



Introduction

We, Daedong instruments, has mottos of principle, trust, and people-oriented management and will become one of world best brand company at civil engineering instruments.

According to development of industrial society, construction & civil engineering keep increasing the requirement of safety, high accuracy, and maintenance. It's making new paradigm in civil engineering business.

Daedong instruments wants to be a company which keeps improving with changes and innovation, meets the demand of the times, and further creates customers' values.

Daedong instruments will think bigger and wider. We're also trying our best to satisfy customers as of a reliable partner with a step ahead of technology and endeavor to make the best products.

We will Endeavor to
Contribute in Engineering Works
Instrument Development that Produce the Product
With High Reliability and High Quality.

Company History

2001. 01. Established Daedong instrument
2003. 04. Developed Piezometer
2004. 12. Developed Extensometer
2005. 10. Awarded 100 top companies in Busan (APEC)
2005. 12. Certificate of ISO 9001
2005. 12. Certificate of a venture company
2006. 01. Built R&D center
2007. 05. Facility movement
2007. 08. Developed Magnetic Extensometer
2007. 11. Certificate of INNO-Biz
2008. 10. Daedong instruments Co. Ltd.
2009. 12. Awarded a front-runner industry in Busan
2009. 12. Awarded a new technological innovation in Busan
2010. 01. Certificate of CE mark



Performance

Rails

Busan subway line #3
East-South railway
Seoul-Busan KTX
(High-speed railway)
Jinju-Gwangyang railway
Daegu subway

Others

Seaport

Busan new port
Gwangyang port
Masan port

Others

Oversea

India
Catar
UAE dubai
Turkey
Singapore
Taiwan
Vietnam

Others

Roads

Gwangyang main road
Daejeon-Yusung main road
Naengjung-Busan freeway
Haman-Jinju freeway
Janghueng-Kwangyang freeway

Others

Others

Incheon international airport
Kimhae international airport
Gyeongju radioactive waste
New Gori nuclear power plant
Gunsan thermoelectric power plant
Water resource corporation – Sabuk dam
Kimcheon Buhang dam
Shinguem grand bridge
Geoga grand brige
Kimhae industrial estate
West-Busan industrial estate
Others

Calibration report & warranty

Geogage

Vibrating Wire Load Cell Calibration Sheet

Model : 34000 Ser/Date : 2017.02.02
Serial No. : 3384 Calibrated By : S/O/SSS
Empy : Africa

Applied Load	Bridge	Output	Change	Calculation	Linearity
(kg)	(mV)	(mV)	(mV)	(mV)	(mV)
0	1440	1440	0	1440	0.00
10	1510	1510	70	1510	0.11
20	1580	1580	70	1580	0.22
30	1650	1650	70	1650	0.33
40	1720	1720	70	1720	0.44
50	1790	1790	70	1790	0.55
60	1860	1860	70	1860	0.66
70	1930	1930	70	1930	0.77
80	2000	2000	70	2000	0.88
90	2070	2070	70	2070	0.99

Gage Factor : 4.00 Kg/Kg
Zero Reading : 1440
Calculated Load = Gage Factor (Output Reading - Current Reading) / Gage Factor

Note: The above calibration was a least square method. The Zero Reading shown is that for
single line comparison and does not really agree with the actual no load reading
Linearity = (Calculated Load - Applied Load) / (Max. Applied Load) x 100%

Ref : CCMC, Sheet, page 1, White, page 1, Green, page 1, Yellow, Blue, Teal

Calibration Sheet

Daedong Instruments Co., Ltd.

Calibration Record

VIBRATING WIRE LOAD CELL CALIBRATION SHEET

Customer : 0
Model : 34000
Serial No. : 3384
Date of Calibration : 2017.02.02
Empy : Africa
Ref/No : 3384

Applied Load	Bridge	Output	Change	Calculation	Linearity
(kg)	(mV)	(mV)	(mV)	(mV)	(mV)
0	1440	1440	0	1440	0.00
10	1510	1510	70	1510	0.11
20	1580	1580	70	1580	0.22
30	1650	1650	70	1650	0.33
40	1720	1720	70	1720	0.44
50	1790	1790	70	1790	0.55
60	1860	1860	70	1860	0.66
70	1930	1930	70	1930	0.77
80	2000	2000	70	2000	0.88
90	2070	2070	70	2070	0.99

Reading (mV) = (Applied Load - Zero Reading) / (Gage Factor - Zero Reading) x Gage Factor

Gage Factor : 4.00 Kg/Kg
Zero Reading : 1440
Calculated Load = Gage Factor (Output Reading - Current Reading) / Gage Factor

Note: The above calibration was a least square method. The Zero Reading shown is that for
single line comparison and does not really agree with the actual no load reading
Linearity = (Calculated Load - Applied Load) / (Max. Applied Load) x 100%

Ref : CCMC, Sheet, page 1, White, page 1, Green, page 1, Yellow, Blue, Teal

Calibrated By : S/O/SSS

Calibration Record

【 품질보증서 】

1. 당사로서 calibration 결과 정확도 0.1% 이내의 정확도를 보증합니다.

2. 당사 제품 calibration 결과 1년 이내의 정확도를 보증합니다. (단, 사용 환경에 따라 정확도가 달라질 수 있습니다.)

3. 당사는, calibration 결과 정확도 0.1% 이내의 정확도를 보증합니다. (단, 사용 환경에 따라 정확도가 달라질 수 있습니다.)

4. 당사는, calibration 결과 정확도 0.1% 이내의 정확도를 보증합니다. (단, 사용 환경에 따라 정확도가 달라질 수 있습니다.)

구분	내용
제품명	V.W. Load Cell
모델명	34000
제출일	2017.02.02
검정일	2017.02.02
검정인	2017.02.02

2017.02.02 4월 13일

Daedong Instruments Co., Ltd.

Warranty

Vibrating Wire Read out



GG-400

Composition and operating principle

In the case of a vibrating wire type, tensile strength of steel wire becomes different, depending on the strain of the steel wire built in a sensor. If a change is given to the magnetic field by vibrating the steel wire with an electric coil that is installed beside the steel wire, alternating voltage is generated. The number of vibrations of the output voltage is same as that of the steel wire, and Vibrating Wire Read Out measures the number of vibrations through cable.

The vibrating wire-type sensor uses the number of vibrations, instead of voltage, as output signal. The number of vibrations is not influenced by resistance change of cable, contact resistance with the ground, and electric leakages.

Technical specification

- ◆Excitation range : 400Hz~6,000Hz
- ◆Resolution : 0.1 micro strain
- ◆Time base accuracy : 0.01%
- ◆Temperature sensor type : Thermistor
- ◆Temperature reading range : -20°C ~ 80°C
- ◆Temperature resolution : 0.1°C

Mode	Calculation	Units	Frequency sweep (Hz)
A	Period in seconds	μ seconds	450 – 6,000
B	$F^2 \times 10^{-3}$	Digits	1,200 – 3,500
C	$F^2 \times 10^{-3} \times 4.062$	Strain	450 – 1,000
D	$F^2 \times 10^{-3} \times 3.304$	Strain	450 – 1,000
E	$F^2 \times 10^{-3} \times 0.39102$	Strain	1,000 – 3,500
F	$F^2 \times 10^{-3}$	Digits	2,500 – 6,000



V.W Load Cell



L4000



L4000S

Composition and operating principle

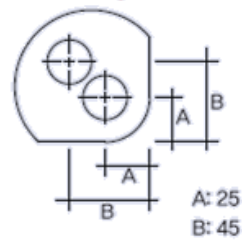
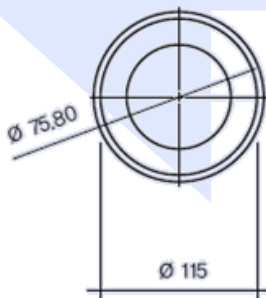
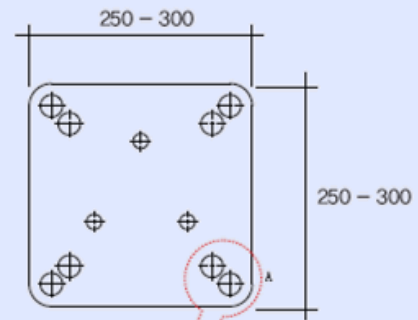
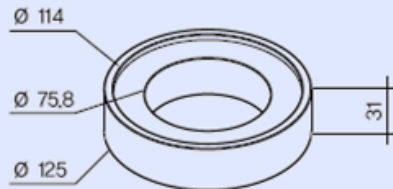
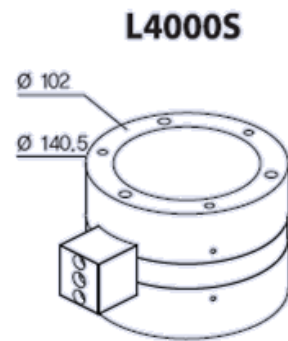
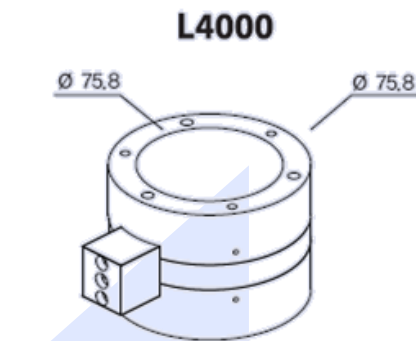
V.W. Load Cell is composed of a cylinder cell, a vibrating wire, a plucking coil, a temperature sensor, and a plate. The vibrating wire is mounted in the cylinder cell, divided into three equal parts. It is designed to measure load working on struts or earth anchor. V.W. Load Cell is slightly strained once load is given to a cylinder cell. At this time, a plucking coil perceives changes in the frequency of vibrating wire, which is transmitted to a frequency meter and then, indicated in a particular unit. It is calculated in load by the given gage factor, and used.

Purpose

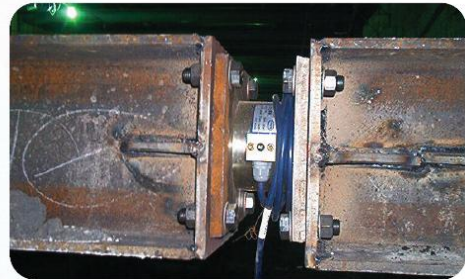
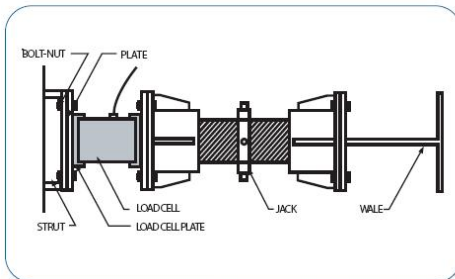
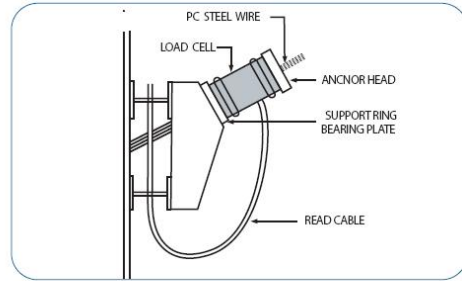
- ◆ Measurement for the variation of the load working on earth anchor during excavation.
- ◆ Measurement for temporary loads working on the located cable of the bridge.
- ◆ Evaluate the validation and confirm the stability for the supporting system such as revetment, earth anchor, or etc.
- ◆ Measurement for long term loads working on earth anchor, V.W Rock Bolt, or etc.
- ◆ Highly sensitive and waterproof. Pile test.

Technical specification

- ◆ Type : Vibrating Wire
- ◆ Rated capacities : 100ton ~500ton (Others per customer's requirement)
- ◆ Over range capacity : 150% full scale
- ◆ Sensitivity : $\pm 0.025\%$
- ◆ Resolution : 0.025% full scale minimum
- ◆ Accuracy : ± 0.5 to $\pm 1\%$ full scale (in case of high capacity, ± 0.5 to $\pm 1\%$ full scale)
- ◆ Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆ Excitation method : Pluck or Sweep
- * According to operation and environment, the accuracy can be different.



* Per its capacity, the size can be different.

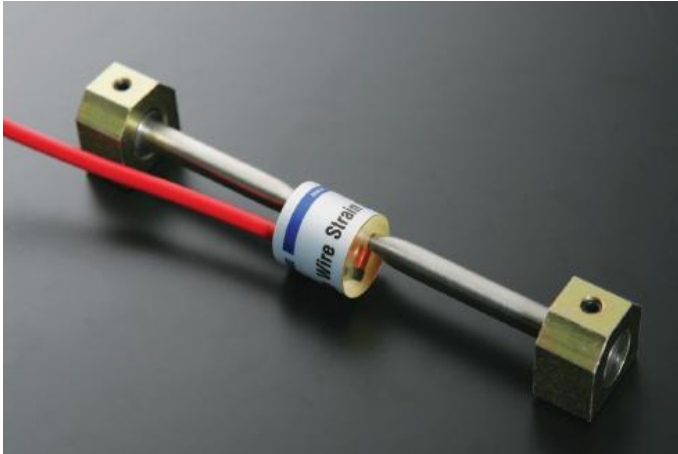


Installation procedure

1. When installing on earth anchor, in advance, Wale should be machined as per Load Cell's specification. (To prohibit the deformation of Wale's flange and web, Stiffener has to be installed.)
2. After connecting the cable, standard point (0 point) should be recorded with a measuring instrument.
3. It should be built up in order that lower plate, load cell, upper plate, and pressure plate are placed vertically on machined Wale. At that time, the anchor cable must not contact to the cell or Wale.
4. With hydraulic extended instrument, Anchor should be installed after checking the load expected at design. At that time, Load Cell must not be eccentric. If using Oil Jack to minimize the loss of pressure stress, Anchor head should be inserted after taking a certain amount of time (land : 5minutes, rock : 2minutes) under maximum pressure. After inserting Anchor head, it is well-assembled if it is completely pushed out when keeping 30 seconds.
5. Measure the extended amount and compare to the expected amount by the design. Initial quality for the condition of Earth Anchor assembly can be checked and controlled.

	MODE	Calculation	Units	Frequency sweep(hz)
	B	$F^2 \times 10^{-3}$	digits	1,200 – 3,500

V.W Strain Gage



GV4000

Composition and operating principle

V. W Strain Gage is composed of: two blocks that fix steel wire; a stainless pipe which protects steel wire, a gage which is treated waterproof with o-rings; and a plucking coil. Once the gage is strained, frequency of steel wire becomes different. At this time, a plucking coil generates resonance frequency and delivers it to a measuring instrument.

The measuring instrument converts this signal into strain and then, indicates. Measured data are converted into stress or load by modulus of elasticity and cross section of a member.

Purpose

- ◆ Measurement for variation rate of Bridge or Building's standing structural steels.
- ◆ Measurement for the load of the Strut standing on the revetment.
- ◆ Measurement for variation rate of Tunnel's lining and supporting structure.
- ◆ Measurement for the area of concentric stress working on the pipe line.
- ◆ Measurement for variation rate of concrete casting with the anchor stuck on the surface of the concrete.
- ◆ Measurement for variation of Strut's stress which occurs the variation of the ground by earth pressure during retaining construction.
- ◆ Measurement for stress variation of building's subsidiary material and Con'c after installing on Pile, Wale, support Strut, or various steels during excavation in downtown.

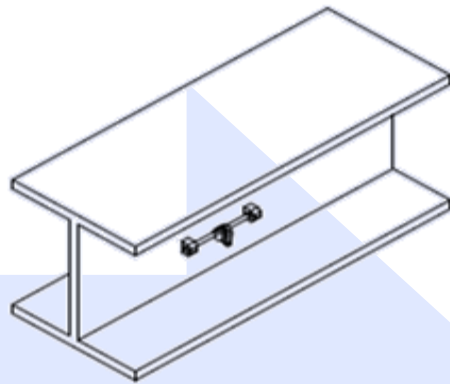
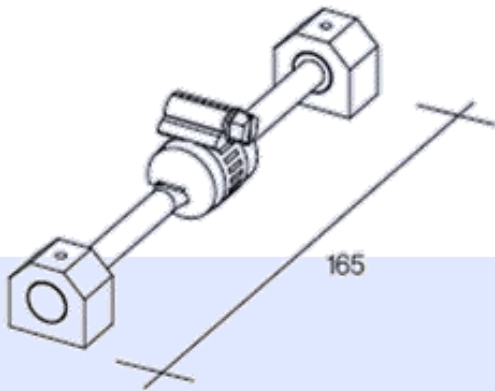
Characteristics

- ◆ Stability and reliability in an extreme situation.
- ◆ Electric welding
- ◆ Easy coordination at construction field.
- ◆ Resistance temperature sensor with high accuracy.



Technical specification

- ◆Type : Vibrating Wire
- ◆Range : 3000 micro strain
- ◆Accuracy : $\pm 0.1\%$ full scale
- ◆Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆Gage length : 150 mm
- ◆Sensor material : stainless steel
- ◆Sensitivity : 1.0 micro strain
- ◆4core shielded signal cable



MODE	Calculation	Units	Frequency sweep(hz)
C	$F^2 \times 10^{-3} \times 4.062$	strain	450 - 1,000

V.W Spot Strain Gage



GV4150

Composition and operating principle

V. W Strain Gage is composed of: two blocks that fix steel wire; a stainless pipe which protects steel wire, a gage which is treated waterproof with o-rings; and a plucking coil. Once the gage is strained, frequency of steel wire becomes different. At this time, a plucking coil generates resonance frequency and delivers it to a measuring instrument.

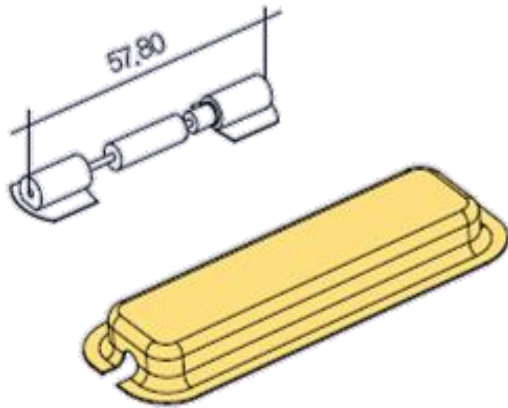
The measuring instrument converts this signal into strain and then, indicates. Measured data are converted into stress or load by modulus of elasticity and cross section of a member.

Characteristics

- ◆ Spot welding type.
- ◆ 100% absorption for deformation of subsidiary material. Coordinate the measuring range.
- ◆ Coil housing can be re-used. Resistance temperature sensor with high accuracy.
- ◆ Good reproducibility and responsibility as the frequency output is not affected by cable's length or resistance variation.

Purpose

- ◆ Measurement for variation rate of Bridge or Building's standing structural steels.
- ◆ Measurement for variation of the load working on earth anchor of underground excavation.
- ◆ Measurement for variation rate of Tunnel's lining and supporting structure.
- ◆ Measurement for the area of eccentric force working on the pipe line.
- ◆ Measurement for distributed load during pile strength test.



Technical specification

- ◆Type : Vibrating Wire
- ◆Range : 3000micro strain
- ◆Sensitivity : 0.5~1.0 micro strain
- ◆Accuracy : ±0.1% full scale
- ◆Gage length : 51 mm
- ◆Sensor material : stainless steel



MODE	Calculation	Units	Frequency sweep(hz)
E	$F^2 \times 10^{-3} \times 0.39102$	strain	1,000 – 3,500

V.W Embedment Strain Gage



GV4200

Composition and operating principle

V. W Strain Gage is composed of: two blocks that fix steel wire; a stainless pipe which protects steel wire, a gage which is treated waterproof with o-rings; and a plucking coil. Once the gage is strained, frequency of steel wire becomes different. At this time, a plucking coil generates resonance frequency and delivers it to a measuring instrument.

The measuring instrument converts this signal into strain and then, indicates. Measured data are converted into stress or load by modulus of elasticity and cross section of a member.

Deformation of concrete is transferred to the body and vibrating wire through the flange. When having tensile or compressive force, vibrating wire is magnetized by plucking coil and it outputs resonance frequency. Finally, this frequency turns to engineering values through the Readout. By conversion coefficient, it can calculate the stress and deformation rate.

Characteristics

- ◆ Stability and reliability in an extreme situation.
- ◆ Good reproducibility and responsibility as it is not affected by cable's length or resistance variation.
- ◆ Permanent method and rust preventative.
- ◆ Resistance temperature sensor with high accuracy.

Technical specification

- ◆ Type : Vibrating Wire
- ◆ Range : 3000micro strain
- ◆ Sensitivity : 0.5~1.0 micro strain
- ◆ Accuracy : $\pm 0.1\%$ full scale
- ◆ Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆ Gage length : 150 mm
- ◆ Sensor material : stainless steel
- ◆ Sensitivity : 1.0 micro strain
- ◆ 4core shielded signal cable

MODE	Calculation	Units	Frequency sweep(hz)
D	$F^2 \times 10^{-3} \times 3.304$	strain	450 – 1,000



V.W Total Pressure Cell



TC5000



TC5001

Composition and operating principle

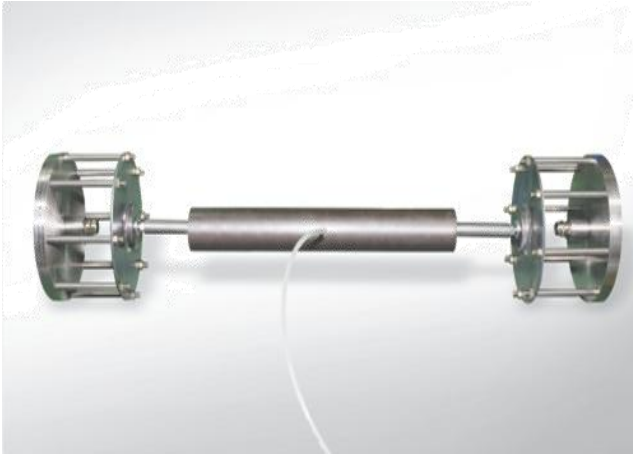
V.W. Total Pressure Cell is composed of a thin cylinder cell, which receives earth pressure, and a pressure sensor.

Once the cylinder cell of V.W. Total Pressure Cell takes stress caused by filling pressure or load of the surrounding ground, the liquid which fills the inside of the cylinder cell gets to receive pressure and this pressure is delivered to pressure sensor. If pressure is given to the diaphragm of pressure sensor, tension of vibrating steel wire is changed. At this time, magnetic coil perceives frequency of the vibrating steel wire.

Once the primary coil generates a frequency signal on the vibrating steel wire, the secondary coil sends the frequency to a measuring instrument. The measured frequency is converted into pressure through calibration factors.

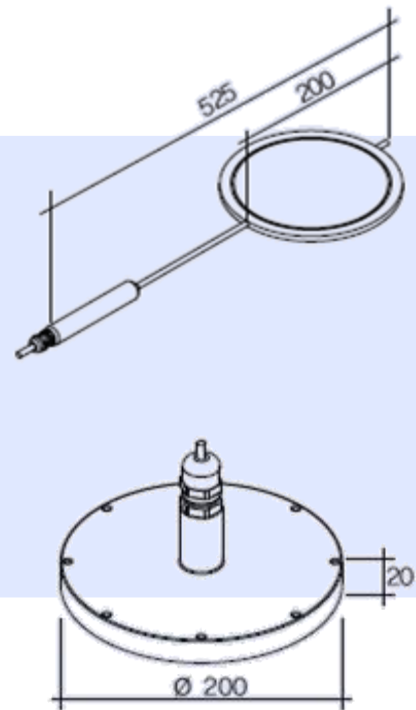
Purpose

- ◆ Measurement for variation of Slurry Walls, Concrete piles, Caissons, Osterberg pile tests, and other concrete structures.
- ◆ Measurement for the stress by the ground load and earth pressure.
- ◆ Measurement for vertical load. Also, check the transferring amount of the stress in Core layer of a stone dam. It should be installed to the Filter layer which is stronger than Core.
- ◆ Measurement for variation of earth pressure during excavation in downtown.



Technical specification

- ◆ Type : Vibrating Wire
- ◆ Range : 300,500,700,1000 kPa
- ◆ Dimensions : $\Phi 200 \times 6\text{mm}$ (TC-5000)
 $\Phi 200 \times 26\text{mm}$ (TC-5001)
- ◆ Resolution : 0.025% full scale (minimum)
- ◆ Accuracy : $\pm 0.1 \sim \pm 0.5\%$ full scale
- ◆ Temperature range : $-20^{\circ}\text{C} \sim -80^{\circ}\text{C}$
- ◆ Over-range capacity : 150% full scale
- ◆ Material : stainless steel



MODE	Calculation	Units	Frequency sweep(hz)
B	$F^2 \times 10^{-3}$	digits	1,200-3,500



V.W Rebar Stress Meter



RB190

Composition and operating principle

V.W. Rebar Stress Meter is composed of: a V.W. Strain Gage installed in the center of a cylinder steel bar, a plucking coil, and deformed bars combined on both sides.

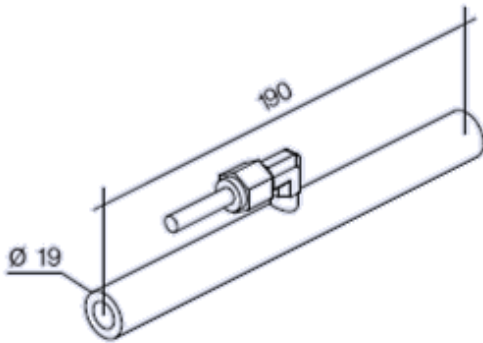
Once the gage which is installed on Rebar Stress Meter is strained, frequency of the steel wire becomes different. At this time, a plucking coil generates resonance frequency and sends it to the meter. This Rebar Stress Meter indicates this signal in a necessary unit. By the given gage factor, it is converted into strain or stress.

Purpose

- ◆ Measurement for variation of Slurry Walls, Concrete piles, Caissons, Osterberg pile tests, and other concrete structures.
- ◆ Verification for excessive pressure and estimated amount on design.

Characteristics

- ◆ Stability and reliability in an extreme situation.
- ◆ Good reproducibility and responsibility as it is not affected by cable's length or resistance variation.
- ◆ Resistance temperature sensor with high accuracy.



* Per its capacity, the size can be different.



Fixed by welding or steel wire.

Technical specification

- ◆ Type : Vibrating Wire
- ◆ Dimensions : $\Phi 20, \Phi 19, \Phi 13$ (Others per customer's requirement)
- ◆ Range : 2500 micro strain
- ◆ Sensitivity : 1.0 micro strain
- ◆ Resolution : 0.4 micro strain
- ◆ Accuracy : $\pm 0.25\%$ full scale
- ◆ Nonlinearity : 0.5% full scale
- ◆ Length : 190 mm
- ◆ Sister bar diameter : 13mm
- ◆ Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆ Material : High Strength Carbon Steel



MODE	Calculation	Units	Frequency sweep(hz)
B	$F^2 \times 10^{-3}$	digits	1,200–3,500



V.W Displacement Sensor



DP50

Composition and operating principle

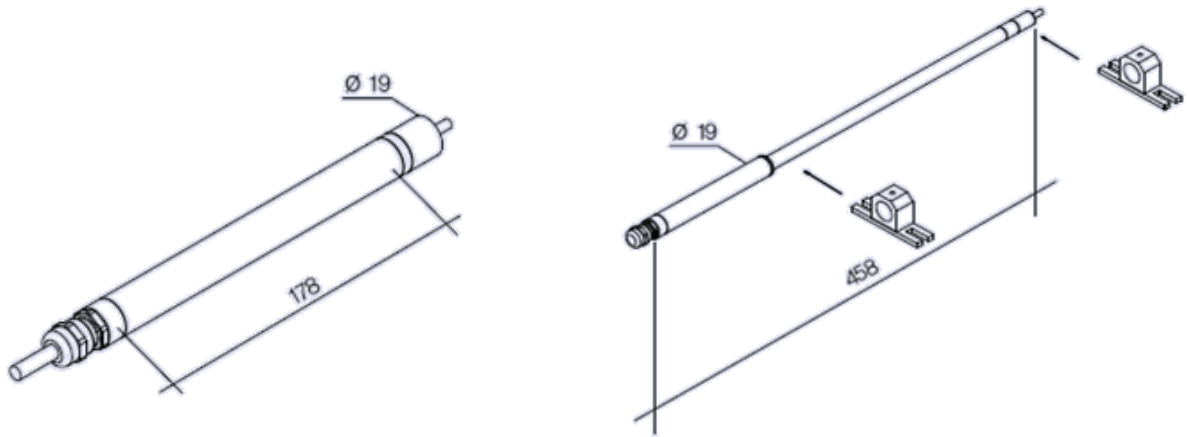
V.W. Displacement Sensor is composed of a sensor and mounting blocks. Generation of cracks or displacement is measured by fixing mounting blocks on both sides where cracks are being made. Once cracks or displacement happens, it is delivered to the sensor through mounting block. At this time, frequency becomes different because of the amount of cracks or displacement. The measured frequency is converted into the amount of displacement by the gage factor.

Purpose

- ◆ Measurement for variation of the distance between connected areas in concrete structures or rock.
- ◆ Measurement for variation of the distance at connected areas or crack of close structures or buildings by unpredictable move.
- ◆ Check the crack condition of structure on a seismic area.
- ◆ Measurement for progressing crack on old tunnel, bridge, etc.

Characteristics

- ◆ Stability and reliability in an extreme situation.
- ◆ Good reproducibility and responsibility as it is not affected by cable's length or resistance variation.
- ◆ Easy coordination at construction field.
- ◆ Easy installation
- ◆ Permanent method and rust prevent.



Caution : The bock can't be installed on the enter of the head.

Technical specification

- ◆ Type : Vibrating Wire
- ◆ Range : 30mm,50mm,100mm
- ◆ Sensitivity : $\pm 0.025\%$ full scale
- ◆ Accuracy : $\pm 0.1\%$ full scale
- ◆ Resolution : 0.025% full scale
- ◆ Nonlinearity : 0.5% full scale
- ◆ Temperature range : $-20^{\circ}\text{C} \sim +80^{\circ}\text{C}$
- ◆ Material : stainless steel



MODE	Calculation	Units	Frequency sweep(hz)
B	$F^2 \times 10^{-3}$	digits	1,200–3,500



Magnet Extensometer



M600

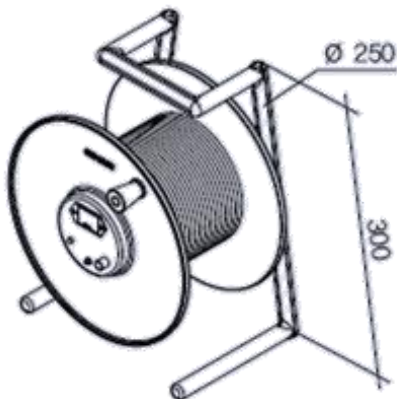
Composition and operating principle

Magnet Extensometer is composed of a probe, a reel frame, a signal tape, a light, a buzzer, several spider magnets, and a guide pipe.

Several magnets installed on a guide pipe get to have settlement or heave according to up/down movements of a layer. When a probe follows the guide pipe to come into the magnetic field that is made on magnets, the reed switch gets closed. Then, the light and the buzzer work. At this time, it is possible to check the depth of magnet. Especially, the signal tape is coated on the steel tapeline. So, it is very strong and durable.

Purpose

- ◆ Measurement for settlement or heave of a retaining wall, foundation work, dam, soft soil ground.
- ◆ To measure the layered settlement by embankment of soft soil ground, it should be drilled to the center of the embankment.
- ◆ To measure the layered settlement amount in the ground of harbor, it should be installed at the reclamation.
- ◆ Measurement for the layered vertical settlement amount after installing magnets on core layers of a dam.

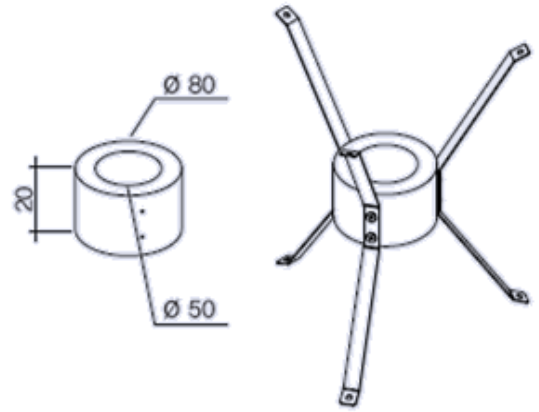


Technical specification

- ◆ Range : up to 200 m
- ◆ Sensitivity : ± 1 mm
- ◆ Repeatability : ± 3 mm
- ◆ Signal tape : coated tape
- ◆ Measuring range : 50M
- ◆ Resolution : 1mm
- ◆ Weight: 2.5kg
- ◆ Temperature range: $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆ Probe material: stainless steel
- ◆ Probe diameter: 16mm
- ◆ Reel material: High Carbon Steel



Ring Magnet



* The size can be different from its drilling.

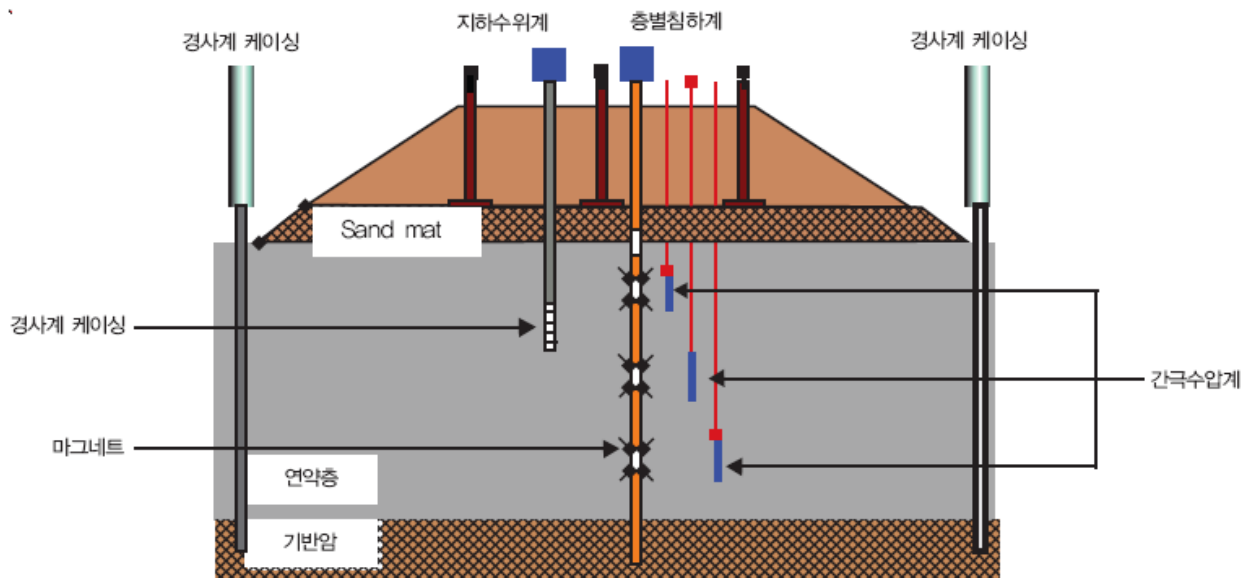


Spider Magnet



Telescopic section

: It is installed together in soft soil ground when Magnet Extensometer is installed.





V.W Piezometer



EB5000

Composition and operating principle

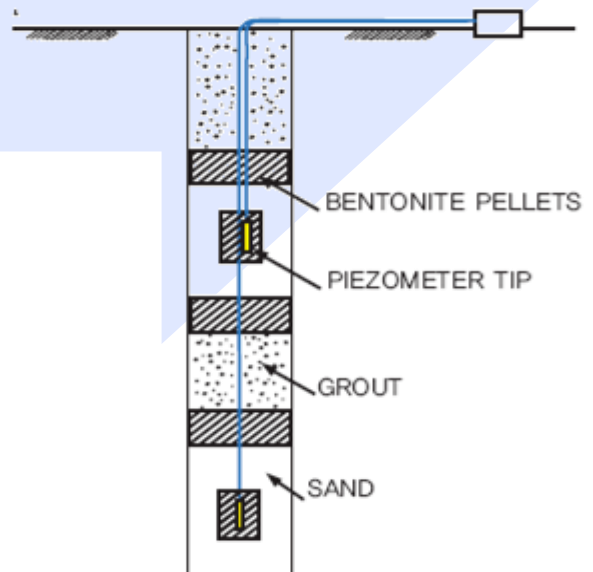
V.W. Piezometer is composed of a diaphragm, vibrating steel wire, a magnetic coil, a temperature sensor, and a filter. Once pressure is given to the diaphragm, tension of the vibrating wire is changed. At this time, the plucking coil perceives the frequency of the vibrating wire. If the primary coil generates a frequency signal on the vibrating wire, the secondary coil sends the frequency to a meter. And the measured frequency is converted into pressure through gage factor. It can be installed in the area of embankment and generally at most of construction field such as for measuring in a pipe, inside hole, and etc.

Characteristics

- ◆ Stability and reliability in an extreme situation.
- ◆ Resistance temperature sensor with high accuracy.

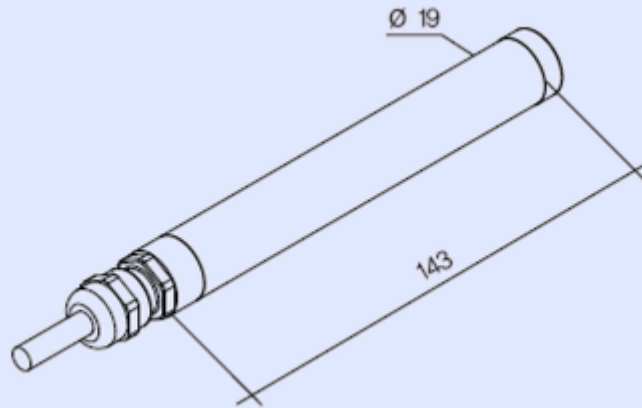
Technical specification

- ◆ Nonlinearity : 0.5% full scale
- ◆ Range : 300,500,700 kPa
(Others per customer's requirement)
- ◆ Dimensions : $\Phi 19 \times 160$ mm
- ◆ Weight : 0.16kg
- ◆ Filter : 50 micron, stainless steel
- ◆ Temperature sensor : Thermistor (standard)
- ◆ Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆ Resolution : 0.025% full scale
- ◆ Material : stainless steel
- ◆ Accuracy : $\pm 0.1\% \sim \pm 0.3\%$ full scale
(in case of high capacity, $\pm 0.5\% \sim \pm 1\%$ full scale)



Purpose and installation

- ◆To measure drainage and water level for excavation of a land-side protection wall, to examine stability of a slope, to measure pore water pressure of the filled and soft ground, and to measure the flow and water leakage of underground water of dams and banks.
- ◆High accuracy measurement for the settlement.
- ◆Estimation of pressure density is logically better than the evaluation per settlement amount.
- ◆Verify the stability after measuring the deviation of pore water pressure at construction field.
- ◆Measurement for pore pressure to get safety and drainage.
- ◆Stability study for sand and ground.
- ◆Measurement for leakage and flow of underground water, artificial lake and dam.
- ◆To check the pressure density as measuring pore water pressure in soft ground, it should be installed into the center of the embankment.
- ◆To measure pore water pressure of filter and reclaimed area for harbor construction, it installs.
- ◆To check grouting effect and pervious flow during center core stone dam construction, it should be installed on the base stone of dam. To measure excessive pore water pressure during core zone construction or to calculate pervious speed and check appropriateness of previous outflow after filling water, it should be installed into the core. It should be checked the function of the filter after installing into the filter of the upper and lower stream.
- ◆To measure pore water pressure in the ground during downtown excavation, it should be installed into the ground of an earthen wall.



MODE	Calculation	Units	Frequency sweep(hz)
B	$F^2 \times 10^{-3}$	digits	1,200–3,500



Water Level Meter



W500

Composition and operating principle

Water Level Meter is composed of a reel frame, a signal tape, a circuit plate, an on/off switch, a light, and a buzzer.

Especially the signal tape which is made of steel is coated, so it is strong and durable.

When 2 conductible cables are connected to a probe and the probe reaches to water table, the electric current flows in circuit and light and buzzer are operated all.

Purpose

- ◆ It is designed to measure the underground water level of pipe or borehole.
- ◆ To measure the deviation of underground water level in soft ground, it should be installed after drilling from the base to the aquifer.

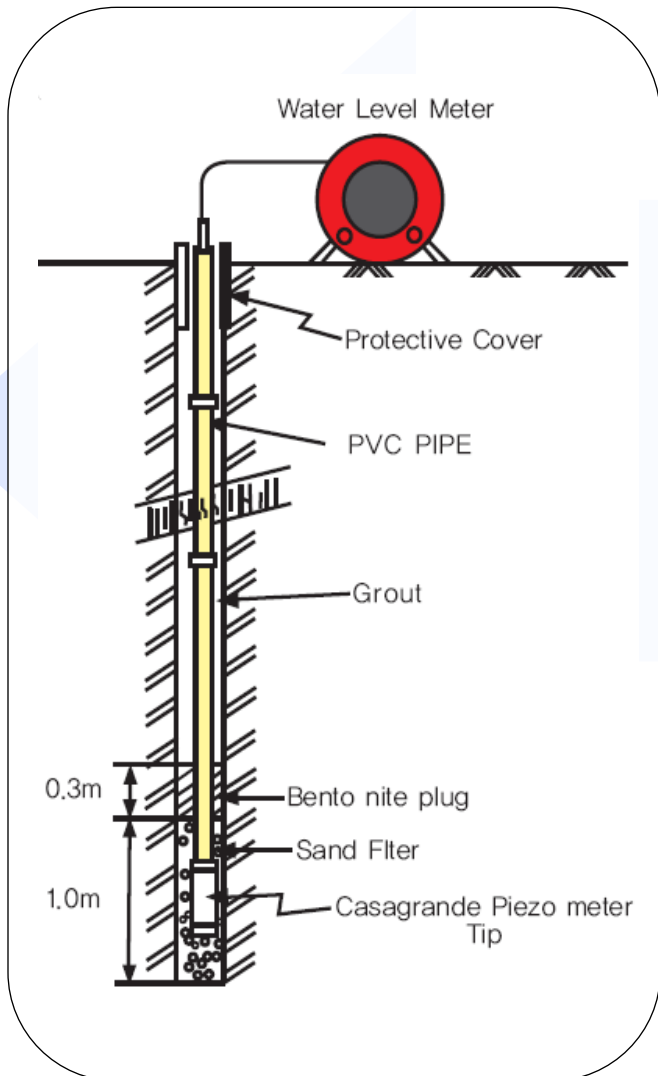
Technical specification

- ◆ Probe diameter : 16mm
- ◆ Probe length : 230mm
- ◆ Material : Brass + Chrome coating
- ◆ Width : 16mm
- ◆ Sensitivity control : 10Ω
- ◆ Reel material : High Carbon Steel



Water Level Meter Tip

WT500





ABS Inclinometer Casing



GV3000

Specification

		Casing	Coupling	End cap
60Φ	OD (mm)	60	66	66
	ID (mm)	52	61	
	Length(mm)	3000	200	
	Weight (kg)	2.42	0.17	0.06
70Φ	OD (mm)	70	76	76
	ID (mm)	62	71	
	Length(mm)	3000	200	
	Weight (kg)	2.67	0.15	0.07
85Φ	OD (mm)	85	91	91
	ID (mm)	77	86	
	Length(mm)	3000	200	
	Weight (kg)	3.59	0.23	0.09

If the torsion is high, it is twisted too much as accumulating while connecting and actual displacement direction & amount might not be able to be supposed. In this case, it may sometimes happen to miss the time of reinforcement. On the other hand, it is worked consistently when the casing connecting and It must be used high quality controlled product. Especially, when there is a close structure which requires the protection or if it's a very difficult construction, it has to be very careful because it may occur a disaster unless it is predicted the emergency.

Purpose and others

- ◆60Φ : Small borehole, short ground displacement, measurement in downtown, or short period
Install into the concrete or stick on the structure
Install into the borehole of rock
Small amount of displacement or region working distributed loads
- ◆70Φ : International standard, versatile, 100mm borehole
Right amount of displacement
Most of structures and embankment
- ◆85Φ : Soft ground or long term measurement, multistage inclinometer, 125mm borehole
Depth over 40M or many shears of land
When horizontal inclinometer installs

It is a purpose to install portable a servo accelerometer or a multi measuring points & continuous fixed inclinometer which are measuring for the strain on the ground.

Generally, it is installed into the borehole. Also, it can be installed on the structure, into the concrete, or under the embankment.

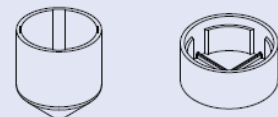
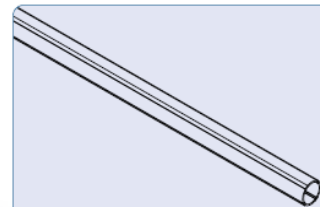
If ABS casing is leaving in the direct sun light or in the hot for long time, it occurs the deformation or torsion inside. Therefore, it must be packed when carrying. Also, it is packed, carried, and stored on the wide and flat area where there isn't sun light if keeping long at construction field.

Characteristics

- ◆It can be installed on the structure, into the borehole, concrete, or embankment.
- ◆No corrosion. Light and high strength.
- ◆Softer than aluminum.
- ◆Strong connection, so the connected area isn't easily broken (especially, great at soft ground)

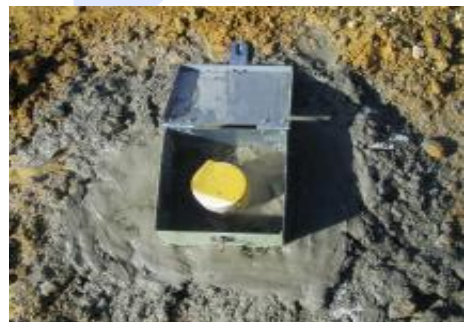
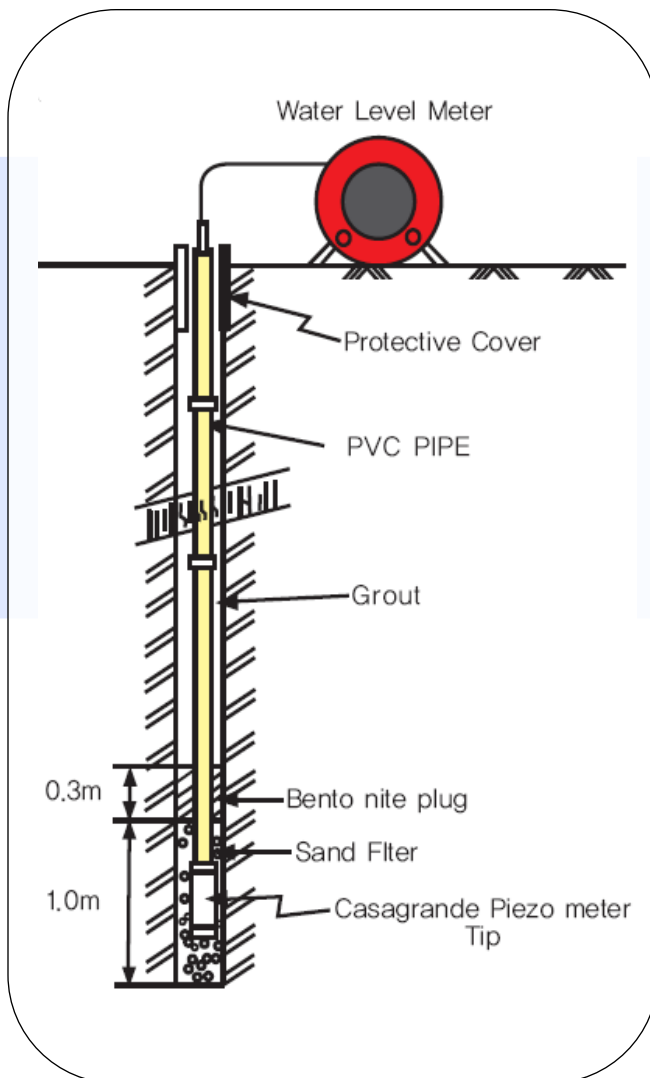
Technical specification

- ◆Material : ABS
 - ※ABS: Acrylonitrile Butadien Styren
Light, good durability and elasticity.
- ◆Collapse rating : 1960 kPa(1770kPa)
- ◆Bend rating : 3.07kN(2.65kN)
- ◆Maximum temperature : 80°C
- ◆Tensile strength : 705kgF(700kgF)
- ◆Torque : 520Nm(481Nm)
- ◆Casing length : 3,000 mm
- ◆Outside diameter : 60mm, 70mm, 85mm





Coupling, End cap



V.W Concrete Lining Stress



CS100

Composition and operating principle

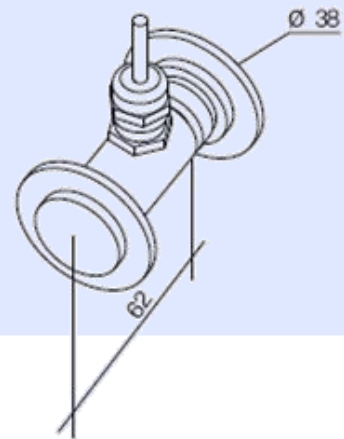
V.W. Concrete Lining Stress Meter is a vibrating wire type and vibrating wire is built in its body. If the gage is strained, frequency of vibrating wire becomes different. At this time, a plucking coil generates resonance frequency which is delivered to a measuring instrument. The measuring instrument converts this signal into strain and indicates. It is converted into stress by the given gage factor, modulus of elasticity of shotcrete, and measured strain.

Purpose

◆ V.W Concrete Lining Stress is used for measuring the stress of concrete lining working on tunnel, D-wall, revetment, or etc.

Technical specification

- ◆ Type : Vibrating Wire
- ◆ Range : 3000 micro strain
- ◆ Sensitivity : 1 micro strain
- ◆ Accuracy : $\pm 0.1\%$ full scale
- ◆ Nonlinearity : 0.5% full scale
- ◆ Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$



MODE	Calculation	Units	Frequency sweep(hz)
E	$F^2 \times 10^{-3} \times 0.39102$	strain	1,000-3,500



V.W Shotcrete Stress Meter



SS200

Composition and operating principle

V.W. Shotcrete Stress Meter is a vibrating wire type and vibrating wire is built in its body. If the gage is strained, frequency of steel wire becomes different. At this time, a plucking coil generates resonance frequency which is delivered to a measuring instrument. The measuring instrument converts this signal into strain and indicates. It is converted into stress by the given gage factor, modulus of elasticity of shotcrete, and measured strain.

Purpose

- ◆ Measurement for stress working on radian and tangential direction of tunnel shotcrete.
- ◆ With tape extensometer, V.W displacement sensor, and V.W rock bolt, it can be measured the size and direction of the force working to Lining. It is useful to decide the thickness of Lining and the time for 2nd shotcrete casting.

Characteristics

- ◆ Stability and reliability in an extreme situation.
- ◆ Good reproducibility and responsibility as it is not affected by cable's length or resistance changes.

Installation procedure

1. When shocrete casting, 2~4pcs anchor bolts should be installed.
2. To place radial direction sensor on the ground, solid epoxy should be applied.
3. Sensor and anchor bolt should be fixed by steel wire or cable tie.
4. After protecting the measuring cable, it should be marked to distinguish the directions. (radial and tangential)
5. With V.W Readout, record the value after connecting the measuring cable.

Technical specification

- ◆Type : Vibrating Wire
- ◆Range : 3000 micro strain
- ◆Sensitivity : 1 micro strain
- ◆Accuracy : $\pm 0.1\%$ full scale
- ◆Nonlinearity : 0.5% full scale
- ◆Temperature range : $-20^{\circ}\text{C} \sim 80^{\circ}\text{C}$
- ◆Material : steel

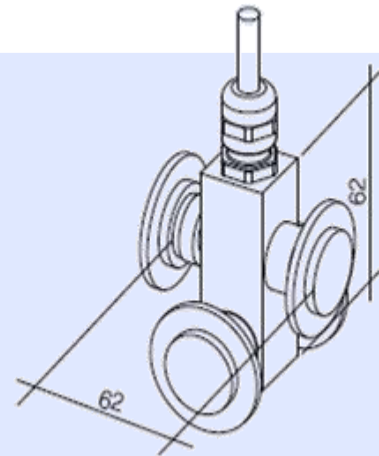
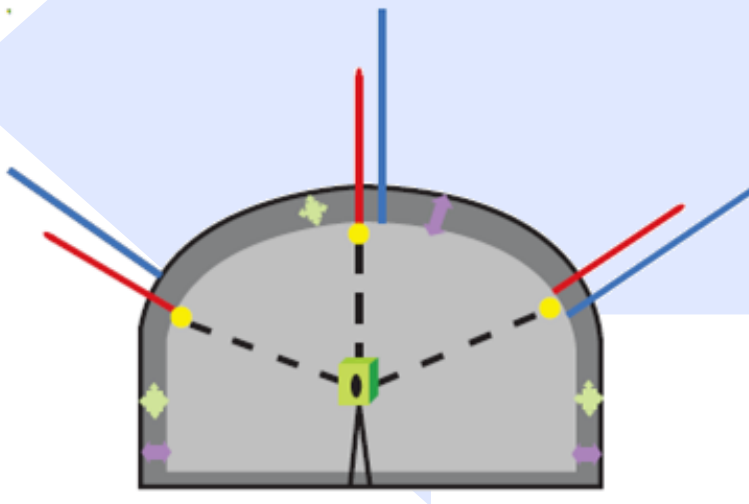
$$P = (R1 - R0) \times E$$

P : Stress

R0 : Initial Reading

R1 : Reading

E : Shotcrete Modulus of elasticity



- 지중 변위계
- 락볼트 축력계
- 스utc리트 응력계
- 라이닝 응력계
- 광파타켓



MODE	Calculation	Units	Frequency sweep(hz)
E	$F^2 \times 10^{-3} \times 0.39102$	strain	1,000~3,500



V.W Rod Extensometer



EM600

Composition and operating principle

V.W. Rod Extensometer is composed of a vibrating wire sensor, a rod, an anchor, and a plastic pipe. Once the displacement occurs due to movements, relaxation, or joints of rock bases, it is delivered to a rod by an anchor and measured by a displacement sensor.

Rod Extensometer is more accurate than the electronic sensor and it doesn't have a mistake and difficulty on measurement per manual type. It is almost permanent measuring instrument and has water & rust resistance.

Purpose

◆ Measurement for horizontal and vertical displacement of clay in the tunnel or rock, the deformation of a slope, and the displacement of close ground according to concentration during underground excavation works such as tunnel, telegraphic, or conduit construction.

◆ To measure the displacement of close ground for tunnel excavation, it should be checked the range of slacken ground by displacement sensor.

Characteristics

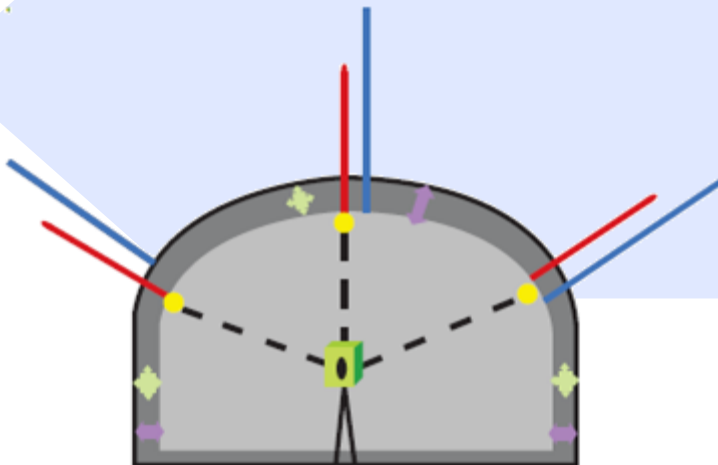
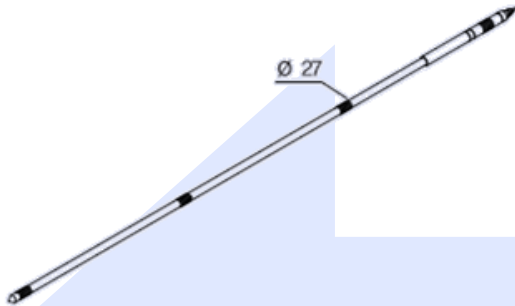
- ◆ Small size vibrating sensor with high accuracy.
- ◆ Stability and reliability in an extreme situation.
- ◆ High strength, low coefficient of expansion, light glass anchor rod.
- ◆ Resistance temperature sensor with high accuracy.

Installation procedure

1. Right after digging a tunnel, it should be 30~40mm bore holed at the installing point.
2. After checking the depth, displacement sensor should be inserted and Mortar or Resin has to be filled up.
3. After protecting the measuring cable, numbers of installed gages should be marked on the cable per depth.

Technical specification

- ◆Type : Vibrating Wire
- ◆Range : 50mm
- ◆Resolution : 0.025% range
- ◆Accuracy : $\pm 0.2\%$ full scale
- ◆Operating temperature : $-20^{\circ}\text{C} \sim +80^{\circ}\text{C}$
- ◆Dimensions : Sensor OD 34mm
Rod OD 26mm
Length 2,3,4,6,8 M
Measuring points : 3,4,5P
- ◆Borehole size for installing : Approx. 38mm



- 지중 변위계
- 락볼트 축력계
- ✚ 슛크리트 응력계
- ↔ 라이닝 응력계
- 광파타켓



MODE	Calculation	Units	Frequency sweep(hz)
B	$F^2 \times 10^{-3}$	digits	1,200–3,500



V.W Rock Bolt



RT400

Composition and operating principle

V.W. Rock Bolt stress meter is composed of a hollow anchor and V.W. strain gage which is connected to each side point of the hollow body.

Once axial load occurs due to movements, relaxation, or joints of rock bases, it generates slight deformation. At this time, V.W. strain gage which is connected to the anchor measures the displacement.

Purpose

- ◆ It is used for measuring axial load working on rock bolt which is installed to strengthen the rock during underground excavation works such as tunnel, telegraphic, or conduit construction. It is checked the effective depth and numbers of rock bolts.
- ◆ It is designed for measuring exact axial force working on rock bolt which is to make rock strengthen at the construction field such as tunnel, mine, telegraphic, conduit construction, or etc.

Characteristics

- ◆ Small size vibrating sensor with high accuracy.
- ◆ Stability and reliability in an extreme situation.
- ◆ 100% absorption for deformation of subsidiary material. Good reproducibility and responsibility

Installation procedure

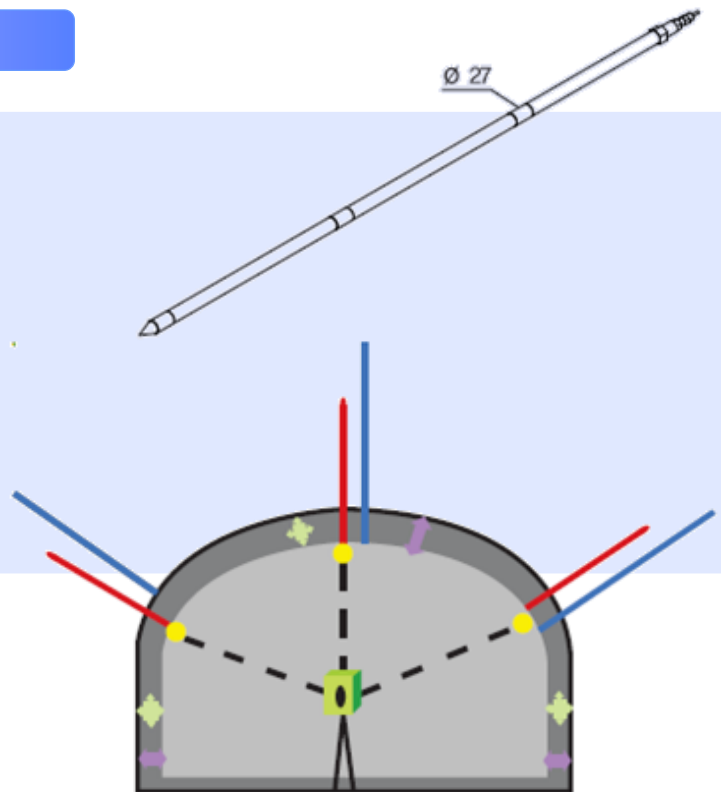
1. Right after digging a tunnel, it should be 30~40mm bore holed at the installing point.
2. After checking the depth, displacement sensor it should be inserted and Mortar or Resin has to be filled up.
3. After protecting the measuring cable, numbers of installed ones should be marked per depth on the cable.
4. With V.W Readout, record the value after connecting the measuring cable.



Technical specification

- ◆Type : Vibrating Wire
- ◆Range : Approx. 170 KN
- ◆Accuracy : $\pm 0.1\%$ full scale
- ◆Operating temperature : $-20^{\circ}\text{C} \sim +80^{\circ}\text{C}$
- ◆Dimensions : OD 27mm
Length 2,3,4,5 M
Measuring points : 2,3,4,5P
- ◆Borehole size for installing : Approx. 38mm

- 지중 변위계
- 락볼트 축력계
- 숏크리트 응력계
- 라이닝 응력계
- 광파타켓



MODE	Calculation	Units	Frequency sweep(hz)
E	$F^2 \times 10^{-3} \times 0.39102$	strain	1,000-3,500



Bireflex Target



T60

Composition and operating principle

The light reflection principle of a geodimeter that is used for surveying is applied to this product. By installing Bireflex Target in a tunnel and recording the location of each point, according to continuous surveying, amount of the displacement is calculated.

Purpose and installation

Measurement for deformation of underground room, slope, or structure on tunnel, telegraphic, conduit construction.

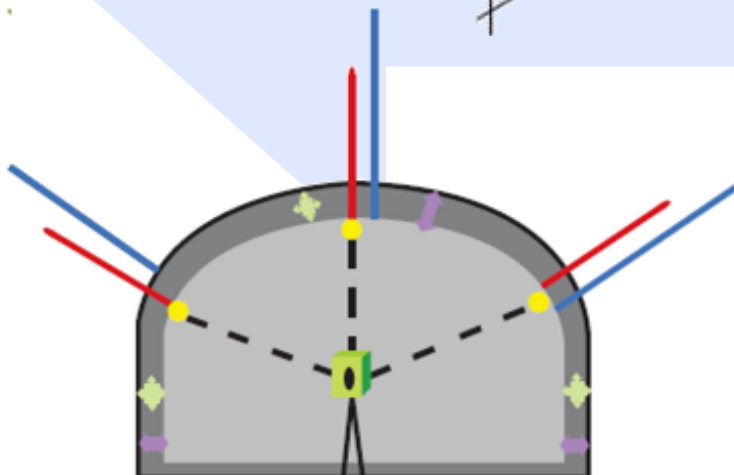
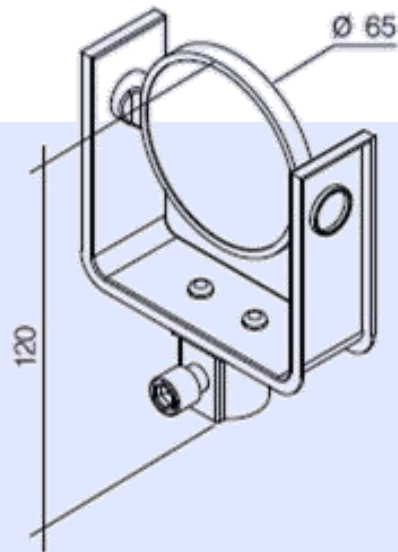
Right after digging a tunnel, it should be drilled 30~40mm boreholes to install anchor pins.

Anchor pin should be fixed into the borehole. With connecting bolt, Bireflex target should be fixed.

With Bireflex target, it is recorded the measured value and the distance to mine, process flow, excavation, and retaining pattern should be recorded.

Specification

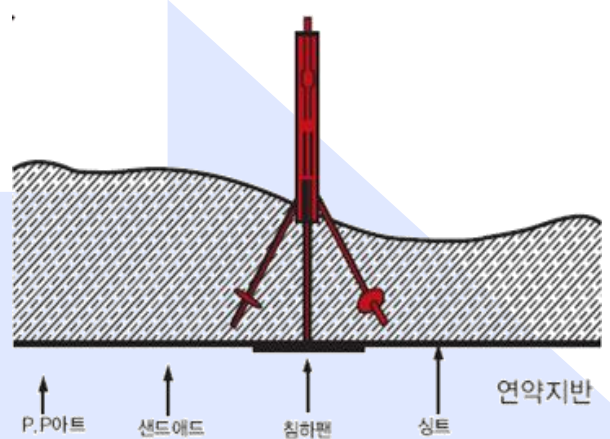
Major components : A deformed steel pin, Bireflex target, High-luminous reflective paper.



- 지중 변위계
- 락볼트 축력계
- + shotcrete 움직임계
- ↔ 라이닝 응력계
- 광파타겟



Settlements Plate



	Material	Spec.
Settlement plate	steel plate	900 x 900 x 9mm 900 x 900 x 10mm
Support bar	steel bar	OD 165mm
Settlement pipe	steel pipe ID	25mm Length 1M
Protect bar	steel bar	OD 165mm Length 1M
Protect plate	steel pipe 25mm	L 80cm, W 80cm, H 120cm Yellow painting, Possible to assemble/disassemble

* Above Spec. is the standard and can be manufactured per customer's requirements.
(Painting with rust-prevent paint)

Tilt Plate



TP100

Composition and operating principle

It is used for measuring the angle of the slope at the measuring area. It should be fixed and stuck with epoxy glue in general.

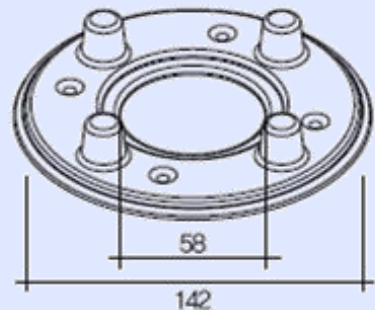
It is better to get the initial value before the excavation is started.

In general, Servo-Accelerometer type of measuring instrument is using.

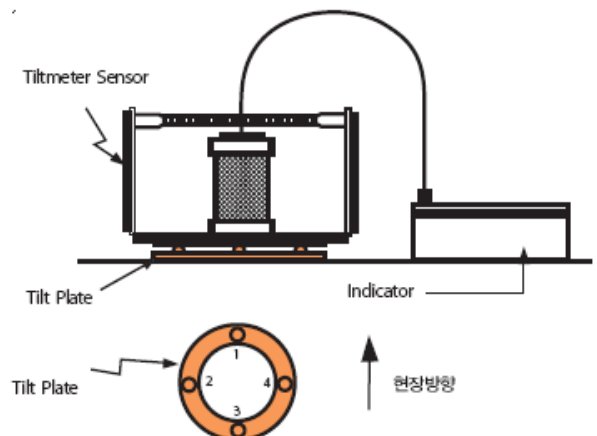
* Material : Aluminum (It is hardly worn out by repeated measurements.)

Purpose

- ◆ Measurement for the angle of the slope at the measuring point with installing on the close structure, revetments, or foundation during construction for a retaining wall, foundation work, embankment.
- ◆ Vertical displacement, slope, crack.
- ◆ When close structure or foundation has crack, it checks the size and variation of crack and support to analyze for other measuring result.



Clean the sticking area, stick after mixing epoxy.





Others



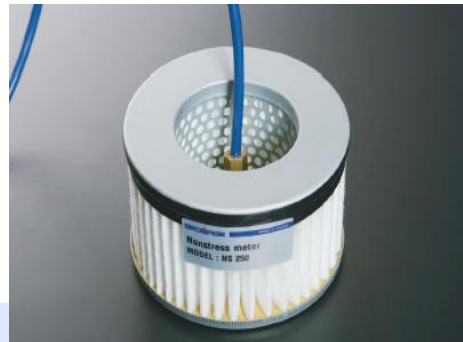
Rock Bolt



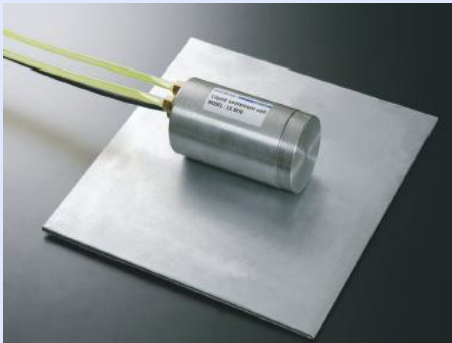
Rod Extensometer



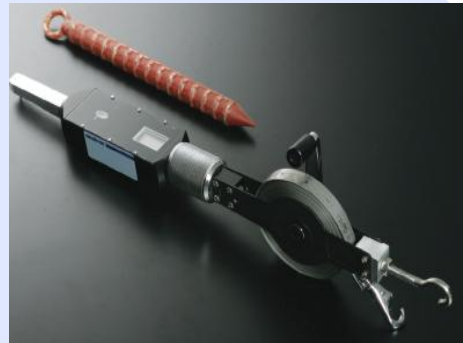
Concrete Temperature Sensor



Non-stress Meter



Liquid Settlement Cell



Taper Extensometer

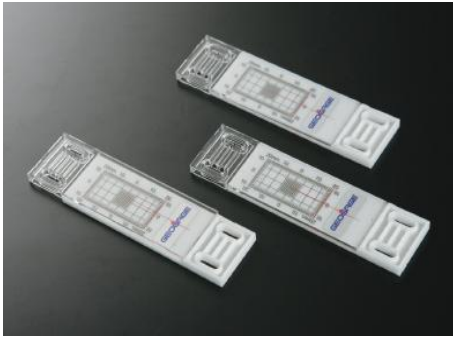


Settlement Read Out



Measuring points on surface of ground

Others



Crack Gage Tip



Crack Gage



Protection Box



Switch Box



Tilt (Probe type)



Certificates & Patent



ISO certificate



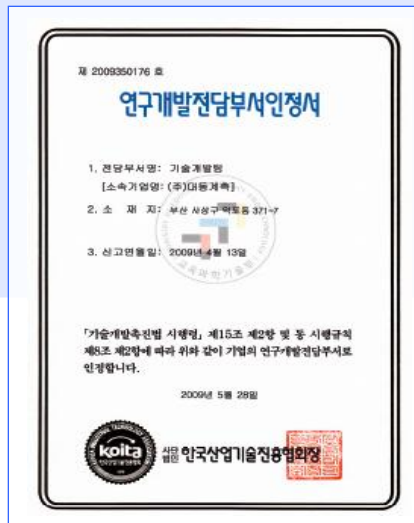
INNO-BIZ



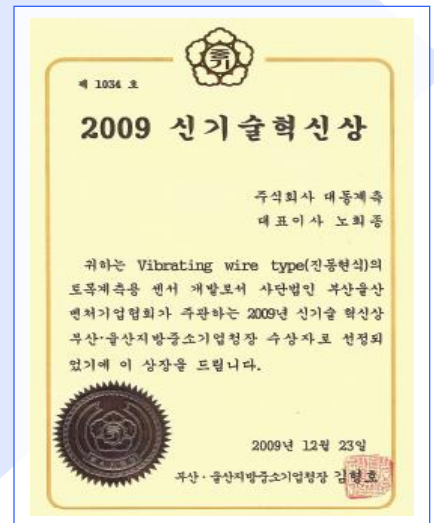
Trademark registration



Patent - Piezometer



R&D center

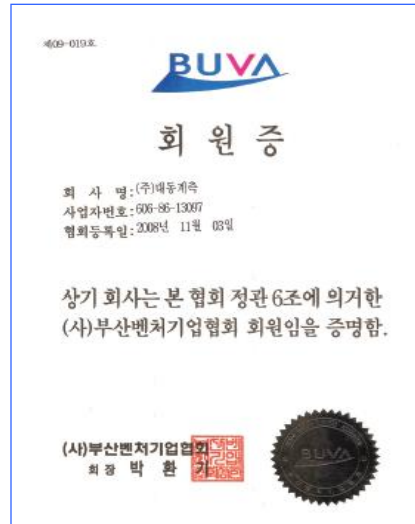


New technological innovation

Certificates & Patent



Front-runner industry



Venture company

Patents & Registration progressing

Magnet Extensometer, System, Measuring method
Patent No. 10-2009-0072163



Registrattion No. 40-2009-0037543

V.W. Schotcrete Stress Meter Patent and Design
Patent No. 10-2009-0096548
Design No. 30-2009-0044749