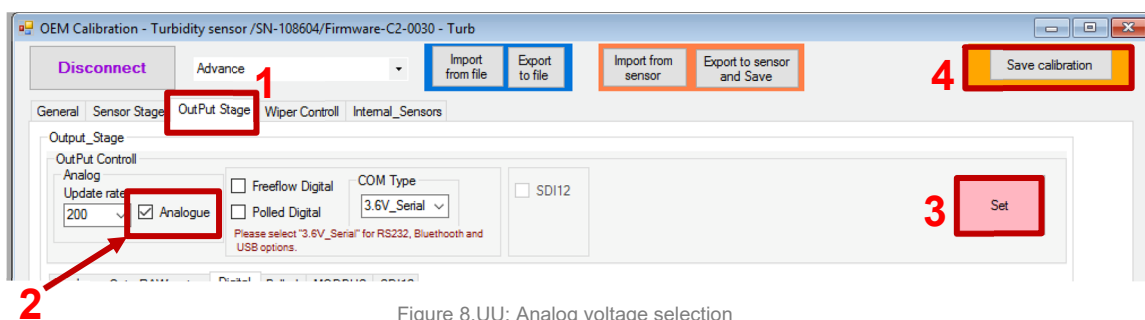


Figure 8.UU: Analog voltage selection

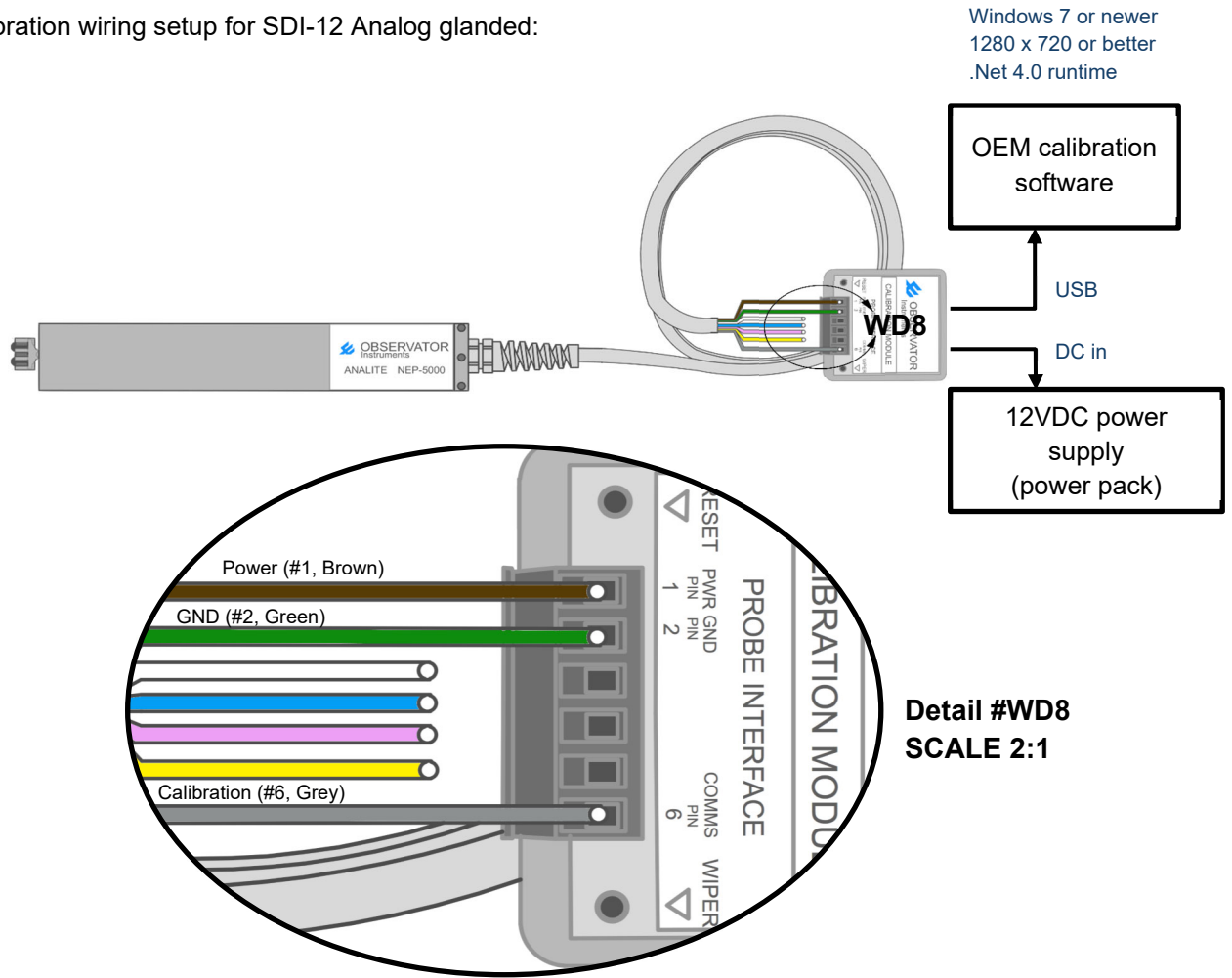
To select voltage option, please follow the steps below:

- Select “OutPut Stage” option (Figure 8.UU: Analog voltage selection#1).
- Select the “Analog voltage” option (Figure 8.UU: Analog voltage selection#2).
- Then press, (Figure 8.UU: Analog voltage selection#3) and (Figure 8.UU: Analog voltage selection#4) to save settings permanently to the sensor memory.

For further information regarding voltage output, please refer to **section 7.2.4:** “Measurement via Analog interface” of this manual.

8.8 SDI-12/Analog glanded-NEP cable option (#WD8)

Calibration wiring setup for SDI-12 Analog glanded:



NEP-5000 wire colour	Voltage option	Calibration module pin
Brown	Power +10V to +24V DC (+Ve)	#1
Green	Power GND, SDI-12 GND, and Analog GND	#2
White	SDI-12 Data	N/A
Blue	4-20mA loop to power GND via 100 ohms	N/A
Pink	N/A	N/A
Yellow	Voltage out (pin 1 as GND ref)	N/A
Grey	Calibration / wiper	#6

Figure 8.VV: SDI-12/Analog glanded pinout configuration

8.8.1 #WD8-A SDI-12 glanded

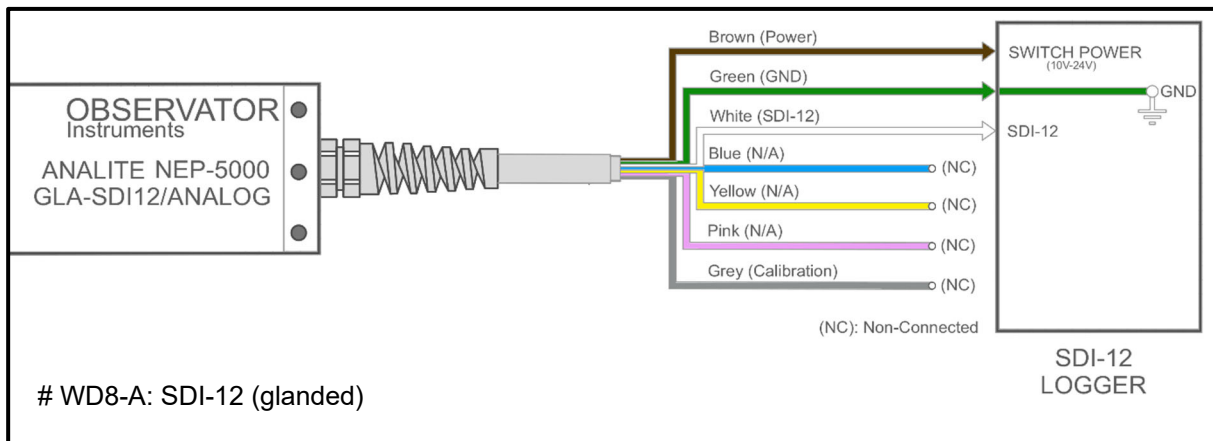


Figure 8.WW: SDI-12 glanded logger configuration

Description

When the NEP-5000 sensor is configured as SDI-12 communication, it can offer a full range of sensor operations via the SDI-12 bus. Some of these options are initiating and reading turbidity measurements, statistical measurements, changing measurement ranges and operating the optical wiper. The user must select appropriate SDI-12 addresses from the PC-configuration software.

SDI-12 selection

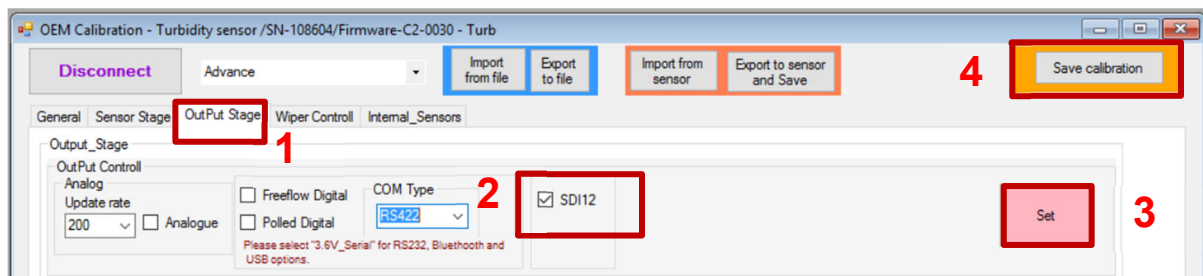


Figure 8.XX: SDI-12 selection

When SDI-12 selection is being used, the user must tick (Figure 8.XX: SDI-12 selection#2). Then press, selection (Figure 8.XX: SDI-12 selection#3) and (Figure 8.XX: SDI-12 selection#4) to save settings permanently to the sensor memory.

For further information regarding SDI-12, please refer to **section 7.2.3: “SDI-12 mode”** of this manual.

8.8.2 #WD8-B Analog glanded

Connect NEP-5000 to 4-20mA logger:

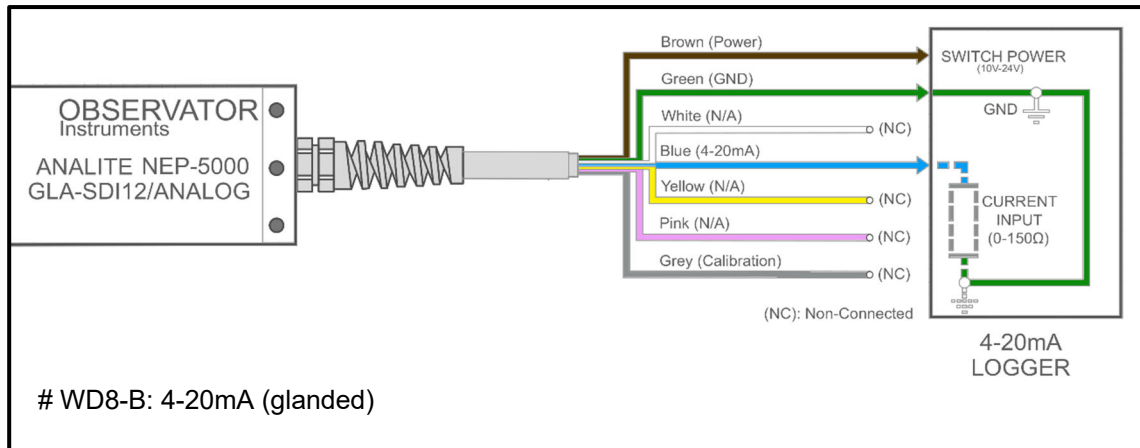


Figure 8.YY: Analog glanded logger configuration

Note : Activate wiper: Short grey wire to GND. Further information, refer to **section 7.3.2:** "Recommended method of triggering the optical wiper using a dedicated wiper wire".

Description

The NEP-5000 with current driver option outputs turbidity is represented as: 4-20mA or 0-20mA. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

4-20mA selection

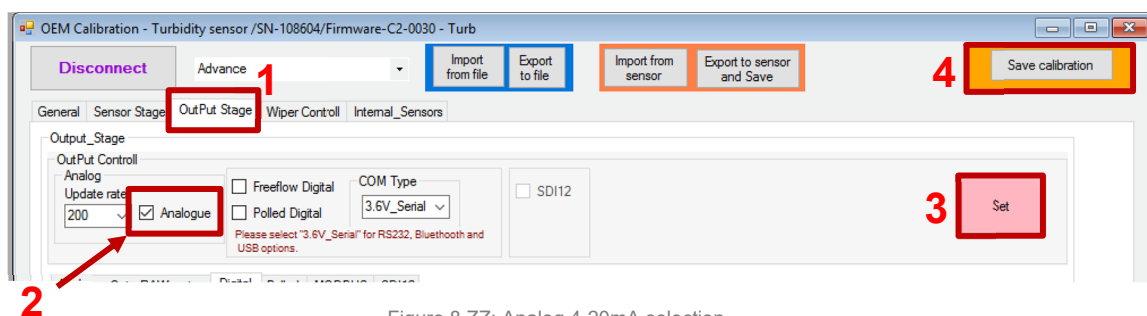


Figure 8.ZZ: Analog 4-20mA selection

To select current option, please follow the steps below:

- Select "OutPut Stage" option (Figure 8.ZZ: Analog 4-20mA selection#1).
- Select the "Analog current" option (Figure 8.ZZ: Analog 4-20mA selection#2).
- Then press, selection (Figure 8.ZZ: Analog 4-20mA selection#3) and (Figure 8.ZZ: Analog 4-20mA selection#4) to save settings permanently to the sensor memory.

For further information regarding current output, please refer to **section 7.2.4: “Measurement via Analog interface”** of this manual.

8.8.3 #WD8-C voltage glanded

Connect NEP-5000 voltage logger:

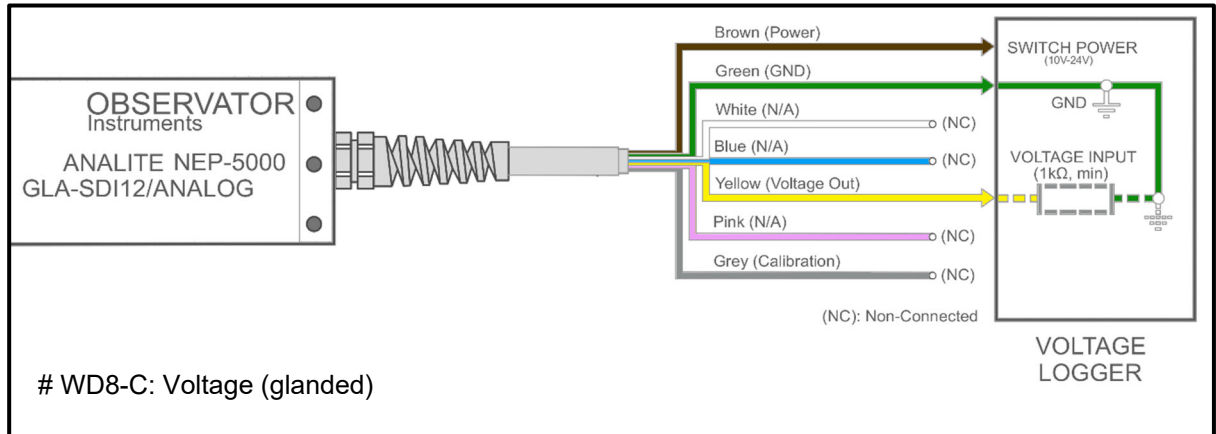


Figure 8.AAA: Voltage glanded logger configuration

Note : Activate wiper: Short grey wire to GND. Further information, refer to **section 7.3.2: “Recommended method of triggering the optical wiper using a dedicated wiper wire”**.

Description

The NEP-5000 with voltage driver option outputs turbidity is represented as: -2.5V to +2.5V, 0 to 2.5V or 0 to 1V. The sensor also allows to control built-in optical wiper using a control wire or periodic control.

Voltage selection

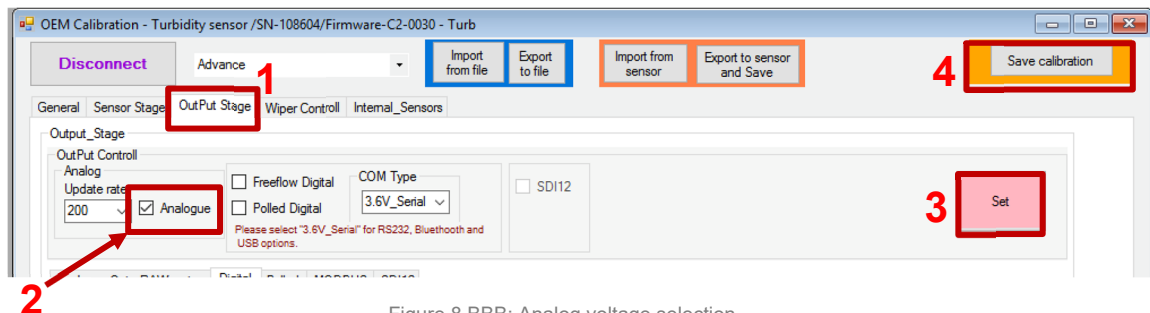


Figure 8.BBB: Analog voltage selection

To select voltage option, please follow the steps below:

- Select “OutPut Stage” option (Figure 8.BBB: Analog voltage selection#1).
- Select the “Analog voltage” option (Figure 8.BBB: Analog voltage selection#2).
- Then press, selection (Figure 8.BBB: Analog voltage selection#3) and (Figure 8.BBB: Analog voltage selection#4) to save settings permanently to the sensor memory.

For further information regarding voltage output, please refer to **section 7.2.4: “Measurement via Analog interface”** of this manual.

9 Connect to the calibration software

This section will guide the user with step-by-step instructions on how to connect the NEP-5000 sensor to its calibration PC software.

Note: For starting up information, please refer to **chapter 6**: [“How to use this manual \(where to begin?\)”](#).

9.1 Installing the probe for the first time

To run NEP-OEM Software you will need a Windows 7 machine or above.

9.1.1 Install calibration module driver

1. Download, and unzip “[NEP-OEM software](#)” from the Analite website.

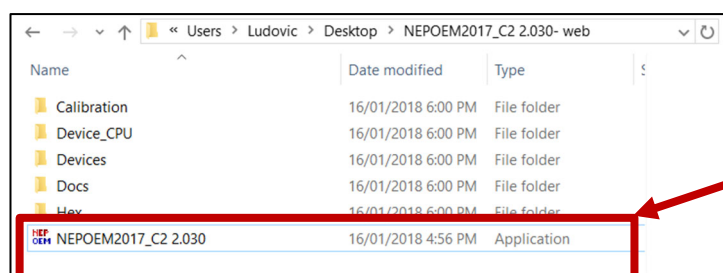


Figure 9.A: Nephelometer OEM software icon.

Note: Alternatively run the software directly from the USB provided or copy the folder to a local drive (make sure you include all the supporting folders to the same location).

2. Copy the unzipped folder to your local drive.
3. Connect calibration module to the PC via the supplied USB cable.
4. Install the driver:
 - Recent Operating Systems (Windows 7 and above) will automatically install the driver when provided with an internet connection, otherwise [“download the driver”](#).
5. Open the “Windows device manager” from your control panel, find the newly connected device and identify the COM port number.

Note: Skip this step if the COM port is known and installed correctly.

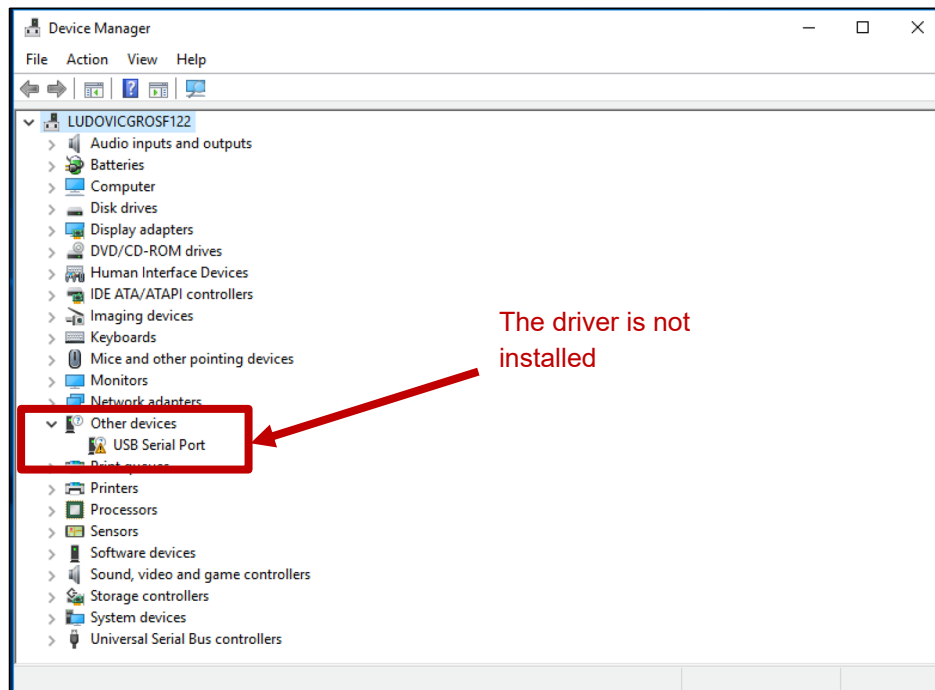


Figure 9.B: Device manager window

- Right click and select “Update device software”, then choose “driver software from your computer” option.
- Using the “Browse” button select “optic driver” when prompted and “OK”.
- Wait for the completion of the driver installation.
- After successful installation, the “Windows device manager” should display a COM port in “Ports (COM & LPT)” category.
- Note the new port number.

9.1.2 Run NEP-OEM software

1. Press “Start” button.

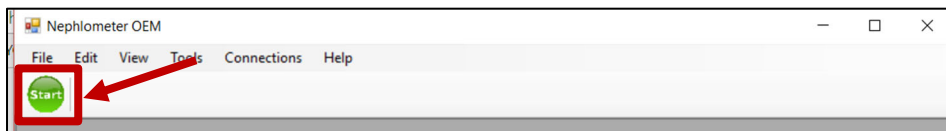


Figure 9.C: Start NEP-OEM software

2. Select your communication port from the dropdown menu and press “OK” to continue.

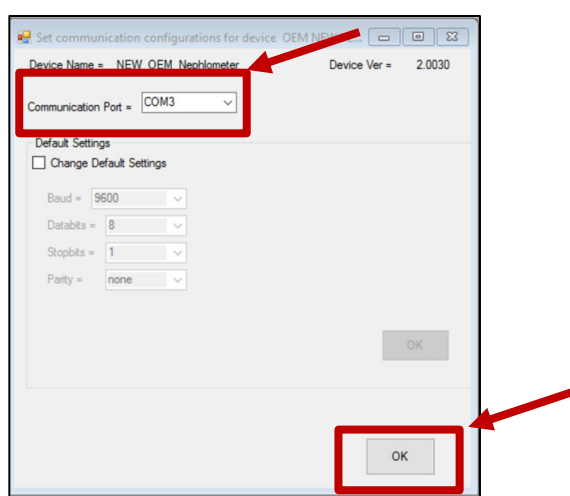


Figure 9.D: Selection of the communication port

3. The output window should show the following when the correct communications port is selected:

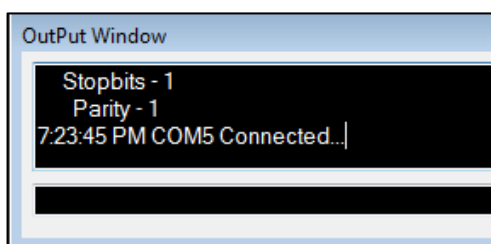


Figure 9.E: Output window overview

4. Make sure you have connected your sensor to the calibration module.
If not, connect the probe to the calibration module (blue box) as shown in **chapter 8: “Pinout & wiring diagram”**, based on your probe wiring set up (refer to the correct calibration wiring set up RS232/Analog SubConn connector option (#WD1) to SDI-12/Analog glanded-NEP cable option (#WD8).

9.2 Make the calibration connection with the sensor

Note: Please refer to **section 9.1**: “Installing the probe for the first time” for connecting and installing drivers first.

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

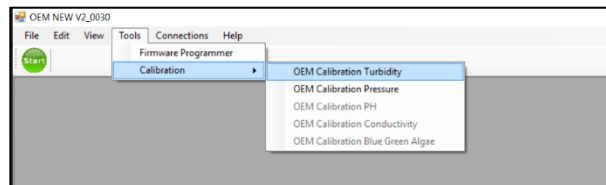


Figure 9.F: Select OEM Calibration Turbidity option

1. Press “Connect Button” on the software and establish the connection.

Make sure you have connected your sensor to the calibration module.

If not, connect the probe to the calibration module (blue box) as shown in **chapter 8**: “Pinout & wiring diagram”, based on your probe wiring set up (refer to the correct calibration wiring set up RS232/Analog SubConn connector option (#WD1) to SDI-12/Analog glanded-NEP cable option (#WD8).

Note: Pressing the maximize button (top right) will enable a larger view.

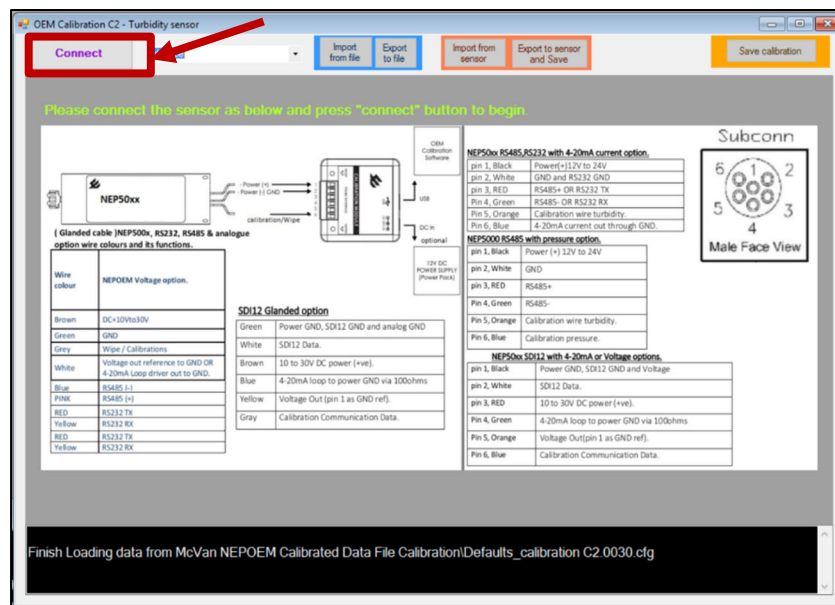


Figure 9.G: Connect to the probe

Immediately, after pressing “Connect button”, long press (1 second) and release the “RESET” button on the calibration module (blue box) to power cycle the sensor.



Figure 9.H: Calibration module “RESET”

Note: If you do not press the “RESET” button in-time, an error message will be shown, the user may restart step (2) of the above procedure.

1. Wait a few seconds until the calibration window is ready:

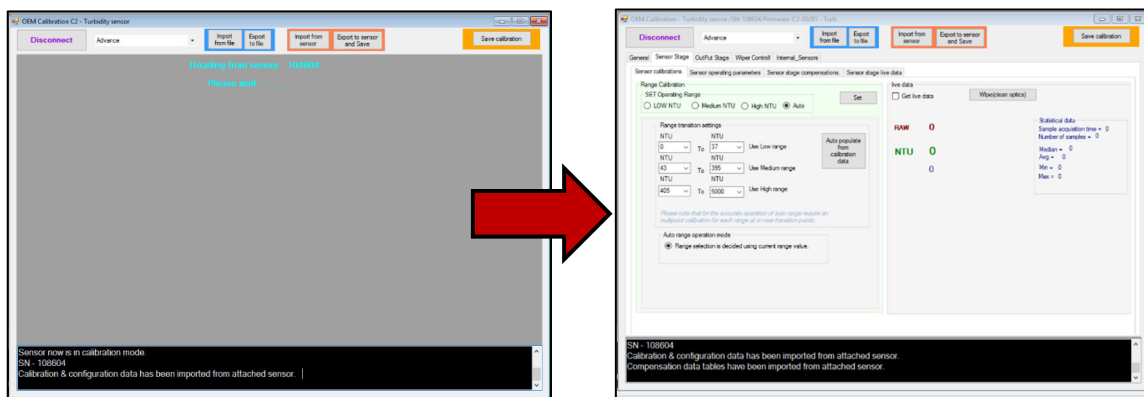


Figure 9.I: Access to the calibration window

Note 1: The output Window should show Figure 9.I: Access to the calibration window when successful. In this stage the calibration & configuration data from the sensor has been imported to the PC software.

Note 2: The general tab shows sensor firmware version and serial number, please make sure you are using the matching revision between the firmware and PC software. Please refer to “[Firmware-updating-procedure](#)” application note to change your sensor firmware.

Note 3: Select “Advance” in the top left drop down window to display all available options.

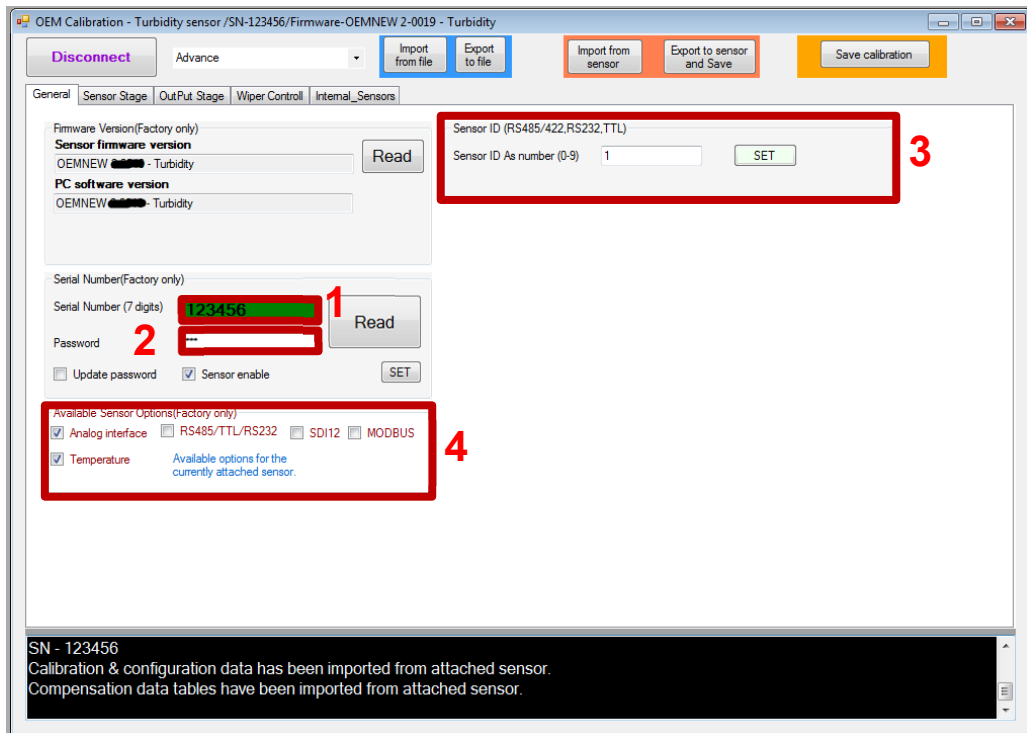


Figure 9.J: General settings menu

9.2.1 Serial number

A unique serial number is assigned to the running probe during manufacturing. Serial numbers cannot be changed.

9.2.2 Password

Factory usage only.

9.2.3 Sensor ID

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


9.2.4 Available sensor options

Provides a list of available output interfaces, corresponding to the hardware that is physically installed.

10 Turbidity calibration

The NEP-5000 sensor comes with a full factory calibration and this includes profiling of the optics (multi-point calibration) and calibration of all 3 ranges (2-point calibration).

When the optical data profile is already available (from the factory calibration file), only a 2-point calibration is generally required at each service interval by the user.



Observer Instruments Pty Ltd
ABN 56 007 283 963

8 - 10 Keith Campbell Court, Scoresby
PO Box 9039, Scoresby
VIC 3179 AUSTRALIA

Calibration Certificate

ANALITE NEP-5000 Turbidity Probe

Customer:	
Model:	
Digital output:	
Analogue output:	
Serial Number:	
Date of Calibration:	

Calibration Results:

Ranges	0 NTU	40 NTU	100 NTU	400 NTU	1000 NTU	5000 NTU
Low range						
Mid range						
High range						
Standard Solution Batch No.	DI Water	C	C	C	C	C

Other measurements:

Wiper motor current with wiper fitted (if fitted):	mA
Probe Current (working mode):	mA
Probe Pressure test passed?	Yes


Default settings:

Output:	SDI-12 AD=
Range:	
Wipe	PWR ON Wipe (single)

Notes:

Job Number:

Calibrated by:



An Observer brand

Tel: +61 3 8706 5000 - Email: sales.au@observer.com - Web: www.observator.com

Figure 10.A: Factory sample calibration sheet

10.1 When do you need to calibrate?

- It is recommended that after one year of field use, the user may verify the calibration using appropriate calibration solutions mentioned in the original factory calibration certificate. The user may order this solution when ordering the sensor.
- The correct calibration solution and its batch number are also mentioned in the calibration sheet of the sensor.
- The user may also find the original factory calibration data including optical profiling (multi-point calibration on the [“Analite website”](#)).

10.2 Two-point calibration requirements

- When auto-range mode is employed, it is recommended that user may calibrate all three ranges at the same time using matching batch numbering solutions (so that batch to batch tolerance in the turbidity standards are minimal).
- When single range is being employed, the user may calibrate only the desired single range.

10.3 Before you begin calibration

Before you begin, please make sure you have the following items:

1. Prepare AMCO CLEAR® turbidity standard solutions for all three ranges.

	Low-range	Mid-range	High-range
<p>Low calibration point (bottom)</p>	 <p>ONTU turbidity standard</p>		
<p>High calibration point (top)</p> <p>AMCO CLEAR® solution required</p>	<p>10NTU solution</p> 	<p>400NTU solution</p> 	<p>3,000NTU solution</p> 

Figure 10.B: Prepare calibration solutions

2. It is recommended to use quality distilled water as dissolved solids – 3 parts per 1,000,000. Please note, accurate bottom end calibration is essential for low range turbidity measurements.
3. It is recommended to use Ultraviolet (UV) absorbent bottles. The UV absorbent bottles help to minimize the light bouncing effect caused by the container's wall.

It is important that the user also isolates external UV light (UV present in ambient light) entering to the sensor during the calibration process.



Figure 10.C: Use UV absorbent bottles

4. Use appropriate wash solutions, in a wash cup containing distilled water to avoid cross-contamination of solutions when moving from one solution to the other.



Figure 10.D: Prepare a wash cup

5. Air duster or a cleaning/wiping cloth.



Figure 10.E: Prepare an air duster or a cleaning cloth

10.4 2-point calibration for 3 ranges

Note: To obtain the NEP-5000 data sheet specification, the following procedures must be followed.

10.4.1 Clean the sensor

Begin the calibration procedure by cleaning the sensor optical face using a wash solution. Move the probe up and down in the water. Make sure you never touch the optics.

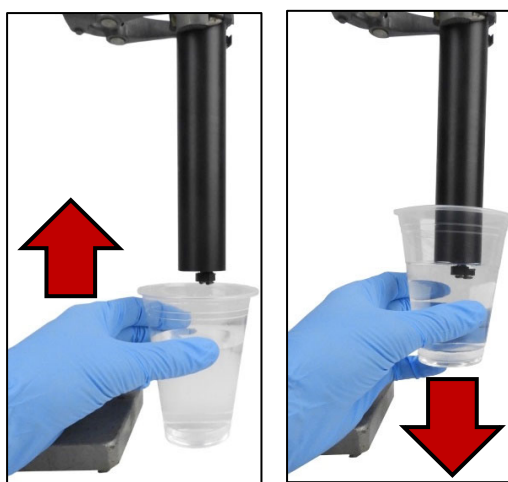


Figure 10.F: Wash the sensor

10.4.2 Dry the sensor

Dry the sensor with the air duster or cloth.



Figure 10.G: Dry the probe

10.4.3 Connect to the calibration software

Connect the sensor to the calibration software by using the **chapter 0:** “

Connect to the calibration software”.

10.4.4 Load the optical profile

Load the optical profile (original factory calibration of the sensor) by downloading appropriate CFG file (match serial number) from the “Analite website” and apply it to the sensor.

- Download the CFG file to your local drive.



Figure 10.H: Load the optical profile

- Go to the calibration software and press button “import from file”.

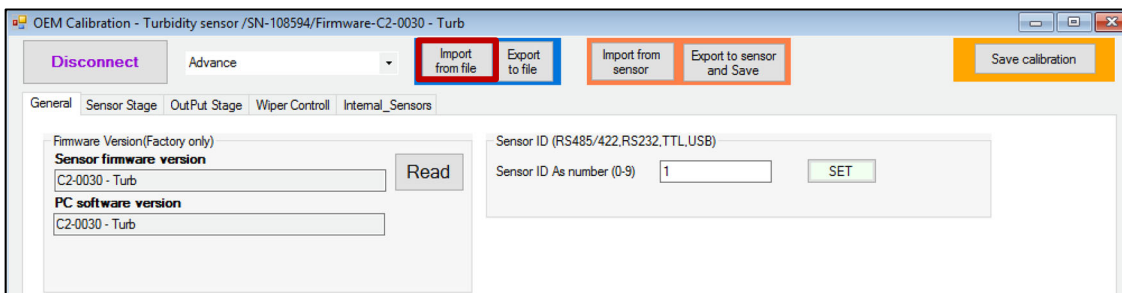


Figure 10.I: Import optical profile

- When opening the CFG file, the calibration software will display basic information about the importing file, please verify and press “ok”.

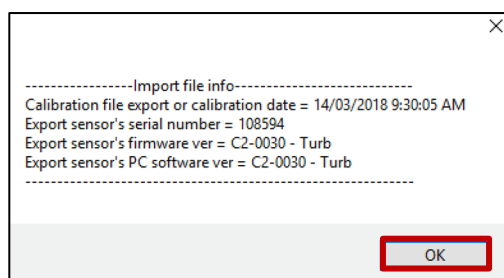


Figure 10.J: Press ok

- Press “Yes” to write newly imported factory calibration data to the attached sensor.

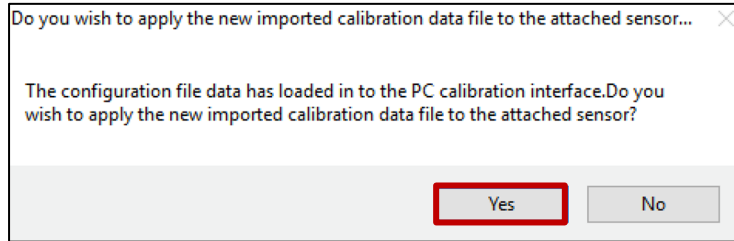


Figure 10.K: Apply calibration data file to the sensor

- Please wait until the process is fully completed. It may take up to a minute.

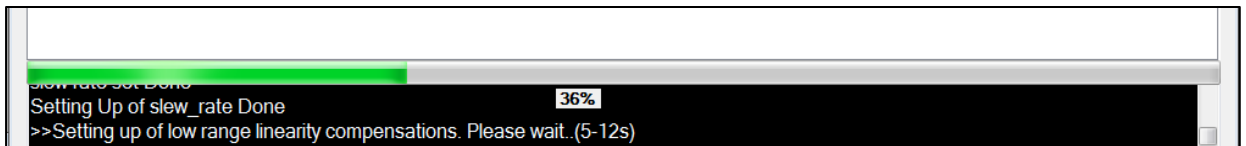


Figure 10.L: Applying changes

- Successful completion of data upload to a sensor should display as follows. Press “OK”.

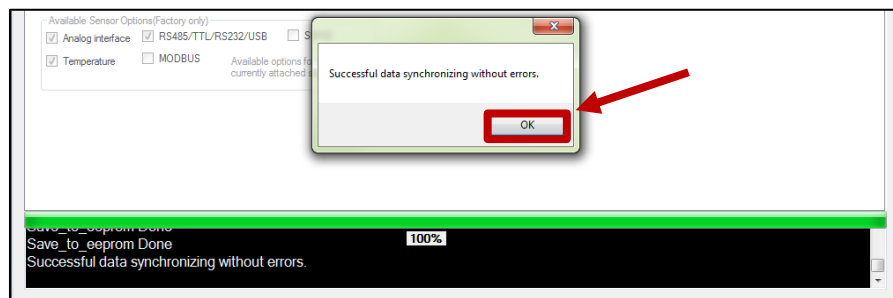


Figure 10.M: Successful synchronizing

10.4.5 Set up zero-point calibration values for all ranges

Note: This stage will be required for every range that the user wishes to calibrate.

- After cleaning the sensor by dipping the sensor a few times into the washed solution, dry and then submerge the sensor into the 0NTU solution as shown below:

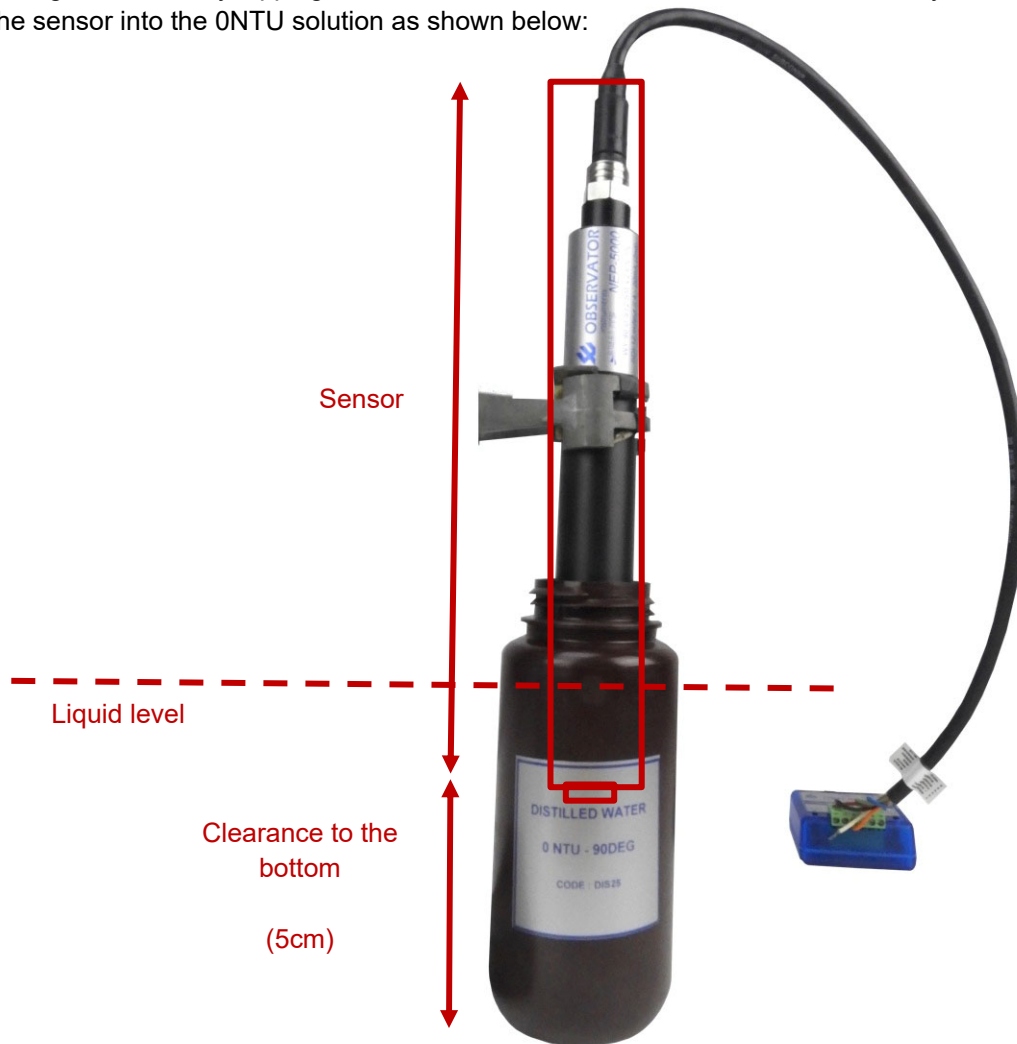


Figure 10.N: Submerge the sensor into the 0NTU solution

Important note: It is recommended to use a lab stand or similar to hold the sensor.

- Now press the “Wipe(clean optics)” button to get rid of the air-bubbles formed in the optical face.

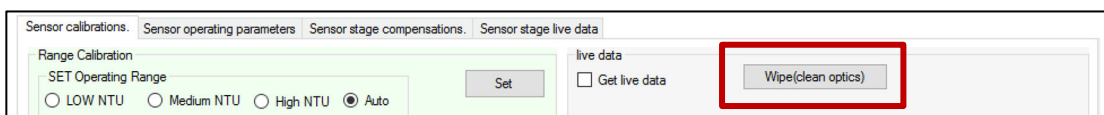


Figure 10.O: Perform a wipe to clean optics

- Now, select “LOW NTU” and click “Set” and wait until the “LOW NTU” is set (the set button will turn pink).

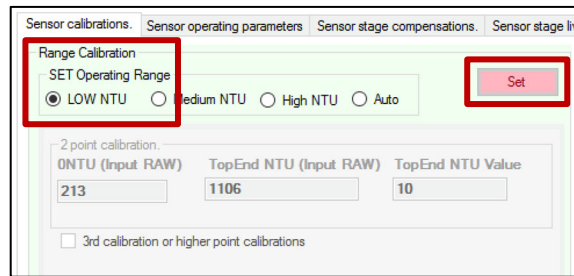


Figure 10.P: Low NTU

- Tick “Get live data” tick box to read current measurement from the sensor, the “NTU” & “RAW” should display un-calibrated 0 NTU solution values.

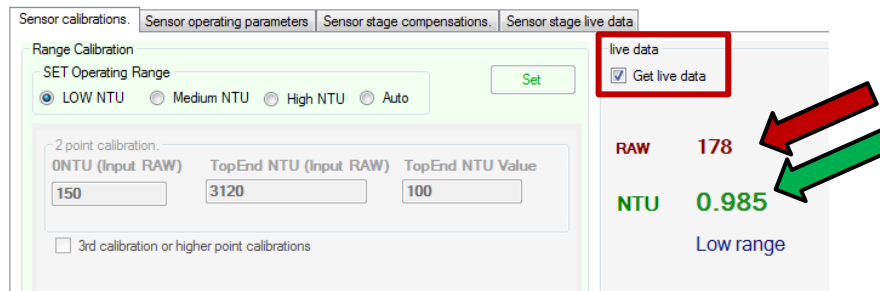
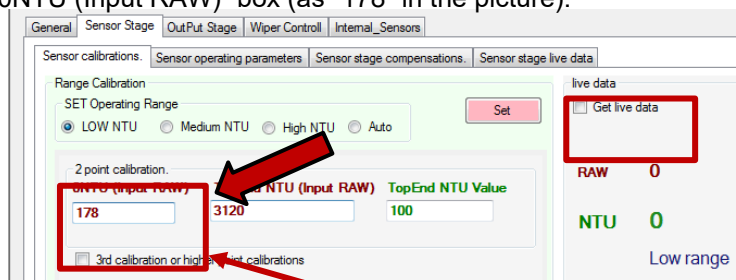


Figure 10.Q: Get live data

- Please observe the “RAW value” and when stable, untick the “Get live data” button and type the raw value into the “0NTU (Input RAW)” box (as “178” in the picture).



Type 0NTU RAW
value here

Figure 10.R: Record the 0NTU RAW value

- Now, click “Set” and read the live data by tick “Get live data”, the reading is getting closer to 0NTU solution figure.

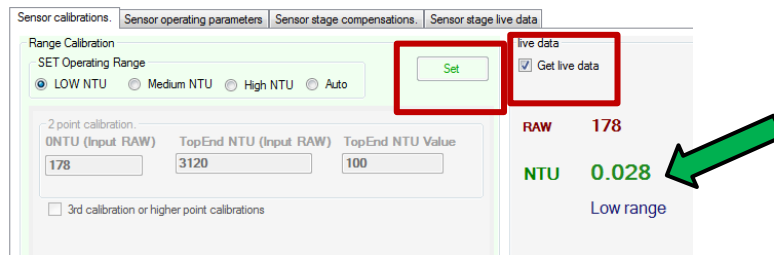


Figure 10.S: Set the 0NTU Raw value

- To make 0 NTU reading better, increase “0NTU (Input RAW)” by “2NTU” (as 180 in the picture), click “Set” and read the live data again by ticking “Get live data”. Now the “NTU” value is much closer (as 0.009 in the picture). Please note you may need to repeat a couple of times to get the correct reading. “0.009” is a typical value for 0NTU reading.

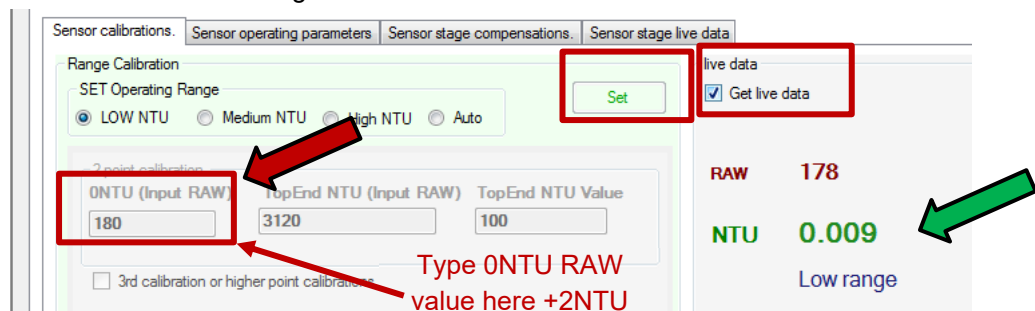
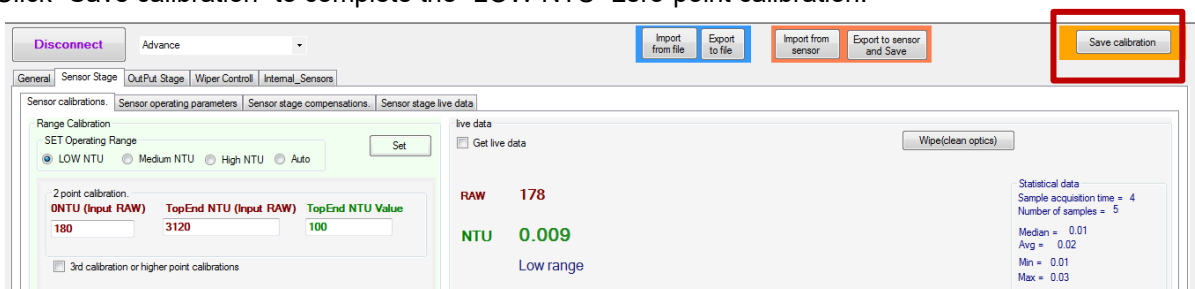


Figure 10.T: Improve the 0NTU Raw value

Note: After each alteration of the “0NTU (Input RAW)” value, the user must click “Set” before reading the live data.

- Click “Save calibration” to complete the “LOW NTU” zero-point calibration.



- Repeat all previous steps for all the ranges, by selecting “Medium NTU” and “High NTU” range and set their 0NTU values.

Note: Each range 0NTU raw value, will not be the same.

- Zero-point NTU calibration has now been completed for all three ranges.

10.4.6 Set up low-range top calibration value

- Please insert the sensor to the appropriate top limit value solution (e.g. 10NTU).

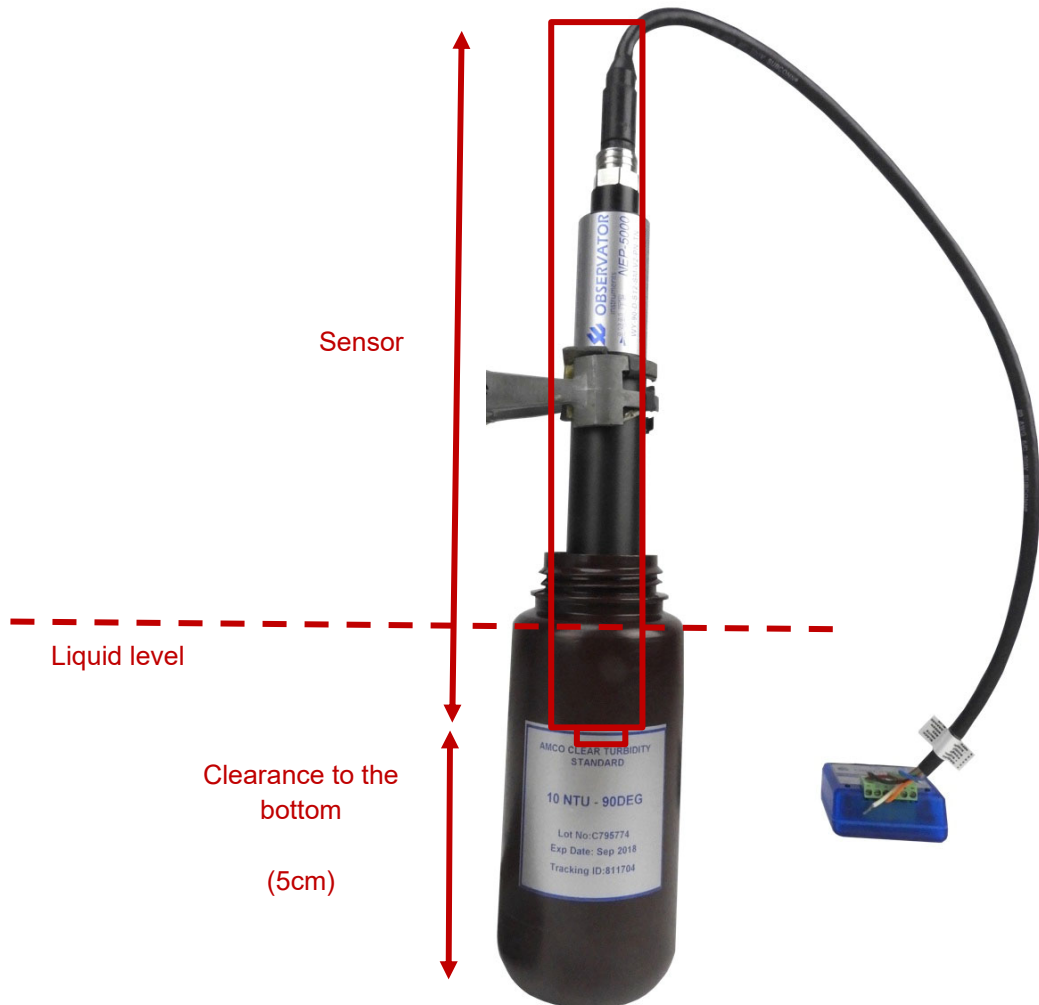


Figure 10.U: Insert the sensor in the top calibration value

Important note: The distance between the bottom of the container and sensors optical face must be a minimum of 5cm.

- Now press the “Wipe(clean optics)” button to get rid of the air-bubbles formed in the optical face.

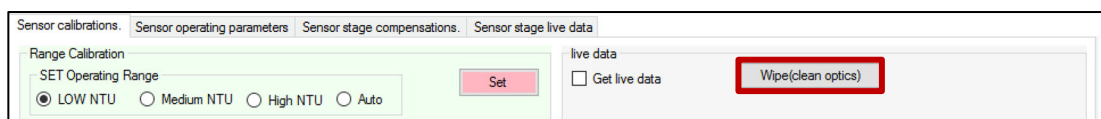


Figure 10.V: Perform a wipe to clean optics

- Now, select “LOW NTU”, then “Set”, and tick “Get live data” tick box to read current measurement from the sensor.
It should display the “RAW” & “NTU” values, but the “NTU” reading is out of the low top-range NTU value (it reads 36.795NTU instead of 10NTU).

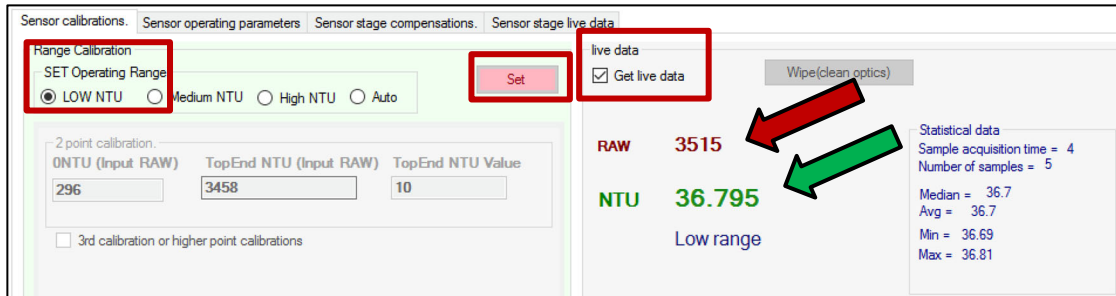


Figure 10.W: Get live data

- Please observe the “RAW value” and when stable, untick the “Get live data” button and type the raw value into the “TopEnd NTU (Input RAW)” box (e.g. ‘3516’).

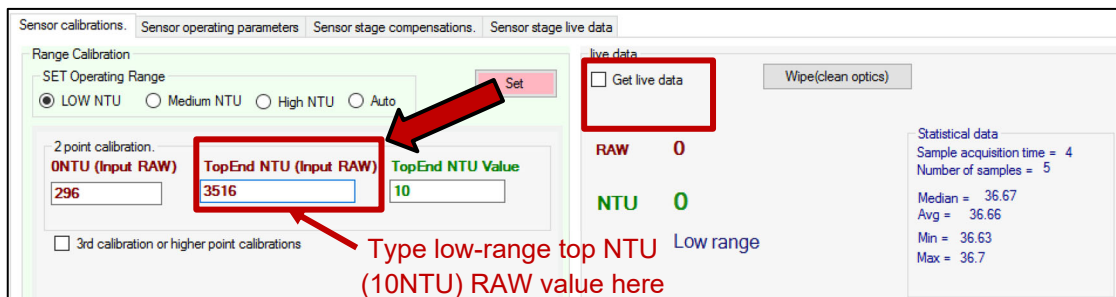


Figure 10.X: Record the low-range Top NTU RAW value

- To finalize the low-range calibration, please type the top turbidity calibration standard value into the “TopEnd NTU Value” box (e.g. “10”).

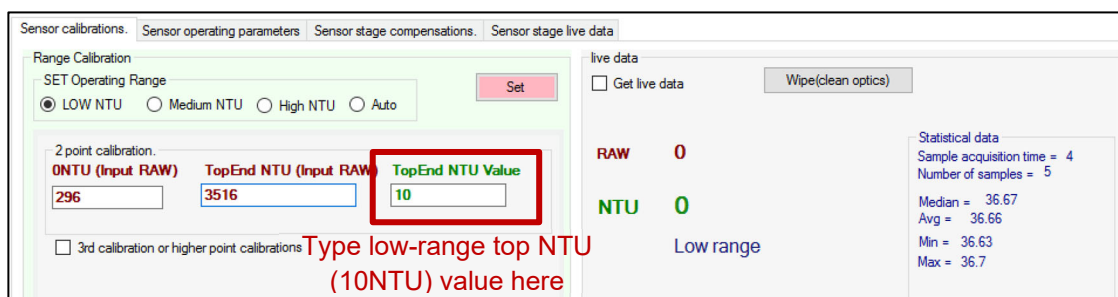


Figure 10.Y: Record the low-range Top NTU value

- Press: “Set”, and “Get live data”, but the reading is still un-desirable. Redo all previous steps until the reading is close enough to the high top-range NTU value.

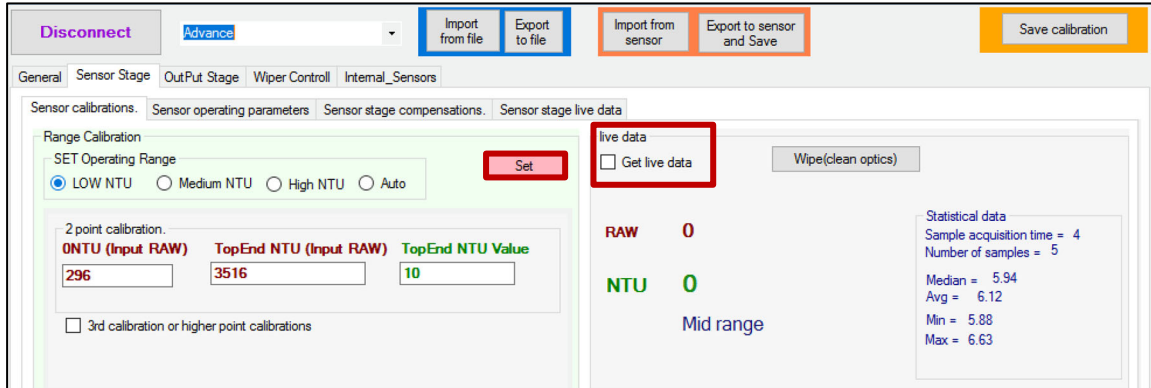


Figure 10.Z: Set the low-range top calibration value

- Press “Save calibration” to commit your new calibration data to the permanent memory inside the sensor.

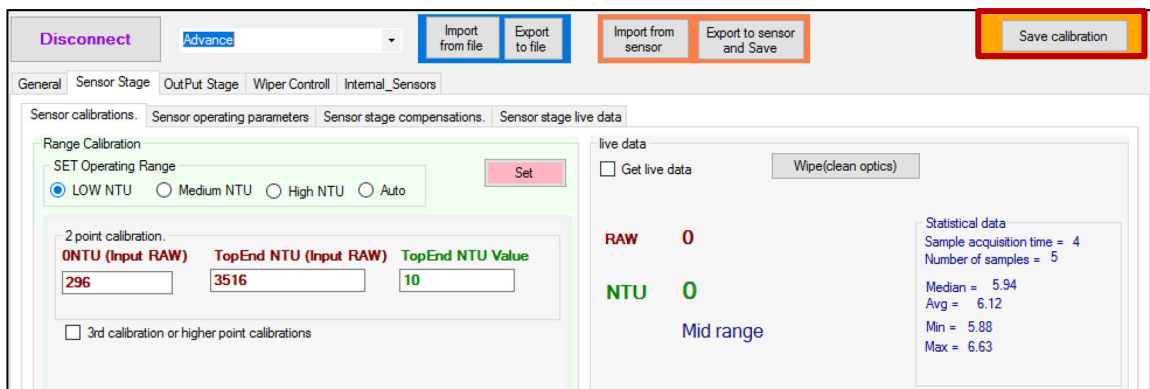


Figure 10.AA: Set the low-range top calibration value

Note: It is recommended that you export the newly calibrated live data data to a file for future use.

- Clean the sensor optical face using a wash solution. Move the probe up and down in the water. Make sure you never touch the optics. Then dry the sensor with the air duster or cloth.



Figure 10.BB: Wash and dry the sensor

Two-point low-range calibration has now been completed.

10.4.7 Set up mid-range top calibration value

- Please insert the sensor to the appropriate top limit value solution (e.g. 400NTU).

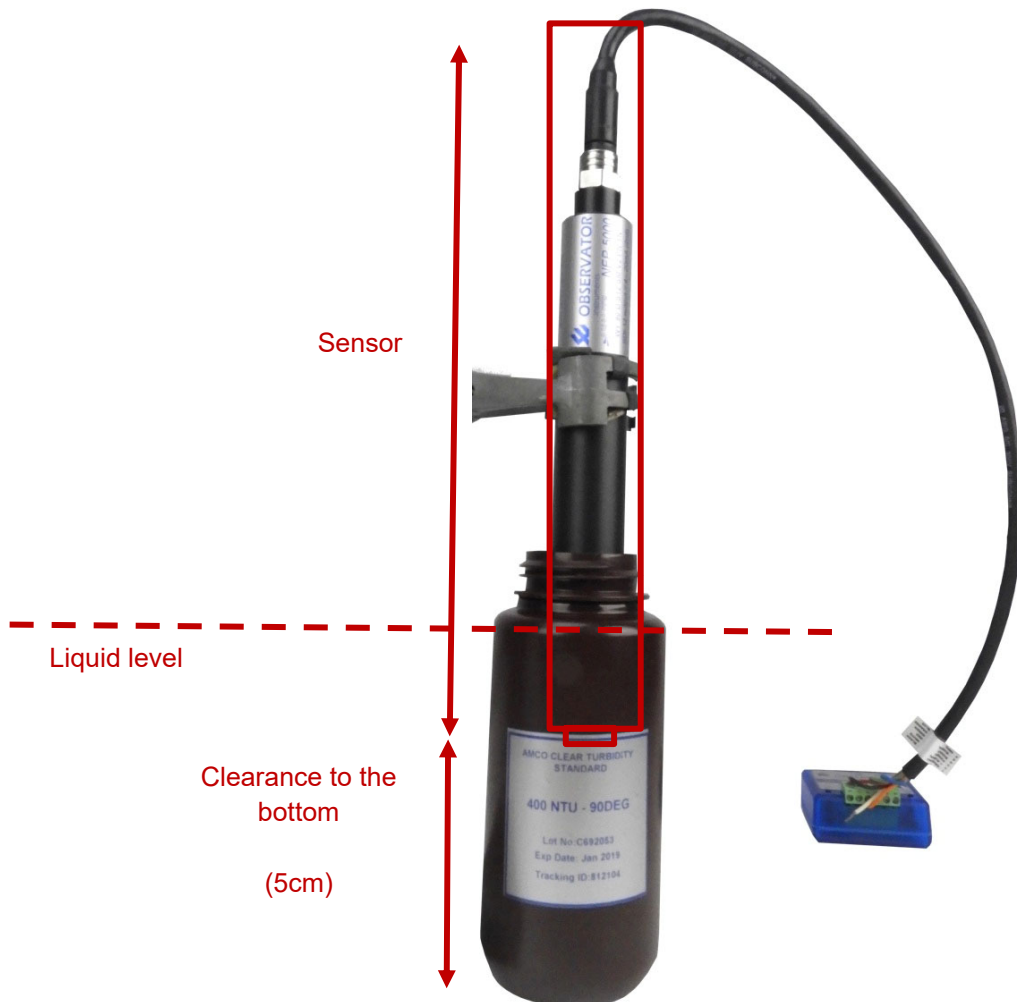


Figure 10.CC: Insert the sensor in the top calibration value

Important note: The distance between the bottom of the container and sensors optical face must be a minimum of 5cm.

- Now press the “Wipe(clean optics)” button to get rid of the air-bubbles formed in the optical face.

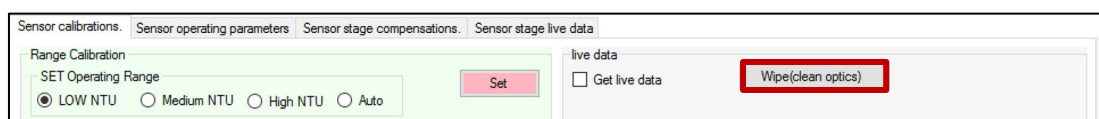


Figure 10.DD: Perform a wipe to clean optics

- Now, select “Medium NTU”, then “Set”, and tick “Get live data” tick box to read the current measurement from the sensor.
It should display the “RAW” & “NTU” values, but the “NTU” reading is out of the medium top-range NTU value (it reads 1.97NTU instead of 400NTU).

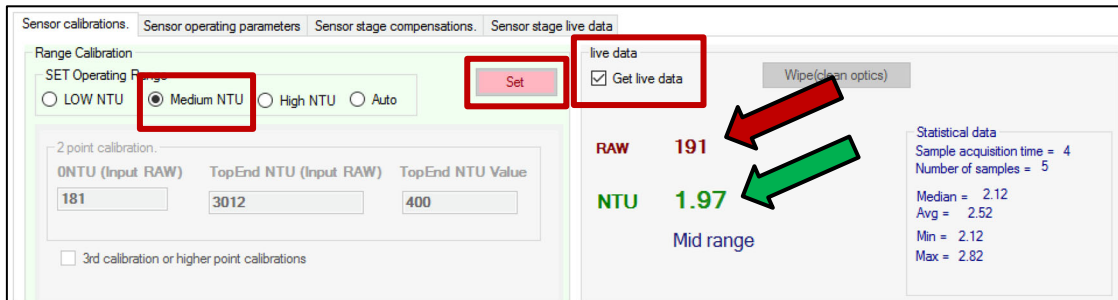


Figure 10.EE: Get live data

- Please observe the “RAW value” and when stable, untick the “Get live data” button and type the raw value into the “TopEnd NTU (Input RAW)” box (e.g. “197”).

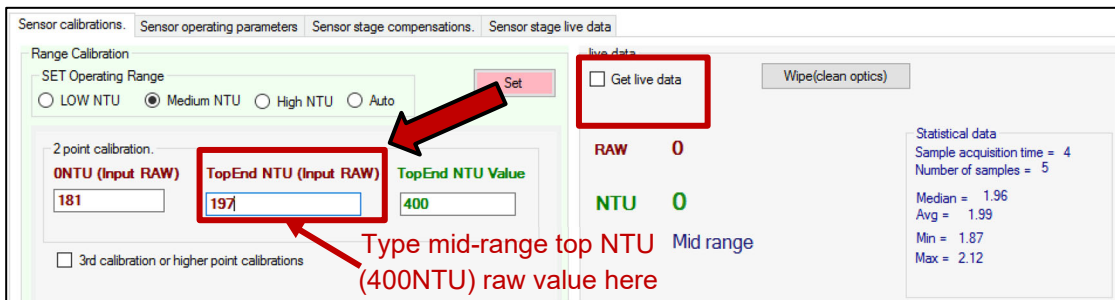


Figure 10.FF: Record the mid-range Top NTU RAW value

- To finalize the mid-range calibration, please type the top turbidity calibration standard value into the “TopEnd NTU Value” box (e.g. “400”).

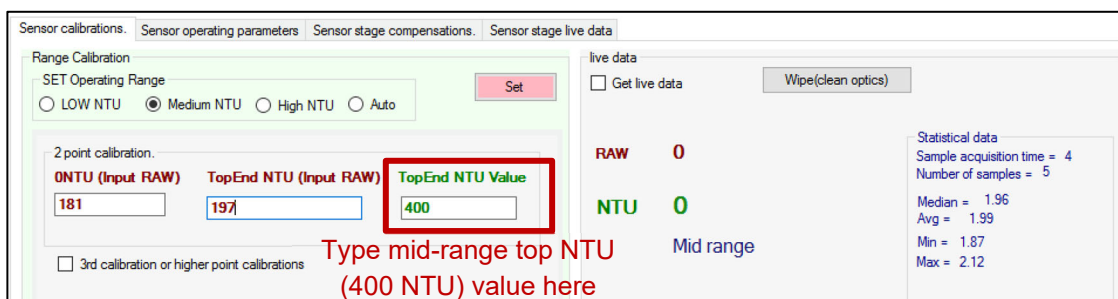


Figure 10.GG: Record the mid-range Top NTU value

- Press: “Set”, and “Get live data”, but the reading is still un-desirable, redo all previous steps until the reading is close enough to the high top-range NTU value.

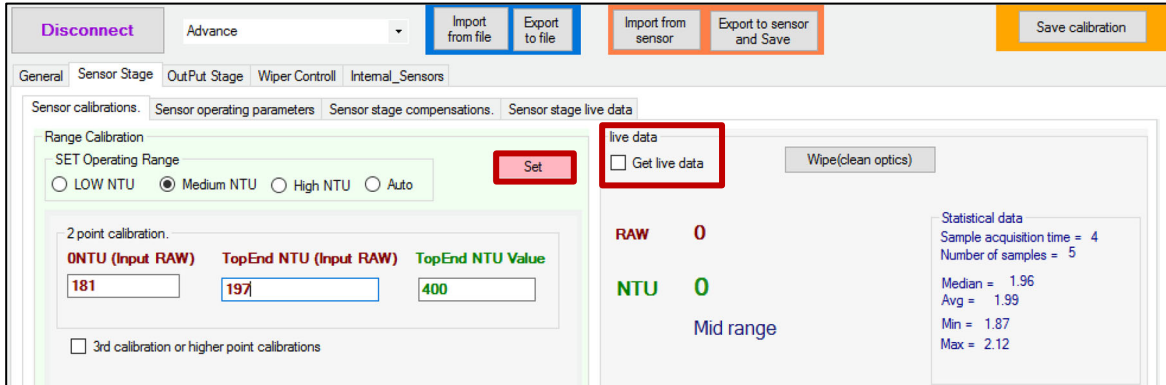


Figure 10.HH: Set the mid-range top calibration value

- Press “Save calibration” to commit your new calibration data to the permanent memory inside the sensor.

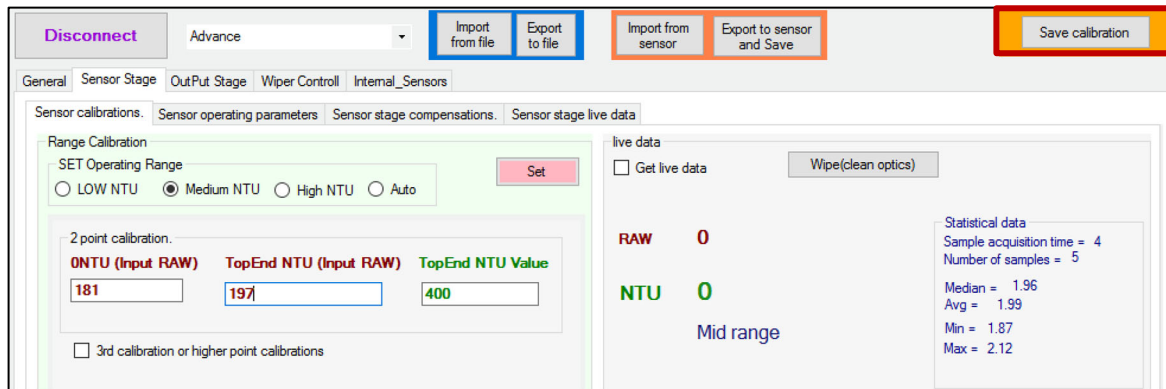


Figure 10.II: Set the mid-range top calibration value

Note: It is recommended that you export the newly calibrated data to a file for future use.

- Clean the sensor optical face using a wash solution. Move the probe up and down in the water. Make sure you never touch the optics. Then dry the sensor with the air duster or cloth.



Figure 10.JJ: Wash and dry the sensor

Two-point medium-range calibration has now been completed.

10.4.8 Set up high-range top calibration value

- Please insert the sensor to the appropriate top limit value solution (e.g. 3,000NTU).

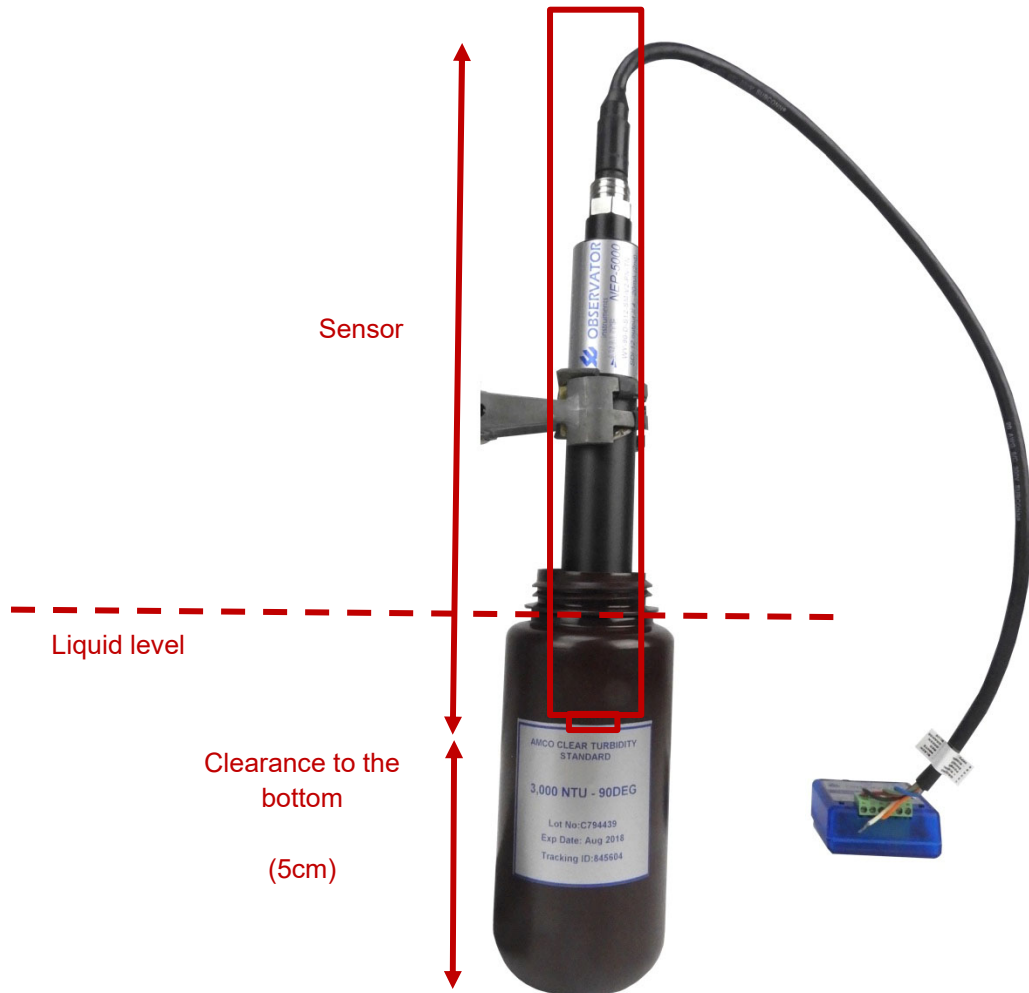


Figure 10.KK: Insert the sensor in the top calibration value

Important note: The distance between the bottom of the container and sensors optical face must be a minimum of 5cm.

- Now press the “Wipe(clean optics)” button to get rid of the air-bubbles formed in the optical face.

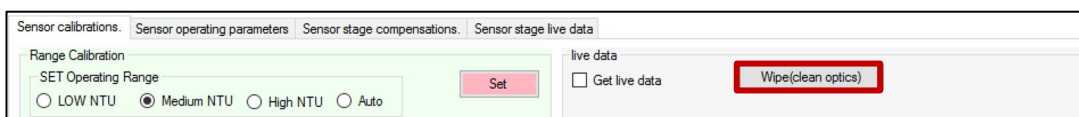


Figure 10.LL: Perform a wipe to clean optics

- Now, select “High NTU”, then “Set”, and tick “Get live data” tick box to read current measurement from the sensor.
It should display the “RAW” & “NTU” values, but the “NTU” reading is out of the high top-range NTU value (it reads 1140.63NTU instead of 3,000NTU).

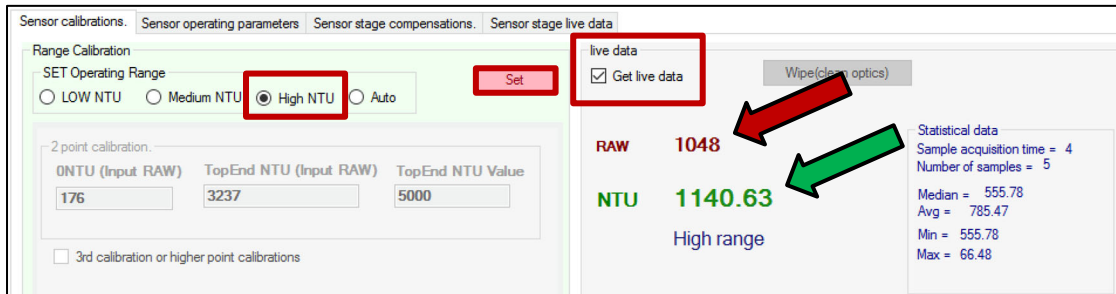


Figure 10.MM: Get live data

- Please observe the “RAW value” and when stable, untick the “Get live data” button and type the raw value into the “TopEnd NTU (Input RAW)” box (e.g. “1061”).

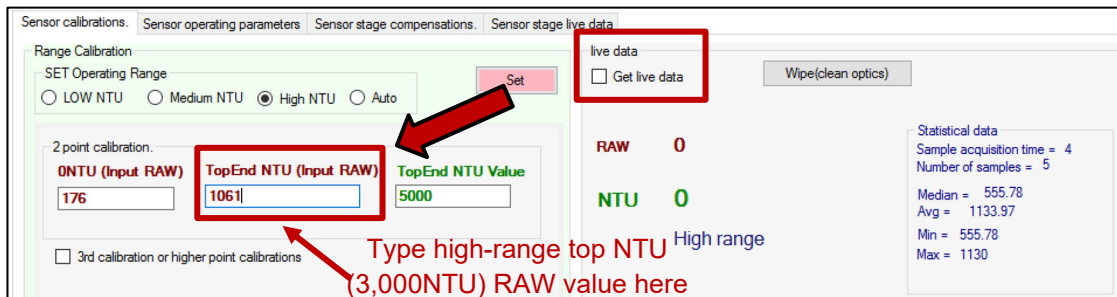


Figure 10.NN: Record the high-range Top NTU RAW value

- To finalize the high-range calibration, please type the top turbidity calibration standard value into the “TopEnd NTU Value” box (e.g. “3,000”).

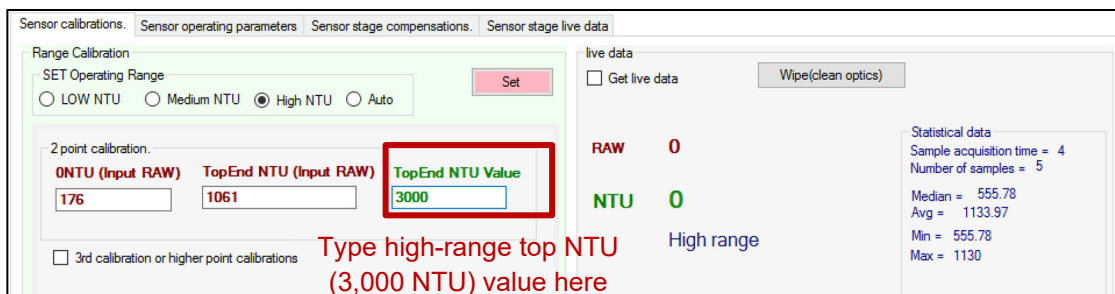


Figure 10.OO: Record the high-range top NTU value

- Press: “Set”, and “Get live data”, but the reading is still un-desirable, redo all previous steps until the reading is close enough to the high top-range NTU value.

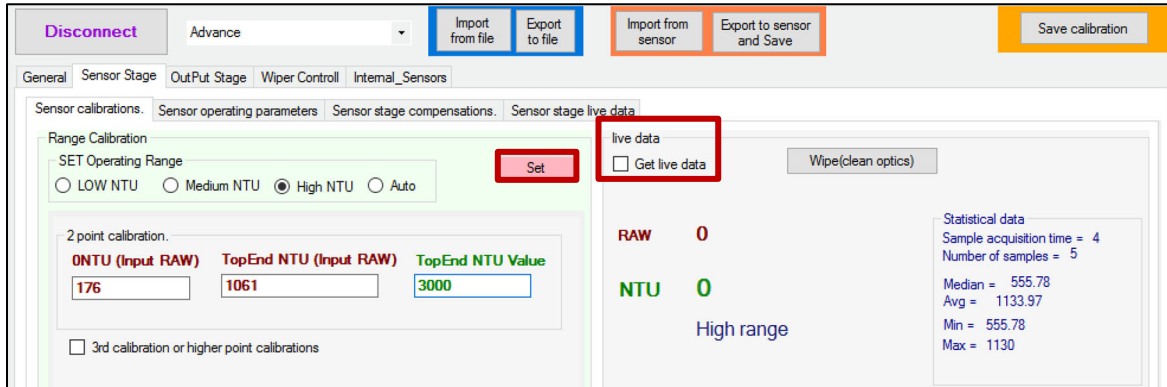


Figure 10.PP: Set the high-range top calibration value

- Press “Save calibration” to commit your new calibration data to the permanent memory inside the sensor.

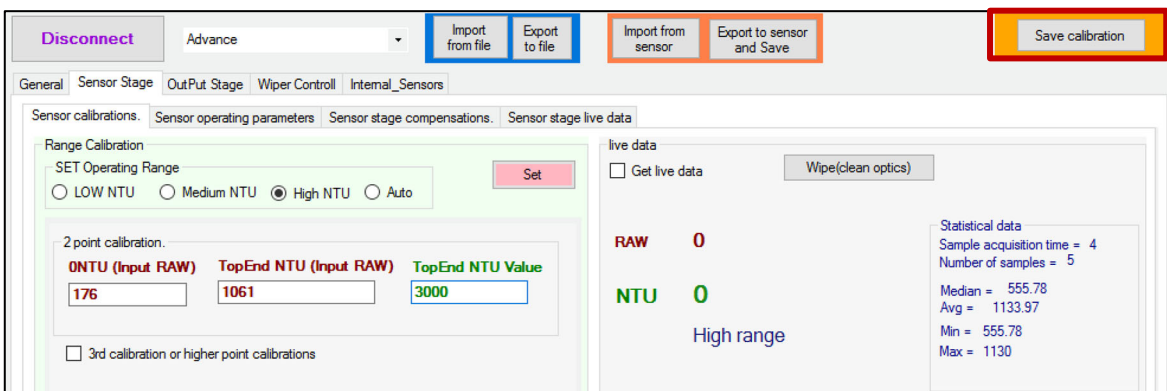


Figure 10.QQ: Set the high-range top calibration value

Note: It is recommended that you export the newly calibrated data to a file for future use.

- Clean the sensor optical face using a wash solution. Move the probe up and down in the water. Make sure you never touch the optics. Then dry the sensor with the air duster or cloth.



Figure 10.RR: Wash and dry the sensor

Two-point high-range calibration has now been completed.

Note: Please follow to the multi-point calibration procedure if required for your application. Refer to [“NEP-5000 multi-point calibration”](#) application note for further information.

11 Frequently Asked Questions (FAQ) - do/don't

11.1 Calibration

How often should I calibrate my probe?

The factory calibrations are guaranteed to provide 1% total accuracy for all ranges for 1 year. After the 1-year period, the total accuracy may reduce. It is recommended that the user verifies the calibration once a year and if calibration is required, the user may do one of the following.

1. Calibrate by the user via a 2-point calibration process described in this manual.
2. Send the unit to Observator Instruments Australia for a full service and calibration of the sensor (highly recommended).

Where do I get calibration standards from?

NEP-5000 family sensors can be calibrated using a variety of turbidity standard solutions (AMCO Clear®, StableCal® or formazin) with appropriate calibration containers which can be purchased from Observator Instruments Australia or GFS chemicals.

What is a 2-point calibration?

2-point calibration is a calibration of turbidity ranges using 0NTU and range top turbidity NTU value such as: 100NTU, 400NTU, 5,000. NEP-5000 family sensors consist of 3 ranges; hence, the user requires up to 4 solutions to complete the calibration.

Can I read data via calibration software?

- Yes, to obtain measurements via calibration software, the user requires to connect the sensor to the PC software using the calibration box. Please refer to **chapter 0**: “

Connect to the calibration software”.

Where do I get the factory calibration files from the web?

Refer to **section 10.4.4**: “Load the optical profile” or download the appropriate CFG file (match serial number) from the “Analite website” and apply it to the sensor.

How can I connect my sensor to the computer?

- The user requires to have a calibration module as well as a capable Windows PC. Please refer to **chapter 0**: “

Connect to the calibration software for further details.

11.2 RMA Requests

How do I request/arrange a servicing of my sensor? How do I request a Return Merchandise Authorization (RMA)?

Please contact your distributor or contact Observator instruments directly through the "Observator website".

Observator Instruments:
Tel: +61 3 8706 5000, Fax: +61 3 8706 5049
Email: sales.au@observator.com

What information should I provide prior to shipping?

Please fill out the "RMA request form" provided by Observator Instruments.

11.3 SDI-12

Why can't I get my SDI-12 probe to work with my logger?

NEP-5000 SDI-12 option offers a variety of configuration to suit many needs. So, the user must select appropriate settings prior to connecting to the SDI-12 recorder or logger. For further information, please refer to **section 7.2.3**: "SDI-12 mode" or "NEP-5000-SDI-12, RS485 and Analogue: wiper operations" Application note.

How can I enable SDI-12 option?

Please refer to **section 7.2.3**: "SDI-12 mode".

11.4 Analog

How can I enable Analog option?

Please refer to **section 7.2.4**: "Measurement via Analog interface".

11.5 User maintenance:

What maintenance regime do I require?

Please refer to "Wiper Replacement" Application note.

Can I buy replacement wipers and mount them myself?

Please refer to "Wiper Replacement" Application note document.

Where can I find the technical support contact details?

Observator Instruments:
Tel: +61 3 8706 5000, Fax: +61 3 8706 5049
Email: sales.au@observator.com

11.6 Software

Should I install the latest software?

No, updates are done to fix bugs or add features. Not all firmware updates are necessary for every customer; hence please use the firmware that originally worked for your application. For further information, please refer to "Firmware-updating-procedure" Application note.

Where do I get the latest software from the web?

You can "download" the latest software from the Analite website.

11.7 Deployment

What minimum clearance is required from the probe head?

Please refer to the article "Retro-scatter versus 90-degree turbidity measurement" on the Analite website.

Do I need a shroud prior to installation?

Yes, it is highly recommended to employ a shroud to protect the optics and block any unwanted light signal entering into the optics. Please refer to application note "Shroud Installation" for further information.

12 Electrical conformity

EC Declaration of Conformity according to Council Directives 2014/30/EU and 2011/65/EU

We, Observator Instruments Pty. Ltd., declare under our sole responsibility that the following products:

Analite NEP-5000 series turbidity sensors,
Analite NEP-9000 series turbidity sensors,
Analite OEM turbidity sensors

manufactured by:

Observator Instruments Pty. Ltd.

to which this declaration relates, are in conformity with the protection requirements of Council Directives:

2014/30/EU on the approximation of the laws relating to Electromagnetic compatibility and
2011/65/EU with adaption 2015/863/EU on the restriction of hazardous substances in electrical and
electronic equipment.

This Declaration of Conformity is based upon compliance of the product with the following harmonized
standards:

Electrical equipment for measurement, control and laboratory use: EN61326-1:2013
Electromagnetic Compatibility Part 3-2: EN61000-3-2:2014
Electromagnetic Compatibility Part 3-3: EN61000-3-3:2013
RoHS compatibility: EN63000:2018.

Signed by:



Dana Galbraith – Managing Director

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Scoresby, VIC 3179 AUSTRALIA



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