ANALITE

ANALITE
NEP495
TURBIDITY AND TEMPERATURE LOGGING PROBE

INSTRUCTION MANUAL

kenelec scientific
measuring up

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ANALITE NEP495 Turbidity Logging Probe

Instruction Manual

Contents

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ANALITE NEP495 Turbidity Logging Probes

FOR THE CONVENIENT LOGGING OF TURBIDITY AND TEMPERATURE

Introduction

The ANALITE NEP495 turbidity probes can monitor and log turbidity and temperature in a sturdy self-contained package that is easy to set up and easy to selectively download the data collected.

The ANALITE NEP495 microprocessor based turbidity probe is designed for monitoring and logging applications where turbidity levels of up to 1,000NTU may be encountered. Available ranges are 40NTU, 100NTU, 400NTU and 1,000NTU, which can be set by the user. The ANALITE NEP495 probe, with its integral wiper assembly, is designed to operate over an extended period of time where bio-fouling or sedimentation build-up is likely. The ANALITE NEP495 turbidity probes may be submerged to a depth rating of 100 meters (approx. 330 feet).

All ANALITE NEP495 probes use 90° optics and employ infrared light in accordance with ISO7027 and use a unique modulation technique that ensures almost total rejection of ambient light conditions. The salient features of the ANALITE NEP495 probes are tabled below:

Feature	NEP495
RS232 Interface	Yes
Integral and Auto Wiping	Yes
Turbidity Logging	Yes
Temperature Logging	Yes
User Range Select	Yes
User Calibrate	Yes
Firmware Upgradeable	Yes

The user may calibrate the probe at any time as well as allowing later versions of firmware to be uploaded by the user via the RS232 interface.

The ANALITE NEP495 probes are similar to the ANALITE NEP395 probe but with the inclusion of temperature measurement and a flexible self contained logging function. As normally supplied, the ANALITE NEP495 can store over 30,000 data sets with each data set consisting of turbidity, temperature, time and date. Logging intervals can be set from less than 1 second to over 18 hours. Data is stored in non-volatile memory.

The ANALITE NEP495 is self-contained requiring no external power or commands once logging has commenced. The internal batteries have a life expectancy of over 30,000 data sets or about 60 days - whichever comes first and assuming a wipe prior to each reading.

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Applications

The applications suited to the ANALITE NEP495 probes are so extensive and too numerous to elaborate on in this document but generally they include:

1) Monitoring of streams and rivers.
2) Monitoring of water storage bodies including stratification studies.
3) Intermediate and final effluent treatment monitoring.
4) Environmental impact studies.
5) Hydrological run off studies.
6) Ground and bore water analysis.
7) Water filtration efficiency.
8) Industrial process monitoring.
9) Sludge and dredge monitoring.

Although advanced digital processing in the ANALITE NEP495 will effectively measure the true turbidity of water when large particle are passing by the optical face it is recommended that steps be taken to protect the optical face from possible abrasive effects these particles may cause. 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.

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Specifications

Technique	90° Infra-Red (ISO7027).
Range	40, 100, 400 and 1,000NTU – set by user, factory default setting is 100NTU.
Resolution	**Range** **Resolution** 40NTU ±0.01NTU 100NTU ±0.02NTU 400NTU ±0.1NTU 1,000NTU ±0.2NTU
Repeatability	±1% at 25°C.
Linearity	Better than 1% for 40NTU, 100NTU and 400NTU, 3% for 1,000NTU (using 3 point calibration).
Temperature	-10°C to 50°C with ±0.1°C resolution and ±0.5°C accuracy. Time constant 50 seconds in water.
Output	RS232 – 1200, 2400, 4800 or 9600BPS, 7 data bits, even parity, one stop bit. The factory default setting is 9600BPS. VT100 emulation.
Measurements	**RS232 Realtime** Latest turbidity measurement -1 sample. Mean and Sample Variance (over 100 samples). Median (over 100 samples). Minimum (over 100 samples). Maximum (over 100 samples). Probe battery voltage. External (water) temperature. **Logging** Each logging point generates a data set containing: Turbidity in NTU External (water) Temperature in °C Time at which the data set was recorded. Date on which the data set was recorded.
Logging Interval	User set, from 1 second to over 18 hours in 1 second increments. Factory set to 900 seconds (15 minutes).
Data Capacity	32,000 data sets minimum but depends on memory capacity installed in the probe. Memory technology is non-volatile FlashRAM Logging stops when memory is full.
Calibration	Turbidity - 2 or 3-point calibration for each range. May be set by the user only through the RS232 interface and for the range selected. Can revert back to factory calibration settings after user calibration. Temperature – factory calibration only.
Power	3 off 1.5 V batteries – C cells alkaline. Battery drain - 0.9mA STANDBY, 15mA ON, 40mA ON and wiping all at 4.7V.
Wipe Time	8 seconds nominal.
Weight	1.6kg - probe including batteries. Shipping weight – 3kg.
Dimensions	502mm long overall, 38mm diameter max.

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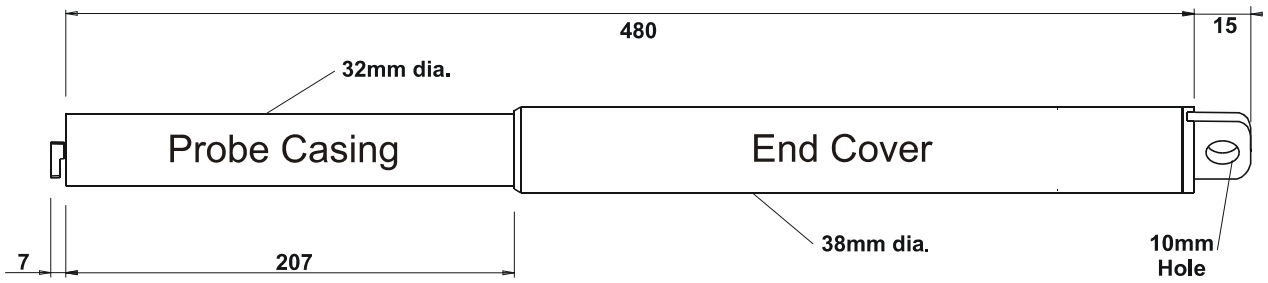
Construction	316 Stainless steel casing. Optic face is polished PVC and acrylic fibres. Screw on End Cover to allow battery replacement and PC connection via RS232 interface.	
Depth Rating	100m (330ft) static water column.	
Operating Temp.	-10°C to 50°C.	
Storage Temp.	-20°C to 55°C.	
Data Cable	5 core + shield, 6mm dia. with female DB9 connector for PC end and external dc power connector (centre pin = negative).	
Data Cable Length	3 meters standard.	
Ordering Details	ANALITE NEP495 Turbidity Probe incl. 3m data cable	NEP495
	Data Cable for NEP490 series – 3 meter length	NEP495-CBL
	Protective shroud for optic end, 38mm OD.	NEP49SHRD
	Wiper kit includes 4 wipers and hex key	NEP19WIPE
	O ring kit for NEP495 Probe Casing – 2 O rings	NEP49OKIT

Physical Dimensions



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Installation

There are two aspects to consider when preparing to install an ANALITE NEP495 turbidity probe in the field.

1) Installation of the probe proper into the environment where measurements are to take place.
2) Connection of the probe into the data collection and control system.

Probe Installation

The probe is normally installed with the optics pointing downwards or in a horizontal alignment. In a simple application the probe is simply immersed into the water to the desired depth, but within the depth rating of the probe. Please note the depth rating is based on static water. Allowances must be made for the effect of flowing water to ensure the static depth rating is not exceeded. If the probe is to be installed downwards then it is recommended to install it a few degrees away from the vertical to allow air bubbles to escape easily from the optic face of the probe.

It is important that the optic end of the probe is kept clear of obstruction such as the riverbed. The minimum distance between the optic head and any object should be 50mm (2”).

The casing of the ANALITE NEP495 probe is made of type 316 stainless steel but the optic face is made of a plastic material and so should be protected from accidental scratching or abrasion. To avoid crevice corrosion on the 316 stainless steel casing in salt water deployments it is strongly recommended that the probe be thoroughly washed in clean water after deployment and prior to storage. Failure due to crevice corrosion is not covered under warranty.

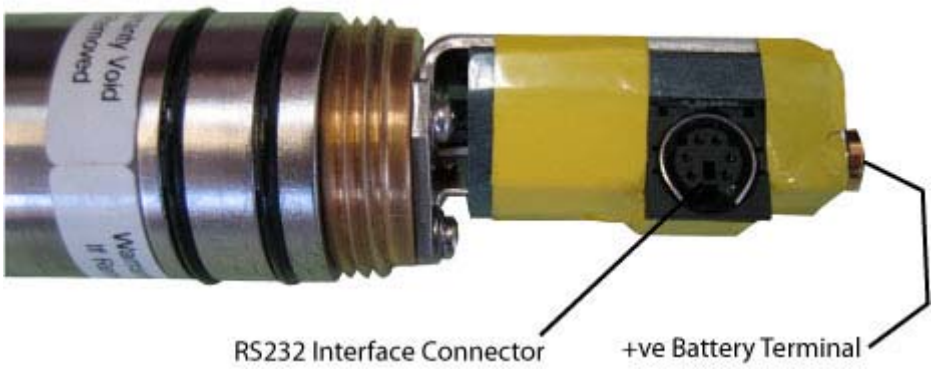
If the probe body is to be installed in a glanded fitting (for insertion into a pipe etc.) then care must be taken to ensure the sealing surface pressures offered by the gland fitting are not excessive so as to not cause distortion of the probe casing and force leakage. The ANALITE 495 is a thin walled instrument and so glanding pressure must be minimal and spread over the largest possible area.

Probe RS232 Connection

All ANALITE NEP390 series and NEP495 probes have an RS232 interface. Connection between a NEP495 probe and an RS232 port on a PC is best done using the NEP495-CBL assembly provided as it offers the simplest connection. The NEP495-CBL is provided as standard with the NEP495 but may also be purchased as a spare part.

Connect the NEP495 probe to the COM (RS232) port of a PC by first unscrewing the end cover anti-clockwise off the probe casing. Point the end cover downwards whilst unscrewing it from the probe casing as it contains the batteries and they may otherwise fall out. Withdraw the end cover away from the probe casing gently and in line with the probe casing so as not to damage the two sealing “O” rings at the end of the probe casing. Put the end cover with its batteries to one side.

The end of the probe casing will reveal a small multi-pin connector. This is the NEP495’s RS232 interface point.



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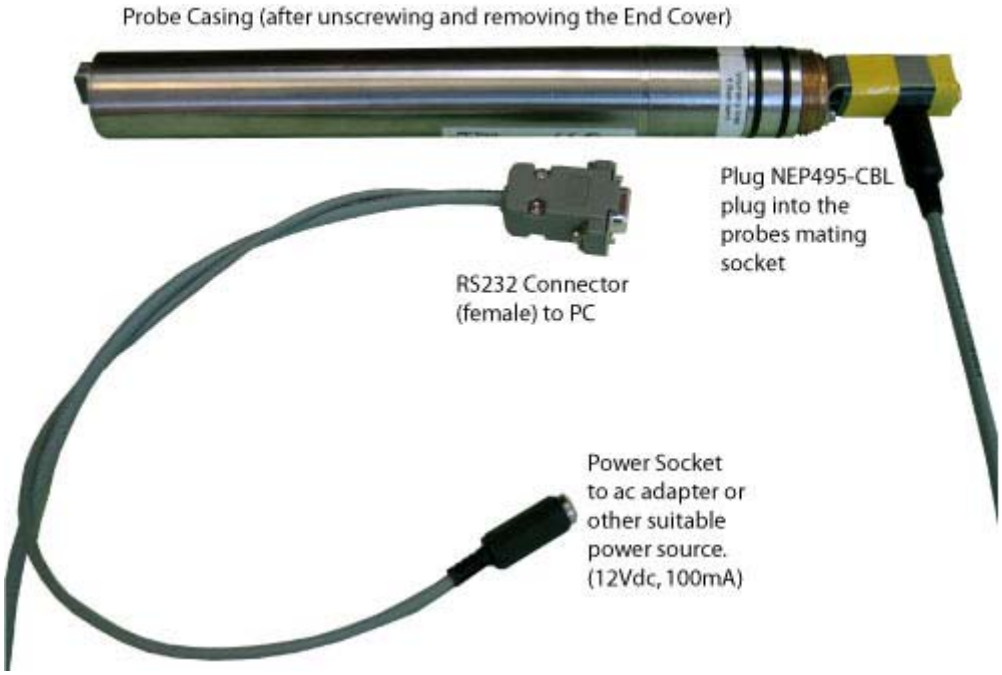
Connect the mating connector of the NEP495-CBL cable assembly provided to this connector.



The probe must be externally powered during configuration or data download. Connect a suitable 12Vdc source to the power socket on the NEP495-CBL cable provided. The centre pin of this socket is negative polarity (-12Vdc).

A specification for a suitable ac adapter is provided near the end of this manual.

Connect the RS232 DB9 connector to a PC COM port.

Communications with the probe can then be set up using common communication software normally supplied with most operating systems. Refer to the Operating System documentation for details on setting up a communication port and configuring its parameters. For Windows 95/98/2000/XP, you can use HyperTerminal.

Set the communications parameters on the PC to 9600BPS, 7 data bits, even parity, one stop bit and Flow Control set to NONE. Where terminal emulation is available, select VT100.

With the communications setting properly configured to the selected COM port and the communication program running connect the female DB9 connector at the other end of the cable assembly to the selected COM port on the PC. You should obtain the response "Ready" from the probe after a short while. Then enter the **`status`** command followed by the Enter (↵) key; the following typical response should result:

```
VCC = +5.0 V
Vbatt = +4.5 V
Mot = 0 mA
Int = +22.5 C
Ext = +23.6 C
```

Where **Vcc** is the internal regulated voltage supply within the probe. It should be between 4.9 to 5.1 volts. The **Vbatt** parameter is the battery voltage within the probe or the ac adapter voltage if connected. It should be between 4.8 to 3.5Vdc for the battery voltage and about 13Vdc when the ac adapter is connected. **Mot** represents the wiper motor current and should be 0mA when not operating or not fitted. **Int** and **Ext** represent the internal temperature of the probe and the measure external temperature respectively and should realistically reflect the probes environmental situation. The internal temperature measurement is used for temperature correction over the range –10°C to +50°C.

The probe is now ready to respond to other RS232 commands.

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RS232 Command Set

All ANALITE NEP390 series and NEP495 probes allow for RS232 connection and share a common RS232 command set as well as commands specific only to the NEP495. All commands must be entered in lower case.

The RS232 Command Set allows for the setting up and calibration of the ANALITE NEP495 probes as well as obtaining sensor data. RS232 connection between a probe and a PC is best implemented using the data cable provided. Refer to the **Installation** section for more details.

Command Set Listing

The RS232 interface is factory set to operate on 9600BPS, 7 data bits, even parity and one stop bit but can be set to slower rates using the NEP495 only **baud $** command. All RS232 commands are lower case. All commands should result in a response from the probe. Using the Enter (↵) key before entering another command should terminate entry of an incorrect or mistyped command.

NEP390/495 Commands (these command are common to both the NEP390 series and the NEP495)

Command	Title	Comment
help	Listing of NEP390/495 commands.	Returns a list of all common NEP390/495 commands and a brief description of function and format.

status	Probe identity and internal conditions.	Typical NEP495 return is:
		`Vcc = +5.0 V  Probe supply`
		`Vbatt = +5.5 V Battery voltage`
		`Mot = 0 mA  Motor current`
		`Int = +23.6 C  Internal probe temp'`
		`Ext = +23.6 C  External temp'`

single	Take single turbidity measurement.	Returns a "`Starting single`" response followed by a single turbidity measurement a short time later.
measure	Take 100 measurements.	Returns a "`Starting measure`" response followed 100 measurements in sequence followed by their minimum, maximum, mean, median and sample variance.
wipe	Perform one wiper rotation.	Forces a single wipe rotation. Returns a "`Starting wipe`" response followed by a sequence of lines at about 1 second apart corresponding to the wiper motor current. Nominal wipe current is 20mA. The probe may return a single numeric 1 or 2 in the event of an error. 1 = Motor current exceeded. 2 = Wiper time exceeded.
autosingle $	Set auto single measurement period	Allows the return of single measurement data at predetermined interval $. $ can take the range of 0 to 65,500 seconds where 0 represents the instruction to never measure automatically. The probe will return the response "`$ sec auto-single`" followed by a turbidity measurement at the selected interval. The **save** command must be used to permanently change to the selected interval.

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sstats	Outputs statistic of last 100 autosingle data	Returns the minimum, maximum, mean, median and sample variance of the last 100 measurements taken under the **autosingle** command. Should the internal buffer not yet have 100 measurements the probe will return the response "`NO DATA`".
autowipe $	Set auto wipe period.	Sets the automatic wipe time within the probe. The probe returns a "`$ sec auto-wipe`" response. This will ensure a wipe at regular interval. The period timer is reset after each wipe whether initiated by the **autowipe** command, the **/w** switch or by the **wipe** command. $ can take the range of 0 to 65,500 seconds where 0 represents the instruction to never wipe automatically. The **save** command must be used to permanently change to the selected period.
automeas $	Set auto measure period.	Allows the return of data at predetermined intervals $. The probe returns a "$ sec auto-measure" response. $ can take the range of 0 to 65,500 seconds where 0 represents the instruction to never measure automatically. The **save** command must be used to permanently change to the selected interval.
range $	Select range of measurement (0 to 3).	Sets the probes measurement range: 0 = 1,000NTU 1 = 400NTU 2 = 100NTU 3 = 40NTU. The probe returns a "`$ selected`" response. Factory default value is 2 (100NTU). The **save** command must be used to permanently change to the selected range.
temp $	Set temperature compensation.	Sets the probes temperature compensation in % per degree. Normally set at about 0.43%/°C. It is not recommended that this be altered unless thorough temperature compensation tests have been conducted. The **save** command must be used to permanently change to the selected compensation setting.
zero	Set zero NTU calibration point.	Calibration command. Sets the zero calibration point for the selected range.
low $	Set low NTU calibration point.	Calibration command. Sets the middle calibration point for the selected range – used for 3-point calibration only.
high $	Set high NTU calibration point.	Calibration command. Sets the high-end calibration point for the

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		selected range – used in both 2-point and 3-point calibrations.
calibrate	Apply new calibration points (3 point).	Activates the new calibration points for 3-point calibration but does not save them.
calibrate2	Apply, ignoring middle point (2 point).	Activates the new calibration points for 2-point calibration (disregards the low $ point) but does not save them.
save	Save calibration points to memory.	Saves permanently the calibrations points set up by the user using the **calibrate2** and **calibrate** commands. Also permanently saves any changes to the **range**, **automeas**, **autosingle**, **autowipe, logInt** and **temp** parameters.
factory	Restore factory calibration.	Returns probe to factory calibration points.

(note: $ stands for a decimal value that must be supplied)

NEP495 Only Commands

help log	Listing of NEP495 only commands.	Returns a list of all NEP495 only commands and a brief description of function and format.
baud max		Returns a message indicating the maximum permissible RS232 baud rate.
baud $	Set up new RS232 baud rate.	$ can currently be 1200, 2400, 4800 or 9600.
date ?	Returns the probe date.	The returned format is yyyy.mm.dd.
time ?	Returns the probe time.	The returned format is hh:mm:ss in 24 hour format.
date yyyy.mm.dd	Set date.	Sets a new date in the probe. No **save** command is required.
time hh:mm:ss	Set time.	Sets a new time in the probe. No **save** command is required.
logint $/w	Sets the logging interval.	The logging interval $ may any integer from 0 to 65,500 seconds. In the case of $ = 0 the logging interval as at the maximum rate of approximately 0.5 second. The **/w** switch is only used when a wipe is required just prior to the measurement. The **save** command must be used to permanently change to the selected interval and the **log on** must be used to commence the logging.
logfree	Returns available data memory.	This indicates the amount of free memory available for data sets. A typical probe response is "`Room for 31200 more log entries`".

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log on	Starts logging.	Logging will commence at intervals set by the **logInt** command. The probe responds with the message "`Logging On`".
log off	Stops logging.	Logging will cease. All data will be stored in the probes non-volatile memory module. The probe responds with the message "`Logging Off`".
download	Downloads all collected data.	The default format is an underscore delimited ASCII output with each line comprising one data set. The data is preceded with a header. The output format can be changed by adding a **/c** switch at the end of the command. The **/c** switch is used to download data in a comma delimited format. The format structures are detailed in the next section of this manual.
download a to b	Downloads data within defined constraints.	Collected data is download within the two constraints a and b, where a and b may be a date or date_time or logged record number. The output format can be changed by adding a **/c** switch at the end of the command. The **/c** switch is used to download data in a comma delimited format. The format structures are detailed in the next section of this manual.
download from a	Downloads data from the data point a.	Collected data is download from the constraint a, where a may be a date or date_time or logged record number. The output format can be changed by adding a **/c** switch at the end of the command. The **/c** switch is used to download data in a comma delimited format. The format structures are detailed in the next section of this manual.
download to b	Downloads data up to the data point b.	Collected data is download up to (and including) the constraint b, where b may be a date or date_time or logged record number. The output format can be changed by adding a **/c** switch at the end of the command. The **/c** switch is used to download data in a comma delimited format. The format structures are detailed in the next section of this manual.
abort		Aborts a download in progress.

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purge	Clears logger memory.	Clears all memory of data collected from previous logging session. The logging function must be off using the **log off** command. A confirmation question will be presented and only a response of **Y** (uppercase) will affect the **purge**.

(note: $ stands for a decimal value that must be supplied,
a and b may be in date, date_time or record number as defined below:

date:	yyyy.mm.dd
date_time:	yyyy.mm.dd_hh:mm:ss
record number:	1 to logsize (max = 32,000)

Data Set Output Format Structures

When sending the command a **download** command, the data format is as follows:

Header
Data Sets

The exact format depends on whether a switch (/) has been included at the end of the download command. If a switch is not included the output is an underscore delimited ASCII string. If the /c switch is included the output is a comma delimited ASCII string.

Default download command (not including a switch at the end of the command):

Header

NEP49x_Vx.x_P#####_DATA_9999999<cr><lf>
Range_r_Place _d_Cal_u_v_w_x_y_z_TempCo_ttt_TempAdj_a<cr><lf>

Where:
_ represents an underscore (delimiter),
NEP49x is the model number, normally NEP495,
Vx.x is the firmware version,
P##### is the probes serial number,
9999999 represents the total available memory in data sets (determined by memory module installed),
<cr> represents a carriage return,
<lf> represents a line feed.
r = the range value (0 to 3).
d = the number of decimal places of the NTU reading.
u, v, w, x, y, z = calibration constants determined during calibration.
ttt = the probe temperature coefficient in 0.ttt%/°C.
a = the temperature adjustment coefficient.

Data Sets

yyyy.mm.dd_hh.mm.ss_DDDDD.DD_NTU_TT.T _C_r<cr><lf>

Where:
yyyy.mm.dd represents the date the data set was logged (all numerals),
_ represents a underscore (delimiter),
hh:mm:ss represents the time the data set was logged,
DDDDD.DDNTU is the measured value of turbidity at the date/time of the data set (leading zeros are suppressed),
TT.T C is the measured value of temperature in °C at the date/time of the data set (leading zeros are suppressed,
r is the range value (0 to 3).

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Alternate download command (including /c switch at the end of the command):

Header

Analite Turbidity Probe, McVan Instruments.
Serial Number: #####
Log Download for date: dd mm yyyy

Range, Places, Cal x0, Cal y0, Cal x1, Cal y1, Cal x2, Cal y2, Temp Coeff, Temp Adj
r, d, u, v, w, x, y, z, ttt, a

Date (Y.M.D), Time (H:M:S), Turbidity, External Temperature, Range

Data Sets

yyyy.mm.dd,hh:mm:ss,DDDD.DD,TT.T,r

At the end of any download the last line will be:

End of Download. X log records sent.

Where x is the number of data sets downloaded

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Calibration and Solutions

The ANALITE NEP495 probes are factory calibrated in all ranges but may be recalibrated by the user. Calibration may be either 2-point or 3-point and can only be done using the RS232 command set. For most applications, particularly when using the 40, 100 and 400NTU ranges, a 2-point calibration will be adequate. However, for the most critical applications and for the 1,000NTU range, a 3-point calibration may be required. Please note that factory calibration is 2 point on all ranges using zero and the end range values as calibration points, so for example for the 100NTU range the two points set were zero and 100NTU.

A 2-point calibration assumes the probe transfer curve is linear following the general equation $y=bx+c$, whereas the 3-point calibration assumes it to be a second order polynomial with the general equation $y=ax^2+bx+c$.

2-point calibration of a selected range

Enter selected range to be calibrated (e.g. 0 - 40NTU - range 3)

range 3↵

The probe will respond:

```
Range 3 selected.
```

Place the probe into the ZERO NTU calibration solution and then enter

measure↵

A typical probe response may be:

```
+5.78 NTU        1710 raw
+5.34 NTU        1577 raw
```

A TOTAL OF 100 readings are taken and displayed

```
+5.75 NTU        1702 raw
+5.96 NTU        1765 raw


+5.23 NTU min
+6.39 NTU max
+5.69 NTU mean
+5.69 NTU median
+0.0388 NTU2 variance
```

Assign the mean of the raw data to be equal to ZERO NTU turbidity by entering:

zero↵

Probe response:

```
Raw 1685 = +0.00 NTU
```

Next place the probe into the 40NTU calibration solution and then enter

measure↵

A typical probe response may be:

```
+43.76 NTU      13719 raw
+43.76 NTU      13728 raw
```

A TOTAL OF 100 readings are taken and displayed

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```
+43.33 NTU      13615 raw
+43.58 NTU      13679 raw


+42.78 NTU min
+44.34 NTU max
+43.58 NTU mean
+43.61 NTU median
+0.0746 NTU2 variance
```

Assign the mean of the raw data to be equal to 40 NTU by entering:

high 40↵

Probe response:

```
Raw 13697 = +40.00 NTU
```

Complete the 2-point calibration by entering:

calibrate2↵

Probe will respond with:

```
Applying
```

Test each reference point again, read the turbidity of each by placing the probe into each solution and then enter:

single↵

The result should be a reading very close to the calibration solution value. After confirming the correct calibration of the range, the calibration constants may be stored into the probes permanent memory by entering the command:

Save↵

Probe response is:

```
Saved
```

If the **save** command is not executed then the new calibration points will be lost when the probe is powered down.

Repeat the above procedure for all the ranges to be calibrated. Make sure that the save command is followed by the correct response. Repeat the procedure for range 2 (0 - 100NTU) using a zero solution and the 100NTU solution, range 1 (0 - 400NTU) using a zero solution and the 400NTU solution and range 0 (0 – 1,000NTU) using a zero solution and the 1,000NTU solution. Other calibration reference points may be used but it is recommended that they are not far away from the selected range limit; for example in the 100NTU range, calibration solution values of 60 to 100NTU should be acceptable

3-point calibration of a selected range

For the purposes of this example we will use the 40NTU range and use ZERO, 10NTU and 40NTU as the calibration solutions.

Enter selected range to be calibrated (e.g. 0 - 40NTU, range 3)

range 3↵

Probe response is:

```
Range 3 selected.
```


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Place the probe into the ZERO calibration solution and then enter

measure↵

Probe response is typically:

```
+5.78 NTU        1710 raw
+5.34 NTU        1577 raw
```

A TOTAL OF 100 readings are taken and displayed

```
+5.75 NTU        1702 raw
+5.96 NTU        1765 raw

+5.23 NTU min
+6.39 NTU max
+5.69 NTU mean
+5.69 NTU median
+0.0388 NTU2 variance
```

Assign the mean of the raw data to be equal to ZERO NTU by entering:

zero↵

Probe response is:

```
Raw 1685 = +0.00 NTU
```

Place the probe into the 10NTU (middle) calibration solution and then enter

measure

Probe response is:

```
+10.25 NTU      6023 raw
+10.20 NTU      6989 raw
```

TOTAL OF 100 readings are taken and displayed

```
+10.22 NTU      6001 raw
+10.30 NTU      6052 raw

+9.85 NTU min
+10.50 NTU max
+9.82 NTU mean
+10.17 NTU median
+1.2620 NTU2 variance
```

Assign the mean of the raw data to be equal to 10 NTU by entering:

low 10↵

Probe response is:

```
Raw 5785 = +10.00 NTU
```


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Place the probe into the 40NTU (high-end) calibration solution and then enter

measure↵

Typical probe response may be:

```
+43.76 NTU      13719 raw
+43.76 NTU      13728 raw
```

A TOTAL OF 100 readings are taken and displayed

```
+43.33 NTU      13615 raw
+43.58 NTU      13679 raw

+42.78 NTU min
+44.34 NTU max
+43.58 NTU mean
+43.61 NTU median
+0.0746 NTU2 variance
```

Assign the mean of the raw data to be equal to 40 NTU by entering:

high 40↵

Probe response is:

```
Raw 13697 = +40.00 NTU
```

Complete the Three Point calibration by entering:

calibrate↵

Probe response:

```
Applying
```

Test each reference again, read the turbidity of each by placing the probe into each solution and then by entering:

single↵

After confirming correct calibration of the range has been achieved the calibration factors are stored into the probes permanent memory by entering the command:

Save↵

Probe response is:

```
Saved
```

If the **save** command is not executed then the new calibration points will be lost when the probe is powered down.

Repeat the above procedure for all the ranges to be calibrated. Make sure that the save command is followed by the correct response. Repeat the procedure for range 2 (0 - 100NTU) using a zero solution and two other values, range 1 (0 - 400NTU) using a zero solution and two other values and range 0 (0 - 1,000NTU) using a zero solution and two other values.

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Calibration Solutions

Because a turbidity probe is inherently an optical device, care must be taken during calibration to ensure that external effects are kept to a minimum. This is best implemented by placing calibration solutions in dark, leakproof bottles with a non-reflective finish such as Nalgene® 2106 bottles in amber. These are available with wide necks and a nominal capacity of 1,000ml.

Another important factor is cleanliness. Any debris or water that makes its way into the calibration solutions will affect its value and adversely affect the proper calibration of an instrument. It is therefore a good practice to have an ample supply of distilled de-ionized water and a means of properly drying the probe end (clean compressed air is ideal). Probes should be flushed in two containers of distilled water with thorough drying in between and before insertion into a calibration solution. Also where ever possible, calibration should commence at a lower value (usually zero) and work up in value to further minimize the effects of cross contamination.

10NTU, 20NTU, 100 NTU, 400NTU and 1,000NTU neutral-density polymer-based turbidity standards specifically tailored for the ANALITE ISO7027 compliant probes are available from McVan Instruments and their distributors, or directly from the manufacturer[1] for US customers only. We recommend the use of these standards and distilled de-ionized water (for ZERO) for a 2 or 3-point calibration. These standards should not be diluted, as this will reduce the effect of the anti-fungal agent contained in the solutions.

When inserting the ANALITE NEP495 probe into the calibration solution ensure that the optic face of the probe is at least 50mm from the base and all sides of the bottle and submerged at least 10mm. This is particularly important for low turbidity solutions below 200NTU. Hold the probe a few degrees from the vertical and gently tap it on the bottle rim so as to dislodge any air bubbles on the optic face. If the probe is properly placed the measurement value will not vary if the probe is gently moved a few millimeters in any direction.

Although the user selects the calibration solution values, a few points should be kept in mind when selecting the calibration solution values.

1. To ensure the selected range is useful the high-end calibration solution should have a value near the full-scale range limit.

2. The zero point must always be ZERO NTU. In a 3-point calibration, the low point solution value should be 20% or less of the high point high point solution value. Using a low point value that is outside the guideline band may result in a **`Bad Calibration Data`** message from the probe during calibration. If a **`Bad Calibration Data`** message is received the calibration process is not complete and under no circumstances should the range be used or saved until a valid calibration has been completed.

Below is a table of suggested calibration solution values. The user may use other values dependent on the application and the turbidity measurements anticipated. Given the excellent inherent linearity of the NEP495, a 3-point calibration is normally only required for the 1000NTU range.

Range	Low Point (3-point only)	High End Point (2 and 3 point)
40NTU	5NTU	40NTU
100NTU	20NTU	100NTU
400NTU	50NTU	400NTU
1,000NTU	200NTU	1,000NTU

Formazin-based turbidity standards can also be used to calibrate the system. These standards can either be prepared as described in Standard Methods for the Examination of Water and Wastewater or by volumetric dilution of 4,000 NTU Formazin standard solutions.

CAUTION: Formazin contains material that can cause cancer. If you use this material for a calibrant, be certain to pay close attention to the warnings provided by the supplier.

[1] GFS Chemicals, Columbus, Ohio, USA.

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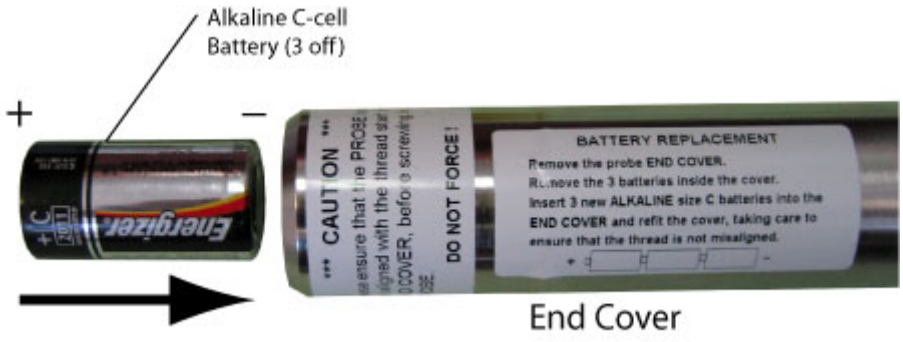
Battery Replacement

The NEP495 requires three high quality standard alkaline C-cell batteries. Other types of batteries may cause damage or unreliable operation and will void the warranty.

To install or replace the batteries unscrew begin by first unscrewing the end cover anti-clockwise off the probe casing. Point the end cover downwards whilst unscrewing it from the probe casing as it contains the batteries and they may otherwise fall out. Withdraw the end cover away from the probe casing gently and in line with the probe casing so as not to damage the two sealing “O” rings at the end of the probe casing. Put the probe casing carefully to one side.



Remove any installed batteries by simply tipping them out. Place in the three new C-cells in the end cover with the negative terminals entering the tube first. Make sure the first battery makes contact with the contact spring at the end of the end cover. Ensure the subsequent batteries make contact with the previously inserted battery.

Screw the probe casing into the end cover carefully ensuring the threads are properly aligned and the “O” rings properly seated. Fasten the end casing onto the probe casing firmly but not tightly.

Wiper Replacement

The effectiveness of the wiper in maintaining a clean optical surface will eventually be compromised, the rate being dependent on the water under investigation and the number of wiping cycles carried out. We recommend periodic inspection of the wiper’s silicon pad to determine if the wiper material is deteriorating or if there is an excessive build up of material from bio-fouling. In addition, as a precaution we recommend changing the wiper prior to each long term deployment. The wiper is a consumable item. Wiper packs are available from McVan Instruments or their distributors (Part No. NEP19WIPE).

It is strongly recommended that the wiper be replaced prior to a new deployment. After a deployment, the wiper pad may dry out and the collected material adheres to the probe face. Operating the wiper under such conditions could then damage the internal mechanics. Such damage is not covered under warranty.

To change the wiper, loosen the set screw on the old wiper with the 1.5mm hex key provided until the wiper can be removed from the shaft. Place a new wiper on the shaft in the same position as the wiper just removed so that the set screw in the new wiper faces the flat on the probe’s wiping shaft. Very gently press the silicon rubber pad of the wiper against the face of the probe and then tighten the set screw. It is crucial that the wiper arm body does not make contact with the probe face – only the silicon pad should be in contact. A gap of 3mm between the wiper arm body and the probe face is typical when a new wiper has been properly installed.

CAUTION: Do not over tighten the set screw or manually attempt to rotate the wiper arm once set onto the shaft. Any attempt to manually rotate the wiper may cause gearbox damage and void the warranty.

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Firmware Upgrades

The ANALITE NEP390 series and NEP495 probes are microprocessor based turbidity sensors and have been designed so that any firmware upgrades can be uploaded to replace the existing resident program within the probe. This means that as McVan Instruments improves the operation of the probe by enhancing the firmware, users can upload these improvements using a very simple procedure.

Firmware upgrades will be made available on the McVan Instruments website www.mcvan.com as they are released. The files that are download from our website will be zipped files. When unzipped, there will be at least one file. One file will have the name structure **NEP495V###.exe** where ### is the firmware version number. Other files (if included) may include text information on the upgrade details or additional User Manual information and these should be consulted before proceeding with the firmware upgrade.

Extract the **NEP495V###.exe** file and place it in a suitable directory – we suggest c:\NEP495. We will assume for the purpose of example below that the extracted file is located in the directory c:\NEP495.

Make sure all communication software programs that will take control of the selected COM port are shutdown (such as Windows HyperTerminal).

Next we enter Windows command prompt mode. This can be done by clicking on the **Start** button at the bottom left hand side of normal Windows desktop display. Select **Run..** and enter the text **cmd** followed by the ↵ (Enter) key. This will open the Command Prompt window showing a typical DOS command prompt cursor.

At the DOS cursor, change to the directory where the ANALITE Upgrade firmware file is located, e.g.:

```
cd c:\NEP495↵
```

The resultant prompt should now confirm that you are in the selected directory, e.g.:

```
c:\NEP495 >_
```

Next enter the firmware upgrade file followed by a space and the selected COM port (in this case COM1), eg:

```
NEP495V### COM1↵
```

The program will respond:

```
crc: 0xae3b
Waiting for target. (Connect to rs232 and cycle probe power.)
```

The characters following the crc: text may vary depending on the firmware version.

Set up the ANALITE NEP495 probe using the data cable supplied connected to the selected COM port on the PC.

The response in the Command Prompt window should soon then display:

```
boot mode
rs232 detected
ok
Programming
Page # of y
Verifying
Page # of y
Done
```

The ANALITE NEP495 probe has been reprogrammed with the version of firmware embodied in the file NEP495V###.exe.

All user set and calibration constants that have been saved using the RS232 save command earlier are retained during a firmware upgrade. Factory calibration constants are also retained.

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Electrical Conformity

EC DECLARATION OF CONFORMITY ACCORDING TO COUNCIL DIRECTIVE 89/336/EEC

WE, MCVAN INSTRUMENTS PTY LTD, DECLARE UNDER OUR SOLE RESPONSIBILITY THAT THE PRODUCT:

ANALITE NEP390 SERIES AND NEP495 TURBIDITY PROBES AND ACCESSORIES,

MANUFACTURED BY:

MCVAN INSTRUMENTS PTY LTD

TO WHICH THIS DECLARATION RELATES, ARE IN CONFORMITY WITH THE PROTECTION REQUIREMENTS OF COUNCIL DIRECTIVES 89/336/EEC ON THE APPROXIMATION OF THE LAWS RELATING TO ELECTROMAGNETIC COMPATIBLY.

THIS DECLARATION OF CONFORMITY IS BASED UPON COMPLIANCE OF THE PRODUCT WITH THE FOLLOWING HARMONISED STANDARDS:

EMISSIONS: EN50081-1:1992
IMMUNITY: EN50082-1:1997

SIGNED BY:

JOHN VAN DE VREEDE – DIRECTOR

DATE OF ISSUE: 1 DECEMBER 2003

PLACE OF ISSUE: MCVAN INSTRUMENTS PTY LTD
58 GEDDES STREET, MULGRAVE
VIC. 3170 AUSTRALIA

N827

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Warranty

The ANALITE NEP495 turbidity probes are warranted against defects in material and workmanship for one year from date of purchase. The warranty does not cover the batteries, wiper arm assembly, corrosion or leakage due to corrosion. Unauthorized service, tampering or abuse will void this warranty. Damage as a result of improper installation and care will also void this warranty.

Should you require service (under warranty or otherwise) please contact the McVan Instrument distributor from whom you purchased the probe, or our Service Centre. If the probe is being returned for service under warranty please supply proof of purchase.

When making queries regarding a probe (whether for warranty purposes or not) it is preferred that the serial number be given to assist us.

McVan Instrument's Service Centre
58 Geddes Street, Mulgrave
Vic. AUSTRALIA. 3170
Tel: (+61-3) 9582-7333, Fax: (+61-3) 9560-1164
Email: info@mcvan.com

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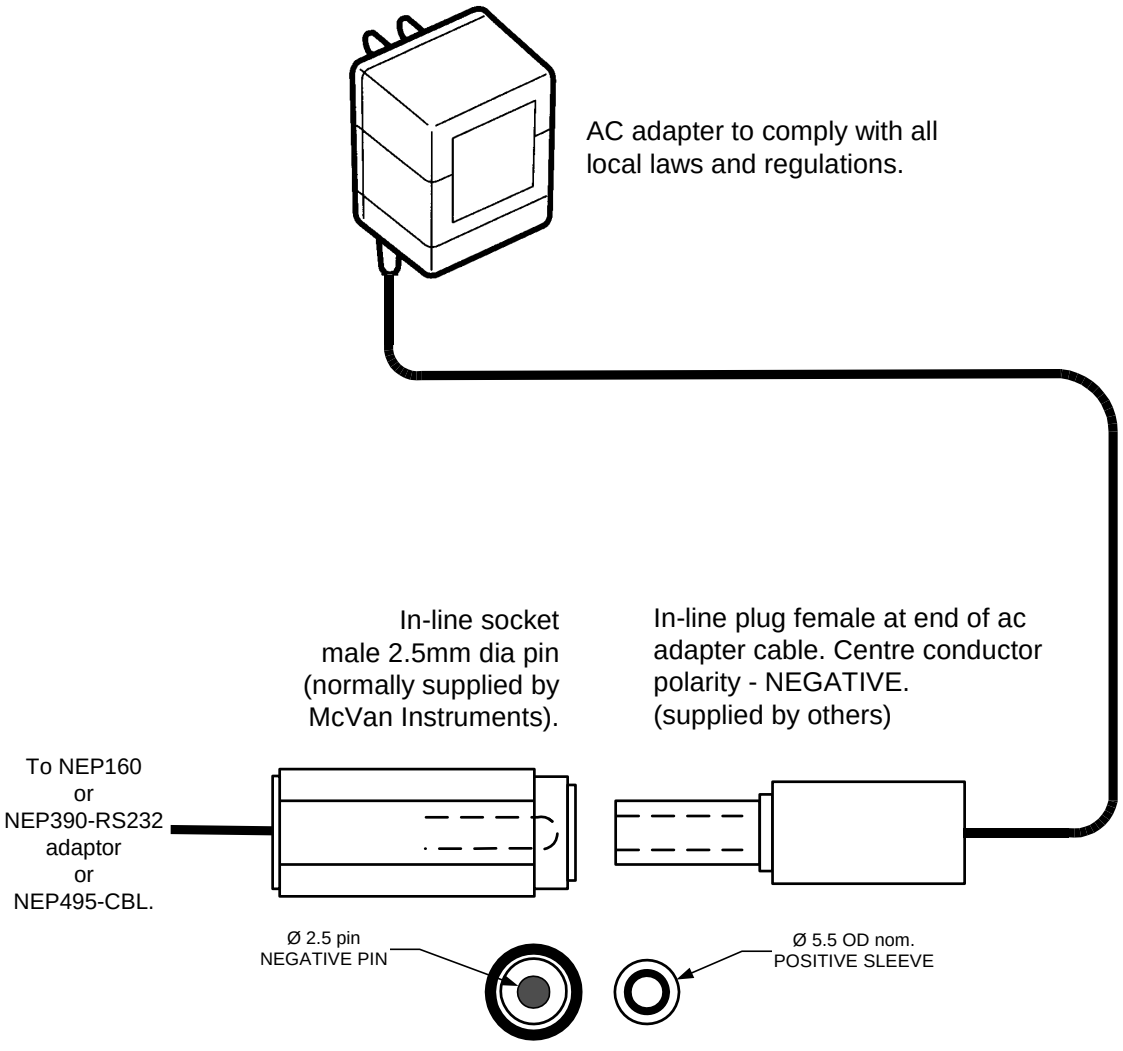
AC Adapter Specifications

Specifications:

The AC adapter shall have the following specifications to ensure proper operation of the ANALITE NEP160 or the NEP390/395 (via the NEP390-RS232 adaptor) and NEP495 (via NEP495-CBL) whenever it is powered by the AC adapter. Operation also includes the charging of the internal 6V NiMH battery assembly within the NEP160.

Output voltage:	10Vdc (min) to 16Vdc (max) over output current range.
Output Current:	Not less than 400mA (100mA for NEP390/395/495) capacity. Output voltage must remain between 10Vdc and 16Vdc over current range 0 to 400mA (100mA for NEP390/395/495).
Connection:	In-line plug female for 2.5mm centre pin (see drawing below).



All dimensions in mm unless otherwise stated

ANALITE			McVan Instruments PTY LTD Fax: (+61-3) 9560-1164, E-mail: info@mcvan.com
	Drawing	3552 D	**ANALITE NEP160 and NEP390/395/495 AC ADAPTER REQUIREMENTS**
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