48 Spencer Street
Lebanon, NH 03766, USA
Tel: 603·448·1562
Fax: 603·448·3216
Email: geokon@geokon.com
http://www.geokon.com

Instruction Manual

Model 6101D

MEMS Portable Tiltmeter

No part of this instruction manual may be reproduced, by any means, without the written consent of GEOKON®.

The information contained herein is believed to be accurate and reliable. However, GEOKON® assumes no responsibility for errors, omissions or misinterpretation. The information herein is subject to change without notification.

Copyright © 202 by GEOKON®
(Doc REV L, 7/11/22)

Warranty Statement

GEOKON warrants its products to be free of defects in materials and workmanship, under normal use and service for a period of 13 months from date of purchase. If the unit should malfunction, it must be returned to the factory for evaluation, freight prepaid. Upon examination by GEOKON, if the unit is found to be defective, it will be repaired or replaced at no charge. However, the WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion or current, heat, moisture or vibration, improper specification, misapplication, misuse or other operating conditions outside of GEOKON's control. Components which wear or which are damaged by misuse are not warranted. This includes fuses and batteries.

GEOKON manufactures scientific instruments whose misuse is potentially dangerous. The instruments are intended to be installed and used only by qualified personnel. There are no warranties except as stated herein. There are no other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and of fitness for a particular purpose. GEOKON is not responsible for any damages or losses caused to other equipment, whether direct, indirect, incidental, special or consequential which the purchaser may experience as a result of the installation or use of the product. The buyer's sole remedy for any breach of this agreement by GEOKON or any breach of any warranty by GEOKON shall not exceed the purchase price paid by the purchaser to GEOKON for the unit or units, or equipment directly affected by such breach. Under no circumstances will GEOKON reimburse the claimant for loss incurred in removing and/or reinstalling equipment.

Every precaution for accuracy has been taken in the preparation of manuals and/or software, however, GEOKON neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages or losses that result from the use of the products in accordance with the information contained in the manual or software.

TABLE of CONTENTS

FIGURES

1. INTRODUCTION

The GEOKON Model 6101D MEMS Portable Tiltmeter is a precise, portable instrument designed to make rapid determinations of tilting when monitoring structures, soil, and rock masses. It has applications in landslide monitoring, movements adjacent to excavations, tilting in buildings, retaining walls, bridge abutments, dams, etc.

The MEMS tiltmeter system usually consists of three main components. They are:

- 6101D Portable Tiltmeter (Figure 1)
- Handheld Field PC running GK-604D IRA software (Figure 2)
- Ceramic, stainless steel, or copper plated aluminum tilt plates (Figure 3)

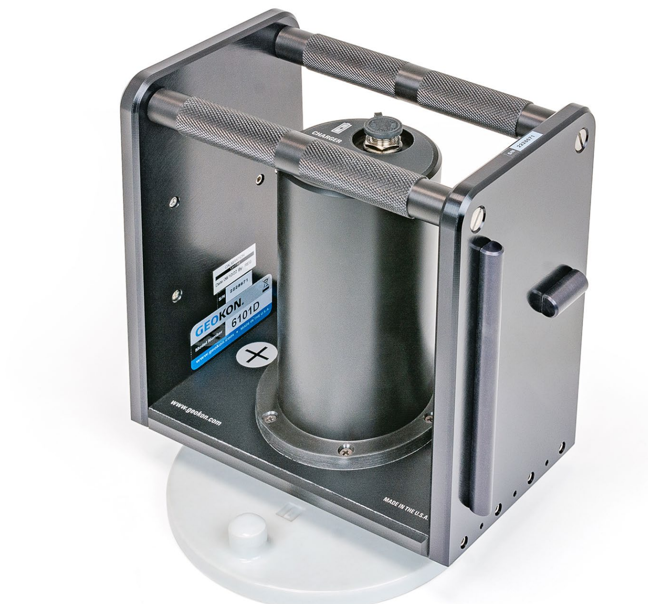

Figure 1 - Model 6101D MEMS Portable Tiltmeter

Figure 2 - Model FPC-2 Handheld Field PC

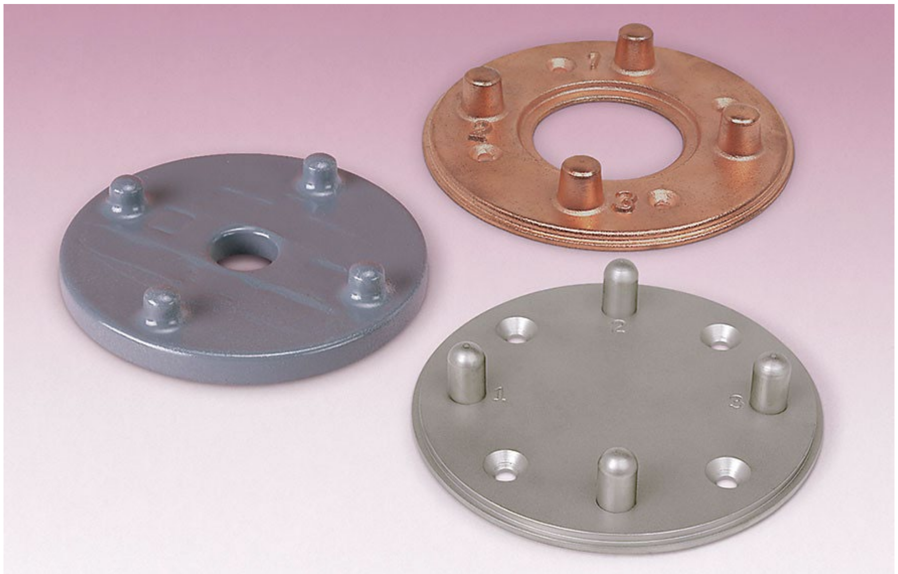

Figure 3 - Copper Plated Aluminum, Ceramic, and Stainless Steel Tiltplates

The sensing elements in the tiltmeter are two Micro-Electro-Mechanical Systems (MEMS) sensors oriented at 90 degrees from each other and sealed in a waterproof housing. Axis A is aligned with the body of the tiltmeter; tilting in the direction of the end marked **+** produces a positive change in the readings of the A axis. At the same time, a reading on the B axis will be taken; the B axis is located at 90 degrees clockwise from the A axis when looking down on the tiltmeter. The output of the GEOKON Model 6101D MEMS tiltmeter is equal to approximately four volts at ±15 degrees.

Readout is accomplished using the Model FPC-2 Handheld Field PC running the GK-604D Inclinometer Readout Application (GK-604D IRA). The tiltmeter connects the Field PC via Bluetooth wireless, eliminating the need for an interconnecting cable and greatly facilitating the readout procedure.

Tiltplates are designed to be permanently attached to the structure. This is normally accomplished by epoxy bonding ceramic plates, and by bolting the stainless steel and copper plated aluminum plates. Epoxy bonding and mounting hardware kits are available from GEOKON, part numbers 6201-2 and 6201-5 respectively.

The sensor is aligned on the tiltplate using the alignment bars of the tiltmeter; this guarantees the same position and orientation for every reading.

2. INSTALLATION AND USE OF THE TILTPLATES

The tiltplates should be installed on firm, clean surfaces as close to flat as is possible. (**If using ceramic tiltmeter plates care should be taken to avoid nicking or cracking the ceramic surface of the tiltplate pegs. The ceramic material is very brittle**.) Most installations utilize epoxy as the bonding medium. A resin such as Devcon VW 11800 can be used. The epoxy should be allowed to fully cure before readings commence. Bolts may be used in conjunction with the stainless steel and copper plated aluminum tiltplates.

Because portable tiltmeters are manually read, the location of the tiltplates must be both protected and accessible. Covers are available for installations in areas where heavy construction is ongoing or where vandalism may be a problem.

Tiltplates are numbered one through four in a clockwise direction. It is recommended that Peg one be oriented towards the direction of the greatest expected tilting. Each tiltplate should have a unique identification written on it, which can be referenced while recording data.

2.1 Vertical Installations

For vertical installations such as building walls, bridge abutments, etc., the tiltplate must be mounted so that the pegs are aligned as close to vertical as possible, with peg number one at the top.

When taking readings in the vertical plane, the tiltmeter must be kept upright, with the side of the unit up against the tiltplate (Figure 4).

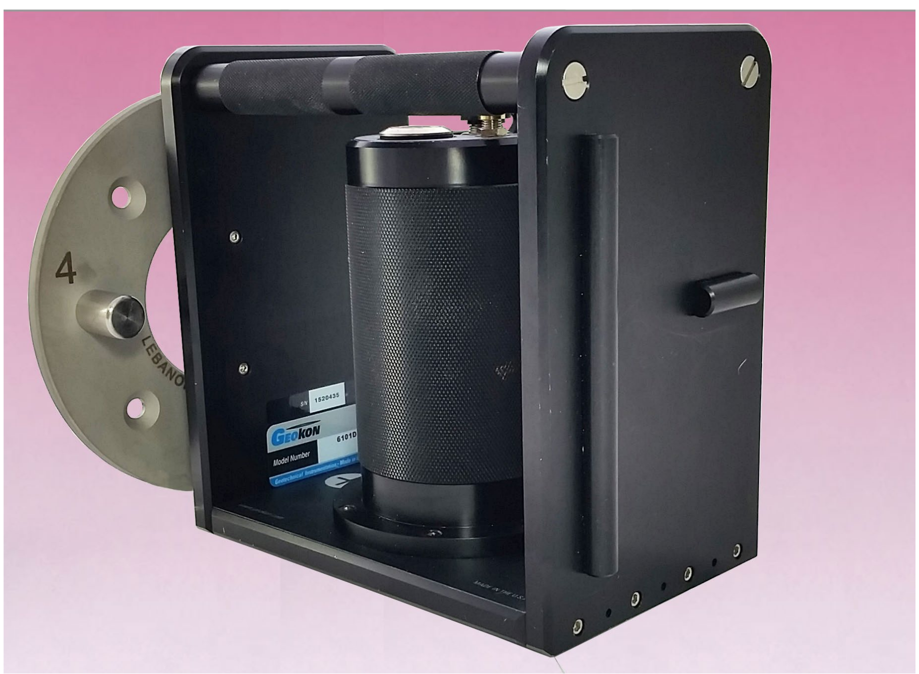

Figure 4 - Vertical Positioning of Tiltmeter and Tiltplate

Hold the positive (+) side of the tiltmeter against the tiltplate so that the long bar lies to the left of pegs one and three and the short bar lies on top of peg two, as shown in Figure 5. Once the tiltmeter is in position, the first set of readings (A axis and B axis) may be taken. (Section 3 gives instructions on how to take readings using the Handheld Field PC.)

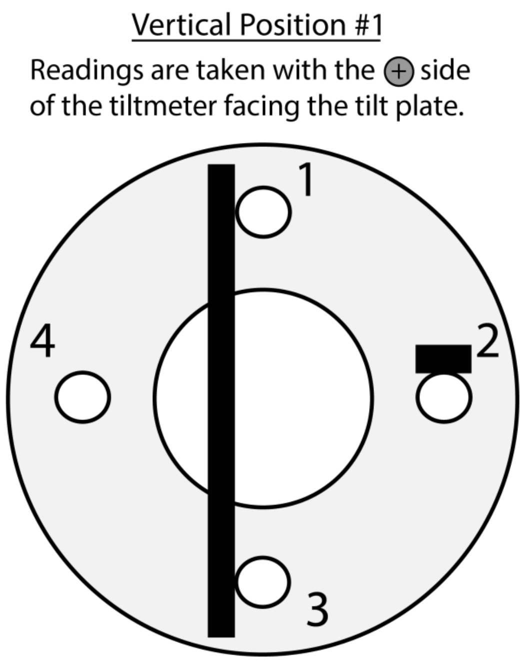

Figure 5 - Vertical Tiltmeter Orientation, Position One

After the first set of readings have been taken, turn the tiltmeter around so that the negative (—) side of the tiltmeter is against the tiltplate. Position the long bar to the right of pegs one and three, and the short bar on top of peg four, as shown in Figure 6. With the tiltmeter in this position, take the second set of readings (A axis and B axis). The second set of reading is the reverse (180°) of the first set of readings. Taking the difference of the two sets of readings and dividing by two yields a number that eliminates any zero offset in the two MEMS sensors.

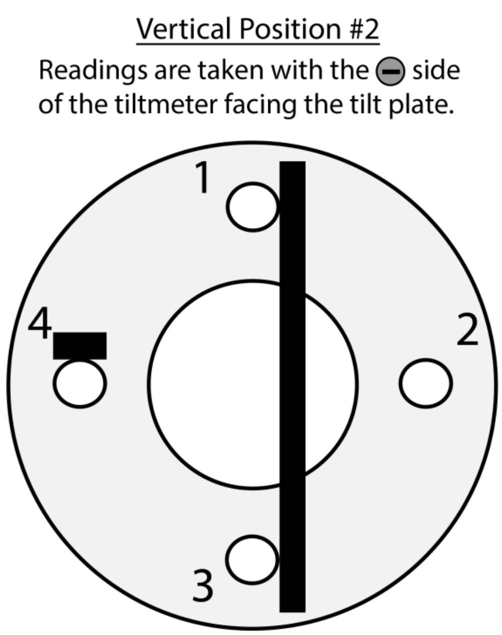

Figure 6 - Vertical Tiltmeter Orientation, Position Two

2.2 Horizontal installations

For horizontal installations such as slopes, embankments, etc., the tiltplate pegs should be aligned so that peg number one is facing in the same direction as the expected tilt.

When taking readings in the horizontal plane, the tiltmeter must be kept upright, with the bottom of the unit resting on the tiltplate (Figure 7).

Figure 7 - Horizontal Positioning of Tiltmeter and Tiltplate

Place the positive (+) end of the tiltmeter over peg one, so that the long bar on the underside of the tiltmeter lies to the left of pegs one and three and the short bar lies against peg two, as shown in Figure 8. Once the tiltmeter is in position, the first set of readings (A axis and B axis) may be taken. (Section 3 gives instructions on how to take readings using the Handheld Field PC.)

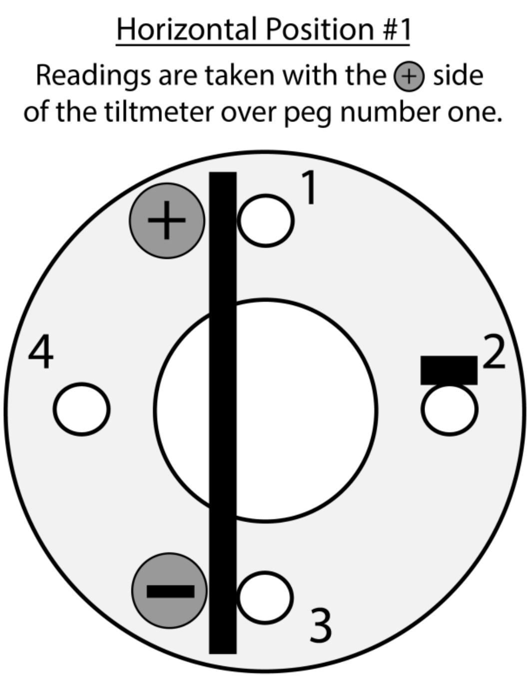

Figure 8 - Horizontal Tiltmeter Orientation, Position One

After the first set of readings have been taken, turn the tiltmeter end for end so that the + side of the tiltmeter is now over peg three. Position the long bar to the right of pegs one and three, with the short bar resting against peg four, as shown in Figure 9. With the tiltmeter in this position, take the second set of readings (A axis and B axis). The second set of reading is the reverse (180°) of the first set of readings. Taking the difference of the two sets of readings and dividing by two yields a number that eliminates any zero offset in the two MEMS sensors.

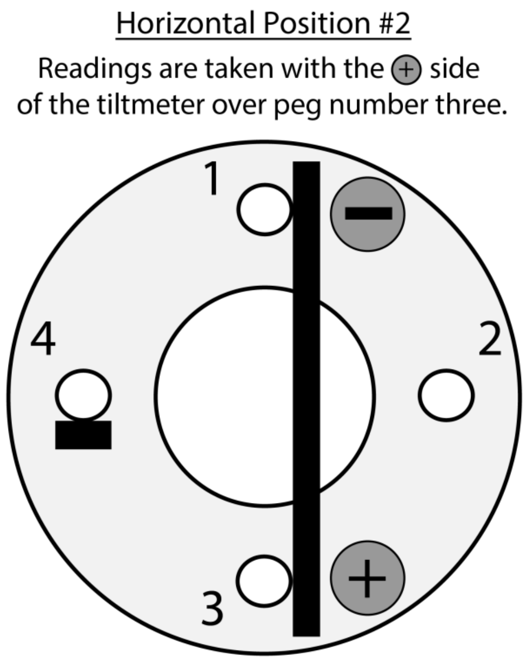

Figure 9 - Horizontal Tiltmeter Orientation, Position Two

3. SOFTWARE OPERATION

3.1 Before using the GK-604D IRA Program

- The readout software runs as an application under Windows Mobile 6 operating system installed on a hand-held PC (FPC-2).
- The user should familiarize themselves with the FPC-2 and the Windows Mobile OS.
- It is assumed in the instructions below that the user can launch applications from the Start button including File Explorer and the Bluetooth Settings manager.
- It is assumed that the user can tap the keyboard icon as needed and use the on-screen keyboard to enter text and numbers.

If all parts of the 6101D system were purchased as a system from the factory, continue to Section 3.2.

If the hand-held PC was purchased from GEOKON as a separate item, complete the steps in Appendix C before continuing.

If using a hand-held PC that was not purchased from GEOKON, follow the instructions in Appendix B and Appendix C before continuing.

3.2 Taking Readings

It is assumed that a valid Bluetooth pairing exists between the 6101D and the FPC-2. (See Appendix C. for more information about establishing Bluetooth pairings.) The recommended steps for connecting to and taking a reading with the Model 6101D Tiltmeter are as follows:

1) Launch the GK-604D IRA by tapping on "Start" from the FPC-2 main window, tap "Programs", then tap the GK-604D IRA icon.

2) The Main Window shown in Figure 10 will be displayed. (If prompted to create a workspace name, refer to Appendix C.1)

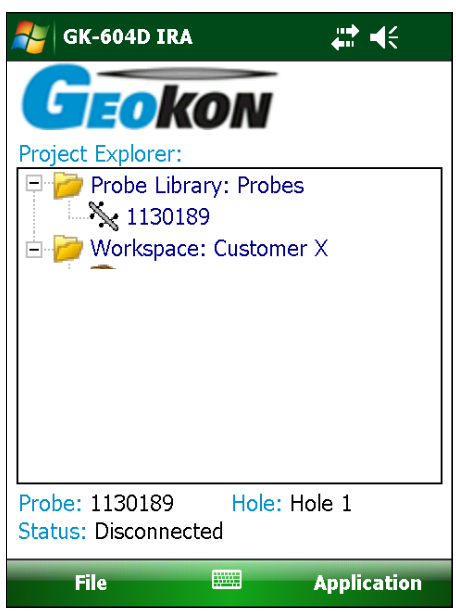

Figure 10 - User Interface

3) Tap and hold on the workspace to bring up the context menu. Select "Add Project" to create a new project within the workspace.

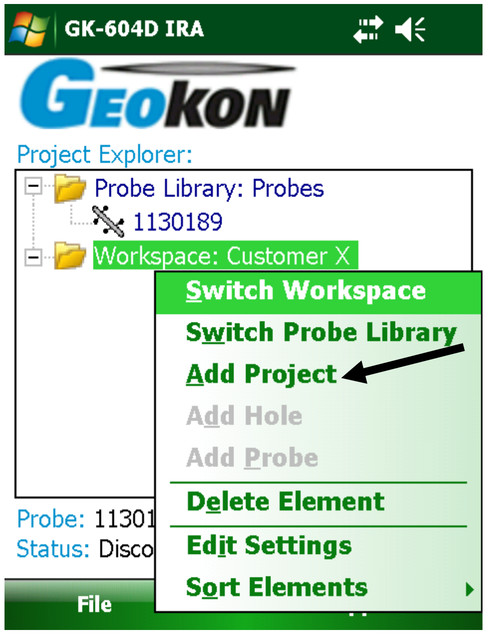

Figure 11 - Add Project

4) The Projects Settings dialog will be displayed (Figure 12).

Figure 12 - Project Settings

Project Settings are as follows:
Project ID: Read-only value, generated upon project creation. Used internally by the GK-604D IRA.
Project Name: Use the on-screen keyboard to enter a unique and descriptive project name.
Description: Optional. Use the on-screen keyboard to enter a brief description pertaining to the project.
Created On: Read-only date and time value, generated when the project was created.

5) When done editing the project settings, tap “Menu” then “Save Settings”.

6) Create an initial “hole” configuration corresponding to the unique location of the tiltplate where tilt is to be measured by completing the steps below:

   a) Using the Context Menu, after highlighting the Project element, select the “Add Hole” menu item (Figure 13) to create a new configuration.

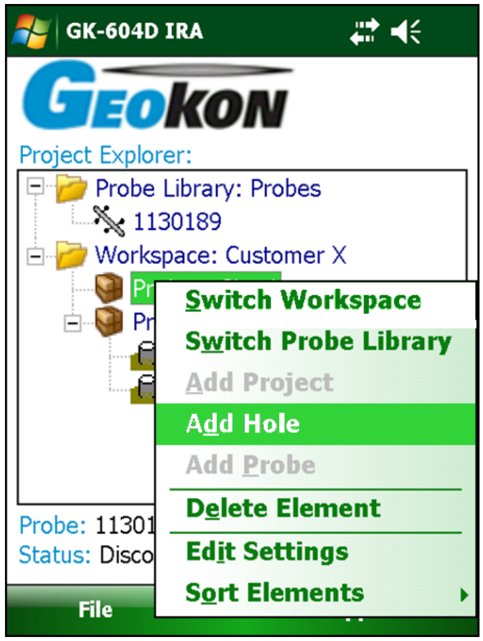

Figure 13 - Context Menu

   b) Since the “hole” corresponds to a physical location, be sure to name it appropriately, such as, “Location1”.

   c) Additional information may be entered in the “Description” field.

   d) For the first location (hole) created, select “UNKNOWN” for “Probe name:”.

   e) The hole parameters such as “Starting Level”, “Interval”, “Top Elevation” and “Azimuth Angle” are not applicable for Tiltmeter operation and can be left blank.

   f) Tap “Save Settings” to save the new location (hole) configuration.

7) Make sure that the “hole” corresponding to the location to be measured is selected in the Project Explorer.

8) Press the “ON/OFF” button on the 6101D Tiltmeter and ensure that the blue indicator is blinking.

9) Tap the “Live Readings” menu item from the “Application” menu to start the reading process. If a valid Bluetooth connection can be established, a dual axis, tiltmeter specific, Live Readings screen will be displayed (see Figure 14).

Note the dropdown control in Figure 14, located just to the right of the "A:" value display. This allows the "A" and "B" values to be displayed in three different units, described below.

Digits: Digit values are read directly from the 6101D Tiltmeter and are internally calculated as follows:
R1 = internal MEMS module voltage, (volts)
R0 = Zero Shift A [from internal probe configuration]
GF = Gage Factor A [from internal probe configuration]
GO = Gage Offset A [from internal probe configuration – usually zero]
DIGITS = (((2500 * R1) – R0) * GF) + GO

Volts: **PV** = **DIGITS / 2500** [for GEOKON Tiltmeters: ±4V ≈ ±15 degrees]

Degrees: **DEGREES** = **arcsin(DIGITS / 38637.03305) * 180/Pi**

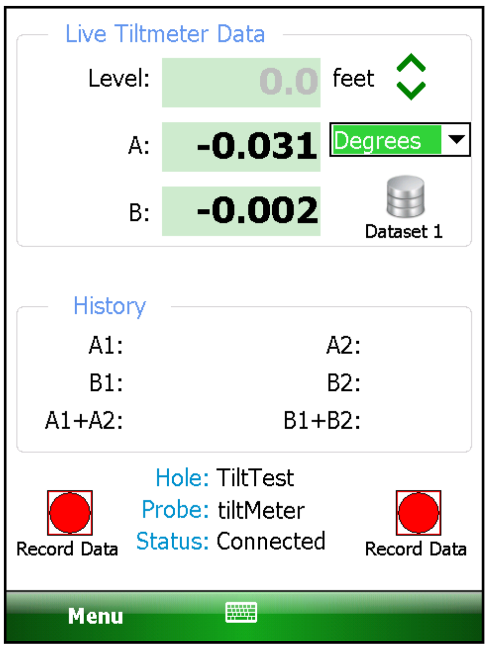

Figure 14 - Live Readings (Tiltmeter)

10) From the dropdown menu, select "Degrees".

11) Align the Tiltmeter on the tiltplate in the A+ orientation, then tap "Record Data" to take the "A+" reading for the Model 6101D, the "B+" reading is taken at the same time as "A+".

12) Tap the "Dataset" icon and observe that the dataset number changes to "2".

13) Reverse the Tiltmeter orientation to A- and, again, tap "Record Data" to take the "A-" reading. For the Model 6101D, the "B-" reading is taken at the same time as "A-". Tapping "Menu-›Exit Live Readings" will display the window in Figure 15.

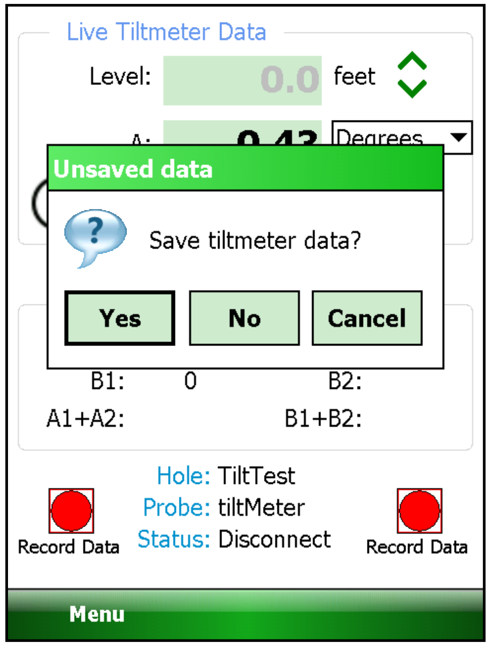

Figure 15 - Saving Data Query

14) Tap the "Yes" button to start the data saving process. The "Save File" dialog (Figure 16) will be displayed, allowing the user to name the data file to save.

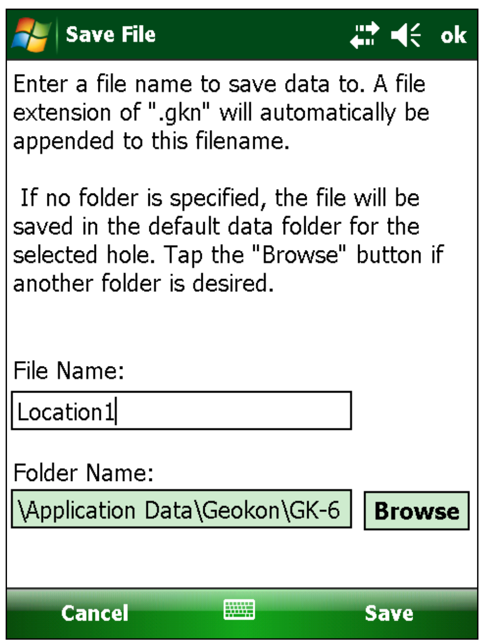

Figure 16 - Save File Dialog

15) After tapping "Save" the GK-604 IRA will determine if the file exists. If this is a new file then the data will be written to it in a format similar to the standard Inclinometer format. If a file of the same name already exists then the dialog shown in Figure 17 will be displayed.

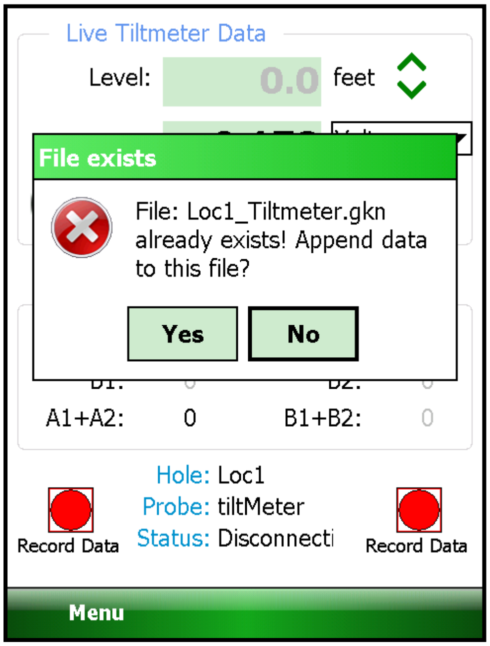

Figure 17 - File Exists Dialog

16) Tapping "Yes" on the "File exists" dialog allows multiple reads for this location to be stored in a single data file. See Section 3.3 for an example of Dual Axis Tiltmeter data format.

17) Tapping "No" at the "File exists" dialog will again call up the "Save File" dialog (see Figure 16) and another opportunity will be given to select a new file.

3.3 Dual-Axis Tiltmeter Data Format

```
***
GK 604E(v1.3.0.0,02/15);2.0;FORMAT II
PROJECT  :Site 1
LOCATION :Loc1
DATE     :02/19/15
TIME     :14:54:17
PROBE NO.:Tiltmeter
UNITS    :DEGREES
FILE NAME:Loc1_Tiltmeter.gkn
   A+,      A-,       B+,       B-,        Date/Time
 -0.031,  +0.028,   +0.002,  -0.002,     2/19/15 14:50:25
 -0.033,  +0.030,   +0.002,  -0.002,     2/17/15 13:54:40
 -0.037,  +0.036,   +0.002,  -0.002,     2/14/15 13.45.20
 -0.038,  +0.035,   +0.002,  -0.002,     2/10/15 11:23:30
```

4. DATA RECORDING AND REDUCTION

4.1 Change in Tilt and Deflection

The change in tilt and deflection can be calculated by comparing the values of the A+ and A - and the B+ and B - readings on subsequent days, i.e.,
Change of Tilt in the A axis = Δ (A+ - A-)/2
and Change of Tilt in the B axis = Δ (B+ - B-)/2
on subsequent days.

The change of tilt can be converted into a deflection using the conversion factor:
One arc second = 0.0048 mm/meter or **One arc second = 0.000058 inches/ft.**

4.2 Example Readings from a Horizontal Tiltplate

Four readings are taken following the instructions of Section 3; two each for Pegs one and three, and two each from Pegs two and four. For example:
Reading Peg one to three (A+) = +0.0447 Degrees
Reading Peg three to one (A-) = –0.0581 Degrees
Reading Peg two to four (B+) = –0.0469 Degrees
Reading Peg four to two (B-) = +0.0342 Degrees

For Pegs one and three, the tilt in the A axis direction is given by the difference:
(A+ - A-)/2 = (+0.0447 – (–0.0581)) / 2 = + 0.0514 Degrees

For Peg two and four, the tilt in the B axis direction is given by the difference:
(B+ - B-)/2 = (– 0.0469 – (+0.0342))/2 = – 0.04055 Degrees

Note that the tilt is towards Peg one (positive) and towards Peg four (negative). A positive figure for both A and B axes means that the tilt is towards Peg one and towards Peg two. These two tilts can be combined, to give the maximum resultant tilt and its direction. This is done by first calculating the deflections in the A axis and the B axis, using the following relationships:
One arc second = 0.0048 mm/m or **One arc second = 0.000058 inches/ft.**

From the above example:
Deflection in the A axis direction (DA) = +0.0514 x 3600 x 0.0048 = + 0.89 mm/m
Deflection in the B axis direction (DB) = - 0.04055 x 3600 x 0.0048 = - 0.7 mm/m

The maximum deflection (Dmax) is given by the equation:
$Dmax = \sqrt{[(0.89)^2 + (-0.7)^2]} = 1.13$ mm/m

And the angle **θ**, the angle between the direction of Peg one and the direction of the maximum tilt, is given by the formula:
$\theta = Tan^{-1} [(DB)/(DA)$
$\theta = Tan^{-1} [(-0.7)/(0.89) = 38$ degrees

And the direction of the maximum defection is 38 degrees from the direction of Peg one in the direction of Peg 4.

4.3 Calibration

The typical calibration report in Figure 18 shows the calibration factors that are entered into the tiltmeter at the factory so that the tiltmeter output can be shown directly in degrees.

GEOKON 48 Spencer St. Lebanon, N.H. 03766 USA

Model 6101D MEMS Portable Tiltmeter Calibration Data

Inclinometer Type:	Digital	Inclinometer S/N:	1532051
Date of Calibration:	October 7, 2015	Technician:	KDB
Calibration Instruction:	CI-6000		

The Gage Factors and Zero Offsets are stored in the MEMS Portable Tiltmeter.
These Factors and Offsets have been entered at the factory.

Inclinometer Probe S/N:	1532051
A Axis Zero Offset:	1.0
B Axis Zero Offset:	-3.5
A Axis Gage Factor:	0.9654
B Axis Gage Factor:	0.9679

The instrument above was found to be in tolerance in all operating ranges.

Calibration Issued By: KLBellavance Date: October 08, 2015

QA Manager: Date:

The above named instrument has been calibrated by comparison with standards traceable to the NIST, in compliance with ANSI Z-540-1

This report shall not be reproduced except in full without written permission of Geokon, Inc.

Figure 18 - A Typical Tiltmeter Calibration Report

5. TROUBLESHOOTING

The main concerns of tiltmeter surveys are the measurement of change in magnitude and direction of rotational movement. The zero offset of the sensor is not critical because the algebraic difference of the two readings eliminates the effect.
A tiltplate tilted at an angle and located on a stable surface can be read periodically to check the calibration of the instrument. The sensor should not be opened in the field and if the unit fails to work it should be returned to GEOKON for repair.

APPENDIX A. PORTABLE TILTMETER SPECIFICATIONS

Range	±15°
Output at ±15° tilt[3]	±4 Volts DC or 10,000 digits (Nominal)
Resolution[1]	±4 arc seconds (±0.02 mm/m)
Accuracy[2]	±10 arc seconds. (±0.05 mm/m)
Thermal zero shift	0.0003volts/ºC rise
Temperature Range, Operating	-40 to+ 70 °C
Temperature Range, Storage	-40 to +70 °C
Shock Survival	2000g
Dimensions	Sensor: 172 mm x 102 mm x 166 mm
Weight	6.5Kg(including case)
Connector	Bluetooth ®
Power Requirements	7.2 VDC (5V min. / 15V max.)

Notes:
[1] Averaging will yield resolution on the order of two arc seconds
[2] Based upon the use of a second order polynomial
[3] Digits are calculated, Volts are measured.

APPENDIX B. INSTALLING THE GK-604D IRA

The installation of the GK-604D IRA requires a Hand-held device (HHD) running Windows Mobile Classic 6.0 or higher, with at least 50 Mbytes of free memory. HHD must be Bluetooth enabled and be able to assign a Bluetooth connection to a COM port. Windows .NET 3.5 Compact Framework (CF) and .NET framework English-language Messages package installed on HHD. Both "CAB" file installers are included in the GK-604D IRA installer "Zip" file, available on GEOKON's website (http://www.GEOKON.com/digital-inclinometer-system/).

Also required is Microsoft ActiveSync version 4.5.0 or higher running on the host PC (Figure 19) or Windows Mobile Device Center if PC is running Windows 7 (Figure 20 on the following page) as well as the HHD. An active connection between the two must be established via either a physical link or Bluetooth.

Note: For customers using a PC running Window 10 operating system; Windows Mobile Device Center (WMDC) may no longer operate as it should because of an operating system update (released October of 2017) called "Fall Creator Update". If WMDC no longer launches when a mobile device is connected via USB cable or will not manually launch, the link below should help fix the issue. Please note that administrative privileges are need to launch some of the files involved in the fix so your local IT person may need to be involved. The fix can be accessed via the following link:
https://www.handheldgroup.com/support-rugged-computers/knowledgebase-KB/22996/

Should the link above fail to fix the WMDC launch problem, the link below offers another possible solution:
http://www.junipersys.com/Juniper-Systems-Rugged-Handheld-Computers/support/Knowledge-Base/Support-Knowledge-Base-Topics/Desktop-Connection-ActiveSync-or-Windows-Mobile-Device-Center/WMDC-in-Windows-10

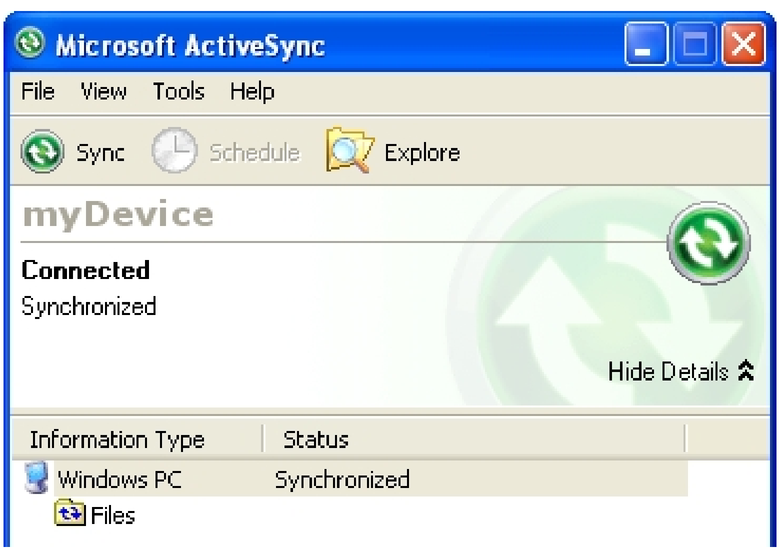

Figure 19 - ActiveSync Window showing active connection

Figure 20 - Windows Mobile Device Center

B.1 Launching the GK-604D Installer

1) From the Windows Mobile Device Center window on a desktop PC (see Figure 20 above), click on the folder icon labeled “Browse the contents of your device” to call up an Explorer Window for the HHD (Figure 21). The procedure for ActiveSync is very similar.

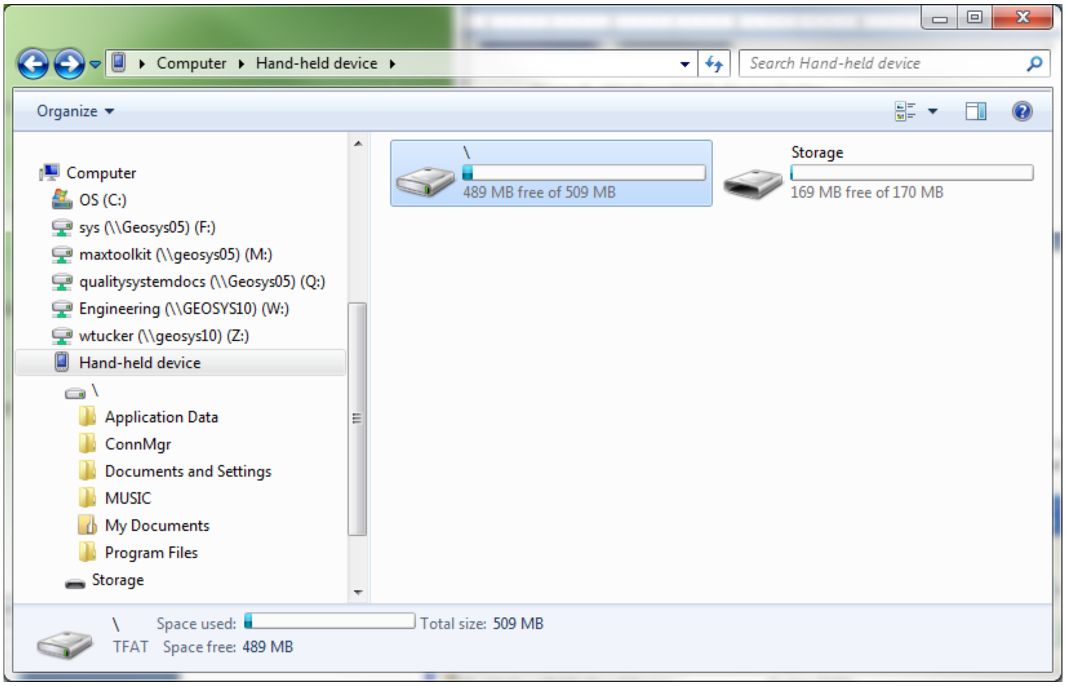

Figure 21 - Windows Explorer Window Displaying HHD Root Folder

2) In the Explorer Window, double-click the icon labeled “\” to navigate to the hand-held PC’s system root shown in Figure 22.

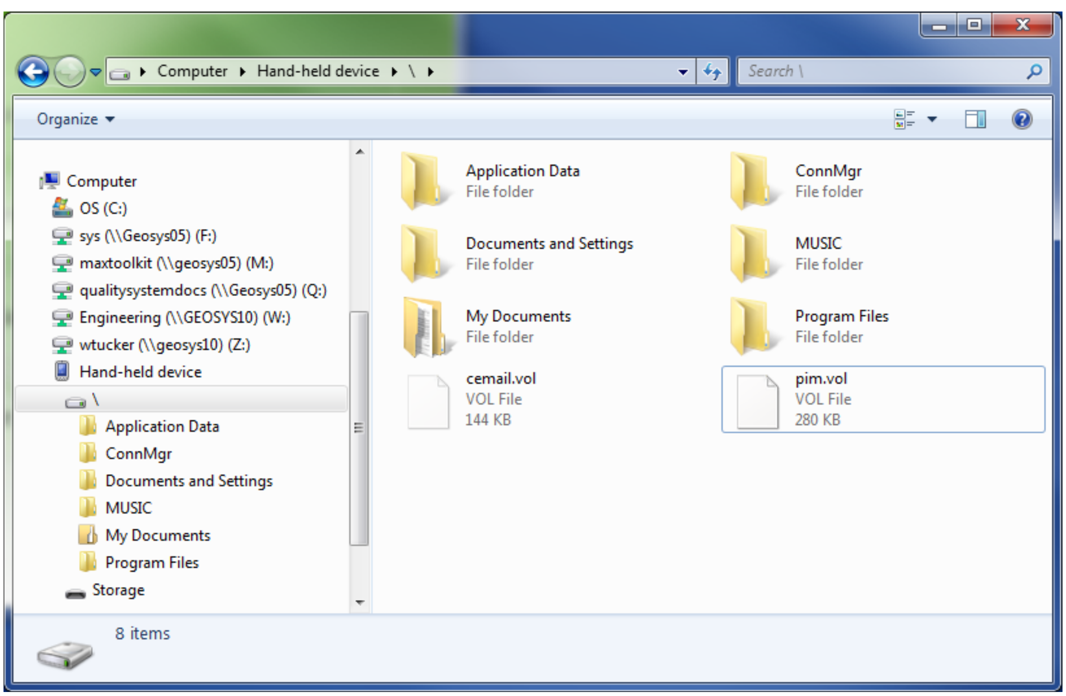

Figure 22 - Hand-held device root folder contents

3) Unzip the GK-604D Installer (downloaded from GEOKON's website), open a Windows Explorer window, and then navigate to the root folder of the Installation folder (Figure 23).

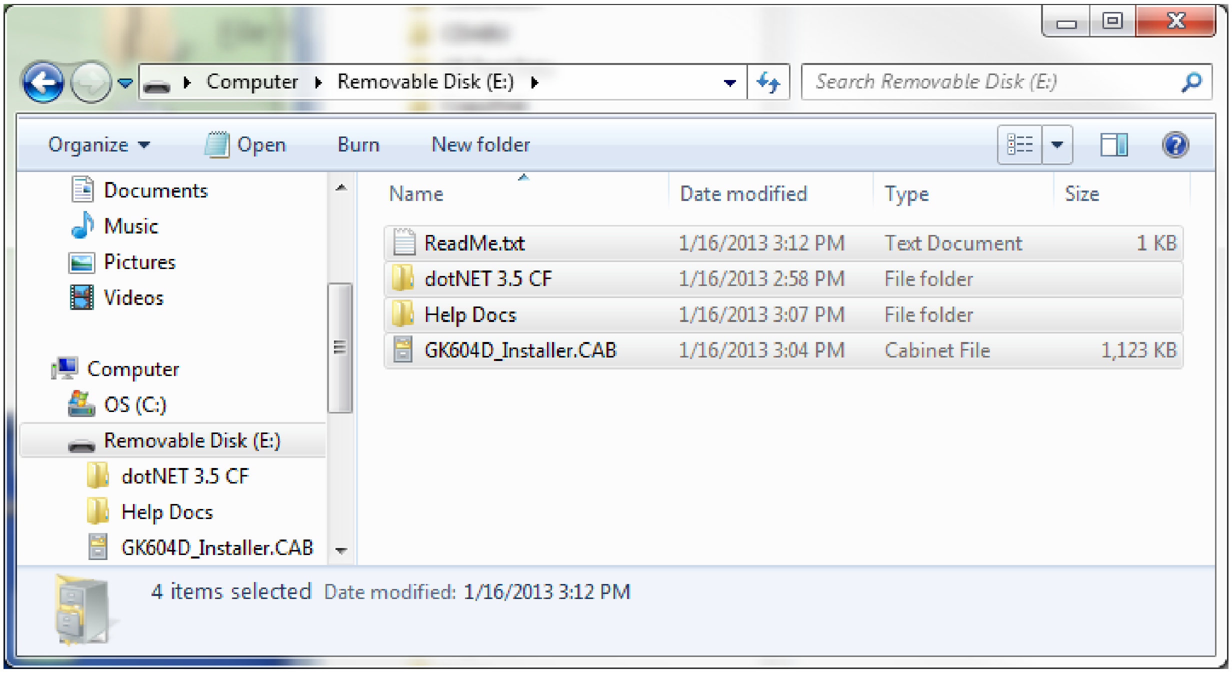

Figure 23 - Installation Folder Contents

4) Copy the file, "GK604D_Installer.CAB" from the installation folder to the HHD system root folder. From the HDD, navigate to the system root folder using File Explorer (Figure 24) and tap the file, "GK604D_Installer" to execute the installer.

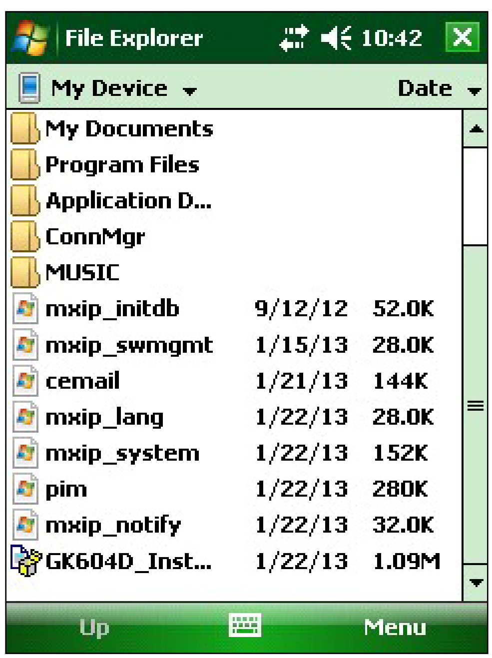

Figure 24 - GK-604D Installer at root of HDD

5) If there is a storage card installed in the HHD then the user will be prompted to choose the location for the installation (Figure 25). It is recommended that "Device" be selected then tap "Install" with the stylus to initiate the install process.

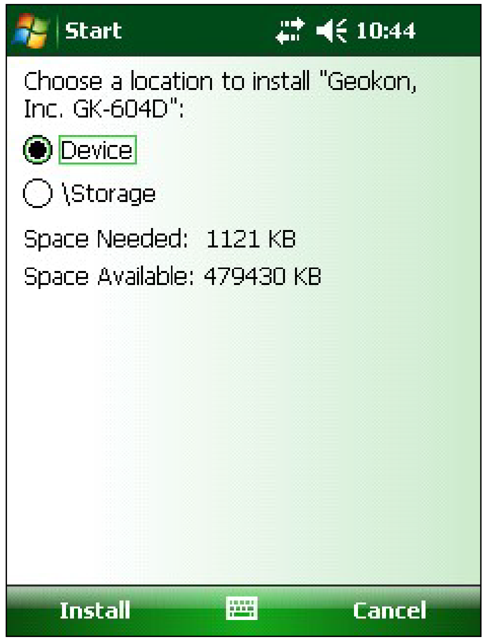

Figure 25 - GK-604D Install Screen

6) The file, GK604D_Installer.CAB can be now deleted from the system root folder to free up memory. The GK-604D IRA is now installed and its icon should appear in "Start->Programs" (Figure 26).

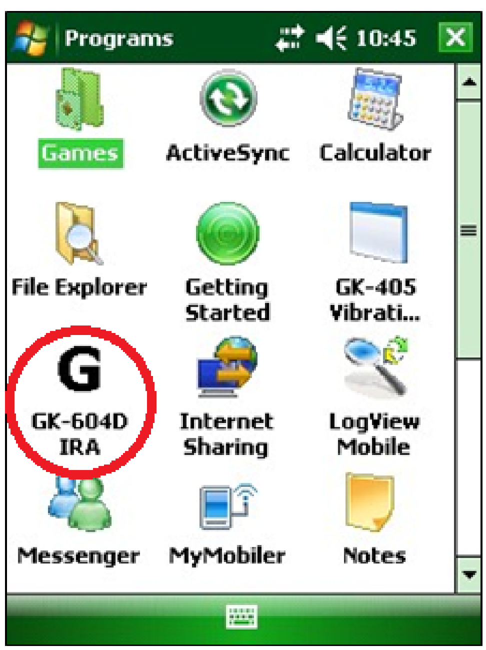

Figure 26 - GK-604D IRA Icon in Start->Program

APPENDIX C. ESTABLISHING CONTACT WITH THE REMOTE MODULE

GEOKON makes every effort to ensure that the system is completely set up and working before it leaves the factory. This includes the wireless pairing between the Field PC and the Remote Module.

In general, this should only need to be done once and is typically done before it leaves the factory. Follow the steps below to ensure the 'partnership' with the remote is established before using the readout software:

1) Use the Bluetooth Settings Manager on the hand-held PC to set up the link to the remote. Read about setting up a Bluetooth "partnership" in Chapter 9 of the Field PC's Reference Guide. See the diagrams below for two examples of how to start Bluetooth Manager.

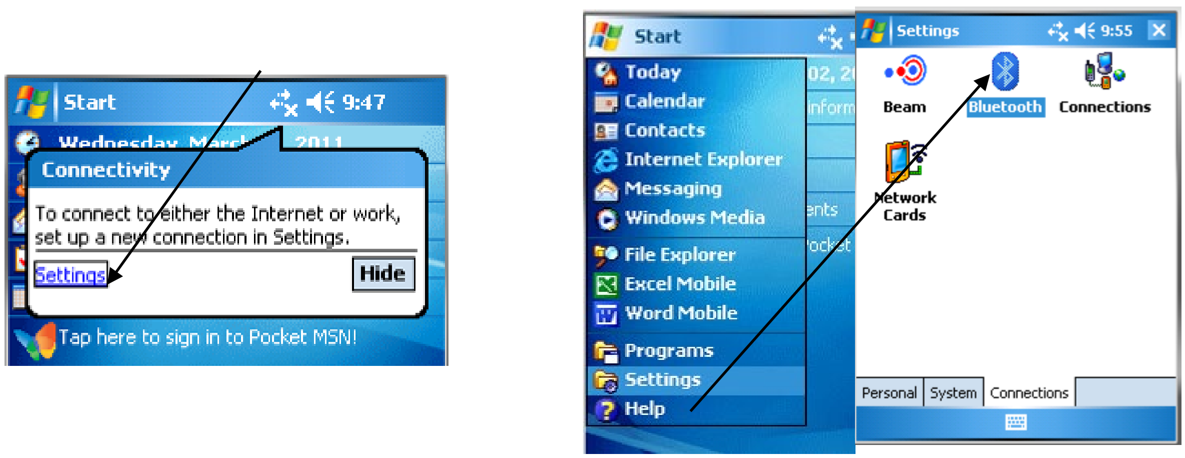

Figure 27 - Starting Bluetooth Manager

2) Once in the Bluetooth Settings Manager, click on the "Mode" tab and then make sure that the box next to "Turn on Bluetooth" is checked (Figure 28).

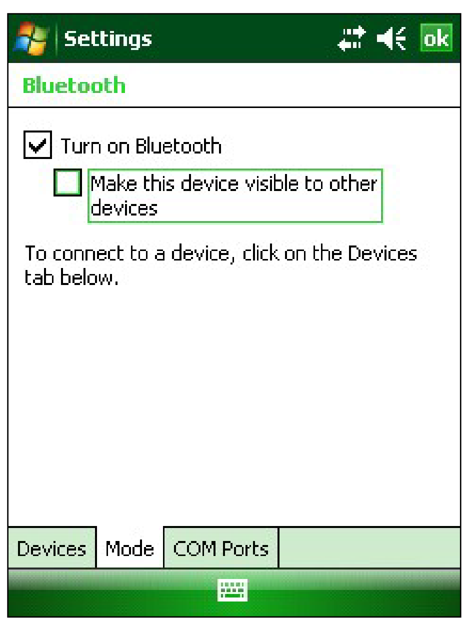

Figure 28 - Turn on Bluetooth

3) Click on the "Devices" tab. If it shows a "GEOKON" device (name will start with "GK-604" and contain the remote's serial number), go to step six. Otherwise turn on the remote module (should see a flashing blue indicator on the remote) and select "Add new device…".

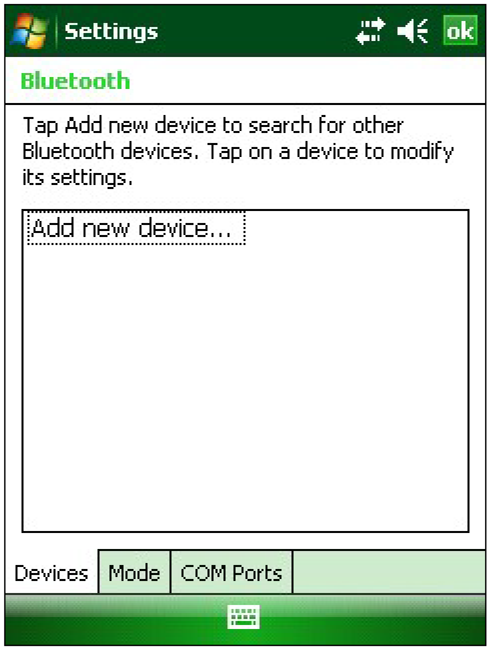

Figure 29 - Add New Device

4) When a suitable remote is discovered, highlight the device and tap "Next" (Figure 30).

Figure 30 - Select a Bluetooth Device

5) A prompt will be displayed for a password; tap “Next”. If a partnership with the device is successfully established the screen will momentarily display the prompt shown at the bottom of Figure 31 and then return to the Bluetooth Devices screen. Click “Cancel” on the “Enter Passcode” screen then click “Done”.

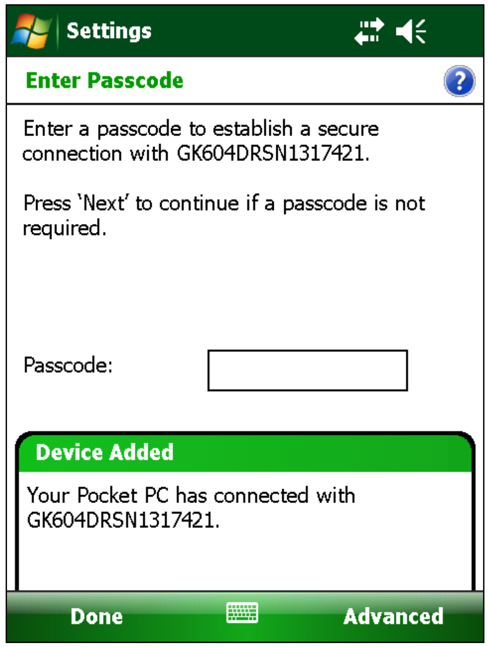

Figure 31 - Enter Passcode

6) Click on the COM Ports tab. If the “GEOKON” device is already assigned to a COM Port, skip to step nine. If no COM port is assigned, select “New Outgoing Port”. In the example shown in Figure 32, there is no COM Port assigned to a “GK604” device.

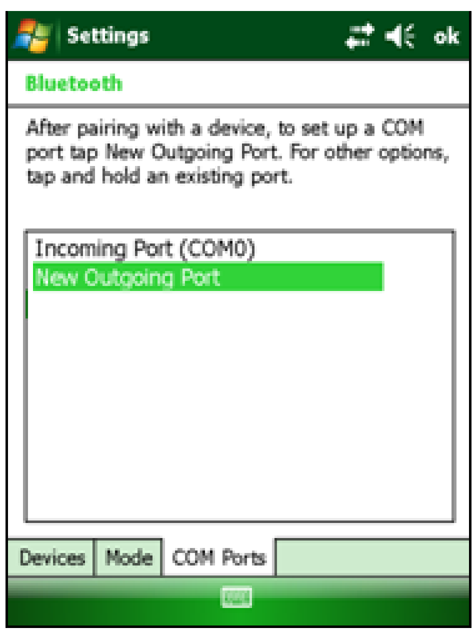

Figure 32 - New Outgoing Port

7) Figure 33 shows the devices that a COM Port may be selected for. Select the appropriate "GEOKON" device from the list and tap "Next".

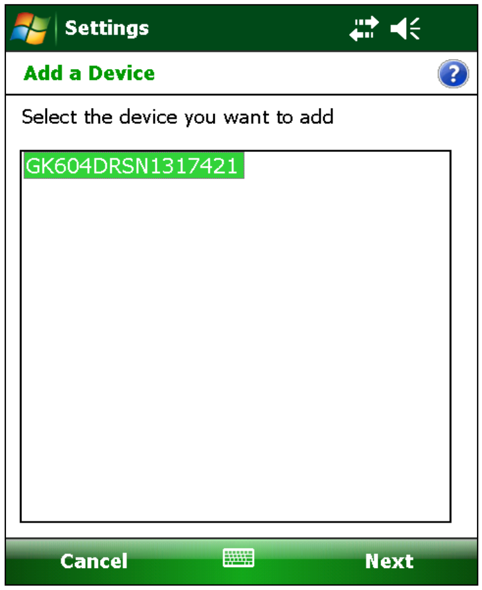

Figure 33 - Add a Device

8) From the "Port:" drop-down list, select COM6, COM7, or COM8. (The other COM Ports are used by the system and are not available.) Be sure to remember the number of the COM port as you may have to select it later in the readout software. Make sure to "uncheck" the "Secure Connection" check box (Figure 34). Tap "Finish" when done to return to the Bluetooth Settings "COM Ports" screen.
*Note: If using a Nautiz X7, COM5 may be available, depending on the model.

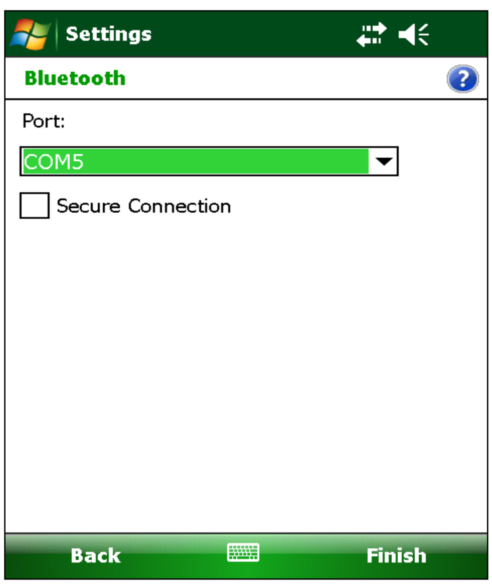

Figure 34 - COM Port Selection

9) Lastly verify that the Bluetooth device is set for Serial Port operation. From the "Devices" tab of the Bluetooth Settings manager, tap the device to be used to communicate with the remote. Figure 35 will be displayed. Ensure that the "Serial Port" checkbox is checked. Tap "Save" to complete the Bluetooth Settings.

Figure 35 - Serial Port Check Box

NOTE: After "Save" is selected, you will be brought back to the "Devices" window. There will be a "Connect" button available at the bottom of the screen. See Figure 36 below.

DO NOT USE THE "CONNECT" BUTTON TO TEST THE CONNECTION!

It will always fail after the pairing has been made successfully. Test the pairing by entering the GK-604D_IRA application.

Figure 36 - Connect Button

C.1 Starting the Inclinometer Readout the first time

The readout software is launched by tapping the Start button (or clicking on Programs) and then selecting the GK-604D IRA icon (shown on the right).

If the application fails to launch and the message, “This application requires a newer version of the Microsoft .NET Compact Framework than the version installed on this device”, is displayed then the .NET Compact framework that is included in the installer “Zip” file should be installed. The .NET Compact Framework installer is called “NETCFv35.wm.arm4i.cab” and is located in a folder called “dotNET 3.5 CF” (see Figure 23). Installation is very similar to installing the GK-604D IRA.

A companion package for the .NET Framework, “NETCFv35.Messages.EN.wm.cab”, should also be installed at this time and is located in the same folder.

When starting the GK-604D Inclinometer Readout Application (GK-604D IRA) for the first time, you will be prompted to create a workspace name (Figure 37). The workspace name can be any combination of letters and numbers and should be descriptive in nature. After creation, this name will be displayed in the Project Explorer window.

Figure 37 - Select Workspace Name

Once the name for your workspace is selected, you will be prompted to choose or create a folder on your PC where all the workspace elements will be stored (Figure 38). The default workspace location is in a folder named the same as the workspace name, under a special shared folder reserved for workspaces. For Windows Mobile devices, this folder is located at: \Application Data\GEOKON\GK-604D\Workspaces.

GK-604D IRA appends the name of the new workspace to this shared folder and uses it as the default location for the new workspace. The user is free to select their own location, either by entering it directly, or the Browse button ( ) may be used to navigate to a different folder location or to create a new folder

This workspace location will be stored in the GK-604D IRA configuration for subsequent application access. After workspaces are created, all future user access to workspaces is always by name.

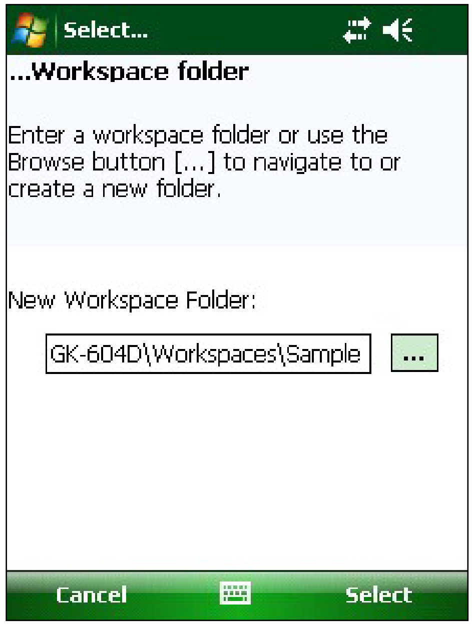

Figure 38 - Select Workspace Folder

Note: If the newly selected workspace folder contains an existing workspace, GK-604D IRA will display a dialog prompt asking the user if they want to import the workspace as is or to rename it with the previously specified new workspace name (Figure 39).

Figure 39 - Workspace Exists

Much like what was done for the initial workspace, a probe library also needs to be created before the application can fully launch. After specifying the workspace folder, you will be prompted to create a probe library name (Figure 40). The probe library name can be any combination of letters and numbers and should be descriptive in nature. After creation, this name will be displayed in the Project Explorer window.

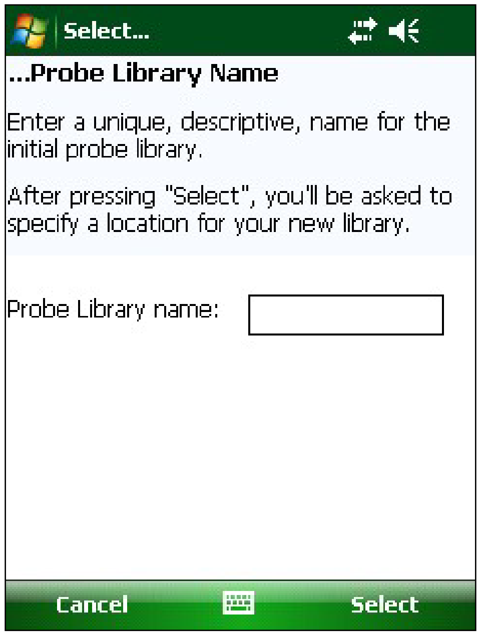

Figure 40 - Select Probe Library Name

Once you have selected the name for your probe library, you will be prompted to choose or create a folder on your PC where all the probe library elements will be stored (Figure 41). The default probe library location is in a folder named the same as the probe library name, under a special shared folder reserved for probe libraries. For Windows Mobile devices this folder is located at: \Application Data\GEOKON\GK-604D\Probe Libraries

GK-604D IRA appends the name of the new probe library to this shared folder and uses it as the default location for the new probe library. The user is free to select their own location, either by entering it directly, or the Browse button (...) may be used to navigate to a different folder location or to create a new folder. This probe library location will be stored in the GK-604D IRA configuration for subsequent application access. After probe libraries are created, all future user access to probe libraries is always by name.

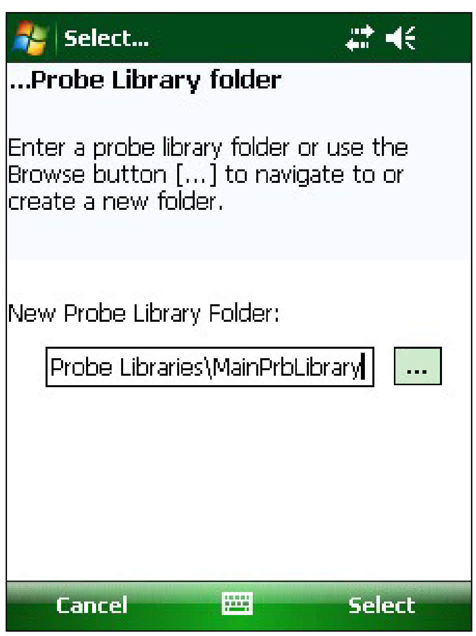

Figure 41 - Select Probe Library Folder

Note: If the newly selected probe library folder contains an existing probe library, GK-604D IRA will display a dialog prompt asking the user if they want to import the probe library as is or to rename it with the previously specified new workspace name (Figure 42).

Figure 42 - Probe Library Exists

After the initial workspace and probe library are created the GK-604D IRA will open, displaying the newly created workspace and probe library (Figure 43). New project(s) and hole configurations may be added to your workspace as well as adding new probes (settings) to the new probe library.

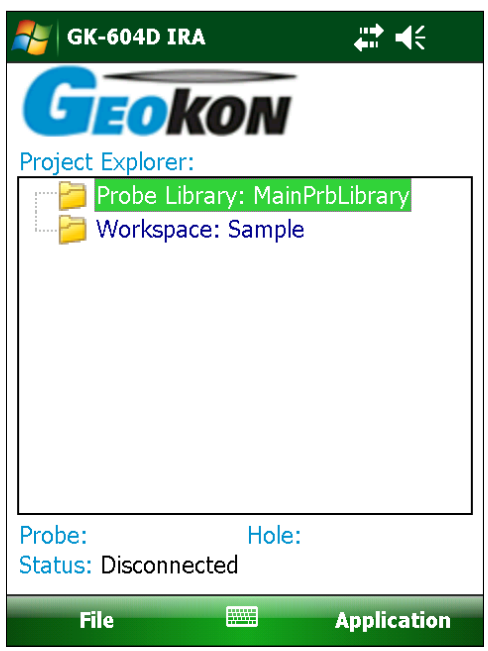

Figure 43 - Empty Workspace and Probe Library