2017
Geotechnical & Structural Instrumentation

Civil engineering solutions

Structures & power plants
Bridges
Dams
Tunnels
Piles
Marin Structures
Foundations
Slope Stability
Landfills
Excavations
Embankments
Ground water
Railway & Roadway

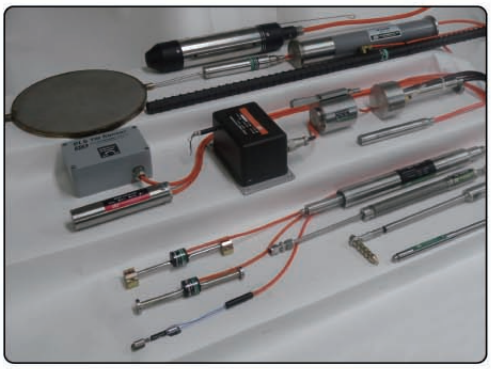
ACE Instruments

ACE INSTRUMENT CO., LTD.
The first value in the Geotechnical & Structural Instrumentation
www.aceinstrument.com

About company

ACE INSTRUMENT CO., LTD which are a group of experts for civil instrumentation are exported to more than 30 countries and supply the civil engineering industry. we are producing our products to use in construction site, rock, environmental instruments with using our data loggers, operating software to check design validation and safety construction.

Our company hopes to develop new products and technologies through challenge and innovation to create a new future.



About products

Our produced civil engineering instruments are used that dams, tunnels, railways, bridges, roads, soft ground improvement work, pile test, stress, strain, earth pressure, water level, pore pressure, slope angle, physical feature of a base rock.

In addition, we also produce the in-situ test equipment, hydraulic cell for pile load test and variety of data loggers and analysis software.

About technology

ACE INSTRUMENT has the design, manufacture, calibration technology about the vibrating wire sensor that is suitable for repeatability, stability is excellent permanent monitoring, and FSG(foil strain gage) type sensor that is suitable for dynamic characteristic detection and experiment with a model.

Our products produce by **CE**, **ISO-9001** so we can supply the manufactured products of the highest quality.

ACE INSTRUMENT has been supplying instruments in more than 15 location dams and construction site to be measured for more than 50 years in Turkey, Iran, Indonesia and so on.

About service

- ▶ Manufacturing geotechnical & structural instrumentation, the readout unit, data logger.
- ▶ Installing & supervising service of the geotechnical sensor and the data logger.
- ▶ Developing the various analysis software for civil engineering monitoring.
- ▶ Technical support for geotechnical engineering.
- ▶ Facilities rental service for civil engineering.
- ▶ Inspection & calibration of sensor and facilities.
- ▶ Web monitoring service

CERTIFICATE NO : QA130224

CreBiz

CERTIFICATE

QUALITY MANAGEMENT SYSTEM

ACE INSTRUMENT CO., LTD.

9, Dangjeong-ro 27beon-gil, Gunpo-si, Gyeonggi-do, Korea

Valid until : 06th May, 2017 / Date : 10th May, 2014

Issue Date : 25th April, 2014

Standards of Certification

KS Q ISO 9001:2009 / ISO 9001:2008

Scope of Certification

Design, Development, Manufacture and Servicing of Civil Engineering Measuring Instrument

Approved by: President CreBizQM

CreBizQM

About quality

Our company has been certified by ISO-9001 quality management system in the design, development, manufacture and service of civil engineering equipment.

Through quality management and quality innovation, we guarantee the quality and pursue the service organization in order to impress the customers.

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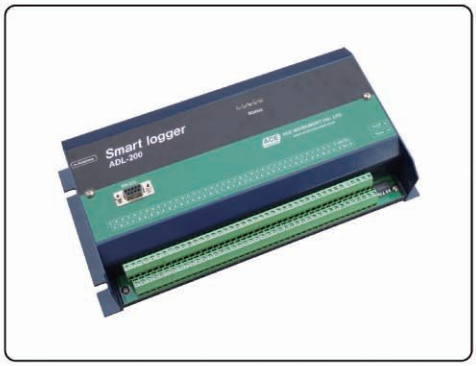
1. Smart controller

Smart controller connects 7 sets of ADL-200 smart logger through network in middle and large fields in order to make wired and wireless control.
The product is useful in the fields that has difficulty with cable wiring, such as tunnel, weak ground, large structure, dam, and port construction fields. In interaction with smart logger, this product featuring practicability, convenience, and high precision makes possible automatic measurement in small, middle and large fields.

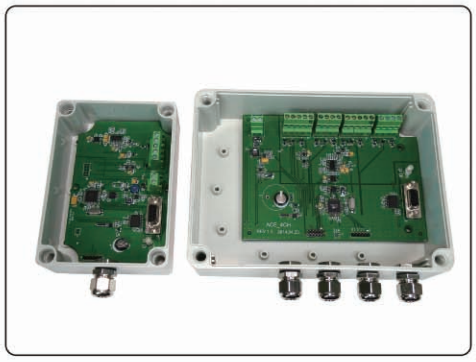
Model		ARF-100 (smart controller)	ADL-200 (smart logger)
Max network quantity		1	7
Power source		DC12V	
External MODEM		3G (controller-PC)	
Communication (on-site)	Wired	RS-232, RS-485 (controller-smart logger)	
	Wireless	ZigBee method (controller-smart logger)	
	Communication range	200~600m (controller-smart logger)	



2. Smart logger

Smart logger has vibrating wire sensor of 16ch and mV & mA sensor of 16ch connected to the main body simultaneously in order for remote automatic measurement independently.
In case of a small & large field with many sensors to install, 1 set of smart controller is able to operate 7 sets of smart loggers through wired and wireless network in field. The product features easy operation software, practicability, convenience, and high precision.

Model	ADL-200
Applied sensor	VW, mV, mA, FSG sensor
Sensor channel	VW sensor 16ch, analogue sensor 16ch
Accuracy	VW sensor 0.05% FSR, analogue sensor 0.1% FSR
Resolution	0.01% FSR
Power source	DC 12V
External MODEM	3G (Smart logger-PC)



3. VW mini loggers

ACE-1100, VW mini logger connects to 1 VW sensor, it can automatically measure it with high precision and low cost for a long time. VW mini logger is useful for unmanned operation, connecting the vibrating wire sensor individually such as few VW displacement sensor, VW piezometer, VW crackmeter on site for the safety check, measuring the water level. Data can stores 6,000 points and selects frequency signal & temperature sensor, it boasts highest performance and confidence among contemporary mini loggers regardless of country.

Model	ACE-1100	ACE-1104
Applied sensor	1ch vibrating wire	4ch vibrating wire
Range	450~6,000㎐	
Accuracy	0.02% FSR	
Resolution	0.1㎐	
Memory	6,000 point read / record	32,000 point read / record

4. MEMS mini logger

ACE-900 MEMS sensor mini logger is a low-cost, high-efficiency data logger that can measure automation for a long time by concerting 1 channel of MEMS sensor.
It is a battery-powered high performance logger in the field for safely diagnosis or in a small installation.
It is powered by class D alkaline batteries and can be measured for 6 months without battery replacement.

Model	ACE-900
Applied sensor	1ch MEMS sensor
Resolution	18 bit
Accuracy	±0.05% FSR
Memory	6,000 point read / record
Input	DC 3.0V

5. VW readout unit

ACE-800 vibrating wire readout unit is the smallest, and high quality product in the world. It can be accessed to vibrating wire sensor. ACE-800 is the best class type product that has no anxiety of defect by using four membrane switches, it is easy to measure due to concurrent display mode, the remaining battery lifetime, RTD, the thermistor temperature and the selected frequency units by using the large screen.
ACE-800 also can implement the measurement at night time with backlight function, and it can be used for 40 hours continuously with one time charge, and it is the world best product that can be used in any unfavorable condition because of being manufactured with waterproof ABS case.

Model	ACE-800
Applied sensor	Vibrating wire sensor
Range	450~6,000㎐
Displayed unit	㎐, ㎲ec, 10^3㎐^{2}, ℃, ㎌0.391, ㎌0.7756, ㎌3.304, ㎌4.062
Resolution	0.1㎐ / temperature sensor 0.1℃
Accuracy	0.02% FSR

6. VW data recorder

ACE-1000 VW data recorder for the specialist that can read VW sensor, store by its number, and transmit the data to computer by RS-232 communication and the exclusive program. It is the data logger with high reliability that can store 4,000 points of measured values into max. 64 pieces of data set.
It displays 4 types of engineering mode such as the ㎐, 10^3㎐^{2}, ㎲ec, temperature with large screen, and built in backlight function, auto power break function.
ACE-1000 adopts the nickel hydrogen battery to measure for 30 hours, and ABS case for waterproof and impulse endurance.

Model	ACE-1000
Applied sensor	Vibrating wire sensor
Data capacity	4,000 data point memory in max. of 64 data sets
Range	450~6,000㎐
Displayed unit	㎐, 10^3㎐^{2}, ㎲ec, ℃, ㎌0.3911, ㎌0.7756, ㎌3.304, ㎌4.062
Resolution	0.1㎐ / temperature sensor 0.1℃
Accuracy	0.02% FSR

7. FSG readout unit

ACE-600 is normally called as strain meter with the readout for exclusive reading that can read foil strain gage sensor.
It is highly reliable product that microstrain and remaining battery lifetime are displayed at same time on large LCD screen, and that backlight function and waterproof function is equipped.
It can implement measurement for 20 hours continuously, battery replacement is not required until lifetime being finished, and it adopts the impulse endurance ABS case.

Model	ACE-600
Applied sensor	FSG(foil strain gage) sensor
Bridge circuit type	Full bridge, Half bridge
Input resistance	120Ω , 350Ω
Resolution	1×10^6 strain
Accuracy	±0.1% FSR

8. ELS readout unit

ACE-1500 ELS readout unit is a subminiature readout unit which can be connected to ELS sensor. ACE-1500 is possible to measure accurately because of amplification and stabilization cricuit. ACE-1500 can read model 5420 ELS beam sensor and MEMS sensor or potentiometer of mV output. the function of ACE-1500. are battery life display, mV, thermistor, backlight, continuous 14 hours operation and waterproof ABS plastic case.

Model	ACE-1500
Applied sensor	ELS sensor, MEMS sensor, potentiometer
Range	−5,000㎷~5,000㎷
Resolution	0.1㎷
Accuracy	±0.1% FSR
Displayed unit	㎷, ℃

9. VW Display logger

ACE-1100D display logger is a 1ch logger that is a highly efficient data logger that can be used for long-term automated measurement and is also a displayer.
Depending on the function key selection, data storage, data display, data display and storage can be selected, and automatic measurement can be performed for six months by connecting a vibration wire piezometer, crackmeter, inclinometer and strain gage. ACE-1100D can be used by connecting battery or always power.

Model	ACE-1100D
Applied sensor	1ch vibrating wire sensor
Range	450~6,000Hz
Resolution	0.1Hz / temperature sensor 0.1℃
Accuracy	0.02% FSR
Memory	32,000 point read/record
Display	16×2chareter LCD
Display unit	Engineering unit, Hz, ℃, bettery remains & memory remains

10. Water level logger

ACE-1100L water level logger can be installed in the lake, water purification plant, dam and so on by integrating the battery and pressure sensor and installing the integrated data logger under the water surface to read and save the water level and temperature.
The data logger case is a high-performance product that can automatically measure STS 316 stainless steel for about 6 months.

Model	ACE-1100L
Applied sensor	1ch vibrating wire sensor(inside enclosed capsule)
Range	450~6,000Hz
Resolution	0.1Hz / temperature sensor 0.1℃
Accuracy	0.02% FSR
Memory	32,000 point read/record
Case material	STS 316 stainless steel

11. Pneumatic readout unit

ACE-2500 pneumatic readout is easily connected through one touch coupler of pneumatic sensor.
The nitrogen gas pressure acting on the sensor can be measured up to maximum of 20 bar. ACE-2500 pneumatic readout consists of output device and pressure sensors to measure the gas pressure and nitrogen gas tank inside of the shock resistance water-proofing case.

Model	ACE-2500
Applied sensor	Pneumatic sensor
Range	0~20bar (290 psi)
Resolution	Gage-dependent
Accuracy	±0.1 % FSR (0.02bar)
Internal tank	Ø80×320㎜ (1.0 liter) Nitrogen gas less than 3ppm H_2O
Dimensions	185×300×450㎜

12. Water level meters

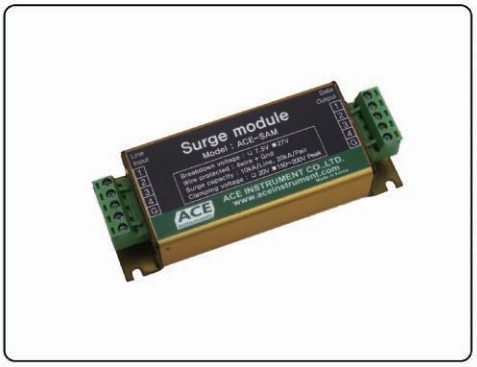
Model **4650, water level meter** consists of a reel frame with a buzzer and a light, a graduated 50m~500m tapes and a probe.
As the tape is covered with fiberglass jacket, preventing from corrode and contamination. As the linked part between probe and tape are processed in framework, the semi-permanent precision measuring is possible without a risk of breaking the wire and a short. In case of using PVC stand pipe, it can be used after installing the filter tip.

Model	4650	4550 (magnetic extensometer combined)
Range	50m~100m / 150m~500m	
Tape resolution	1㎜	
Weight	2.5~15㎏	
Density / Material	50㎛ / polyethylene filter or ceramic filter	
Dimensions	152(W)×278(L)×282(H)㎜ / 400(W)×400(L)×400(H)㎜	

13. Magnetic extensometers

The magnetic extensometer is used to measure a settlement or a heave in fills, foundations and dams.
Magnetic extensometer consists of sensing magnets, a magnet indicator, an access pipe, telescopic sections and an end is anchored in stable ground, the depth of each magnet is referenced to a ring magnet that is fixed to the of the access pipe bottom of the access pipe. The sensing magnets include plate magnets, spider magnets and ring magnets. When a probe is lowered down inside the access pipe and enters a magnetic field, the lamp turns on and the buzzer rings. The tape is graduated in millimeter. The tape graduations refer to the depth of the magnet.

Model	4680	4550 (water level combined)
Range	50m~100m / 150m~500m	
Resolution	1㎜	
Weight	2.5~15㎏	
Dimensions	152(W)×278(L)×282(H)㎜ / 400(W)×400(L)×400(H)㎜	



14. Surge module

ACE-SAM is surge module that built in diode, arrester, protective PCB to remove the plasma and excess-current through the cable by the strong thunderbolt.
On the site that data logger with sensor is very important, and that the semi-permanent measuring is required, ACE-SAM has to be attached on the sensor or logger.

Model	ACE-SAM
Applied sensor	All type sensor
Break down voltage	5V or 27V
Peak current	10kA / 820㎲
Temperature range	-20~70℃
Response speed	Less than 1 nano -sec

15. Voltage amplifier

VA10 voltage amplifier is a device for restoring the strength of the measured voltage caused by the increase of the resistance of the cable core thickness and the drop of the DC voltage.
The output voltage of the voltage amplifier is normally DC12V and should be attached to the cable extension every 500m for long distance transmission.

Model	VA10
Applied sensor	mV sensor
Output voltage	DC12V
Min, amp voltage	DC3.3V
Max. Resistance	60Ω
Material	AL diecast

16. Universal terminal boxes

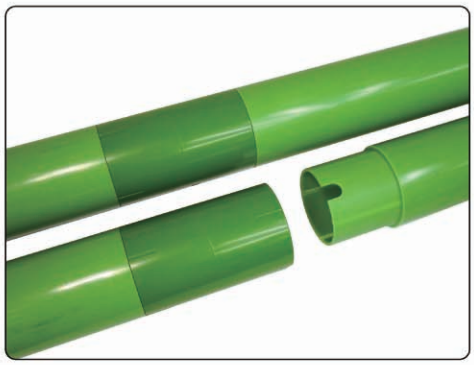
Model **7012** and **7024 Universal terminal box** are used to connect all type electrical sensors up to 12 or 24 sensor. The sensors in an adjacent area connect signal cables to a terminal box. It provides saving for cost, the reduction of measuring hours and keeping performance of sensors. Model 7024 is useful in the large field or on the ground, which has lots of sensor cable capabilities, as it is able to connect to the maximum 24EA sensors.

Model	7012	7024
Applied sensor	All type	
Connectional channel of sensor	Up to 12EA	Up to 24EA
Dimensions	280×190×180㎜	350×250×180㎜
Weight	2.0㎏	3.0㎏
Material	Glass fiber reinforced ABS	

17. RC casings

Model **RC casings** is highly reliable and precise product and coupling is not required for connecting the casing. It is manufactured the guide groove inside of the casing with the broaching machine. It is manufactured using precision CNC lathe with non recycled virgin of ABS resin. The rapid installation is the big advantage because it is designed as snap in type. So, the operation efficiency is very high.

Model	RC 70	RC 85
Diameter	Ø59 × Ø70㎜	Ø73 × Ø85㎜
Cutting length	1,555㎜ / 3,055㎜	
Spiral angle	Less than 0.3° / 3m	
Load test	More than 600㎏·f	



18. SC casings

Model **SC casings** is, as standard casing, highly reliable and precise product that the connected part between guide groove and coupling inside of the casing is processed.
This product needs the coupling, and the external diameter of coupling is similar to the external diameter of the casing. This product is more fitted when the setting depth is deep, In case of installation, ABS solvent, POP rivet, and mastic tape are required.
This product is highly reliable product that the proper intensity, the softness, and the twisted angle is guaranteed.

Model	SC 70	SC 85
Diameter	Ø59 × Ø70㎜	Ø73 × Ø85㎜
Coupling O.D.	Ø70㎜	Ø90㎜
Cutting length	1,500㎜ / 3,000㎜	
Spiral angle	Less than 0.3° / 3m	
Load test	More than 320㎏·f	

19. DC casings

DC casing is the high-precision casing which the guide grooves inside of inclinometer casing and the connecting parts of the coupling are proceed by a broaching machine. The outside surface of DC casing is proceed by CNC lathe, and it is finished by O-ring. DC casing was designed as snap-in type. So after taking off the protective tube of O-ring, it can be directly inserted. DC casing is possible to install quickly. ABS bond is unnecessary. And to rivet and to tape is unnecessary because DC casing is waterproof by O-ring.

Model	DC 70	DC 85
Diameter	Ø59 × Ø70㎜	Ø73 × Ø85㎜
Cutting length	1,555㎜ / 3,055㎜	
Spiral angle	Less than 0.3° / 3m	
Load test	More than 320㎏·f	

20. WC casings

WC casing is manufactured the guide groove inside of the casing with the broaching machine and using precision CNC lathe with non recycled virgin of ABS resin. The rapid installation is the big advantage because it is designed as snap in type. So, the operation efficiency is very high. It is not required following process such as rivetting or taping. The reasons are that it uses wire connecting type which can connect fast and O-ring for waterproof. There are no protrusion at casing connection area.

Model	WC 70	WC 85
Diameter	Ø59 × Ø70㎜	Ø73 × Ø85㎜
Cutting length	1,555㎜ / 3,055㎜	
Spiral angle	Less than 0.3° / 3m	
Load test	More than 230㎏·f	

21. FC casings

FC casing is cut into 3m length with a casing finished in a plastic extruder. It is a flexible product with twist angle of less than 0.5° / 3m and rigidity of 250㎏·f or more. extrusion casing are useful when installation depth is less than 20m.

Model	FC 70	FC 85
Diameter	Ø59 × Ø67 × Ø70㎜	Ø73 × Ø81 × Ø85㎜
Cutting length	3,000㎜	
Spiral angle	Less than 0.5° / 3m	
Load test	More than 250㎏·f	

22. Digital vertical inclinometer

Digital MEMS vertical inclinometer consists of a probe, a bluetooth cable reel and a cable guide. download and use native app for your android smartphone. This product has the ultimate quality of ultra-light, high accuracy, high reliability and high response. the cable reel and smartphone are linked with bluetooth and can use for 40 consecutive hours. the operating app has data storage, data viewing and e-mail sending function.

Model	5481
Applied sensor	2-MEMS sensor
Range	±30° (horizontal)
Resolution	0.005㎜ / 500㎜
Accuracy	±2㎜ / 25m
Data logger	Android 4.3 or later OS/smart phone

23. Digital horizontal inclinometer

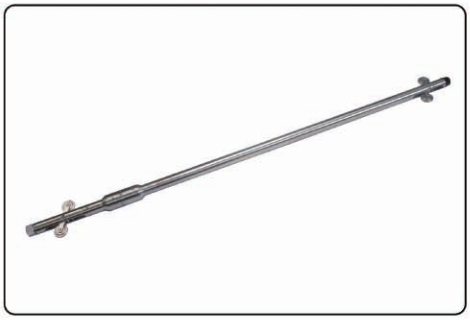
Digital horizontal inclinometer is the device for precisely measuring vertical displacements such as subsidence or uplift in banks and road soil part. It consists of horizontal probe, bluetooth reel, and the app for android mobile phones which is required to be downloaded. The best quality product features ultra lightweight, high precision, high reliability, and high response. The cable reel and a smart phone are linked with each other via bluetooth. The product can be used 40 hours continuously. The app has the functions of saving data, viewing data, and sending an e-mail message.

Model	5481H
Applied sensor	1-MEMS sensor
Range	±30° (vertical)
Resolution	0.005㎜ / 500㎜
Accuracy	±2㎜ / 25m
Data logger	Android 4.3 or later OS/smart phone

24. Digital slope inclined inclinometer

Digital slope inclined inclinometer has 2-MEMS sensor installed at 45° of slope internally. It is used for measuring subsidence or uplift in the slope of dam or in the slope of the stiffener of retaining wall. It consists of slope probe, bluetooth reel, and the app for android mobile phones which is required to be downloaded. The best quality product features ultra lightweight, high precision, high reliability, and high response. The cable reel and a smart phone are linked with each other via bluetooth. The product can be used 40 hours continuously. The app has the functions of saving data, viewing data, and sending an e-mail message.

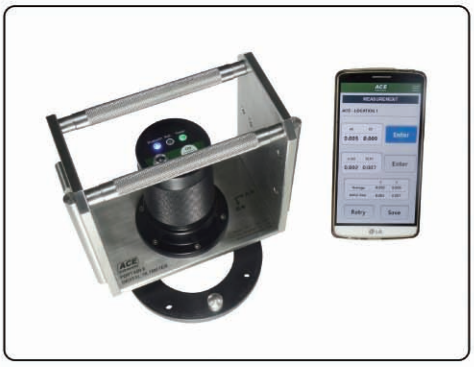
Model	5481T
Applied sensor	2-MEMS sensor
Range	±30° (45° inclined plane)
Resolution	0.005㎜ / 500㎜
Accuracy	±2㎜ / 25m
Data logger	Android 4.3 or later OS/smart phone



25. Spiral sensor probe

Model **5480P spiral sensor probe** 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.

Model	5480P
Applied sensor	Disposable integrated potentiometer
Range	±10°
Resolution	±0.01°
Accuracy	±0.5% FSR
Range length	1,000㎜



26. Portable digital tiltmeter

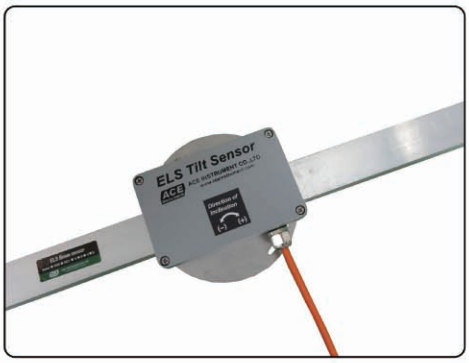
Portable digital tiltmeter is a safety diagnostic measuring instrument for measuring the stability of building structure. It is light and simple with built-in 2-MEMS sensor, data logging circuit, and bluetooth circuit in the tiltmeter. Native app is downloaded and used on android smartphone, so data loggers and jumper cables are unnecessary and provide innovative and convenient usability. The digital tiltmeter and smartphone are linked with bluetooth and can use 17 consecutive hours. The operating app has data storage, data viewing, and e-mail sending function.

Model	5411
Applied sensor	2-MEMS sensor
Range	±30°
Resolution	0.0005° (2 arc seconds)
Accuracy	±3 arc seconds
Data logger	Android 4.3 or later OS/smart phone
Tilt plate	50% fiber reinforced plastic, stainless steel

27. ELS tilt sensor

Model **5440 ELS tilt sensor**, which is high precise electrolyte tilt sensor, is attached to the aluminum beam case. Basically, the range of ELS tilt sensor is only ±1°~±3°, but it is possible to spread up to ±4° through out adjusting knob after installation.

Model	5440
Applied sensor	ELS sensor (electrolytic level sensor)
Range	±1~3°
Resolution	1~3 arc seconds
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR



28. ELS beam sensors

Model 5420 series are designed with **ELS tilt sensor** put on aluminum pipe which has 1~3m of gage length. These are possible to measure the displacement (subsidence or uplift) through out calculation as gage length (L) times tilt and size or outline for subsidence or uplift when it is connected at end of model 5420.

Model	5420V (vertical)	5420H (horizontal)
Applied sensor	ELS sensor (electrolytic level sensor)	
Range	±1~3°	
Resolution	1~3 arc seconds	
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	
Gage length	1~3m	

29. VW inclinometer

VW inclinometer 1410 has superior the reproducibility, responsibility, and resolution because of transmitting the frequency signal, and so quite a precise measurement is possible as being affected by the variation of the temperature.
It can precisely measure the size of horizontal, vertical displacement connecting it on the 1~2m length of beam. And especially, it is useful when it is installed on the place that is affected by electrical noise such as subway etc.

Model	1410	
Applied sensor	Vibrating wire sensor	
Range	±5°	±10°
Resolution	5arc seconds	10arc seconds
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	

30. FSG inclinometers

FSG type inclinometer 4410 is attached the foil strain gage inside of the housing. There are ±3° and ±5° inclinometer sensors and these transmits the variation of the resistance in portion to the size of the inclination angle of structures or bridges.
It is sealed after the housing precisely being processed; the silicone oil is injected inside of the housing for protecting against the impulse. So it is especially useful when being installed on sea place that the temperature variation and impact is significant.

Model	4410	
Applied sensor	FSG (foil strain gage) sensor	
Range	±3°	±5°
Rating output	1㎷/V (1,000×10^{-6})	
Accuracy	±0.1% FSR	
Resistance	350Ω	

31. MEMS inclinometers

Model **5310 MEMS inclinometer** has MEMS sensor, it supply very excellent resolution and accuracy in real-time.

Model	5310 (1axis)	5310B (2axis)	5310A (1axis)	5310AB (2axis)
Applied sensor	MEMS sensor (micro electro mechanical system)			
Range	±5° / ±10°			
Output	-5V~+5VDC		4~20mA	
Accuracy	±0.1% FSR			
Non-linearity	±0.5% FSR			

32. VW vertical multi point inclinometers

Model **1430, VW vertical multi point inclinometer** is the device that the several VW sensors are connected using ass'y and the extension tube.
Model **1430** can achieve semi permanent measurement, since it is precisely manufactured using the waterproof capacity of 20 bars and stainless corrosion resistant material.

Model	1430U (uniaxial)	1430B (biaxial)
Applied sensor	Vibrating wire sensor	
Range	±5° / ±10°	
Resolution	5arc seconds / 10arc seconds	
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	

33. ELS/MEMS vertical, horizontal multi point inclinometers

Model **4480, ELS type vertical, horizontal multi point inclinometer** consists of several ELS sensors, model 4490 MEMS type inclinometer consists of several MEMS sensor, the guide wheel, the extension tube, and the inclinometer casing. Model 4480, 4490, the remote measurement or unmanned operation is possible using data logger. This product is manufactured with the corrosion resistant stainless steel for waterproof and rust inhibition.

Model	4480	4490 (single or biaxial)
Applied sensor	ELS sensor (electrolytic level sensor)	MEMS sensor
Range	±10°	±10° / ±30°
Resolution	10arc seconds	
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	

34. Serial type multi point inclinometers

The **serial type multi point inclinometer** with built-in serial communication chip connect multiple MEMS sensors through signal cables to save data sequentially.
The serial type multi point inclinometer has a simple connection for data logger, and can easily be installed in field. Featuring water-proof, the product is designed with vertical, horizontal, uniaxial and biaxial types.

Type	Horizontal (uniaxial)	Vertical (uniaxial)	Vertical (biaxial)
Model	4490HS	4490MS	4490BS
Applied sensor	MEMS sensor		2MEMS sensor
Range	±10°		
Resolution	10 arc Seconds		
Accuracy	±0.1% FSR		
Gage length	Selection of standard length 1, 2, 3m		

35. Pendulum system

The **Pendulum system** of model 8100A can measure the horizontal relative displacement between a dam and rock foundation at a vertical line. After installation of direct or invert type of pendulum system, it is required to use charge coupled device (CCD) in order to decide the wire position inside of readout and send measured data to automatic readout.

Model	8100A
Applied sensor	CCD (charge coupled device)
Range	±75㎜ (manual) / 50㎜ (automatic)
Resolution	0.1㎜
Accuracy	±0.1㎜
Components	invert pendulum, direct pendulum, wire, portable pendulum readout, automatic readout

36. VW load cells

VW load cells are divide into 2 types as hollow type that has hollow interior, and strut specific solid type for the measuring the load being applied to support cable (strand), strut and earth anchor of the structures. We manufacture load cell of up to 1,500 ton. According to the applied load size, 3~6 pieces of VW strain gage is built in load cell, and it is manufactured into the highly reliable product through the validity verification by the proved universal testing machine.

Model	1102 ~ 1170S
Applied sensor	Vibrating wire sensor
Rated capacity	20~1,000 ton·f
Safe overload	150% FSR
Resolution	0.025% FSR
Accuracy	±0.1%~±0.5% FSR

37. FSG load cells

FSG type load cells are designed hollow type for the measuring the load being applied to tie back, rock bolt, earth anchor. We manufacture load cell of up to 1,000 ton.
Even if the eccentric loading is applied to FSG type load cells, it independently readout into the automatically compensated value. And it can be used optimally when the pile load test or the dynamic measurement is being required. It is highly reliable product through the validity verification by the proved universal testing machine.

Model	4102 ~ 4170S
Applied sensor	FSG sensor (foil strain gage) / 4~16 gages
Rated capacity	20~1,000 ton·f
Resistance	350Ω
Safe overload	120% FSR
Rating output	1.5㎷/V(1,500×10^{-6})
Accuracy	±0.1~±0.5% FSR

38. Hydraulic load cells

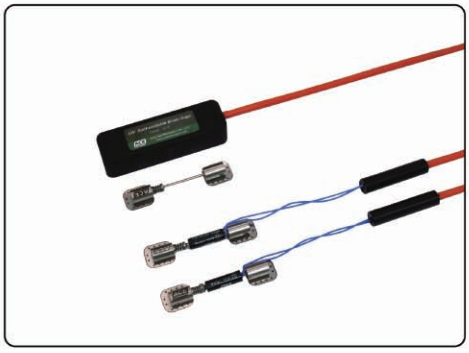
Hydraulic load cell are designed to directly check the capacity of load at the tieback, rock bolt, and timbering wall that are used as the timbering system.
Hydraulic load cell are directly connected the pressure sensor of analog type on the main frame of cell. The pressure sensor is revised by our universal testing machine for calibrating as ton·f unit. And it was designed as Europe type that is optimum to use at the severity site.

Model	AH50 P.R	AH75 P.R	AH100 P.R	AH150 P.R	AH200 P.R
Rated capacity(ton·f)	50	75	100	150	200
Applied sensor	Analogue manometer				
Safe overload	120% FSR				
Resolution	2 ton·f				
Accuracy	±1.0% FSR				
Thermal shift	0.25% FSR / ℃				

39. Hydraulic cells for pile load test

We provide **hydraulic cell and hyd. pump units** which are for pile load test.
We provide customized single acting and double acting hydraulic cell which are for 400 to 1,500ton·f (commom pressure 1,500bar)
These hydraulic cells are made by our CNC turn-mill center machines. Hyd. cells are including leak tightness preventers and super high pressured airtight design. Also, we take 100% load test for each cell before consignment.

Type	Single acting	Double acting
Common pressure	1,500 bar	
Load	400 / 600 / 800 / 1,000 / 1,500 ton·f	
Allowable pressure	2,000 bar	
Stroke	150㎜ 〈optional 250㎜〉	



40. VW spot weldable strain gages

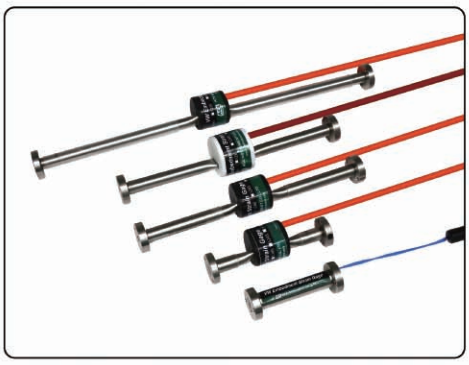
1210, VW spot weldable strain gage, is designed as the small size so that it can measure the strain at the steel structure such as bridges, piles, tunnel linings and buildings, after attaching it with spot welding and epoxy. Model **1215** is suitable for tie back, and soil nail as having the small structure that is connected plucking coil on the surface of gage. **1215A** and **B** are possible to measure wide range. **1215C** is possible to adjust it s range of 10,000$\mu\varepsilon$.

Model	1210	1215(mini)	1215A(large range)	1215B(large range)	1215C
Applied sensor	Vibrating wire sensor				
Range	3,300 microstrain		5,000 microstrain	10,000 microstrain	
Resolution	0.5 microstrain		1 microstrain	2 microstrain	
Accuracy	±0.1% FSR				
Non-linearity	±0.5% FS				

41. VW weldable strain gages

VW weldable strain gages is measuring gages to measure the stress of bridge, building, structure, Model **1220** can measure the stress or strain of the member such as strut, pile. Exactly model **1222** is designed to long gage type product with the length of 250㎜. It can measure more exactly when established in the direction of member length (measure of longitudinal strain). Model **1224** is useful if being applied in testing the concrete file improving steel as manufactured with the structure for high temperature able to were endurable at 200℃. Model **1220A** is for large range type.

Model	1220	1222(long gage)	1224(high temp.)	1220A(large range)
Applied sensor	Vibrating wire sensor			
Range	3,000 microstrain			5,000 microstrain
Resolution	0.5 microstrain			1 microstrain
Accuracy	±0.1% FSR			
Non-linearity	±0.5% FSR			



42. VW embedment strain gages

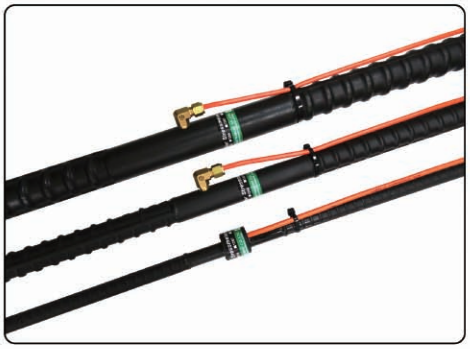
VW embedment strain gage is designed to measure strain in reinforced concrete and mass concrete. Short gage length of Model **1230** is designed to be useful at tunnel. The model **1230B** is useful for measuring strain toward tangential and radial direction tunnel shotcrete. The model **1235** of the super small size is usefully used when mock tested with the gage of 51.5㎜ or there is the limit on the condition of establishment. The model **1243** is useful if being applicable in testing the concrete file improving steel as manufactured with the structure for high temperature able to were endurable at 200℃. The model **1245** as the gage with 250㎜ shows the excellent performance more than normal type model since the seal or compression is great big at the prestressed concrete. **1240A** is for large range type.

Model	1230 (tunnel)	1230B (tunnel)	1235 (mini)	1240 (standard)	1245 (long gage)	1243 (high temp.)	1240A (large range)
Applied sensor	Vibrating wire sensor						
Range	3,000 microstrain						5,000 microstrain
Resolution	0.5 microstrain						1 microstrain
Accuracy	±0.1% FSR						
Non-linearity	±0.5% FSR						

43. FSG strain gages

Model **4240** is designed to measure the effective displacement precisely that operates inside of concrete structure by laying into reinforced concrete or concrete structure. Specially, it is useful for real time measurement when dynamic measurement is needed for measurement of strain after curing of mass concrete, or for the object of study experiment.

Model	4240 (embedment)	4220 (surface mount)
Applied sensor	FSG (foil strain gage) sensor	
Range	±5,000 microstrain	
Rating output	5㎷/V(5,000×10^{-6})	
Accuracy	±0.5% FSR	
Resistance	350Ω	



44. VW rebar stressmeters

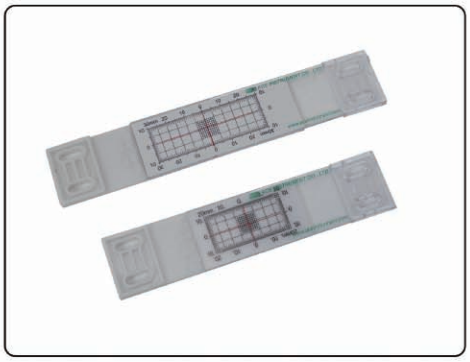
VW rebar stressmeters consist of a VW transducer, which are load sensing element and two lengths of reinforcing bar. The local compressive or tensile strain are induced directly into the reinforcing bar and monitored with a coaxially transducer. FSG sensor is used in model 4260 and 4290.

Model	1265(D13)	1260(D25)	1290(D32)	4260(D25)	4290(D32)
Applied sensor	Vibrating wire sensor			FSG sensor (foil strain gage)	
Range	3,000 microstrain			±5,000 microstrain	
Resolution	0.025% FSR				
Accuracy	±0.1% FSR			±0.5% FSR	
Non-linearity	±0.5% FSR			±1.0% FSR	

45. VW strand strainmeter

Model **1315 VW strand strainmeter** are useful to measure magnitude of force or elongation, size of earth anchor or strand or support cable. It consisted of connection bracket that can attach to model 1315 increasing sensor department and cable and can attach easily to strand.

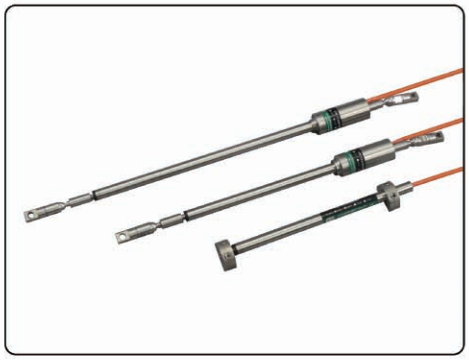
Model	1315
Applied sensor	Vibrating wire sensor
Range	30,000 microstrain
Resolution	0.025% FSR(0.01㎜)
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR



46. Plastic crackmeters

Plastic crackmeters is suitable to use in a site which is not needed in high-accuracy instrumentation site with lower price of crack monitor instead of sensors.
Other company's product is made of acrylic, so it is broken easily. But because our plastic crack monitor is made of polycarbonate, it is very strong as metal and never broken.

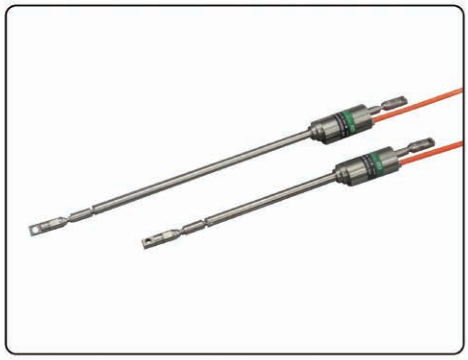
Model	SC-100A	SC-100B
Range	±20㎜ (L,R), ±10㎜ (U,D)	±30㎜ (L,R), ±10㎜ (U,D)
Resolution	1㎜ (grid type)	
Dimensions	32×102×5㎜ (duad)	32×132×5㎜ (duad)
Material	Polycarbonate	



47. VW crackmeters

VW crackmeter are useful for measuring displacement at joints, and cracks in concrete structures or rock. The VW crackmeters are equipped with a temperature device for compensating for temperature variation.
We recommend using 1322 in demanding precision measuring structure.

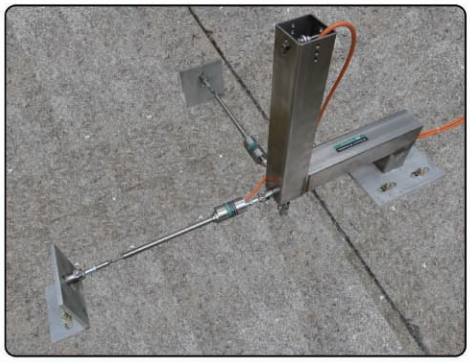
Model	1322(miniature)	1325(miniature)	1330	1340
Applied sensor	Vibrating wire sensor			
Range	5㎜	25㎜	50㎜	100㎜
Resolution	0.025% FSR			
Accuracy	±0.1% FSR			
Non-linearity	±0.5% FSR			



48. VW waterproof crackmeters

VW waterproof crackmeter is an epoch-marking waterproof product which works at 20bar. It is designed with STS 316 so that it can measure displacement at dam site which is close or inside of sea site.

Model	1330W	1340W	1341W	1342W
Applied sensor	Vibrating wire sensor			
Range	50㎜	100㎜	150㎜	200㎜
Resolution	0.025% FSR			
Accuracy	±0.1% FSR			
Non-linearity	±0.5% FSR			
Waterproof	250m H_2O (25bar)			



49. VW 3D jointmeters

VW 3D jointmenter is for 3 axial and it is useful to measure 3-dimentional structure such as concrete dam joint or crack at tunnel and tank. It is designed for waterproof system by STS316 so that it can use at sea site.

Model	1330W-3D	1340W-3D	1341W-3D	1342W-3D
Applied sensor	Vibrating wire sensor			
Range	50㎜	100㎜	150㎜	200㎜
Resolution	±0.025% FSR			
Accuracy	±0.1% FSR			
Non-linearity	±0.5% FSR			
Components	Target, sensor bracket, anchor bolt			
Material	STS304, STS316(L) for sea side			

50. VW compression displacement sensors

VW compression displacement sensor is sensor designed to measure displacement of straight such as LVDT or potentiometer.
The spring is applied at end of VW compression displacement sensor and it allows to measure up to 0.01㎜ at pile load test and crack.

Model	1325C	1330C	1340C
Applied sensor	Vibrating wire sensor		
Range	25㎜	50㎜	100㎜
Resolution	0.025% FSR(0.01~0.02㎜)		
Accuracy	±0.1% FSR		
Non-linearity	±0.5% FSR		

51. FSG crackmeters

FSG type crackmeter is composed of sensor part and anchor fixed part. Anchor should be fixed by anchor bolt or grouting in the both ends of crack across the crack. Model 4330 FSG type crackmeter is provided with correction record by sensors, by digital calibrator it correct electric resistance feature in proportion to displacement. Therefore It guarantees confidence and reproducibility.

Model	4330	4331
Applied sensor	FSG(foil strain gage) sensor	
Range	5㎜	25㎜
Rating output	1㎷/V (1,000×10^{-6})	4㎷/V (4,000×10^{-6})
Accuracy	±0.5% FSR	
Resistance	350Ω	

52. Mechanical 3D jointmeters

Model **6310** is measuring kit for 3 axial and it is useful to measure 3-dimentional structure such as dam site by dial guage.

Model	6310		
Range	±12.5㎜	±25㎜	±50㎜
Resolution	0.01㎜		
Material	SM 45C steel (standard)	STS 316 (sea side)	

53. VW soil strainmeters

Model **1360** is designed to measure the magnitude and rate in underground movement in dam. The strainmeter employs a VW displacement gage, which has 150㎜ to 300㎜ range, to stainless steel rod inside housing, and anchors, which is composed 5 meters of 1 kit. The VW soil strainmeter converts lateral movement to frequency signal.
Model **4360** has a potentiometer inside, and same structure and functions with VW type.

Model	1360		4360
Applied sensor	Vibrating wire sensor		Potentiometer
Range	150㎜	300㎜	100~300㎜
Resolution	0.03㎜	0.06㎜	Infinite
Accuracy	±0.1% FSR		
Non-linearity	±0.5% FSR		

54. VW jointmeters

The model **1310, VW surface mount jointmeter** measures the magnitude of and trend of displacements in dams, bridge piers and abutments.
Model **1310** consists of a VW transducer, mounting brackets for installation and anchor kits. The VW transducer is available uniaxial and triaxial versions. The installation procedure is similar for both jointmeters. The model **1320 VW embedment jointmeter** is used to measure orients, magnitude of and rate of the movement in concrete structures such as dams, foundations and abutments using with installation kits.
It is composed of a VW transducer, a sensor socket and target for installation kit.

Model	1310 (surface mount type)	1320 (embedment type)
Applied sensor	Vibrating wire sensor	
Range	50㎜~200㎜	
Resolution	0.01㎜~0.04㎜	
Accuracy	±0.1% FSR	
Non-linearity	±0.5% F	

55. Electrical jointmeter

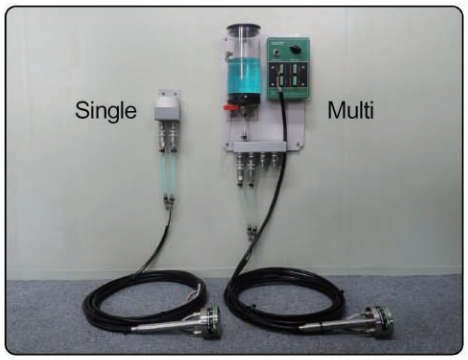
The Model **4315 electrical jointmeter** measures the magnitude of and trend of displacements in dams, bridge piers and abutments.
For accurate measurement, this model uses high-accurate potentiometer and it shows voltage (mV) under every different displacement by working site.

Model	4315
Aplplied sensor	Potentiometer
Range	25~150㎜
Resolution	Infinite
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR

56. Long range crackmeter

Model **5900, long range crackmeter** has wire to rotary potentiometer that can measure maximum 3m. It can measure displacement that can occur greatly in wall of apartment if is rock slope or cut off wall precisely.

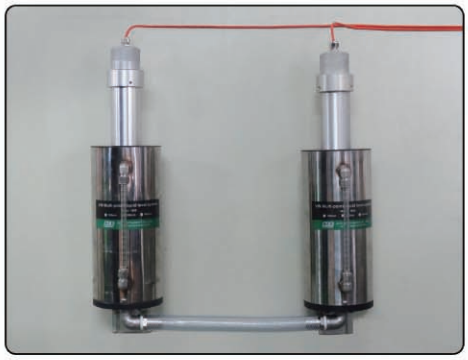
Model	5900
Applied sensor	Rotary potentiometer
Range	0.5m, 1m, 2m, 3m
Rating output	1kΩ
Resolution	Infinite
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR



57. VW settlement gage

Liquid settlement gage that have VW sensor can measure microscopic settlement or heave of construction site. Model **1810, VW settlement gage**, is are consisted of liquid feed tank kit, tube that liquid fills and VW pressure sensor and automation measure is available and long distance transmission of output signals is available.

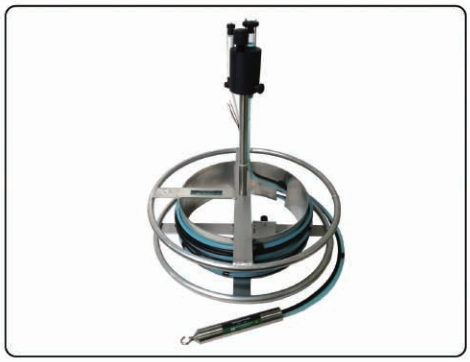
Model	1810
Applied sensor	Vibrating wire sensor
Range	0.7~2.0kg·f
Resolution	0.5~4.0㎜
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR



58. High sensitivity settlement systems

Model 1680, VW high sensitivity settlement system is designed to measure the delicate deflection in the bridge or pole and largely divided into 2 parts: reference water tank, monitoring vessel, and so on. In each monitoring vessel, buoy is attached onto VW force transducer. And reference water tank should be set up on the stable ground or structure. Model 1680 has got the wide measuring range compared to model 4660, and semi-permanent measuring is possible. Model **4660, electrical type** is very similar to model 1680, and due to LVDT or high level of potentiometer is built inside of the vessel, sensor directly detects the location change of the buoy. So it can detect the vertical displacement of 0.01㎜.

Model	1680			4660
Applied sensor	Vibrating wire sensor			LVDT or potentiometer
Range	100㎜	300㎜	600㎜	Standard : 100㎜, Optional : 50㎜
Resolution	0.02㎜	0.06㎜	0.12㎜	0.01㎜ (Infinitely)
Accuracy	±0.1% FSR			
Non-linearity	±0.5% FSR			



59. Settlement profiler

Portable settlement profiler can measure the settlement and uplift at bank, LPG or LNG tank, road, etc. There is a semiconductor sensor inside of probe and liquid tube is coiled at reel.

Model	5200
Applied sensor	Semiconductor pressure sensor
Range	10mH_2O
Resolution	0.01%FSR
Accuracy	0.1% FSR
Dimension	200×Ø35㎜(probe) / 200×Ø600㎜(reel)

60. Induction current extensometer

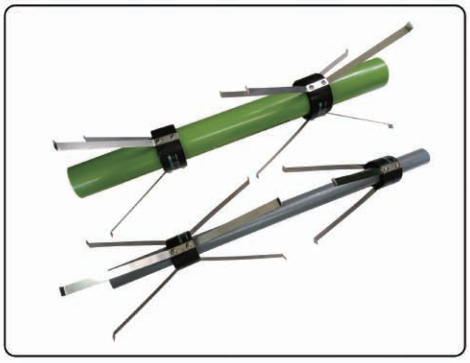
The Model **5600** is used to monitor settlement in excavations, dams, and embankments by accessing inside of inclinometer casing.

Model	5600
Applied sensor	Induction current type
Range	50m, 100m
Resolution	1㎜
Weight	2.5㎏, 4.5㎏
Dimentions	Probe : Ø42㎜ /152(W)×278(L)×282(H)㎜

61. Rail track monitoring system

ELS rail track monitoring system can precisely measure any settlement or twist of rails on railroad tracks. With any transformation on a railroad bed, the placed angle of tilt sensor as much as the changed amount of influenced X-axis. The angle of the sensor changes along with any change of sinking or rising of Y-axis to measure the length direction. We can also diagram the displacement value as graph use in RTM-PRO.

Model	ACE-RTM
Applied sensor	2-MEMS sensor
Range	±10°
Resolution	10arc seconds
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR



62. Magnetic sensors

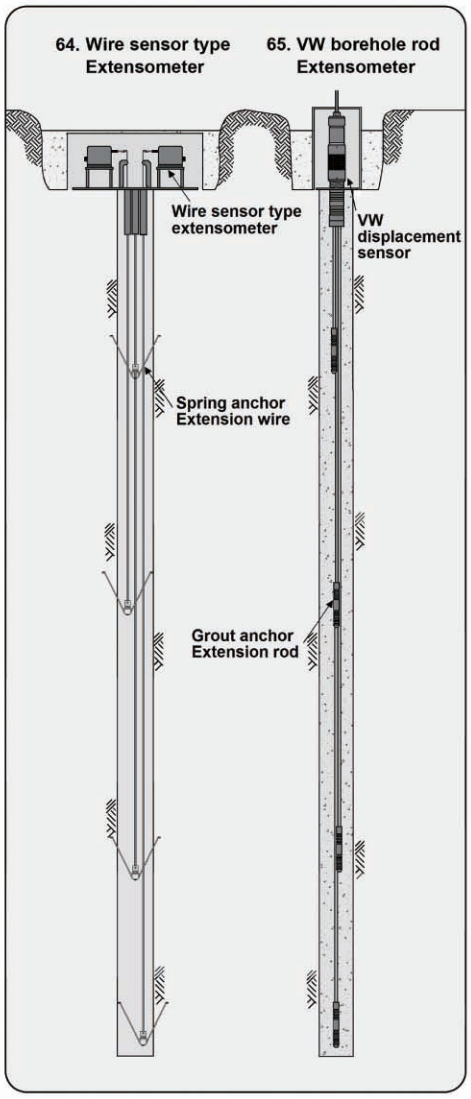
The magnetic extensometer measures a settlement or a heave in fills, foundations and dams. **Magnetic extensometer** consists of sensing magnets, a magnet indicator, an access pipe, telescopic sections and an end is anchored in stable ground, the depth of each magnet is referenced to a ring magnet that is fixed to the of the access pipe bottom of the access pipe. The sensing magnets include plate magnets, spider magnets and ring magnets.

Model			4680P	4680C	4680D
Sensing magnet	Ring magnet	To install at stable ground	for O.D 38mm PVC pipe	for O.D 70mm casing	for O.D 85mm casing
	Spider magnet	To install several pieces at each stratum			
	Plate magnet	To install at embankment			

63. USBR type settlement probe

Model **5010SP USBR settlement probe** type is designed to measure ground settlement and uplift.
Also, it is useful for accuracy elevation of inclinometer data.

Model	5010SP
Range	Inclinometer casing (ID:Ø50~Ø73㎜) which is applied telescopic section
Weight	3.3㎏
Accuracy	Ø40×600㎜



64. Wire sensor type extensometer

Model **4750**, **wire sensor type extensometer**, is consisted of wire displacement sensor for installation point, grouting anchor at foundation rock inside of borehole for fixing. It is also consisted of stainless wire and protective tube for connecting between wire sensor and grouting anchor.
Wire sensor has rotary type of potentiometer inside for high precision. It is optimized to measure accurate data and wide range. Also, this model has treated to waterprof.

Model	4750
Applied sensor	Rotary potentiometer
Range	500~3,000㎜
Resolution	Infinite
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR
Operating temperature	-20~80˚C

65. VW borehole rod extersometers / MPBX

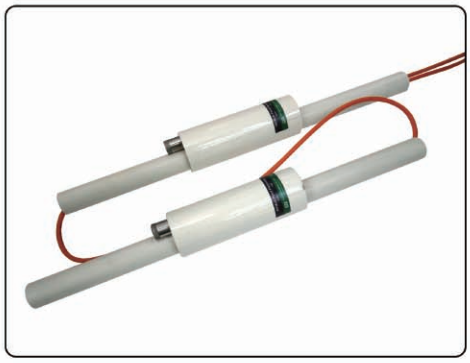
Model **1380 VW borehole rod extensometer** consisted of anchors, rods, protective tubes, with VW displacement sensors in housing. The VW transducer is available 50㎜ and 100㎜ range. If the VW transducer of 50㎜ range is used, it is turned its sleeve to set to 25㎜ long. It lie distance between extension and compression.
FSG sensor is applied to model 4380.

Model	1380		4380
Applied sensor	Vibrating wire sensor		FSG (foil strain gage) sensor
Range	50㎜	100㎜	50㎜
Resolution	0.01㎜	0.02㎜	0.01㎜
Accuracy	±0.1% FSR		±0.5% FSR
Non-linearity	±0.5% FSR		±1.0% FSR
Measuring point	standard : 1~6 points		

66. VW piezometers

The **VW piezometers** are designed to measure pore water and fluid pressure.
Model 1510 VW piezometer is designed to be embedded in earth fills and at concrete interfaces or inserted into boreholes and small diameter pipes. Model **1515** is designed for low pressure and model **1500S** and **1500US** are for subminiature. Model **1520** available for pushing directly into soft ground. Model **1530** VW transducer is designed to measure fluid pressure in pipelines for industrial and hydraulic. And it is useful to measure up stream pressure in a hydroelectric power plant. Model **1540** available for heavy duty. This model is specially manufactured to use in the site where semi permanent measurement is necessary like dam site.

Model	1510 (std)	1515 (low pressure)	1520 (push in)	1530 (pressure)	1540 (heavy duty)	1500S (miniature)	1500US (ultra miniature)
Applied sensor	Vibrating wire sensor						
Range	2~70㎏/㎠						
Resolution	0.025% FSR						
Accuracy	±0.1% FSR						
Non-linearity	±0.5% FSR						



67. VW multi point piezometer

Model **1500 VW multi point piezometer** can measure drilling hole internal stratification pore water pressure because it consisted of 1510 VW piezometer and PVC extension tube, housing to attach piezometer. This product can cope water leakage problem that appear when install several piezometer to 1 drilling hole and install is simple.

Model	1500
Applied sensor	Vibrating wire sensor
Range	2~70㎏/㎠
Resolution	0.025% FSR
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR

68. VW vented piezometer

Model **1560 VW vented piezometer** are useful at detailed survey time that atmospheric pressure revision unnecessary and thin having atmospheric pressure tube to signal cable. This product is useful to water level measurement of lake, river.

Model	1560
Applied sensor	Vibrating wire sensor
Range	2~70㎏/㎠
Resolution	0.025% FSR
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR

69. FSG/Semiconductor piezometer

FSG type piezometer was designed to measure pressure vessel or pipeline, embankment and pore water pressure and so on.
Specially, because dynamic measure is available, is suitable in study purpose or spot that need real time measure.
Model 4510 was designed to lay under the ground directly on embankment or foundation.
Semiconductor piezometer is used in model 4515, and very useful measure to low pressure.

Model	4510	4515
Applied sensor	FSG(foil strain gage) sensor	Semiconductor sensor
Range	2~ 35㎏/㎠	1~20㎏/㎠
Rating output	1㎷/V	4~20㎃ 2wire
Accuracy	±0.5% FSR	
Resistance	350Ω	

70. Lab. instruments

Model **4530 miniature piezmeter** and model **4950 miniature earth pressure cell** are a very useful product when need scale model test in research institute with engineering works connection learning of university.
This product becomes corrosion treatment by sensor that foil strain gage attaches by fixing accuracy and high authoritativeness and dynamic measure and long distance transmission are available.

Model	4530	4950
Applied sensor	FSG(foil strain gage) sensor	
Range	1~10kg/㎠	
Rating output	1�V/V (1,000×10⁻⁶)	
Accuracy	±0.5% FSR	
Resistance	350Ω	

71. Pneumatic piezometer

Model **2510** was designed so that value can measure hole's water pressure and pore pressure by inexpensive high authoritativeness piezometer for accuracy that is excellent read canceled pressure balanced value of nitrogen gas pressure. Reading is obtained by a **pneumatic readout (ACE-2500)**.

Model	2510
Applied sensor	Pneumatic sensor
Range	0~15kg/㎠
Resolution	0.001kg/㎠
Accuracy	±0.5% FSR

72. VW weir monitoring system

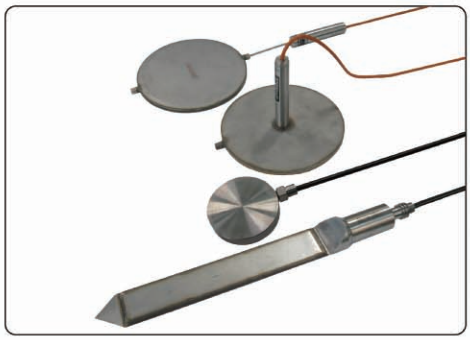
Model **1650 VW weir monitoring system** employs a VW force transducer and is sensitive to water level.
This consists of the VW transducer, a cylindrical buoy. assembly to detect water level, and a chamber to inject water. Water level in a chamber serves as buoyancy that is equal to adjacent water level.
When using it under weir monitoring system on the dam site. You have to apply them to accessories on V notch, wave filter and discharge weir and the size or installing place has to be consulted beforehand.

Model	1650
Applied sensor	Vibrating wire sensor
Range	300㎜, 600㎜, 1,500㎜
Resolution	0.025% FSR
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR

73. Stand pipe piezometer

Stand pipe piezometer is useful to receive precious data instead of using electrical transducer. consists of a reel frame with a buzzer and a light, a graduated 50m~500m tapes and a probe.
For use this to piezometer, after the filter tip and standpipe are installed down hole, it should be covered the around filter tip with sand. The top of the filter zone is sealed with bentonite to isolates the pore water at the tip. The upper bentonite zone is back filled to the surface with a bentonite grout to prevent vertical migration of water.

Model		4650
Water level meter	Range	50m~500m
	Tape resolution	1㎜
	Weight	2.5~15kg
Filter tip	Density / Material	50㎛ / polyethylene filter or ceramic filter
	Dimensions	Ø39×390㎜



74. VW earth pressure cells

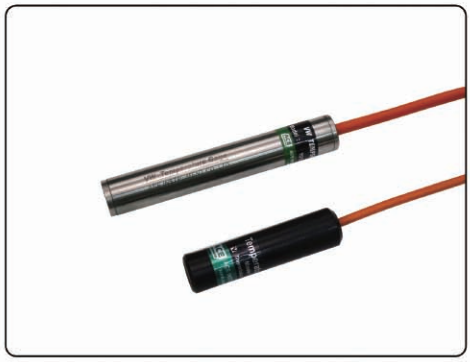
The VW earth pressure cells are used to verify design total pressure on the structures. Model **1910** is used to measure total pressure on the embankments, buildings, sheet piles and abutment of bridges. Model **1920** is designed to measure total pressure on retaining walls and slurry walls. It must be use with a hydraulic jack, a bearing plate and a reaction. Model **1930** is manufactured in a form that has VW strain gage inside of cell, it displays frequency signal and is useful to experiment of model designed to be small size of Ø114㎜. Model **1940** can be pushed attaching at the boring drill.
Model **1911** and Model **1921** are the compect type of OD 150㎜.

Model	1910	1911	1920	1921	1940	1930
	(standard)		(jack out)		(push in)	(VW strain gage)
Applied sensor	Vibrating wire sensor					
Range	2㎏/㎠~70㎏/㎠					20㎏/㎠
Resolution	0.025% FSR					
Accuracy	±0.1% FSR					±0.5% FSR
Non-linearity	±0.5% FSR					±1.0% FSR

75. FSG earth pressure cells

FSG type of earth pressure cells are useful on real-time measure when dynamic measure does requisitely in examination construction of censure consolidation special quality or study purpose. Model **4910** uses to measure whole virtual pressure acting to earth embankment, clam, building, relief rotation of bridge and sheet pile by standard type (O.D : Ø230㎜). Model **4920** was designed to measure whole virtual pressure acting in breast wall or slurry wall by jack out type (O.D : Ø230㎜). Model **4930** and model **4940** O.D : Ø100㎜ in dynamic measure such as limitation of establishment place and model test as useful.

Model	4910	4920	4930	4940
Applied sensor	FSG (foil strain gage) sensor			
Range	2~50㎏/㎠			
Rating output	1㎷/V (1,000×10^{-6})			
Accuracy	±0.5% FSR			
Non-linearity	±1.0% FSR			
Resistance	350Ω			



76. Temperature gages

Model **1010, VW temperature gage** consists of the strainless steel transducer body to which a VW sensor element is attached.
The frequency signal from VW temperature gage is very stable and accurate. Automatic measuring and long distance transmission are possible. Moreover, VW temperature gage is possible to measuring in semi-permanent, and it is manufactured in the structure of waterproof. Model **5550**, thermistor probe or RTD is the temperature gage that thermistor is built in it, it is useful for measuring the long range of temperature, and short period.

Model	1010	5550
Applied sensor	Vibrating wire sensor	Thermistor or RTD
Range	−40~150℃	−30~120℃
Resolution	0.03℃	0.1℃
Accuracy	±0.1℃	±0.5℃
Non-linearity	±0.5% FSR	

77. Multi point temperature gage

Model **5560 multi point temperature gage** is developed in the way of connecting multiple thermistors in each position of multi cable and applying plastic-finishing to its outside for waterproof. The multi point temperature gage is designed for measuring the curing temperature of each position in concrete dam or large-cast concrete.

Model	5560
Applied sensor	Thermistor
Range	−30~80℃
Resolution	0.1℃
Accuracy	±0.5℃
Waterproof	500mH_2O

78. Digital tape extensometer

Model **2350D tape extensometer** is mainly used to quickly and accurately measure small displacement between both walls, which are in opposite sides in excavation, tunnel, and mine s open-cut section, or between crown side and bottom side. Digital tape extensometer consists of a steel tape, a tension adjusting sleeve, a moving hook used in adjusting tension, and a digital gauge's scale.

Model	2350D
Applied sensor	Digital gage (Mitutoyo's, Japan)
Range	Standard 20m, optional 30m
Resolution	0.01㎜
Accuracy	±0.1㎜

79. VW convergence meters

Model **1345** is mainly used to understand any changes in size, ratio and tendency of tunnel, caused by constructing tunnels or underground structures. The main body of VW convergencementer is made of strong stainless material. The key products are composed of sensor part, stainless extension load and hook. It is a precise instrument, which measure inner section between 2 points by placing hooks at both sides' ends.

Model	1345	1346
Applied sensor	Vibrating wire sensor	
Range	0~50㎜	0~100㎜
Resolution	0.01㎜	0.02㎜
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	

80. Rock bolt pull tester set

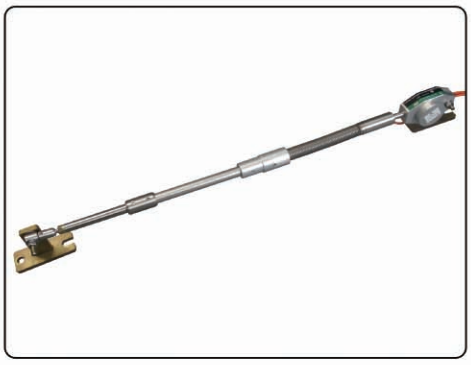
Model **7200 rock bolt pull tester set** to determine an appropriate suitability and effective mass of rock bolt in tunnel or slope. This set consists of portable hydraulic pump, hydraulic cylinder, cylinder frame and reaction plate, and magnet stand, which are attached with dial gage.

Model	7200
Portable pump	· Portable · Max pressure power : 700㎏/㎠ · Weight : 10.9㎏
Pressure meter	· Rating pressure : 700㎏/㎠ (35ton·f)
Oil pressure hose	· Sheath : neoprene rubber · Length : 3m · Size : Ø13×Ø15㎜
Cylinder (RAM)	· Portable · Stroke : 63㎜ · Hollowness type · Capacity : 32.6ton
Frame, Reaction plate	· SCM Steel
Magnetic stand & dial gage	· Resolution : 0.01㎜

81. Geodetic targets

Model **7500** is a optical meter for civil engineering works such as tunnel or excavating underground. There are a triple prism and bireflection target for a light wave target. Bireflection target uses high brightness for displacement and thus its accuracy is lower than triple prism and its range of force is up to 100m. As it allows for 2 dimension measurement, it is very handy for civil engineering works such as tunnel and its price is very low compared to prism.

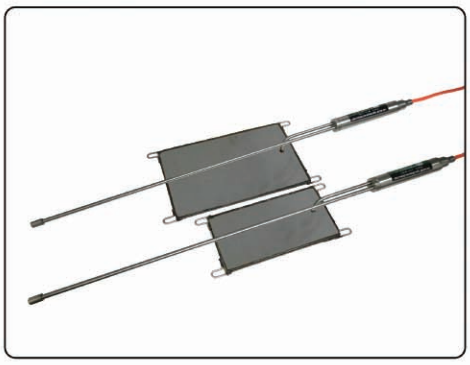
Model	7500 (reflection target)	7510 (prism target)
Accuracy	Angle±0.5mgon, distance±1.2㎜	Angle±0.3mgon, distance±1.0㎜
Weight	0.1㎏	0.2㎏
Material	Nylon #66 + G.F 50%	
Target grade	High bright reflection sheet	Crystal prism



82. Tunnel convergence monitoring systems

Model **ACE-TCS** is used for detecting the size and direction of the deformed cutting plane in tunnel or underground structure. For a single track tunnel, 8~10 displacement sensors and angle sensors are installed; for a double track tunnel, 14~16 are installed along the tunnel wall. ACE-TCS has VW displacement sensor and MEMS tilt sensor built in. Therefore, it can easily be installed, enduring the measured data with high precision. When the analysis program 'TCS-PRO' is used, 2D graphics are displayed in the unit of 0.01㎜.

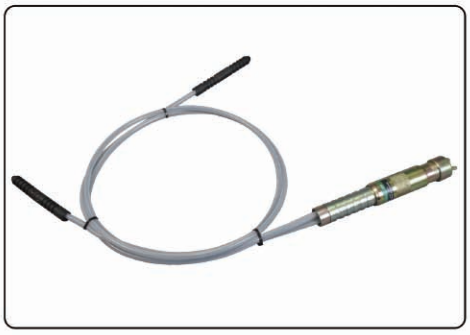
Model	ACE-TCS	
Applied sensor	VW displacement sensor	MEMS tilt sensor
Range	20㎜	±5°
Resolution	0.005㎜	5arc seconds
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	



83. VW NATM shotcrete stress cells

The **VW NATM shotcrete stress cells** are designed to measure radial and tangential stress in shotcrete tunnel linings, which is suitable for NATM method.
They are often used in conjunction with a tape extensometer, VW extensometer and VW rock bolt stressmeters to measure the magnitude and the orient of stresses on the lining and to determine whether the shotcrete lining is thick enough.

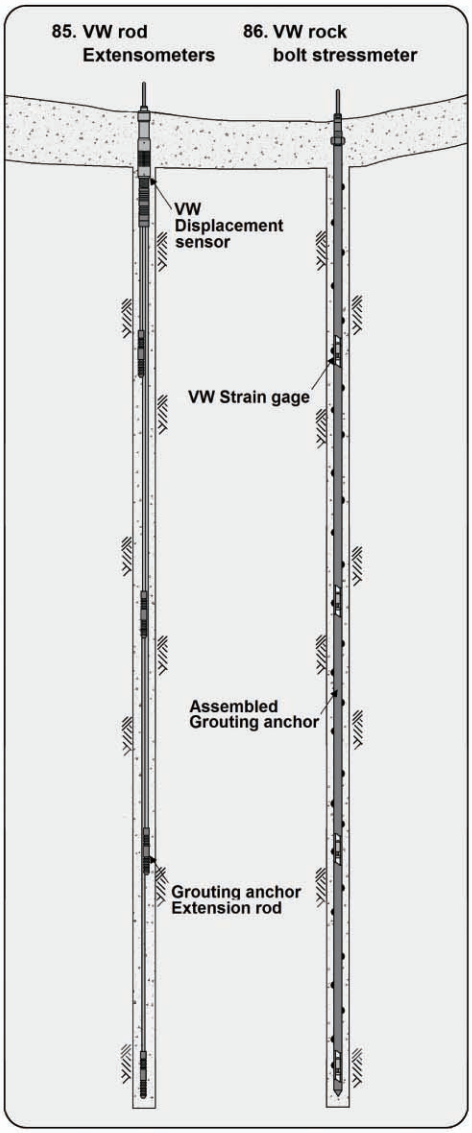
Model	1270 (tangential)	1280 (radial)
Applied sensor	Vibrating wire sensor	
Range	70, 200kg/㎠	30, 50kg/㎠
Resolution	0.025% FSR	
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	



84. Mechanical extensometers

Mechanical extensometer is designed to measure depth by gauge.
Model 2390 is manufactured to measure 6m and Model 2391A is provided fiberglass anchor rod.

Model	2390	2391A	2391B
Measuring solution	Dial depth gauge		
Measuring point	4P	1~4P	1~6P
Range	standard : 50㎜ / optional : 100㎜		
Length	2~6m	Over 7m	



85. VW rod extensometers / MPBX

The VW rod extensometer is useful to measure of displacement of ground by convergent excavation in the ground like tunnel, mind, or common duct and to measure deformation of slope and horizontal or vertical displacement of soil or rock in tunnel.
Model **1391** is VW rod extensometers whose point distance is over 6m and is designed into a structure that is possible to assemble and establish in the construction site.
FSG sensor is used in model 4390.

Model	1390 (standard)	1391 (ass'y on site)	4390
Applied sensor	Vibrating wire sensor		FSG sensor (foil strain gage)
Range	50㎜, 100㎜, 200㎜		
Resolution	0.01㎜		
Accuracy	±0.1% FSR		
Non-linearity	±0.5% FSR		

86. VW rock bolt stressmeters

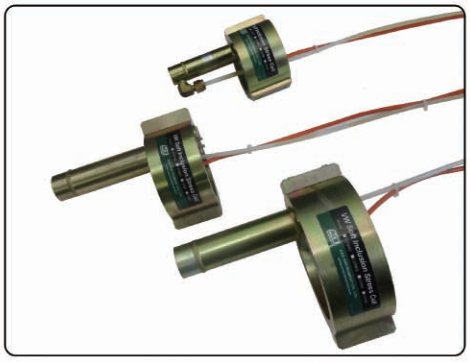
Model **1350 VW rock bolt stressmeter** is used to verify validity such as effective length, quantity and stress of rock bolts. It is also equipped with four VW strain gages, each other equally spaced in the rock bolt, and is water proof and anticorrosive.
The VW rock bolt stressmeter employs typically four measuring points that is equivalent to layers.
FSG sensor is used in model 4350.

Model	1350	4350
Applied sensor	Vibrating wire sensor	FSG sensor(foil strain gage)
Range	3,300 microstrain	
Resolution	1.0 microstrain	
Accuracy	±0.1% FSR	
Non-linearity	±0.5% FSR	

87. VW borehole rock stressmeters

Model **1338 VW borehole rock stressmeter** is a sensor for automatic measuring and is substituted for the portable GOODMAN JACK system. It can be applied to the holes of Ø38㎜ EX size and Ø60㎜ BX size and Ø75㎜ NX size and VW stressmeters are classified into two types for hard rock and soft rock.

Model	1338EX	1338BX	1338NX
Boreholes diameter	Ø37~Ø39㎜	Ø58~Ø61㎜	Ø74~Ø77㎜
Applied sensor	Vibrating wire sensor		
Range	700㎏/㎠ (70MPa) compression, 30㎏/㎠ (3MPa) tension		
Resolution	0.014~0.07㎏/㎠ (14~70kPa)		
Accuracy	±0.1% FSR		



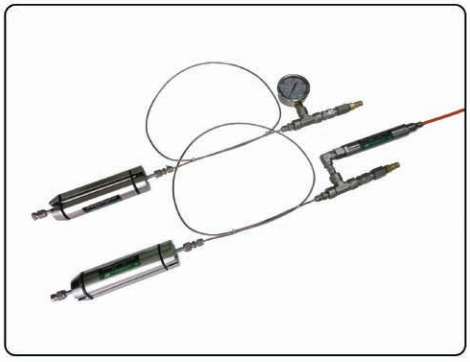
88. VW soft inclusion stress cells

Model **1370 VW soft inclusion stress cell** is sensor for automatic measurement. It can be installed at the large borehole of HQ, PQ, and 6 inch.

VW soft inclusion stress cell consists of round shape sensing part, wedge sensing the stress, and bearing plate for taking load. It can be installed in the precisely bored holes by using manual setting tools.

In the VW sensor structured in the form of center hole, wedge sensing the scale of the impacted force transmits it to the sensor, and magnetic coil and vibrating wire are built-in.

Model	1370HQ	1370PQ	1370H	1370M
Applied sensor	Vibrating wire sensor			
Borehole diameter	D93㎜ HQ	D123㎜ PQ	D152㎜(6inch)	D152㎜(6inch)
Setting tool type	Hydraulic type			Mechanical
Range	±35 MPa (±350㎏/㎠)			
Resolution	±0.025% FSR			
Accuracy	±0.1% FSR			



89. VW borehole pressure cell

Model **1339 VW borehole pressure cell** can measure the stress at the rock as the degree of fixation. 2nos pressed steel plate was weld at the plat jack, inside of model 1339 has oil. End part of Model 1339 was attached the check valve and connection part. And VW piezometer was attached on these parts. So you can get the credibility data.

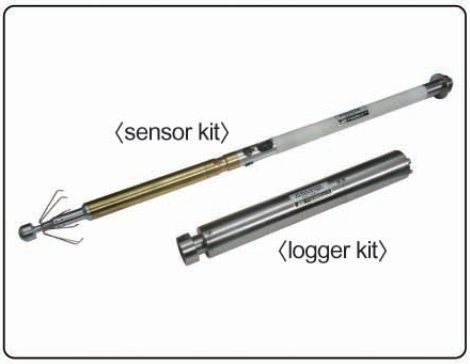
Model	1339	1339A
Applied sensor	Vibrating wire sensor	Analogue mano meter
Range	20, 35, 70 MPa	
Resolution	0.25% FSR	0.5% FSR
Accuracy	±0.1% FSR	±0.5% FSR
Non-linearity	±0.5% FSR	±0.1% FSR

90. VW biaxial stressmeter

Model **1375 VW biaxial stressmeter** was designed to measure the change of the rock(BX drill hole - Ø60㎜) stress.

Stressmeter has 3nos VW strain gages in the direction 60˚, so you can know direction and size of stress acting to the axial direction of sensor element.

Model	1375
Applied sensor	Vibrating wire sensor
Range	70 MPa
Resolution	14~70 KPa
Accuracy	±0.1% FSR
Non-linearity	±0.5% FSR



91. 3D rock borehole deformation gage & data logger

The **3D rock borehole deformation gage** & **data logger** uses overcoring technique to measure the deformation modulus of rock. This equipment is commercialized for the first time in the world with the use of the patent of researchers of **Korea Institute of Geoscience and Mineral Resources**. The product consists of the sensor drive part with built-in 3D-4 angle rosette type strain gauge and epoxy actuator at the time of overcoring and the logger part with dynamic logger and compressed air tank, ensuring high reliability, high precision, and engineering-friendliness. The cutting-edge equipment supports the separation of the dynamic logger after test and the installation to PC program for analysis. The sensor part is disposed of after one-time use. The data logger is collected together with installation tools, and can be used almost semi-permanently. With the use of PC program, it is possible to check the analysis results easily.

Model	4336 (sensor kit)	4336D (logger kit)
Applied sensor	3D-FSG sensor	Dynamic data reading, storage
Resistance	120Ω	
Resolution	1.0 microstrain	
Accuracy	±0.5% FSR	
Borehole diameter	Ø38㎜(EX hole diamond drill)	
Overcoring depth	Min 1.0m~max 15m	
Material	STS steel	

92. 2D borehole deformation gage

Model **4338** are an equipment that measure stress of base rock at overcoring of base rock as in-situ test equipment. If is been pressed down within hole because plunger that can detect base rock strain or 3 directions to model 4338 install after the first EX drill hole and transfers by out device. 4338 was designed so that fine setting may be available in base rock boring in tunnel, nuclear plant construction, hydroelectric power plant construction etc.

Model	4338
Applied sensor	FSG sensor(foil strain gage)
Drill diameter	Ø38㎜ (EX hole diamond drill)
Resolution	1.0 microstrain
Accuracy	±0.5% FSR
Overcoring depth	Min 210㎜~max 15m

93. Rock borehole pressuremeters

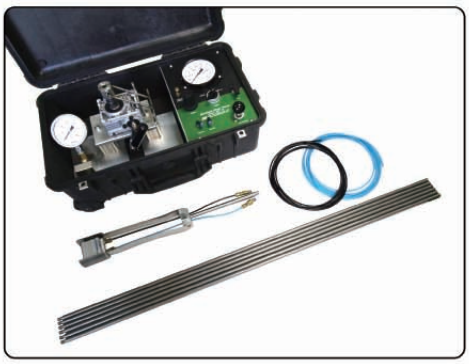
Rock borehole pressuremeter is attached bearing plate of jack to measure the contraction and expansion for the displacement of borehole wall pressured by a hollow wall. This jack is located in appointed location of hole connected such as drill rod of NX bearing machine for hydraulic lines and signal cable.
When applied hydraulic to manual pump, the jack s bearing plate will expansion and the borehole will attached to borehole wall. Jack has 2 LVDT (Linear Variable Differential Transducer) to measure the displacement deviation of rock. Display readout (GJ-75R) for displacement sensor connected to signal cable.

Model	GJ-75H (hard rock)	GJ-75S (soft rock)
Applied sensor	LVDT (2.5㎜) 2 nos	
Piston quantity	12 nos	3 nos
Borehole diameter	Ø76㎜	
Range	Ø70~85㎜	
Components	Readout : GJ-75R Hand pump : GJ-75P	Hydraulic hose : 15m (STD) Signal cable : 15m (STD)

94. Borehole pressuremeter

Borehole pressuremeter is the lateral load testing equipment of borehole whose pressure capacity is 20MPa. This equipment is the LLT test equipment and aims to measure hard soil layer that is impossible to measure.

Model	PMT-75	
Applied sensor	Measuring displacement of diameter : LVDT Measuring inside of water pressure : water pressure sensor	
Range	Ø77~Ø97㎜ (20㎜)	
Components	Readout : PMT-75R Pressuremeter probe : PMT-75 Hand pump : PMT-75P	Hyd. hose Signal cable Testing jig



95. Borehole share tester

BST-75 is designed for measuring share resistance at Ø75㎜ size of borehole inside so that it can provide adhesive power and frictional angle. It is possible to take a test at several point of inside of borehole.

Model	BST-75
Test standard	Ø70~Ø52㎜ / Max. pressure:1.0MPa
Max. authorized pressure	1.0MPa
Components	Indicator Tester head set Extension rod/Hyd. hose/Foot pump

96. Portable spot welder

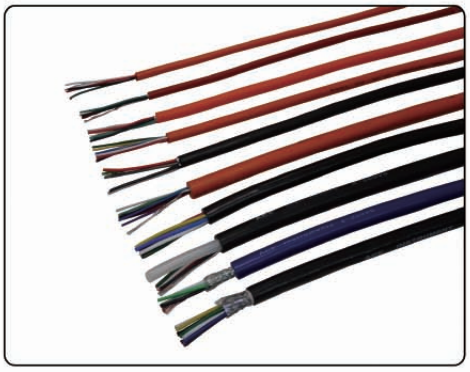
Model **ACE-1200 portable spot welder** is designed to use ACE's spot weldable strain gage more conveniently on the site. It charges with electricity 100% by SCR condenser. It also offers you highly precise and qualified welding effect. As its welding time is short, the deformation by heat and deformation of welding electrode are minimal. Therefore, it is easy for even beginners to work with less restriction on welding and working condition. Also it is designed as a compact size to maximize its portability.

Model	ACE - 1200
Input	220VAC / 4.5KVA
Welding capacity	0.8t
Controller	SCR condenser
Dimensions	320×190×190(H)㎜
Weight	25㎏

97. Sealing kits

When connecting the communication lines to extend, the **Sealing Kits** is a product that makes the connecting part being connected even better than the original state of the lines. the sealing kits are prepared in wide variety for Ø3~Ø14㎜.

Model	K - A, B, C	
Size of applied cable	A type : Ø3~Ø7㎜ C type : Ø8~Ø14㎜	B type : Ø5~Ø10㎜
Material	PVC & PE	
Useing epoxy	Quick setting epoxy for liquid type	



98. Signal cables

Signal cables are made to various quality of the material and diameter to apply in engineering works spot. It can use usefully at base rock or concrete laying because is insulated with excellent biographical special quality and waterproofed.

PVC cable	Standard	On site that which have pollution
PVC cable with shielded	Standard	Connect to FSG transducer at noise environment
PU cable	Standard	On site that which have pollution
Silicone cable	High temp.	Make concrete pile of high temp.
P.E sheath cable	Heavy duty	Dam site(big displacement) or demand the durability
Neoprene sheath cable	Heavy duty	On site that expect big displacement

99. Web monitoring program

Web monitoring program is for sharing the information and for supporting the prompt decision-making with the person concerned under construction at a site.
The measured data is saved to the server computer by internet network.
It is program that drawing up the measuring report, making a graph of engineering unit, giving an alarm, and lookup of a real-time measuring data are possible on the basis of the saved data.
Web monitoring program can draw up the report using all computers that web browser is installed at the remote place, so you can work quickly and efficiently.
Web program that we developed for information construct at the company of civil and building construction, or engineering company of design, supervision, and measuring.
It is a rental service for automatic measure using the web monitor center program as rental type by the month period without the construction cost of the system or the server computer.
And we carry out the OEM development service as inexpensive cost depending on the customer s requesting spec and project condition.

2017
Geotechnical & Structural Instrumentation

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- We can provide the custom products which are not contained in this catalogue.