

NXG Vertical Inclinometer User Manual



Soil Instruments Limited has an ongoing policy of design review and reserves the right to amend these specifications without notice.

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What's this manual about?

This manual tells you about the NXG Vertical Inclinator and how to use it to take readings of lateral deflections.

Who does this apply to?

Installers, field engineers and technicians using the NXG Vertical Inclinator. If the equipment is used in a manner not specified in this manual then the protection provided by the equipment may be impaired.

Welcome!

Thank you for choosing the NXG Vertical Inclinator.

This manual has been written to help you utilise all of the functions of the NXG Vertical Inclinator. Please read this manual thoroughly before use to help avoid any problems and keep it handy when using the NXG Vertical Inclinator System.

NXG Vertical Inclinator.

The NXG Vertical Inclinator comprises a biaxial probe, cable reel and a rugged Tablet supplied with 'In-Port Pro' application.

The inclinometer probe measures lateral deflections using MEMS sensors, enabling the system to take highly accurate and repeatable readings whilst transferring the measurements via a digital signal for interference-free data transmission.

The system incorporates Wireless Connectivity technology for communicating from the inclinometer reel to the Tablet, offering a complete cable free data transmitting system with no connectors to corrode or break.

The graduated cable is constructed with Vectran[®], making it very strong and durable whilst remaining lightweight and consists of a metal cable marker system which, when used in conjunction with the cable gate, provides highly accurate and repeatable depth control.

With all these combined design features, the NXG Vertical Inclinator is a robust, effective and highly accurate system that is light, compact and easy to operate in any site environment.

OVERVIEW & INTRODUCTION	1
Important information	1
PRODUCT CHANGES	1
WARRANTY	1
DISPOSAL	1
System Description.	
Things You Need to Know About the NXG Vertical Inclinometer	2
ABOUT INCLINOMETERS	2
SYSTEM COMPONENTS	2
SYSTEM OPERATING CONDITIONS	2
NXG VERTICAL INCLINOMETER PROBE	4
MEASUREMENT AXIS	4
NXG REEL CABLE	5
HOW TO NEGATE PLOTTING ERRORS	5
WIRELESS CONNECTIVITY REEL	6
BATTERY PACK	6
CABLE GATE	6
HANDLING THE PROBE	6
FRONT PANEL LED'S	7
POWER BUTTON & POWER LED	7
COMMS READY LED	7
BATTERY LED	7
BATTERY CHARGER	7
QUICK START GUIDE	8
Using the NXG Vertical Inclinometer	8
BEFORE YOU GO TO SITE	8
CHARGING THE BATTERY	8
CONNECTING THE PROBE	9
WIRELESS CONNECTIVITY PAIRING	10
DISCONNECTING THE PROBE	10
Safety Advice - When Using the NXG Inclinometer System	11
PERSONNEL PROTECTIVE EQUIPMENT	11
CABLE MANAGEMENT	11
CABLE GATE SAFETY FEATURES	11

REEL LOCATION	11
In-Port Pro App Overview	12
IN-PORT PRO SOFTWARE	12
ACTION BAR	12
Adding An Inclinometer	13
THE INCLINOMETER LIST	13
ADDING AN INCLINOMETER	13
FIELDS ON THE INCLINOMETER FORM	14
Recording Inclinometer Surveys	15
A-GROOVES	15
ORIENTATION OF PROBE	16
THE SURVEY SCREEN	17
0-PASS SCREEN	17
180-PASS SCREEN	17
SURVEY BUTTONS	18
CHANGING THE ACTIVE DEPTH	18
RESUMING AN INTERRUPTED SURVEY	19
HALTING A SURVEY	19
RECORDING THE SURVEY	20
RECORDING THE 0-PASS	22
RECORDING THE 180-PASS	26
DETAILED SOFTWARE GUIDE	30
Plotting Inclinometer Surveys	30
INTRODUCTION	30
CHECKSUMS	30
CHANGE FROM INITIAL	30
CHANGE FROM LAST	30
PROFILE	30
VIEW DATA	30
Advanced Borehole Features	31
AUTORUN (HANDS-FREE MODE)	31
QR CODE FEATURE	32

Sending Data Files to a PC	33
USB TRANSFERS	33
EMAIL TRANSFERS	35
SETTING UP EMAIL RECIPIENTS	35
EMAILING FILES	36
DROPBOX TRANSFERS	37
SENDING FILES TO DROPBOX	37
Options Menu	39
OPTIONS LIST	39
SURVEY CONTROL	40
Technical Details	41
READING UNITS	41
FILES AND FOLDERS	41
FILE MANAGEMENT	41
MAINTENANCE GUIDE	42
Maintaining the NXG Vertical Inclinator System	42
ROUTINE MAINTENANCE	42
CABLE MAINTENANCE	42
MOISTURE MANAGEMENT	43
WHEEL BRACKET	43
Probe Inspection	43
WHEEL	43
Probe Maintenance	43
WHEELS	43
Cable Inspection	43
CABLE	43
Cable Maintenance	43
MOISTURE MANAGEMENT	43
CABLE	43
Charger Maintenance	43
ELECTRICAL SAFETY	43

APPENDICES	44
Appendix A-Data Download Format and Manual Data Reduction	44
DATA REDUCTION VARIABLES	44
DATA REDUCTION TO INCREMENTAL DATA	44
DATA REDUCTION ABSOLUTE PROFILE	44
DATA REDUCTION CULMUTIVE PROFILE	44
Appendix B	45
CHECKSUMS	45
CALIBRATION AND SERVICE	45
CUSTOMER SUPPORT	45

OVERVIEW & INTRODUCTION

Important information

The following symbols are used throughout the manual



**IMPORTANT
INFORMATION**



QUESTION



WARNING



TIP



Failure to observe the warning may result in injury, product malfunction, unexpected readings, loss of data or damage to the product that may invalidate its warranty.



TIP

Tips give additional information that may be helpful when using the NXG Vertical Inclinometer.

PRODUCT CHANGES

Soil Instruments has an on-going policy of design review and reserves the right to amend the design of their product and this instruction manual without notice.

WARRANTY

Refer to our terms and conditions of sale for warranty information. The batteries are a consumable item and are excluded from the warranty.

DISPOSAL



Products marked with the  symbol are subject to the following disposal rules in European countries:

- This product is designated for separate collection at an appropriate collection point
- Do not dispose of as household waste.
- For more information, contact Soil Instruments or the local authority in charge of waste management.

System Description.

Things You Need to Know About the NXG Vertical Inclinometer

ABOUT INCLINOMETERS

An inclinometer system includes inclinometer casing, a probe, control cable, and tablet.

Inclinometer casing is permanently installed in a near-vertical borehole that passes through a zone of suspected movement. The probe, cable, and tablet are used to survey the casing.

The first survey establishes the baseline profile of the installed casing. Subsequent surveys will reveal changes in the profile if ground movement has occurred. Plotting these changes reveals the rate, depth, and magnitude of ground movement.

SYSTEM COMPONENTS

The NXG Vertical Inclinometer system includes an inclinometer probe, Cable, a Wireless Connectivity reel, a cable gate, and an In-Port Pro app that the supplied Tablet.

SYSTEM OPERATING CONDITIONS

The NXG Vertical Inclinometer system has been designed to be used in outdoor environments. The Inclinometer Probe has a water resistance depth of more than 200M and will operate in temperatures of -20°C to +70°C.

The Reel is IP66 rated and will operate in temperatures of -10°C to +50°C.

The Field Tablet is IP68 Rated and will operate in temperatures of -10°C to +50°C.

All charging accessories are only to be used in dry indoor environments.

NXG Vertical Inclinometer Probe



NXG Vertical Inclinometer
Stainless Steel Probe with
innovative, alignment free
connector.

NXG Vertical Inclinometer
Probe precision sprung
wheel assembly with long-
life bearings.



NXG Vertical Inclinometer
Probe Carry Case.

NXG Vertical Inclinometer Reel

NXG Vertical Inclinometer Reel Vectran®-re-enforced EMC-shielded orange cable fitted with lightweight cable markers and Metre Marker Labels.



NXG Vertical Inclinometer Reel Hub, with Battery Charging socket, 3 Indicator LED's and On/Off button.

NXG Vertical Inclinometer Reel innovative, alignment free connector.



NXG Vertical Inclinometer Reel carry bag containing, Accessories bag with Reel Charger, Mineral Oil, Duster, and Tetherable Cable Gate.



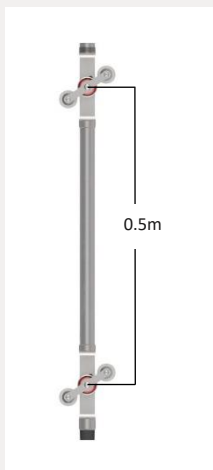
Android Tablet with In- Port Pro App Pre-Loaded



NXG Vertical Inclinometer Field Tablet with a long Battery life and Pre-Loaded with In-Port Pro software for easy data capture.

NXG VERTICAL INCLINOMETER PROBE

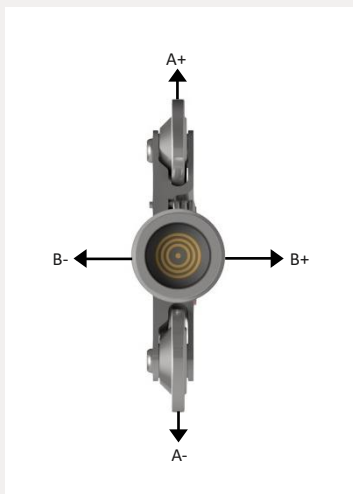
The NXG Vertical Inclinator is supplied in metric version only and has a gauge length of 0.5m. A + mark is engraved on the body of the probe. This is used to orient the probe during a survey.



MEASUREMENT AXIS

There are two MEMS tilt sensors inside the probe. The A-axis sensor measures tilt in the plane of the wheels. The B-axis sensor measures tilt in the plane perpendicular to the wheels.

When the top of the probe is tilted in the + direction, tilt values are positive, and when the probe is tilted in the - direction, tilt values are negative.



NXG REEL CABLE

The cable is used to control the depth of the inclinometer probe. It also conducts power and data between probe and reel.

- Metric probe cables have half-meter graduations with labels every meter. The first graduation is 0.5 meters from the top wheels of the probe.

HOW TO NEGATE PLOTTING ERRORS

The NXG Vertical Inclinometer system displays readings as mm of tilt, and this reading applies at the depth of the top wheel set pivot point.

The Soil Instruments standard inclinometer along with inclinometer systems from some other manufacturers use cable markers that are spaced from the middle of the probe (mid-probe datum systems), but this has some unexpected effects when the readings are plotted.

NXG Vertical Inclinometer system has been designed to negate these plotting errors.

If you are using your NXG Vertical Inclinometer system in new boreholes, then the following does not apply.

However, if you use a NXG Vertical Inclinometer in a Borehole that has previously been read using a mid-probe datum inclinometer you will see anomalies in the data plots when comparing the previous borehole runs with the new borehole runs.

There are 3 options of how to negate these anomalies:

Option 1

- Take a new datum set and exclude the previous data runs from the plot.

Option 2

- Add a 250mm section of casing to the borehole which will position the new probe in the same positions in the borehole as the original probe.
- The 250mm value may need adjusting for differences in cable support gates.

Option 3

- Use the Depth Index adjustment feature in In-Profile to reposition the previous data sets.
- See article Using In-Profile Depth Index Correction, found on our Knowledge Base at soilinstruments.com



IMPORTANT INFORMATION



Caution! Ensure you carry out a Manual Handling Risk Assessment before transporting the NXG Reel Assembly. Considering the environment to be traversed along with the size and weight of the system.

**HANDLING THE
PROBE**

The inclinometer probe is a sensitive measuring instrument. Handle it with care.

- When you insert the probe into the casing, cup the wheels with your hands to compress the springs and allow a smooth insertion. Take care to keep fingers clear of the Wheel arm as it closes during entry into the Casing
- When you lower the probe into the borehole, do not allow it to strike the bottom.
- When you withdraw the probe from the casing, again cup the wheels with your hands to prevent them from snapping out.
- When you rotate the probe, keep it upright and perform the rotation smoothly.
- The probe is rated for temperatures from -20 to 70°C (-4 to 158°F). Avoid using the probe in temperatures outside this range.

CABLE GATE

The cable gate is pushed onto the top of the inclinometer casing to serve as the reference for the depth graduations.

During the survey, successive cable graduations are locked into the cable gate to hold the probe steady for readings.

The cable gate fits two diameters of casing: 85 and 70mm (3.34 and 2.75 inch).



**WIRELESS
CONNECTIVITY
REEL**

The Wireless Connectivity reel provides a convenient way to carry the probe, control cable, and cable gate. The reel transmits commands and data between the tablet and the probe. A battery pack inside the reel powers both the reel and the probe.

BATTERY PACK

The Battery Pack, Soil Catalogue Code C17-BATT is located inside the Hub of the Wireless Connectivity Reel and is designed to be replaced by Soil Instruments or Soil Instruments approved service agents. A fully charged Battery Pack will allow an NXG Vertical Inclinometer to run with continual use for over 40 Hours.

Soil Instruments recommends the Battery Pack is replaced every 2 years to keep the system operating in peak condition. Contact Soil Instruments if a Battery Change is required.

The Battery Pack is only intended to be charged in “Indoor Conditions”. Do not Charge in Wet/Damp locations or in an environment with high levels of condensation.

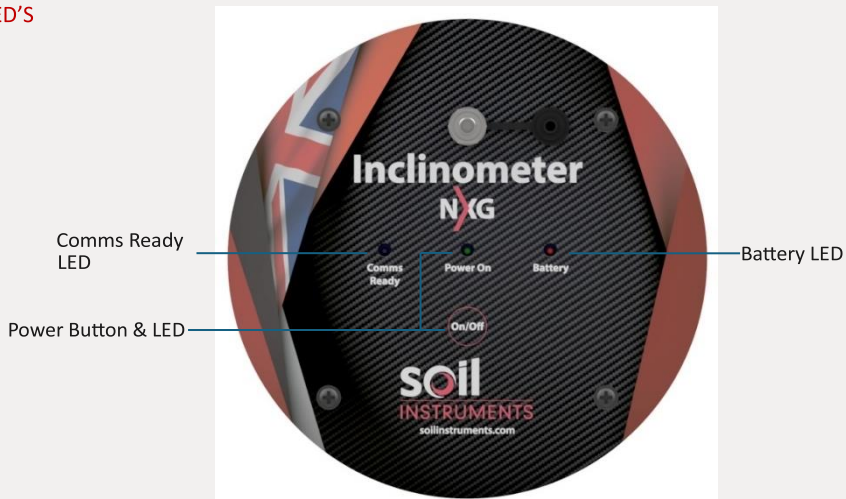
Battery Pack Specifications.

7.2v	4.5Ah
6Cell	Resetting Thermal Fuse



FRONT PANEL LED'S

The front panel has three LED indicators and a power button.



POWER BUTTON & POWER LED

Press to switch on. Press again to switch off. The Power LED glows green when power is on. The reel switches off automatically after 5 minutes without a Wireless Connectivity connection or after 10 minutes if no data is transmitted between tablet and probe.

COMMS READY LED

The Comms Ready LED blinks slowly while the Wireless Connectivity reel waits for a connection, then glows a steady blue when the connection is made.

BATTERY LED

The Battery LED stays off during normal use. A fully charged battery provides about 40 hours of operation. If the battery charge is very low, the Battery LED blinks red when you first switch on the reel.

BATTERY CHARGER

The Wireless Connectivity Reel System is supplied with a 15V switching power supply to charge the reel battery. Only the supplied charger or a Soil Instruments replacement can be used to charge the system. Soil Instruments catalogue code C17-NXG-CHARGE.

Voltage Input	90 ~ 264VAC	Voltage Output	15VDC
Current Output (Max)	2A	Operating Temperature	0°C ~ 40°C

Warning! Risk of electrical shock, fire, personal injury, or death.



The Battery Charger is intended for "Indoor Use" only. Do not use in Wet /Damp locations or in an environment with high levels of condensation.



The unit is double insulated.



- Do not modify or repair the charger. There are no serviceable parts inside.
- Do not open the charger as high voltages may still be present sometime after disconnection.
- Long term storage may affect the charger performance. Check before use.



The charger must be disposed of safely and in accordance with local regulations.

QUICK START GUIDE

Using the NXG Vertical Inclinometer

BEFORE YOU GO TO SITE

- Unpack the NXG Vertical Inclinometer, retaining the packaging for future carriage to Soil Instruments for calibration.
- Charge the NXG Vertical Inclinometer by carefully following the charging procedure below.
- Check that there is sufficient battery power in the tablet by tapping on the battery icon located on the top right-hand side of the home screen. Ideally the battery should be over 50%; however, the tablet will function at a lower level.
- Read this manual to familiarise yourself with the Instrument. The NXG Vertical Inclinometer must only be operated by a competent operator.

CHARGING THE BATTERY

Plug the AC adaptor into a wall socket. If the NXG Reel has been used check the charge socket is dry and clean before inserting the barrel-plug into the charge socket in the hub side of the reel and screw the plug securely in place.

The Battery LED glows a steady red while the battery is charging. When charging is finished, the green Power LED blinks slowly.

You can charge the battery every night. A charging circuit inside the reel limits charge time to 5 hours.

If the battery is fully discharged, a full recharge may take longer than 5 hours. In that case, it is possible to reset the charge timer by disconnecting and then reconnecting the AC adaptor.

The adaptor provides 15 Vdc. Polarity of barrel connector is +ve inside and -ve outside.



Always follow the charging procedure outlined in this manual to properly maintain the NXG Vertical Inclinometer System. Only use the charger supplied, using other chargers will invalidate the warranty.



The NXG Vertical Inclinometer System and tablet are fully charged during the manufacturing process, however, Soil Instruments advise you to follow the correct charging procedures before first use.

CONNECTING THE PROBE

Remove and retain the protective caps from the cable connector and the NXG probe. Check for any contaminants on the connectors and the O-ring on the Probe.



Insert the Connector into the rear of the Probe and engage the collar by turning clockwise. There is no requirement to line the connectors up due to the Ring and Roller Pin connection design. The Collar should be done up firmly by hand with little to no rotation of the Cable or probe.



The connection between the NXG cable connector and the NXG Probe should only be assembled and disassembled in a dry and clean area, to prevent contamination of the connectors and O-Rings. The Protective caps must be replaced when the units are disassembled!

DISCONNECTING THE PROBE

Ensure you are in a clean and dry environment before disconnecting the probe. Wipe off any moisture around the connection. Undo the collar and pull the connection apart. Check that the O-ring is clean and gently wipe down the connectors.



Fit the protective caps to the cable connector and the probe.



The connection between the NXG cable connector and the NXG probe should only be assembled and disassembled in a dry and clean area, to prevent contamination of the connectors and O-Rings. The protective caps must be replaced when the units are disassembled!

WIRELESS CONNECTIVITY PAIRING

For information on how to pair an Android Wireless Connectivity device please refer to our Knowledge Base at [SoilInstruments.com](https://www.soilinstruments.com) and search for;

Android Tablet - Connect & Disconnect

Safety Advice - When Using the NXG Inclinometer System

REEL LOCATION Measuring locations may be in difficult to access, and high or uneven terrain. Ensure that the reel is situated in a location where it will not be knocked over and is secured against falling or tumbling from height and becoming a hazard.

Additionally, the reel should not be situated in a location where it may become submerged or exposed to excessive rain for a prolonged period.

CABLE MANAGEMENT During a measurement run the cable will be pulled from the borehole and will require management to ensure it does not become a hazard. If adequate space around the borehole allows, place the cable in a safe location to one side of the borehole as the probe is retrieved. Aim to keep the cable out of any access or egress routes and on a flat area.

If adequate space is not available, then it is strongly recommended that the cable is reeled back onto the reel after every 5Meters or so of measurement to prevent the cable becoming a hazard.

Care must be taken when winding the cable back onto the reel. Pay attention to the probe when winding the last section on as the probe could be dragged or yanked by the cable causing damage to the system or harming the operator.

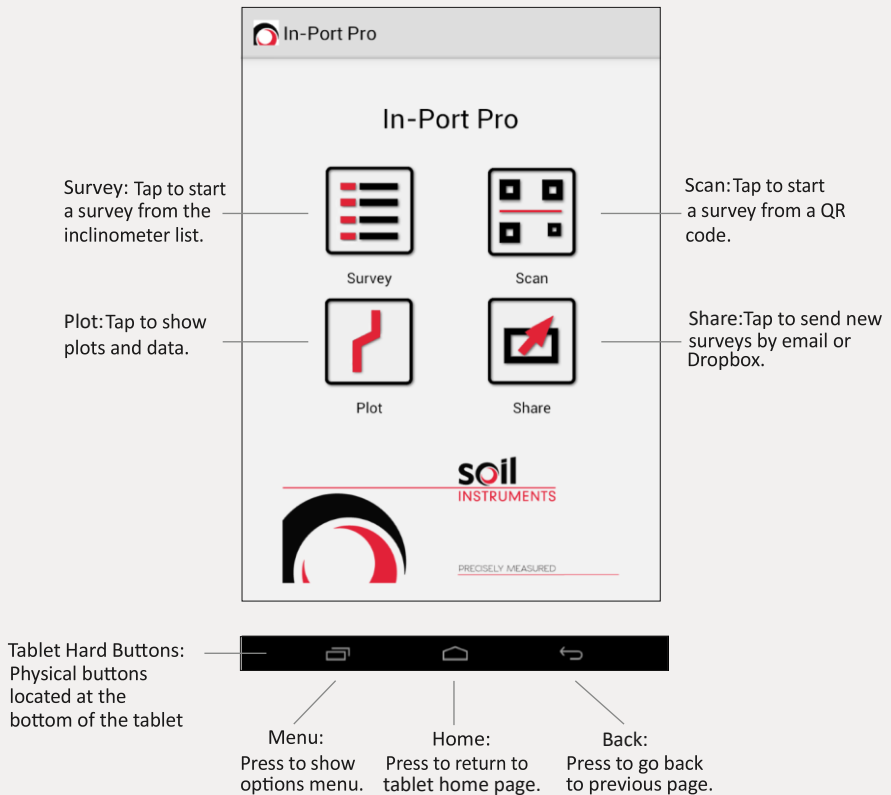
PERSONNEL PROTECTIVE EQUIPMENT Ensure you are wearing any appropriate PPE as per the risks identified at your site. Soil Instruments recommends as a minimum safety footwear when transporting the system and safety gloves when handling the cable.

CABLE GATE SAFETY FEATURES The NXG Cable Gate comes with a safety lanyard and a wrist strap. The wrist strap should be attached onto the casing a few inches below the top. This will limit the distance the cable gate can fall if it is knocked from the casing. This is especially important on steep embankments and cut aways.

In-Port Pro App Overview

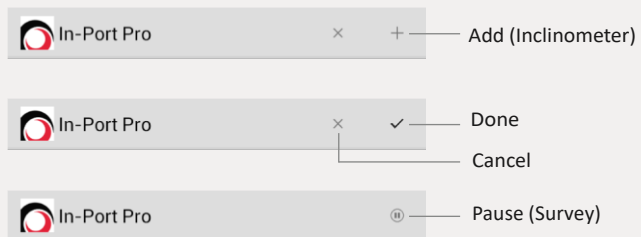
IN-PORT PRO
SOFTWARE

Tap the In-Port Pro icon to open the app.



ACTION BAR

The 'Action Bar' contains tap icons that vary depending on the screen.



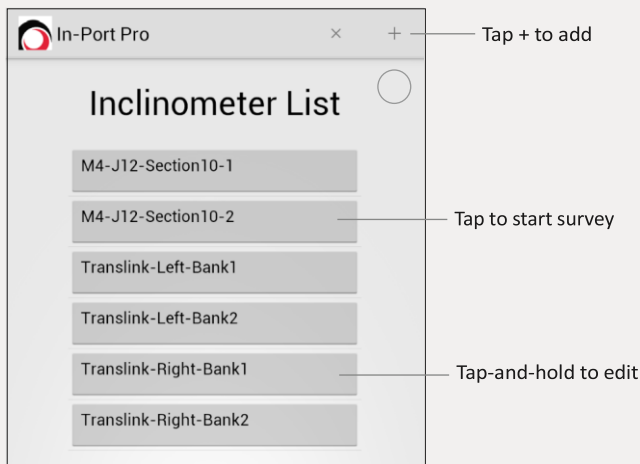
Adding An Inclinometer

THE INCLINOMETER LIST

The App keeps a list of inclinometers along with the survey data for each inclinometer. To see the list, tap the Survey icon (See right).



- To add an inclinometer to the list, tap the '+' symbol.
- To start a survey, tap the inclinometer you wish to use.
- To edit an inclinometer, tap-and-hold the inclinometer.



ADDING AN INCLINOMETER

1. Tap "Survey" to display the list of inclinometers.
2. Tap "Add" to display the inclinometer form.



3. Make entries as explained below. If the keyboard hides part of the form, slide the form upwards with your finger.
4. Tap "Done" when the form is complete.

FIELDS ON THE INCLINOMETER FORM

Site & Inclinometer: These two fields are used together to identify an inclinometer. Each field can contain 12 characters.

Description: Optional. (35 Max Characters)

A0 direction: Optional. Compass heading 0 to 359.

North = 0, South = 180

Units: Tap to switch between metric and English units.

Display Unit: Use mm for metric probe and Inch for English probe.

Depth Unit: Fixed to meters or feet.

Interval: Typically, 0.5 for metric and 2 for English.

Top Depth: Typically, 0.5 for metric and 2 for English.

Bottom Depth: Enter a multiple of 0.5 for metric systems or a multiple of 2 for English systems.



TIP

If the probe is 0.5m gauge length, then select metric. Likewise, for the imperial probe, if the gauge length is 2ft then select English.



The app turns a field red if it finds an unacceptable entry. Check that you have entered no spaces, punctuation, or special characters. Also check that the top and bottom depths are multiples of the interval.

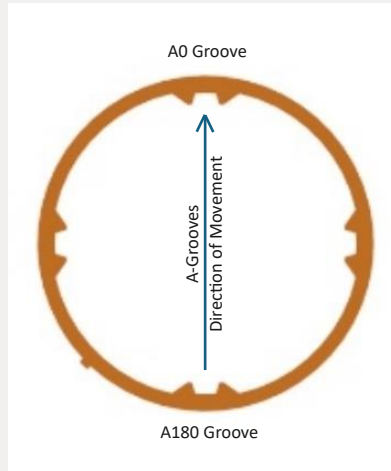
Recording Inclinometer Surveys

During a survey, the probe is drawn from the bottom to the top of the inclinometer casing. This is called a “pass”. A complete survey consists of two passes, a “0 pass” and a “180 pass”.

A-GROOVES

Inclinometer casing is installed with one set of grooves aligned with the expected direction of movement (downhill or towards the excavation). These are the “A” grooves.

Only the A-grooves are used in the survey. The A0 groove is usually marked for easy identification.



IMPORTANT

To maintain accurate depth control, cut the inclinometer casing as level as possible after installation to ensure the cable gate fits securely over the casing. You must not cut the casing if readings have been taken previously.



TIP

Soil Instruments recommend marking the A0 direction on the inclinometer casing with a permanent marker to make sure the borehole is always read with the correct orientation.

**ORIENTATION OF
PROBE**

0-Pass Readings: For the 0 pass, insert the probe with the + mark facing the A0 direction.

The + mark appears on the body of the probe above the top wheel set.



180-Pass Readings: For the 180 pass, remove the probe, rotate it 180°, and insert it with the + mark facing the A180 groove.

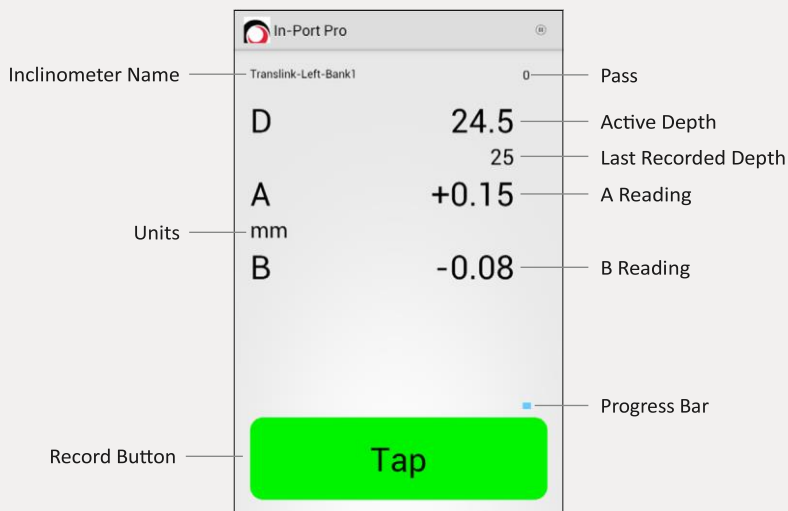


THE SURVEY SCREEN

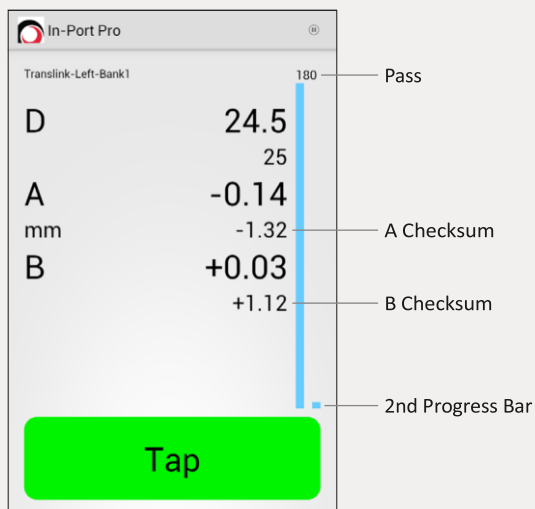
The survey screen guides you through the survey.

0-PASS SCREEN

The elements of the survey screen are explained below.



180-PASS SCREEN The 180-Pass screen adds checksums and a second progress bar.



SURVEY BUTTONS The record button is yellow when readings are not stable. The record button is green when readings are stable and ready to record. If the button stays yellow or flickers between green and yellow, tap to record the reading anyway.



Wait for stable readings



Readings are stable.
Tap to record

The record button is orange at the beginning and end of each pass. Tap "Start" to enable recording. Tap "End" to disable recording. This prevents accidental recording of readings while you position the probe.

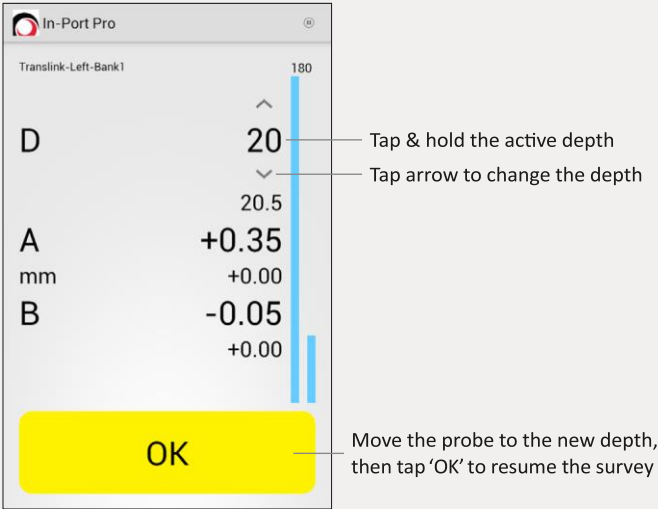


Tap to start recording



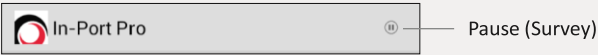
Tap to end recording

CHANGING THE ACTIVE DEPTH If cable depth and "active depth" get out of sync, tap & hold the active depth until arrows appear. Tap the arrow to change the depth. Then move the probe to the new depth and tap OK to resume the survey. The new "in-sync" readings overwrite the previous "out-of-sync" readings.

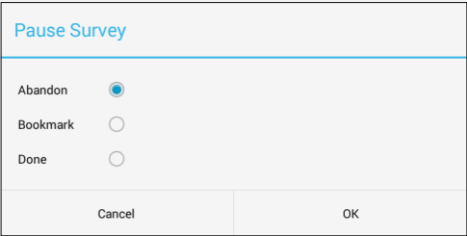


HALTING A
SURVEY

1. Tap Pause to halt the survey for any reason.



2. Make a choice, then tap OK. Or tap Cancel to resume the survey.



Abandon: Deletes the current survey.

Bookmark: Sets a bookmark at the last recorded reading.

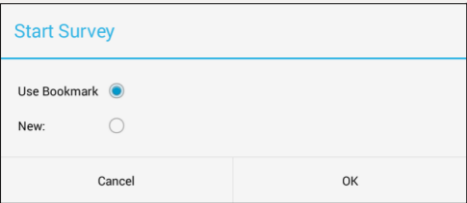
Done: Saves the current survey as is. This is useful if you are correcting a few readings and then want to stop.

RESUMING AN
INTERRUPTED
SURVEY

The app automatically stores a “bookmark” with each recorded reading. If the survey is interrupted, you can resume the survey from the last recorded depth.

1. Tap the inclinometer to start a survey in the normal way.

2. Tap OK to start the survey from the bookmark. To abandon the bookmarked survey and start a new survey, choose New.

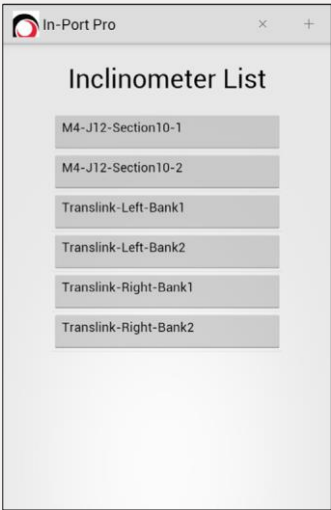


**RECORDING THE
SURVEY**

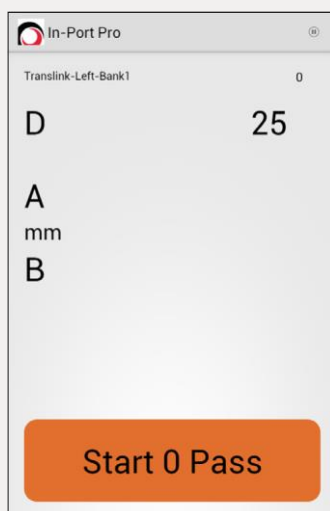
- 1. Switch on Reel and Reader. Tap the In-Port Pro icon to start the app. Wait for a steady blue glow from the Wireless Connectivity LED to show that a connection has made.
- 2. Tap “Survey”



- 3. Tap the inclinometer to survey.



4. The reader displays the start depth for the survey. Insert the probe, with + mark facing the A0 groove and lower it to the start depth.



Do not allow the inclinometer probe to drop to the bottom of the borehole of its own accord as this will result in damage to the inclinometer probe components and calibration.



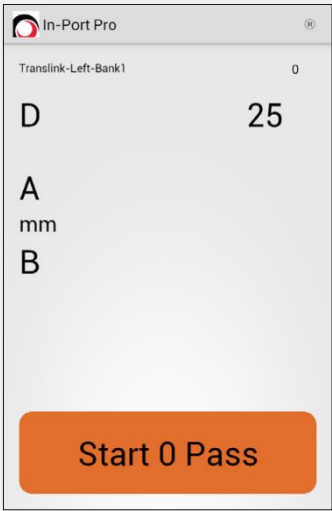
Pay special attention to ensure that the inclinometer cable markers are never dropped into the cable gate. Always make sure that the cable markers are placed into the cable gate at each depth to avoid the risk of causing cable damage or marker slippage.

5. Place the cable gate onto the casing and lock in the cable.

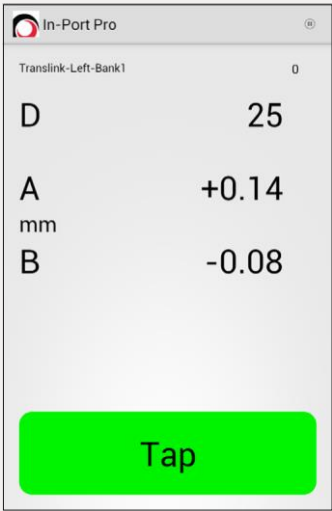
6. Wait ten minutes for temperature adjustment. You can switch off the tablet while you wait.

RECORDING THE
0-PASS

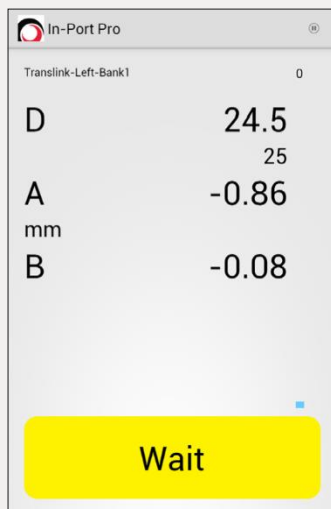
1. Switch on In-Port Pro and tap “Start 0 Pass”



2. The A and B readings appear. The probe has been immobile, so readings are stable. Tap to record.



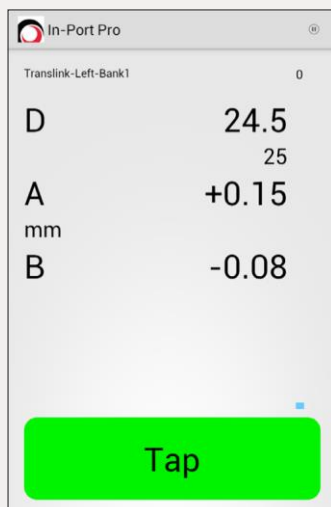
3. The tablet displays the next active depth. Raise the probe to this depth and wait for stable readings. The last recorded depth appears just below the new active depth.



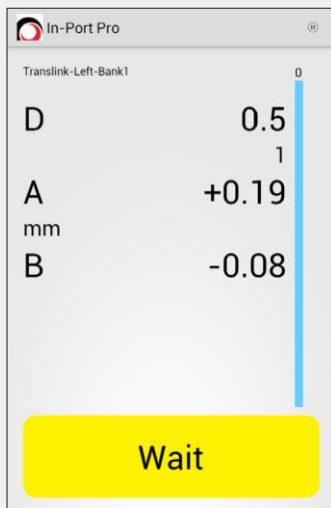
4. Tap the record button when it is green.

5. The tablet displays the next active depth. Raise the probe to this depth, wait for stable readings, and then tap the record button.

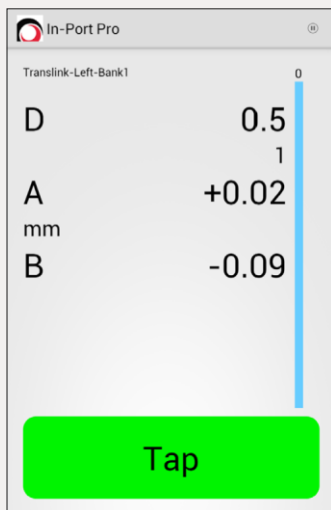
6. Repeat these operations until the probe reaches the top depth.



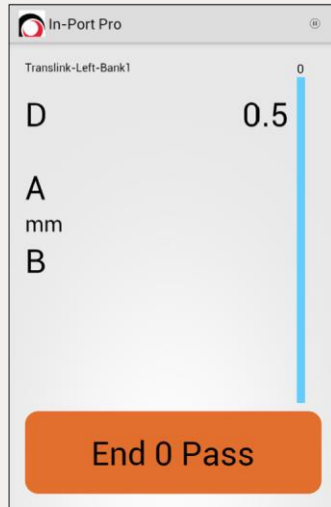
Now the tablet displays the top depth. Raise the probe to this depth and wait for a stable reading.



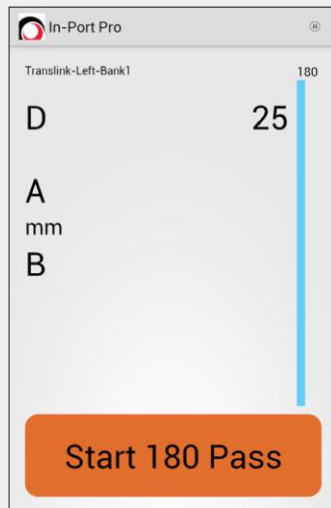
7. Tap when the record button is green.



8. Tap “End 0 Pass”. This disables recording so you can handle the probe.

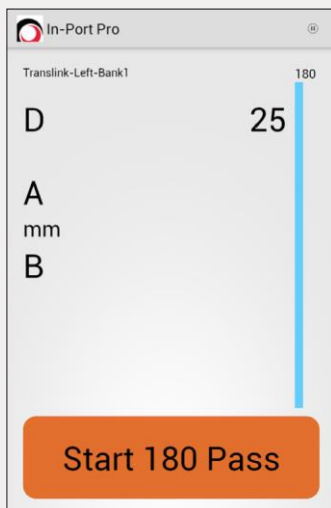


9. Now the tablet displays the start depth for the 180-Pass. Recording is still disabled. Remove the probe, rotate it 180 degrees, and insert it with the + mark facing the A180 groove. Lower it to the start depth.

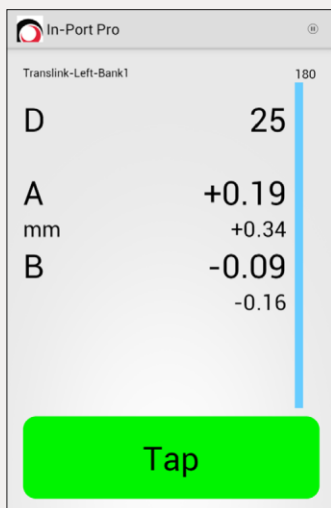


RECORDING THE 180-PASS

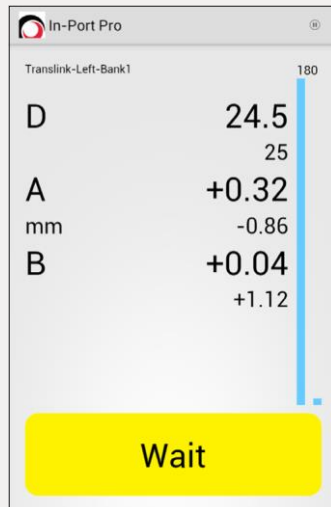
1. Tap "Start 180 Pass". This enables recording.



2. Tap the record button when it is green. You can see checksums now.

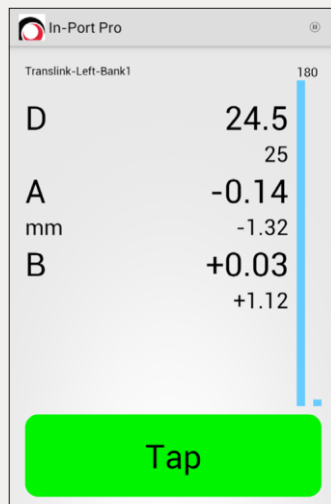


3. The tablet displays the next active depth. Raise the probe to this depth and wait for a stable reading.

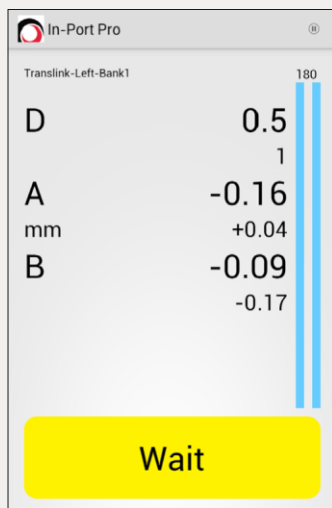


4. Tap the record button when it is green.

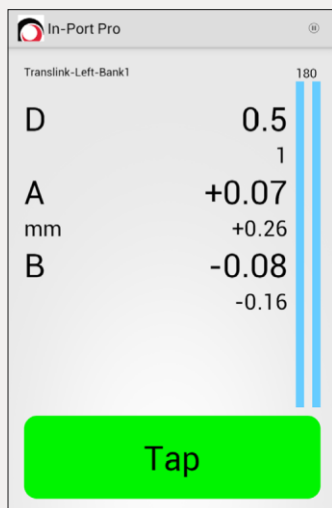
5. The tablet displays the next active depth. Raise the Probe to this depth, wait for stable readings, and then tap the record button. Repeat these operations until the probe reaches the top depth.



6. Now the tablet displays the top depth. Wait for a stable reading.

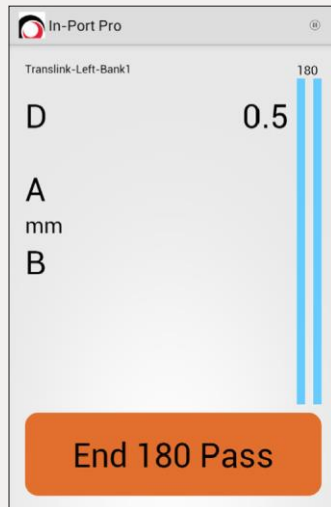


7. Tap the record button when it is green.



6. Tap “End 180 Pass”. The survey is complete.

The app saved readings during the survey so there is no need to save anything now. When you tap the “End” button, the app takes you to the “Plot” screen.

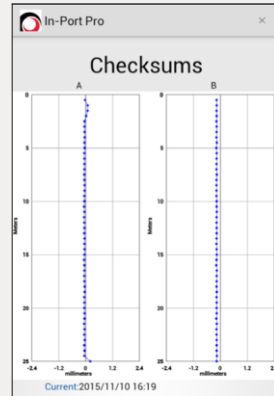
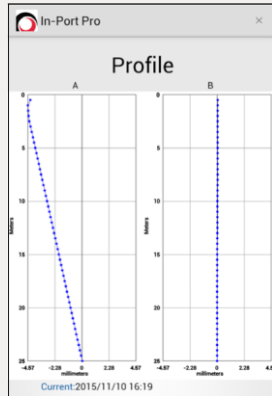


DETAILED SOFTWARE GUIDE

Plotting Inclinometer Surveys

INTRODUCTION

The In-Port Pro app can display four types of plots. These are useful for validating the survey. These plots cannot be printed directly, but if necessary, you can take screen shots, transfer them to a PC, and print them using Word. For more control of plots and printing, we suggest using the In-Profile software.



CHECKSUMS

Checksums are the sum of the 0 and 180 reading at each depth. The ideal checksum is 0. In practice, checksums are typically some small non-zero value. Checksum plots are displayed in the reading units used in the survey.

CHANGE FROM INITIAL

‘Change in initial’ shows the change in profile (cumulative displacement). There are three profiles shown: current-initial, last-initial, and initial-initial (which plots on the 0 line).

CHANGE FROM LAST

This plot shows also shows cumulative displacement, but in this case, the change in profile is plotted as current - last, and last-last (which plots on the 0 line).

PROFILE

This plot shows cumulative deviation, the profile of the casing.

VIEW DATA

This shows a table of data. If your checksum plot shows a bad reading, look at the data table to identify the depth and pass (0 or 180) of the bad reading. If you are still on site, you can reopen the survey and make the correction with the inclinometer probe. The steps are:

1. Tap and hold the depth the the bad reading.
2. Choose 0 or 180.
3. The Reader displays that depth and a live reading. Orient the probe for 0 or 180, insert it into the casing, and lower it to the depth displayed on the Reader.
4. Click OK to enable recording. Tap the record button to record a replacement reading. Continue upwards as needed, or tap the “Pause” button to exit the survey.

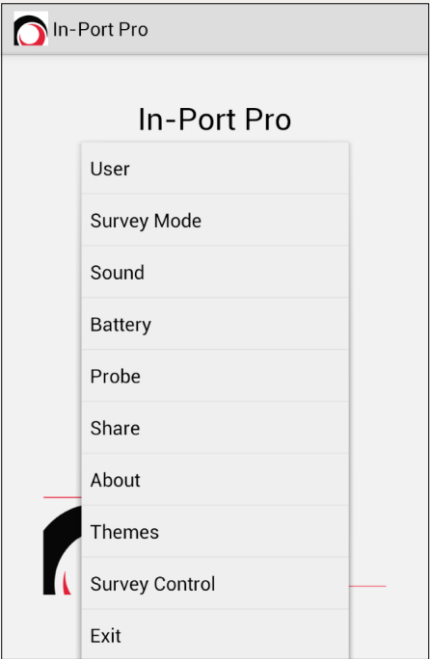
Advanced Borehole Features

AUTORUN
(HANDS-FREE
MODE)

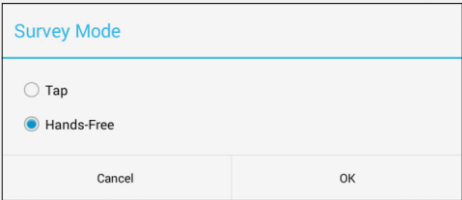
As well as manually recording the readings the system can automatically record readings with nothing more than a pull on the cable.

You can switch between the two methods of readings whenever you like, even if you are already partway through a run.

Press the ‘Menu’ hard button on the tablet. Then select “Survey Mode”



Select “Tap” for manual survey or “Hands-Free” for the Autorun survey.



When performing the run this way, the prompt buttons at the bottom of the screen will change in the following way.

Pull

“Pull” will appear to inform you to pull the cable up to the next depth marker, this will initiate the saving process.

Saved

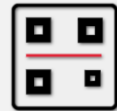
“Save” will appear once you have pulled the cable to the next depth to inform you the readings are being saved.

Wait

“Wait” appears when the readings are not within the predetermined stability range. The prompt will disappear once the unit is stable.

QR CODE FEATURE

Once a borehole has been completed and imported to the evaluation software, you can then print a QR code for that specific borehole. This QR code can then be stuck to your borehole to help you initiate a run in the future.



Tap the Scan icon (See right). This will take you to a QR scanner.



The scanner will read the QR code and take you straight to the readings page. This method will allow you to initiate the run even if you are using another tablet that doesn't have the borehole programmed.

Sending Data Files to a PC

There are three ways to transfer inclinometer files (.dux files) from the Reader to a PC.

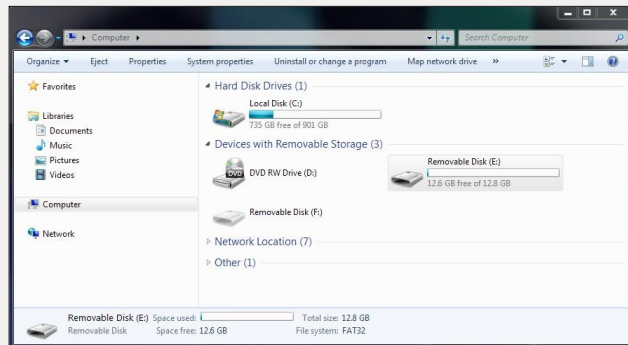
1. USB (Completely manual, requires USB connection cable).
2. Email (Partially automated, requires internet access).
3. Dropbox (More automated, requires internet access).

For more information, please refer to the Knowledge Base at soilinstruments.com.

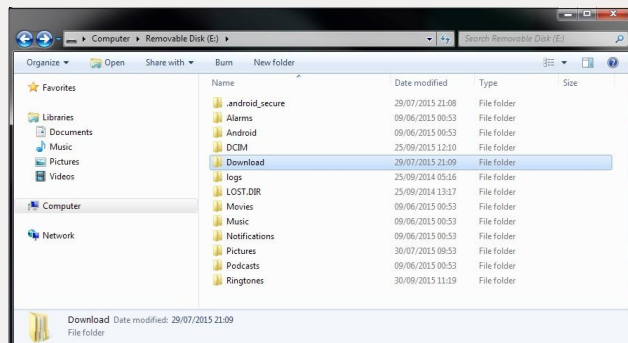
USB TRANSFERS

This method requires the USB cable supplied with your Reader device and the Windows file manager (Windows Explorer).

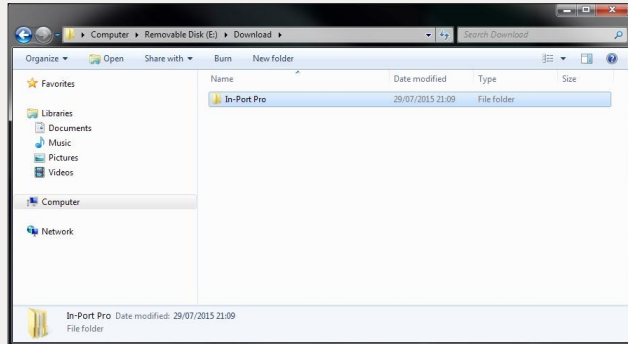
1. Connect the tablet to the PC using the USB cable and change the tablet from charging mode to SD card mode. Open 'My Computer' and select the device. It should appear as a removable disk drive.



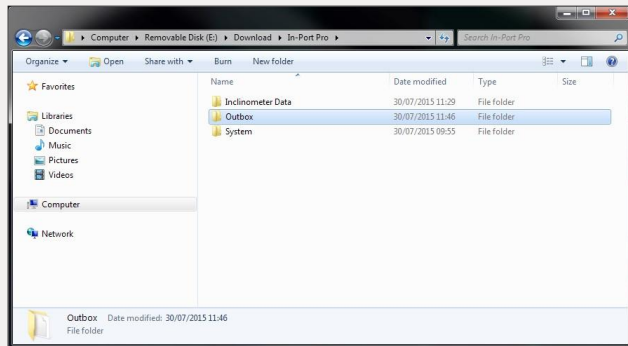
2. The app can be located inside the 'Download' folder.



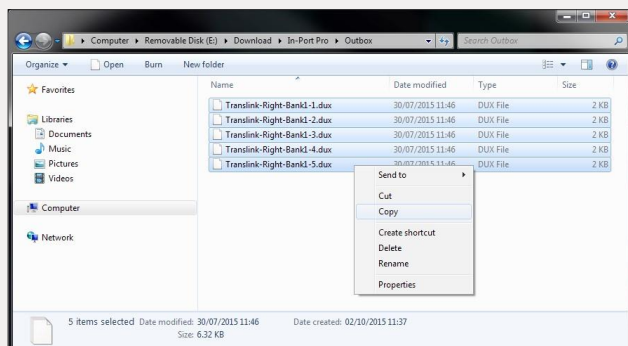
3. Click on the In-Port Pro folder.



4. Click on the "Outbox" folder. This folder holds any updated inclinometer files.



5. Copy all the .dux files in the Outbox and paste them into a folder on your PC.

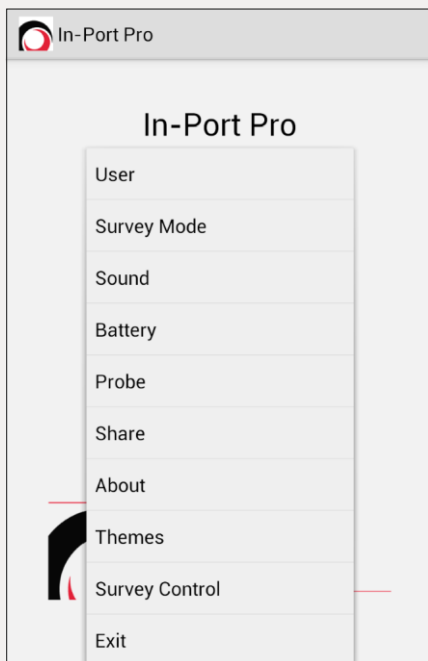


6. (Optional) Verify that the .dux files are on your PC, then delete the files in the Outbox. This has no effect on the "real" inclinometer files in the tablets Inclinometer Data folder.

EMAIL TRANSFERS This method sends the inclinometer files as email attachments and requires an internet connection. You can use Gmail or an email client configured for your company's exchange server.

**SETTING UP
EMAIL RECIPIENTS**

1. Setup is a one-time task. Press the 'Menu' hard button, then "Share".



2. Enter one or more email addresses. Then tap Done.

A screenshot of the 'Email Addresses' input screen. The screen has a light gray background. At the top, the title 'Email Addresses' is displayed. Below the title, there are four horizontal input fields, each preceded by the label 'Email:'. The input fields are white with a light gray border. The entire input area is enclosed in a rounded rectangle.

EMAILING FILES

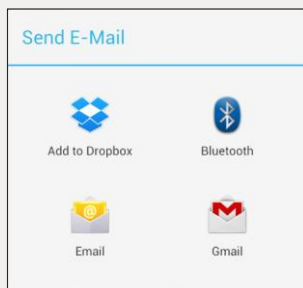
1. Tap the 'Share' icon.



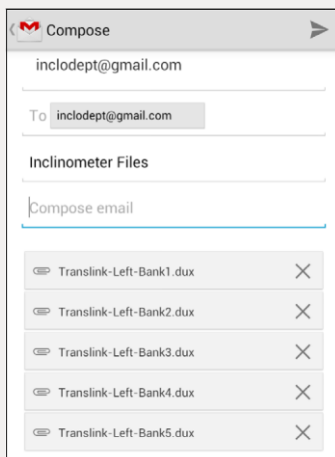
2. Tap Share.



3. Tap Gmail. If your Reader has been setup for exchange server, you can also tap the E-mail icon.



4. The Reader attaches files automatically. Tap Send.



5. When the email arrives, the recipient saves the attached files into a folder on the PC.

DROPBOX TRANSFERS

Dropbox is a “cloud storage” service that you can use for file transfers. The process explained here should also work with services offered by other companies, so long as they support Windows and Android devices.

1. Download the Windows Dropbox program from [Dropbox.com](https://www.dropbox.com). After you run the setup program, create a Dropbox account. Accounts are free or paid. Log in to the account and create a folder to hold inclinometer data.
2. Download the Android Dropbox app from the Google Playstore.
3. Run the Dropbox app on your tablet and log in to your new account. The tablet stays linked to Dropbox, so you don’t have to do this often. Now you’re ready to transfer files.

SENDING FILES TO DROPBOX

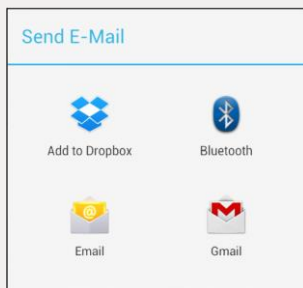
1. Tap the ‘Share’ icon.



2. Tap Share.



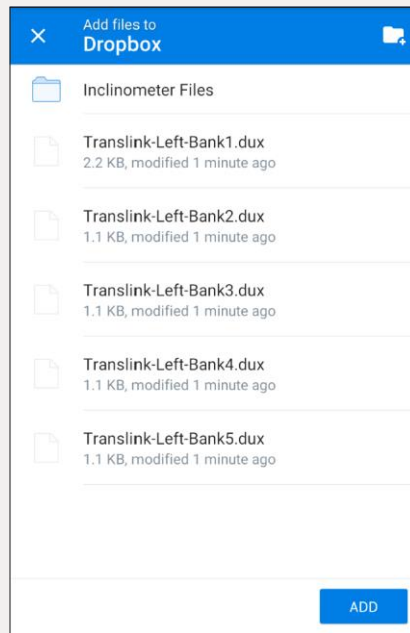
3. Tap Dropbox (or any other cloud storage service).



4. Dropbox will open up showing your list of folders and files. This should be empty when you first open the program. To upload the files, simple tap the “Add” button. The program will then start the upload to your dropbox.

Note: This process will vary with with other cloud based storage services.

5. Soon afterwards, the files appear in the Dropbox folder on your PC. (Look for the folder in My Documents).



There is an Android bug that affects files for USB connection. The files are not visible until the Android device has been restarted.

Options Menu

OPTIONS LIST Press the 'Menu' hard button on the tablet.

Survey Mode: Choose "Tap" or "Hands-Free". In Hands-Free mode, the record button says "Pull" when the readings are stable. When you pull the cable, the app records the most recent stable reading.

Sound: Choose the sound that the reader makes when you record a reading.

Battery: Displays battery level of the Reader. Does not display the battery level of the Reel.

Probe: Displays "live readings" from the probe. Tap the units label to specify different units (Keep in mind that metric units should be used with metric probes and English units should be used with English probes).

Share: Enter email addresses for sending data files by email.

About: Displays embedded serial number and firmware versions.

Themes: Light theme shows black text on a light background. Dark theme shows white text on a black background. If visibility is a problem, try changing the theme. The theme takes effect when you display a different screen.

User
Survey Mode
Sound
Battery
Probe
Share
About
Themes
Survey Control

SURVEY CONTROL These settings can improve your surveys.

Stability: This is the variation allowed for stable readings. The default value is 6 sine units, equivalent to 0.03mm or .001 inch. If your readings take a long time to stabilise, consider using a value up to 12.

Motion: When a reading exceeds this number the app assumes the probe is in motion. Used for hands-free mode. If the app fails to detect your pulls, try setting a lower number. Users who pull slowly need a lower number and users who pull quickly need a higher number. Normal values are 80 to 100.

If there is a lot of vibration at the site, tap mode may be your only choice, but you could try setting "motion" to a higher number and then make your pulls quick, rather than slow. The higher number decreases sensitivity to the ground vibration, but you must accelerate the probe faster so that a pull can be detected.

Tap Lockout: This tells the app how long to display the "saved" message. During that time, the app will not accept new input. The default is 2 seconds.

Pull Lockout: Same as above but used for hands free mode. Lockout is more important for hands-free mode. Experiment to find the right lockout timing. New users may be more comfortable with a lockout of 3 seconds or more. Expert users who develop a rhythm may prefer a 2 second lockout.

Exit: Turns off the Wireless Connectivity connection and closes the app.

Technical Details

READING UNITS

The NXG Vertical Inclinometer records tilt readings as $100000 \times \sin(\theta)$, where θ is the angle of tilt. During the survey, the Reader app displays the following units:

Metric Units: mm of deviation, assuming a 500mm gauge length.

English Units: Inches of deviation, assuming a 24 inch gauge length.

FILES AND FOLDERS

The In-Port Pro app creates a .dux text file for each inclinometer. The .dux file contains inclinometer parameters and all surveys for that inclinometer. New surveys are appended to the end of the file. Transferring inclinometers and data is a matter of copying these .dux files from one location to another location.

The In-Port Pro app creates the following folders:

In-Port Pro: Top Level folder.

Inclinometer Data: This folder holds all the inclinometer (.dux) files. The Reader app scans the Inclinometer Data folder to create its list of inclinometers.

Outbox: This folder holds a copy of any .dux inclinometer file that has been updated with a new survey. All the file transfer methods use files in this folder.

System: Holds system files. It contains the bookmark file which allows any interrupted survey to be restarted with no loss of data. Most files are machine-readable, not human-readable.

FILE MANAGEMENT The final repository for your inclinometer data should be a database on your PC or network. The .dux files on the Reader should be regarded as temporary, not long term.

Inclinometer Data: This folder holds the “original” files. As mentioned above, the app scans the inclinometer folder to create its list of inclinometers.

- If you want two readers to have the same list of inclinometers, copy the .dux files from one Reader to the other.
- If you want to remove an inclinometer from the list, delete its .dux file in the inclinometer data folder.

Outbox: After you transfer the files from the tablet to the PC, you can delete the files in the Outbox, either with the “Empty Outbox” button on the Reader or via a file manager.

MAINTENANCE GUIDE

Maintaining the NXG Vertical Inclinometer System

ROUTINE MAINTENANCE

Although the NXG Vertical Inclinometer System is a robust unit, it still needs to be treated with care and properly maintained.

The NXG Vertical Inclinometer System is supplied with a cloth for removing moisture and dirt and oil for maintaining the moving parts, such as the wheel assemblies. It is important that these components are kept clean and regularly oiled to preserve the quality of the parts.

The NXG Vertical Inclinometer System and all its components should be wiped clean and the wheel assemblies oiled after each use.

CABLE MAINTENANCE

When using the inclinometer on site, the cable needs to be well maintained and kept away from all sharp or abrasive objects that could cause cable damage. For this purpose, we recommend that after the cable has been fully extended to the bottom of the borehole and the AO reading process has started, that the inclinometer cable is either wound back onto the inclinometer reel or placed in a suitable container. If multiple data sets on one borehole are required, it may be more appropriate to have a dedicated container on site to place the inclinometer cable into. The cable should be placed in an orderly fashion, ensuring no kinks and twists are present.

It is important to pay attention to how the inclinometer is used in conjunction with the cable gate. The inclinometer cable markers should never be dropped into the cable gate. You must ensure that at each depth the cable markers are placed into the gate, if this is not adhered to you risk the possibility of applying additional stresses into the cable. If the cable markers are dropped into the cable gate, depending on the height at which they are dropped, there is the risk of causing cable marker slippage. If this were to occur, the readings would be offset at each depth and would not align with previous readings taken on the same borehole.

It is essential that any twist on the cable is reversed immediately. This may only be noticed when the inclinometer is replaced in its cradle on the reel, however all that is required to reverse the twist is that the probe is rotated, as required, until there is no more twist in the cable. This twisting may not always be obvious; to ensure that you can see any twisting that is occurring, we recommend that the cable is cleaned and inspected regularly.



To minimise twist in the cable from multiple borehole runs, Soil Instruments advise alternating between rotating the Probe Clockwise to the A180 and Anti-Clockwise to the A180 on alternate Boreholes. This will reduce the chances of successive boreholes creating excessive twist in the cable.

Probe Inspection

WHEEL BRACKET The bracket does not return to fully extended position:
If the bracket is dirty, clean it. If the problem persists the spring may be broken or weak.

WHEEL The wheel does not run/spin freely:
Lubricate the wheel bearings with light machine oil.

Probe Maintenance

MOISTURE MANAGEMENT Wipe off the instrument cable and probe when you finish the days final survey. Do not store wet cloth with the probe. If the Probe Cable Connection has been undone gently wipe the connectors and ensure that the protective caps are fitted.

Lubricate the wheels. This helps displace moisture.

WHEELS Lubricate the wheels by applying drops of a light machine oil on the wheel bearings. Do *not* use WD-40 or any other lubricant spray that contains chlorinated solvents. Wheels should be lubricated at the end of each day of usage, prior to storage of the probe.

Cable Inspection

CABLE Twists/Twists indicate a poor coiling technique. Change practice - do not tie the cable over the side of the reel - reel off and reel on.

Work markings:

The user is dragging the cable through the cable gate. Change practice - pull cable out then up.

Kinks and/or gouges:

If the kinks do not straighten, there is probably internal damage and likelihood of intermittent reading failures. If there are any deep gouges, water can enter the cable. In both cases the bad section of cable must be removed, either by shortening the cable or replacing the cable.

Cable Maintenance

MOISTURE MANAGEMENT Wipe off the instrument cable as you draw the probe up on the last run of the day.

When necessary, rinse cable in clean water or wash the cable in a detergent.

CABLE Do not use solvents to clean the cable. Do not submerge the reel.
If the Reel, Probe Connection has been undone gently wipe the connectors and ensure that the protective caps are fitted.

Charger Maintenance

ELECTRICAL SAFETY The Charger is tested and inspected as part of the manufacturing process. The end user should perform routine inspection and testing to ensure the charger is still fit for use.

APPENDICES

Appendix A-Data Download Format and Manual Data Reduction

Soil Instruments have designed and developed a powerful data interpretation software package called 'In-Profile' to analyse Digital Inclinator System data. If a user chooses to manually reduce the inclinometer data outside of this software, they should only do so providing they have full competency. Soil Instruments cannot be held liable for incorrectly manually reduced data. We offer the following guidelines to reduce Soil Instruments Digital Inclinator System Data.

DATA REDUCTION VARIABLES

Inc =	Displacement over Probe Length
G =	Gauge constant for probe (Metric = 0.005)
A+ =	Commonly referred to as A0 results. A axis Results from first run in direction of expected movement, leading wheel direction
A- =	Commonly referred to as A180 results. A axis second run results 180° from direction of expected movement, trailing wheel direction
B+ =	Commonly referred to as B0 results. B axis Results from first run in direction of expected movement, leading wheel direction
B- =	Commonly referred to as B180 results. B axis second run results 180° from direction of expected movement, trailing wheel direction

DATA REDUCTION TO INCREMENTAL DATA

A axis Inc =	$((A+) - (A-)) / 2 * G$
B axis Inc=	$((B+) - (B-)) / 2 * G$

DATA REDUCTION ABSOLUTE PROFILE

Accumulate Inc results at each depth to obtain the absolute profile

DATA REDUCTION CULMUTIVE PROFILE

Subtract the previous absolute profile from the current absolute profile to get the change in deflection

Appendix B

CHECKSUMS

The readings screen on the tablet shows two checksum boxes. The checksum is the 0° direction reading (e.g. A0) at each depth added to the 180 degree reading (e.g. A180).

In an ideal situation, these two readings would be exact opposites of each other and cancel each other out, giving a checksum of zero, however, checksums are rarely zero due to manufacturing tolerances in the probe and very small differences in both the 0° and 180° position of the probe wheels; in other words, the probe is never exactly in the same place, so the readings are never exactly opposite.

The checksum is still of use to you as a check that all depths have been correctly read for the A0 and A180 directions; if a depth is missed, the checksums from this point onwards would be very large. It is also useful for checking that the probe is not showing any sign of deterioration as the checksums at each depth should be;

- Approximately the same
- Consistent along the length of the borehole

Checksums should only be of concern, no matter what their actual numeric value if they fall outside the parameters above. It is worth remembering that if the readings are taken near a casing joint, the checksums for these readings may present a face error. If all the other checksums are consistent, then this also is quite normal.

CALIBRATION AND SERVICE

Any inclinometer system should be regularly calibrated to ensure that the readings taken with the system are accurate. Soil Instruments recommends that the Digital Inclinometer System is calibrated on a yearly basis.

To return your Inclinometer for calibration and or service, email **Servicing@SoilInstruments.com** requesting an RMA number.

CUSTOMER SUPPORT

Soil Instruments provide a wealth of articles on our knowledge base to help support customers. The Knowledge Base is found at **SoilInstruments.com**.

To contact our dedicated customer support team please email **Support@SoilInstruments.com**

EU Declaration of Conformity

Soil Instruments Ltd., located at 34 Bell Lane, Uckfield, East Sussex, TN22 1QL, United Kingdom.

We hereby declare that the devices described below are in conformity with the directives listed. In the event of unauthorised modification of any devices listed below, this declaration becomes invalid.

Type: NXG Vertical Inclinometer

Product Model: C17-NXG series 1146-150/xxx, 1146-100

This declaration is issued under the sole responsibility of the manufacturer.

The products described above are in conformity with the relevant Union harmonisation legislation:

- RoHS Directive 2011/65/EU
- EMC Directive 2014/30/EU
- LVD 2014/35/EU
- RED 2014/53/EU
- WEEE Directive 2012/19/EU

References to the relevant harmonized standards used in relation to which conformity is declared:

- EN IEC 63000:2018 (RoHS)
- EN 301-489-1 v 2.2.3(EMC)
- EN 61326-1:2021(EMC)
- EN 55032:2015(EMC)
- EN 61000-4-3:2020(EMC)
- EN 61000-4-4: 2012 (EMC)
- EN 61000-4-6: 2014 (EMC)
- EN 61000-4-2: 2009(EMC)
- ETSI EN 300 328 V2.1.1 (2016-11)(RED)

Signed for and on behalf of Soil Instruments Ltd

Eugene Gallacher



General Manager,

Date: 01/11/2024

Issued in: Bell Lane, Uckfield, East Sussex, TN22, 1QL, United Kingdom

UKCA Declaration of Conformity

Soil Instruments Ltd., located at 34 Bell Lane, Uckfield, East Sussex, TN22, 1QL, United Kingdom.

We hereby declare that the devices described below are in conformity with the statutory requirements listed. In the event of unauthorised modification of any devices listed below, this declaration becomes invalid.

Type: NXG Vertical Inclinator

Product Model: C17-NXG series 1146-150/xxx, 1146-100

This declaration is issued under the sole responsibility of the manufacturer.

The products described above are in conformity with the relevant statutory requirements:

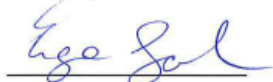
- RoHS (SI 2012/3032)
- EMC Regulations (SI 2016/1091)
- The Electrical Equipment (Safety) Regulations 2016 (SI 2016/1101)
- Radio Equipment Regulations 2017/1206
- WEEE Regulations 2013

References to the relevant designated standards used in relation to which conformity is declared:

- EN IEC 63000:2018 (RoHS)
- EN 301-489-1 v 2.2.3(EMC)
- EN 61326-1:2021(EMC)
- EN 55032:2015(EMC)
- EN 61000-4-3:2020(EMC)
- EN 61000-4-4: 2012 (EMC)
- EN 61000-4-6: 2014 (EMC)
- EN 61000-4-2: 2009(EMC)
- ETSI EN 300 328 V2.1.1 (2016-11)(RED)

Signed for and on behalf of Soil Instruments Ltd

Eugene Gallacher



General Manager,

Date: 01/11/2024

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