DIGITAL INCLINOMETER SYSTEM

GEOKON®

MODEL GK-604D

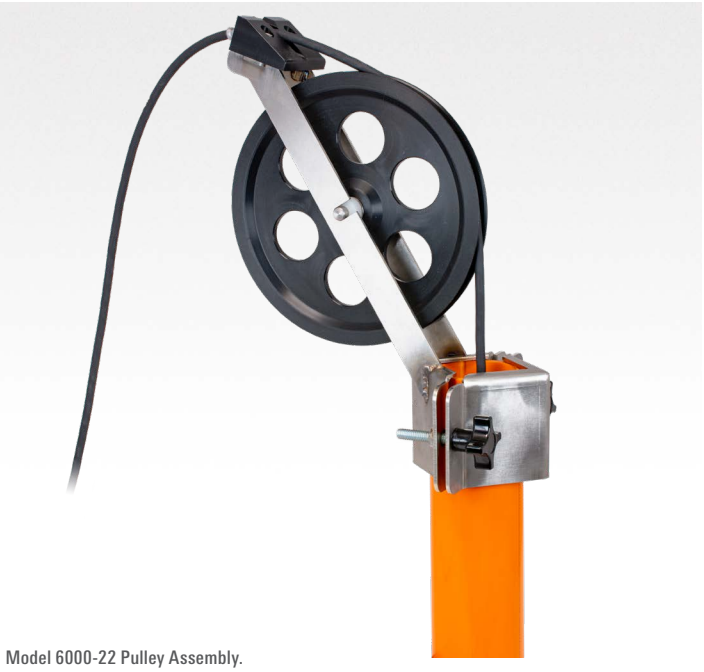


Model GK-604D Digital Inclinometer System.

APPLICATIONS

The Model GK-604D Digital Inclinometer System is used to determine and measure the lateral movements in and around:

- Landslides
- Unstable Slopes
- Dam Embankments
- Landfills
- Slurry walls
- Caissons
- Piles
- Sheet Piling
- Tunnels



Model 6000-22 Pulley Assembly.

INTRODUCTION

The Model GK-604D Digital Inclinometer System is delivered in its entirety and includes a Model 6001D-2 reel-mounted control cable and a Field PC. The signal from the probe is transmitted by the control cable to the cable reel containing the Interface, which communicates via Bluetooth® wireless technology with the Field PC.

OPERATING PRINCIPLE

Inclinometer surveys are conducted in the conventional way using grooved inclinometer casing to engage and hold the spring-loaded wheels of the probe in a known orientation. The probe is connected to the cable and lowered to the bottom of the casing, whereupon it is raised in increments to the top of the hole. At each increment, the metal cable marker is set into a groove in the pulley assembly and a reading of the vertical deviation of the probe is taken on the handheld Field PC. The spacing of the reading increments is determined by the metal markers crimped to the control cable, which are spaced at the same interval as the probe wheels (0.5 m or 2 ft).

Once the first set of readings is complete, the probe is removed from the casing, turned 180°, and lowered to the bottom of the casing. The reading procedure is then repeated. The difference between the two sets of tilt readings is used to calculate the vertical profile of the inclinometer casing, which, when compared to profiles taken on different dates, will reveal the magnitude and location of any deflections occurring along the length of the casing.



Model 6105 Digital Inclinometer Probe.

INCLINOMETER PROBE

The Model 6105 Digital Inclinometer Probe uses MEMS (Micro-Electro-Mechanical Systems) technology to provide precise biaxial measurements over a range of ±90°. MEMS tilt sensors are capable of withstanding shocks as large as 5000 g. Nevertheless, a rubber cushion fixed to the bottom of the probe helps to soften the blow of a probe inadvertently allowed to hit the bottom of the grooved casing—and care must still be exercised when handling the probe.

A Digital Compass is built into the Inclinometer Probe body allowing spiral surveys to be made using the same probe. The surveys obtained can be used to correct the inclinometer data sets for any twist (or spiraling) that may be present in the installed inclinometer casings. The spiral survey data is presented on (and stored in) the same Field PC used for taking inclinometer readings. The compass will not work in close proximity to ferrous metals such as steel pipes and rebar.

The wheels of the probe are self lubricated for longer life and the wheel assemblies are designed to be replaceable should wear become excessive.

The cable connector at the top of the probe is designed to be replaceable if it suffers damage or excessive wear. A protective cap is supplied to cover the connector when not in use.

TECHNICAL SPECIFICATIONS (INCLINOMETER PROBE)

Range[1]	±90°
Resolution (99% Confidence Interval[2])	0.00025° (0.004 mm/m)
Precision (99% Confidence Interval[3])	±0.0075° (±0.13 mm/m)
Nonlinearity	±0.005° across ±30° range (±0.09 mm/m)
Temperature Dependent Uncertainty	±0.001° across ±5° range (±0.016 mm/m) ±0.0016° across ±15° range (±0.026 mm/m) ±0.0026° across ±30° range (±0.042 mm/m)
Operating Temperature	–40 °C to 65 °C (–40 °F to 149 °F)
Wheel Base	0.5 m or 2 ft
Length × Diameter[4]	700 × 25 mm or 32 × 1 in
Casing Size I.D.[5]	48 to 89 mm (2 to 3.5 in)
Weight (with case)	7.5 kg (16 lb)
Shock Survival[6]	5000 g
Maximum Cable Length	500 m (1640 ft)
Compass Sensor Resolution	±0.1°
Compass Sensor Repeatability	±1.6°

[1]Calibrated Range: ±30°.
[2]99% confidence interval (i.e. 99 out of 100 individual readings fall within this tolerance).
[3]Includes random walk (changes between consecutive readings that have no discernible cause) and seismic noise during testing.
[4]The cable connector adds 150 mm to the length of the probe.
[5]The probe is designed for use in all standard inclinometer casing up to a maximum diameter of 89 mm (3.5 inches).
[6]The Inclinometer Probe is a highly sensitive device and should be treated with great care at all times in order to maintain calibration. Particular attention should be given to preventing the probe from hitting the bottom of the casing with any impact.



Model 6000-17 Cordura® Carry Case, with padded interior, is used to protect the probe, FPC-4 Field PC and accessories from shock during transportation. Case contents (top; left to right): Inclinometer Probe, Universal Power Adapter, Wall Charger for the Field PC, Deoxit Spray and Waterproof Grease, Field PC, Spare Parts for the Inclinometer Probe, Car Charger and USB cable for the Field PC, Cable Reel Charger.

CONTROL CABLE

The Model 6001D-2 Control Cable is lightweight, less than 8 mm in diameter and comprises a central core and a double pressure extruded Polyurethane jacket with an additional braid between the jacket layers. The minimum breaking strength is 500 lbs. The conductors and stainless steel aircraft wire members are firmly attached to the probe cable connector, which effectively prevents the cable from stretching and allows for a heavy



pull in the event the probe becomes jammed in the casing. Non-slip metal depth markers are crimped onto the cable at intervals equal to the wheel base of the inclinometer probe (0.5 m or 2 ft). These markers engage with the pulley assembly while the probe is being read.

CABLE REEL AND CASE

The cable reel contains the Interface, which converts the digital signal from the probe into a radio signal and transmits it to the Field PC via Bluetooth®. The size of the reel varies with cable length. Reels for cables under 200 m (500 ft) are supplied with a nylon carrying case.



TECHNICAL SPECIFICATIONS (GK-604D INTERFACE)

Battery	>40 hours continuous operation, per charge
Temperature Range	–30 °C to +50 °C

CABLE PULLEY

The Model 6000-22 Cable Pulley is used to guide the cable while raising and lowering the inclinometer probe and to grip the depth markers of the control cable while taking a survey. The pulley places no stress on the cable markers and removes any tendency for markers to slip over the cable as when using cable holds.

The pulley assembly is designed to fit casings sold by GEOKON but will also fit most casings that have an external diameter between 85 mm and 70 mm. A casing extension can be used in situations where the inclinometer casing is inside a protective tube or below grade level.

DUMMY PROBE

The Model 6000-10 Dummy Probe is geometrically identical to the Model 6105 Digital Inclinometer Probe but does not contain any sensors. It is used to check that installed inclinometer casings are free of obstructions or distortions that might prevent



removal of the standard probe. The dummy probe is lowered and raised using coated stainless steel aircraft cable.

MODEL FPC-4 FIELD PC



Model FPC-4 Field PC showing a Live Inclinometer Data reading screen shot.

OPERATING PRINCIPLE

The Model FPC-4 Field PC is a rugged, handheld, easy-to-use instrument featuring a touchscreen display, high-resolution front and rear cameras, an array of built-in sensors, and a broad spectrum of communication technologies. It is fully dust proof, waterproof, can operate in extreme temperatures, and is resistant to impact, vibrations, humidity and altitude.

The FPC-4 is used to read digital inclinometer probes by communicating with the Interface in the cable reel via Bluetooth® wireless technology. Probe readings are stored by tapping "Record" on the Field PC display. An audible beep indicates the completion of the reading storage. All readings are saved to the internal Solid State Drive. The checksum can be displayed on the LCD screen during a deflection survey, a useful tool for checking the survey data in the field to minimize reading errors.

A spiral survey can be performed at the same time as the normal inclinometer survey. The compass heading is displayed with the inclinometer readings during the survey. Spiral survey data is stored in a separate data file and can be used to correct the inclinometer data sets for any twist (or spiraling) of the inclinometer casing.

Survey data, log files, and entire databases can be exported as a file or email attachment. Data reduction, graphing and reporting can be accomplished on a PC using SiteMaster Software. (Sold separately. Please see the SiteMaster data sheet for details).

The Field PC comes complete with a USB sync cable, Lithium-Ion battery, AC wall charger (with international plug kit), screen protector, and Quick Start Guide.

TECHNICAL SPECIFICATIONS (FPC-4 FIELD PC)

System	Operating system: Android™ 14 GMS (Google Mobile Services) certified using EDLA Processor: Qualcomm® QCM4490 octa-core up to 2.4 GHz
Storage	Memory (RAM): 8 GB Internal Storage (ROM): 128 GB MicroSDXC Card Storage up to 512 GB
Display	Screen size (diagonal): 6.26" (159 mm) Screen resolution: 2280 x 1080 FHD+ Capacitive multi-touch interface for wet conditions Chemically-strengthened Gorilla® Glass 5 Optimized for extreme environments including wet touch
Connectivity	5G with 4G LTE fallback, Dual Nano SIM card slots Cellular: LTE-FDD Wi-Fi® Bluetooth® 5.2 Duel-band GPS, GLONASS, Beidou, Galileo, QZSS NFC USB Type-C (5Gbps, 5V power delivery), OTG
Ruggedness	Ingress protection: IP68 waterproof & dustproof Operating Temperature: -4 F to 140 F (-20 C to 60 C) Meets MIL-STD-810H test procedures: Method 500.6 Low Pressure, Method 501.7 High Temperature, 502.7 Low Temperature, 503.7 Temperature Shock, 506.6 Rain, 507.6 Humidity, 510.7 Sand and Dust, 512.6 Immersion, 514.8 Vibration, 516.8 Shock
Physical	Weight: .72 lbs (325 g) Dimensions: 174 x 85 x 15 mm 2 user programmable buttons
Camera	Front: 16 MP Rear: 48 MP with LED illumination
Battery	Removable Li-ion battery Battery size: 4500 mAh Internal 300 mAh battery allows for hot-swapping

ORDERING INFORMATION

Model GK-604D-20M: Inclinometer Readout System with Digital MEMS Biaxial Inclinometer Probe, FPC-4 Field PC, Software, Cable Reel, requisite Carry Cases, Pulley Assembly, and 20 m Cable marked every 0.5 m.
Model GK-604D-30M: As above, with 30 m Cable.
Model GK-604D-50M: As above, with 50 m Cable.
Model GK-604D-70M: As above, with 70 m Cable.
Model GK-604D-100M: As above, with 100 m Cable.
Model GK-604D-130M: As above, with 130 m Cable.
Model GK-604D-150M: As above, with 150 m Cable.
Model GK-604D-170M: As above, with 170 m Cable.
Model GK-604D-200M: As above, with 200 m Cable.
Model GK-604D-100E: Inclinometer Readout System with Digital MEMS Biaxial Inclinometer Probe, FPC-4 Field PC, Software, Cable Reel, requisite Carry Cases, Pulley Assembly, and 100 ft Cable marked every 2 ft.
Model GK-604D-150E: As above, with 150 ft Cable.
Model GK-604D-200E: As above, with 200 ft Cable.
Model GK-604D-250E: As above, with 250 ft Cable.
Model GK-604D-300E: As above, with 300 ft Cable.
Model GK-604D-350E: As above, with 350 ft Cable.
Model GK-604D-400E: As above, with 400 ft Cable.
Model GK-604D-450E: As above, with 450 ft Cable.
Model GK-604D-500E: As above, with 500 ft Cable.

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