

INSTRUCTION
MANUAL

MEMS Digital Portable Spiral Sensor (USB-C) From Serial DRI-1000



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1. VERSION CONTROL

Version	Date	Author	Approved	Released
V1.0	Aug 2026	TB	RM/DO	GC

2. INTRODUCTION

This manual is intended for all users of the **Portable Spiral Sensor** systems manufactured by **Geosense®** and provides information on their operating principles, conventions, operation and maintenance.



**It is VITAL that all personnel responsible
for the use of the Portable Spiral Sensor
READ and UNDERSTAND
this manual, prior to working with the equipment**



2.1. General Description

The **Geosense® Portable Spiral Sensor** equipment is an environmentally sealed assembly that is used to accurately and reliably register changes of rotation within specialist inclinometer casing. The assembly comprises a probe connected to a graduated cable that is held on a cable reel. The reel is Bluetooth enabled for wireless connection to an Android Smart Device (ASD).

Inclinometer Casing can be installed or included in many types of structures and monitoring regimes. It can be within vertical, inclined or horizontal installations.

This manual is focused on the **Portable Spiral Sensor**.

Common applications include the following:

- Embankment stability monitoring
- Settlement/heave profile monitoring
- Dam monitoring

Particular features of all **Geosense® Portable Spiral Sensor** Systems are:

- Reliable long-term performance
- Ruggedness; suitable for demanding environments
- Bluetooth, cable free interconnection
- High accuracy
- Digital output and full EMI shielding
- Designed with the user in mind

The **Geosense® Portable Spiral Sensors** are based upon Micro Electro-Mechanical Systems technology (MEMS). The MEMS magnetometer sensors in the Spiral Probe are configured to measure changes in rotation between the top and base wheelsets of the probe.

Electronic circuitry within the probe interrogates the sensor and the corresponding output is converted from an Analogue to a Digital signal, making it particularly suitable for the demanding environments of geotechnical and civil engineering applications.

Geosense® Spiral probes carry 'onboard' calibration data so that probe / cable / reel / readout combinations are all interchangeable. Each element also has a unique serial number.

Portable Spiral Sensor systems are commonly used where monitoring is to be infrequent or automated monitoring is too expensive. These systems are used to determine the inherent spiral of the inclinometer casing at intervals along its length (commonly 0.5m or 2ft). This information is processed to allow for the correction of inclinometer data for spiral errors that may result in long runs of casing.

2.2. Theory of Operation

Special tubes, commonly referred to as Casing or Access Tubes, are installed into or fixed onto the structure or formation to be monitored. (see **Geosense®** Inclinometer Casing Installation Manual).

Inclinometer casing is a specially machined ABS tube that has 4 equally spaced, parallel 'keyways' in its inner surface and a reference 'rib' on its outer surface. The inclinometer casing is designed to move with the structure/formation into which, or onto which it is fixed, if the structure changes.

The Portable Spiral Sensor System is used to detect and quantify any twist in the 'shape' of the installed casing. The spiral probe, connected to its cable, is inserted into the inclinometer casing with its wheels located in the A+ / A- keyways (Figure 1: Schematic of inclinometer casing keyways).

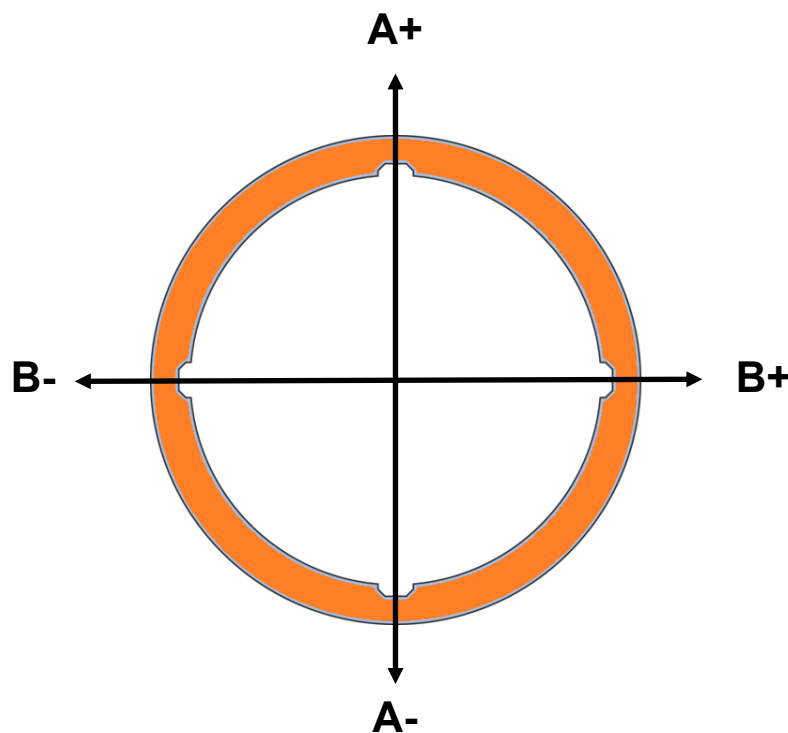


Figure 1: Schematic of inclinometer casing keyways

The **Geosense® Digital Portable Spiral Sensor** houses an array of extremely sensitive Micro Electro-Mechanical System (MEMS) magnetometer sensors mounted around a rotational joint in the centre of the probe. This allows for any rotation between the top and bottom wheelsets of the sensor to be detected and recorded.

The probe is attached to a highly robust and flexible support / signal cable that is, in turn, connected to a portable cable reel. The cable reel includes a Bluetooth communication module and a re-chargeable battery power supply. The cable is fitted with 'crimped' cable markers that securely identify 0.5 metre (or 2ft) intervals along its length.

The Cable Reel Bluetooth module is used to connect to an **Android Smart Device (ASD)** to the probe. The spiral sensor software on the **ASD** first connects to the reel modules and then to the probe at the end of the cable. Once connected the **ASD** displays the spiral reading from the probe in degrees.

The displayed values represent the value of rotation in degrees between the top and bottom wheelset on the probe (Figure 2).

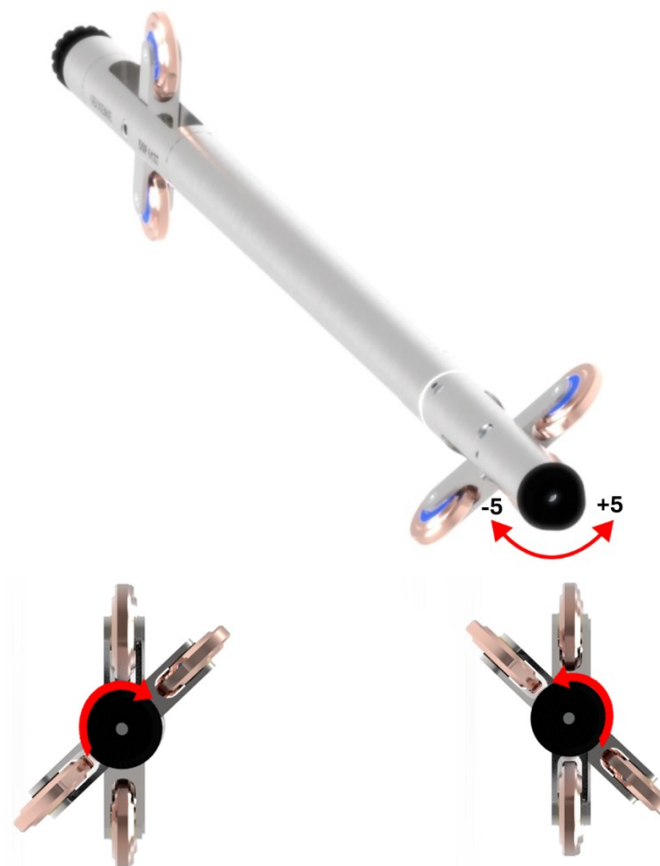


Figure 2: Example of wheelset rotation around central axis, with reference to the fixed top wheelset.

2.3. Measurement of Spiral (Twist)

To generate a profile of twist, the probe utilises a single face survey (as opposed to the standard inclinometer probes which typically use a double face survey).

The probe is lowered to the base of the installation and run at intervals up to the top of the casing, using the intervals (0.5m or 2ft) on the graduated cable and the cable gate to hold the unit in place during each reading.

The produced output can be input into a visualisation software such as **Geosense® IncloPro Insight** to allow for subsequent inclinometer surveys to be compensated for the twist value of the casing.

3. CONFORMITY

Simplified EU Declaration of Conformity for Radio Equipment Directive (2014/53/EU)

This information is provided for information purposes only and the accuracy of the text is not guaranteed and may be checked at in the relevant language version of 2014/53/EU published on the EU EUR-LEX website at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0053>

Geosense Ltd tímto prohlašuje, že tento Portable MEMS Inclinator je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/EU.
Undertegnede, Geosense Ltd erklærer herved, at følgende udstyr Portable MEMS Inclinator overholder de væsentlige krav og øvrige relevante krav i direktiv 2014/53/EU.
Hiermit erkläre, Geosense Ltd dass sich das Gerät Portable MEMS Inclinator in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 2014/53/EU befindet.
Käesolevaga kinnitab, Geosense Ltd seadme Portable MEMS Inclinator vastavust direktiivi 2014/53/EL põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
Hereby, Geosense Ltd declares that Portable MEMS Inclinator is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.
Por medio de la presente Geosense Ltd declara que el Portable MEMS Inclinator cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/UE.
ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ, Geosense Ltd ΔΗΛΩΝΕΙ ΟΤΙ Portable MEMS Inclinator ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/ΕΕ.
Par la présente, Geosense Ltd déclare que l'appareil Portable MEMS Inclinator est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/UE.
Con la presente, Geosense Ltd dichiara che questo Portable MEMS Inclinator è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/UE.
Ar šo Geosense Ltd deklarē, ka Portable MEMS Inclinator atbilst Direktīvas 2014/53/ES būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
Šiuo Geosense Ltd deklaruoja, kad šis Portable MEMS Inclinator atitinka esminius reikalavimus ir kitas 2014/53/ES Direktyvos nuostatas.
Hierbij verklaart, Geosense Ltd dat het toestel Portable MEMS Inclinator in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EU.
Hawnhekk, Geosense Ltd, jiddikjara li dan Portable MEMS Inclinator jikkonforma mal-htigijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Direttiva 2014/53/UE.
Alulírott, Geosense Ltd nyilatkozom, hogy a Portable MEMS Inclinator megfelel a vonatkozó alapvető követelményeknek és az 2014/53/EU irányelv egyéb előírásainak.

Simplified EU Declaration of Conformity for Radio Equipment Directive (2014/53/EU)

Niniejszym <i>Geosense Ltd</i> oświadcza, że Portable MEMS Inclinator jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/UE.
<i>Geosense Ltd</i> declara que este Portable MEMS Inclinator está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/UE.
<i>Geosense Ltd</i> izjavlja, da je ta Portable MEMS Inclinator v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/EU.
<i>Geosense Ltd</i> týmto vyhlasuje, že Portable MEMS Inclinator spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 2014/53/EÚ.
<i>Geosense Ltd</i> vakuuttaa täten että Portable MEMS Inclinator tyyppinen laite on direktiivin 2014/53/EU oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Härmed intygar <i>Geosense Ltd</i> att denna Portable MEMS Inclinator står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EU.
Hér með lýsir <i>Geosense Ltd</i> yfir því að Portable MEMS Inclinator er í samræmi við grunnkröfur og aðrar kröfur, sem gerðar eru í tilskipun 2014/53/EU.
<i>Geosense Ltd</i> erklærer herved at utstyret Portable MEMS Inclinator er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 2014/53/EU.
Noi, <i>Geosense Ltd</i> , declarăm pe propria noastră răspundere că produsul Portable MEMS Inclinator este în conformitate cu cerințele esențiale și celelalte prevederi aplicabile ale Directivei 2014/53/UE.

47 CFR § 2.1077 Compliance Information

Unique Identifier: **Geosense®** Ltd Portable Spiral Sensor

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Responsible Party – U.S. Contact Information:

iCertify
2445 NE Division Street, Suite 202
Bend, Oregon 97703 USA
Tel: +1 866 885 4575
Internet: www.iCertify.com

4. MARKINGS

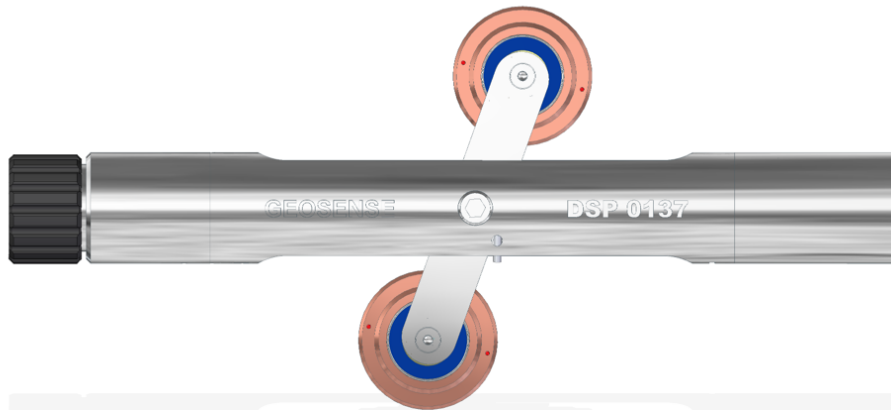


Figure 3: Geosense Inclinator Probe Markings

All **Geosense® Digital MEMS Spiral Sensors** are labelled with the following information and each component carries a **unique** identification serial number that is included on the labels.

- Product group: MEMS Spiral System
- Product type: MEMS Spiral System
- Model: Spiral
- Serial numbers: Probe: DSP XXXX / Cable Reel: DRI XXXX
- CE mark
- FCC ID
- WEEE mark
- UKCA mark



5. DELIVERY

This section should be read by all users of equipment manufactured by **Geosense®**.

5.1. Packaging

Geosense® Spiral Sensors are 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®**.

5.2. Handling

Whilst they are robust devices, **Geosense®** Spiral Sensor systems are precision measuring instruments. They, and their associated equipment, should always be handled with care during transportation, storage and installation.

Once the shipment has been inspected (see 5.3), it is recommended that equipment remains in its original packaging for storage or onward transportation.

5.3. Inspection / Functionality Check Readings

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.

Geosense® Spiral Sensors are supplied with calibration information stored on the probe itself. Digital calibration records are available from **Geosense®** upon request.

Wherever possible, it is suggested that the Spiral Sensor systems should be functionally checked soon after arrival to ensure they have not been damaged during transportation. This is a basic 'out of the box' functional check.

5.4. Storage

All equipment should be stored in an environment that is protected from direct sunlight. It is recommended that equipment be stored in a dry environment with caps in place.

Batteries should be charged regularly, even when the equipment is not in use, to maintain their capacity and life expectancy. If the probe is to be stored for long periods, a light coat of light lubricant on the moving parts is advisable.

Whilst in storage, it is vital that storage areas should be free from rodents as they have been known to damage cables and cases.

No other special requirements are needed for medium or long-term storage although temperature limits should be considered when storing any such instruments and readout equipment.



ALWAYS store the reel with a fully charged battery



ALWAYS store the system in a dry environment



6. INCLINOMETER CASING INSTALLATION THEORY

6.1. Baseline

Prior to any survey taking place, the appropriate **Geosense® Inclinator Casing** will need to have been installed on site. The **Geosense® Spiral Sensor** system can then be used to measure the entire length (or part length) of the casing.

It is good practice to undertake a spiral survey at the start of a project, to enable subsequent readings from an inclinometer probe to be corrected for twist in the casing.

If a change in twist is expected during the course of the project, it may be necessary to undertake subsequent surveys, to be used to correct subsequent inclinometer surveys.

7. OPERATION

This section of the manual is intended for all users of portable **Geosense® Spiral Sensors** and is intended to provide guidance with respect to its use.

It must be remembered that no two installations will be the same and it is inevitable that some 'fine tuning' of the following procedures will be required to suit specific site conditions.

7.1. System Components

The **Geosense® Portable Spiral Sensor** consists of two carry cases. One for the reel, and one for the sensor probe and ancillary equipment (Figure 4: Reel Carry Case) (Figure 5: Spiral Carry Case).



Figure 4: Reel Carry Case

Figure 5: Spiral Carry Case

Illustrated below (Figure 6: Spiral Components) are the components of the **Geosense®** Spiral and Readout System

- A. SPIRAL PROBE**
- B. CABLE**
- C. CABLE REEL/ASD CHARGER and CABLE**
- D. ASD (ANDROID SMART DEVICE) and STYLUS**
- E. CABLE SUPPORTS**
- F. CAPS**

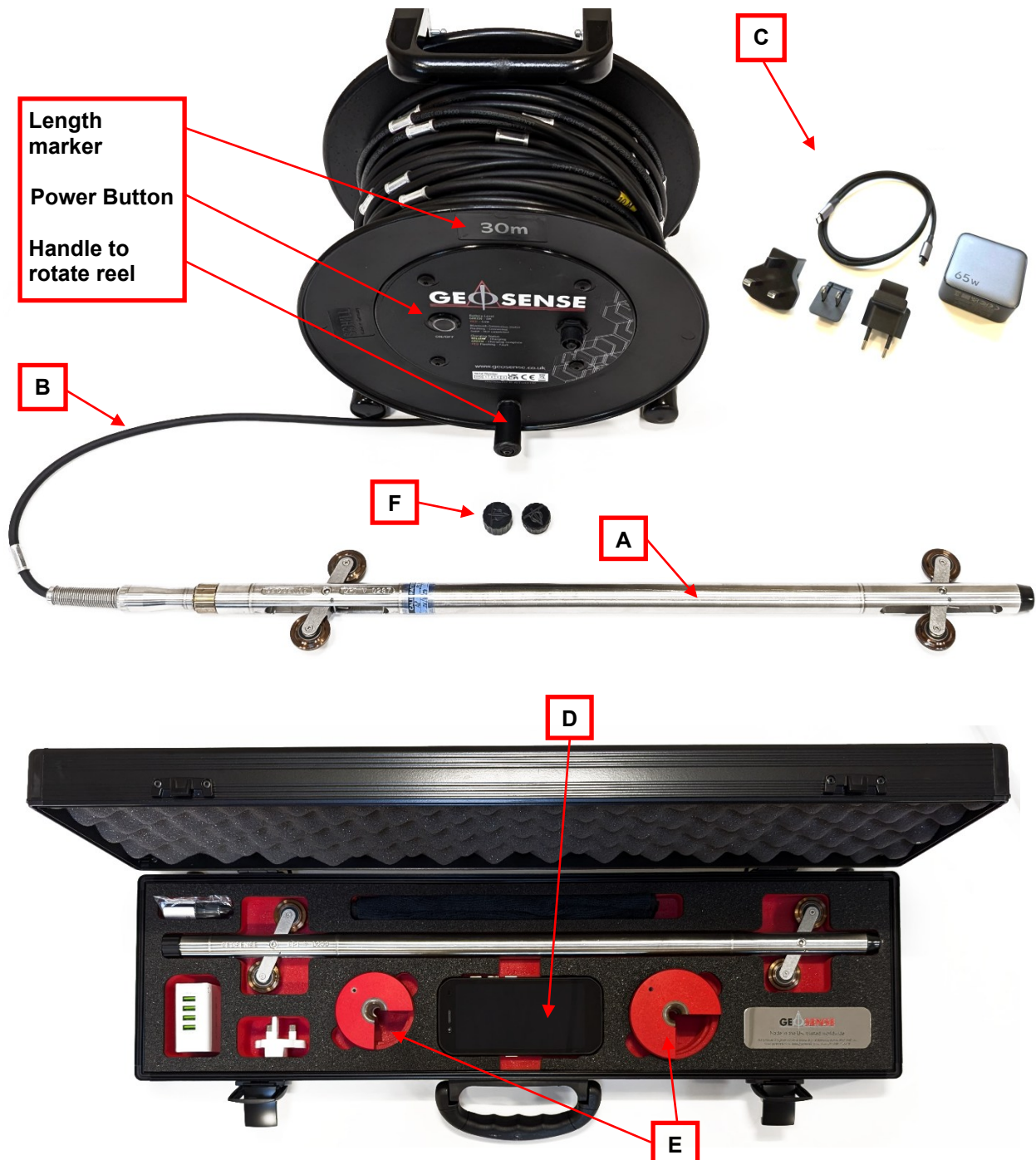


Figure 6: Spiral Components

7.2. System Component Descriptions

1) SPIRAL SENSOR PROBE

The special probe in which the sensors and electronics are housed. Two pairs of wheelsets provide stability for the sensor within the casing. The base of the probe, including the section with the lower wheelset, is free to rotate between -5 degrees and +5 degrees.

2) CABLE

A rugged and flexible cable for electrical connection to the probe. Fitted with secure cable markers at 0.5 metre (or 2 ft) centres to accurately position the probe inside the inclinometer casing at defined and repeatable locations.

3) CABLE REEL with CHARGER

A convenient carrying facility for the graduated cable. Included in the reel body is the main spiral probe power supply and the Bluetooth communication module. The battery is charged by connecting the supplied charger to the charging socket on the face of the reel. Clips are fitted to the reel for convenient probe transportation.

4) ASD with CHARGER and STYLUS

A ruggedized, GSM enabled, Android device for reading, recording, displaying and transmitting the data from the spiral probe. Its internal battery is charged using the supplied USB charger / power supply.

5) CABLE SUPPORTS

For fitting into the top of all **Geosense®** Inclinometer casing (and the casing from most other manufactures), these are used to position the probe at a repeatable location within the casing.

6) CAPS

Protection for the electrical connections to be used when the probe is not connected to the reel.

7) CARRYING CASES

Anodised aluminium hard case for the spiral probe, readout and accessories. Hard wearing fabric case with shoulder strap for the cable reel and its charger.

8) SOFTWARE

The **Geosense® IncloPro ASD** application allows for data collection and basic review upon completion of a successful survey. Datasets can be graphically compared in the field and data can be stored either directly on the device or sent to the desired location. Further visualisation, interpretation and reporting software is provided in the **Geosense® IncloPro Insight** software (sold separately).

7.3. Battery Charging

Whilst the reel and ASD have long battery lives, fully charging the equipment prior to visiting site is strongly recommended.

As with most handheld equipment, the ASD can be easily charged using most USB chargers and power banks. The reel requires a high wattage fast charger.



Note that the reel requires charging with the 65watt fast charger.



- 1) Remove the ASD, USB cable and charger from the hard case. Connect the USB connector to the ASD and the standard USB plug to the charger.

The charger is supplied with various mains plug adaptors. Select and fit the adaptor appropriate to the available mains electrical sockets.



- 2) Connect the charger to a mains electrical supply, switch it on and allow the ASD to charge fully.
- 3) Remove the cap from the reel connector and fit the USB-C to USB-C lead (supplied with the reel) to the reel.



- 4) Connect the charger to a mains electrical supply, switch it on and allow the readout to charge fully – indicated by a solid green light.

When in use and on charge, the power button of the cable reel will illuminate depending on the status of the system. The reel has the legend printed on it so the user can understand the status of the reel.

<u>Battery Level</u>	
GREEN	- OK
RED	- Low
<u>Bluetooth Connection Status</u>	
Flashing	- Connected
Solid	- Not connected
<u>Charging Status</u>	
YELLOW	- Charging
GREEN	- Charging complete
RED Flashing	- Fault

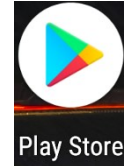
7.4. Installing the IncloPro Application on the ASD

It is necessary to install the **Geosense® IncloPro** app onto the ASD from the **Google® Play Store**. This will ensure the latest version is downloaded.

For this, it will be necessary to establish an 'Identity' with Google® and establish a connection to the internet.

- 1) Start the ASD and tap on the Google® Play Store.
This will be on the Home Screen.

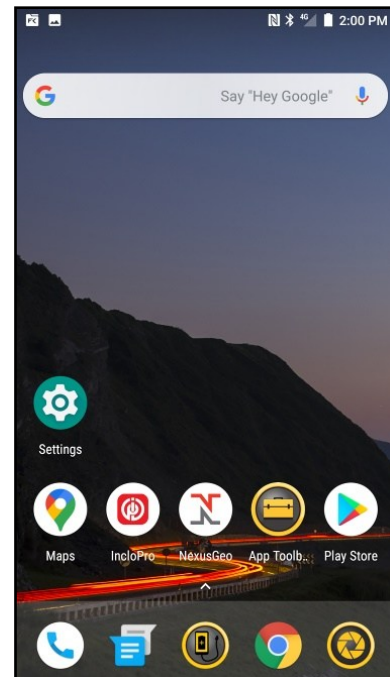
At this point, it will be necessary to either sign in to a Google® account or create an account.



- 2) Once logged in, search for the **Geosense®** Inclinometer Application named '**IncoPro**'.

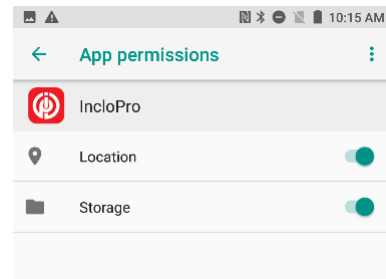


- 3) Tap on the icon to open the app details.
- 4) Tap "install".
- 5) Tap "Accept & Download" after reviewing the list of permissions.
- 6) The **IncloPro** icon will normally appear on the ASD Home Screen. If the icon does not appear, locate the icon in one of the App folders (it can then be moved to the Home Screen for convenience).



- 7) App permissions must now be set in order for the ASD to connect to the reel. This can be accessed through the phone settings:

Settings → Apps & Notifications → App Info
→ Select 'IncoPro' app → Permissions
→ Allow Location and Storage Permissions



- 8) The app is now ready to connect to a reel.

8. USING INCLOPRO SOFTWARE APPLICATION (ANDROID)

8.1. System Assembly and Survey

Most of the components of the **Spiral Sensor System** are contained within the hard carry case. Only the cable and the reel are housed within the soft case.

- 1) Remove the probe from the hard case and remove the black cable connector cover.
- 2) Remove the cable reel from its case and remove the cable connector cover.



- 3) Taking note of the machined mating 'D' alignment in the plug and socket and the alignment markers, carefully connect the cable to the probe. Place the probe in a position where it cannot fall or be damaged.



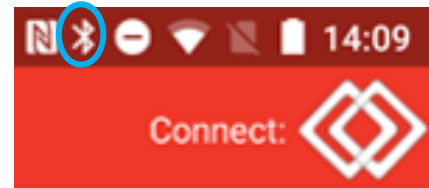
- 4) Remove the ASD from the hard case and turn it on.



- 5) Press the ON/OFF button on the side of the reel, holding until its light switches on. This shows that the power is on with a **GREEN** light indicating an adequate battery level and a **RED** light indicating insufficient battery (the reel would need to be charged before monitoring is carried out).



- 6) On the ASD, check that the 'Bluetooth' symbol is showing in the top bar (by default it is set to turn on, but if it is not, go to the ASD settings and turn it on).



- 7) Open the **Geosense® IncloPro** app.



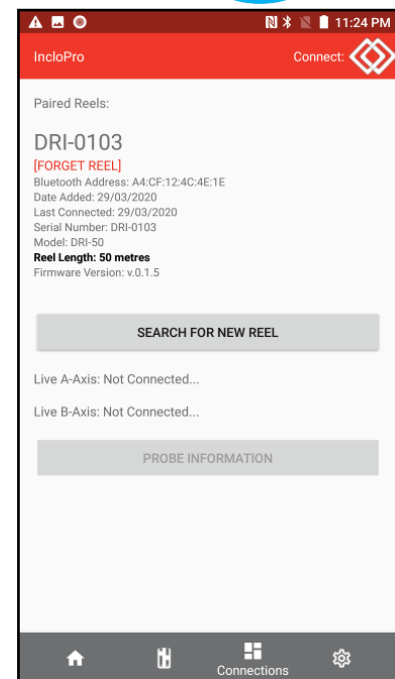
- 8) Tap the 'Connections' icon on the lower menu bar to open the Connections page.



A list of 'Paired Reels' will be presented. Check that the serial number of the reel to be used is included in the list. If not, tap the 'SEARCH FOR NEW REEL' bar.

A list of all local Bluetooth devices will be presented on the screen. Scroll through the list to locate the serial number of the reel being used and tap on it to activate the pairing operation.

When using the app for the first time, it will be necessary to search for the reel to carry out this pairing operation. Once paired, the ASD memorises the configuration.

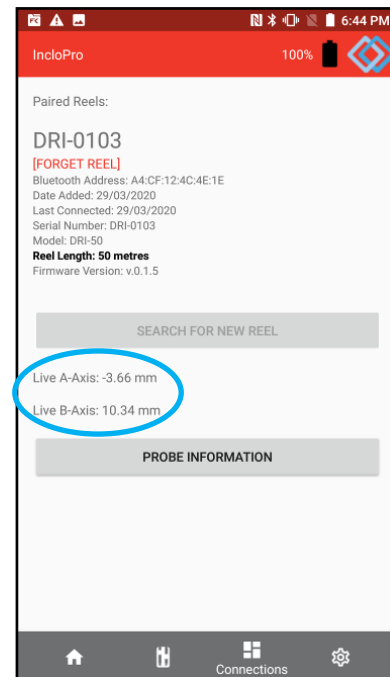


- 9) Tap the connect  icon to check the Bluetooth connection. When connected, the connection is confirmed by displaying the Reel battery condition and the Reel temperature.



In addition, live probe readings are shown on the screen, above the '**PROBE INFORMATION**' bar.

- 10) Tap the connect  icon to break the Bluetooth connection. It should return to an 'all white' colour.



- 11) Remove the cover from the inclinometer access tube, if there is one (a secure cover is strongly recommended).

- 12) Identify the 'Primary' axis keyways in the tube, sometimes referred to as the 'A' or 'A+/A-' axis (this is usually the pair of keyways that are closest to the direction of expected movement).



- 13) Release the brake screw on the side of the Cable Reel.



- 14) With one finger, push the lower wheelset so as to close it in towards the probe and insert it into the access tube, taking care that the wheels are located in the keyways.

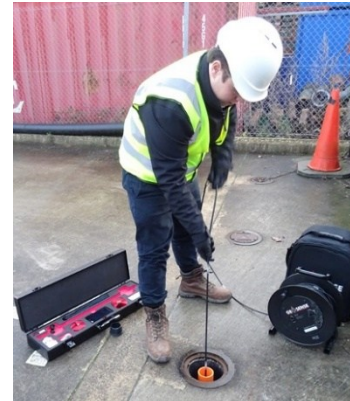


- 15) Repeat this for the upper wheel set.

- 16) Carefully lower the probe into the access tube until it reaches the base of the tube, or the required depth.



**NEVER ALLOW
THE PROBE TO FREEFALL
DOWN THE TUBE**



- 17) Select the appropriate 'Cable Support' from the hard case and push it into the access tube as shown. Ensure that it fits firmly and is pushed down to sit on one of the machined 'shoulders'.



- 18) Lift the cable until a marker can be positioned in the support, thereby maintaining the probe in suspension in the base of the tube. **The lowest reading must be recorded with the probe suspended, NOT resting on the bottom of the tube.**

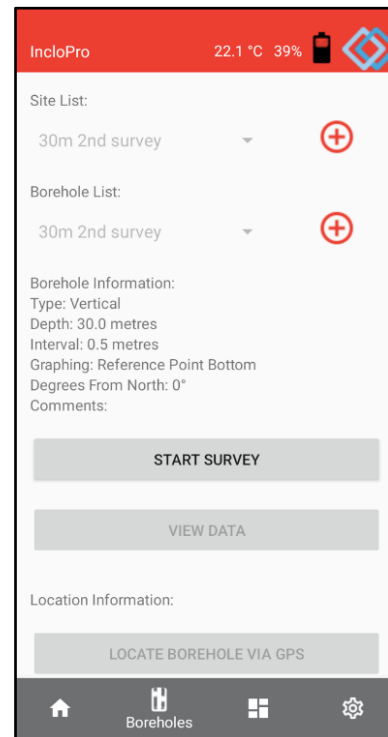


19) Determine the depth of this first reading from the marks on the cable. Individual markers are 0.5m (or 2ft) apart with numeric indications at 5.0m (or 16ft) intervals.

20) Tap the connect  icon to disconnect the Bluetooth connection.

21) Tap the Boreholes  icon at the base of the screen.

22) Select the Site and Borehole from the lists. If a new Site or Borehole is needed, tap  the Add icon as required and fill in the necessary information.

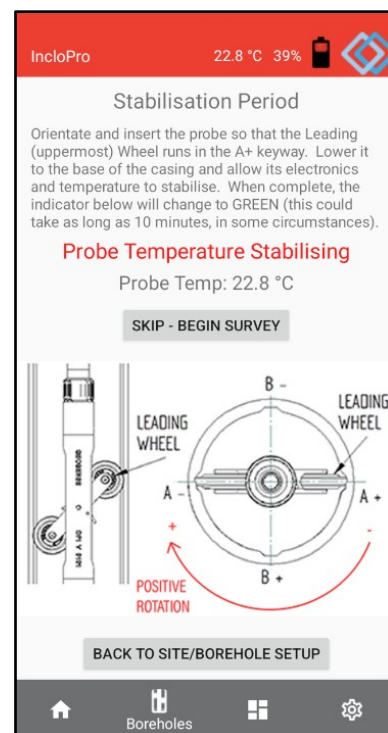


23) With the probe positioned and suspended at the base of the Inclinator tube, tap '**START SURVEY**'.

This will open the initial **Stabilising Page**.

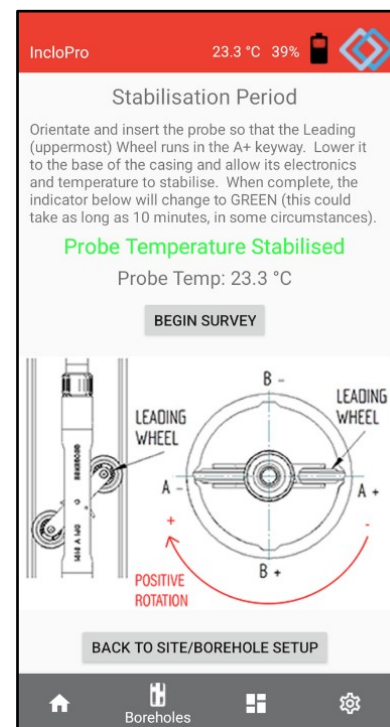
Since any sensing system can be affected by temperature gradients over its electronics and their mountings, the **Geosense® IncloPro** app automatically monitors the temperature inside the probe. If temperature changes are deemed to risk affecting the data, the app will display 'Probe Temperature Stabilising' and will display the current temperature.

The screen also displays the correct orientation of the probe.



- 24) Once any temperature changes have reduced to an acceptable level, the screen indicates that the temperature has stabilised.

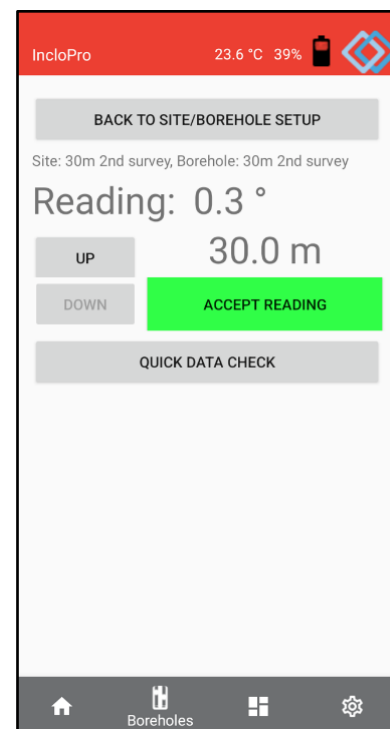
In exceptional circumstances, this period can be curtailed by tapping '**SKIP**' to advance to starting the Inclinator survey.



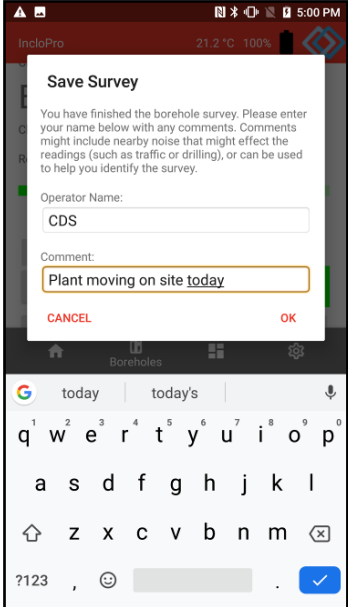
- 25) Begin the Spiral Survey.

Two values will be displayed in a large font on the screen: the twist reading in degrees and the depth of the readings in metres.

Readings can be taken with a short delay in-between to allow the sensor output to stabilise.



- 26) When the survey is complete, the ASD screen will prompt the operator to '**Save Survey**'. In addition, the operator's name can be added together with any specific site notes, particularly those that may have affected the readings.



The screenshot shows a mobile application interface with a 'Save Survey' dialog box. The dialog text reads: 'You have finished the borehole survey. Please enter your name below with any comments. Comments might include nearby noise that might effect the readings (such as traffic or drilling), or can be used to help you identify the survey.' The 'Operator Name' field contains 'CDS'. The 'Comment' field contains 'Plant moving on site today'. There are 'CANCEL' and 'OK' buttons at the bottom of the dialog. Below the dialog is a standard QWERTY keyboard.

- 27) If the monitoring is complete, the cable should be wound onto the reel and should be disconnected from the probe. The end caps must be fitted to both the probe and the cable plug.

ENSURE CONNECTORS ARE CLEAN AND DRY BEFORE FITTING END CAPS.

However, if monitoring is to continue at another location nearby, the cable should be wound onto the reel. The probe can remain connected to the cable with the probe fitted into the transport clips on the frame.

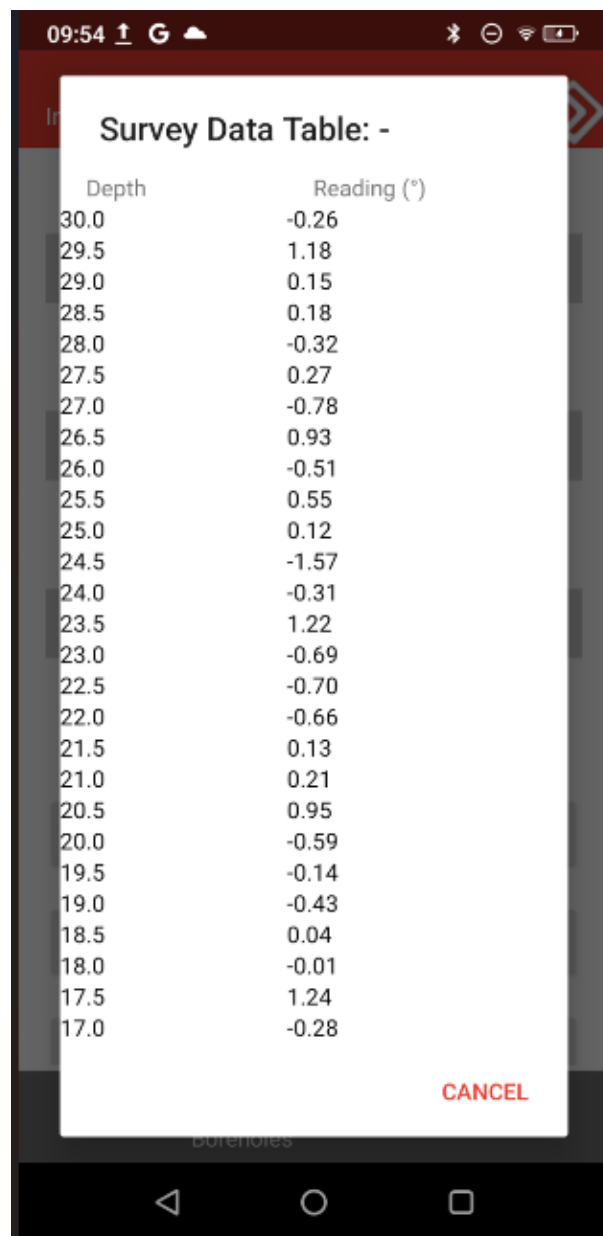
Care must be taken not to damage the cable and connector during transportation.



8.2. Viewing Data

All completed surveys can be accessed from the “**VIEW DATA**” screen, located within the Borehole selection screen.

Spiral data is available in data table format only on the Android app – further processing must be completed in **IncloPro Insight**.



Depth	Reading (°)
30.0	-0.26
29.5	1.18
29.0	0.15
28.5	0.18
28.0	-0.32
27.5	0.27
27.0	-0.78
26.5	0.93
26.0	-0.51
25.5	0.55
25.0	0.12
24.5	-1.57
24.0	-0.31
23.5	1.22
23.0	-0.69
22.5	-0.70
22.0	-0.66
21.5	0.13
21.0	0.21
20.5	0.95
20.0	-0.59
19.5	-0.14
19.0	-0.43
18.5	0.04
18.0	-0.01
17.5	1.24
17.0	-0.28

CANCEL

Figure 7: Survey results viewable in the Android IncloPro app after a successful spiral survey.

Table 1: View Data - Options available to the user

View Settings	Description
Survey Data Table	On screen display of the survey data (one survey selected at a time)
Upload Selected Survey to FTP	Creates an output file (in select output format) and uses FTP details entered into the settings menu to FTP the file for further analysis.
Email/Save to Phone/Bluetooth	Creates an output file (in selected output format) ready to be saved onto the phone or emailed. A default email address can be entered into the settings menu to speed up this process.
Delete Selected Surveys	Allows for surveys to be deleted

8.3. Initial / Base Surveys

Typically, a spiral survey is carried out before subsequent inclinometer surveys (including baseline surveys) are undertaken. This allows for any spiral in the inclinometer casing to be accounted for in subsequent inclinometer surveys.

The spiral survey needs to start at the same depth as the inclinometer surveys begin at, to ensure reliable data integration between the two survey types.

The user lowers the probe into the installation to the base depth of the borehole (usually the lowest depth accessible within the casing, without the probe touching the base – it must hang).

Once the user has acquired the spiral survey for a borehole, due to the limited risk of a significant change to the twist of the casing, no further spiral surveys are usually required. If the user however deems they do wish to undertake further spiral surveys, these can be undertaken and subsequent inclinometer surveys can be processed using the newer spiral surveys.

8.4. Upload Selected Survey to FTP

Where data is to be sent directly to a remote server, this option creates a file in the selected output format (CSV or RPP) and uses FTP details entered into the settings menu, to send the transmission. A mobile data connection (SIM Card) or Wi-Fi network connection is required.

8.5. Email/Save to Phone/Bluetooth

This option creates output files for each data set selected. The file name structure will be:

[site name]-[borehole name]-[date]_[time].csv

Or

[site name]-[borehole name]-[date]_[time].rpp

The App asks where the file(s) are to be stored or sent. An email client must be configured on the phone to send the data via email. A default email address can be entered into the settings menu, to speed up this process.

First select the files to be transferred, then tap the **“EMAIL/SAVE TO PHONE/BLUETOOTH”** option. This will bring up the transfer option window on the ASD.

To email the files, select the mail client and follow their particular procedures.

To save the file locally, select **“Save to Device”** (wording may vary with Android build), which will lead to the save location window.

Select 'Internal Storage' to save to a particular location on the device or 'Downloads' for directly to that location (other options are available).

To save the file(s) for later transfer by Bluetooth or USB cable, it's suggested that a folder is created in the 'root directory' in the internal storage of the ASD.

9. DATA HANDLING

9.1. Data Format

Once a spiral survey has been completed, the readings are saved to the database on the ASD. The data can be viewed on the ASD using the Application, as described earlier in section 8.2 of this manual.

For detailed analysis, either automated or manual, the recorded values need to be transferred to another device. This can be done by USB / email / Bluetooth or other means.

If '.csv' format is selected, the exported data file format is ASCII, making it commonly accessible via many software packages, and small in size.

Data exported from the ASD can be simply and easily imported into **Geosense® IncloPro Insight** for clear and effective computation and presentation. For details refer to **Geosense® Ltd Sales or Support departments**.

The structure of an exported file is detailed below. It comprises a header that includes details of the site, borehole, equipment, survey and operator, followed by strings of data. Below is an example of the information included in the header and its 'comma separated' layout (as opened in a Text Editor).

Site Name: Carpark
Borehole Name: 30m 2nd survey
Borehole Depth: 30.0 metres
Interval: 0.5m
Degrees From North: 0
Latitude: 50.630998, Longitude: -3.20214
Operator Name: David O
Probe Serial Number: DSP00141
Reel Serial Number: 1001
Survey Date: 20260506_115618
Survey Comment: 141(1)

Opened in a spreadsheet, each comma should be set to delineate a column so the header information would be presented as follows:

Table 2: Manually entered borehole information

Site Name: Carpark	
Borehole Name: 30m 2nd survey	
Borehole Depth: 30.0 metres	
Interval: 0.5m	
Degrees From North: 0	
Latitude: 50.630998	Longitude: -3.20214
Operator Name: David O	
Probe Serial Number: DSP00141	
Reel Serial Number: 1001	
Survey Date: 20260506_115618	
Survey Comment: 141(1)	

The following highlighted line of the file identifies the sequence of the variable values.

3	Borehole Depth: 30.0 metres			
4	Interval: 0.5m			
5	Degrees From North: 0			
6	Latitude: 50.630998	Longitude: -3.20214		
7	Operator Name: David O			
8	Probe Serial Number: DSP00141			
9	Reel Serial Number: 1001			
10	Survey Date: 20260506_115618			
11	Survey Comment: 141(1)			
12	ID	DEPTH_METRES	READING_DEG	
13	5097	0.5	-0.054	
14	5096	1	-0.25	

Figure 8: Sequence of variable value columns

9.2. Data Reduction

Data reduction is performed using **Geosense® IncloPro Insight** for Microsoft Windows®.

For more information on **IncloPro Insight** please contact **Geosense®**.

9.3. Temperature Considerations

Geosense® has carried out significant research into temperature effects on the Probe and its electronics and has found that the thermal effects are very small. However, at the beginning of a survey it is strongly recommended that the temperatures in the probe be allowed to 'normalise', (referred to as the stabilising period) thereby removing temperature gradients within the MEMS circuitry.

Where the probe is used in an inclinometer access tube in a borehole or other subsurface structure, there is usually little variation in temperature over the length of borehole, so thermal effects will be small, and corrections will not be necessary.

However, if the probe is subjected to rapid temperature changes, the readings may be affected. Thermal influences are complex. The effect of temperature changes on the MEMS sensor are generally insignificant, but this relates purely to the 'sensor' on the circuit board, inside the probe. Effects on the body of the probe, together with the structure into (onto) which the tubing is installed, will be very complex and difficult to quantify. Consequently, reliable compensation for such changes would be unreliable, so are not considered of value.

10. MAINTENANCE

10.1. Lubrication and Cleaning

The **Geosense® Portable Spiral Sensor** is a low maintenance device. With careful use, routine inspections and a small amount of maintenance, it will provide reliable data over a long period.

Upon completion of a monitoring exercise it is strongly recommended that the probe and cable be wiped down to remove moisture and debris. The connectors should be cleaned and dried fully and caps should be fitted whenever the connector is separated.

Do not store a wet cloth with the probe in the hard case. Connectors should always be dry and free from dirt before being stored for any periods, as trapped moisture may cause corrosion.

The probe wheels include faced bearings and should be lubricated with silicone oil. The wheel carriage spindles should be occasionally lubricated with a light machine oil, to maintain free movement and reduce wear.

The cable connector includes a double 'O' ring sealing system. The 'O' rings should be wiped clean and lubricated with a small amount of Silicone Grease to maintain ease of connection. Contact **Geosense®** for information on how to service the connectors should they become dirty. A dirty connection will impede the function of the system; it is important to keep all connectors clean and free from debris at all times.

Batteries in the Reel and the ASD should be charged regularly to prevent deterioration and maintain their capacity. Only approved chargers should be used.

General Inspections should include the following:

Probe Wheels: Do they move freely and is there any wear in the bearings?

Probe Wheel Carriages: Do they move freely?

Probe Connector: Is the connector clean, free from debris?
Are the pins straight and clear?
Are the seals in good condition and lightly lubricated with silicone grease?

Probe Swivel: Does the swivel rotate freely?

ASD: Is it dry and are the ports clear of foreign materials?

Cable: Is the cable free from twists and 'kinks'?
Are there cuts or gouges in the sleeve?

10.2. Storage

Store all equipment, in dry cases, in a dry location. (Dry the cloth prior to storing it in the case). The cable connectors should be dried, and caps fitted to protect the pins. Do not fit caps if any water is present as this will cause the connectors to corrode during storage.

10.3. Calibration

All MEMS Portable Spiral Sensor probes are calibrated at manufacture prior to shipping, with all calibration factors stored internally on the board containing the MEMS sensors. This allows for the unit to provide accurate survey data directly without the need for compensation using calibration factors by the user.

Normal calibration periods are specified at 12-month intervals for probes under light use. For probes under heavy use or that are transported frequently, it may be advisable to increase the frequency of calibrations to ensure the sensors remain within the calibrated tolerances.

It is strongly recommended that any probe that has received a significant shock or vibration, or any damage to the wheel sets, is recalibrated before next use.

11. TROUBLESHOOTING

The below tables represent potential issues and their remedies.

11.1. Probe

Table 4: Probe Troubleshooting

Fault	Possible Cause	Remedy
Difficulty connecting cable		
	Keyways are not aligned Lack of lubrication	Align keyways
	Damaged/bent pins	Return to Geosense® for repair
	Dirt/debris	Clean with fresh water and remove all contaminants, then dry
	Threaded collars cross threaded	Do not force threaded parts together, undo and restart thread
Wheelset does not return to fully extended position		
	Presence of dirt / lack of lubrication	Clean with fresh water and dry, then lubricate with light machine oil. If problem persists, replace wheel sets*
Wheels do not turn freely		
	Presence of dirt / lack of lubrication within bearings	Clean with fresh water and dry, then lubricate with light machine oil. If problem persists, replace wheel sets*
*If the wheel sets are replaced the probe should be recalibrated		

11.2. ASD Readout

Table 5: ASD Readout Troubleshooting

Fault	Possible Cause	Remedy
ASD will not turn on		
	Flat battery	Charge battery
	Faulty charger	Try new charger and cable / check outlet is powered
	Faulty battery	Replace battery
The ASD cannot find the reel or finds but cannot connect		
	Reel not turned on	Power the reel on
	Bluetooth is not enabled	Enable Bluetooth on the ASD
	Incorrect connection sequence	ALWAYS use the IncloPro app to initiate the Bluetooth connection, NOT the phone Bluetooth options
	Interference from other paired Bluetooth devices	Restart reel and ASD and power off other Bluetooth items such as speakers that are linked to the same ASD
	Bluetooth fails to connect despite using the app	Return to Geosense® for inspection
The ASD freezes after extended periods of use		
	Bluetooth connection	Power cycle the reel and reconnect using the app to continue monitoring
	Power saving settings	Make sure there are no power saving options enabled in the ASD settings
Fluctuating readings		
	Faulty signal from probe	Check probe connection Check cable for damage Check Bluetooth connection Check ASD settings Change from AUTO to MANUAL mode to record data

	Site conditions	Make sure the casing is still and there are no sources of movement
	Damage to probe	Make sure no damage has occurred to the probe and that it has not been dropped to the base of the hole or incurred any shocks

11.3. Reel and Cable

Table 6: Reel and Cable Troubleshooting

Fault	Possible Cause	Remedy
Reel will not turn on		
	Flat battery	Charge battery and check charger is functioning
	Fault with battery	Replace battery – refer to Geosense® support
Cable becomes kinked/twisted		
	Allowing probe to freefall or incorrect deployment/recovery and storage	Replace cable Do not allow probe to freefall

12. SPARE PARTS

Under normal use spare parts are not generally required for **Geosense®** Portable Spiral Systems.

However, the following items are available. It is strongly recommended that replacement service components be fitted by **Geosense®** or their qualified representatives:

- 1) Wheel and Carriage sets, including pins and springs
- 2) Batteries and Chargers - Reel & ASD
- 3) Cable support
- 4) Connector caps

Contact **Geosense®** for more details and Service / Calibration options.

13. RETURN OF GOODS

13.1. Returns Procedure

If goods are to be returned for either service/repair or warranty, please fill in the information via the website <https://www.geosense.com/returns/> where a **Returns Authorisation Number** together with a **Returns Form** will be automatically generated and sent to you via email.

The **Returns Form** should be sent together with the returned goods.

13.2. 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 fee for inspecting the equipment and providing an estimate is also chargeable.

A valid purchase order (credit customer) or advance payment for the inspection fee(s) is required before inspection can take place. In the event of a warrantable claim being accepted, the value will be credited back to the customer's account (credit customer) or refunded (pre-payment customer).

13.3. 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 **Portable Spiral System** must be handled and used in accordance with the manufacturer's instructions and has not been subjected to misuse.

In order to make a warranty claim tick the warranty claim box under **REASON FOR RETURN** on the website and return the goods as above. You will then be contacted and informed whether your warranty claim is valid.

13.4. 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.

13.5. Transport & Storage

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

14. LIMITED WARRANTY

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

Sufficient site data has been provided to **Geosense®** by the purchaser as regards the nature of the installation to allow **Geosense®** to select the correct type and range of **Spiral System** and other component parts.

The **Spiral System** equipment shall be installed in accordance with the manufacturer's recommendations.

The equipment is warranted for **2 years** 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 **Spiral System** equipment 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 **Spiral System** equipment from the time of delivery to Purchaser



HEAD OFFICE

Nova House
Rougham Industrial Estate
Rougham, Bury St Edmunds
Suffolk IP30 9ND
England

+44 (0)1359 270457
sales@geosense.com
support@geosense.com

NORTH AMERICA OFFICE

15 West 38th Street
Suite 632
New York
NY 10018

+1 518-920-3483
sales@geosense.com
support@geosense.com

www.geosense.com