ENCARDIO RITE METASENSING FOR MEGA STRUCTURES

DIGITAL INCLINOMETER (HORIZONTAL)

Model EAN-26M-H

DATASHEET

OVERVIEW

The EAN-26M-H Digital Horizontal Inclinometer System is designed for accurate horizontal displacement measurement in geotechnical and structural applications. It is ideal for monitoring settlement and heave in storage tanks, embankments, landfills, road construction, dams, and other structures. The system uses a digital MEMS inclinometer probe that connects wirelessly via Bluetooth to a mobile phone, providing real-time data on displacement and deformation. The inclinometer offers high resolution and accuracy, with data stored on the mobile phone and easily transferred over GSM/GPRS for central server monitoring. The system is lightweight, shock-resistant, and uses readily available Android mobile phones, simplifying data collection and analysis on-site.

The EAN-26M-H system consists of a traversing type digital tilt sensing probe with MEMS technology, connected to a reel unit kept at gage well opening, which transmits data wirelessly via Bluetooth to an Android-based mobile phone. This setup eliminates the need for traditional slip rings and cables, enhancing reliability and ease of use. The system measures lateral displacement with a range of ±30° and an accuracy of ±2 mm over 30 meters, providing high-resolution data for detailed monitoring. Data is stored locally on the mobile phone and can be visualized in graphical and tabular formats, facilitating real-time analysis and immediate investigation of anomalies. The use of a commercially available mobile phone as the readout unit allows for easy servicing and replacement, reducing downtime and operational delays. Additionally, the mobile phone's capabilities, such as camera functions and GPS, can be utilized for site documentation and location tracking.

It operates by inserting a digital tilt sensing probe into a horizontally installed access tube within a borehole. The probe traverses the entire length of the casing, taking readings at fixed intervals from one end. A servo accelerometer within the probe senses the inclination of the casing in two perpendicular planes, ensuring accurate measurement of horizontal displacement. To eliminate offset errors, the probe is reversed and readings are taken from the opposite end. Initial base readings establish a reference datum, and subsequent measurements are compared to these to calculate settlement or heave using the formula:

$$\text{Displacement} = L \times (\sin(\theta 1) - \sin(\theta 0))$$

where L is the gage length, θ1\theta_1θ1 is the current angle of inclination, and θ0\theta_0θ0 is the initial angle of inclination. By summing successive readings, a complete profile of the borehole is obtained, allowing for the determination of settlement or heave over time.

FEATURES

- **Advanced mems technology:** Provides high accuracy and reliability with a resolution of ±10 arc seconds.
- **Wireless connectivity:** Bluetooth connection between reel and mobile phone eliminates traditional cable issues.
- **High data capacity:** Mobile phone memory allows storage of over 1 million data points, ensuring extensive data logging capability.
- **Graphical data display:** Instantly compares logged data with previous readings using various graph types on a high-resolution color display.
- **Ease of use:** Lightweight, shock-resistant design preferred by field personnel for ease of transport and operation.
- **Instant data transmission:** Data can be sent instantly to a central server via GSM/GPRS connection, facilitating real-time monitoring.
- **Mobile phone integration:** Utilizes widely available Android phones, simplifying maintenance and replacement of readout units.

SYSTEM COMPONENTS

The Encardio Rite model EAN-26M-H Inclinometer system basically consists of four components:

Access tube and fittings: ABS access tubes have longitudinal keyways, specially produced to close tolerances. Wheels of tilt sensing probe can run smoothly inside these keyways. Access tubes are 3 m (~9.85') in length. These are provided with fixed couplings. Design of these couplings ensure that correct alignment of keyways is maintained throughout depth of gage well.

EAN-AT70 self aligning access tube: Self aligning ABS tubing, 70 mm o.d., 58 mm i.d., 3 m length.

EAN-FC70 ABS fixed coupling (70 mm) : ABS fixed coupling for 70 mm o.d. access tube, 77 mm o.d. x 160 mm length

EAN-25M-H/1.1 End cap for ABS tubing (70 mm): ABS end cap with fixed pin, for 70 mm o.d. access tube

EAN-25M-H/1.2 Top cap for ABS tubing (70 mm): ABS end cap with removable pin, for 70 mm o.d. access tube.

Pop rivets for ABS tubing: Pop rivets packets of 100 numbers for fixed coupling.

Self tapping screws for ABS tubing: Self tapping screws packets of 100 numbers for telescopic coupling.

Pop rivet gun: Hand held manually operated.

Power drill: 230 V 50 Hz operation power drill with two 3.2 mm dia drill bits.

Mastic tape: 50 mm width x 10 m long mastic tape.

Sealing accessories: BOPP tape 50 mm width x 30 m long.

Digital tilt sensing probe

EAN-26MH/2.1 Inclinometer probe: The uniaxial digital probe consists of a precision MEMS accelerometer inside stainless steel enclosure, fitted with two pairs of pivoted sprung wheels which can rotate freely.

Standard gage length between the wheels is 500 mm. An option of 2 ft gage length (Imperial unit) is also available. The spring loaded wheel arms help to position the probe centrally inside the access casing at any required depth. The rear end of probe has provision to fix an eye bolt used to connect pull cable when taking readings. A four pin connector is provided for connection to the cable.

EAN-26MH/2.2 Dummy probe : It has the same dimension as the actual probe. It is used for checking any blockage/deformation of installed access tubing.

EAN-26MH/2.3 Calibration check jig: It enables verification of calibration of the data logger for known angles of tilt of the sensing probe.

Interconnecting cable

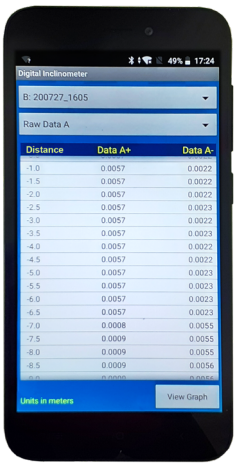
EAN-26MH/3.1 Operating cable and cable reel: Two core abrasion resistant polyurethane sheathed, weather proof signal cable with high tensile straining member, graduated at every 0.5 m (or 2 ft Imperial). This is available in different lengths.

A four pin connector is provided for connecting to the probe. The cable reel comprises of a plastic winding reel on suitable frame to hold the specified length of the cable.

EAN-26H/3.2 Pulling cable with optional reel: It is used to pull inclinometer probe from the other end. This cable is always left inside the casing, stretched throughout the length, hooked to the end caps.

Mobile Phone Datalogger

An Android mobile phone with the Digital Inclinometer application software serves as a handheld readout. The application software is included in the supply. A phone can be supplied upon request or sourced locally. Data transfer requires a SIM card (client's scope)



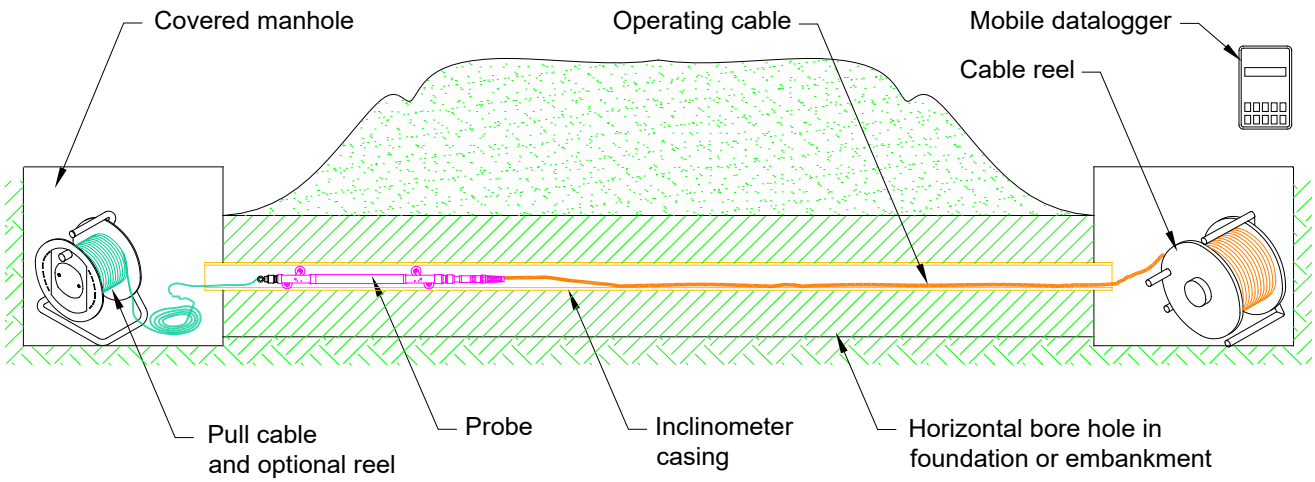
Tabular display of data over a period of time

SPECIFICATIONS

Probe specification	
Measuring range	± 30° of vertical
Resolution (Metric)	± 0.008 mm/500 mm
Resolution (Imperial)	± 0.0004 in/2 ft
Distance between wheels	500 mm Metric (standard) 2 ft Imperial (on request)
Operating temperature	-20°C to + 70°C
Probe dimensions	Overall 32 mm dia (excluding wheel arm) x 650mm (~30.9 in) length
Probe weight	1.4 kg (~3.1 lb)
Probe casing	AISI 316L Stainless steel
Total system accuracy[1] (Metric)	± 2 mm/30 m (readings at every 500 mm)
Total system accuracy[1] (Imperial)	± 0.1 in/100 ft (readings at every 2 ft)

Cable specification	
Details	2 core polyurethane sheathed
Diameter	6 mm (~ 0.24 in)
Weight	1.9 kg/50 m (3.8 lb/150 ft); including ferrules

Cable reel specifications	
Upto 100 m (330 ft) cable reel	300 mm (~ 12 in) diameter (flange)
100 - 200 m (330-650 ft) cable reel	380 mm (~ 15 in) diameter (flange)



*All specifications are subject to change without prior notice

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Encardio-Rite Electronics Pvt. Ltd. A-7, Industrial Estate, Talkatora Road, Lucknow, UP-226011, India | info@encardio.com | T: +91 522 2661039-320