

## Digital inclinometer system

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### Applications

#### [Digital vertical inclinometer / 5481]

Digital vertical inclinometer system is used to survey the horizontal displacement from inside of casing.

It is used to monitor subsurface deformations of the ground in landslides, embankments, and dams and around deep excavations and tunnels.

#### [Digital horizontal inclinometer / 5481H]

The digital horizontal inclinometer is a device that precisely measures the vertical displacement such as settlement and uplift of the embankments.

It operates with horizontal probe, Bluetooth reel and smart device.



#### [Digital slope inclined inclinometer / 5481T]

The digital slope inclined inclinometer is equipped with an inclination sensor set at a slope inclined of 45 in the inside to precisely measure the slope of the dam, the retaining wall, and the settlement and uplift of the slope inclined of the stiffener.

It operates with slope inclined probe, Bluetooth reel and smart device.



## Digital inclinometer system

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### Description

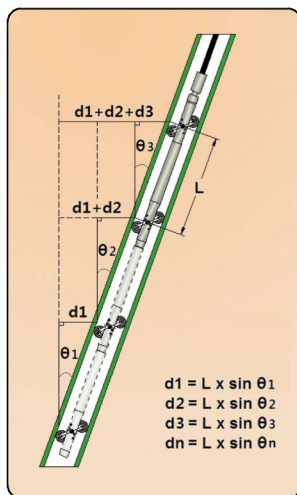
#### [Digital horizontal inclinometer / 5481H]

Digital vertical inclinometer system has pursued a development by concentrating on high-performance nature such as responsiveness, ultra-light and high-reliability.

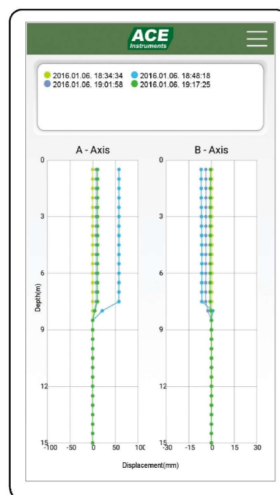
Digital vertical inclinometer system includes as lightweight digital inclinometer probe, bluetooth reel, cable guide and the software as "Inclinometer Collector" App for Android and iOS based device.

The data that was acquired at smart device can be transferred to PC by e-mail and it is operated by Geopro software program. Digital inclinometer probe provides excellent resolution and accuracy because it built in  $\pm 30^\circ$  MEMS sensor and 2-axis electronic circuit inside.

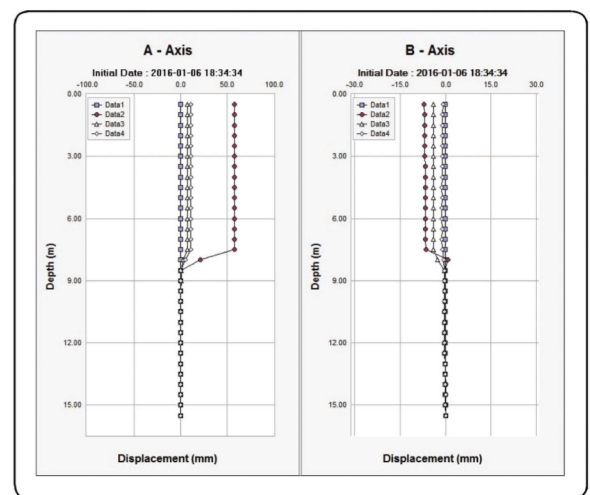
In case of installed inclinometer casing at zone of suspected displacement in a vertical borehole, it is possible to acquire the data to smart device through digital inclinometer system.



[Theory of displacement calculating]



[Smart device  
\_Inclinometer Collector]



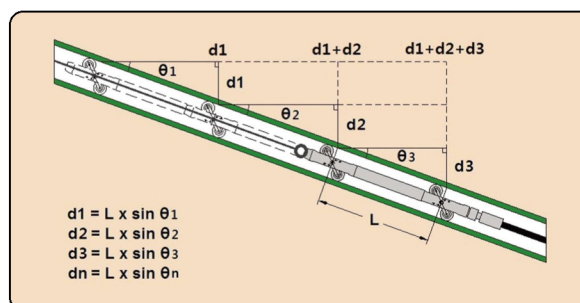
[PC\_Geopro graph]

#### [Digital slope inclined inclinometer / 5481T]

Digital horizontal / slope inclined inclinometer system has pursued a development by concentrating on high-performance nature such as responsiveness, ultra-light and high-reliability.

Digital horizontal / slope inclined inclinometer system consists of a lightweight probe and lightweight bluetooth cable reel. You can download and run native apps provided by our company on your own or your company's smart device.

Ground displacement is generated in the inclinometer casing which is installed along the horizontal or slope inclined depending on the surrounding load. The horizontal plane is measured by a horizontal probe, Model 5481R bluetooth cable reel, smart device. The slope inclined is measured a slope inclined probe, a model 5481R bluetooth cable reel, a smart device to acquire data by inserting the probe into the inclinometer casing.



[Theory of calculation]

## Digital inclinometer system

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### Features

- **High-speed measurement**

The overall measuring and storage time between each point (50<sub>cm</sub> interval) has been improved within 5 seconds included 1 second of stabilizing time.

- **Easy to carry**

The digital inclinometer probe, Bluetooth reel, and cable guide are mounted in one carriage so that it is easy to carry and handle at work site.

- **Applied durable control cable**

The control cable are composed with Ø6<sub>mm</sub> polyurethane outside and Ø3<sub>mm</sub> aramid fiber inside so that it holds over 200kg·f weight.

- **Applied lightweight digital inclinometer probe**

It is designed to carry easily. The probe size is Ø25.4<sub>mm</sub> × 687<sub>mm</sub> and weight is 1.3kg

- **The data transitions and store by smart device**

It is possible to download application "Inclinometer Collector" at Play store or App store and it can be used in any smart devices that over android 10 or over iOS 13 is applied.

- **The interwork with PC software**

The application "Inclinometer Collector" interworks with Geopro V3.0 which is verified program for a long time.

- **Linkage Bluetooth (Reel & Remote control)**

The Bluetooth has own module code so that it can connect with Bluetooth reel and smart device easily. Also, you can additionally link the commonly used camera remote control for smartphone via Bluetooth to save by pushing the remote control without tapping by hand during measurement.

- **Applied rechargeable Bluetooth reel**

It is applied rechargeable battery inside of Bluetooth reel. Therefore, it is possible to use 40Hr (based on 20°C) continuously after single charging.

### Explanation

#### [Digital inclinometer probe]



**Model 5481 Digital inclinometer probe** provides excellent resolution and accuracy because it built in  $\pm 30^\circ$  MEMS sensor and 2-axis or 1-axis electronic circuit inside. MEMS sensor detect the inclination amount of displacement accurately because it does not substantially affected by the vibration.

The outer diameter of digital inclinometer probe is Ø25.4<sub>mm</sub> with STS steel. Also, it can be used inner diameter Ø48<sub>mm</sub> ~ Ø85<sub>mm</sub> inclinometer casings.

This probe is composed with bearings and springs and it made by stainless steel so that it can be used for a long time.

#### [Control cable and Bluetooth reel]



The **Bluetooth reel** is composed with reel and control cable. Bluetooth circuit is built in reel and connected control cable basically. The control cables have 5 signal wires and cover with Ø3<sub>mm</sub> Kevlar and then, extrude with Ø6<sub>mm</sub> polyurethane sheath.

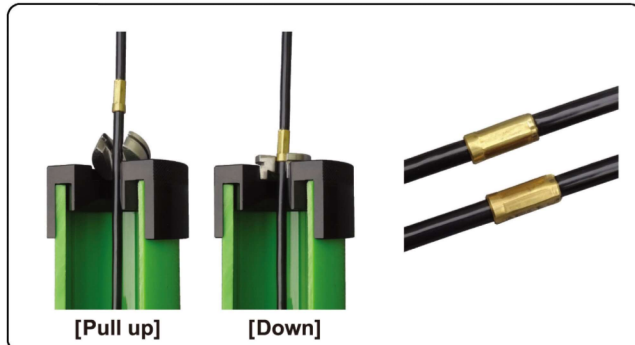
Also, the brass gafts are graduated at every 50<sub>cm</sub> intervals on control cable.

It is applied rechargeable battery inside of Bluetooth reel. Therefore, it is possible to use 40Hr continuously after single charging.

## Digital inclinometer system

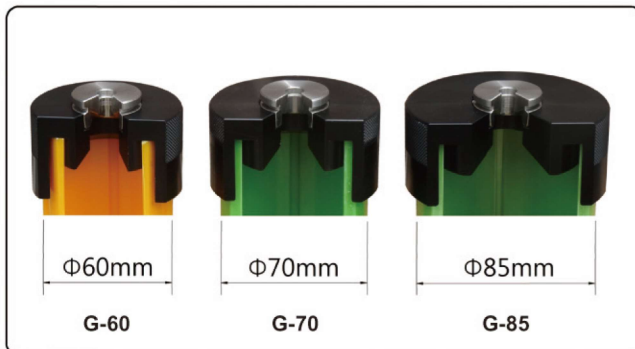
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### [Cable Guide]



During the monitoring, the cable guide helps the brass Gaff to be set on right place.

Our company's cable guide is designed with automatic hooks for quick and easy measurement.



[Cable guides]

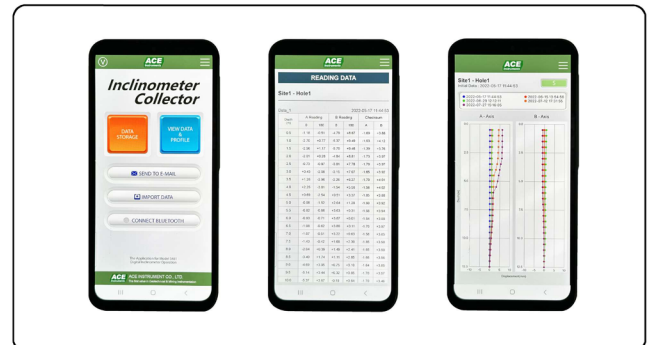
The cable guides for inclinometer casings are manufactured in three sizes as  $\Phi 60$ ,  $\Phi 70$ ,  $\Phi 85$ mm. The main product,  $\Phi 70$ mm casing, is supplied in the digital inclinometer set,  $\Phi 60$  and  $\Phi 85$ mm casings are sold separately.

### [PDA / Android OS]

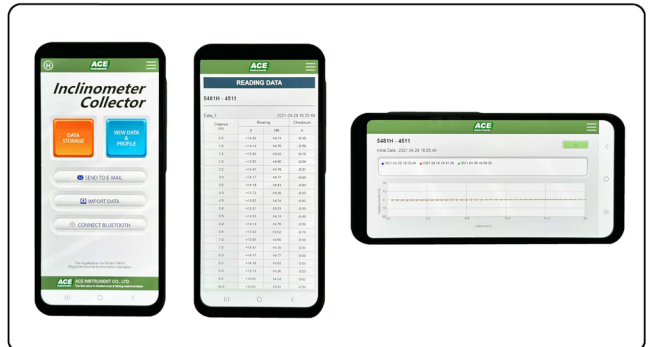
Our company sells PDA (Personal Digital Assistant) as an optional measuring instrument base on Android OS.



### [Operating Application / For Vertical]



### [Operating Application / For Horizontal, Slope inclined]



The operating program is "inclinometer collector". It is an application program only for digital vertical inclinometer system.

#### • DATA STORAGE

To set work site and borehole up first and to pull the digital inclinometer probe. Then, to read the data and save it.

#### • VIEW DATA & PROFILE

To find out displacement data and accumulated displacement graph.

#### • IMPORT DATA

After copying e-mail or data by using the import data function, you can enter data files on different smart devices for continuous measurement and management.

#### • SEND TO E-MAIL

To send data that measured by smart device by e-mail. Then, it can be changed by Geopro program on PC.

#### • CONNECT BLUETOOTH

To Display a list of Bluetooth reels for connectable digital inclinometer system and their current connection status.

## Digital inclinometer system

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## Specification

Model		5481	5481T	5481H
Digital inclinometer probe	Applied sensor	2-MEMS sensor		1-MEMS sensor
	Measuring range	± 30°		± 30° (45° Slope inclined)
	Resolution	0.005 <sub>mm</sub> /500 <sub>mm</sub>		
	Rating output	Digital		
	Nonlinearity	0.02% FSR / ± 10°		
	Repeatability	± 0.003°		
	Shock coefficient	2000g		
	Operating temp.	-20~70℃		
	Wheel gage length	500 <sub>mm</sub>		
	System accuracy	± 2 <sub>mm</sub> / 25m		
	Dimension	Ø25.4 × 687 <sub>mm</sub>	Ø25.4 × 778 <sub>mm</sub>	
	Weight	1.3 kg	1.4 kg	
	Material	Stainless steel		
	Water proof	1000m H <sub>2</sub> O		
	Accessories	Carry bag, Spanner		
Control cable	Operating temp.	-25 ~ 80℃		
	Stiffener	Ø3 <sub>mm</sub> Kevlar (Aramid fiber)		
	Outer diameter	Ø6.0 <sub>mm</sub>		
	Wire	0.3 <sub>mm</sub> <sup>2</sup> × 5C		
	Max. tensile strength	200 <sub>kg</sub> · f		
	Material of cable	Polyurethane rubber		
	Weight	About 3.3kg / 50m		
Cable guide	Material	Aluminum		
	Weight	0.3 kg		
	Applied casing	Outer diameter Ø60, Ø70, Ø85 <sub>mm</sub> casing	Outer diameter Ø70, Ø85 <sub>mm</sub> casing	
Bluetooth reel	Material	Polycarbonate		
	Dimension	350(W) × 250(D) × 360(H) <sub>mm</sub>		
	Status display	Power, Bluetooth, Charge		
	Convenience	ON/OFF Switch Probe holder Cable guide holder		
	Battery	Ni-MH 7.2V		
	Weight	2.0 kg		
	Operation time	Cont' 40 Hr		
	Charging time	Cont' 7 Hr		
	Accessories	Charger, Carry bag		
Operating application	Application	Inclinometer Collector		
	Function	Data storage View data & graph Import data Send to e-mail		
	Device	Over Android 10, iOS 13 Smartphone or device		
PC Program		Geopro (V3.0)	None	
Remote Control		Bluetooth camera shutter		

## Digital inclinometer system

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## Accessories



[Probe carry bag \_ Parts code : 017110]

To provide a safe portable convenience about model 5481 digital probe, Inside of nylon bag is made by sponge pad. The bag is used to carry or to store control cable if no using a long time. The control cable needs to clean by oil after separating with probe.



[Bluetooth reel carry bag \_ Parts code : 017301]

To provide a safe portable convenience about model 5481R bluetooth reel, Inside of nylon bag is made by sponge pad. In case of no using reel set or carrying control cable only, the bag can be used.

## STD control cables

Model	Description	Weight
5481R-30	30m Control cable & Bluetooth reel	3.5kg
5481R-50	50m Control cable & Bluetooth reel	4.4kg
5481R-75	75m Control cable & Bluetooth reel	5.8kg
5481R-100	100m Control cable & Bluetooth reel	7.0kg
5481R-150	150m Control cable & Bluetooth reel	9.5kg

※ It is required the special order for over 150m control cable and special Bluetooth reel.

## Ancillary equipment

- Dummy probe (Model 5480D)
- Dummy probe reel (50m)
- Dead-end return pulley
- Return pipe
- Wire Rope & Reel
- PDA (Android OS)
- Self calibrator (Model 5480C)
- Spiral sensor probe (Model 5480P)
- Wheel cartridge [Parts code: 017307]
- Torsion spring [Parts code: 200019]

The wheel cartridge & torsion spring are purchasable items, and the wheel cartridge set can be used at site to easy replace of broken cartridge s wheel part.



[Wheel cartridge &amp; Torsion spring]

## Excellent function

Division	Excellent function
Probe	By minimizing of 687mm the probe length, it can be used at the minimum bending radius when displacement of the inclinometer casing occurs.
Bluetooth Reel	The cable guide can be mounted on the Bluetooth reel, making it easy to move and use. The cable guide is made in the form of a cam-type clamp, making measurement very fast and easy.
Device & App.	We don't sell or assign a dedicated device and you can use your Android and iOS device. Therefore you have freedom of choice. It is possible to display accumulated graph and manage data without limitation in native app.

## Digital inclinometer system

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### [Model 5480P Spiral sensor probe]

It is useful to find out matching up between direction of inclinometer casing and direction of measuring. Also, this model can find out the twisting while connection with casing each. The gage length is 1m and there is potentiometer is side of probe and can check out the twisting up to  $\pm 10^\circ$  by each 1m. It is also can connect to cable of data logger.



#### Specification

Model	5480P
Sensor element	1 Rotary potentiometer
Range	$\pm 10^\circ$ Degree
Resolution	$\pm 0.01^\circ$
Accuracy	$\pm 0.5\%$ FSR
Dimension	$\varnothing 40 \times 1160 \text{ mm}$
Gage length	1000 mm
Weight	2.0 kg
Readout unit	ACE-1500

### [Dummy probe]

Model 5480D dummy probe is not real probe. There is not sensor in it. It is a kind of tester to find out condition of inclinometer casing. In case of many different displacements happened at underground, inclinometer casing might be damaged or bent. At this time, push the dummy probe into inside of casing and to find out the condition of casing. It is designed with STS  $\varnothing 2 \text{ mm}$  wire rope



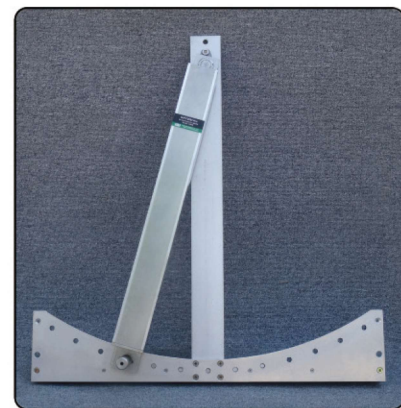
[Model 5480D dummy probe]

### [Self calibration frame]

It is useful to check the condition of inclinometer probe or calibrate. It is designed with "└" shape of aluminum frame and pivot which is hang behind of aluminum frame. Also, it can divide and calibrate 5 point as  $-10^\circ$ ,  $-5^\circ$ ,  $0^\circ$ ,  $+5^\circ$ ,  $+10^\circ$ . Aluminum frame which is anodizing can fix to the wall and it can use anytime as necessary.

#### Specification

Model	5480C
Material	Aluminum frame, Epoxy painting inclinometer case
Calibration point	13 point ( $\pm 30^\circ / 5^\circ$ interval)
Dimension	$820 \times 800 \times 97 \text{ mm}$
Probe case	630 mm
Weight	About 7.5 kg



[Model 5480C self-calibration frame]

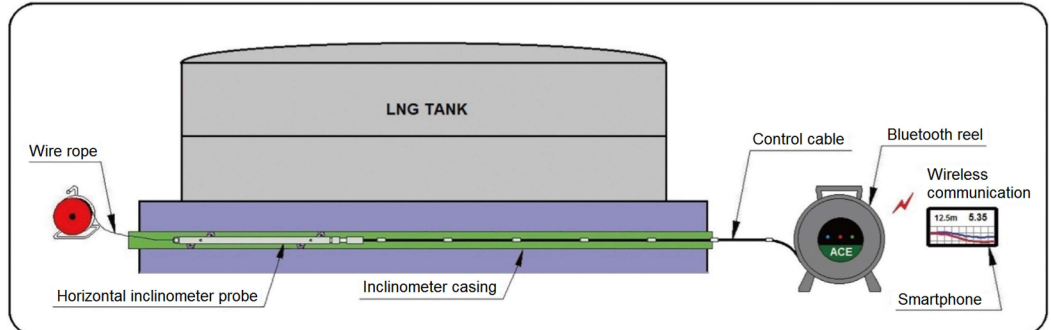
## Digital inclinometer system

### Horizontal / Slope inclined inclinometer installation

#### [Digital horizontal inclinometer / 5481H]

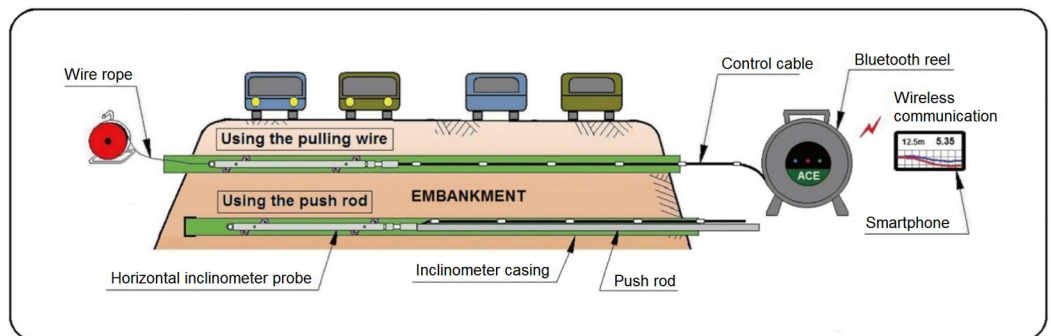
- **Measurement of LNG tank settlement**

The settlement of basal part of LNG tank, LPG tank or oil tank can be measured.



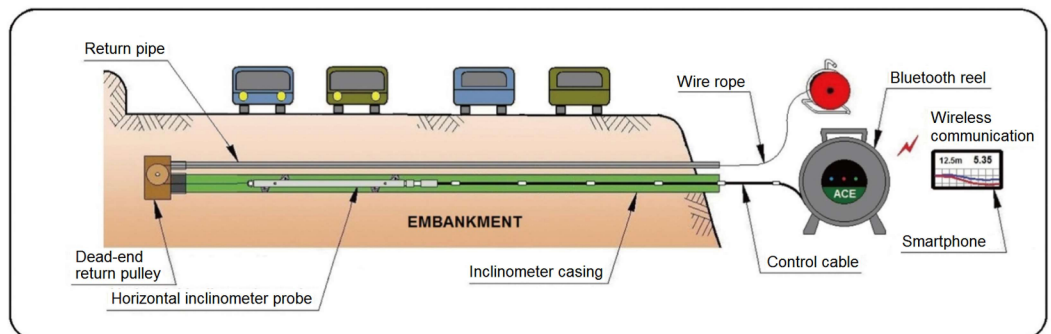
- **Measurement of vertical displacement of embankment**

The settlement can be measured by filling the casing in the buried soil for road improvement. Measurements can be made by pulling the wire rope from the opposite side or by pushing it with the push rod.



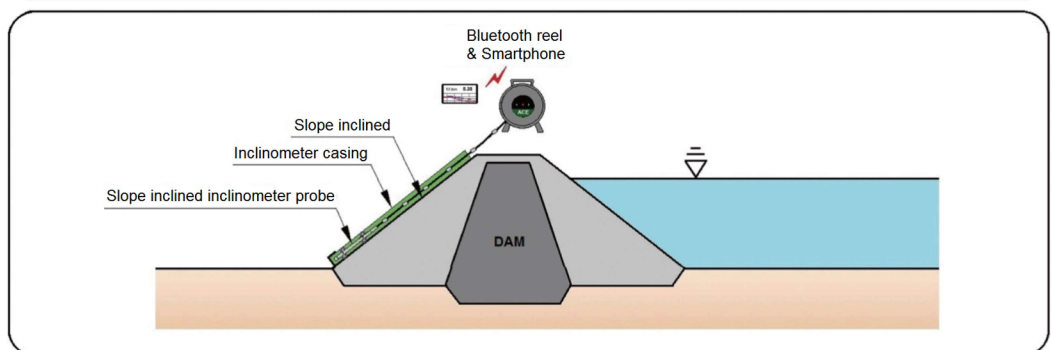
- **Measurement of Dead-End type**

The settlement is measured by installing return pulley with casing and return pipe in areas where one side is difficult to access or blocked.



#### [Digital slope inclined inclinometer / 5481T]

Measure the displacement of a fill dam, a concrete dam, or a casing installed on a slope inclined of a retaining wall. The slope inclined inclinometer is equipped with a 45° diagonal MEMS sensor.



### Recommendations

It is recommended to use the OD  $\varnothing 85\text{mm}$  casing as possible because the horizontal inclinometer will cause the normal settlement largely due to the installation operation.