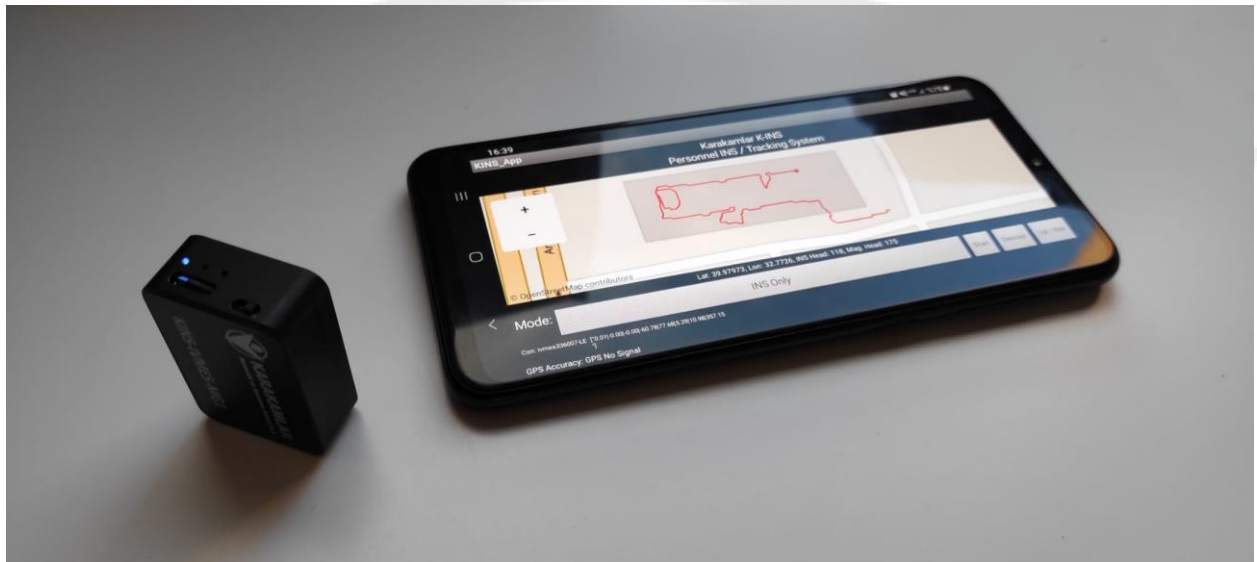




K-INS-MG1 Personnel Inertial Navigation System



Ingredients

1	System Description	2
2	Technical Specifications.....	3
3	Installation and Usage.....	5
	3.1 Connection Features and On-Off Switch.....	5
	3.2 Calibration	6
	3.3 Personnel Integration.....	6
	3.4 Characteristics of Incoming Data	7
	3.5 KINS Integrator App Connection.....	7
4	Points to be considered	10
5	Possible Problems and Solution Suggestions	11
6	Guarantee	12
7	Contact information	13



1 System Description

KINS-IVMES-MG1 Inertial Navigation System for Personnel provides approximate location and heading data of personnel in environments where any global positioning system (GPS, GLONASS, GALILEO, etc.) is unavailable and the heading data is difficult to find from the magnetic field (indoors, close to metal objects). It is a computational hardware. This equipment, which works completely insulated from external factors, is not affected by metal objects, building or cave environments, electromagnetic fields, signal mixers. It processes the information obtained from various sensors especially accelerometers and gyroscopes, with sensor fusion algorithms and combines it with human motion detection algorithms to give the location and direction of the moving people. Since it makes position calculations by detecting human movements, it **is not used as an inertial navigation device, except for personnel who move forward by step**. For this reason, it cannot be used in sliding objects, personnel who take very small or different steps, personnel in the vehicle, land, air and sea vehicles.

Since it does not use any external reference, the position and direction error will increase due to the deviations accumulated over time in long-term use. For this reason, it is suitable to be used in short time intervals where GNSS and compass data cannot be obtained.



Figure 1: K-INS-MG1 Overview



Also system can work with KINS Integrator mobile app via connection through the bluetooth 5.0. With the app user can prefer to use GPS/GNSS sensors already integrated on the phone to increase accuracy. Also in the absence of GPS/GNSS signal KINS Integrator app help user to select the first point on the map to start inertial navigation.

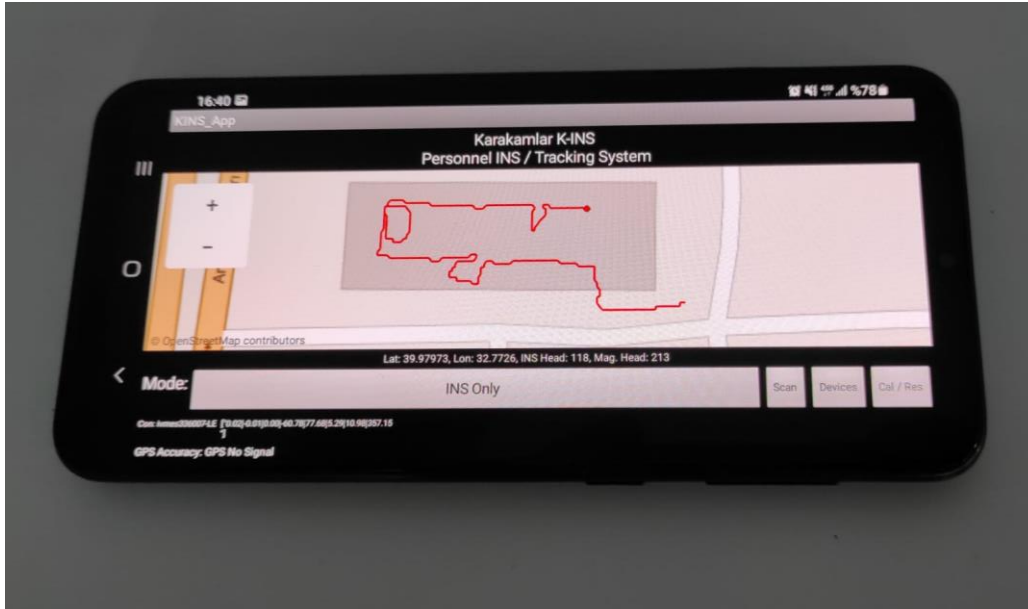


Figure 2: KINS Integrator app interface

2 Technical Specifications

The key features can be summarized in the table below:

Weight	15 g
Dimensions	41.0 x 27.2 x 13.2mm
Measured Parameters	Acceleration in Three Axes, Position in the XY Plane, Angle of Bank, Angle of Elevation, Angle of Heading
Acceleration Limits	4 g
Bank-Ascension Angles Limits	-80° / +80°
Estimated Heading Deviation Over Time While In Motion *	< 3 degrees / 10 minutes *
Estimated Position Deviation Over Time While Moving *	< 5 meters / 10 minutes *
Estimated Heading Deviation over Time at Steady State *	< 1 degree / 10 minutes *
Estimated Position Deviation Over Time While At Steady *	< 1 meter / 10 minutes *
Operation System for the mobile app	Android (IOS will be supported soon)

* Estimated Deviation Values may change, be better or worse depending on usage situation and personnel movements.





Figure 3: KINS-IVMES-MG1 Technical Drawings

3 Installation and Usage

K-INS system can be used both by third party applications and with KINS Integrator mobile app developed by Karakamlar Aerospace. All inertial navigation calculations done automatically by the system from the beginning.

3.1 Connection Features and On-Off Switch

Electrical power and data transmission is provided by USB Micro-B cable.



Figure 4: USB Micro-B Cable

On the on/off switch, the key should come out (far from the USB port). It will not be a problem to leave the on-off button on, when the cable is inserted, the device will automatically turn on and start providing data.

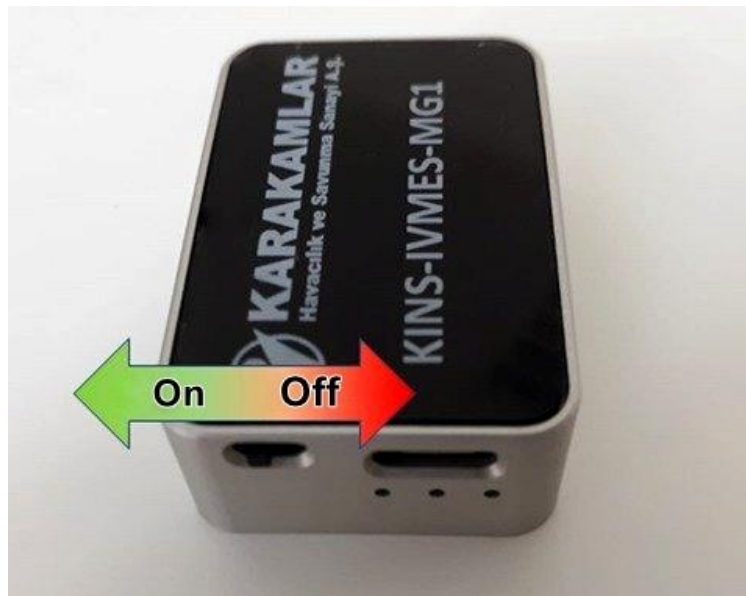


Figure 5: On/Off Switch

3.2 Calibration

K-INS-MG1 system has a state-of-the-art gyro, accelerometer and temperature calibration algorithm. To start calibration system should be connected via bluetooth or cable to a serial terminal if mobile interface is not used.

Put the sensor to a vibration free flat surface and send “C”, wait for 10 seconds for accelerometer calibration.

Gyro rotation and temperature compensation calibrations is done at factory level, users don't need to make any change.

3.3 Personnel Integration

Great attention should be paid to the orientation of the device in the integration of the personnel. On the side of the device, the arrows and inscriptions indicating the front and the upper side are laser engraved on the chassis. The device must be fixed on personnel in this direction.



Figure 6: Signs and Inscriptions Indicating the Direction of the Device

K-INS-MG1 sensor should be replaced around the body. The mechanical connection should be tight and there should be no gaps or slack. There are some example connections to the body is given:



Figure 6: Connection to assault vest



Figure 6: Connection to CG of the body by waist belt

3.4 Characteristics of Incoming Data

The device can be used separately from KINS Integrator app for third party applications both via bluetooth or cable. When the cable is plugged in and the power supply is provided while the on/off button is in the on position, the data sent by the device via USB Serial Communication is sent at 115200 BaudRate rate also user should prepare the necessary arrangements to connect the system bluetooth 5.0 to the third party application. After successful connection device send the data with the following format:

acceleration_x	" "	acceleration_y	" "	acceleration_z	" "	position_x	" "	position_y	" "	Angle_roll	" "	Angle_pitch	" "	Angle_yaw
----------------	-----	----------------	-----	----------------	-----	------------	-----	------------	-----	------------	-----	-------------	-----	-----------

For example, you will receive data like the following:

6.46 -3.63 7.75 16.22 21.26 -4.08 -12.06 298.39

Here, the first three values are the acceleration values, the next two values are the position values on the x and y axes, and the last three values are the bank, elevation and direction angles.

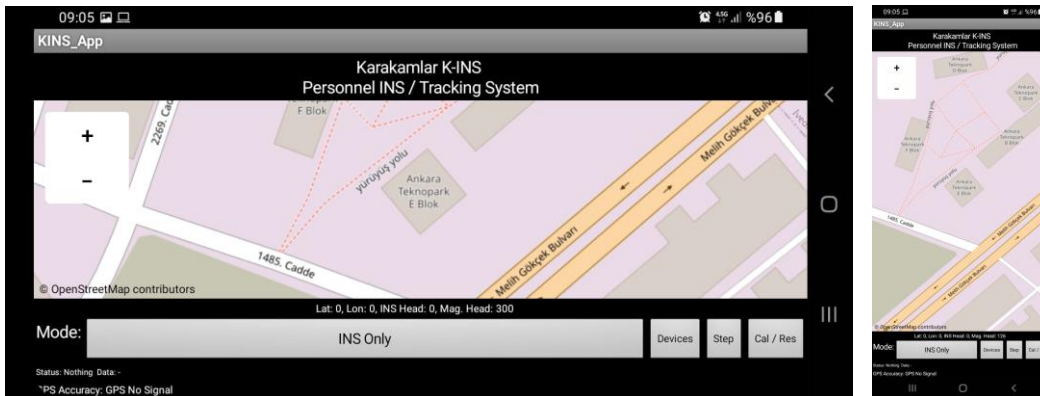
3.5 KINS Integrator App Connection

Download and install the KINS Integrator app from Google Play Store if you want to use the system with the interface. Then follow the instructions below:

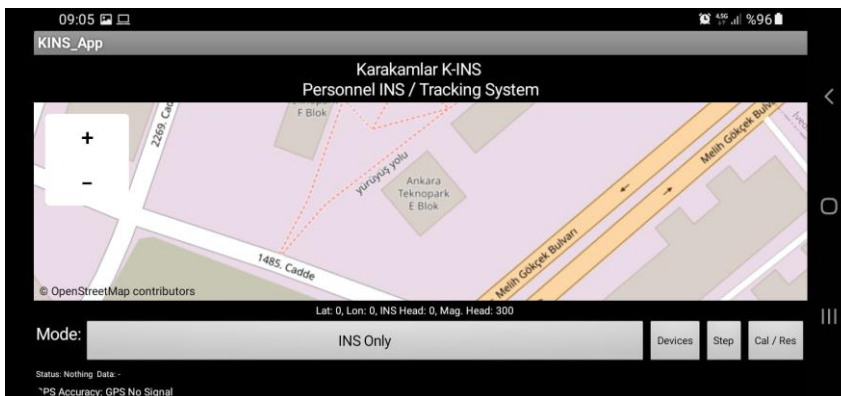




Switch on the Open the KINS Integrator app



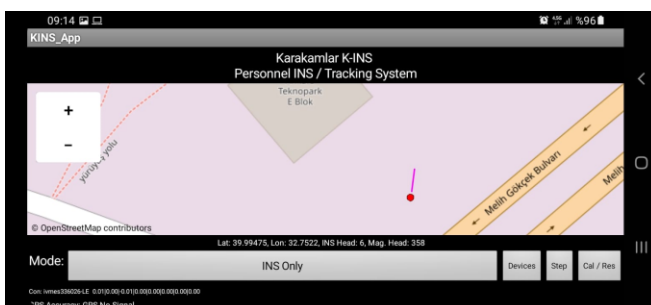
Go to DEVICE menu at the bottom of the app interface.



Select the Device from the List

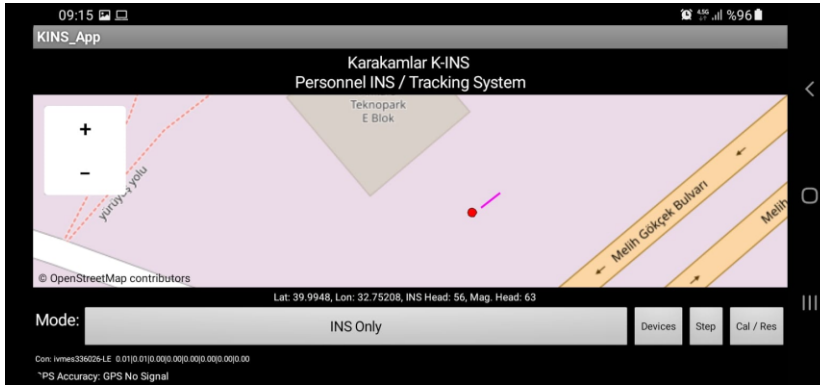


Align the phone with the direction of K-INS hardware, then long press a location on the map.

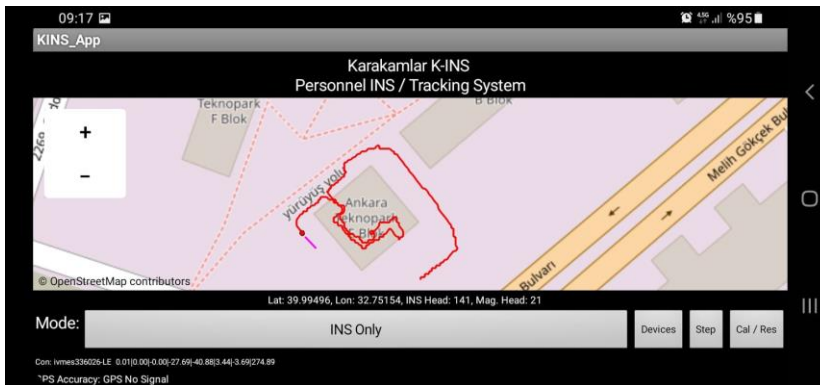


If the heading indicator looks mismatched, repeat the previous step until the location and heading are consistent.

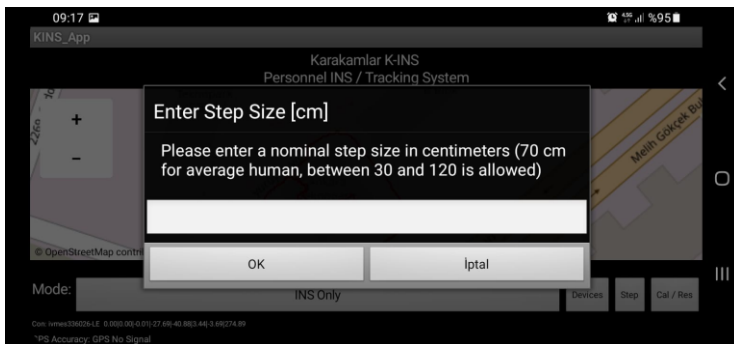




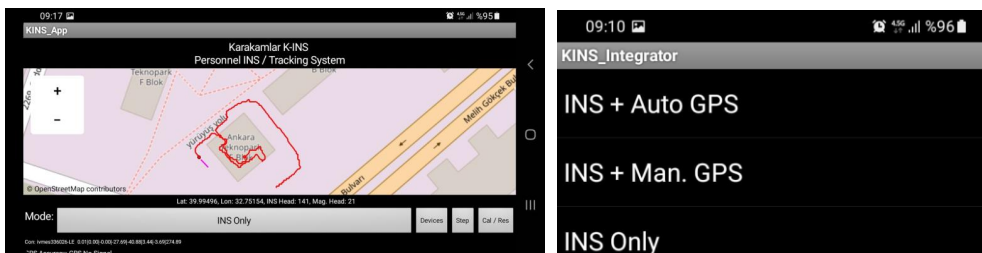
The user can start walking.



The nominal step length can be adjusted from the menu.

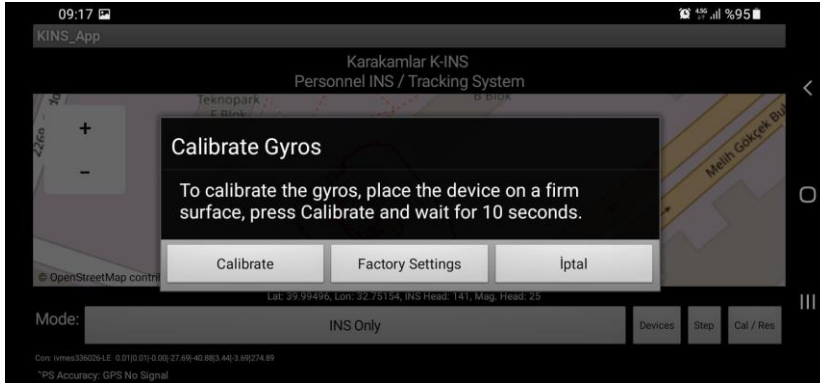


Also, the modes (INS Only Mode, INS + Manual GPS Mode and INS + Auto GPS Mode) can be selected while using the device.





Angle reset and gyro calibration can also be done by the user interface. User must follow the instructions according to the interface.



4 Points to be considered

Please read this user manual carefully before using the product. The manufacturer is not responsible for damage and malfunctions caused by use contrary to the user manual. Keep all documents that come with the product. Consider the following:

- Do not try to disassemble or open the product.
- Keep away from direct water contact.
- Do not store the product in a humid environment.
- Prevent from Electrostatic Discharge (ESD).
- Make sure that no crushing or bending force is applied to the product, and that no heavy objects are placed on it.
- Given accuracies are tested for 30 minutes walking periods.
- Do not drop the product on the ground.
- When using the product with the cable, make sure that the cables are firmly attached.
- When using the product with the cable, make sure that there is no voltage fluctuation or reverse supply.
- Use the product in an environment with a temperature of -15 °C to 50 °C
- Storage the device between -25 °C to 60 °C of temperature.





5 Possible Problems and Solution Suggestions

- No data from the device:
 - Make sure the cable is plugged in.
 - Make sure the power switch is on the right side (outward, opposite the USB port).
 - Make sure the red LED light is on.
 - Make sure the blue LED light is on.
 - Make sure that the BAUDRATE is 115200 in the serial listening section of the receiver system .
 - Unplug the device and plug it back in.
 - If the problem persists, contact the manufacturer.
- Continuous increase or decrease of angle information even though the device is stationary:
 - Make sure the device is vibration-free and still.
 - Unplug and plug the cable
 - If the problem persists, contact the manufacturer.
- Inaccurate or inaccurate location and direction information:
 - Make sure that the device has not been operated for a long time (+10 minutes).
 - Unplug and plug the device cable
 - Walk at a normal pace to form a large rectangle and observe location information
 - If the problem persists, contact the manufacturer.





6 Guarantee

The warranty starts with the delivery of the product and continues for 12 months.

The following situations are not covered by the warranty:

- Damages and malfunctions caused by user error
- Damages that may occur during the transportation of the product
- Damages caused by natural disasters
- Damages and malfunctions that may occur due to use other than the User's Guide

The warranty of the product will expire as a result of intervention to the product by unauthorized persons.

The customer accepts the product as it is. The manufacturer will not be held responsible for any damage or consequences that may arise from the use of the product.





7 Contact information



KARAKAMLAR
Havacılık ve Savunma Sanayi A.Ş.

Address İvedik OSB Mh . 2224.Cad. No:1 E-108
Technopark Ankara Yenimahalle/ANKARA

phone +90 312 385 88 20

web www.karakamlar.com

E-mail contact@karakamlar.com

