RITE GEOSYSTEMS

ENCARDIO RITE
METASENSING FOR MEGA STRUCTURES

PRODUCT CATALOG

Leaders in Engineered Sensor Technology

- 55+ Years, 1000+ Projects
- 100% Client Satisfaction
- Plug & Play Instrumentation

TUNNELS | DAMS | CONSTRUCTION | RAIL | BRIDGES

Encardio-Rite Group - India | Bhutan | Bahrain | Qatar | Saudi Arabia | UAE | Greece | Spain | UK | USA

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ENCARDIO GROUP

Encardio Rite is a pioneer in manufacturing advanced Geotechnical and Structural Health monitoring instrumentation. Incorporated in 1966, our journey began with the goal of developing, manufacturing and marketing instruments involving high technology and providing turnkey services. Over the years, we have consistently evolved, leveraging cutting-edge technology to ensure safety of large-scale construction projects and megastructures.

At the heart of our offerings lies the innovative Metasensing, epitomizing Encardio Rite's commitment to precision and excellence. Our fail-proof, experience-based, plug-and-play instrumentation aims to enhance safety, ensure zero risk, increase productivity and deliver an exceptional monitoring experience.

With a presence in over fifty countries and branches in eight nations supported by qualified and experienced industry professionals, Encardio Rite stands as a globally trusted partner.

Our in-house R&D department, accredited by the Government of India, drives continuous innovation. Combined with state-of-the-art manufacturing and calibration facilities, we ensure our products meet the highest industry standards.

From the highest building to the deepest tunnel in the world, from the most challenging mountain terrain to deep underwaters, Encardio Rite's contributions have left an indelible mark. Encardio Rite has supported over a thousand global infrastructure projects. Our groundbreaking Metasensing philosophy has been pivotal in enhancing safety for megastructures across the globe. Our collaboration with distinguished Contractors and Consultants further solidifies our reputation in the industry.

RITE GEOSYSTEMS

Rite Geosystems Inc, an Encardio-Group Company in Pittsburgh, PA, is leading the group's operation in USA.
Rite Geosystems has successfully supplied instrumentation for a wide range of structures, from under-construction projects to existing infrastructure. Some of their most notable projects include:

- The Harry Nice W Memorial Bridge in Maryland
- Montgomery Locks and Dam
- The Los Angeles Metro Purple Line
- The Baltimore Light Rail Tunnel
- The Ohio River Tunnel

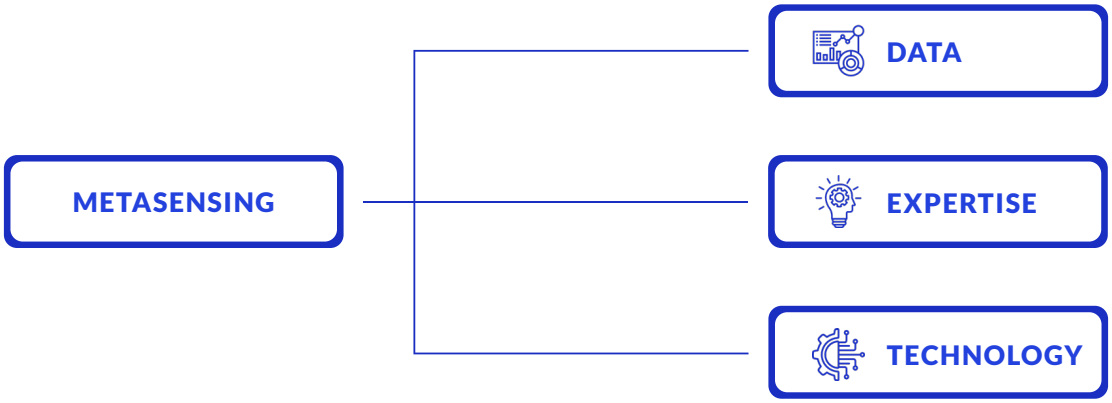
Rite Geosystems has a proven track record of success in a variety of challenging projects. A trusted partner, Rite Geosystems is highly valued for its excellent customer service and domain expertise.

WHAT IS METASENSING?

As an integrated solutions provider, our promise goes beyond sensing. Meta in Greek means beyond and with Metasensing, we deliver data, expertise and technology, ensuring the safety of structures, and keeping you in control – anytime, anywhere.

This is done physically through a complete range of in-house manufactured sensors. We are the largest manufacturer of these sensors in the world. This is done digitally by our own datalogger with wireless transmission. Globally we have experienced and qualified engineers providing on-ground assistance when and where required. We have one of the most advanced software that integrates all these parameters in near real-time and delivers alerts so that you can act in time.

Because of this promise of Metasensing for mega structures, our clients have trusted us repeatedly with the most challenging projects in the world.



DATA

An array of best-in-class products acquire and transmit precise surface and sub-surface measurements from all megastructures - from hydroelectric projects to tunnels to construction, rail to bridges, and mining. Encardio Rite manufactures two categories of products:

SENSORS:

Encardio Rite has an extensive product range to measure various parameters

WATER PRESSURE & LEVEL	Piezometer, Water Level Sensor, Seepage Sensor, Water flow, Uplift Pressure Sensor
STRESS & PRESSURE	Concrete Pressure Cell, Earth Pressure Cell, Soil-Rock Interface Cell, Shotcrete Pressure Cell, Jack-out Pressure Cell.
INCLINATION/TILT	Inclinometer, In-place Inclinometer (IPI), In-place Inclinometer with Settlement (3D IPS), Tilt Meter, Beam Sensor, Digital Plumb Line
DEFORMATION & SETTLEMENT	Laser Displacement Sensor, Borehole Extensometer, Soil Extensometer, Crack & Joint Meter, High Precision Liquid level Settlement System, Optical & Geodetic targets, GPS rover and reference stations
FORCE – LOAD & STRAIN	Compression & Center Hole Load Cell, Embedment & Arc Weldable Strain Gage, Sister Bar, Dynamic Strain Gage
TEMPERATURE	Vibrating wire temperature meter, Thermistor, Thermocouple, RTD Probe
ENVIRONMENTAL & MATERIAL RESPONSE	Automatic weather station, Scour Monitoring system, Corrosion Monitoring system, Seismometers & Accelerometers

DATALOGGERS:

Our Dataloggers and data transmission devices provide seamless and remote communication across multiple frequencies (GSM/ GPRS and RF).

GSM/GPRS DATALOGGER	Multi-channel Digital Datalogger
	Single-channel VW Datalogger & Datalogger for Hydrology
	Data Acquisition System with Control modules, Bus-Mux, etc
RF DATALOGGER	RF Nodes/Dataloggers - Vibrating Wire Node, Analog Node, Digital Node, Relay Node
	Gateway

EXPERTISE

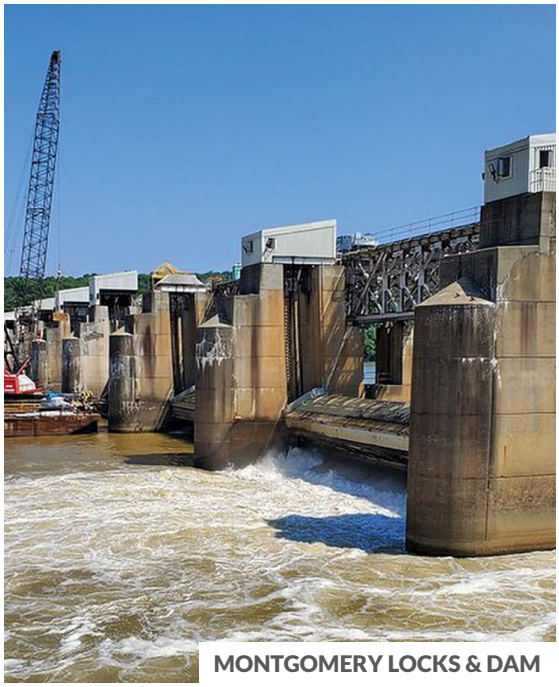
Support and partnership in executing large-scale complex projects.

With over 55 years of domain expertise and an experience base of over 1000+ critical infrastructure and high complexity projects, our Global team of Engineers, supported by an accomplished R&D, share knowledge and expertise that adds value to the safety of structures.

Some of the landmark projects that we have supported are:

Los Angeles Metro, USA	Harry Nice Bridge, USA	Montgomery Locks and Dam, USA
Barcelona Airport, Spain	Grand Paris Metro, France	I-78 Eastacon Road, USA
Copenhagen Metro, Denmark	Strategic Tunnel Enhancement Programme (STEP) Project, UAE	Muharraq STP Project, Bahrain
One Za'abeel Twin Towers, UAE	Expolink Route 2020 Dubai Metro	DRIP Contracts for 67 Dams, India
Pir Panjal Rail Tunnel, India	Lima Metro, Peru	Deep Tunnel Storm water, terminal pimping station and Sea outfall, UAE
Hatta Pump Storage Hydro Power Plant Project, UAE	Tehri Dam, India	Marina Bay Sands Towers, Singapore
Nam Pha Gnai Hydropower Project, Laos	Deira Waterfront Development, UAE	Idduki Dam, India
Doha Metro, Qatar	Etihad rail UAE	8000 groundwater wells

LA METRO



MONTGOMERY LOCKS & DAM

BARCELONA AIRPORT

EXPERTISE

Key Manufacturing Processes

We have been guided by our enthusiasm as Engineers to build solutions and not just products. Some of our key manufacturing processes validate this philosophy.

- **Electron Beam Welding -** A wide range of sensors is hermetically sealed by electron beam welding under a vacuum of 0.001 Torr inside them, resulting in IP-68 protection. Most of the sensors have stainless steel enclosures. This makes our sensors resistant to the effect of corrosion and ingress of moisture and water, making them best suitable for long-term monitoring.
- **Testing Protocols -** Encardio-rite products comply with the ISO-9001 quality system conforming to international standards. The sensors are tested for accuracy, hysteresis, linearity, functionality, robustness, waterproofing, etc.


HARRY NICE BRIDGE, USA


ETIHAD RAIL, UAE

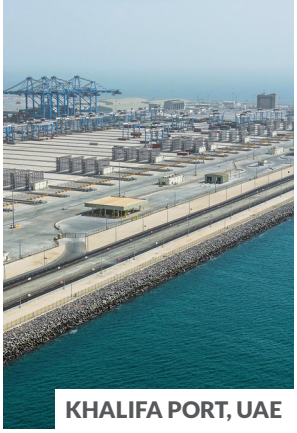

LETSENG DIAMOND MINE, LESOTHO


PAULO AFONSO DAM, BRAZIL


MARINA, QATAR


CHINCHERO AIRPORT, PERU


IDUKKI DAM, INDIA


KHALIFA PORT, UAE

EXPERTISE

MARINA BAY SANDS, SINGAPORE

A few test procedures conducted are:

Temperature compensation test - data accuracy is checked against thermal variations from -20 to +80 degrees C.

Overload test - Up to 150 % of load cell range. Internal testing capabilities up to 15000 kN

Reverse pressure test - to check leak tightness

Accuracy Test - on strain gauges using high-resolution digital displacement gauges with a resolution of 0.001 mm.

Pressure cycling test - to ensure performance integrity over time. Pressure cycling of **2000** cycles is conducted.

Waterproof test - tested up to 100 mwc (Meter Water Column) for waterproofing All products undergo rigorous testing. Tested for precision climate resilience intensively to minimise risk and ensure Zero Error.

1000 km + of Monitoring

250 km of Metro tunnels

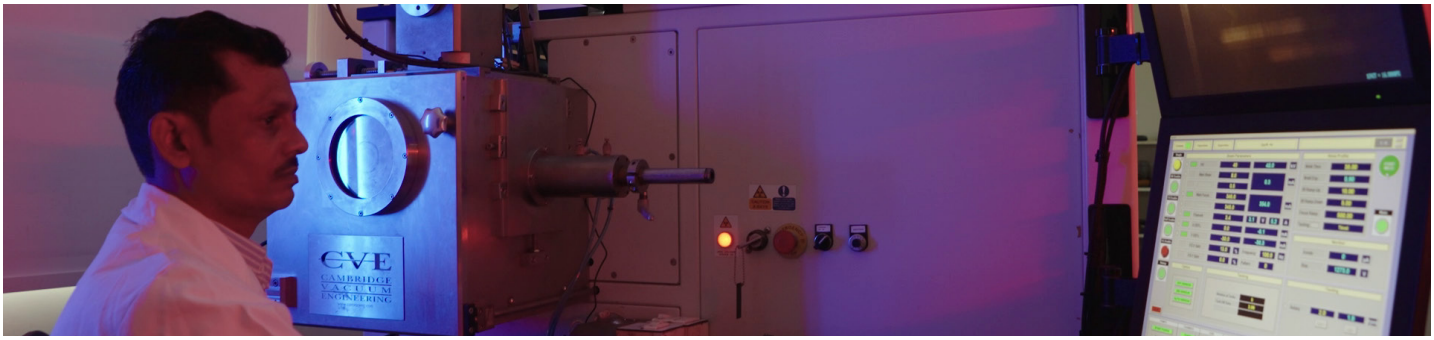
325 km of Rail and road tunnels

200 km of sewer tunnels

200 Dams

100 high-rise buildings

8000 online groundwater wells.



TECHNOLOGY

proqio

With over 50 years of first-hand experience across 1000 Infrastructure projects, we have acquired data and intelligence and merged it with Modern AI to create Proqio, the NextGen Infrastructure Data Intelligence Platform. Proqio acquires data across sources - such as project management software, sensors, UAV, InSAR and more.

It seamlessly integrates all this data.

Processes it as per specific and customised project needs And delivers accurate and actionable intelligence to each stakeholder as per their roles and requirements.

Key Features

- Integrate any sensor, any data logger
- Visualize your streaming data with our Real-time engine.
- Transformative Geospatial Environment to provide intelligence to your spatial data, drones, laser scanner etc.
- Outstanding report generation tool with scheduling capabilities
- Instant alerts and notifications to stay ahead of trends and changes, smart alarms
- Time record of site activities to control daily progress & integrate and track your TBM parameters and activities
- Integrate your Satellite Monitoring
- Up-to-Date Information with Mobile App Access
- Receive worldwide support 24/7

RISK ASSESSMENT SOLUTIONS

Automated Data Management For Risk Assessment

Encardio Rite Group offers comprehensive geotechnical monitoring and geodetic survey services which can be summarized as follows:

Geotechnical Monitoring

To ensure zero risk during the construction process, we offer a comprehensive range of sensors with advanced database management. Our manually and automatically monitoring systems facilitate monitoring of sub-surface and surface parameters like stress, strain, load, piezometric pressure, water level, lateral deformation, joint openings, cracks, settlement, convergence and tilt.

The near real time data is provided online to the construction contractor and consultants at their finger tips, with instant alerts through SMS and emails. This expedites work in the safe zones and takes corrective actions where there is possibility of any risk.

Structural - Asset Monitoring

To ensure safety of existing buildings and infrastructures, our structural health monitoring includes smart sensors with automatic dataloggers, automatic surveying and our comprehensive database systems. We also provide advanced systems like laser scanning with our innovative OPSIS software.

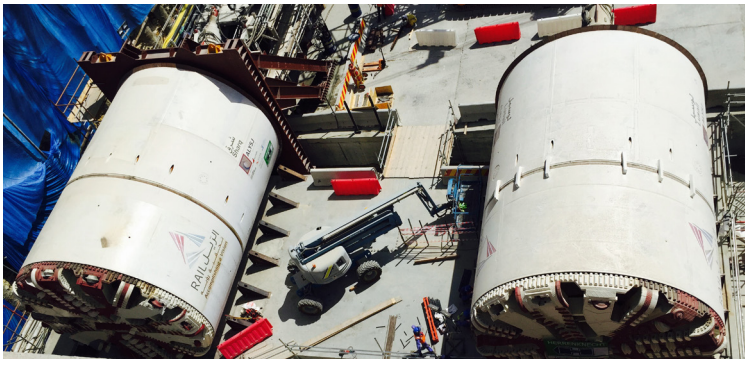
We aim to assist and keep owners, designers, contractors and architects informed about continued performance of structures under gradual or sudden changes to their state. Encardio Group has great expertise in this field, and has executed a number of projects in Gulf countries and worldwide.

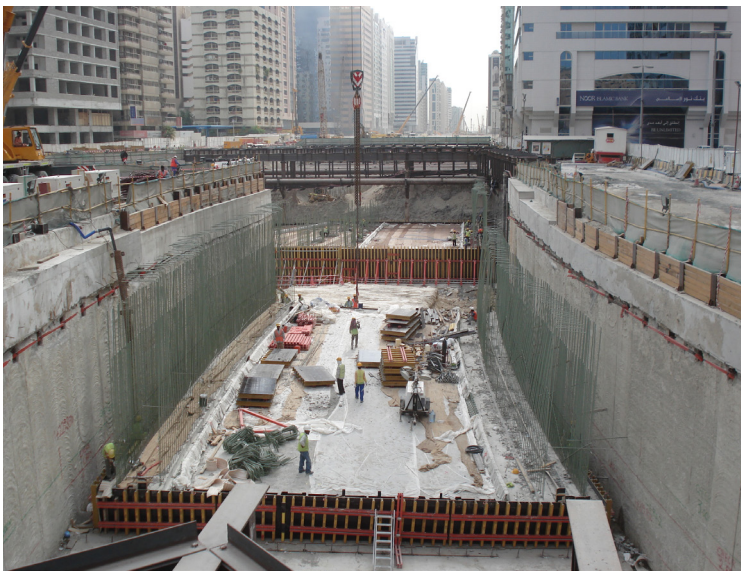
Deformation Monitoring

It is a systematic measurement and monitoring of changes in the shape or dimensions of any structure. The monitoring procedure includes applied topography and geomechanics and is directly related to civil engineering, mechanical engineering and rock mechanics. It is useful in application areas like dams, roads, tunnels, bridges and overpasses, multi-storey and historical buildings, foundations, mining - exploitation, landslides and sloping, earthquake prone regions.

TBM/Tunnel Monitoring

Tunnel excavation has an inevitable association with ground loss and high pressure conditions which, in turn, result in associated ground movement. Therefore, it is empirical to closely monitor the tunnel boring machine (TBM) parameters during the tunnelling process, especially in urban areas. With our specially designed advanced software, we can integrate the essential parameters from the TBM with the geotechnical monitoring, survey and geophysical data to provide essential correlations.





ADVANCED SOLUTIONS

Topographic and Aerial Mapping using UAVs (Drones)

UAVs are the latest trend in geodesy's technology for aerial mapping. Unmanned and remotely-piloted aircrafts that follow a pre-programmed path for take-off, flight and landing. These aircrafts are equipped with HD/IR/thermal cameras that compute aerial images and videos over a defined area at a specified height. The point clouds, meshes and 3D models produced are the data to be compared between sequel flights during monitoring time.

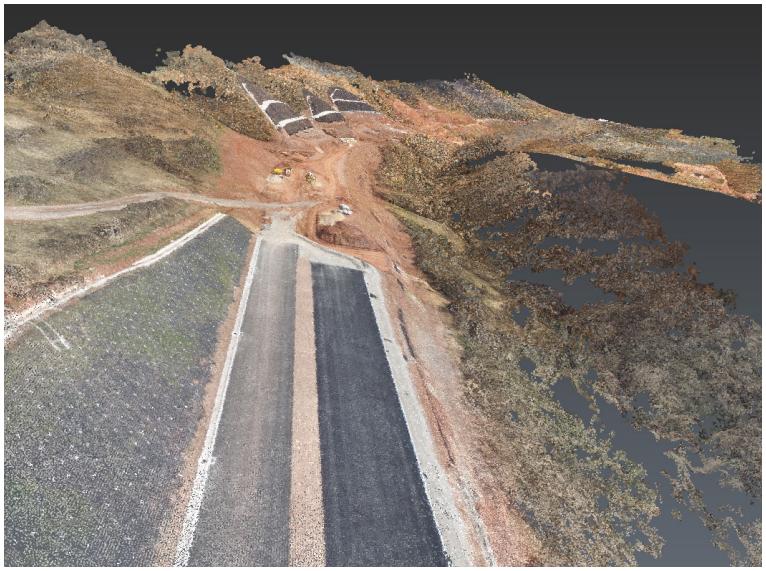
This is a very fast, accurate and low cost way to monitor the progress of any large scale project, where frequent geospatial and/or imaging information is needed, in order to monitor earthmoving issues or the progress of a running project.

Laser Scanning

Laser scanning is based on exceptionally dense mapping of three dimensional coordinates of the points on the surface to be monitored. It is a rapid and reliable surveying method as it collects the data in static, stop and go or kinematic mode. From the point where cloud is produced, the exported section profiles can be used to monitor deformations or displacements. Although these are mainly used in tunnels, they can also be used in structures or landslide.

Construction Monitoring

Construction progress monitoring by surveying is a specialized method used to track the advancement of construction projects, especially NATM tunnels. Surveying techniques play a vital role in ensuring accurate measurements, alignment control and quality assurance during tunnel excavation and lining installation. By employing precise surveying tools and methods, project teams can monitor the progress, detect potential issues, and make necessary adjustments to keep the projecton schedule and meet specifications.



DATALOGGERS

WIRELESS MONITORING SYSTEMS

Wireless sensor network are vital in monitoring large construction sites, structures and landslide areas. Encardio-rite is one of the only companyies that offers two of the advanced wireless technologies for dataloggers - GSM and RF, thus providing the best combination of wireless solutions for effortless, efficient and cost effective project monitoring.

Both the RF nodes (dataloggers) with gateway and GSM/GPRS dataloggers can connect a wide range of sensors. Our expertise in both the systems, enable us to provide best solution to meet a project's real time data demands with least fuss. The solution can include either any of the two, or a combination of the two wireless technologies, depending on specific site requirements.

With our wireless monitoring solution, the client gets best cost effective option to have the field data at fingertip, with minimal downtime, quick installation and improved reliability.

NODES & GATEWAY (RF DATALOGGERS)

Encardio-rite offers a reliable wireless radio frequency (RF) network solution that allows real-time monitoring of geotechnical, structural and environmental sensors in challenging conditions with precise data transfer without any delay. In this end-to-end wireless monitoring system, the sensors are interfaced with the long range, low power wireless network through nodes that send recorded data to the gateway with utmost reliability. Gateway uploads the collected sensor data to the central/cloud server.

Encardio-rite offers the following range of wireless products:

VibraLink Solo	Vibrating wire node, single channel. Suitable for vibrating wire sensors.
VibraLink Quint	Vibrating wire node as above, 5 channel
VibraLink Deca	Vibrating wire node as above, 10 channel
SignalLink Solo	Analog node, single channel. Suitable for sensors with millivolt, voltage, 4-20 mA, wheatstone bridge outputs.
SignalLink Quad	Analog node as above, 4 channel.
DigiLink	Streamlined digital interfacing for SDI-12 sensors.
Relay	Expand the reach and reliability of your RF network effortlessly.
Hub	The nexus of your RF LORA network, ensuring seamless data flow to the cloud or local server.
TiltSense	A fusion of sensor and node for immediate, intuitive monitoring.
TiltRange	Accurate tilt combined with laser precision range measurement.

A cloud-hosted data management and configuration software is provided to manage the wireless network. The configuration can be done with an easy to use smartphone application that comes free with the system. Encardio Rite wireless system is a highly scalable system. It allows client to add or replace nodes in an ongoing project, without compromising data integrity.

DATALOGGERS

DATALOGGERS (GSM/GPRS)

NexaWave DigiLog

Datalogger [Multichannel]

Premier datalogger designed for SDI-12 digital sensor interfaces. Embark on a journey of precision and versatility with the Digilog (ESDL-30). As our flagship digital datalogger, it not only supports the SDI-12 digital ensuring adaptability for varied use-cases. Every data point, including time stamps and battery status, is logged with unparalleled accuracy. Crafted for the modern world, it brings together the reliability of established protocols and the innovation of NexaWave. Digilog ensures your data is always in safe hands.

NexaWave DigiLog Plus+

Datalogger [Multichannel]

Premier datalogger designed for SDI-12 digital sensor interfaces and Modbus compatibility. Capture the essence of precision with the Digilog Plus+. As our flagship digital datalogger, it supports flexible programming and ensures that every data point, along with time and battery status, is logged meticulously. With the robustness to handle diverse climates and the capability to integrate with multiple telecommunication options, the Digilog Plus+ stands out as a pinnacle in the NexaWave line.

NexaWave VibraLog

Datalogger [Single Channel]

Stay connected with your site data. The VibraLog (ESCL-12VT) facilitates automated data collection and transmission, minimizes field costs with remote diagnostics, and supports varied telecommunication options. Crafted for rugged environments, this datalogger ensures dependable operation and accurate data, all while being power efficient.

NexaWave HydroLog

Datalogger [Single Channel]

Precise monitoring of water metrics, seamlessly connecting via Bluetooth to your mobile device. With added features like barometric pressure monitoring and compatibility with tipping bucket rain gauges, the HydroLog (ESCL-10VT) ensures comprehensive data collection. Opt for telemetry via GSM/GPRS or direct retrieval through a laptop.

Specifications

Input	ESDL-30: Sensor with SDI-12 digital output. ESCL-12VT & ESC L-10VT: Vibrating wire sensor, Frequency range-400Hz to 5kHz
Scan/upload interval	5 seconds to 168 hour s
Memory capacity	8 MB Flash RAM, can store 3,145,728 data point s
Data output format	CSV text file. Can be easily imported in many third party applications like Microsoft® Excel.
Communication port	RS-232 (Standard) 115 kbps
Operating temperature range	-30° to 70 °C
Humidity	100 %
Power supply	2 x D size 3.6 V /19 Ah Lithium cells, o r 2 x D size 1.5 V Alkaline high power cells, o r 12V SMF battery chargeable from AC mains or solar panel
Housing	Corrosion resistant weather proof enclosure.
Antenna (in telemetry option)	Built-in or separately mounted antenna.

Digital Sensor Networking System

Encardio-rite digital sensors are equipped with SDI-12 (Serial Data Interface at 1200 baud). The SDI-12 system allows a huge reduction in cabling costs as only a single bus cable is required to interconnect the sensors and dataloggers spread across a vast area. Encardio Rite has integrated this protocol across a wide range of sensors, including vibrating wire, resistive strain gage, MEMS, 4-20 mA, electro-level sensors and tipping bucket rain gage. Few digital sensors also have the option of utilizing ModBus communication protocol.

NexaWave GeoLog

Datalogger

The GeoLog Pro is a masterclass in precision, versatility, and reliability. Designed for seamless plug-and-play integration with a comprehensive range of sensors, this datalogger stands as a beacon of high-precision solutions for various industries. From construction sites to deep excavation areas, stay connected with real-time insights and ensure the seamless flow of critical data for informed decision-making.

Offerings:

GeoLog ET

Real-time data transmission over cellular networks or fast, dependable data transfer via Ethernet, ensuring you're always in touch with your critical sensor readings.

GeoLog CL

Experience the convenience of wireless two-way live communication with the in-built modem, enabling real-time data transmission and interactive communication with the datalogger

Handle diverse sensors ranging from vibrating wire and analog sensors to digital sensors with SDI-12 or Modbus output, ensuring comprehensive monitoring capabilities.

The above dataloggers are quite rugged featuring wide operating temperature range, dependable standalone operation, low power consumption, compatibility with many telecommunication options and flexibility to support a variety of measurement and control applications to provide accurate and reliable data.

Following data transmission options are available in above dataloggers:

- Telemetry through GSM/GPRS modem
- Readout/data retrieval using laptop

Sensor Input

1. The standard variants of datalogger and three input channel and can connect following sensors.

Sensor Type	Max Quantity
Vibrating wire and analog sensors through suitable digital interfaces	4
Digital sensors with SDI-12 output (in single bus)	60
Digital sensors with Modbus output (single bus)	7

2. Datalogger has provision to connect additional sensors as follows.

Sensor Type	Max Quantity
Vibrating wire & analog sensors using external interface boxes and SDI-12 sensors (in single bus)	56
Any one type of sensor i.e. VW/analog or SDI-12 or Modbus sensors	To Consult ER

Please contact Encardio Rite for more details or in case only one type of sensor needs to be connected.

Specifications

Input	Vibrating wire and analog sensors with suitable interface Digital sensors with SDI-12 or Modbus output
Memory capacity	Flash Memory (64-Mbit); 2 Million data points
Current drain	500 mA
Data output format	CSV text file. Can be easily imported in many third party applications like Microsoft® Excel.
Operating Temp.	-20°C to +70°C
Antenna	Built-in or separately mounted antenna
Power supply (internal)	Battery-backed 12~15 VDC @ 1 A nominal, chargeable from AC mains or solar panel.
Power supply (external)	Model ESP-12V1A battery-backed solar power supply; 12 VDC @ 1A (available on order)
Enclosure Protection	IP-65

DATALOGGERS

Model EDAS-10 (GSM/GPRS)

Automatic Data Acquisition System

EDAS-10 delivers accurate and reliable measurement in a variety of applications. It is most suitable for unattended or network applications. We provide multiple options. The options for connecting the data acquisition system to PC, are like RS232C serial interface, short haul modems, GSM/GPRS modem, RF modem etc. Built around the Campbell Scientific middle level programmable measurement and control module, the Encardio-rite data acquisition system is available in multiple configurations depending upon the type, number of sensors used and their locations in a particular project.

Please contact Encardio-rite for any specific requirement giving details of the type, quantity and locations of sensors used in the particular project. The complete system includes datalogger, multiplexers, signal conditioners for vibrating wire sensors, interface cables, power supply, transfer software, etc. Units are available from 16 to 192 channels in different cabinet sizes. Specification depend n teh choice of dataloggers being used in the system.

TCB

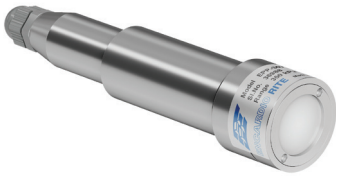
Control Box for Automated Total Station

If used judiciously with geotechnical instrumentation, geodetic monitoring provides co-related data which is relevant and extensively used in civil construction and structural monitoring. For real time geodetic monitoring, displacement data is measured from the prism targets by a high precision automatic/robotic total station (ATS).

Encardio-rite offers an in-house developed control box with advance software to control the robotic total stations. This results in an automatic three-dimensional (3D) deformation monitoring system with the highest accuracies achievable in the industry presently. The system ensures valuable and timely monitoring of the displacements, providing high measurements density, simultaneous wireless transmission and automatic entry of the results in the monitoring database at central server or cloud.

With the control box, the system can be accessed and controlled remotely from anywhere for maintenance, changing frequency, making corrections, turning off/on or reset control box. This makes the system very efficient, prompt, user friendly and economic ensuring minimal time lag between measurements and its evaluation.

GROUNDWATER MONITORING



Model EWLR-101

Automatic Groundwater Level Monitoring

Model EWLR-101 automatic water level monitoring system provides significant quantitative data on the magnitude of water column, water table and temperature in a borehole. The monitoring system includes an absolute water level sensor with cable and automatic datalogger with required data retrieval/transmission options. The datalogger is programmed to automatically store the water head/pressure data at fixed intervals with a minimum scan/upload interval from 5 seconds to 168 hours with different options to download data. Data can be remotely transmitted at scheduled times with telemetry (GSM/GPRS inbuilt modem) or downloaded on a laptop/ mobile in field through Bluetooth or a cable.

The water level data can be corrected for specific gravity variations in water through the datalogger application software. Automatic correction for atmospheric pressure variation is provided by an in-built barometric pressure sensor in the datalogger, thus eliminating the requirement of a vented tube cable and desiccant chamber.

Model EWLR-101 monitoring solution allows water level at remote locations to be monitored continuously in near real time from a central location and also sends alerts through SMS and email. The solution enables researchers and decision makers quick access to the groundwater data with little effort and cost.

Specifications

Input	EPP-30V, EPP-40V, EPP-60V pressure sensor
Sensor Range (MPa)	EPP-30V: 0.2, 0.35, 0.5, 0.7, 1.0, 1.5, 2.0, 3.5, (20, 35, 50, 70, 100, 150, 200, 350 m WC) EPP-40V: 0.35, 0.5, 0.7, 1.0, 2.0 (35, 50, 70,100, 200 m WC) EPP-60V: 0.10, 0.20 (10, 20 m WC)
Sensor Accuracy	± 0.2 % fs standard | ± 0.1 % fs optional
Cable	CS-1102 or CS-1302 four conductor
Data logger	ESCL-10VT/ESDL-30
Logger Memory capacity	8 MB Flash RAM, can store 3,145,728 data points
Communication port	One RS-232 serial port
Measuring modes	Linear or event sampling
Power supply	Lithium cells, Battery life is more than 5 years for 4 measurement/day and one transmission/day.
Bluetooth port	Detachable dongle

Model ERG-200/201

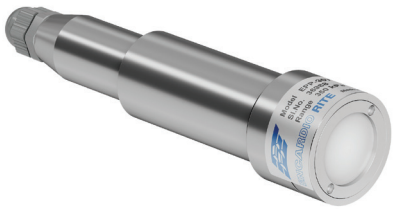
Rainfall Gage

Model ERG-200/201 rain gage with a proven tipping bucket mechanism provides a cost effective and reliable method for measuring and recording rainfall with the ESCL-10VT datalogger. It is corrosion resistant having a stainless steel outer housing, designed for many years of trouble free operation. Each rain gage is individually calibrated for optimum accuracy. It comes with an optional SDI-12 interface unit that makes it compatible with the ESDL-30VB datalogger.

Specifications

Sensor Type	Tipping bucket
Accuracy	± 2 % at around 30 mm/hour ± 5 % at around 120 mm/hour
Resolution	0.2 mm/tip for model ERG-200 0.5 mm/tip for model ERG-201
Humidity	0 – 100 %
Output	Potential free contact, one momentary switch closure per tip
Catchment area	200 mm diameter

PIEZOMETER



Model EPP-30V

Piezometer [Heavy Duty]

EPP-30V is a vibrating wire piezometer used to measure pore water pressure in soil, earth/rockfills, foundations and concrete structures. EPP-30V is of stainless steel construction and hermetically sealed under a vacuum of around 0.001 Torr inside it. Each sensor has built-in thermistor for temperature measurement and surge arrestor for lightning protection. A glass to metal seal solder pin connector is provided for easy cable connection. The piezometers are suitable for mounting at different levels in a borehole using the grout–in technique.

Specifications

Range (MPa)	0.2, 0.35, 0.5, 0.7, 1.0, 1.5, 2.0, 3.5, 5.0, 10.0, specify
Accuracy	± 0.25 % fs standard ± 0.1 % fs optional
Non linearity	± 0.5 % fs
Over range limit	150 % of range
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent
Dimension (Ø x L)	42 x 185 mm

Model EPP-40V

Piezometer

EPP-40V is a small size vibrating wire piezometer specifically designed to be used for pore water pressure measurement in small diameter boreholes and standpipes. It is of stainless steel construction with built-in thermistor for temperature measurement and surge arrestor for lightning protection. A glass to metal solder pin connector is provided for easy cable connection. The sensor is hermetically sealed with a vacuum of around 0.001 Torr inside it.

Specifications

Range (MPa)	0.35, 0.5, 0.7, 1.0, 2.0
Accuracy	± 0.2 % fs standard ± 0.1 % fs optional
Dimension (Ø x L)	19 x 155 mm

Other specifications same as EPP-30V

Model EPP-50V/EPP-51V

Push-In Piezometer

EPP-50V is a push-in type vibrating wire piezometer, designed to measure pore water pressure in soft soil/clays and landfills. It has a pointed cone at one end and drill rod threads at the other end. When threaded into a drill rod, the piezometer can be pushed into soft soil directly. Thread options are EW drill rod thread or M28, or direct push-in (EPP-51V). Model EPP-51V is a variant of push-in piezometer that has a conical tip at one end but without threads on the other end. The drill rod is simply pushed over the cylindrical body of piezometer, upto the conical tip, and then pushed into soil

Specifications

Range (MPa)	0.35, 0.5, 0.7, 1.0, 2.0
Accuracy	± 0.2 % fs standard
Dimension (Ø x L)	35 x 166 mm

Other specification same as EPP-40V

Model EPU-20V

Uplift Pressure Sensor

EPU-20V is a vibrating wire uplift pressure measurement system that uses a vibrating wire pressure sensor. It is designed for monitoring uplift pressure of water in foundation of dams and concrete structures. The sensor is similar to EPP-30V except that instead of filter, a 25 mm BSP adaptor is provided for pipe connection. A perforated/non-perforated pipe is inserted in the borehole, at the top of which EPU-20V is mounted through valves and fittings.

Specifications

Range (MPa)	0.2, 0.35, 0.5, 1.0, specify
Accuracy	± 0.25 % fs standard ± 0.1 % fs optional
Dimension (Ø x L)	42 x 210 mm

Other specifications same as EPP-30V

STAND PIPE\SEEPAGE

Model EPP-10/10SP

Casagrande Piezometer/Standpipe

EPP-10 porous tube piezometer consists of a porous carborundum or allundum (casagrande) tip covered with geotextile cloth, PVC standpipe, suitable adaptors and an end cap.

EPP-10SP standpipe, used for ground water measurement, consists of a PVC slotted pipe covered with geotextile and a series of PVC riser pipes/ standpipes with inbuilt socket & end caps.

Specifications

EPP-10	
Casagrande tip	40 mm o.d., 27 mm i.d., 20, 40, 60 cm long
Standpipe	25 mm o.d., 3 m long each
EPP-10SP	
Porous tip	50 mm o.d., slotted pipe -1 m or 3 m
Standpipe	50 mm o.d., 3 m long each

Model EPP-10/6

Water Level Indicator

EPP-10/6 water level indicator is used to measure depth of ground water in standpipes, boreholes and wells. The unit is light in weight, battery operated and gives accurate and quick readings with audible signal. The tape used is a flat, high tensile, non stretch with suitable markings.

Specifications

Length (m)	30, 50, 100, 150, 200, 300
Resolution	1 mm standard
Length (ft)	50, 100, 150, 300, 500
Resolution	0.1" standard

Model ESM-12S

Digital Seepage Measurement For Weirs

ESM-12S seepage monitoring system mainly consists of a high precision low range digital level sensor with vented signal cable to monitor the water head developed over the V-notch weir. Any change in water level results in change in water head, which is measured by the pressure sensor. V-notch weirs are additionally available on request, if sepcically asked for.

Specifications

Level Sensor	
Sensor range	1000 mm
Sensor accuracy1	± 0.2 mm
Sensor resolution	± 0.025 % fs
Temperature limit	-20° to 70°C
Output	Digital (SDI-12 or Modbus)

1As tested under lab conditions

SETTLEMENT

Model ESM-40S

Digital Liquid Level Settlement System

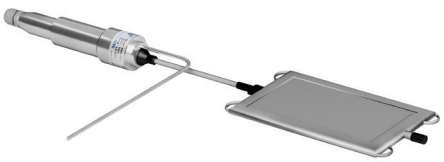
The ESM-40S high sensitivity liquid level settlement measuring system is designed for remote measurement of minute differential settlement. It consists of a low pressure, high sensitivity settlement sensors with digital output, connected in series to a reference reservoir and desiccant unit via fluid filled and air vent tubes respectively. Settlement or heave of any sensor installed at settlement locations, causes difference in elevation between the sensor and reference reservoir, resulting in change in liquid head, which is read by the settlement transducer. A reference settlement reservoir is installed near the reference senso

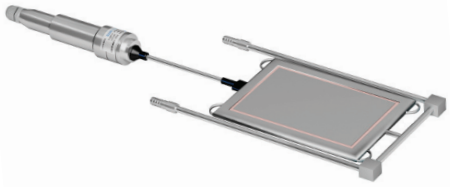
Specifications

Sensor range	1000 mm; can be calibrated to 500 mm
Sensor resolution	0.01 mm
Sensor accuracy[1]	Better than ± 0.4 mm
Output signal	Digital (SDI-12 or Modbus)
Temperature limit	0° to 80°C
Vent Tubing (Two lines)	8 mm o.d. nylon tube
Fluid Tubing	8 mm o.d. nylon tube

[1]As tested under lab conditions

PRESSURE CELL





Model ESC-30V

Shotcrete Pressure Cell

ESC-30V is a NATM style shotcrete-concrete stress cell designed for measurement of radial and tangential stresses in shotcrete tunnel lining. The cell consists of a rectangular pressure pad constructed from two stainless steel plates welded around the periphery. The pressure pad is connected to a vibrating wire pressure sensor through a 6 mm Ø x 165 mm long stainless steel tube. The cavity inside the pressure pad and the pressure sensor is filled with de-aired fluid. A pinch tube (in ESC-30V) or regroutable arrangement (in ESC-30V-R) is provided to inflate the pressure pad after concrete around it has fully cured, to ensure proper contact between pressure pad and surrounding concrete.

Specifications

Range (MPa)	1.0, 2.0, 3.5, 5.0, 10.0, 20.0, 30.0, specify
Accuracy[1]	± 0.5 % fs standard ± 0.1 % fs optional
Over range limit	150 % of range
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent
Pressure pad sizes l x b (mm)	100 x 200, 150 x 250, 200 x 300, 300 x 300

Other sizes also available on request | [1]Calibrated accuracy of pressure sensor

Model EPS-30V-S Earth

Soil Pressure Cell

EPS-30V-S earth pressure cell is designed to measure total pressure in earth fills and embankments. The flexible, circular flat pressure pad is constructed from two stainless steel discs electron beam welded around the periphery. The pressure pad is connected to the vibrating wire pressure sensor through a 6 mm dia x 165 mm long stainless steel tube. The narrow cavity inside the pressure pad and the tube is filled with fluid. Pressure applied by earth on the capsule is transmitted through the fluid to the vibrating wire pressure sensor, which converts it into an electrical signal.

Model EPS-30V-C

Concrete Pressure Cell

EPS-30V-C concrete pressure cell is designed to be embedded in concrete. This sensor is similar to EPS-30V-S, excepting that it has a 600 mm long pinch tube. After the concrete is cured to ensure proper contact between the pressure pad and the surrounding concrete, the pinch tube is squeezed to push the fluid into the pressure pad to expand/inflate it.

Model EPS-30V-I

Concrete Pressure Cell

EPS-30V-I interface pressure cell is designed to measure pressure between soil and rock or concrete interface. The construction is similar to EPS-30V-S, excepting that the diaphragm on rock/concrete side of the pressure pad is thicker to minimise point loading effects.

Specifications

Range (MPa)	0.5, 1.0, 2.0, 3.5, 5.0,10.0, specify
Accuracy[1]	± 0.5 % fs standard | ± 0.1 % fs optional
Over range limit	150 % of range
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent
Pressure pad sizes	200 mm Ø x 7 mm thick (EPS-30V-S/EPS-30V-C) 200 mm Ø x 10 mm thick (EPS-30V-I)

[1]Calibrated accuracy of pressure sensor

Model EPS-30V-J

Jackout Pressure Cell

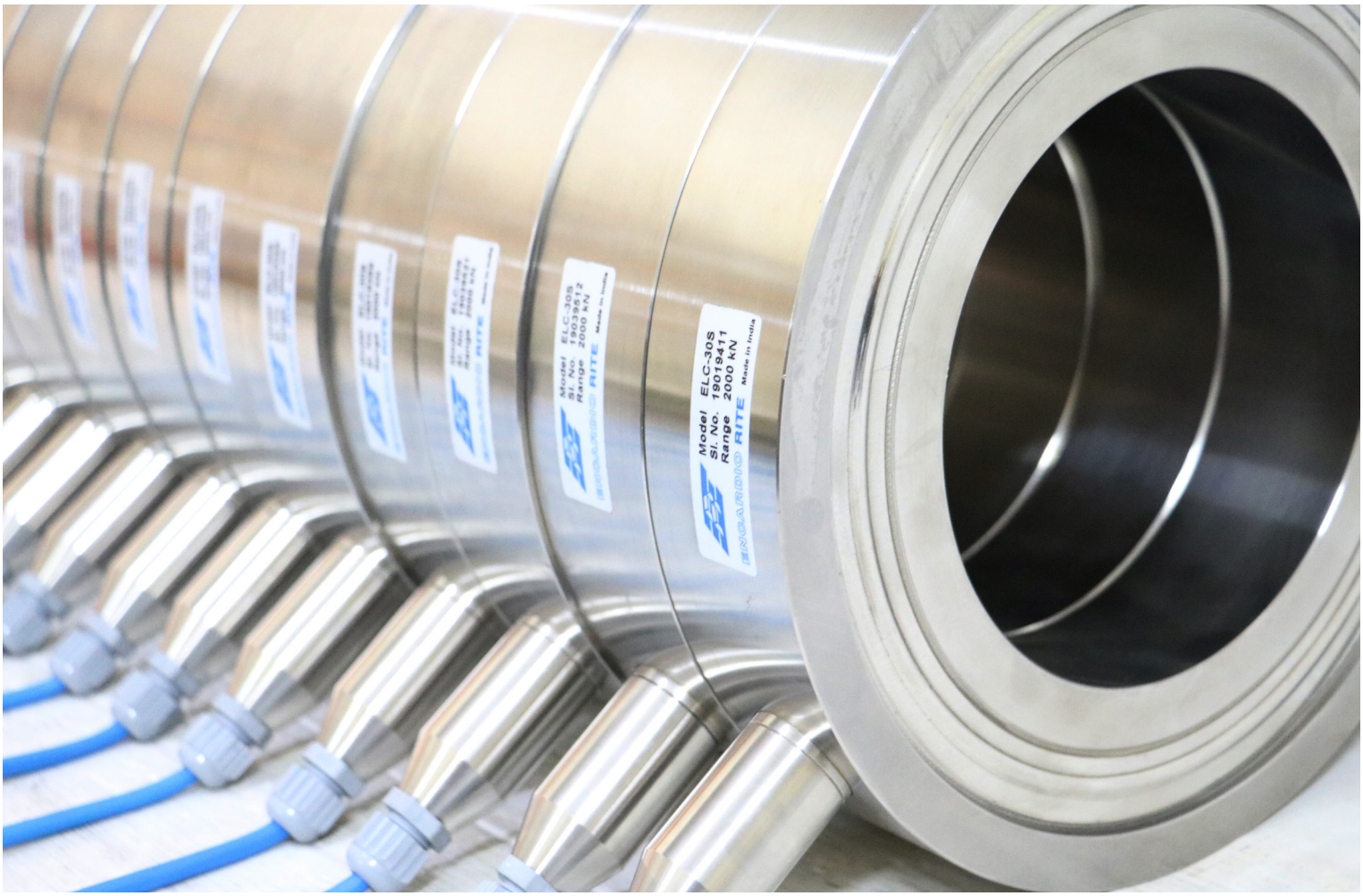
EPS-30V-J jackout pressure cell is designed to measure stress on base slabs, diaphragm/slurry walls, etc. It consists of a thin flexible stainless steel round flat diaphragm electron beam welded to a thick, rigid back plate around the periphery, leaving a narrow space between the two. A vibrating wire pressure sensor is electron beam welded concentric with the back plate. The cavity inside the sensor is filled with de-aired fluid.

Specifications

Range (MPa)	0.5, 1.0, 2.0, 3.5, 5.0, specify
Accuracy[1]	± 0.5 % fs standard | ± 0.1 % fs optional
Over range limit	150 % of range
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent
Pressure pad sizes **l x b (mm)**	125 Ø x 190 h 200 Ø x 190 h standard

[1]Calibrated accuracy of pressure sensor

LOAD CELL



Model ELC-30S

Center Hole/Anchor Bolt Load Cell

ELC-30S is a resistive strain gage type center hole load cell used to determine load in rock bolts, tieback anchors, etc. It comprises of a cylinder of high strength steel with eight 350 Ohm resistance strain gages, wired to form a 700 Ohm bridge. To minimize the effect of an uneven and eccentric loading, the eight gages are mounted around the circumference at 45° to each other. The load cell is hermetically sealed by electron beam welding making it immune to ingress of water and to most corrosive environments.

Specifications

Range (kN)/ID (mm)	200/40, 500/52, 1000/78, 1000/105, 1500/85, 1500/130, 2000/105, 2000/155, specify
Over range capacity	120 % fs
Calibration accuracy	± 0.25 % fs
Non-linearity	± 1 % fs
Temperature limit	-20° to 80°C
Cable connection	Six pin glass to metal seal

Model ELC-30S-H

Center Hole/Anchor Bolt Load Cell [High Capacity]

ELC-30S-H high capacity center hole load cell is similar to model ELC-30S load cell. Load cell with capacity above 5000 kN comprises of a high strength stainless steel element with sixteen 350 Ohm resistance strain gages, wired to form a 1400 Ohm bridge. The 3500/185 and 5000/202 load cells are electron beam welded.

Specifications

Range (kN)/ID (mm)	3500/185, 5000/202, 7500/227, 10000/210, specify
Over range capacity	120 % fs
Non-linearity	± 1 % fs (± 0.5 % fs is available)
Output	1.5 mV/V ± 20 %
Excitation	10 V DC (max. 20 V DC)
Temperature limit	-20° to 80°C
Cable connection	Four core shielded 5m long, specify

Model ELC-210S

Compression Load Cell

ELC-210S is a resistive strain gage type load cell designed to measure compressive load or axial forces. The load cell has great resistance to extraneous forces. This increases the fatigue life, permits less stringent mounting alignment and reduces the possibility of reading error. The load cell is protected against dust, moisture and adverse environmental conditions.

Specifications

Range (kN)	1000, 1500, 2000, 3000, 3500
Rated output	1.5 mV/V ± 10 %
Enclosure	IP 68, electron beam welded under a vacuum of 1/1000 Torr
Temperature limit	-20° to 80°C
Cable	Four-core shielded 2 m long; specify

Other specifications same as ELC-30S

Model ELC-150S-H

Compression Load Cell [High Capacity]

ELC-150S-H is a resistive strain gage type load cell designed to measure large compressive load or axial forces. The load cell has extensive use in pile testing. Like the ELC-210S, this load cell also has great resistance to extraneous forces, and is protected against dust, moisture and adverse environmental conditions.

Specifications

Range (kN)	5000, 6000, 7500, 10000 & 12500
Rated output	1.5 mV/V ± 10 %
Over range capacity	120 % with a maximum upto 14000 kN
Temperature limit	-20° to 80°C
Cable	Four-core shielded 5 m long; specify

Other specifications same as ELC-30S

Model ELC-31V

Vibrating Wire Hydraulic Load Cell

ELC-31V is a vibrating wire type center hole load cell used to determine load in rock bolts, tieback anchors, etc. It is fluid filled with a vibrating wire pressure sensor attached to it, to convert the load into a frequency output. Solid load cell for stress measurement in tunnel supports and struts is also available on request.

Specifications

Range (kN)/ID (mm)	250/35, 500/52, 750/78, 1000/105, 2000/130, 2500/0
Overload	110 % fs
Calibration accuracy	± 1 % fs
Non-linearity	± 2 % fs from 10 % to full range
Temperature limit	-10° to 55°C
Temperature effect	± 0.06 % fs/°C
Thermistor	YSI 44005 or equivalent

STRAIN GAGE

Model EDS-20V-AW

Arc Weldable Strain Gage

EDS-20V-AW vibrating wire strain gage can be arc welded on steel structures and reinforced bars for measurement of stress in tunnel lining, surge shafts, piles, struts and diaphragm walls, etc. Two annular mounting blocks are provided for arc welding the strain gage. Groutable reinforced bar annular mounting blocks are also available for surface mounting the strain gage to a concrete structure. The sensor is of stainless steel construction and has waterproofing to prevent any ingress of water.

Specifications

Range	3000 (± 1500) μ strain
Sensitivity	1 μ strain
Thermistor	YSI 44005 or equivalent
Temperature limit	-20° to 80°C
Size l x b x h (mm)	174 x 28.5 x 30
Cable	Four-core shielded 1 m long; specify

Model EDS-20V-E

Embedment Strain Gage

EDS-20V-E vibrating wire strain gage is suitable for embedment in soil or concrete. It is used to measure strain in underground cavities, tunnels, buildings, concrete and masonry dams etc. Waterproofing is provided on the strain gage sensor to prevent ingress of water.

Specifications

Range	3000 (± 1500) μ strain
Sensitivity	1 μ strain
Thermistor	YSI 44005 or equivalent
Temperature limit	-20° to 80°C
Size l x b x h (mm)	170 x 28.5 x 30
Cable	Four-core shielded 1 m long; specify

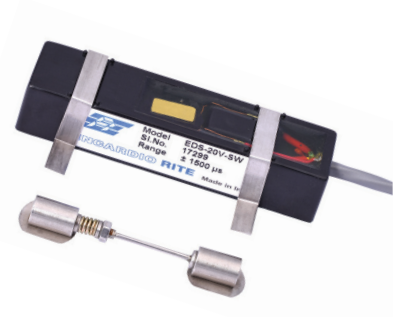
Model EDS-11V

Hermetically Sealed Strain Gage

EDS-11V is a very sturdy and robust high reliability strain gage suitable for embedment in mass concrete or for surface mounting by welding on steel structures. The sensor is electron beam welded, generating a vacuum of around 1/1000 Torr inside the sensor. This eliminates any effect of oxidation, moisture and ingress of water. Accessories available include spider for stain rosette, no stress strain container, dummy strain gage and extender.

Specifications

Range	± 1500 μ strain
Sensitivity	1 μ strain
Active gage length	140 mm
Thermistor	YSI 44005 or equivalent
Temperature limit	-10° to 80°C
Protection	IP 68
Cable connection	Glass to metal seal solder pin connector



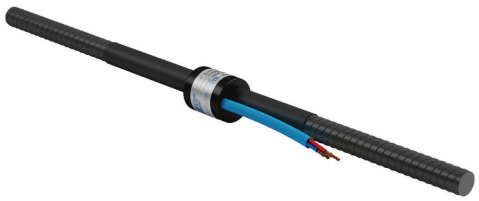
Model EDS-20V-SW

Spot Weldable Strain Gage

EDS-20V-SW vibrating wire strain gage can be spot welded or epoxy bonded on steel structures and struts. It can also be epoxy bonded on concrete structures. A sensor coil housing mounted directly over the strain gage, completely encloses the sensor, forming a watertight enclosure. A pair of clamps are provided to aid in fixing the housing to the substrate using an epoxy adhesive.

Specifications

Range	3000 μ strain
Sensitivity	1 μ strain
Active gage length	50.8 mm
Thermistor	YSI 44005 or equivalent
Temperature limit	-20° to 80°C
Size l x b x h (mm)	87 x 22 x 18
Cable	Four-core shielded 1 m long; specify



Model EDS-12V

Sister Bar Strain Meter

EDS-12V vibrating wire sister bar is used to measure strain in concrete structures such as piles, diaphragm/slurry walls, bridge abutments, tunnel lining, dams, foundations, etc. It consists of a hollow bar with vibrating wire strain gage mounted co-axially inside. The hollow bar is extended on the two sides with 12 mm Ø reinforced bars. Sister bar strain meter is also available with 16 mm Ø reinforced bar option.

Specifications

Range	2500 µ strain
Sensitivity	1 µ strain
Maximum Ø x l (mm)	26 x 1400 (for 12 mm Ø nominal-standard) 30 x 1400 (for 16 mm Ø nominal-standard)
Thermistor	YSI 44005 or equivalent
Temperature limit	-20° to 80°C
Protection	IP 68, waterproofing upto 30 mwc. Special sensors available at request for > 30 mwc waterproofing requirement.
Cable connection	Four-core shielded 1 m long; specify

TEMPERATURE

Model ETT-10V

Temperature Sensor [Vibrating Wire]

ETT-10V temperature sensor is designed for measurement of internal temperature in concrete structures, soil or water. It consists of a magnetic, high tensile strength stretched wire fixed to a material with different co-efficient of linear expansion. Any change in temperature directly affects the tension in the wire, and thus, its natural frequency of vibration. The sensor is of stainless steel construction and is hermetically sealed under a vacuum of around 0.001 Torr.

Specifications

Range	-20° to 80°C
Accuracy	± 0.5 % fs standard; ± 0.1 % fs optional
Dimension (Ø x L)	34 x 168 mm

Model ETT-10TH

Resistance Thermistor Probe

ETT-10TH is designed for measurement of surface temperature of steel and concrete structures, and bulk temperature inside concrete. It can also work submerged under water. ETT-10TH is a low mass water proof temperature probe. Due to its low thermal mass it has a fast response time.

Specifications

Sensor type	R-T curve matched NTC thermistor, equivalent to YSI 44005
Range	-20° to 80° C
Accuracy	1° C
Body material	Tin plated copper
Cable	4 core PVC sheathed

Model ETT-10PT RTD

RTD Probe

ETT-10PT can be used in similar applications as ETT-10TH. The probe has excellent stability and accuracy that makes it well suited for long-term installations where high accuracy and reliability is required. It consists of a ceramic resistance element (Pt 100) with DIN IEC 751 (formerly DIN 43760) European curve calibration. The resistance element is housed in a closed-end robust stainless steel tubing that protects the element against moisture.

Specifications

Sensor type	Pt 100
Range	-20° to 80° C
Accuracy	± (0.3 + 0.005*t)° C
Calibration	DIN IEC 751
Curve (European)	0.00385 Ohms/Ohm/° C
Dimension (Ø x L)	8 x 135 mm
Cable	3 core shielded

Thermocouple

Thermocouple wire consists of T-Copper-Constantan conductors, joined at one end to form a hot junction. This end is sealed against corrosion, and placed at the required location of temperature measurement. The other end of the thermocouple wire is connected to a suitable thermocouple connector to form a cold junction. The thermocouple readout displays a direct reading of the temperature at the installed location, and automatically compensates for the temperature at the cold junction.

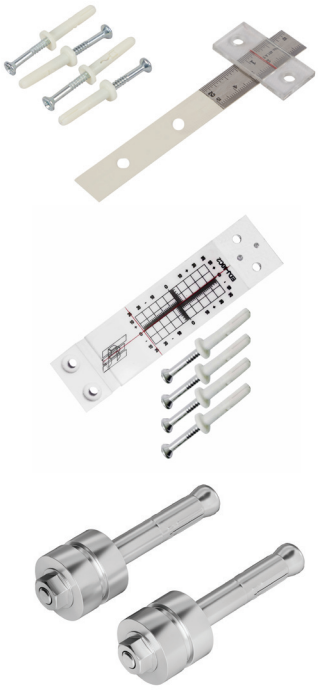
Specifications

Wire Type	T-Copper-Constantan
Wire Insulation	PFA Teflon
Hot junction Temperature	Up to 260°C (Max.)
Cold Junction Temperature	Ambient
Connector Type Miniature	Glass filled Nylon
Service temperature	-20° to 100°C

Thermocouple readout

Sensor Type	T-Copper-Constantan
Input	Two
Display	Two 4 ½ digit + one 6 digit
Range	-200° to 400°C
Accuracy	0.05 %
Alarms	High/Low (audible)

DISPLACEMENT & CRACK/JOINT METER



Model EDJ-40C

Crack Meter [Scale Type]

EDJ-40C crack meter can measure change in width of a surface crack. It consists of a graduated scale and a transparent acrylic plate with a hairline cursor mark. When installed across crack, the graduated scale and cursor move relative to each other depending upon crack opening or closing.

Model EDJ-40C2

Biaxial Crack Meter

EDJ-40C2 crack meter can measure the change in width of a surface crack in 2-axis. It consists of graduated scales on X and Y axis and a transparent acrylic plate with a hairline cursor mark. When installed across crack, the graduated scale and cursor move relative to each other depending upon crack opening or closing.

Model EDJ-41M

Crack Meter [Datum Type]

EDJ-41M is used for monitoring of cracks, joints and fissures. It consists of two stainless steel round datum blocks that are installed on either side of the opening. A digital inside caliper with a resolution of 0.01 mm is used to measure the distance between the grooves of the datum blocks.

Specifications

EDJ-40C	
Range (mm)	50, 100
Resolution	0.5 mm
EDJ-41M	
Range (mm)	150
Resolution	0.01 mm

EDE-VXX-YY (SC/RC/WP)

Range required

015:	15 mm
025:	25 mm
05:	50 mm
10:	100 mm
15:	150 mm
20:	200 mm
25:	250 mm

[Note: If purchase order does not specify type of sensor (SC/RC/WP), 'RC' version will be supplied]

Model EDE-VXX

Displacement Sensor[Vibrating Wire]

EDE-VXX linear displacement transducer incorporates a vibrating wire sensor that converts mechanical displacement to an electrical frequency output. This output can be transmitted over long distances. The sensor can be used in uniaxial joint meters, triaxial joint meters, crack meters, borehole extensometers and soil extensometers, etc. The sensor is available in following variants:

1. EDE-VXX-SC with side cable (suitable for crack gage)
2. EDE-VXX-RC with rear cable (suitable for BHE)
3. EDE-VXX-WP waterproof

Note: If purchase order does not specify, 'RC' version will be supplied.

Specifications

Range (mm)	15, 25, 50, 100, 150 or 200
Accuracy	± 0.2 % fs standard | ± 0.1 % fs optional
Sensitivity	± 0.02 % fs
Non-linearity	± 0.5 % fs
Temperature limit	-10° to 80°C
Thermistor	YSI 44005 or equivalent
Cable	Four-core shielded 1m long; specify

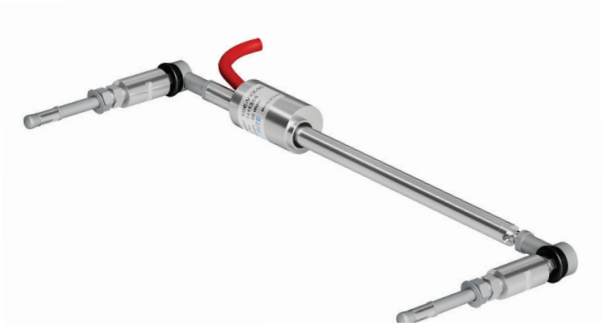
Model EDE-PXX

Displacement Sensor [Potentiometric]

EDE-PXX linear displacement transducer incorporates a potentiometric sensor. The application is same as that of EDE-VXX.

Specifications

Range (mm)	50, 100, 150
Input	5 ~ 13 V DC
Output	0 - 2 V DC (standard)
Accuracy	± 0.1 % fs
Sensitivity	± 0.02 mm
Temperature limit	-10° to 80°C
Cable	Four-core shielded 1 m long; specify



Model EDJ-40V

Crack/Joint Meter [Surface]

This crack/joint meter is designed for surface installation, and consists of EDE-VXX vibrating wire displacement transducer fixed between anchors, installed on opposite side of the crack/joint.

Specifications

Range (mm)	15, 25, 50 specify
Refer to EDE-VXX vibrating wire displacement sensor, for sensor specifications	

Model EDJ-50V

Joint Meter [Embedment]

EDJ-50V measures movement between concrete blocks in a concrete dam, and is suitable for embedment applications. It consists of a plastic housing with a stainless steel flange on one end, and a stainless steel socket on the other end. A vibrating wire displacement transducer inside the housing is connected to the stainless steel flange and the socket with flexible joints, to allow small lateral movement.

Specifications

Range (mm)	15, 25, 50, specify
Accuracy	± 0.2 % fs standard ± 0.1 % fs optional
Sensitivity	± 0.02 % fs
Non-linearity	± 1.0 % fs
Temperature limit	-10° to 80°C
Thermistor	YSI 44005 or equivalent

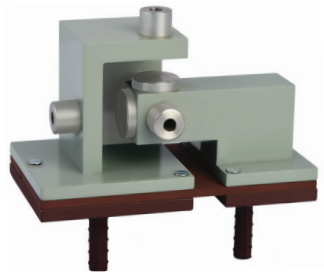
Model EDJ-40T

Crack/Joint Meter [Triaxial]

The triaxial joint meter with three EDE-VXX vibrating wire displacement sensors, flexible joints and accessories is available for monitoring joint movements in the X, Y & Z directions. A typical configuration using model EDE-VXX sensor is shown in the picture.

Specifications

Range (mm)	15, 25, 50 specify
Refer to EDE-VXX vibrating wire displacement sensor, for sensor specifications	



Model EDJ-40TJ

Crack/Joint Meter [Mechanical Triaxial]

EDJ-40TJ used for surface measurement consists of two-precision machined elements attached to re-inforced bar anchor stems. Measurement is made by anchoring the two element on either side of joint/crack and accurately measuring the distance between them over a period of time with a depth gage of 50 mm range and 0.01 mm resolution.

Specifications

Range (mm)	± 15 in X, Y, Z direction
Resolution	0.01 mm
Material	Aluminium with stainless steel bushes and pins; epoxy painted
Optional	AISI 304 stainless steel construction on request

EXTENSOMETER

Model EDS-63U/D & EDS-64U/D

Borehole Extensometer [Mechanical]

EDS-63U/D borehole extensometer mechanically measures deformation of rock mass and adjacent surrounding soil. It is available in 2-3 points suitable for a 76 mm borehole and 4-6 points suitable for a 102 mm borehole. The system comprises of anchors (groutable or packer), extension rods (stainless steel or fiber glass) in protective covering and a head assembly. A digital caliper/micrometer depth gage with a resolution of 0.01 mm is used to take readings.

EDS-64U/D is a single point borehole extensometer; the system is similar to EDS-63U/D. The borehole extensometer is suitable for 50 mm borehole.

Specifications

Type	Mechanical
No. of points	2-3 points; 76 mm borehole (EDS-63U/D) 4-6 points; 102 mm borehole (EDS-63U/D) Single point; 50 mm borehole (EDS-64U/D)
Extension rod	Stainless steel or fibre glass
Anchor	Groutable or packer

Model EDS-70V/EDS-70P

Borehole Extensometer [Electrical]

The system is similar to EDS-63U/D excepting that the EDS-70V head assembly incorporates vibrating wire displacement sensors (model EDE-VXX, range 50, 100 or 150 mm) and EDS-70P head assembly incorporates potentiometric displacement sensors (model EDE-PXX, range 50, 100 or 150 mm). The electrical output can be transmitted over long distances through multicore cable. The readings can be taken with a portable readout unit/ datalogger or through a remote automatic data acquisition system. This system is also available for use with mechanical readout devices.

Specifications

Type	Vibrating wire/potentiometric
No. of points	2 to 6
Extension rod	Stainless steel or fibre glass
Anchor	Groutable or packer
Sensor range	50, 100, 150 mm

Refer to EDE-VXX vibrating wire displacement sensor or EDE-PXX potentiometric displacement sensor for sensor specifications.

Model EDS-71V/EDS-71P

Borehole Extensometer [Electrical]

EDS-71V/EDS-71P is single point borehole extensometer. The system is similar to EDS-70V/EDS-70P. This model is suitable for 50 mm borehole.

Specifications

Type	Vibrating wire/potentiometric
No. of points	Single point (50 mm borehole)
Extension rod	Stainless steel or fibre glass
Anchor	Groutable or packer

Refer to EDE-VXX for vw displacement sensor and EDE-PXX for potentiometric displacement sensor

Model EDS-91

Magnetic Extensometer

EDS-91 magnetic extensometer system measures settlement or heave in foundations, embankments, fills, excavations, etc. The system comprises of access tube, magnet assemblies and a portable magnetic probe with reed switch. Magnet assemblies suitable for inclinometer casing are also available. A similar system for monitoring horizontal displacement is available with a pull cable reel and dead end pulley assembly or with push-in pipes.

Magnet assemblies:

- Datum magnet: for reference
- Spider magnet with 6 leaves: for boreholes
- Spider magnet with 3 leaves: for boreholes; can also be pushed in by a rod or pipe.
- Plate magnet: for fills & embankments.

Specifications

Range (m)	30, 50, 100, 150, 200, 300
Resolution	1 mm
Probe dimension	22 mm Ø , 150 mm long
Access tube	Vertical: PVC, 25.5 mm i.d., 32.5 mm o.d., fitted at both ends, with telescopic couplings having dimensions 35.5 mm i.d., 41.5 mm o.d., length 1 m, 2 m, 3 m Horizontal: PVC, 25.0 mm i.d., 33.4 mm o.d.; push pipe with 38.0 mm i.d., 48 mm o.d.
Range (ft)	50, 100, 150, 300, 500
Resolution	0.1" standard

Model EDS-92

Soil Extensometer

EDS-92 soil extensometer is designed for monitoring of soil and rock movement in embankments and dams. The system consists of a specially mounted EDE-VXX vibrating wire displacement sensor installed inside telescopic protective tubing fixed between two anchor beams with connecting rods. Change in relative position between the anchor beams represents the deformation taking place, and is measured by the displacement transducer.

Specifications

Refer to EDE-VXX vibrating wire displacement sensor for sensor specifications

TILT METER

Model EAN-95MW

Wireless tilt meter [RF]

EAN-95MW wireless tilt meter is suitable for remote monitoring of small changes in inclination and vertical rotation of structures. It combines high precision MEMS sensor with radio transmission network to provide accurate tilt data. The tilt meter features dependable stand-alone operation in weatherproof compact enclosure with low power consumption. The innovative wireless mesh-based data collection network provides seamless connectivity in large sites and tunnels. A cloud-hosted data management and configuration software can be used to manage the network and generate alarms. The configuration can be done with an easy to use smartphone application that comes free with the system.

Specifications

Sensor	Uniaxial/Biaxial
Standard range	± 30°
Sensitivity	± 10 arc seconds
Accuracy[1]	± 0.1 % fs
Temperature limit	-20° to 80°C
Battery	1 D-cell Lithium Thionyl Chloride (Li-SOCl2) 3.6 V 19 Ah batteries.
Radio bands	Sub-1 GHz band; complies with unlicensed ISM band specifications in most countries
Link data speed	625 bps – 2.5 kbps variable bitrate

[1]As tested under laboratory conditions.

Model ESDL-30MT

Wireless Tilt Meter [GSM/GPRS]

ESDL-30MT wireless tilt meter consists of one uniaxial or biaxial MEMS tilt sensor mounted inside a datalogger with digital output. It is a complete unit in itself to monitor tilt at any location. It features a wide operating temperature range, dependable stand-alone operation, low power consumption, compatibility with many telecommunication options and flexibility to support a variety of measurement and control applications. All the measured data is stored, together with the current date, time and battery voltage, as data record in the internal non-volatile memory of the datalogger and can be transferred to a remote server/PC through GSM/GPRS service.

Specifications

Sensor	Uniaxial or biaxial tilt meter
Measuring range	± 15°
Sensitivity	± 10 arc seconds
Accuracy[1]	± 0.1 % fs
Data output format	CSV text file. Can be easily imported in many third party applications like Microsoft® Excel
Temperature limit	-20° to 80°C

[1]As tested under laboratory conditions.

Model EAN-90M/EAN-92M

Tilt Meter

EAN-90M is a MEMS tilt meter, suitable for monitoring inclination and vertical rotation in structures such as buildings, dams etc. Model EAN-92M is a digital tilt meter. Both the tilt meters are rugged, high resolution tilt meters. The tilt meter can be fixed on a vertical or horizontal surface by means of an adjustable bracket and expandable anchor. The stainless steel sensor is electron beam welded with a vacuum of around 1/1000 Torr inside it. The biaxial tilt meter option is also available in same enclosure.

EAN-90M tilt meter has a voltage output, which can be read by any suitable read-out logger or indicator that measures differential voltage output. It can also be directly connected to our automatic data acquisition system through suitable multiplexer or interface units. EAN-92M can be directly connected to our compact digital datalogger.

Specifications

Sensor	Uniaxial or biaxial
Measuring range	± 15°
Output (nominal)	4 V at 15° proportional to sine of angle (EAN-90M) SDI-12 serial output (EAN-92M)
Sensitivity	± 10 arc seconds
Accuracy1	± 0.1 % fs
Temperature limit	-20° to 80°C
Dimension	32 mm Ø x 260 mm L
Cable	6 core cable-2 m long, specify (EAN-90M) 3 core cable-2 m long, specify (EAN-92M)
Dimension (bracket)	65 x 65 x 40 mm, 8 mm (th)

1As tested under laboratory conditions.

Model EAN-91M/EAN-93M

Tilt Meter [Box Type]

EAN-91M tilt meter is similar to model EAN-90M tilt meter, with the only difference that it is housed in a compact, weatherproof enclosure (box type). The enclosure can be directly fixed on a wall/structure. EAN-91M tilt meter has a voltage output, which can be read by any suitable read-out logger, or can be connected to our automatic data acquisition system through suitable multiplexer or interface units. Model EAN-93M is a digital tiltmeter that can be directly connected to our compact digital datalogger.

Specifications

Sensor	Uniaxial
Measuring range	± 15°
Output (nominal)	4 V at 15° proportional to sine of angle (EAN-91M) SDI-12 serial output (EAN-93M)
Sensitivity	± 10 arc seconds
Accuracy[1]	± 0.1 % fs
Temperature limit	-20° to 80°C

[1]As tested under laboratory conditions.

Model EAN-70M

Tilt Meter [Portable]

EAN-70M portable tilt meter is suitable for monitoring change in inclination of a structure. It is rugged in construction, and has excellent temperature stability. The tilt meter system includes tilt plates, a portable tilt meter and a readout unit. Tilt plates (to be separately ordered) available from Encardio-rite are dimensionally stable and weather resistant. Tilt plates are mounted on the structure at specified locations. Tilt readings can be obtained quickly and easily by a single operator. For taking and storing readings, use model EDI-53UTM read-out unit/datalogger (to be separately ordered).

Specifications

Sensor	Uniaxial
Measuring range	± 15°
Sensitivity	10 arc seconds
Accuracy	± 0.1 % fs
Temperature limit	-20° to 80°C
Size l x b x h (mm)	162 x 90 x 145
Dimension (tiltplate)	142 mm Ø x 24 mm high aluminium alloy

Beam Sensors

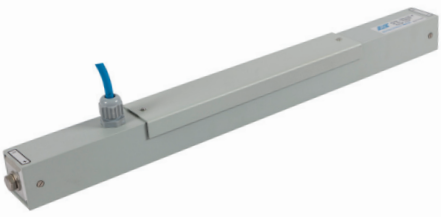
The beam sensors are generally attached to structures for monitoring any differential movement and tilting of structures. For monitoring deflection and deformation of retaining walls, sheet piling, etc., the beam sensors are mounted in vertical strings. The beam sensor can also be installed in long horizontal strings to measure differential settlement along railway tracks, tunnels, pipelines, embankments, etc.

Model EAN-91M-B (Analog) & Model EAN-93M-B (Digital)

EAN-91M-B and EAN-93M-B beam sensors consists of model EAN-91M and EAN-93M tilt meter (with SDI-12 digital interface) enclosure fixed on to a beam (1, 2 or 3 m long) respectively.

Model EAN-41M (Analog) & Model EAN-42M (Digital)

Model EAN-41M and Model EAN-42M (with SDI-12 digital interface) beam sensor consists of the MEMS sensor housed inside a beam (1, 2 or 3 m long and 38 x 38 mm, aluminium).
*Other specifications same as EAN-91M/EAN-93M



Tilt Meters & Beam Sensors [Electrolytic Uniaxial]

Model EAN-31EL | Electrolytic Uniaxial Tilt Meter

EAN-31EL tilt sensor is designed to monitor rotation and deflection of structures such as buildings, retaining walls, etc. in a vertical plane. The sensor is housed in a compact weather proof enclosure. These are rugged and high-resolution tilt meters. The enclosure can be directly fixed on a wall/ structure using adjustable mounting plate.

Model EAN-31EL-B | Electrolytic Uniaxial Beam Sensor

Model EAN-31EL-B beam sensor consists of model EAN-30EL sensor mounted on a beam (1, 2 or 3 m long) that is fixed on to the structure. The individual beam sensors are generally used in linked form to give a differential displacement profile.

Model EAN-41EL-B | Electrolytic Uniaxial Beam Sensor

EAN-41EL beam sensor has the same application as the EAN-31EL-B. In EAN-41EL, the electrolytic tilt sensor is housed inside the beam (1, 2 or 3 m long). The individual beam sensor is fixed on to the structure and can be used in linked form to give differential displacement profile. The voltage output from sensor can be read with the EDI-53ELV read-out logger. The output can also be monitored or logged at a remote location by our automatic data acquisition system/automatic dataloggers.

Specifications

Sensor	Electrolytic level type, Uniaxial
Measuring range**	± 0.5° (30 arc minutes)
Sensor Output	± 1 Volt (nominal) at 0.5°
Excitation supply	12 Volt dc (nominal) (from data logger)
Resolution	1 arc second
Repeatability	± 3 arc seconds
Temperature limit	-20° to 50°C
Beam	38 x 38 mm, aluminium with 1 m, 2 m & 3 m options

** Note: Polynomial linearisation co-efficients are provided for utilizing full measurement range of ± 0.5° .

INCLINOMETER & IPI

Model EAN-26M

Digital Inclinometer

Encardio-rite model EAN-26M is one of the most advanced MEMS digital inclinometer system being produced anywhere in the world. It utilizes the capability of an Android OS based smart phone as a readout and data storage unit.

EAN-26M vertical inclinometer system is used to measure lateral movement and deformation of earth works or a structure. It provides magnitude of inclination or tilt and its variation with time in structures like retaining/ diaphragm walls, piles etc.

The inclinometer system basically consists of inclinometer casings with couplings, digital biaxial tilt probe with operating cable and a smart phone datalogger. Accessories like dummy probe and calibration check jig are available on demand.

Model EAN-26M/2 traversing type digital biaxial tilt sensing probe, having a gage length of 500 mm (2 ft) is designed for use in all standard inclinometer casings i.e. with OD 70 mm (2.75") & 85 mm (3.34"). It is connected to the cable reel unit to take reading. The cable reel unit consists of a winding reel that holds the operating cable and a wireless Bluetooth relay unit that transmits the probe data to the datalogger. Operating cable, graduated at every 0.5 m (2 ft), includes a high tensile Kevlar core that makes the cable stretch proof even with intensive use. A rechargeable battery in the reel unit supplies power to the whole system.

INCLINOMETER

The Encardio-rite Digital Inclinometer application is loaded on the mobile phone to enable it to configure and collect data from the software. The application exploits the huge computational and image processing power of today's mobile phone to display the logged borehole data as tables or various types of graphs commonly used at back end computers to visualize the data. This has a great aadvantage as it allows the operator to verify the logged data and investigate any anomaly immediately at site.

Specifications

Measuring range	± 30° of vertical
Resolution	± 0.008 mm/500 mm (± 0.0004 in/2 ft)
System accuracy	± 2 mm/30 m (± 0.1 in/100 ft)
Temperature limit	-20° to 70°C
Dist. between wheels	500 mm (2 ft)
Probe dimensions	25.5 mm Ø x 685 mm long (excluding wheel arm)
Probe Weight	1.4 kg (3 lb)
Cable	6 mm Ø, 2 core kevlar reinforced polyurethane sheathed
Cable reel upto 100 m (330 ft)	300 mm Ø (flange)
100-200 m (330-650 ft)	380 mm Ø (flange)

Model EAN-26M-H

Horizontal Inclinometer

EAN-26M-H horizontal inclinometer system consists of a traversing type digital tilt sensing probe, mobile phone as an advanced readout device and a cable reel unit. The cable reel holds the operating cable along with wireless Bluetooth relay and battery units.

The inclinometer probe is passed through the inclinometer access tubing, installed horizontally, taking readings at fixed distances from one side. Another set of readings are taken at same intervals from the other end, thus reversing the probe to eliminate any offset error. An embedded processor in the probe provides digital output that gives the horizontal displacement value directly in desired engineering units. Transmitting data digitally to the reel allows any length of cable to be used without affecting the accuracy of the measurement. The readings are trasferred to mobile readout using the BlueTooth, which presents the data as meaningful information instantly. This helps the operator to verify logged data and investigate any anomaly immediately at site.

The system provides significant quantitative data on magnitude of settlement/heave taking place and its variations with time. It also provides the pattern of deformation, zones of potential danger and effectiveness of construction control measures undertaken.

Specifications

Measuring range	± 30°
Sensor	Uniaxial
System accuracy	± 2 mm/30 m (± 0.1 in/100 ft)
Resolution	± 0.008 mm/500 mm (± 0.0004 in/2 ft)
Distance between wheels	500 mm Metric (standard) 2 ft Imperial (on request)
Temperature limit	-20° to 80°C

IN-PLACE INCLINOMETER (IPI)

Model EAN-52M

In-Place Inclinometer

EAN-52M vertical IPI system is used for real time monitoring of lateral movement and deformation of earth works or a structure. It consists of a string of digital in-place sensors, which is positioned inside the gage well to span the movement zone for a complete deflection profile. Each sensor is fitted with a pair of pivoted sprung wheels.

When ground movement occurs, it displaces the inclinometer access tubing, causing change in the tilt of the IPI sensors. This results in change in output of the sensors, proportional to the tilt i.e the angle of inclination from the vertical. The tilt reading applies over the gage length of the sensor (gage length is distance between wheels). This tilt reading can be converted to lateral deviation. The gage length can vary from 1 m to 5 m, depending upon site requirement.

The digital IPI system has a great advantage, as only a single bus cable connects all the sensors in a daisy chain fashion. The sensor chain can be connected directly to our model ESDL-30 compact automatic dataloger, which transmits the recorded data in near real time to a central server. The system also provides instant alerts via SMS or email.

Specifications

Measuring range	± 15°
Sensor	Uniaxial or biaxial digital IPI snesor
Accuracy[1]	± 0.1 % fs
Resolution	± 0.05 mm/m (8 arc seconds)
Output	SDI-12 serial (digital) output
Temperature limit	-20° to 80°C

[1] As tested under laboratory conditions

Model EAN-52M-H

Horizontal In-Place Inclinometer

EAN-52M-H horizontal IPI system provides significant quantitative data on magnitude of settlement/heave in foundations or embankment and its variations with time. Its data logging and real-time monitoring feature helps to provide early warning in case of failures.

Like model EAN-52M verticl IPI system, EAN-52M-H also consists of a chain of digital inclination sensors that are positioned inside horizontally installed access casing. The operating principle is same as that of EAN-52M, only in EAN-52M-H the ground movement monitored provides settlement/ heave data. The gage length can vary from 1 m to 5 m, depending upon site requirement. Settlement of casing can be calculated by subtracting initial deviation from current deviation. A complete profile of the trench/borehole can be obtained by summing the successive readings. By comparing these profiles, the settlement or heave at the installation location, over a period of time, may be determined.

Specifications

Measuring range	± 15°
Sensor	Uniaxial digital IPI sensor

Remaining specifications same as EAN-51M vertical IPI system

3D IPIS - IPI WITH SETTLEMENT

Model EAN-61MS

3D In-Place Inclinometer with Settlement

EAN-61MS is an advanced digital 3D in-place inclinometer cum settlement system used at locations where lateral movement along with settlement/ heave is to be monitored. The system consists of a string of digital probes positioned inside the access tubing in a continuous array to span the movement zone. The sensors measure the tilt and settlement in successive segments to accurately monitor a change in the profile (x-y-z) of the inclinometer casing.

Each IPI cum settlement probe (IPIS) comprises of a high accuracy tilt sensor to monitor lateral movement (X-Y) and a contactless magnetic sensor to monitor settlement/heave (vertical movement-Z), housed in a waterproof stainless steel enclosure. The inclinometer access tubings, inside which the IPIS sensor chain is to be positioned, are installed in the borehole with special magnet rings at desired intervals.

Each probe is fitted with a pair of pivoted sprung wheels and is connected to each other through gage tubes (with adjustable lengths). To position the settlement sensor over the ring magnets, a coarse adjustment of 25 mm/50 mm/75 mm and a fine adjustment of 50 mm (± 25 mm) is provided in the gage tube. Length of spacer tubing determines the distance between each sensor.

Our advanced IPIS system has great advantage as a combination of IPI sensor and IPIS sensor is possible at locations where settlement needs to be monitiored only at a particular depth or at specific depths. The installation and adjustment of IPIS sensors is very easy. Also EAN-61MS requires only a single bus cable to connect all the IPI/IPIS sensors and the sensor chain to model ESDL-30 dataloger.

Specifications

Measuring range	± 15° (X-Y), 100 mm (Z)
Sensor	Biaxial MEMS sensor (monitor X-Y); contactless magnetic sensor (monitor Z); with SDI-12 digital interface
Accuracy[1]	± 0.1 % fs
Output	SDI-12 serial (digital) output
Speed	Speed: 1200 bits/sec
Temperature limit	-20° to 80°C

[1] As tested under laboratory conditions

Inclinometer Casing & Fittings

The inclinometer casings may be installed in a borehole, embedded in fill or concrete during construction or fixed to the face of a completed structure. These are self aligning ABS casings with longitudinal keyways at 90° for probe orientation. The casings and couplings (fixed or telescopic) are joined together with pop-rivets. Mastic tape is used over the joints to make a waterproof joint.

Specifications

Casing	ABS, 70 mm o.d., 58 mm i.d., 3 m long
Fixed coupling	ABS, 77 mm o.d., 160 mm long
Telescopic coupling	ABS, 77 mm o.d., 400 mm long, (150 mm displacement range)
End caps	ABS

PLUMBLINE

Model EDS-50/51, EPR-01S

Normal & Inverted Plumb Line With Digital Readout

EDS-50 (direct) and EDS-51 (inverted) plumb lines are used for monitoring tilt of a tall structure or a high rise building and for measurement and monitoring of relative displacement in a concrete or masonry dam. The EPR-01S automatic readout device for plumb lines is very precise providing an accuracy of 0.01 mm. It uses contactless inductive sensors that give position of the pendulum wire in two directions. It is equipped with a temperature gage for temperature compensation.

Pendulums already in situ can be measured by the automatic digital readout without additional modification. It only requires a target to be added to the pendulum wire for the device to be effective.

Specifications

EPR-01S automatic readout system	
Measuring range	± 40 mm (direct or inverted)
Accuracy	0.01 mm
Repeatability	0.05 % fs
Output	4-20 mA
Operating temperature	-25° to+70°C
Protection	IP67

SCOUR MONITORING

Scour Monitoring

Bridge piers over rivers are embedded in the riverbed and are susceptible to be affected by scour depending on bed soil type and river water flow velocity. Scouring compromises the safety of the bridge. It has been the cause of failure of several bridges around the world. It is thus, critical for the stakeholders to detect the occurrence of stream/riverbed scour at bridge piers and monitor the scour depth variation.

Encardio-rite offers innovative bridge (streambed) scour monitoring solutions that provide crucial information in near real time on the dynamics of sediment scour and aggregation. Each system has its own application and is used based on the site requirement. Their rugged design is ideal for safety monitoring of structures such as bridges that are located in high-current or deep-water environment.

Model EBSM-101M

Scour Monitoring [Magnetic]

EBSM-101M magnetic scour monitoring system comprises of:

- Magnetic collar that slides over a stainless steel (SS) support pipe inserted vertically into the streambed. The bottom end of the SS pipe is a heavy duty pointed cone for ease in driving into the streambed.
- Sensor probe consisting of a switch array at 45 mm intervals inside the SS support pipe
- Data acquisition system
- The magnetic collar assembly slides over the SS support pipe. It follows the level of the streambed, as scouring takes place.

However, if subsequently any silt built-up takes place over the scouring, the magnetic assembly stays in its previous lowest position. Thus, this system records the maximum depth of scouring that has taken place since the system was installed. The tubular magnetic switch assembly probe monitors the downward movement of magnetic collar. As the magnetic collar comes in proximity, a switch at that particular depth closes. The location of the magnetic collar i.e. streambed depth is thus determined and recorded.

Model EBSM-101S

Scour Monitoring [Sonar]

EBSM-101S sonar scour monitoring system comprises of:

- Sonic sensor installed on a bracket fixed to pier to monitor stream/river bed (scouring) depth
- Data acquisition system that receives depth data from the ultrasonic sensor and transfers it to central server.

The sonar sensor monitors the stream/river bed depth by acoustic echo ranging based on speed of sound in water. It measures the elevation of the stream/river bed at programmable time intervals by sending acoustic pulses from the sonar sensor to the streambed. The sonar device uses a narrow 8 degree beam to provide sufficient sonar beam clearance while allowing for reception of the reflected pulses. It is mounted on a bracket at a suitable angle (depending on site conditions), away from the pier.

Model EBSM-101

Datalogger

EBSM-101 datalogger is programmed to accept input from up to three magnetic probes and/or sonar scour monitoring sensor. The magnetic and sonar sensors are connected to the datalogger through separate individual serial bus cables. The datalogger provides necessary power supplies to the magnetic and sonar sensors. It has the facility to collect and store recorded data and transfer it to a central remote server at desired intervals over a wired or cellular telemetry link.

Specifications

EBSM-101M Magnetic scour monitoring system	
Sensor	Magnetic switch array with switches at 45 mm intervals, inside support pipe
Resolution	45 mm
Level uncertainty	± 25 mm
Probe & support pipe	Probe, SS housing, 60.3 mm dia. x 2.75 m deep. Additional 60.3 mm dia. SS support pipes 2.75 m long can be supplied as per requirement depending upon depth of riverbed
Size of magnetic collar assembly	OD: 165 mm, ID: 63 mm and Height: 176 mm (typical)

EBSM-101S Sonar scour monitoring system	
Operating depth	20 m
Resolution	Better than 50 mm
Resonant frequency	200 kHz (Nominal)
Beam width	8°±1°, Conical

EBSM-101 Datalogger	
Scan/upload interval	5 seconds to 168 hours
Memory capacity	Flash Memory (64-Mbit); 2 Million data points
Power supply	12 V SMF battery chargeable from AC mains or solar panel
Housing	Corrosion resistant weather proof enclosure

CORROSION MONITORING

Model ECS-101 Corrosion Monitoring System

The corrosion of reinforcement bars in concrete is a major concern globally, causing premature deterioration of crucial infrastructure. This corrosion compromises structural integrity, leading to cracks, weakened steel cross-sections, and spalling. Encardio-rite addresses this challenge through model ECS-101 corrosion monitoring system, designed to detect and predict the initial stages of corrosion in both existing and upcoming concrete structures.

During the corrosion process, mini anodic and cathodic zones emerge within the reinforcement. Iron dissolves at the anode and iron ions diffuse into the concrete towards the cathode, where it combines with oxygen and moisture to form rust, an expansive product. Factors such as iron ion movement, oxygen, and moisture availability influence the corrosion rate. While reinforced steel bars in high-quality concrete are generally resistant to corrosion due to the concrete's alkalinity, vulnerabilities arise from the porous nature of concrete. Carbonation diminishes alkalinity, and chloride incursion in coastal or de-icing salt-affected areas further exacerbates the risk, potentially leading to steel dissolution rates of up to 10 µm/year. The expansive nature of corrosion products leads to concrete cracking, delamination, and spalling.

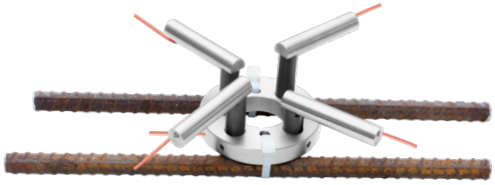
Model ECS-101 corrosion monitoring system incorporates 4-6 anodes at varying depths, adjustable based on concrete cover thickness, paired with a reference combi-electrode. The combi-electrode consists of a reference electrode and a mesh cathode. The anodes are made from the same material as the reinforcement. Additionally, humidity and temperature sensors can be used to enhance data accuracy. The sensors are connected to the measurement node, from where data is transmitted to the controller console/ datalogger via a single digital bus cable. Power options include battery, mains or solar power.

System Components

ECS-101/02: Reference Electrode to measure the actual state of corrosion in reinforcement

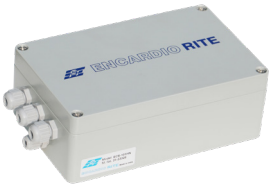
ECS-101/02M Mesh Cathode provides corrosion rate through linear polarization measurement.

ECS-101/01E Metallic Anodes are designed to be retrofitting into existing concrete. 4~6 anodes are usually installed at the required location.



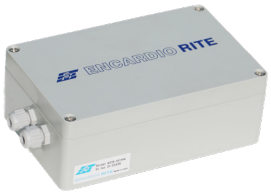
ECS-101/01N consisting of 4~6 steel anodes and a noble metal cathode, is designed for installation during construction.

ECS-101/03T Temperature Probe is embedded near anodes to record temperature measurements affecting corrosion.



ECS-101MN Measurement Node can connect up to 6 anodes, 1 combi-electrode and 1 temperature probe per location. Data from the node is transferred to the Controller Console through a bus cable.

The ECS-101/04H Humidity Probe is installed optionally near anodes to monitor humidity affecting corrosion. It is connected to ECS-101HN Humidity Node.



ECS-101C Controller Console or datalogger collects data from all the nodes installed at a location. It can connect upto 100 nodes.

For manual readings, ECS-101R Handheld zero-ohm ammeter is available to measure minute corrosion currents and EDI-55 Portable Readout unit can be used to measure humidity.

ECS-101 system provides corrosion information by performing scheduled potential decay measurements which will indicate the proper operation of potential measurement. The processing of corrosion data is split between the datalogger and cloud-based software. The data collected is securely transmitted to our Proqio cloud platform, enabling continuous access, advanced analytics, and visualization capabilities.

READ-OUT UNIT

Model EDI-54V
Portable Indicator

EDI-54V indicator is an advanced micro-processor based readout logger which can be used to log data from vibrating wire sensors. The logger uses a smartphone with Android OS as readout unit with a user friendly software. The smartphone provides a powerful platform for managing configuration. Also it makes retrieving, viewing and analyzing sensor data quite efficient. The logger displays the logged data as tables and graphs and keeps the record of previous data. This allows the operator to verify logged data and investigate any anomaly immediately at site.

EDI-54V has data logging feature and can be used as an automatic single channel datalogger. Readings can be stored either manually by accepting reading from the screen or can be stored automatically by running scheduled scan. The indicator has an internal non-volatile memory with sufficient capacity to store about 525,000 readings while scanning from any of the programmed sensor. Each reading is stamped with date and time. The Battery provides nearly 100 hours of operation on a single charge.

A choice of smartphone also provides the functions of camera to record photos or video clips of site conditions, view tutorial videos on site, or fix its geographic location using the inbuilt GPS receiver besides all the functions available in a smartphone.

Specifications

Frequency range	500 Hz to 5 kHz
Measurement time	128 cycles
Parameters	Time period, frequency, freuqency2, engineering units
Resolution	0.01 micro-seconds (in time period display mode)
Accuracy	Period measurement ± (0.006% of reading + 0.004 µsec)
Temp. Measurement Range	-20 to + 80°C
Housing	Impact resistant plastic moulded housing.
Power Supply	Internal rechargeable 6 V, 4 Ah sealed Valve Regulated Lead Acid battery. An external charger is provided for charging batteries
Battery charger	Input: 100 – 240 V AC, 50 or 60 Hz, 500 mA max.; Output: 9 VDC nominal, 2 A max.

CABLES

Model Series	Specifications				
	Model	**No. of cores**	**Color code**	**OD.**	**Weight(approx.)**
CS-0401 Series	7/0.34 mm annealed copper, petroleum jelly filled, 0.5 mm Ø galvanized steel wire armoured, polythene sheathed black color, variants as follows:				
	CS-0401-2	2 core	red/black	15 mm	0.3 kg/m
	CS-0401-4	4 core	red/black & green/ white	15.5 mm	0.35 kg/m
	CS-0401-6	6 core	red/black, green/white & blue/grey	16.5 mm	0.40 kg/m
CS-0402 Series	7/0.25 mm ATC, twisted pairs screened with water blocking aluminum foil, 0.3 mm galvanized iron wire braid armoured, overall polythene sheathed black color, variants as follows:				
	CS-0402-1P	2-core	red/black	10 mm	0.1 kg/m
	CS-0402-2P	4-core	red/black & green/white	11 mm	0.12 kg/m
	CS-0402-3P	6-core	red/black, green/white & blue/grey	11.5 mm	0.14 kg/m
	CS-0402-4P	8-core	all different	12.5 mm	0.16 kg/m
	CS-0402-6P	12-core	all different	14 mm	0.40 kg/m
	CS-0402-10P	20-core	all different	16 mm	0.3 kg/m
	CS-0402-20P	40-core	all different	19.8 mm	0.60 kg/m
CS-0403	7/0.2 mm silver plated copper with braid, 4 core screened cable in red, black, green, white, screened with aluminized polyester film, with drain wire, PTFE sheathed gray color, 3.5 mm o.d., unit weight (approx.) 0.03 kg/m.				
CS-0404	7/0.2 mm ATC, 4-core cable with red/black & white/black, foil shielded; chrome PVC jacket gray color. Maximum service temperature 80° C, ~ 5.6 mm o.d, unit weight (approx.) 0.35 kg/10 m.				
CS-0407 Series	7/0.2 mm annealed copper, petroleum jelly filled, 0.5 mm Ø galvanized sheet armoured, overall PE sheathed black color, variants as follows:				
	CS-0407-5P	10-core	all different	18 mm	0.45 kg/m
	CS-0407-10P	20-core	all different	19 mm	0.50 kg/m
	CS-0407-20P	40-core	all different	20 mm	0.55 kg/m
CS-0410 Series	7/0.2 mm ATC, datalene insulated, low capacitance, shielded cable, chrome PVC jacket black color, variants as follows:				
	CS-0410-5	5-core	red, black, white, green & brown	6.25 mm	0.05 kg/m
	CS-0410-8	8-core	red, black, white, green, brown, orange, blue & yellow	7.1 mm	0.08 kg/m
CS-0502	7/0.25 mm annealed copper, dual twisted pair screened cable in red/black & green/white, PVC sheathed red color, ~ 6.0 mm o.d., unit weight (approx.) 0.55 kg/10 m				
CS-0702	7/0.25 mm annealed copper, dual twisted pair screened cable in red/black & green/white, screened with aluminized polyester film, polyethylene insulation, with drain wire, polyurethane sheathed blue color, 6.35 mm o.d.				
CS-0703	7/0.25 mm ATC, 6 core cable in black, white, red, green, brown, blue, screened with aluminized polyester film, polyethylene insulation, with drain wire, polyurethane sheathed blue color, 6.5 mm o.d.				
CS-1002	7/0.25 mm annealed copper, 3 core screened cable in red, black & green, screened with aluminized polyester film, polyethylene insulation, with drain wire, polyurethane sheathed black color, 4.7 mm o.d.				
CS-1102	7/0.2 mm annealed copper, dual twisted pair screened cable in red/black & green/white, with dual vent tube, polyurethane sheathed yellow color, ~ 10 mm o.d., unit weight (approx.) 0.1 kg/m				
CS-1302	7/0.2 mm annealed tinned copper, 4 core screened cable in red/black & green/white, screened with aluminum polyester film, polyethylene insulation, with drain wire, Kevlar core, polyurethane sheathed yellow color, maximum service temperature 85° C, ~ 7 mm o.d, unit weight (approx.) 0.53 kg/10 m.				
CS-1303	7/0.25 mm ATC, dual twisted pair signal cable in red/black & green/white, foil shielded; chrome PVC jacket gray color. Maximum service temperature 60° C, ~ 5.5 mm o.d., unit weight (approx.) 0.3 kg/10 m.				

JUNCTION & SWITCH BOX

JUNCTION BOX

EJB-10-4-YZ
Suitable for connecting input from up to 10 sensors through ten 4-core input cables to one output cable.
EJB-10-6-YZ
Suitable for connecting input from up to 10 sensors through 6-core input cables to one output cable.
EJB-N-X-YZ
Suitable for connecting input through N (specify number) X-core (specify core) input cables to one output cable.
YZ = specify cable code or cable Ø (for input & output cable)

SWITCH BOX

ESB-10-4-YZ
Suitable for connecting and switching input from up to 10 sensors through ten 4-core input cables to readout unit and to one output cable.
ESB-12-4-YZ
Suitable for connecting and switching input from up to 12 sensors through twelve 4-core input cables to readout unit and to one output cable.
ESB-12-X-YZ
Suitable for connecting and switching input from up to 12 sensors through X-core (specify core) input cables to readout unit and to one output cable.
ESB-N-X-YZ
Suitable for connecting and switching input through N (specify number) X-core (specify core) input cables to the read out unit and to one output cable.
YZ = specify cable code or cable Ø (for input & output cable)

CABLE SPLICING/JOINTING KIT

ECS-05-Y
Suitable for extending length of CS-0404-6/CS-0502/CS-1303 cables with butt crimp terminals (Y - specify cable code); material- ABS.
ECS-06-Y
Suitable for extending other cables with butt crimp terminals (Y - specify cable code); material- FRP/aluminium
ECS-07
Crimping tool for above.
ECS-08-Y
Suitable for extending cables with screwed terminals (Y - specify cable code); material- FRP/aluminium.
ECJ-10-Y
Suitable for making joint between two 4/6-core jelly filled or water blocking cable ends (Y-specify cable code); material- AISI 420 stainless steel.
ECJ-11-Y
Suitable for making a heavy duty joint between two 4/6-core jelly filled or water blocking cable ends (Y-specify cable code); material- AISI 304 stainless steel.

GEODETIC TARGET & SURVEY MARKER

TARGETS

Targets are extensively used for measurement of deformation during tunnelling and subway construction, and for monitoring displacement of a bridge, dam, slope or building structure.

Model ERT-10B

Bi-Reflex Target

ERT-10B consists of reflectors on both sides mounted on a universal joint. The target has a small centre hole to allow precise targeting. Targets are interchangeable.

Specifications

Measuring range[1]	Typically 12 m to 140 m
Material	Reflector support is plastic, mounted on universal joints with reflective foil on both sides.

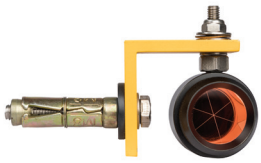
Model ERT-10P2

Prism Target

ERT-10P2 consists of a mini prism mounted on a universal joint such that it can be oriented in any direction as required. The prism is copper coated.

Optional components for ERT-10B & ERT-10P2

- Adaptor with a plastic reference break-off point.
- Convergence bolt of zinc plated steel constructions, 12 mm diameter x 170 mm long, with 3/8" pipe thread stud with protective cap.



Model ERT-20P2-M1

Mini Prism Target

ERT-20P2-M1 mini prism target consists of a prism mounted on a swivel bracket. The prism is copper coated.

Specifications

Measuring range1	Typically 0.3 m to 600 m
Material	Prism support is plastic, mounted on a universal joint.

1 Maximum measuring distance is highly dependent on atmospheric conditions and EDM model used.

Model ERT-60PS-M

Prism Target [60mm]

Model ERT-60PS-M consists of 60 mm dia corner cube glass prism with copper reflective coating, housed in a durable non-rusting, non-corroding AISI 304 SS housing that can be oriented in any direction.

Settlement points

Model EBS-16

Building Settlement Point

EBS-16 building settlement basically consists of a spherical reference locator with threaded bolt.

Model EPS-12

Pavement Settlement Point

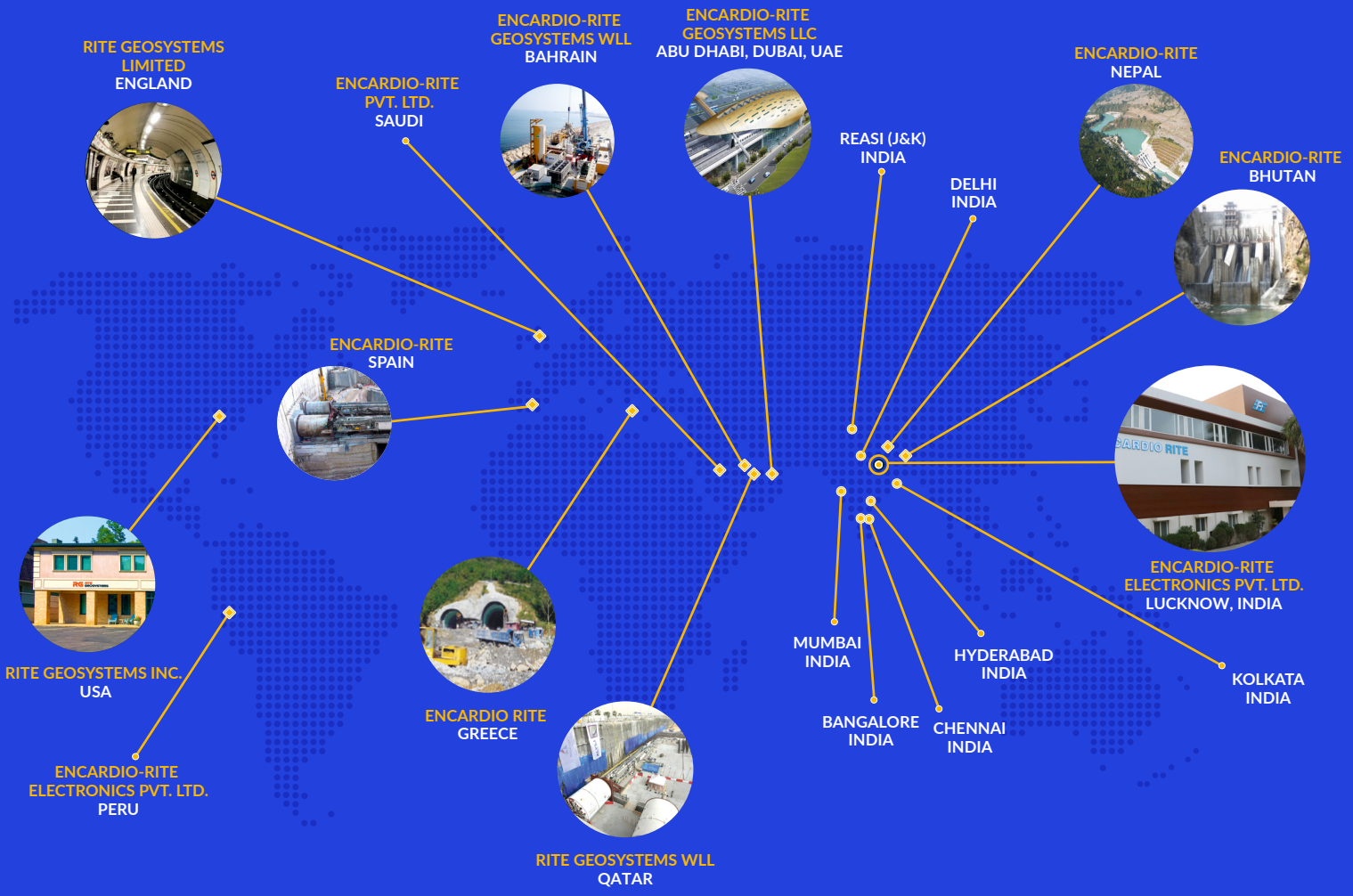
EPS-12 pavement settlement point basically consists of a plastic tapered disc and a special retaining nail.

Model ESMP-10/ESMP-11

Ground Settlement Point

ESMP-10 comprises of an AISI-304 survey pin having a semi-spherical top. A red coloured cross mark is provided at its top. Variations (ESMP-11/ESMP-12) are available with extension rods/anchors to suit different applications.

Encardio Rite Group: Metasensing Worldwide



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An experience base of over 1000+ critical infrastructure and high complexity projects across tunnels, dams, construction, structure, metro + rail and bridges.

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