V1.1 May 2021

MULTI-SENSOR BLUETOOTH INTERFACE

NexusGEO

INSTRUCTION MANUAL

GEOSENSE

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1.0 INTRODUCTION

This manual is intended for all users of the Geosense® **NexusGEO** readout unit and provides a guide for its operation and maintenance.

It is VITAL that personnel responsible for the use of the NexusGEO READ and UNDERSTAND the manual, prior to working with the equipment.

1.1 General Description

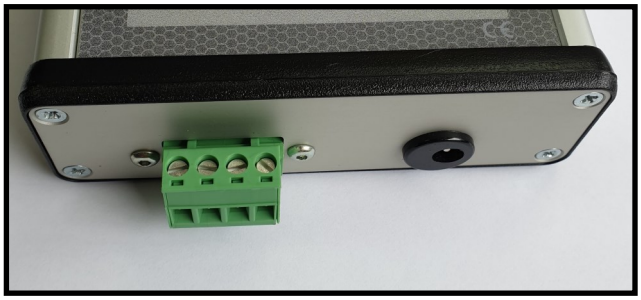
The **NexusGEO** is a portable multi-sensor battery-powered Bluetooth interface, designed to be used with any Android device with Bluetooth and android OS 8 or later* for wireless gathering and storage of sensor readings.

It is provided with a battery charger and four individually coloured leads to connect to analogue sensors and a terminal block for digital sensors.

The **NexusGEO** is to be used with a mobile application (app) which has an easy to use interface and manages data acquisition from the following single sensor outputs:

- Vibrating wire (VW)
- 4-20mA
- Volt
- mV/V
- Pt100
- NTC
- Geosense Digital RS485

Analogue connections can be made directly to the terminals, using the fly leads with crocodile clips supplied with the unit or with the green terminal block on the bottom of the unit for RS-485



*Please note that due to ever changing android device specifications, these specifications are subject to change

1.2 Theory of Operation

The **NexusGEO** is a Bluetooth interface between a range of sensors and an Android device. The raw signal output from the sensor is transferred from the **NexusGEO** to the Android device via the **NexusGEO** app and the values displayed on the Android device where they can be converted into Engineering units, stored on the device and transferred via FTP or email.

1.3 Software

The **NexusGEO** mobile application (app) allows the user to configure the device with a wide range of sensor types and download the data. It is available as a free download on the Google Play Store.

As part of continual improvement, updates to the software may occur and should be downloaded to ensure the current version is being used. Please visit the Google Play Store to check for the latest version.

1.4 Host System Requirements

- Android device with Android OS Version 8 or higher (Minimum SDK Version 19) and Bluetooth
- In order to use FTP functionality, a FTP server will be required.

1.5 EMC – Electro Magnetic Compatibility

EMC is the electromagnetic interaction of electrical and electronic equipment with other electrical and electronic equipment. All electronic devices have the potential to emit and be affected by electromagnetic fields. With the reduction in size of electrical components and the ever increasing amount of electrical & electronic devices such as mobile phones, two-way radios, safety control systems, signalling, generators, welding equipment, power cables etc in all environments, especially construction sites, there is a huge potential for devices to interfere with each other.

The **NexusGEO** has been designed and tested for EMC under the relevant CE marking directives to ensure compliance and reliable operation

1.6 Philosophy of Operation

Calibration Factors

The **NexusGEO** is designed to work with a wide-range of sensors. Most sensors will require calibration factors to convert from the raw reading into an engineering unit. All Geosense sensors are dispatched with a calibration sheet with any factors that may be needed. Digital sensors have the calibration information embedded in the sensor. The **NexusGEO** app will allow you to enter this information when you add the sensor.

Wireless Connection and Data Reading

The **NexusGEO** uses wireless Bluetooth technology to communicate between the Android device and the app. Once paired on the phone, connection can be established at the push of a button, and begin taking readings moments later. Live readings are saved temporarily in a buffer that clears when readings are stopped being taken.

Linear and Polynomial Calculations

Most sensors make use of calibration factors and raw readings to convert to engineering units using either Linear or Polynomial calculations. The equations are detailed on the calibration sheets.

Site Zero Readings

Sensors that convert to engineering units using Linear or Polynomial calculations can use a site zero reading and apply this to the result to make it relative. If you choose to not apply a site zero reading, the result will be absolute (site zero defaults to zero).

Saving Readings

As readings accumulate in the buffer, you can choose to save the readings into a database. Sensor information, raw readings and engineering conversions are all saved for reference later.

Using the Data

Saved data in the app database can then be saved to csv and sent via an FTP, Email or saved to the local phone device for future use

2.0 CONFORMITY

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Rougham Industrial Estate
Rougham, Bury St Edmunds
Suffolk , IP30 9ND
United Kingdom

Tel: +44 (0)1359 270457
www.geosense.co.uk

EC Declaration of Conformity

We Geosense Ltd at above address declare that the equipment detailed below, complies with the requirements of the following EU Directives:-

- Low Voltage Directive 2014/35/EU
- Electromagnetic Compatibility Directive 2014/30/EU
- Waste electrical and electronic equipment (WEEE) 2012/19/EU
- Restriction on the use of certain Hazardous Substances (RoHS2) 2011/65/EU

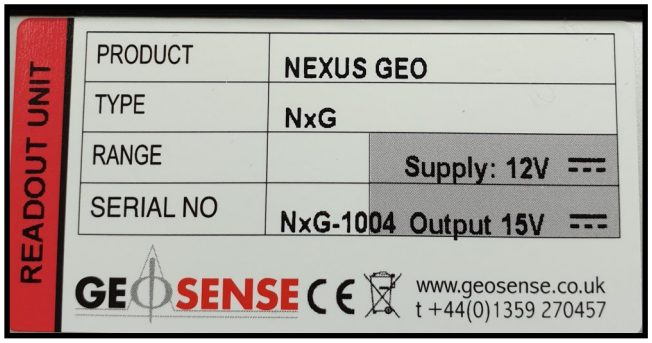
Equipment description:	**NexusGEO**
Make/Brand:	**Geosense**
Model Numbers:	**NxG**

Compliance has been assessed with reference to the following harmonised standard: EN 61326-1:2006 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements.

A technical file for this equipment is retained at the above address.

Martin Clegg
Director
Rougham, June 2019

3.0 MARKINGS



A **Geosense™ NexusGEO** is labelled with the following information:-

Manufacturers telephone number & website address

Product group: NexusGEO

Product type: NxG

Input supply: 12V DC

Serial number: NxG-XXXX

CE mark

WEEE mark

4.0 PACKAGING/HANDLING

The **NexusGEO** comes in a robust carry case and packed for transportation to site. Packaging is suitably robust to allow normal handling by transportation companies. Inappropriate handling techniques may cause damage to the packaging and the enclosed equipment. The packaging should be carefully inspected upon delivery and any damage MUST be reported to both the transportation company and Geosense.

The **NexusGEO** is a precision measuring instrument and its associated equipment should always be handled with care during transportation, storage and use.

Once the shipment has been inspected, it is recommended that the **Geosense™ NexusGEO** components always remains in the carry case for storage or transportation.

4.1 INSPECTION/STORAGE

It is important to check all the equipment in the shipment as soon as possible after taking delivery and well before installation is to be carried out. Check that all the components detailed on the documents are included in the shipment. Check that the equipment has not been physically damaged.

The **NexusGEO** contains electronics and batteries and whilst they are designed for outside use and mounted within a waterproof (IP66) enclosure the internal circuit board can be affected by excessive moisture, dust and temperature. When not in use they should be stored in a cool, dry location.

5.0 GETTING STARTED

This section of the manual is intended for all users of the **NexusGEO** and is intended to provide guidance with respect to its use in obtaining data from a sensor.

5.1 BATTERIES

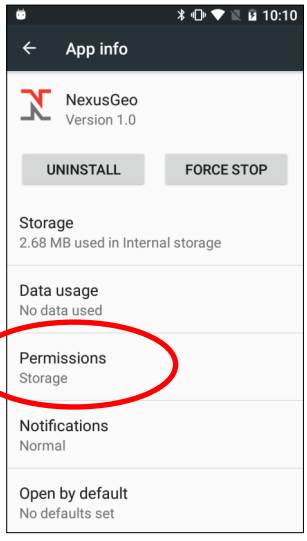
The **NexusGEO** has internal re-chargeable batteries which are not replaceable in the field. If there is a problem with the batteries and change is required please return the unit to Geosense.

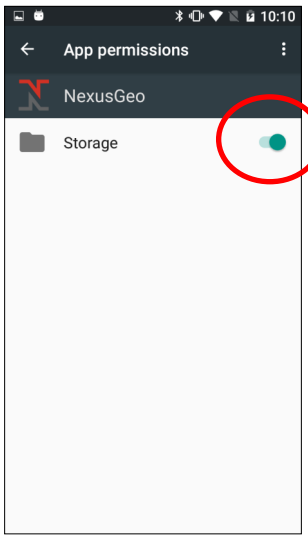
5.2 INSTALLING MOBILE APP

In order to work with an Android device the **NexusGEO** Mobile app will need to be downloaded from the Google Play store.

5.3 PERMISSIONS

To enable full functionality of the app, access permissions will be required. To enable permissions on your phone go to Settings -> Apps -> NexusGEO -> Permissions -> Storage and toggle this on.





6.0 OPERATION

The unit compromises of:

1. Red, Black, Green and White terminal sockets for analogue connections

2. Bluetooth connection indicator

- Blue– Connected and taking readings
- Red– Disconnected
- Clear– No Bluetooth connection

3. Battery level indicator

- Green– Full battery level
- Amber– Half battery level
- Red– Low battery, charge immediately

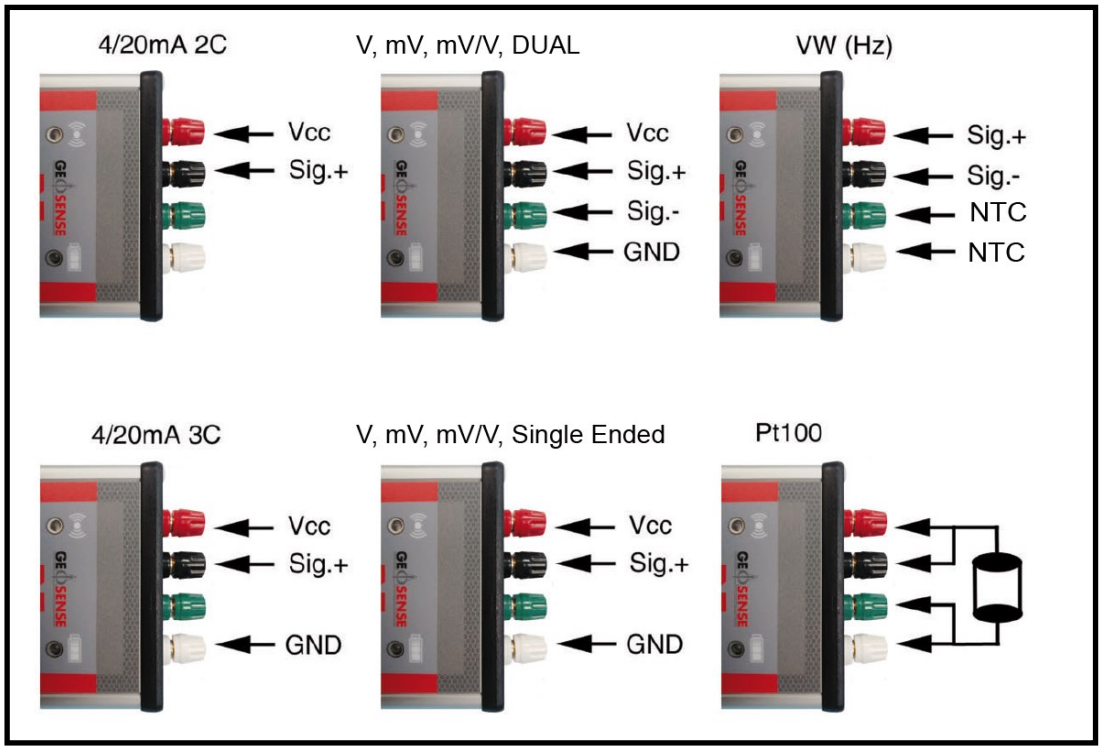
4. On/Off power button

- On– Hold for 1 second to power unit on
- Off– Hold for 4 seconds to power off the device

5. RS485 digital connector

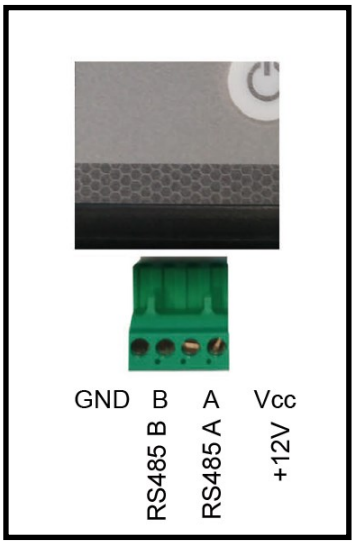
6.1 CONNECTING SENSORS

The **NexusGEO** can be wired in the follow ways using the terminals or crocodile clips provided to read analogue sensors. Ensure that each wire is fully secured before any readings are taken.



It can also be wired to read a Geosense RS-485 digital sensor using the green connector block on the bottom of the unit. Ensure that each wire is fully secured using the screw terminals to establish connection.

NOTE: For other RS-485 sensors please contact Geosense®



6.2 USING THE APPLICATION

6.2.1 HOME AND BLUETOOTH CONNECTION

Turn on the **NexusGEO** device by holding the power switch for 1 second. The device will make a long audible beep and the battery light will display the current battery level for short period of time before going clear. The power button can be pressed again to show the battery level when required.

The battery indicator will periodically flash to indicate the device is switched on, and show current battery levels.

The **NexusGEO** should be able to communicate with the app wirelessly via Bluetooth with a range up to around 4 metres. On the android device turn on Bluetooth and pair with device 'NexusGEO'. No pairing code is required.

Open the mobile APP on the android device and the following screen should be shown: -

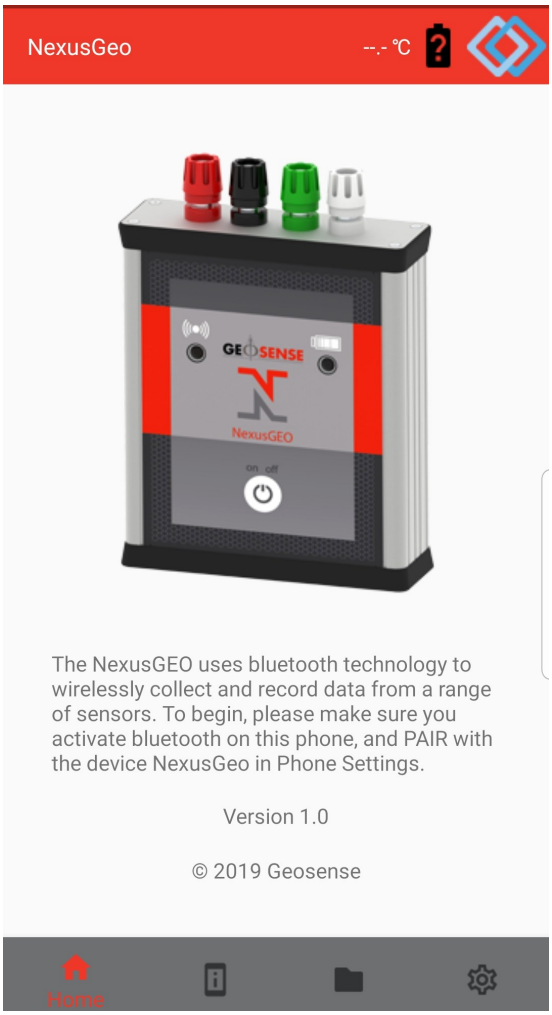
6.2.1 HOME AND BLUETOOTH CONNECTION CONT.

Menu Icons:

- Home
- Readings– Configure sensor and begin to take readings
- Data– Access any readings that have been saved and download them
- Settings

With the android device in range, tap the Bluetooth icon in the top right of the screen to connect to the device. The icon will change to blue as shown below.

The Bluetooth indicator on the NexusGEO will remain clear until readings being taken via the APP



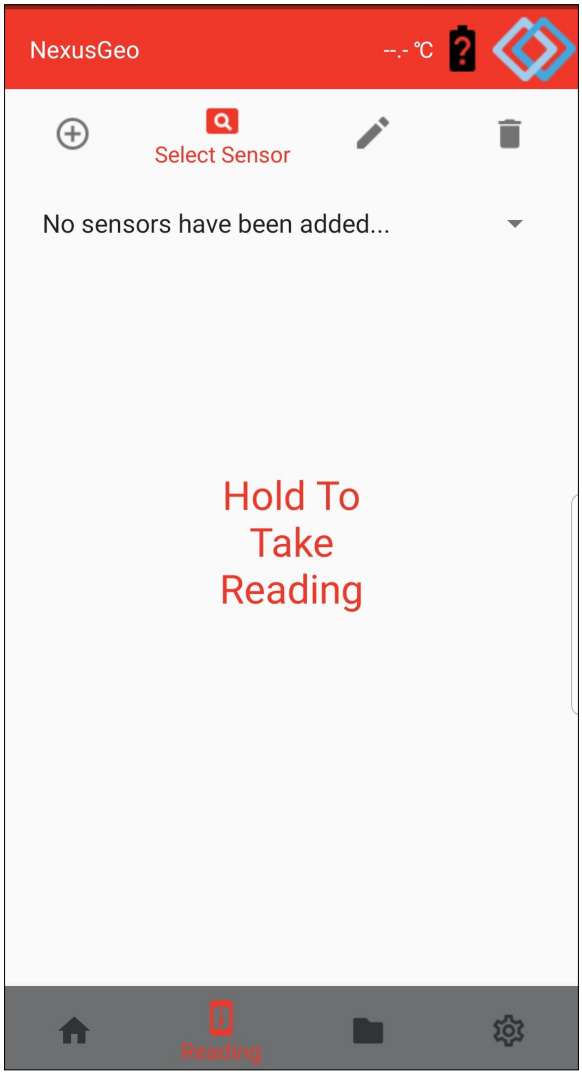
The temperature and battery indicators in the APP will only update when readings start being taken from the sensor

To disconnect from the device, press the Bluetooth icon again.

To turn off the **NexusGEO**, hold the power button down for 4 seconds. The device will make short audible beep before all lights will turn off.

6.2.2 TAKING READINGS

Pressing the Reading menu will show the following screen: -



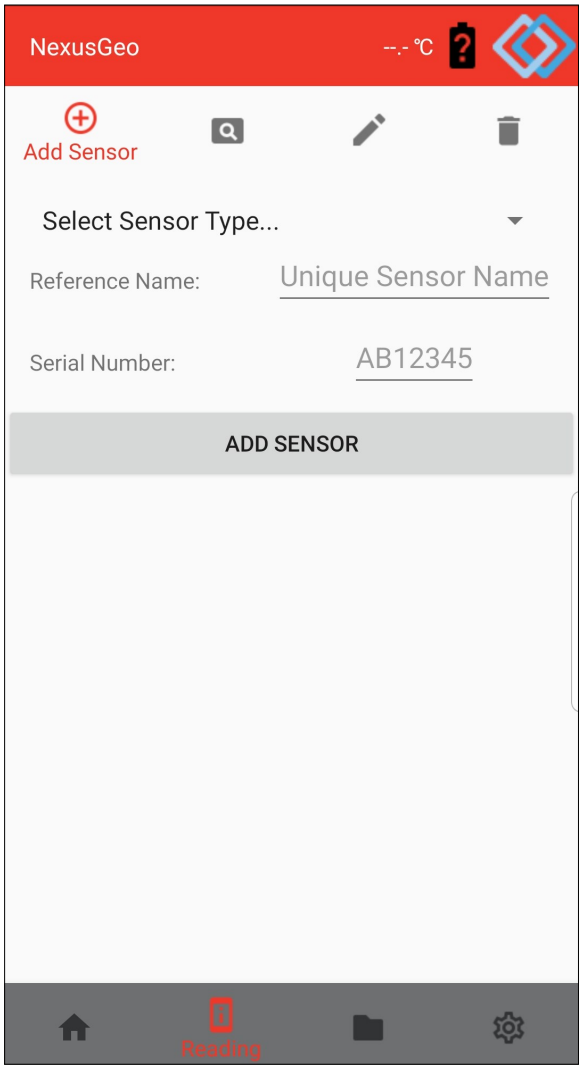
Reading Menu Items:

- Add Sensor
- Select Sensor
- Edit Sensor
- Delete Sensor

Before readings are taken sensor information must be added, this includes sensor type and calibration factors

6.2.3 ADD SENSOR

Press ‘Add Sensor’ and the screen will change to:



The **NexusGEO** supports a wide range of sensors types, and each one has different calibration factors that can be configured to convert to engineering units. Please refer to the following table to the select the appropriate sensor type.

Sensor Type	Calibration Factors	Reading Units	Engineering Units
4-20mA 3 Wire Sensor	None	mA	None
4-20mA Crack Meter	Linear (K) Polynomial (A, B)	mA	Mm
4-20mA Piezometer	Linear (K) Polynomial (A, B)	mA	kPa, Bar, PSI, mH20
4-20mA Transducer	Linear (K) Polynomial (A, B)	mA	kPa, Bar, PSI, mH20
Inclinometer (Analogue)	Linear (M, C) Polynomial (A, B, C, D)	mA	Sin(X), Degrees, mm/M, Radians
Inclinometer (Digital)	None	Sin(X)	Degrees, mm/M, Radians

6.2.3 ADD SENSOR CONT.

Sensor Type	Calibration Factors	Reading Units	Engineering Units
mV/V Displacement Meter	None	mV/V	None
mV/V Strain Gauge Load Cell	Linear (K)	mV/V	kN
NTC Temperature Sensor	None	Ohms	°C
PTC Temperature Sensor	None	Ohms	°C
Tiltbeam (Analogue)	Linear (M, C) Polynomial (A, B, C, D)	mA	Sin(X), Degrees, mm/M, Radians
Tiltbeam (Digital)	None as they are on the chip	Sin(X)	Degrees, mm/M, Radians
Tiltmeter (Analogue)	Linear (M, C) Polynomial (A, B, C, D)	mA	Sin(X), Degrees, mm/M, Radians
Tiltmeter (Digital)	None as they are on the chip	Sin(X)	Degrees, mm/M, Radians
Voltage Output Tiltmeter	None	V	None
Voltage Single	None	V	None
Vibrating Wire Crack Meter	Linear (K) Polynomial (A, B)	Digit (B)	mm
Vibrating Wire Displacement Meter	Linear (K) Polynomial (A, B)	Digit (B)	mm
Vibrating Wire Embedment Strain Gauge (50mm, 150mm, 250mm)	Batch Factor Gauge Factor	Digit (B)	Microstrain
Vibrating Wire Hydraulic Load Cell	Linear (K) Polynomial (A, B)	Digit (B)	kN
Vibrating Wire Liquid Level Settlement	Linear (K) Thermal (T) Polynomial (A, B)	Digit (B)	kPa, Bar, PSI, mH20
Vibrating Wire Load Cell	None	Digit (B)	None
Vibrating Wire Piezometer	Linear (K) Thermal (T) Polynomial (A, B)	Digit (B)	kPa, Bar, PSI, mH20
Vibrating Wire Pressure Cell / NATM	Linear (K) Thermal (T) Polynomial (A, B)	Digit (B)	kPa, Bar, PSI, mH20
Vibrating Wire Sister Bar / Rebar	Linear (K) Polynomial (A, B) Strain (S)	Digit (B)	kN, Microstrain
Vibrating Wire Soil Extensometer	Linear (K) Polynomial (A, B)	Digit (B)	mm
Vibrating Wire Spot Weld Strain Gauge	Batch Factor Gauge Factor	Digit (B)	Microstrain
Vibrating Wire Surface Mount Strain Gauge (89mm, 150mm)	Batch Factor Gauge Factor	Digit (B)	Microstrain
Vibrating Wire Temperature Transducer	Linear (K) Polynomial (A, B)	Digit (B)	°C
Vibrating Wire Transducer	Linear (K) Thermal (T) Polynomial (A, B)	Digit (B)	kPa, Bar, PSI, mH20
Vibrating Wire Weir Monitor	None	Digit (B)	None

6.2.3 ADD SENSOR CONT.

With the appropriate sensor type selected, fill in the relevant factors and choose engineering units (if required). Then press ‘Add Sensor’. A validation check will be made to make sure sensor has a reference name and valid calibration factors.

When adding sensors, some sensor types will add more than one sensor into the app. This is because analogue connections can only read from one sensor at a time, and so for instance with a biaxial tiltmeter, a sensor will be added for each axis (A and B).

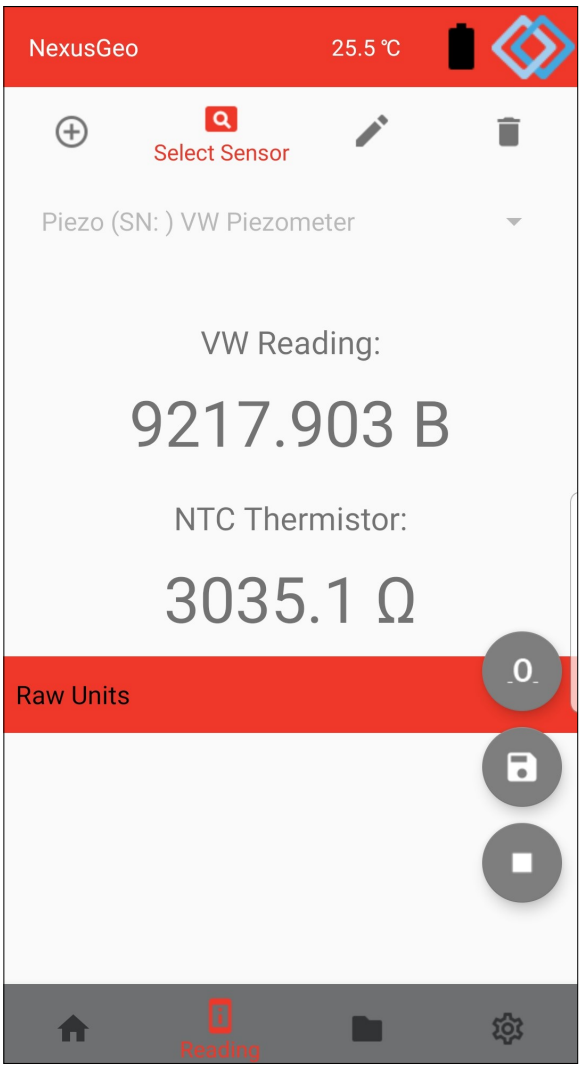
When a sensor is added, the app will automatically go to the select sensor screen.

6.2.4 SELECT SENSOR

At the top of the select sensor screen there is a searchable select box displaying a list of sensors currently configured on the aap. Select the sensor currently connected to the **NexusGEO** and hold down the ‘Hold To Take Reading’ button for 1 second.

Note: Holding down the ‘Hold To Take Reading’ will give the user haptic feedback. This can be turned off in the app settings.

The screen will change to show:



6.2.4 SELECT SENSOR CONT.

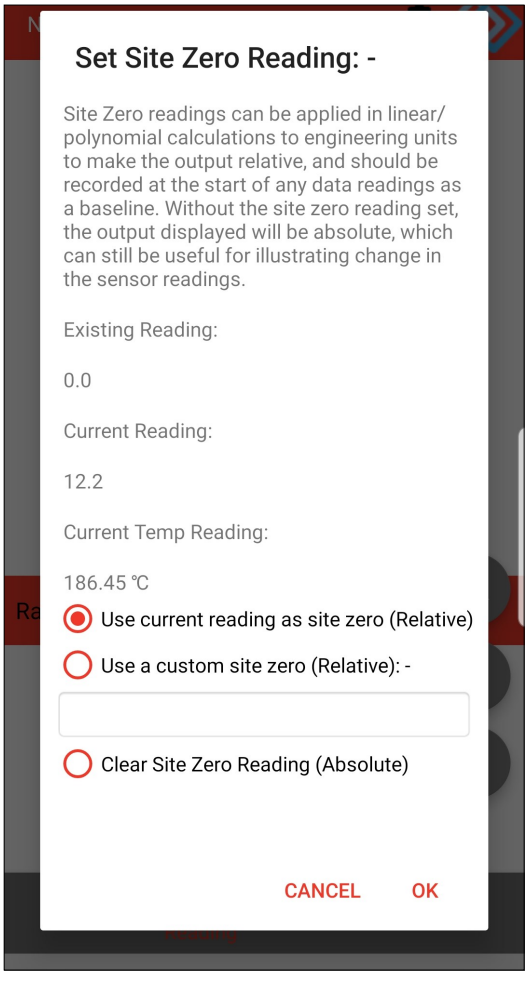
Whilst taking a reading it is not possible to change the selected sensor, or delete the selected sensor. To do this, stop taking readings.

This screen may differ slightly based on sensor type selected. The controls are: -

- **Readings** – live readings will update on screen approximately every second. Up to 3 readings can be shown on screen at the same time for the same sensor (Digital tiltmeter shows A-Axis, B-Axis and Temperature).
- **Raw Units / Engineering Units Selector** – Will switch onscreen readings based on information added during the sensor setup. Any calibration factors and engineering units can be edited live whilst readings are being taken by pressing the edit sensor button.
- **Set Site Zero**
- **Save Readings**
- **Stop Taking Readings**

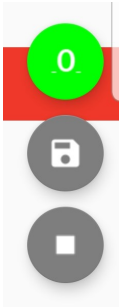
As the app shows the live readings, they are stored in a temporary internal buffer, these can be saved so that readings are not missed

6.2.5 SITE ZERO READINGS



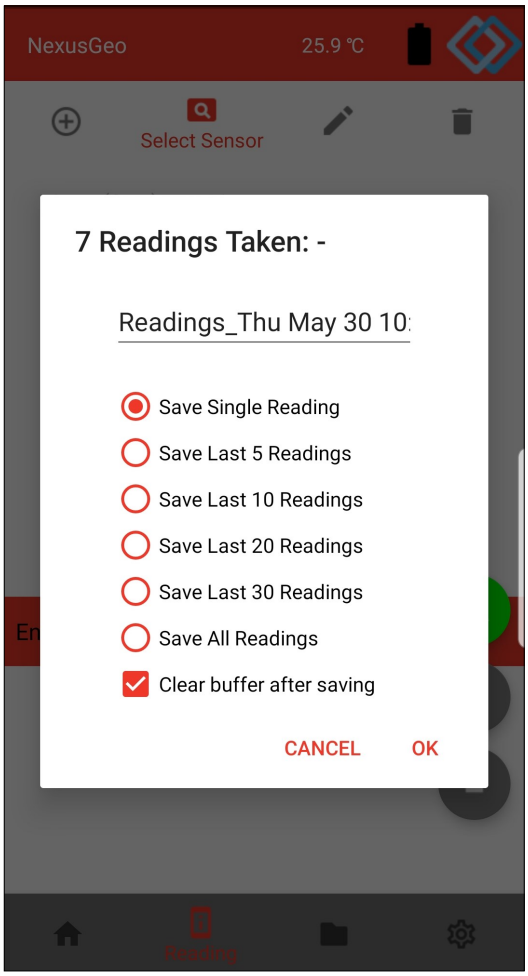
6.2.5 SITE ZERO READINGS CONT.

When converting raw readings into engineering units, a site zero reading can be set to make the calculation relative, rather than absolute. This button enables the user to set, customise and clear the site zero value. Any site zero value that is set, will be saved to the sensor and automatically applied whenever the sensor is being read again (unless removed). The site zero reading is being applied when the button changes colour to green:



6.2.6 SAVING READINGS

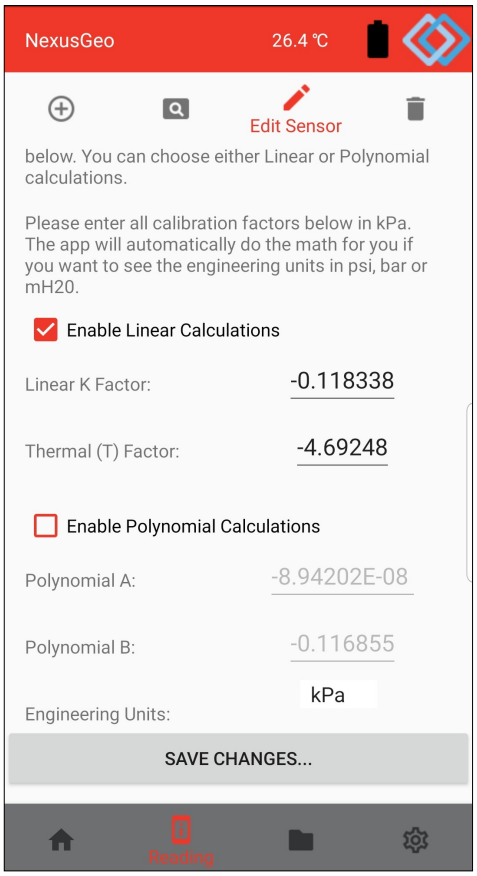
Readings can be stored from the temporary internal buffer using save button shown above



A default option for this selection can be saved in the settings screen, which disables this screen from being shown when saving.

6.2.7 EDIT SENSOR

After a sensor has been added, the edit sensor button can be used to make changes to the sensor. Certain information cannot be changed such as reference name and serial number.



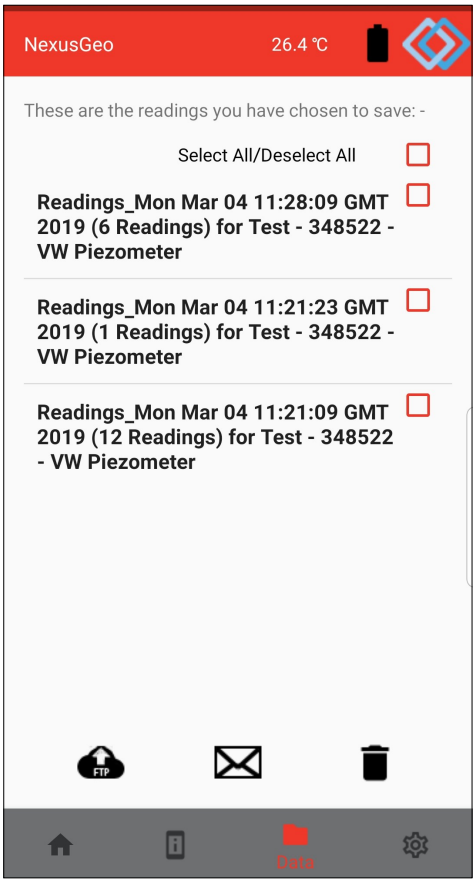
6.2.8 DELETE SENSOR

Select the sensor to be deleted and press the delete button. The user will be asked to confirm this action.

6.3 DATA

Any data that has been saved by the user when reading sensors is shown in this list (Most recent data at the top). Controls are: -

- Select All / Deselect All
- FTP Upload
- Email / Save to File
- Delete



6.3.1 FTP DATA

FTP Settings need to be entered into the settings screen and the FTP Connection Tested before taking advantage of this feature. Data storage permission is also required to generate the temporary csv file that will be uploaded.

Select which data sets are to be uploaded via FTP. Press the FTP button at the bottom left of the screen. CSV files of the data are generated automatically with all readings and information about the sensor.

An on-screen notification will alert the user when the upload has successfully completed.

CSV files are saved using the file name prefix ‘Export’ followed by a number. Be aware that if a file already exists on the FTP server at this location, with this filename, it will be overwritten.

6.3.2 EMAIL / SAVE TO FILE

Email and Save to file requires data storage permissions to generate the csv file that will be sent.

Select which data are to be saved to file or send via email. Then press the ‘Email / Save to File’ button at the bottom middle of the screen. CSV files of the data are generated on the fly with all readings and information about the sensor. The phone operating system will ask what the user would like to do, i.e. Save or Email.

For ‘Save to File’, navigate on your android device to your files and look for a csv file starting ‘Export’. For Email, an email will be auto-generated with the datasets attached as csv’s. The user can then enter the email address you want to send the files to.

Default email addresses can be set in the settings screen

6.3.3 DELETE

Select which data sets to be deleted from the app. Then press the delete button. The user asked to confirm permanent deletion before the delete occurs.

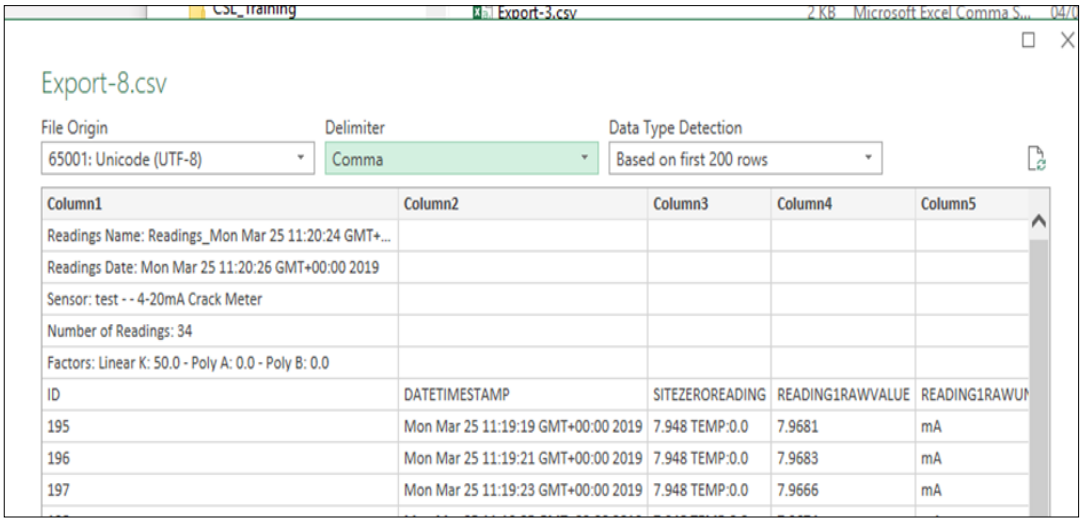
6.3.4 SETTINGS

The settings screen enables the user to customise: -

- Haptic feedback when taking a sensor reading
- Default save options
- FTP connection details
- Default email address

6.3.5 EXPORTED CSV FILES

Exported CSV Files are comma separated CSV files with UTF8 encoding. Excel can be used to import the csv file as shown: -



Column1	Column2	Column3	Column4	Column5
Readings Name: Readings_Mon Mar 25 11:20:24 GMT+...				
Readings Date: Mon Mar 25 11:20:26 GMT+00:00 2019				
Sensor: test - - 4-20mA Crack Meter				
Number of Readings: 34				
Factors: Linear K: 50.0 - Poly A: 0.0 - Poly B: 0.0				
ID	DATETIMESTAMP	SITEZEROREADING	READING1RAWVALUE	READING1RAWUN
195	Mon Mar 25 11:19:19 GMT+00:00 2019	7.948 TEMP:0.0	7.9681	mA
196	Mon Mar 25 11:19:21 GMT+00:00 2019	7.948 TEMP:0.0	7.9683	mA
197	Mon Mar 25 11:19:23 GMT+00:00 2019	7.948 TEMP:0.0	7.9666	mA

7.0 MAINTENANCE

The maintenance for the **NexusGEO** is minimal for most applications but it should be kept as clean and dry as possible.

However users should be aware that the unit contains a rechargeable NiCad battery. Therefore, if not used for long periods of time, the batteries may discharge.

8.0 TROUBLESHOOTING

The NexusGEO app contains a large amount of self help and therefore the user should follow any help found within the app itself.

For any Bluetooth communication problems, please ensure the device and app are within range (and fully charged) and try connecting again.

Please contact Geosense for any further assistance.

9.0 SPARE PARTS

The following spares are available for the **NexusGEO:**

Item	**Part Number**
MP12/VWR1 Charger with 4 plug set	Q22-151
VWR1 Crocodile Connector Cable Set	G200-114

10.0 SPECIFICATIONS

ITEM	SPECIFICATION
Signal Inputs	VW (Hz), mA, V, mV/V, Pt100, NTC, VW, RS-485
Range	VW Hz 400-5000 mA 4-20 V Single ended 0-100 V Differential 0-10 mV/V Singled ended 0-20 mV/V Differential 0-1000 Pt100 Ω 15-400 NTC Ω 250-50,000
Power Supply	Internal 12Vdc Ni-Mh battery, rechargeable
Sensor supply	+20V, +12V, +5V, 750uA, 50uA
Current supply @12V	100mA @ 4-20mA, no load 85mA @ +20V single, no load 70mA @ +12V dual, no load 60mA @ mV/V dual, no load 72mA @ Pt100, 100 Ω load 55mA @ NTC, 3K Ω load 60mA @ VW, 777.1Hz 15mA @ no Bluetooth connection
Measurement resolution	24 bit, 0.1Hz for VW
Display	Android device & NexusGEO app
Sensor connection	Analogue (4mm socket), Digital RS-485
Temperature stability	+15ppm/ºC maximum
Operating Temperature	-20 to +70°C
IP Rating	IP65
Dimensions L x B x H	150 x 105 x 35mm
Weight	465g

11.0 RETURN OF GOODS

11.1 Returns procedure

If goods are to be returned for either service/repair or warranty, the customer should contact **Geosense®** for a **Returns Authorisation Number,** request a **Returned Equipment Report Form QF034** and, prior to shipment. Numbers must be clearly marked on the outside of the shipment.

Complete the **Returned Equipment Report Form QF034**, including as much detail as possible, and enclose it with the returned goods and a copy of the form should be faxed or emailed in advance to the factory.

11.2 Chargeable Service or Repairs (Inspection & Estimate)

It is the policy of **Geosense®** that an estimate is provided to the customer prior to any repair being carried out. A set charge for inspecting the equipment and providing an estimate is also chargeable.

11.3 Warranty Claim (See Limited Warranty Conditions)

This covers defects which arise as a result of a failure in design or manufacturing. It is a condition of the warranty that the **Geosense™ NexusGEO** must be installed and used in accordance with the manufacturer's instructions and has not been subject to misuse.

In order to make a warranty claim, contact **Geosense®** and request a **Returned Equipment Report Form QF034.** Tick the warranty claim box and return the form with the goods as above. You will then be contacted and informed whether your warranty claim is valid.

11.4 Packaging and Carriage

All used goods shipped to the factory **must** be sealed inside a clean plastic bag and packed in a suitable carton. If the original packaging is not available, **Geosense®** should be contacted for advice. **Geosense®** will not be responsible for damage resulting from inadequate returns packaging or contamination under any circumstances.

11.5 Transport & Storage

All goods should be adequately packaged to prevent damage in transit or intermediate storage.

12.0 LIMITED WARRANTY

The manufacturer, Geosense Ltd, warrants the **Geosense® NexusGEO** manufactured by it, under normal use and service, to be free from defects in material and workmanship under the following terms and conditions:-

Sufficient information has been provided to **Geosense** by the purchaser as regards the nature of its use to allow **Geosense** to confirm the applicability of the **NexusGEO.**

The **NexusGEO** shall be used in accordance with the manufacturer's recommendations.

The equipment is warranted for 1 year from the date of shipment from the manufacturer to the purchaser.

The warranty is limited to replacement of part or parts which, are determined to be defective upon inspection at the factory. Shipment of defective part or parts to the factory shall be at the expense of the Purchaser. Return shipment of repaired/ replaced part or parts covered by this warranty shall be at the expense of the Manufacturer.

Unauthorised alteration and/or repair by anyone which, causes failure of the unit or associated components will void this **LIMITED WARRANTY** in its entirety.

The Purchaser warrants through the purchase of the NexusGEO multi sensor interface that he is familiar with the equipment and its proper use. In no event shall the manufacturer be liable for any injury, loss or damage, direct or consequential, special, incidental, indirect or punitive, arising out of the use of or inability to use the equipment sold to the Purchaser by the Manufacturer.

The Purchaser assumes all risks and liability whatsoever in connection with the **NexusGEO** equipment from the time of delivery to Purchaser.

Geosense Ltd

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