# Roctest Profil

# Instruction Manual

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This product should be installed and operated only by qualified personnel. Its misuse is potentially dangerous. The Company makes no warranty as to the information furnished in this manual and assumes no liability for damages resulting from the installation or use of this product. The information herein is subject to change without notification.

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# 1. System Components

## 1.1 ABOUT INCLINOMETERS

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

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

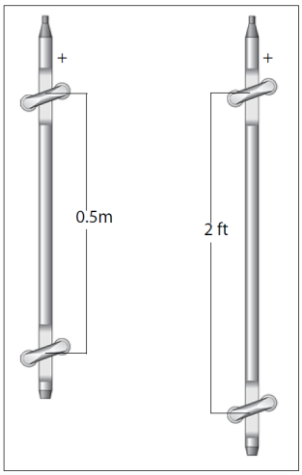
The first survey establishes the baseline profile of the installed casing. Subsequent surveys will reveal changes in the profile if ground movement has occurred. Plotting these changes reveals the rate, depth, and magnitude of ground movement.

## 1.2 SYSTEM COMPONENTS

The Roctest Profil system includes an inclinometer probe, control cable, a Bluetooth reel, a cable gate, a Roctest Reader app that runs on an Android-based Readout, and Profil Manager that runs on Windows.

## 1.3 INCLINOMETER PROBE

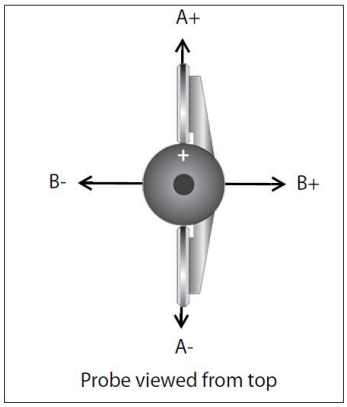
The Roctest Profil inclinometer probe is supplied in metric and English versions.
The metric version has a gauge length of 0.5m. The English version has a gauge length of 2 feet.
A + mark is engraved on the body of the probe. This is used to orient the probe during a survey.



## 1.4 MEASUREMENT AXES

There are two 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.




## 1.5 HANDLING THE PROBE

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

- Transport the probe in its carrying case, if applicable. If you drive to the site, carry the casing in the passenger compartment, preferably on a passenger seat.
- For systems with a removable probe, avoid over-tightening the nut when connecting the control cable to the probe, since this will flatten the O-ring and reduce its effectiveness.
- When you insert the probe into the casing, cup the wheels with your hands to compress the springs and allow smooth insertion.
- 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.

## 1.6 CONTROL CABLE

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

- Metric control cables have half-meter graduations with labels every meter. The first graduation is 0.5 meters from the top wheels of the probe.
- English control cables two-foot graduations with labels every four feet. The first graduation is 2 feet from the top wheels of the probe.

## 1.7 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

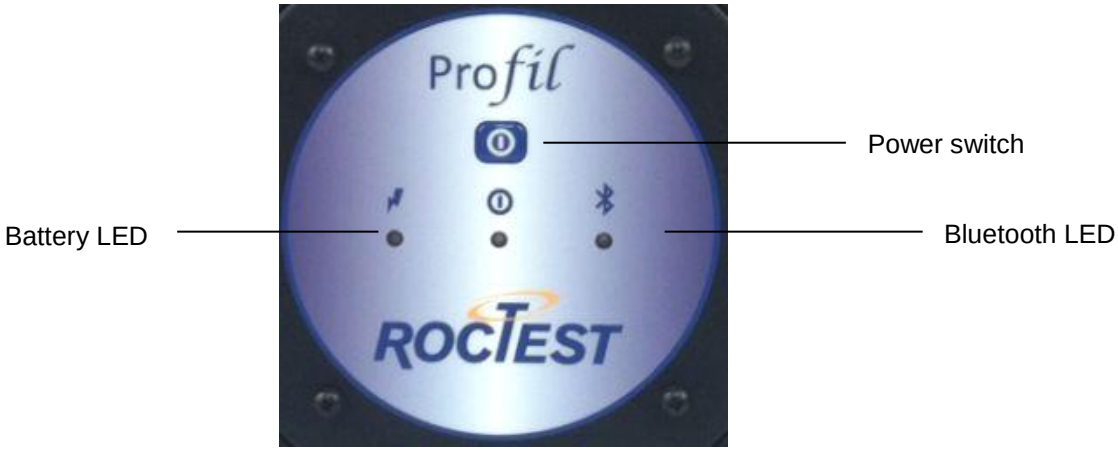
gate to hold the probe steady for readings. The cable gate fits three diameters of casing: 85, 70, and 48 mm (3.34, 2.75, and 1.9 inch).

### 1.8 BLUETOOTH REEL

The Bluetooth reel provides a convenient way to carry the probe, control cable, and cable gate. The reel transmits commands and readings between the Reader and the probe. A battery pack inside the reel powers both the reel and the probe.

### 1.9 FRONT PANEL LEDs

The front panel has three LED lamps and a power switch.




### 1.10 POWER SWITCH & POWER LED

Press to switch on. Press again to switch off. The Power LED & Power LED glows green when power is on.

The reel switches off automatically after 5 minutes without a Bluetooth connection or after 10 minutes if no commands and readings are transmitted between Reader and probe.

### 1.11 BLUETOOTH LED

The Bluetooth LED blinks slowly while the Bluetooth radio waits for a connection, then glows a steady blue when the connection is made.

### 1.12 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.

### 1.13 CHARGING THE BATTERY

Plug the AC adaptor into a wall socket. Insert the barrel-plug into the charge socket on the back side of the reel.

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 12 Vdc. Polarity of barrel connector is + inside and - outside.

### 1.14 ANDROID READER

This manual uses “Reader” to mean an Android device that is running the Profil Reader app. Not all Android devices are certified with the app.

### 1.15 READER BATTERY LIFE

Battery life varies with the device. We recommend that you charge the device every night.
A typical survey requires 30 to 60 minutes. If you have a demanding survey schedule, an accessory battery pack or a second battery may be useful.

### 1.16 PROFIL READER APP

The Profil Reader app is a software that transforms an Android device into a full-featured inclinometer readout. The Reader app is available from Play.Google.com.

### 1.17 PROFIL MANAGER SOFTWARE FOR WINDOWS

Profil Manager is a free Windows program that works with the Profil system. Profil Manager creates a database to hold inclinometer surveys. It also generates plots for data analysis and printing. To download Profil Manager:

1. Direct your browser to www.roctest-group.com/support/downloads
2. Go to Profil Manager section.
3. Run the “setupprofil.exe” program.

# 2. PAIRING BLUETOOTH DEVICES

Pairing takes place at the Android OS level. The process is similar to pairing a Bluetooth headset and a cell phone.

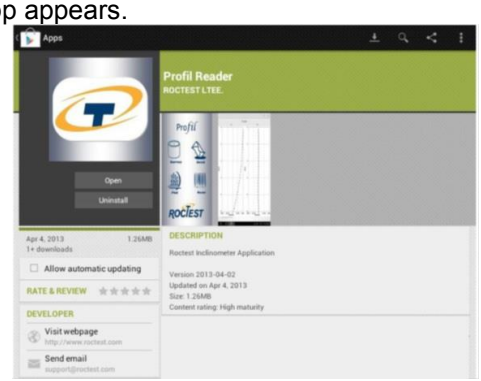
1. Switch on the Bluetooth reel. The blue LED starts blinking.

2. Switch on the Android device.
3. Tap the “Settings” icon.
4. Find Wireless and Network settings and enable Bluetooth.
5. Enable “Search for devices”. (If you don’t see this setting, try tapping the Bluetooth entry).
6. After a short delay, the Android device shows a list of available devices.
7. Tap the device labeled “FireFly-nnnn” (nnnn is a four-digit hexadecimal number). You can find this number on the backside of the Bluetooth reel.
8. Enter the PIN: 1234.
9. Finally, look for a message confirming that the device is paired.

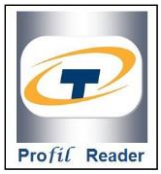
# 3. INSTALLING THE READER APP

The PROFIL Reader app is available from the Google Play Store.

1. Start the Google Play app on your Android device.
2. Search for “Profil Reader.”
3. Tap “Install” when the app appears.



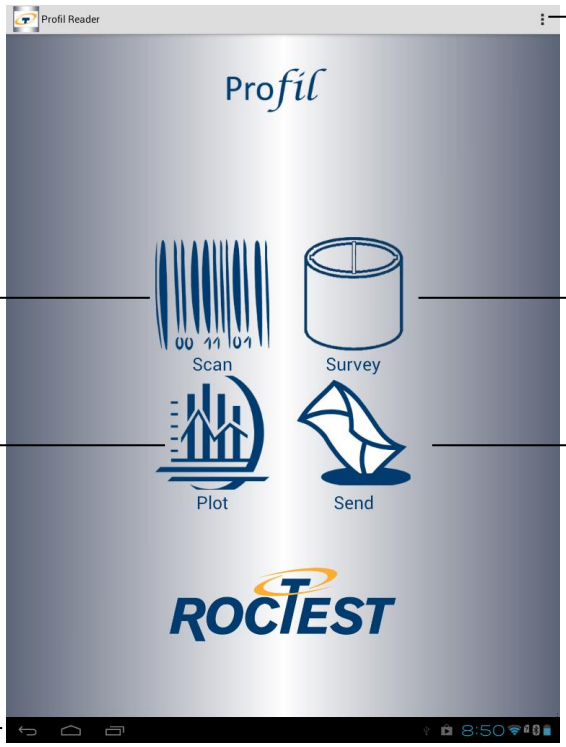

4. Tap “Accept & download” after reviewing permissions.
5. The Profil Reader icon appears on the Android home screen. If the icon does not appear, find the icon in the app drawer. Then tap and hold the icon, releasing it on one of the home screens.




# 4. READER APP OVERVIEW

### 4.1 PROFIL READER APP

Tap the Profil Reader icon to open the app.




**Action Bar:** See below.

**Scan:** Tap to start a survey from a QR code.

**Survey:** Tap to start survey from the inclinometer list.

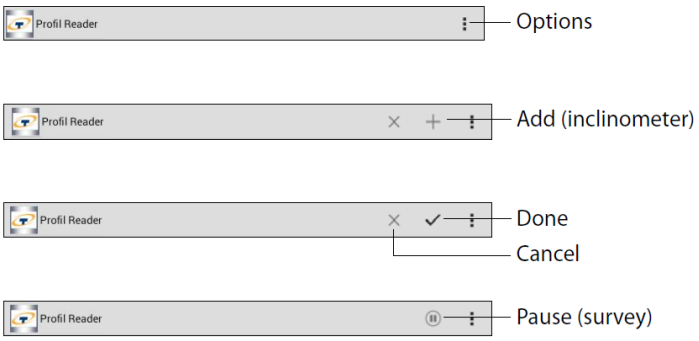
**Plot:** Tap to show plots and data.

**Send**: Tap to send new surveys by e-mail or Dropbox.

**System bar:** Back home, Recent.

### 4.2 ACTION BAR

Tap icon to take action. Icons vary with screen.

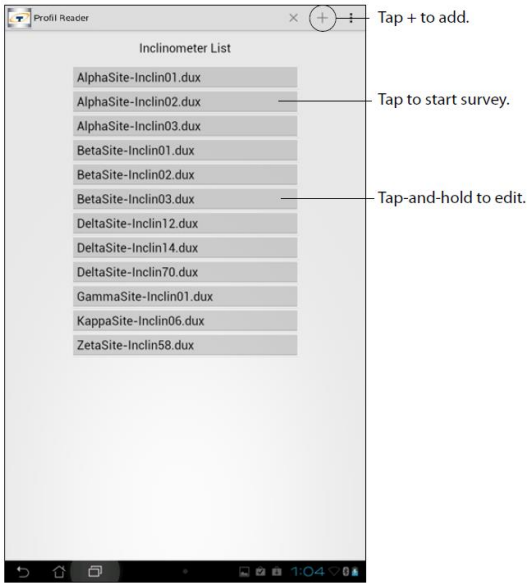



# 5. ADDING AN INCLINOMETER

### 5.1 THE INCLINOMETER LIST

The Reader keeps a list of inclinometers along with the survey data for each inclinometer. To see the list, tap the Survey icon.

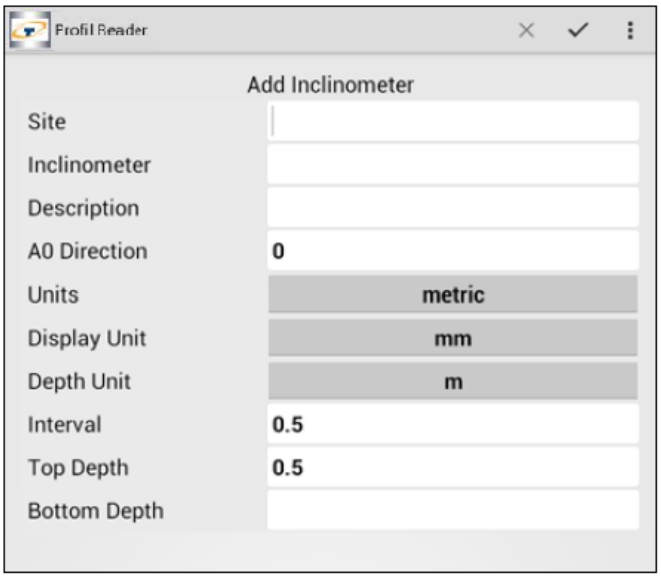
- To add an inclinometer to the list, tap +.
- To start a survey, tap the inclinometer.
- To edit an inclinometer, tap-and-hold the inclinometer.




## 5.2 ADDING AN INCLINOMETER

1. Tap “Survey” to display the list of inclinometers.
2. Tap “Add” to display an 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.

### 5.3 FIELDS ON THE INCLINOMETER FORM

**Site & Inclinometer**: These two fields are used together to identify an inclinometer. Each field can contain 12 characters. Spaces, punctuation, and special characters are not allowed.

**Description**: Optional.

**A0 direction**: Optional. Compass heading 0 to 359.

**Units**: Tap to switch between metric and English units.

**Display Unit**: Tap to switch between mm and Digi-metric or between inch and Digi-English. Digi units are explained in a later chapter.

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

# 6. SURVEY BASICS

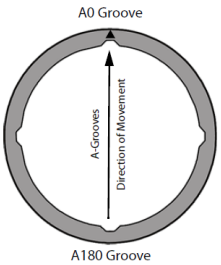
### 6.1 INCLINOMETER SURVEYS

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.

### 6.2 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.

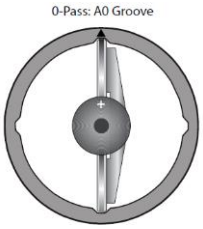
Only the A-grooves are used in the survey. The A0 groove is usually marked for easy identification.



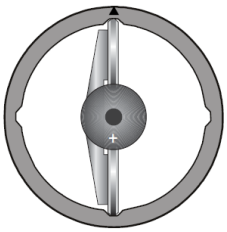

### 6.3 ORIENTATION OF PROBE

**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 wheels.



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

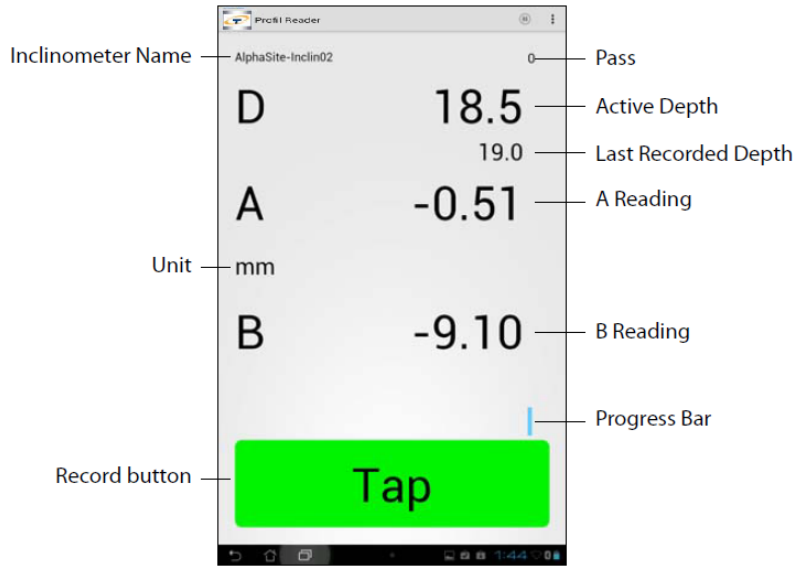


180 Pass: A180 Groove

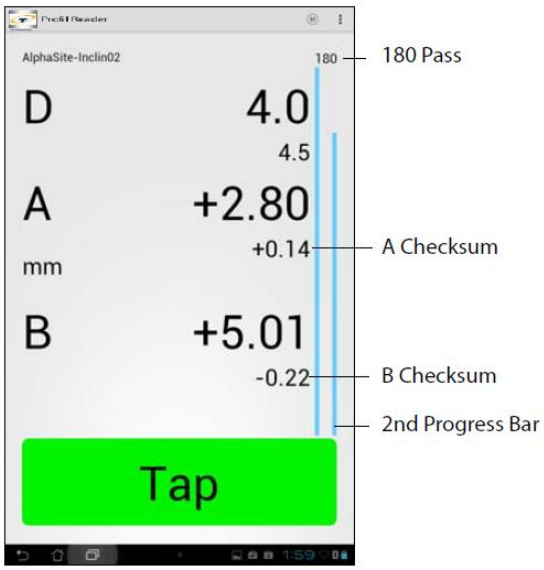
## 6.4 THE SURVEY SCREEN

The survey screen guides you through the survey.

**0-Pass Screen**: The elements of the survey screen are explained below.



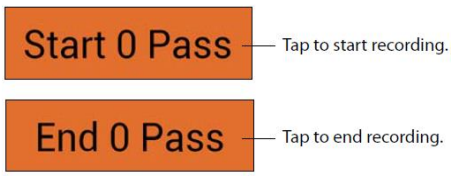

**180-Pass Screen**: The 180-Pass screen adds checksums and a second progress bar.



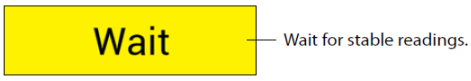
### 6.5 THE RECORD BUTTON

The record button has multiple colors and functions.

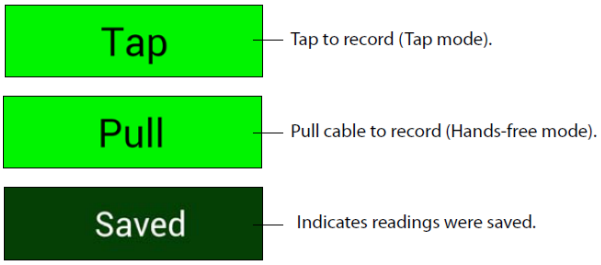
**Start & End**
The record button is orange at the start and end of each pass. Tap “Start” to enable recording. Tap “End” to disable recording. This prevents accidental recording of readings when you position the probe for each pass.




**Wait**
The record button is yellow when readings are not stable. You can tap the Wait button to record a reading, if necessary.




**Tap or Pull**
The record button is green when readings are ready to record. Tap the button or pull the cable (hands-free mode) to save the readings. The button is dark green after readings are saved.




### 6.6 SURVEY MODES

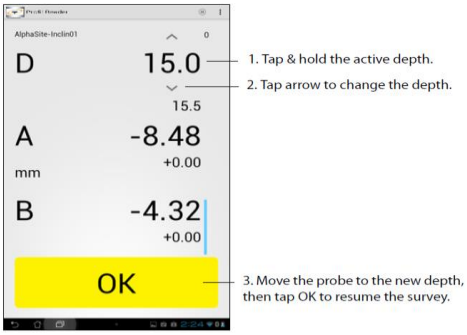
Tap the options icon to change survey mode.

In Tap mode, you tap the record button to save a reading. In hands-free mode, you pull the cable to record the reading. There is no need to hold the tablet or tap the screen except at the beginning and end of a pass. See “Options Menu” later

## 6.7 CHANGING THE ACTIVE DEPTH

If cable depth and “active depth” get out of sync:

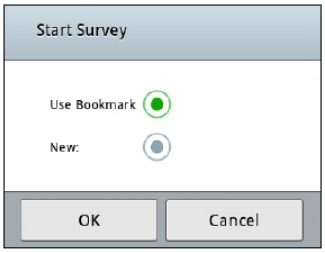
1. Tap & hold the active depth until arrows appear.
2. Tap the arrow to change the depth.
3. Move the probe to the new depth
4. Tap OK to resume the survey. The new “in-sync” readings overwrite the previous “out-of-sync” readings.




## 6.8 RESUMING AN INTERRUPTED SURVEY

The Reader keeps a “bookmark” with each recorded reading. If a survey is interrupted, the bookmark lets you resume from the last recorded depth.

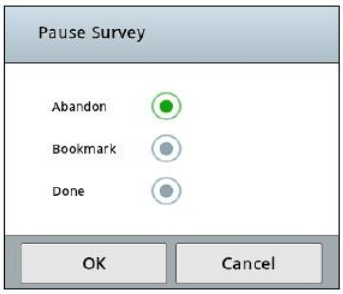
1. Display the inclinometer list.
2. Tap the inclinometer to start a survey. A dialog appears.
3. Tap OK to start the survey from the bookmark. To abandon the bookmarked survey and start a new survey, choose New.




## 6.9 HALTING A SURVEY

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

2. Make a choice and 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.

# 7. SURVEY RUN-THROUGH

### 7.1 SET UP

1. Switch on Reel and Reader. Tap the Profil Reader icon to start the app. Wait for a steady blue glow from the Bluetooth LED to show that a connection has been made.

2. Tap “Survey.”

You can switch between Tap mode and Hands-free mode at any time. The examples here show Tap mode.

3. Tap an inclinometer to survey.

4. The Reader displays the start depth for the survey.

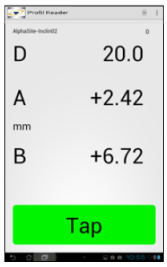
Insert the probe, with + mark facing the A0 groove, and lower it to the start depth.

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 Reader while you wait.

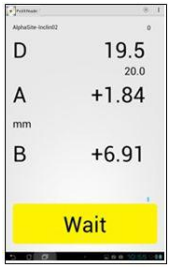
### 7.2 RUN THE 0-PASS

1. Switch on the Reader and tap “Start 0 Pass.”

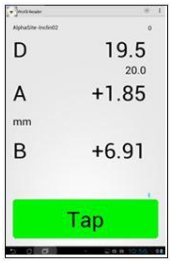
2. The A and B readings appear. The probe has been immobile, so readings are stable. Tap to record.



3. The Reader 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.

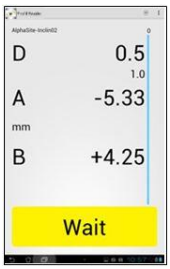



4. Tap the record button when it is green.



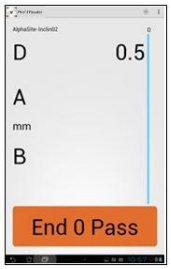

5. The Reader displays the next active depth. Raise the probe to this depth, wait for stable readings, and then tap the record button.
6. Repeat these operations until the probe reaches the top depth.

Now the Reader 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.



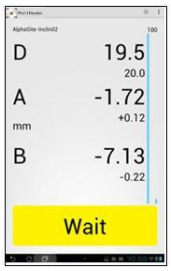

9. Now the Reader displays the start depth for the 180-Pass. Recording is still disabled. Remove the probe, rotate it 180 degrees, and insert it with the + mark facing the A180 groove. Lower it to the start depth.

**7.3 RUN 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.

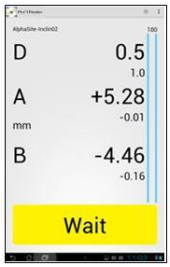
3. The Reader displays the next active depth. Raise probe to this depth and wait for a stable reading.




4. Tap the record button when it is green.

5. The Reader 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 Reader displays the top depth. Wait for a stable reading.
7.



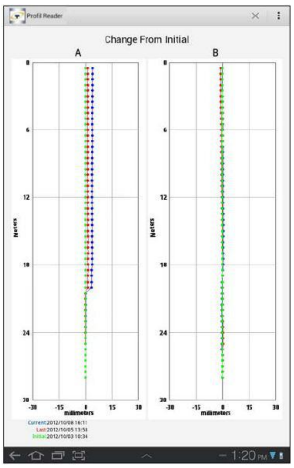

8. Tap the record button when it is green.

9. Tap “End 180 Pass.” The survey is complete. The Reader saved readings during the survey so there is no need to save anything now. When you tap the End button, the Reader takes you to the Plots screen.

# 8. PLOTTING INCLINOMETER SURVEYS

## 8.1 INTRODUCTION

The Reader app can display four types of plots. These are useful for validating the survey. The Reader cannot print plots. Use Profil Manager, DigiPro 2 or Gtilt.




## 8.2 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.

During one survey, comparing at each depth the variation of the checksum to the mean checksum is a good criterion for evaluating the quality of a reading.

Ideally, the checksums should remain constant for all depth in a given hole. If large variations (±5.0 mm) are apparent locally, it may warrant a re-reading at the corresponding depth in the orientation of the defective reading.

Generally with a biaxial probe, the readings in B direction are less accurate than those in A direction because the probe can have a little play in the grooves perpendicularly to the plane of the wheel assemblies. Therefore, in B direction, twice the threshold above is commonly used.

Standard deviation of checksums is the easiest way to validate a survey.

**If the checksum exceeds 2.0 mm, the probe may have a problem.**

Because generally with a biaxial probe the readings in B direction are less accurate than those in A direction (as explained before), twice the threshold above is commonly used.

Engineering judgment must be used when evaluating validity of the data. The previous checks are only guidelines.

For deeper installations or critical measurements, more stringent data may be required. In shallow borehole with fewer readings, wider tolerances may be acceptable.

Compare readings to previous ones. Are they in the same range? Are they moving slowly or abruptly? Consider external factors that can affect the measurements like construction activities, excavations or fills…

In all cases, it is important to realize the error bandwidth of the evaluated data.

### 8.3 CHANGE FROM INITIAL

This plot 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).

### 8.4 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).

### 8.5 PROFILE

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

### 8.6 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:

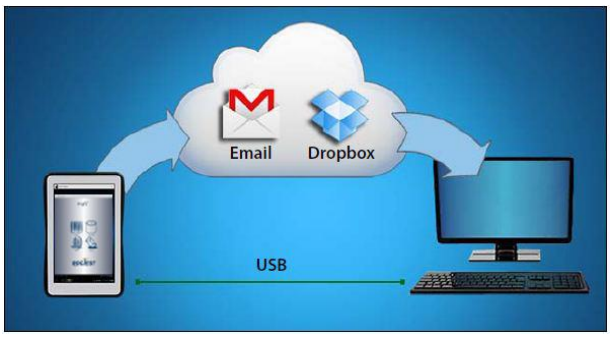
1. Tap and hold the depth the bad reading.
2. Choose 0 or 180.
3. The Reader displays that depth and a live reading. Orient the probe for 0 or 180, insert it into the casing, and lower it to the depth displayed on the Reader.
4. Click OK to enable recording. Tap the record button to record a replacement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

# 9. SENDING DATA FILES TO A PC

### 9.1 INTRODUCTION

Inclinometer data files have a .dux extension.

You can send dux files to the PC by email or Dropbox. Or you can transfer files by USB cable and a Windows file manager).

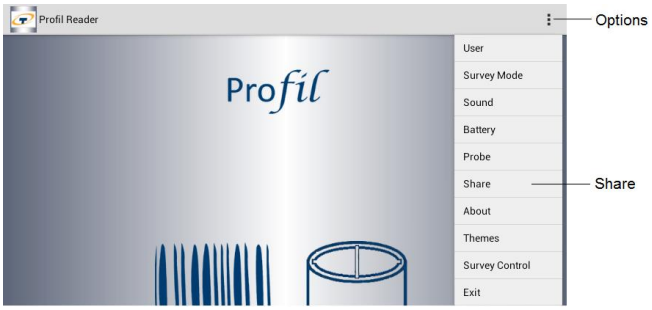



### 9.2 SEND BY EMAIL

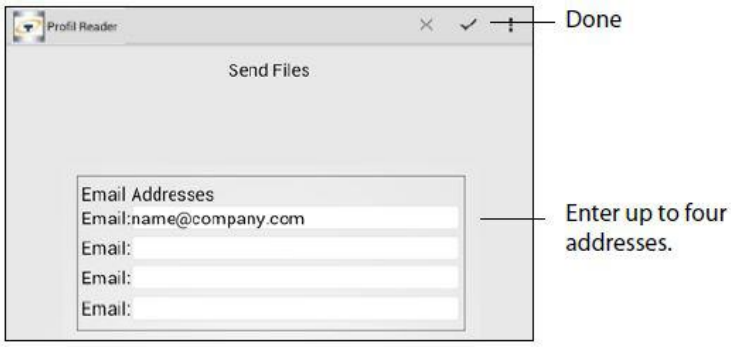
Email transfers require an internet connection and an email program. The instructions below assume you have a Gmail account, since that is a usual with Android devices.

### 9.3 SET EMAIL RECIPIENTS

1. Setup is a one-time task. Tap Options - Share.



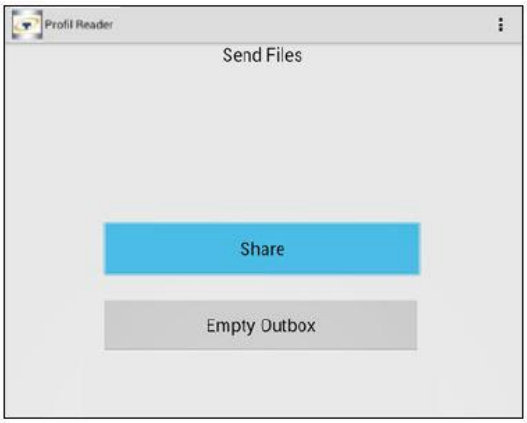

2. Enter one or more email addresses. Then tap Done.




### 9.4 SENDING BY EMAIL

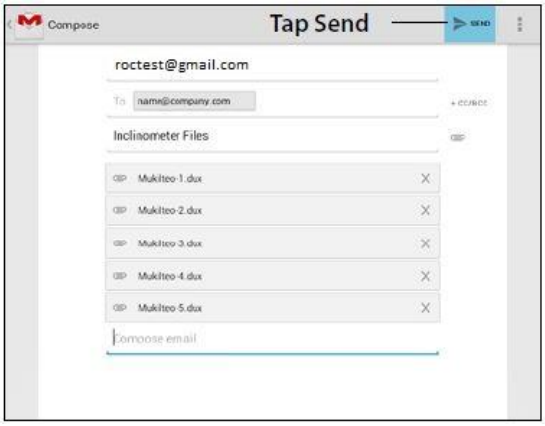
1. Tap Send.

2. Tap Share




3. Tap Gmail

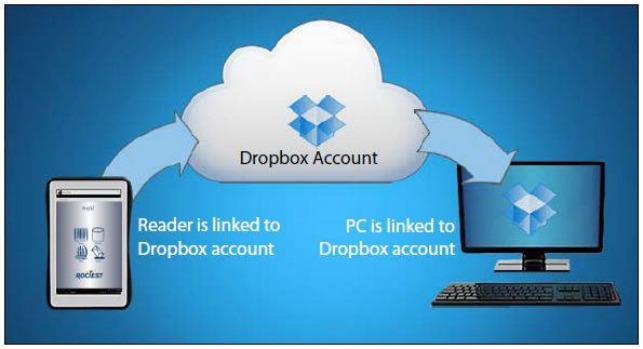
4. Tap Send
   (The Reader attaches dux files automatically)




5. When the email arrives, the recipient saves the attached files into a folder on the PC. If you are using Profil Manager, pasted the files into your default import folder.

### 9.5 SEND BY DROPBOX

Dropbox is a “cloud” service. Dropbox transfers are more automated than email transfers. No user actions are required. The dux files sent from the Reader simply appear in the Dropbox folder on your PC.




The convenience of Dropbox is well worth the time that it takes to set up. Other cloud services such as Google Drive can be set up in a similar way.

### 9.6 SET UP DROPBOX

1. Visit Dropbox.com using your web browser. Create a free Dropbox account. Enter an email address for the User ID, then create a Dropbox password. User ID and password are used again in the next steps

2. On your PC, download Dropbox for Windows. Run the setup program and then log in to Dropbox, using your User ID and password. Now your PC is linked to Dropbox in the cloud.

3. If you are using Profil Manager, create a default import folder in Dropbox (See the Profil Manager manual). Otherwise, just create a folder in Dropbox to hold the dux files.

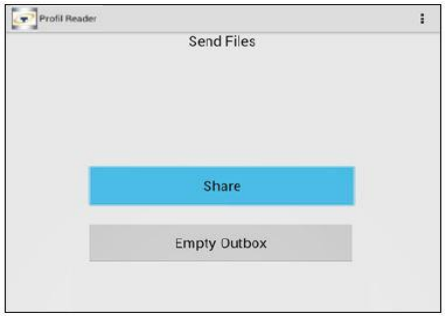
4. Visit the Google Play store using your Android device. Search for Dropbox and install it. You already have a Dropbox account, so login using your User ID and password. Now the Android device is linked to Dropbox, too.

5. The Dropbox file listing on your Android device now shows the folder you created in step 3. That is where the Reader app will send dux files.

### 9.7 SEND BY DROPBOX

1. Tap Send.

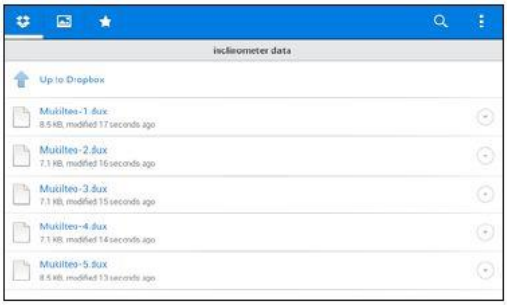
2. Tap Share.



3. Tap Dropbox.

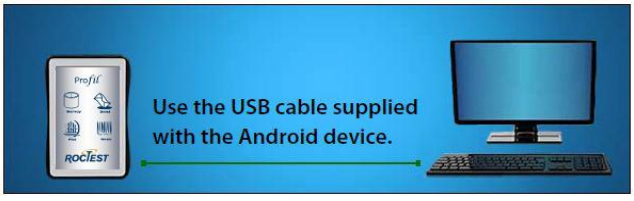
4. Tap Upload. The Reader uploads the dux files to the specified folder.

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

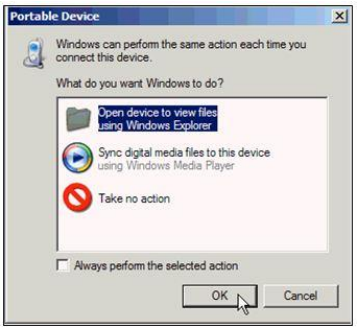



### 9.8 USB TRANSFERS

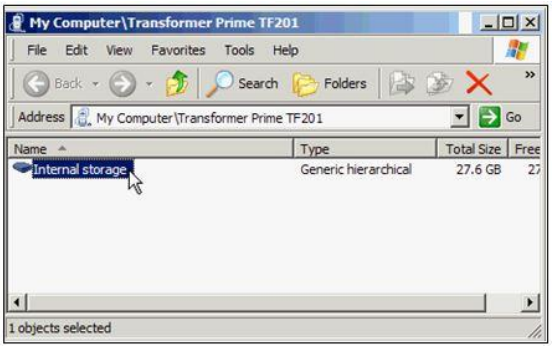
This method requires the USB cable supplied with your Reader device and the Windows file manager (Windows Explorer).



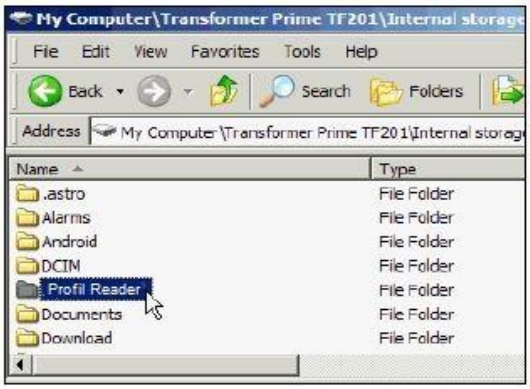

1. Connect the Reader to the PC using the USB cable. Choose “Open device.”



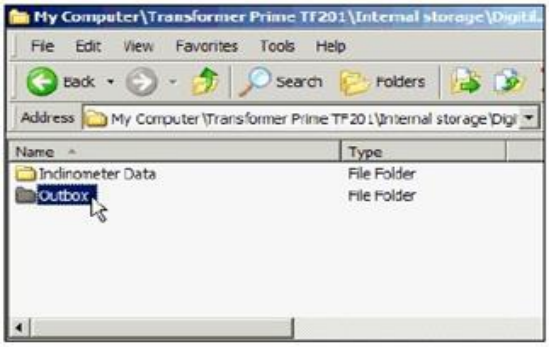

2. The name of the Reader Device appears in the address line. Click on Internal storage.



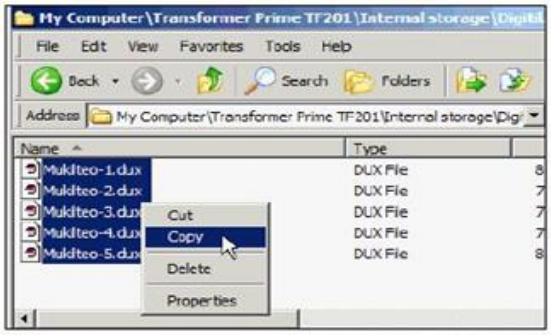

3. Click on the Profil Reader folder.




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



5. Copy all the .dux files in the Outbox.




6. Paste the files into a folder on your PC. If you are using Profil Manager, paste them into the default import folder.

# 10. OPTIONS MENU

Tap the Options icon.

**User:** Change the user name. The user name is recorded with each survey.
**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 Reader 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.

**Survey Control:** Default stability threshold is 6. If there is a lot of vibration at the site, set a higher value. Default motion threshold (hands-free mode) is 100. Default Lockout period is 2 seconds. (This is the length of time that the record button displays “saved” and prevents additional readings from being saved. If you work slowly, set the lockout period to a higher number.

**Exit:** Turns off the Bluetooth connection and closes the app. Use this if you have trouble with Bluetooth or are switching Readers and reels.

# 11. TECHNICAL DETAILS

### 11.1 READING UNITS

The Profil system stores tilt readings as 100000 x sine (θ), where θ is the angle of tilt. During the survey, the Reader app displays the following units:

**METRICS:**

- mm of deviation, assuming a 500 mm gauge length.
- digi-metric, 25000 x sine(θ), the metric unit displayed by the Digitilt DataMate readout.

**ENGLISH UNITS:**

- inches of deviation, assuming a 24 inch gauge length.
- digi-English, 20000 x sine(θ), the English unit displayed by the Digitilt DataMate readout.

### 11.2 INCLINOMETER ''DUX'' FILES

The Profil Reader app creates a file for each inclinometer. The file has a .dux extension. For convenience, it is called a dux file. The dux file contains the parameters of the inclinometer (depth, etc) and all the surveys for that inclinometer. New surveys are appended to the end of the file.

### 11.3 FOLDERS

The Profil Reader app creates the following folders:

**Profil Reader**: 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 file that has been updated with a new survey. All the file transfer methods use files from the Outbox 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.

### 11.4 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 Reader 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 Reader 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.

### 11.5 FCC NOTICE

The Profil system reel contains a Bluetooth wireless module: FCC ID T9JRN41-1. The module label may be viewed by removing the Reel control panel.

# 12. INSPECTION & MAINTENANCE

### 12.1 PROBE INSPECTION

Wheel yoke *(all systems)*

Yoke does not return to fully extended position: If yoke is dirty, clean it. If problem persists, spring may be broken or weak.

Wheel *(all systems)*

Does not turn freely: Lubricate wheel bearings with light machine oil.

Connector keyways *(connector systems only)*

Wear or corrosion: Worn keyway may degrade O-ring seal. Learn how to connect cable without "hunting." Remove corrosion and change practice - allow connector to dry after use.

Connector O-ring *(connector systems only)*

Flattened, split**:** Replace if flattened or split.

Connector pins *(connector systems only)*

Bent pins: Bent pins are easily broken when straightened. Replacement of connector requires recalibration of probe. Change connection practice.

### 12.2 PROBE MAINTENANCE

Moisture Management *(all systems)*

Wipe off the control cable and probe when you finish the day's final survey. Do not store wet cloth with the probe.

Allow the connector to dry thoroughly: remove connector cap and allow connector to air-dry for a number of hours.
Lubricate the wheels. This helps displace moisture.

Wheels *(all systems)*

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.

O-Ring *(connector systems only)*

Lubricate regularly with O-ring lube or silicone based grease. Do *not* use WD-40 or any other lubricant spray that contains chlorinated solvents.

Connectors (*connector systems only*)

Clean connectors as necessary. Use a slim cotton swab moistened with alcohol. Be careful not to bend pins.

Do *not* use electrical contact cleaners, especially sprays. Solvents in these products will attack the neoprene inside the connectors. When attacked, the neoprene swells and reduces the effectiveness of the O-ring seal.

Storage (*all systems*)

Store probe in dry place. Be sure that the box is dry, the wheels are oiled, the connector is dry.

**12.3 CONTROL CABLE INSPECTION**

Cable (*all systems*)

Twists: Twists indicate poor coiling technique. Change practice: do *not* pull the cable over the side of the reel - reel off and reel on.

Worn markings: user is dragging cable through cable gate. Change practice - pull cable out then up.

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

Connector key (*connector systems only*)

Wear: Change connection practice - use witness marks.

Corrosion: Remove corrosion and change practice - allow connector to dry after use.

Connector rubber insert (*connector systems only*)

Swelling, poor seal: Rubber swells when attacked by WD-40 or contact cleaners. Swelling may prevent good seal and allow water to enter connector. Return for service if sealing is compromised.

Connector for Probe (*connector systems only*)

Check O-ring: Do *not* disassemble this connector. Requires about two hours and a pressure test to reassemble.

**12.4 CONTROL CABLE MAINTENANCE**

Moisture Management (*all systems*)

Wipe off the control cable as you draw the probe up on the last run of the day. When you return to the office, remove connector caps and allow
connectors to air-dry for a number of hours.

Cable (*all systems*)

When necessary, rinse cable (but not connectors) in clean water or wash the cable in a laboratory-grade detergent, such as Liquinox. Do not use solvents to clean the cable. Do not submerge the reel.

Connectors (*connector systems only*)

If it is necessary to clean the connector, use a cotton swab moistened with alcohol. Sockets can be cleaned with a brush. Do not use spray lubricants or electric contact cleaners. Solvents contained in such products will attack the neoprene inserts in the connectors.