KAMAN
MEASURING

User's Manual

Air Gap Tool

for

Static Rotor-Stator Clearance

in

Hydro Generators & Electrical Machines

Kaman Precision Products
217 Smith Street
Middletown, CT 06457

Table of Contents

Part 1 - Introduction 3

Part 2 – Setting Up The Air Gap Tool 5

2 .1 – Overview 5

2 .2 – Unpacking The System 6

2 .3 - Cautions and Safeguards 6

Part 3 – Using The Air Gap Tool 7

3.1 – Insertion Tool Top Panel 7

3.2 – Starting The App and Connecting To The Insertion Tool 8

3.3 – App Settings 10

3.4 – Real-Time Data Display And Data Set Recording 11

3.5 – Taking A Measurement 12

3.6 – Logging Data 12

3.7 – Accessing Logged Data 15

3.8 – Battery Charging 17

Part 4 – Troubleshooting 18

APPENDIX A – SPECIFICATIONS 19

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Part 1 - Introduction

Kaman's Air Gap Tool is an instrument designed to measure static rotor-stator gaps for alignment in large scale hydro generators and electrical machines. The measurement is based on Kaman's proven eddy current technology for electronic, accurate, user friendly measurement of gaps between 0.25 and 1.0 inch (0.64 to 25.4 mm).

The Air Gap Tool consists of two main components:

- An Insertion Tool with long life rechargeable battery. The insertion tool measures the rotor-stator gap and transmits the data wirelessly via Bluetooth® to a separate display device.

- A user friendly GUI application on an Android™ tablet for real time gap measurement display and data storage.

It also includes the following accessories:

- Universal USB charger and cable for the insertion tool battery
- Insertion depth stops
- USB charger and cable for the Android™ tablet
- User manual
- Rugged carry and storage case

The application displays the measured gap in inches over the calibrated span of 0.250" to 1.000.

The GUI application is currently designed for use on an Android device. A future release for use on Apple®

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products is also planned for data display, recording, storage, and optional transfer to permanent data storage.

The appllication allows for recording of operator identification information, measured equipment information, and time stamp information. A user-friendly GUI displays real-time measurement data and save the measurement on command.

The Air Gap Tool is provided in a rugged hard shell case that houses the tool, user manual, Android™ tablet, and chargers.

Android is a trademark of Google LLC
Apple is a registered trademark of Apple Inc., registered in the U.S. and other countries and regions

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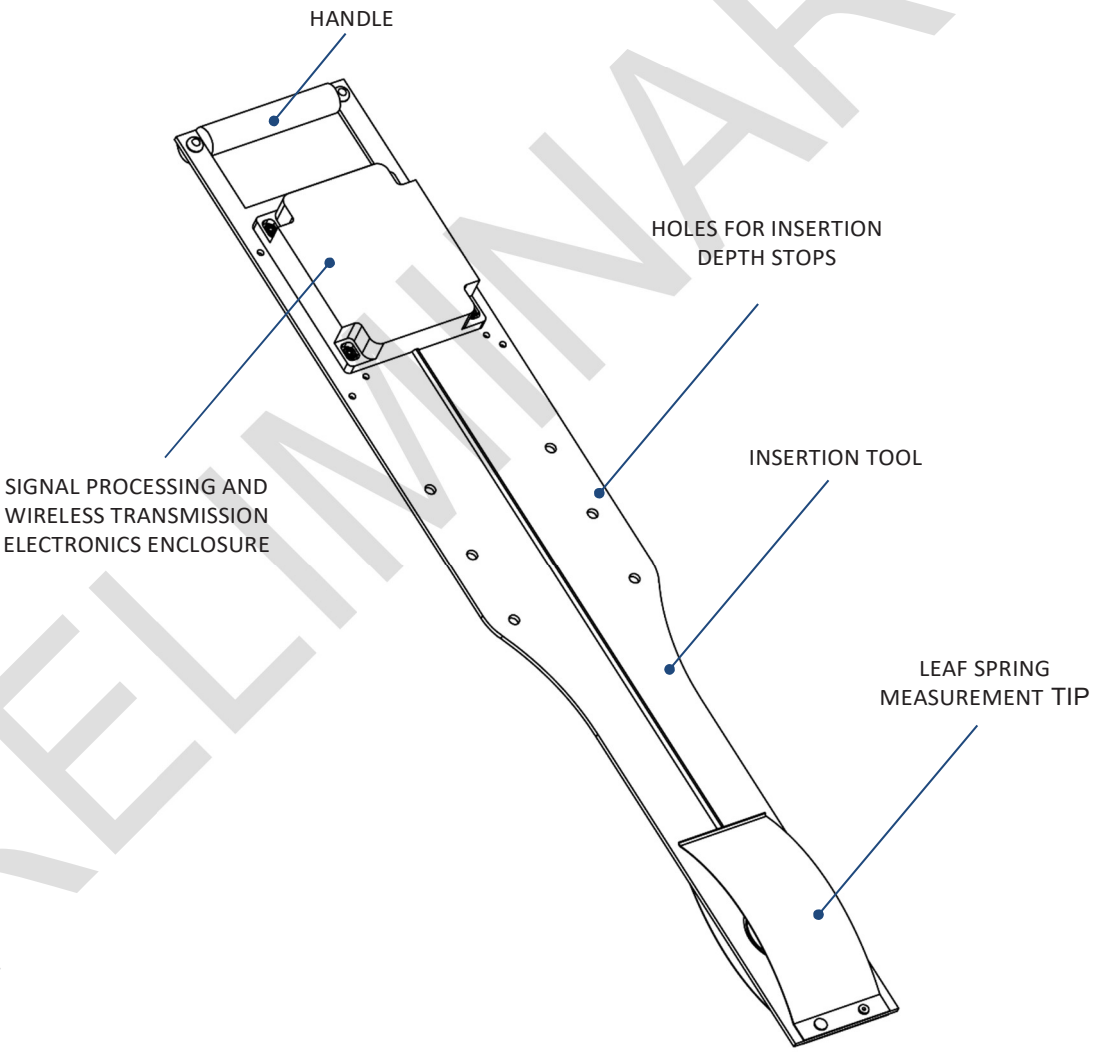
Part 2 – Setting Up The Air Gap Tool

The Air Gap Tool is simple to set up, with no wires to damage, and a user-friendly, fully featured app for reading and recording sensor data.

2 .1 – Overview

The figure below highlights the main features of the Insertion Tool.



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2 .2 – Unpacking The System

- Set the carrying case on a level surface, open the four latches, and fully open the case lid
- Carefully lift the tool from the case and set on a clean, flat surface.
- Using the included USB Micro B cable and wall transformer, plug in the tool until fully charged. ***Ensure the ambient temperature is between 10˚C and 45˚C when charging the Insertion Tool battery.***
- Using the USB type C charger, plug in the optional tablet until fully charged
- Unplug both chargers prior to using the system

The tool is now ready for use.

2 .3 - Cautions and Safeguards

The system is a robust platform, but there are certain practices that must be observed.

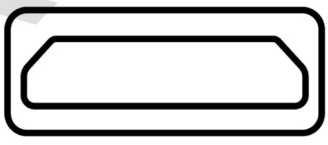
The allowable ambient temperature when charging the battery is 10˚C to 45˚C

The battery is not user serviceable

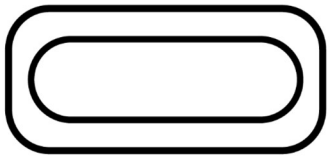
Do not operate the system below 0% battery charge. When the app indicates 0% charge, the system will not shut down immediately. This allows time for the operator to plug the system in as soon as possible.

The allowable ambient operating temperature for the Insertion Tool (not tablet) is 10˚C to

Use only the supplied AC adapters when charging the Insertion Tool and tablet. The sensor uses a keyed (fits in one orientation only) USB micro B connector. The tablet uses a non-keyed USB C connector. The micro B and C connectors are not interchangeable. Failure to use the proper adapter could result in malfunction or damage to the product.



USB MICRO B



USB C

Do not operate the system while charging

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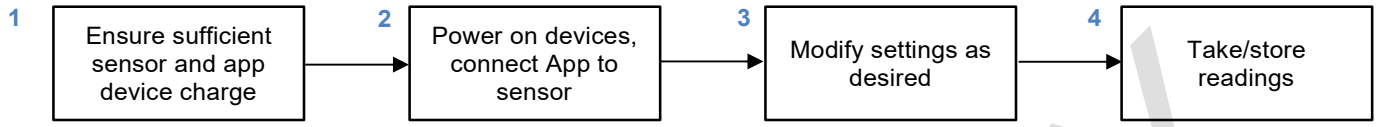
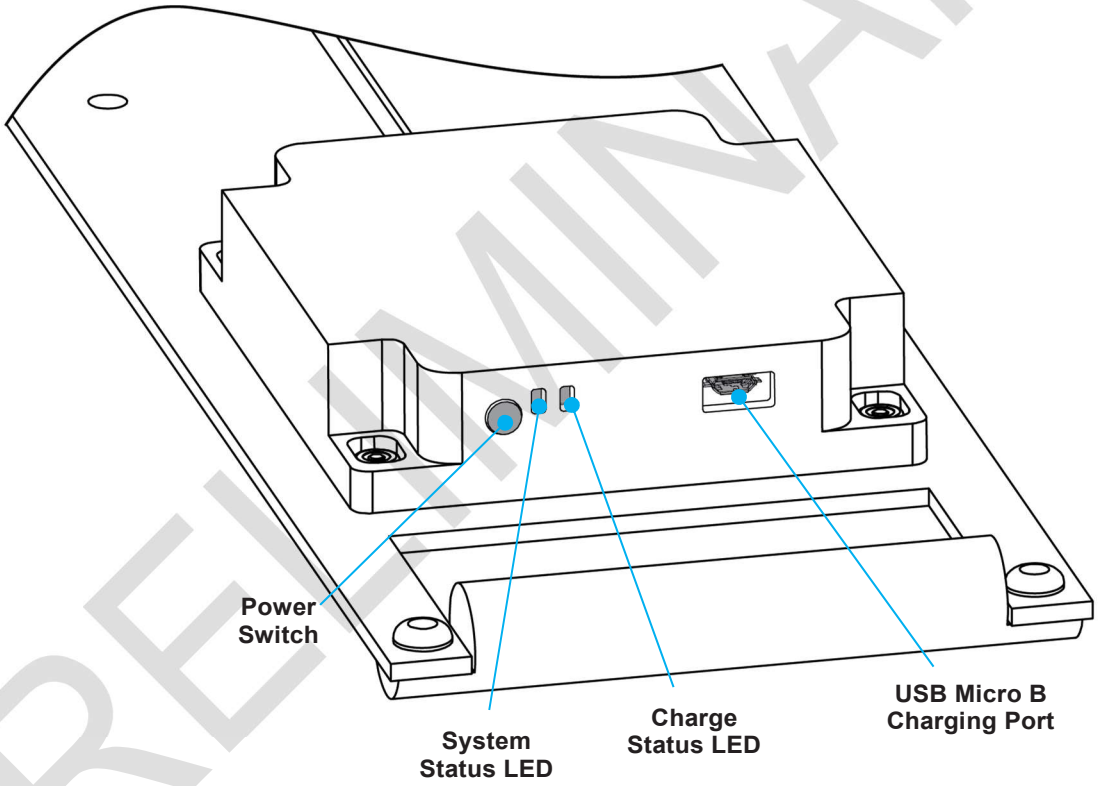
Part 3 – Using The Air Gap Tool

The general workflow for using the system consists of the following steps:



3.1 – Insertion Tool Top Panel

The top panel of the Insertion Tool has a number of functions, as indicated below:



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INTERFACE	FUNCTION/BEHAVIOR
USB Micro B Port	**Charging port** • Charging the tool via the AC Adapter

System Status LED	**Indicates charge amount and connection status**
	• Solid green for 5 seconds at power on to indicate initial boot-up
	• Brief flash then the state of the battery charge is indicated for 10 seconds where:
	  ○ Green, OK to use
	  ○ Yellow, consider charging
	  ○ Red, charge battery
	  ○ Red blinking, charge battery, system will not power on fully
	• Assuming charge state is adequate, LED now blinks blue to indicate system is ready for pairing
	• Solid blue indicates system is paired

Charge LED	**Indicates charging status** • Off if USB power adapter is not connected • Solid red if charging • Solid green if fully charged / trickle charging • Alternating between red and green if attempting to charge the battery while outside the allowable temperature limit
Power Switch	**Momentary switch used to power on and off the unit**

3.2 – Starting The App and Connecting To The Insertion Tool

- Power on the tablet
- Whether the app is run on a provided tablet or the user's own device, ensure that ***location services*** and ***BlueTooth*** are turned on. These can be changed via the devices settings pages.
- From the device home screen, tap on the GapCheckPro icon, which will start up the app

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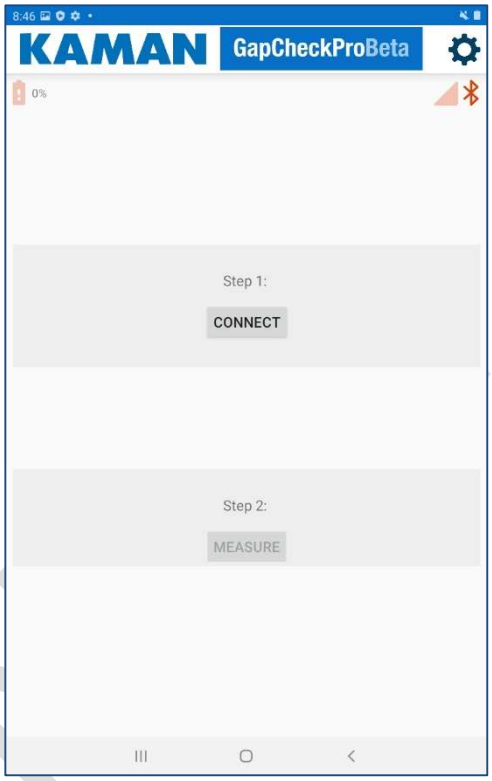
System App Icon



App Home Screen

- The GapCheckPro Beta HOME screen will come up
- At this point the user can change SETTINGS (gear icon), or CONNECT to the sensor
- To connect to the sensor, first ensure the sensor is powered on and the system LED is flashing blue
- Tap on CONNECT
- A list of available sensors will be displayed. If more than one tool is powered on and broadcasting, the list will include them all. Tap on the desired tool name.
- Upon successful connection:
  - The CONNECT icon will change to DISCONNECT
  - The Bluetooth and signal strength icons (upper right hand corner) will change to a green color
  - The sensor battery level icon (upper right hand corner) will become active
  - The app MEASURE icon will be activated
  - The System Status LED on the tool will change to solid blue

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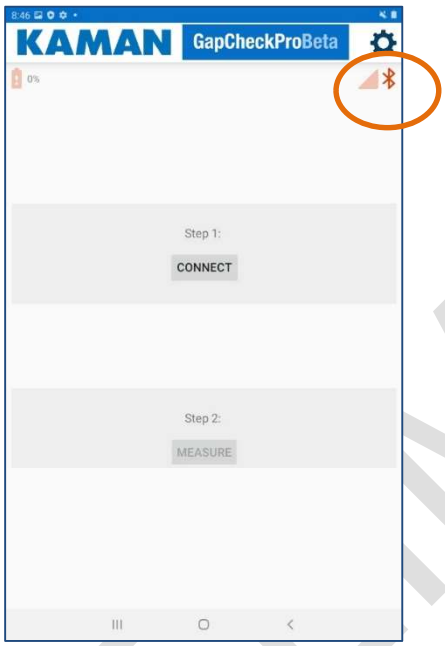
- At this point, the user can choose to enter SETTINGS (gear icon) or start measuring

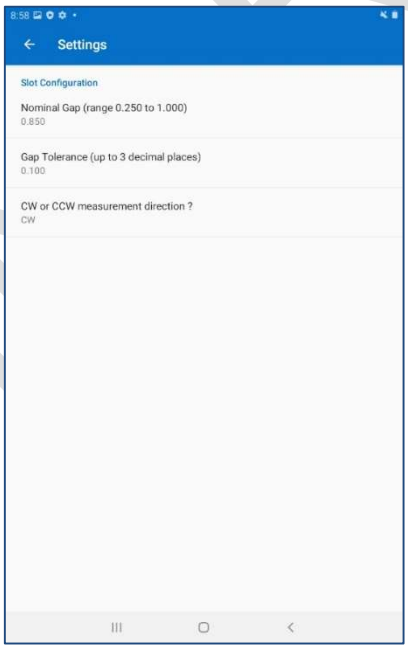
3.3 – App Settings

The SETTINGS page allows for customization of the measurement parameters. The SETTINGS page is accessed by tapping on the gear icon in the upper right hand corner of the screen.

Note that settings can be changed before or after connecting to a tool.



HOME Screen Showing Gear (SETTINGS) Icon



Settings Screen

Tapping on each setting allows for modification of various parameters.

SETTINGS PARAMETER	SETTING DESCRIPTION
Nominal Gap	• Set target gap between 0.25 and 1.00 inch, inclusive of tolerance
Gap Tolerance	• Allowable gap tolerance
Measurement Direction	

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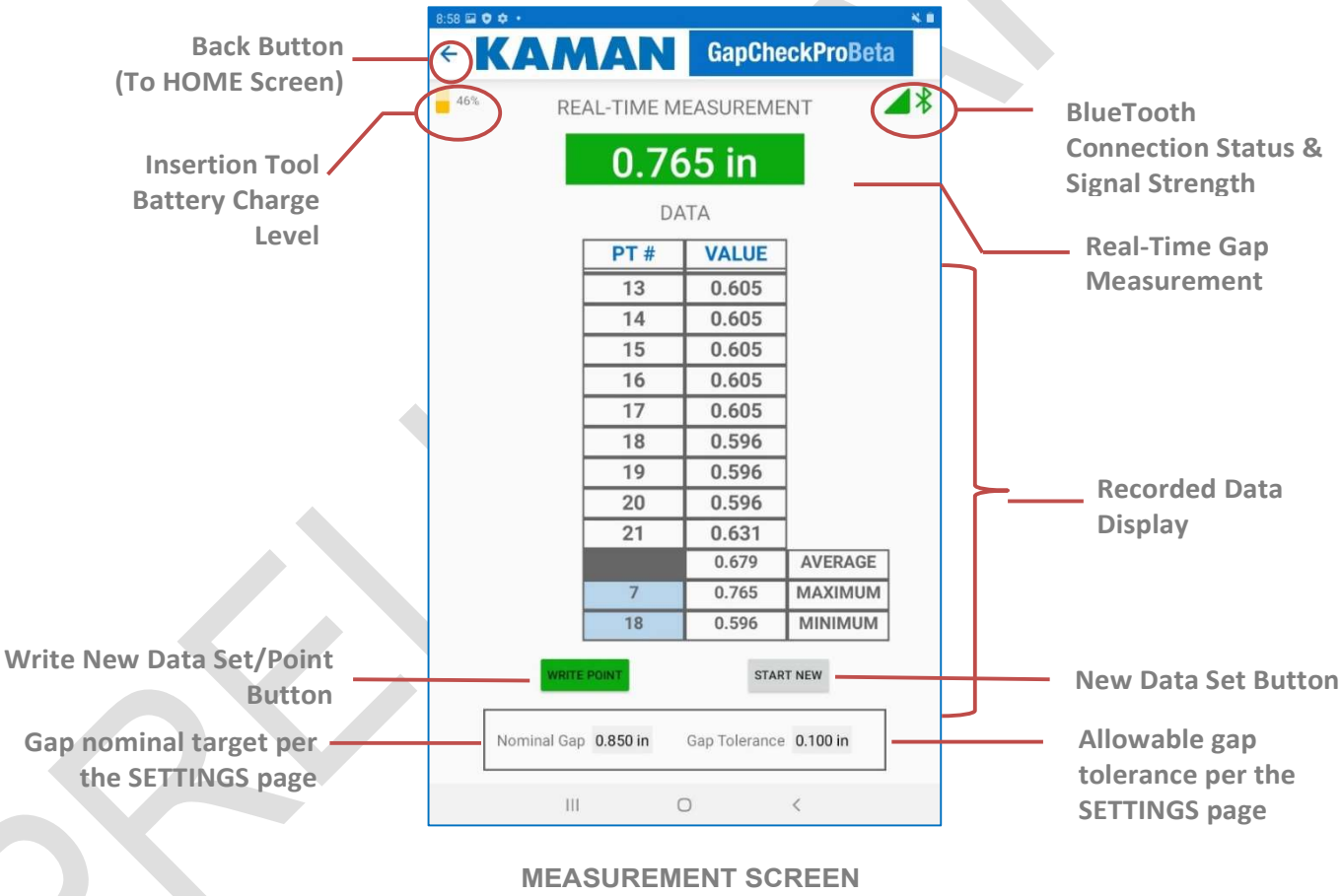
	• Specify the direction of measurement around the rotor/stator gap

After setting values, navigate back HOME using the back arrow in the upper left hand corner of the screen.

3.4 – Real-Time Data Display And Data Set Recording

Once connected to a sensor tap on MEASURE to navigate to the real-time data display and recording page.



MEASUREMENT SCREEN

The system will be displaying gap data in real-time. Note that the real-time measurement background box will change color in relation to the allowable tolerance.

Real-time measurement box color key:

- Green: Measurement is in tolerance

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- Yellow: Measurement is 1 – 2X outside of the tolerance
- Red: Measurement is > 2X outside the tolerance

A visual alarm will also flash at the top of the screen if the measurement is outside the high end of the allowable range. A visual + audible alarm will flash at the top of the screen if the measurement is below 0.25".

3.5 – Taking A Measurement

The unit as shipped is calibrated over the 0.250" to 1.000" range and is ready to use. Insertion stops are provided for repeatable depth of insertion when making rotor-stator gap measurements. Install them to best suit measurement requirements.

Gripping the handle of the device in one hand and steadying with the other, push the spring end of the Insertion Tool into the gap between the rotor and stator. The springs act as the target for the eddy current sensor mounted between them. As the springs compress upon insertion the eddy current sensor will measure the distance between the springs and the app will display the distance in inches between the outside surfaces of the springs.

3.6 – Logging Data

When first navigating to the MEASUREMENT screen, real-time measurements will be displayed, but data is not being written.

To write the data set to a file, tap on the red WRITE POINT button. This will bring up a pop-up in which notes can be taken. These notes will be written to the save file.

Note: The WRITE POINT button has a red background to indicate that a data set write can be initiated. That is, no data is currently being written when the button is red. Once tapped, this initiates a data set write. After completing the pop-up and returning to the MEASUREMENT screen, the WRITE POINT button will be green, indicating a data set is being written and appended to with each tap.

INITIATES DATA SET WRITE

DATA BEING WRITTEN WHEN TAPPED

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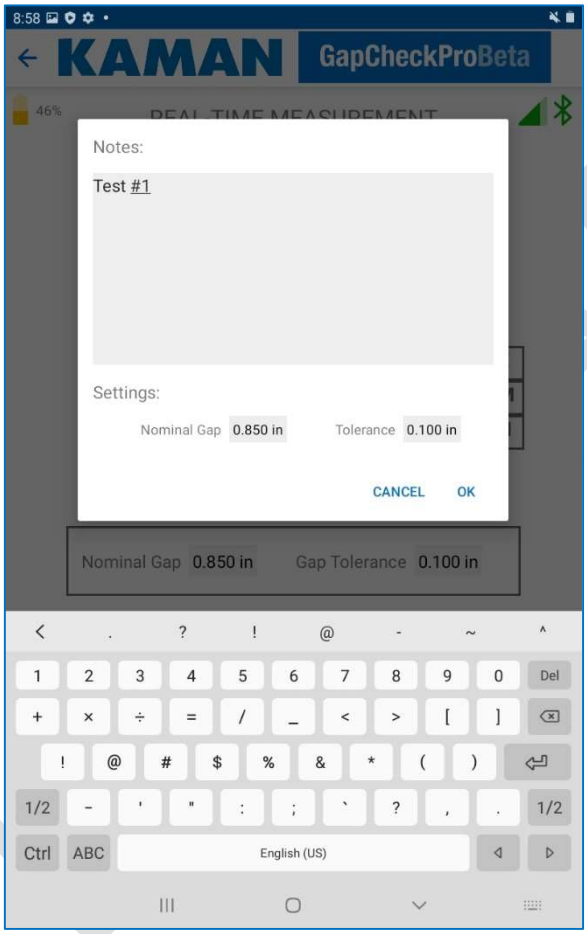

DATA SET POP-UP SCREEN

After tapping OK, the system will go back to the MEASUREMENT screen. Note that the WRITE POINT button is now green, indicating the system is currently writing to a file when tapped.

As the WRITE POINT button is tapped, the recorded value is appended to a file, and added to the scrolling list on the app screen. Over 9 recorded values, the app data will begin to write below the visible portion of the table. The data is viewed by simply swiping the table up or down as desired.

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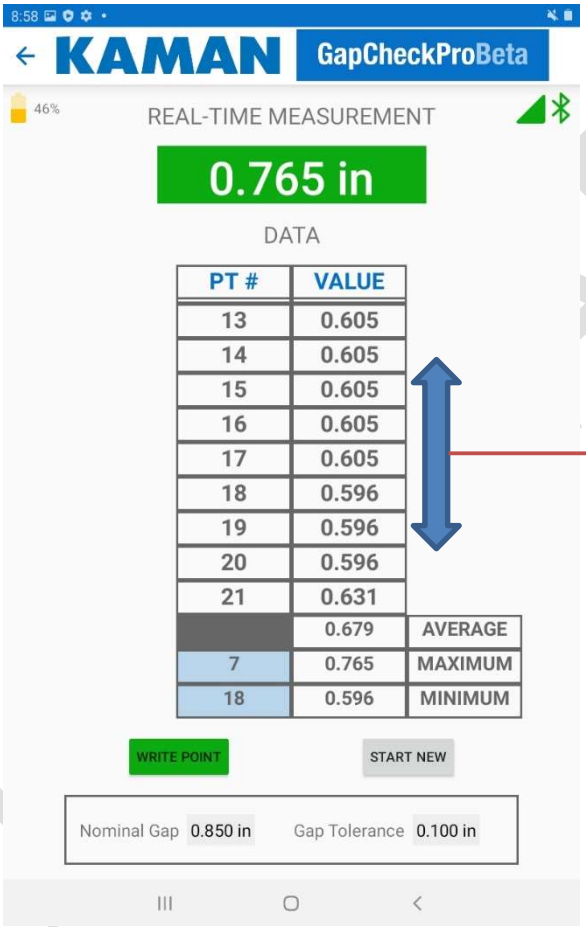

Swipe up and down here to access scrolled data

For convenience, as data is taken, the average, minimum, and maximum values are shown at the bottom of the data set. The light blue boxes indicate which points of the data set contain the max and min values.

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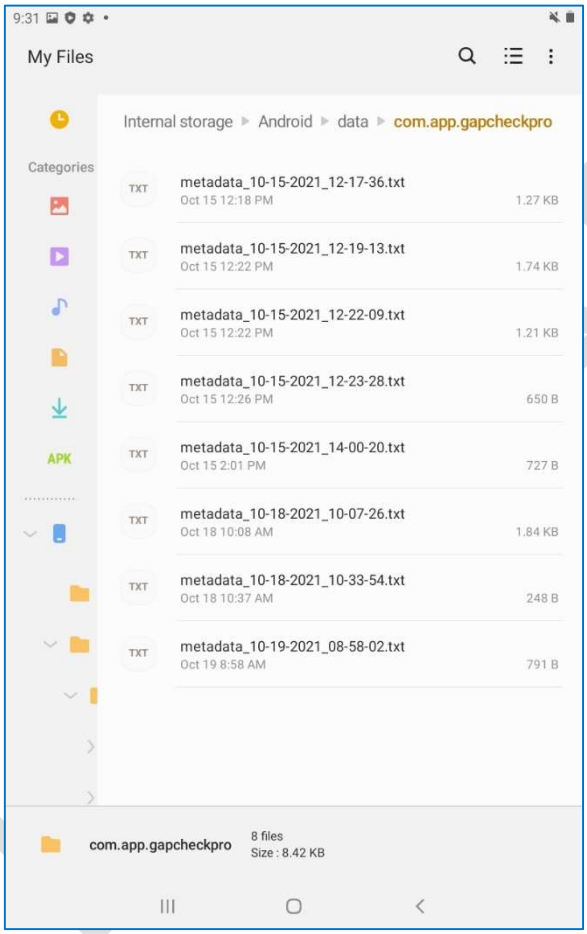
3.7 – Accessing Logged Data

Data taken during an adjustment session is saved to the device that the app is running on.

For Android devices, the path is shown below, along with the file name syntax:



To open a file, simply tap on it. The contents of a typical file are shown below:

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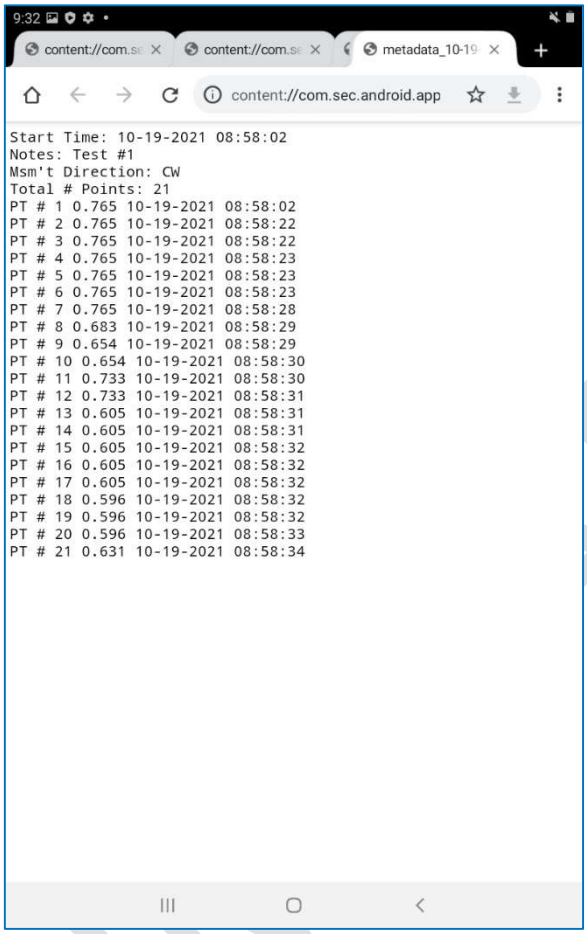

Files can be transferred to a PC using standard methods dictated by the respective operating systems. Typically this is performed by connecting the system to a PC via a USB cable.

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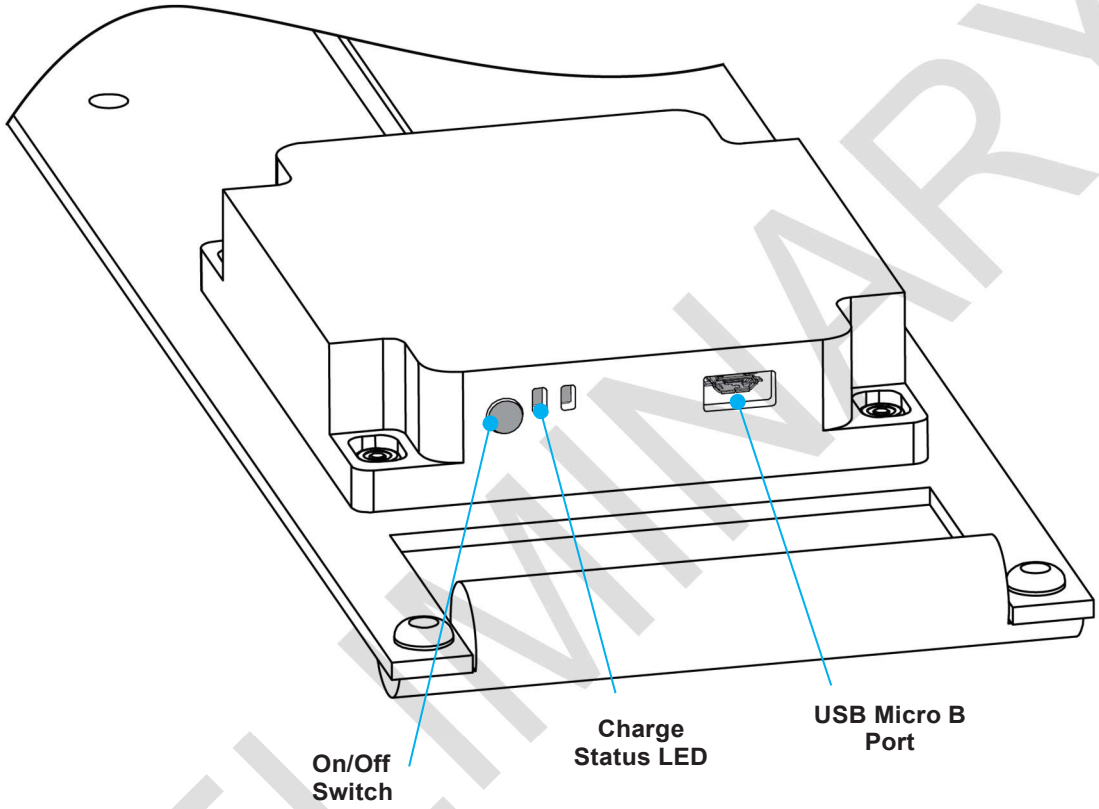
3.8 – Battery Charging

The battery is charged through connection of the supplied USB charger to the USB Micro B port. Ensure the system is powered off prior to charging. The Charge Status LED will illuminate solid red during charging, and will turn solid green when fully charged.



Only use provided USB charger. Damage can result if an alternate is used.

The allowable ambient temperature when charging the battery (system not powered on) is 10˚C to 45˚C

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Part 4 – Troubleshooting

Use the table below to help diagnose and correct issues with the system.

PROBLEM	REMEDY
No sensors show up on the connection list despite the sensor being powered on	Check location services is turned on
Yellow blinking LED	System has not been properly programmed. Contact Kaman customer service.

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APPENDIX A – SPECIFICATIONS

ENVIRONMENTAL	SPECIFICATION
Operating Temperature Range	10°C to 55°C
Battery Charging Temperature Range	10°C to 45°C
POWER	**SPECIFICATION**
Battery Charge Life	> 4 hours
Battery Recharge Cycles	>500
PERFORMANCE	**SPECIFICATION**
Range	.250” to 1.000”
Resolution	

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