ENCARDIO RITE

RELIABLE INSTRUMENTATION & DATA MONITORING SOLUTIONS

GEOTECHNICAL | GEODETIC | STRUCTURAL | HYDROLOGY

Where technology and experience join hands to give advanced ingenious solutions

PRODUCT CATALOG

INDIA | USA | UK | GREECE | SPAIN | MOROCCO | UAE | QATAR | BAHRAIN

CONTENTS

EXPERIENCE

Encardio-rite Group of Companies have acquired varied and extensive expertise in monitoring of large construction projects. We have over 54 years of experience with hundreds of successfully performing projects all over the World. We are informed, we are experienced, we have insights into technology and future, and we evolve accordingly. Encardio-rite has always been ahead of times.

250 km
METRO TUNNELS

325 km
RAIL & ROAD TUNNELS

200 km
SEWER TUNNELS

Over 200
DAMS ALL OVER THE WORLD

Over 100
HIGH RISE BUILDINGS, MONUMENTS, BRIDGES, ASSETS & FOUNDATIONS

Over 4500
ONLINE GROUNDWATER WELLS


HYDROELECTRIC PROJECTS


METROS & TUNNELS

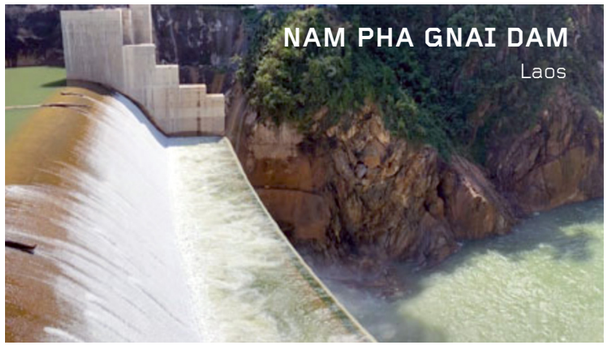

STRUCTURAL MONITORING

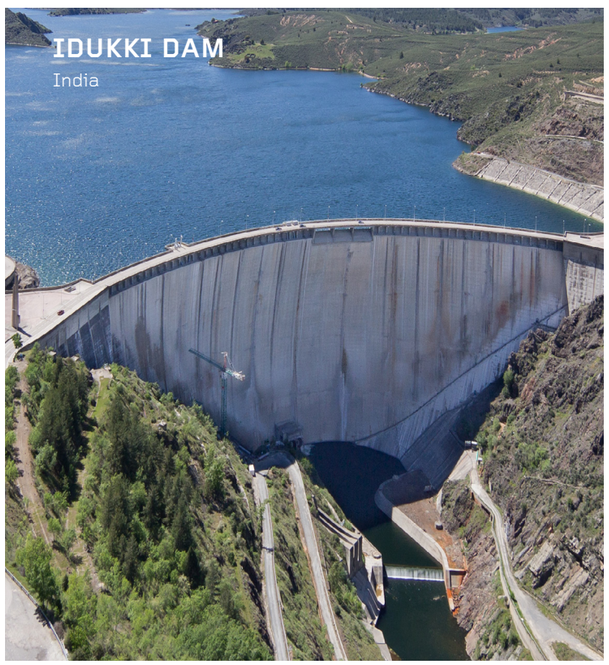

BRIDGE MONITORING


SLOPE MONITORING

HYDROELECTRIC PROJECTS

Dams | Power House | Tunnels | Surge Shafts | Penstock | Spillway





TEESTA HEP (III, IV, V)
India

INDIRA SAGAR DAM
India

GHATGAR UPPER & LOWER DAM
India

KOYNA DAM
India

KOL DAM
India

M'DEZ DAM
Morocco

PINALTO DAM
Dominican Republic

SALMA DAM
Afghanistan

EL PLATANAL DAM
Peru

MIDDLE MARSYANGDI HEP
Nepal

CHHUKHA HEP
Bhutan

DAGACHHU DAM
Bhutan

KOPRUBASI POWER HOUSE
Turkey

UPPER KOTMALE DAM
Sri Lanka

METROS, RAIL, ROAD & SEWER TUNNELS

GRAND PARIS METRO
France

COPENHAGEN METRO
Denmark

LOS ANGELES METRO
USA

LIMA METRO
Peru

ATHENS METRO
Greece

DELHI, MUMBAI, CHENNAI, BENGALURU, KOLKATA METRO
India

EGNATIA MOTOR WAY
Greece

NORTH FRONTIER RAIL
India

AL RAYAN ROAD PROJECT
Qatar

CHENANI NASHRI ROAD
India

DUBAI METRO
United Arab Emirates

PIR PANJAL RAIL TUNNEL
India

BRENNER BASE TUNNEL
Italy

ROHTANG TUNNEL
India

MUHARRAQ SEWER
Bahrain

IDRIS SEWER
Qatar

STRUCTURAL HEALTH MONITORING

High Rise Buildings | Monuments | Foundations | Bridges

ICD BROOKFIELD PLACE
United Arab Emirates

MARSA AL SEEF
United Arab Emirates

AL ZAABI TOWER
United Arab Emirates

MEENA TOWER
United Arab Emirates

DEIRA WATERFRONT
United Arab Emirates

DUBAI WATER CANAL
United Arab Emirates

AL QUID TOWER
Qatar

LODHA WORLD ONE
India

AL MIRANI FORT
Oman

AL SHINDAGHA CORRIDOR
United Arab Emirates

BASILICA OF S. MARIA
Italy

GROUNDWATER, GROUND IMPROVEMENT

Seaport | Airport | Landslide

GROUNDWATER LEVEL
Karnataka, Uttar Pradesh, Assam, Punjab, Telangana, Puducherry, West Bengal - India

YAS MARINA ONLINE WATER LEVEL
United Arab Emirates

SEPETIBA HARBOUR COAL STOCKPOLE
Brazil

SLAB STORAGE STOCKPILE
Brazil

MUNDRA PORT
India

DUBAI AIRPORT
United Arab Emirates

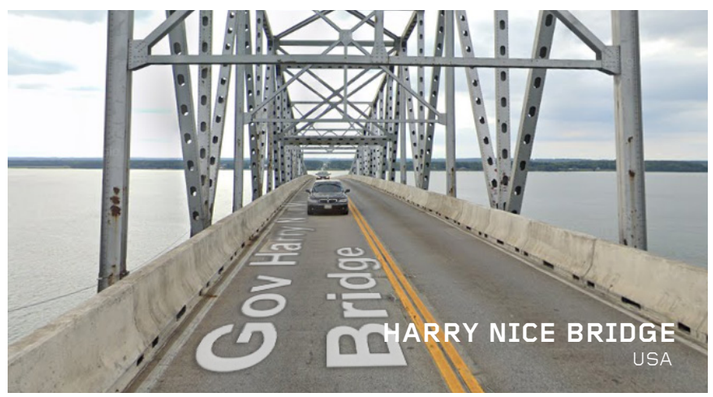
ITD GRSE SOIL CONSOLIDATION
Kolkata, India

LNG MUNDRA TANK
India

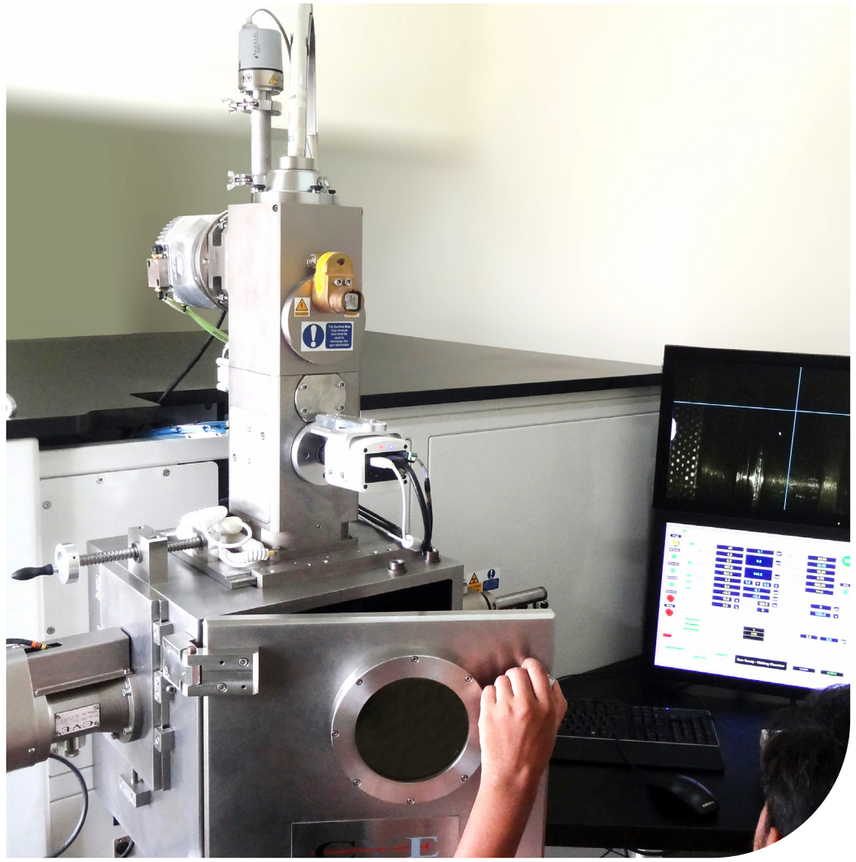
JAWAHAR LAL NEHRU PORT TRUST
India

KANDLA PORT
India

VISHAKHAPATNAM SEA PORT
India



COMPANY PROFILE



Encardio-rite Group

Established in India in the year 1966, Encardio-rite Group is a World leader in real time safety monitoring providing solutions for risk assessment of mega construction projects and existing infrastructure. We provide reliable and accurate data at client's fingertips using disruptive technologies. With us, technology and experience join hands to give the clients innovative solutions they can rely on. Evolving and leading for over 50 years, we go the extra mile for our customers. This has resulted in making Encardio-rite an established and trusted brand Worldwide.

Encardio-rite designs and manufactures widest range of civil engineering and structural monitoring instrumentation available from any single manufacturer in the World. Our advanced monitoring solutions for risk assessments are fully automated using digital sensors, dataloggers, wireless transfer techniques and advanced database management system providing real-time meaningful data at clients' desk 24 x 7. Early warning system allows timely decisions, increased safety, reduction in project delays and cost effectiveness.

We not only provide world-class products and solutions, but also in-depth information, unparalleled customer service and expert advice to our clients. Having worked with some of the best consultants and construction companies in the World on landmark construction projects, the Group has developed substantial expertise in the field.

Encardio-rite has branches in eight countries, supported by well-trained, qualified and experienced industry professionals. At Encardio group, we exchange knowledge and work together to create an environment where ideas and solutions are born.

Our perseverance to innovate, vast expertise and advanced technology has enabled us to provide complex solutions for countless projects. Our excellence is reflected through our key projects like LA Metro, Paris Metro, Copenhagen Metro, Lima Metro, Dubai Metro, Doha Metro, Delhi Metro, Marina Bay Sands, One Za'abeel Towers, Abu Dhabi Underground Sewer System, Tehri Dam, etc.

With Moniterra, we are the world leaders in providing sophisticated turnkey solutions for topographic, land, aerial and construction surveying and mapping along with online data management that includes onsite surveying, data processing and reporting. With varied experience in geotechnical, geodetic and online solutions, we are one of the most formidable group of companies in this field.

Advance Facilities

R&D division

We are leaders in technological advancements with cutting-edge software, instrumentation, monitoring and manufacturing techniques to address the dynamic requirements of the evolving construction and environmental sectors.

Quality

Consistent quality services with reliable products, in compliance with the ISO-9001:2015 quality systems conforming to international standards.

Production

State-of-the-art manufacturing and testing facilities, equipped with the best of tools and technology including electron beam welding and load cell calibration facilities up to 15,000 kN. A wide range of sensors are hermetically sealed resulting in IP-68 protection that result in sensors being almost completely resistant to effect of corrosion and ingress of moisture and water, making them best suitable for long term monitoring.

RISK ASSESSMENT SOLUTIONS

Automated Data Management For Risk Assessment

Encardio Group with partner Moniterra, Europe, 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.

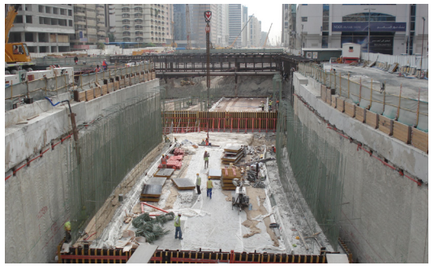
We aim to assist and keep owners, designers, contractors and architects informed about continued performance of structures under gradual or sudden changes to their state. Encardio Group has great expertise in this field, and has executed a number of projects in Gulf countries and worldwide.

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

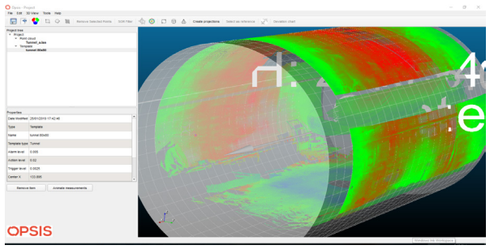
Topographic and Aerial Mapping using UAVs (Drones)

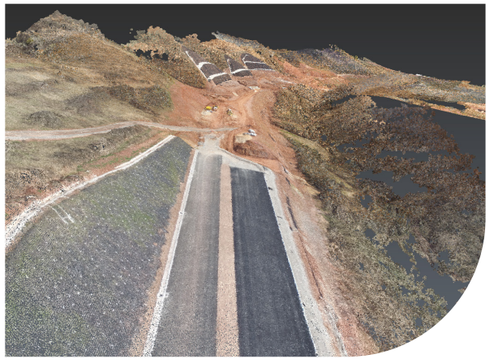
UAVs are the latest trend in geodesy's technology for aerial mapping. Unmanned and remotely-piloted aircrafts that follow a pre-programmed path for take-off, flight and landing. These aircrafts are equipped with HD/IR/thermal cameras that compute aerial images and videos over a defined area at a specified 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.

Opsis for Laser Scanning

Encardio Moniterra Group offers OPSIS software, which is a unique application for deformation monitoring using laser scanning data, a true game changer! OPSIS is a data analysis software that processes 3D data collected by a laser scanner. It optimizes the huge data from laser scanner and provides an analysis directly from the 3D data for accurate and fast monitoring of deformations. With OPSIS one can have complete deformation overview maps, time-displacement graphs and animations depicting deformations occurring with time, in a snap!

Laser scanning is a method to automatically monitor and collect the data in real time with 3D surface coordinates of an object in normal grid. Laser scanning 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, and landslide areas.





REAL-TIME DATABASE SYSTEM

Online Database Management Systems

Encardio-rite offers **DRISHTI**, an advanced web based real time monitoring system that aims to give immediate view of the situation of any civil engineering project, asset, infrastructure, mine, high rise building, landslide area etc. It is a complete management solution for monitoring construction or structures with topographical, geotechnical and environmental sensors.

It has powerful tools for retrieving data from remote dataloggers (which can geographically spread over large area), archiving data in a SQL database, performing required calculations on data and presenting the data in meaningful format at clients' fingertips, in real time, with instant warnings. The early warnings help in taking timely corrective actions, increased safety, reduction in project delays and consequently cost effectiveness.

DRISHTI is a versatile monitoring solution that can accept inputs from a wide variety of dataloggers. It also accepts manual monitored data, images, diagrams and drawings. This helps the user to have an easy access to all the information on a single platform for risk management, evaluation, interpretation and decision-making. It has features like Google Map navigation, graphical navigation to have a quick view of all the monitored data.

Few highlights of DRISHTI database management software:

- Comprehensive data management system that can store data from different sources
- Data from multiple sensor types converted into meaningful information in graphical as well as numerical format
- Using an intuitive interface, it only takes a few mouse clicks to configure data storage, data visualization and alarm settings as per user's requirement
- Scalable to meet any project size, small or large
- Access to combined charts/graphs of selected sensors helps in correlating readings within selected area, in case any variation is found
- Layout plan can be incorporated with locations of each monitoring sensor
- Over Google Map, user can have a quick access to numerical values for the graph being viewed at any time. Users can also directly go to image navigation from Google Map
- Facility to import measurements from ATS (automatic total station) systems directly
- Additional feature for filtering raw data through moving average filter
- Instant alerts via SMS or email to authorized personnel
- Generate reports automatically on daily, weekly or monthly basis
- Results are accessible on laptops, tablets and smartphones
- Multiple authorized users at different locations can simultaneously access data
- Cloud or installation on local server - both possible
- No special software required for accessing the user sites as information can be viewed using most standard and popular web browsers

Another web based database management software, **TERRAWEB**, is also available that has an additional feature to correlate sensor data with Tunnel Boring Machine (TBM) data. It supports up to 6 TBMs simultaneously. The user thus has an easy and immediate access to all the information on a single platform for risk management, evaluation, interpretation and decision-making.

WIRELESS MONITORING

WIRELESS MONITORING SYSTEMS

Wireless sensor network are vital in monitoring large construction sites, structures and landslide areas. Encardio-rite is the only company 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.

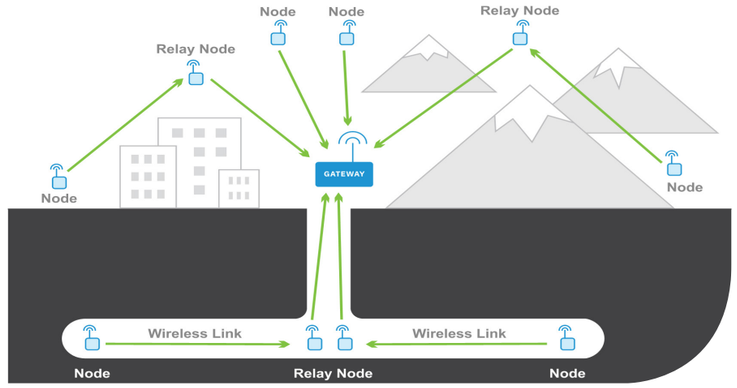
Nodes and Gateway (RF dataloggers)

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:

EWN-01V	Vibrating wire node, single channel. Suitabke for vibrating wire sensors.
EWN-08V	Vibrating wire node as above, 8 channel.
EWN-01A	Analog node, single channel. Suitable for sensors with millivolt, voltage, 4-20 mA, wheatstone bridge outputs.
EWN-04A	Analog node as above, 4 channel.
EWN-01D	Digital node. To be used with digital sensors
EWN-01R	Relay node. To enhance range of any node.
EWG-01	Gateway. To collect sensor data from nodes, upload collected data to remote server.
EAN-95MW	Wireless tilt meter. It is a complete unit in itself including the sensor and the node.

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.



WIRELESS MONITORING

Dataloggers (GSM/GPRS)

Model ESDL-30
Datalogger for Digital Sensors

Model ESDL-30 datalogger is designed to log data from any geotechnical, structural, groundwater or environmental digital sensor. It can be programmed to take a measurement from 5 seconds to 168 hours in linear mode. All the measured data are stored together with the current date, time and battery voltage, as a data record in the internal non-volatile memory of the datalogger.

Model ESCL-12VT
Datalogger for VW Sensors

Model ESCL-12VT single channel vibrating wire datalogger is designed to monitor a single vibrating wire sensor (including temperature) such as a piezometer, crack meter or displacement transducer.

Model ESCL-10VT
Datalogger for Water Level Sensors

Model ESCL-10VT single channel vibrating wire datalogger is designed to monitor a single fluid pressure sensor (including temperature). The datalogger has in-built barometric pressure sensor for correctinng atmospheric pressure variation. It has facility to connect rain fall gage also.

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

Digital Sensor Networking System

Encardio-rite digital sensors are equipped with SDI-12 digital interface. The SDI-12 system allows a huge reduction in cabling costs as only a single three conductor cable is required to interconnect the sensors and dataloggers in a network that can be spread over a wide area. Encardio-rite uses SDI-12 interface units for almost all types of sensors such as vibrating wire, resistive strain gage, MEMS, 4-20 mA, electro level sensors and tipping bucket rain gage.

SPECIFICATIONS

Input	ESDL-30: Sensor with SDI-12 digital output. ESCL-12VT & ESCL-10VT: Vibrating wire sensor, Frequency range-400Hz to 5kHz
Scan/upload interval	5 seconds to 168 hours
Memory capacity	8 MB Flash RAM, can store 3,145,728 data points
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, or • 2 x D size 1.5 V Alkaline high power cells, or • 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.

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 ECTD-30V, ECTD-60V
Conductivity Sensor With Water Level And Temperature

Model ECTD-30V and ECTD-60V CTD sensors are used for monitoring electrical conductivity, water level and temperature in the ground. These are robust, marine grade sensors.

Model ECTD-30V CTD probe consists of model EPP-30V absolute pressure sensor while ECTD-60V includes model EPP-60V absolute pressure sensor. Temperature is measured through inbuilt thermistor sensor. The CTD sensor is supplied with an individual barometric pressure sensor (fitted inside the datalogger) which allows the water level to be corrected for barometric pressure variation. Much of the complex circuitry is in the datalogger, model ESDL-30CTDB, lowering the cost of individual sensors without impacting their accuracy or resolution. This makes the system cost effective.

SPECIFICATIONS

Pressure sensor	ECTD-60V - 10, 20, 35, 50 mWC ECTD-30V - 20, 35, 50, 100 mWC
Conductivity sensor	4 Electrode bulls-eye cell; 120 mS range; cell constant 0.42 ± 0.05
Conductivity sensor range	5 – 120,000 µS/cm
Accuracy	± 0.5 % of reading + 1µS/cm (for 5 – 80,000 µS/cm) ± 1 % of reading (for 80,000 – 120,000 µS/cm)
Resolution	0.1µS/cm (for 5 – 80,000 µS/cm); 1.0 µS/cm (for 80,000 – 120,000 µS/cm)
Temp. sensor	Thermistor 30k Ohm; 0 – 80°C
Protection	IP-68 (IS-60529:2001)

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

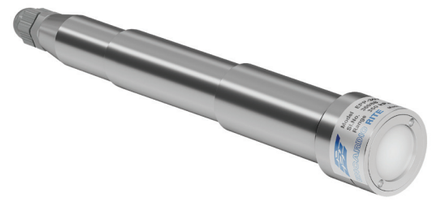
PIEZOMETER

Model EPP-30V
Vibrating Wire Piezometer

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 (ϕ x L)	42 x 185 mm



Model EPP-30VS
Digital Piezometer

EPP-30VS digital piezometer is similar to model EPP-30V piezometer, only it has a digital output instead of frequency output. Digital sensors have a lot of advantages over the conventional sensors; major one is that all the digital sensors can be connected through a single 3 core bus cable to our compact datalogger. The sensor is hermetically sealed with a vacuum of around 0.001 Torr inside it. A glass to metal seal solder pin connector is provided for easy cable connection.

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
Output	SDI-12 serial output
Thermistor	YSI 44005 or equivalent
Dimension (ϕ x L)	42 x 365 mm

Other specifications same as EPP-30V

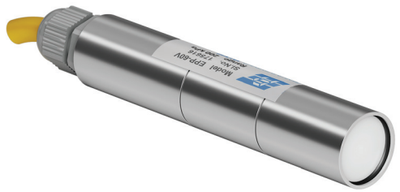
Model EPP-40V
Vibrating Wire Slim Piezometer

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 (ϕ x L)	19 x 155 mm

Other specifications same as EPP-30V



Model EPP-60V

Vibrating Wire Low Pressure Piezometer

EPP-60V is a low pressure sensor, extensively used for settlement measurement and water level/water pressure measurement in boreholes. It is available in two versions- Electron beam welded and with vented tube cable.

SPECIFICATIONS

Electron Beam Welded

Range (MPa)	0.10, 0.20
Dimension (Ø x L)	30 x 160 mm

Glass to metal solder pin connectors

Vented Tube Cable

Range (MPa)	0.035, 0.07
Dimension (Ø x L)	30 x 160 mm
Cable	CS-1102 vented 1 m long; specify

Other specifications same as EPP-30V

Model EPP-60VS

Digital Low Pressure Piezometer

EPP-60VS is a low pressure digitial piezometer. It is similar to model EPP-60V pieozmeter, but has a digital output instead of frequency output. Digital sensors have an advantage that they can be connected through a single 3 core bus cable to our compact datalogger. The sensor is hermetically sealed with a vacuum of around 0.001 Torr inside it.

SPECIFICATIONS

Range (MPa)	0.10, 0.20
Accuracy	± 0.2 % fs standard ± 0.1 % fs optional
Output	SDI-12 serial output
Dimension (Ø x L)	30 x 320 mm

Other specification same as EPP-60V

Model EPP-50V

Vibrating Wire 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.

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

Vibrating Wire Uplift Pressure System

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

Model EPU-20G

Bourdon Gage Type Uplift Pressure System

EPU-20G uplift pressure measurement system is similar to the above excepting that it incorporates a Bourdon gage with dial readout instead of vibrating wire pressure cell that requires an electronic readout.

SPECIFICATIONS

Range (MPa)	1.0 (standard)

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-11V

Seepage Measurement Sensor For Weirs

ESM-11V seepage measurement system consists of a submersible cylinder and level sensor to monitor the water head developed over the V-notch weir. Change in level changes the buoyancy on the cylinder that is measured by a highly sensitive vibrating wire sensor. V-notch weirs are additionally available on request if specifically asked for.

SPECIFICATIONS

Level Sensor	
Range (mm wc)	300, 600, specify
Accuracy	± 0.1 % fs
Non-linearity	± 0.5 % fs
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent

SETTLEMENT

Model EGS-30V

Settlement Measurement System

EGS-30V settlement measurement system is designed for monitoring settlement in fills, embankments and dams, etc. It comprises of a vibrating wire sensor connected to a reservoir via a fluid filled polyethylene sheathed twin nylon tubing. The sensor is installed in soil fill and the reservoir is mounted on firm ground. As the sensor settles with surrounding soil, the fluid head at the sensor increases. The change in measured head is the settlement relative to the reservoir.

A manifold system is optionally available to connect up to seven sensors to the same reservoir.

SPECIFICATIONS

Range (m)	7, 20, 30, 50, 70
System accuracy	± 0.25 % fs to ± 1 % fs
Temperature limit	-20° to 80°C (sensor)
Reservoir housing	400 h x 300 w x 220 d mm
NOTE	
Sensor accuracy	± 0.1 % fs
Sensor non-linearity	± 0.50 % fs
Thermistor	YSI 44005 or equivalent
Cable	CS-1102 (vented) for 7 m range CS-0702 for other sensors
Fluid tubing	6 mm o.d., 4 mm i.d., twin nylon tube

Model ESM-30V

Liquid Level Settlement System

ESM-30V is a high sensitivity liquid level settlement measuring system that uses low range vibrating wire force transducer with a submersible cylinder suspended in a fluid filled vessel. It is designed for remote measurement of minute differential settlement in tunnels, bridges and buildings etc. with high precision. Settlement of any vessel installed, causes change in its fluid level, affecting the buoyancy on the suspended cylinder. The ESM-30V is provided with two or more settlement systems with fluid filled vessels interconnected in series by a fluid filled tube.

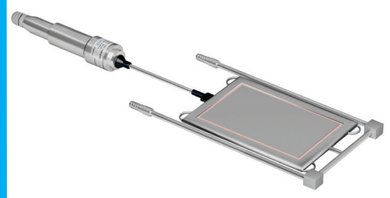
SPECIFICATIONS

Range (mm)	150, 300, 600 specify
Resolution	0.07, 0.15 mm
Accuracy	± 0.1 % fs
Non-linearity	± 0.5 % fs
Temperature limit	0° to 80°C
Thermistor	YSI 44005 or equivalent
Vent Tubing (Two lines)	6 mm o.d., 4 mm i.d., nylon tube
Fluid Tubing	12 mm o.d., 10 mm i.d., nylon tube

PRESSURE CELL

Model ESC-30V
Shotcrete-Concrete Stress 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
Soil And Rock-Concrete Interface 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

BOREHOLE STRESSMETER

Model EPS-62V
Borehole Stress Meter

EPS-62V is a biaxial borehole stress meter, designed to monitor stress changes in hard rock, rock salt or concrete. The stress meter consists of a stainless steel cylinder with three or six vw sensors, spaced at 60 degrees interval, to measure the radial deformation of the cylinder. The stress meter also has in-built temperature sensor to compensate for the temperature variations.

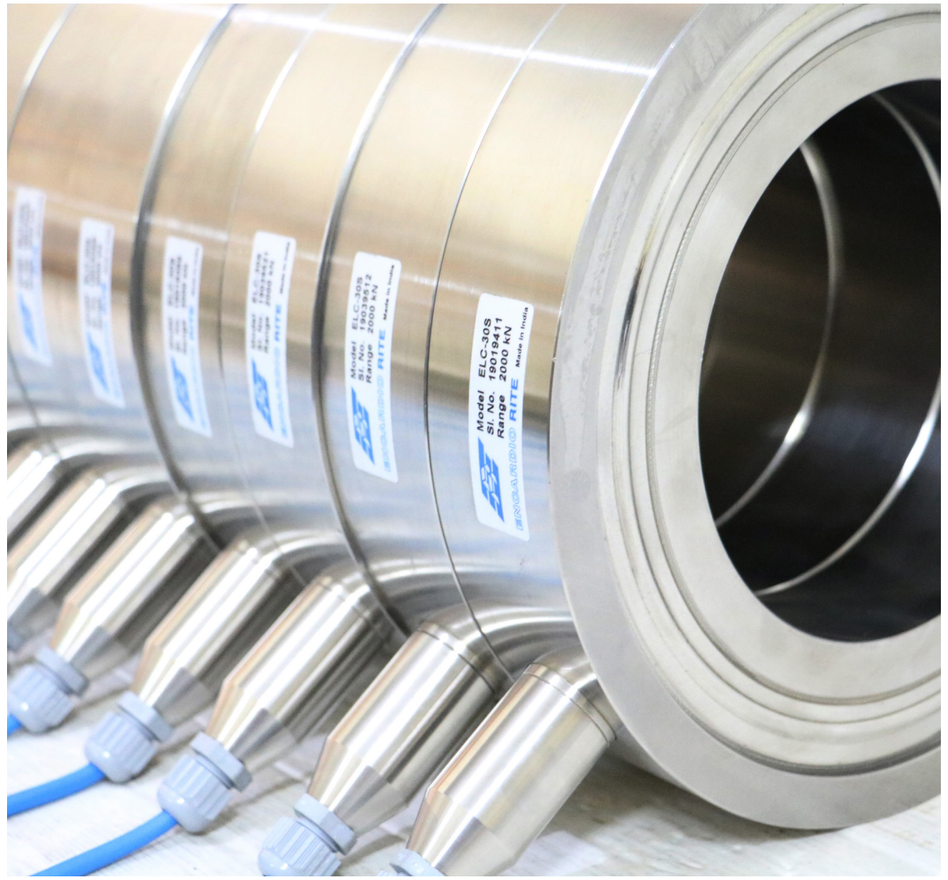
The high rigidity of the stress meter keeps its effective modulus very high. This reduces the effect of variations in modulus of the surrounding material on the calibration of the sensor.

The stress meter is inserted inside a grout-filled borehole using a setting tool and self-aligning setting rods. Small protrusions on stress meter help in centralizing the sensor within the borehole. The stress meter is also available with two expandable anchors that can grip walls of borehole to fix the stress meter at specific location.

SPECIFICATIONS

Sensor type	Biaxial vibrating wire radial sensors. Optional longitudinal sensors also available
Range (MPa)	70
Accuracy	± 0.1 % fs
Resolution	14 to 70 kPa (depends on rock modulus)
Non-linearity	± 0.5 % fs
Over range limit	150 % of range
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent
Borehole diameter	60 mm diamond drilled hole for best results

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

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

High Capacity Compression Load Cell

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 Center Hole 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

Model ELC-32V/ELC-32VS

Vibrating Wire and Digital Center Hole Load Cell

ELC-32V is a vibrating wire type center hole load cell used to determine load in rock bolts, tieback anchors, etc. It comprises of a cylinder of high strength martensitic stainless steel with three vw strain gages mounted at 120° to each other to minimize the effect of uneven and eccentric loading. To determine the load, the average of the three readings is taken. Load cell with six vw strain gages and nine core cable is available on request. Solid load cell for stress measurement in tunnel supports and struts is also available on request.

ELC-32VS is digital center hole load cell, similar to model ELC-32V load cell with digital output. This has a great advantage as it gives single output instead of three (or six) frequency output. Also the load cells can be connected through a single bus cable to our compact datalogger.

SPECIFICATIONS

Range (kN)/ID (mm)	250/27, 500/52, 1000/78, 1500/102, 2000/127, 2000/152, specify (solid load cell available on request)
Overload	150 % fs
Calibration accuracy	± 0.25 % fs
Non-linearity	± 1 % fs
Temperature limit	-20° to 80°C
Thermistor	YSI 44005 or equivalent

STRAIN GAGE

Model EDS-20V-AW

Vibrating Wire 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 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

Vibrating Wire 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 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

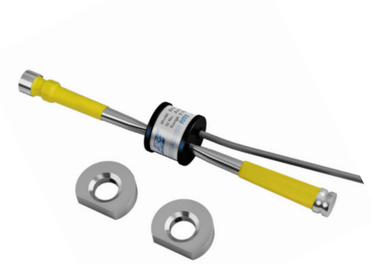
Model EDS-21V-E

High Range Embedment Strain Gage

EDS-21V-E embedment strain gage is designed to measure large strains up to 5000 and 10,000 micro-strains in concrete mass. The strain gage is of stainless steel construction with waterproofing, making it suitable for embedment directly in concrete.

SPECIFICATIONS

Range	5,000 & 10,000 μ strain
Sensitivity	2 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-21V-AW

High Range Arc Weldable Strain Gage

EDS-21V-AW arc weldable strain gage is available with extended range that can measure up to 5000 and 10,000 micro-strains. These can be fixed to steel structure or on concrete surface by suitable mounting blocks for monitoring strain. The sensor is of stainless steel construction and has waterproofing to prevent any ingress of water.

SPECIFICATIONS

Range	5,000 & 10,000 μ strain
Sensitivity	2 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-20V-SW

Vibrating Wire 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-11V

Hermetically Sealed Vibrating Wire 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-12V

Vibrating Wire 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 ϕ reinforced bars. Sister bar strain meter is also available with 16 mm ϕ reinforced bar option.

SPECIFICATIONS

Range	2500 μ strain
Sensitivity	1 μ strain
Maximum ϕ x l (mm)	26 x 1400 (for 12 mm ϕ nominal-standard) 30 x 1400 (for 16 mm ϕ nominal-standard)
Thermistor	YSI 44005 or equivalent
Temperature limit	-20° to 80°C
Protection	IP 68
Cable connection	Four-core shielded 1 m long; specify

TEMPERATURE

Model ETT-10V

Vibrating Wire Temperature Sensor

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 (ϕ 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

Temperature 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

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

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

Model EDE-VXX
Vibrating Wire Linear Displacement Transducer

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 or 150
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
Potentiometric Linear Displacement Transducer

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

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
Embedment Joint Meter

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

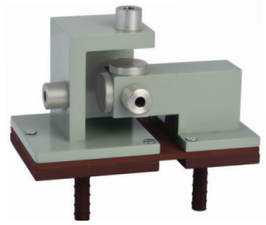
Model EDJ-40T
Electrical Triaxial Crack/Joint Meter

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
Mechanical Triaxial Crack/Joint Meter

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

Mechanical Borehole Extensometer System

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.

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

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.

Model EDS-70V/EDS-70P

Electrical Borehole Extensometer System

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

Electrical Borehole Extensometer System

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 System

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

Model EMA-11

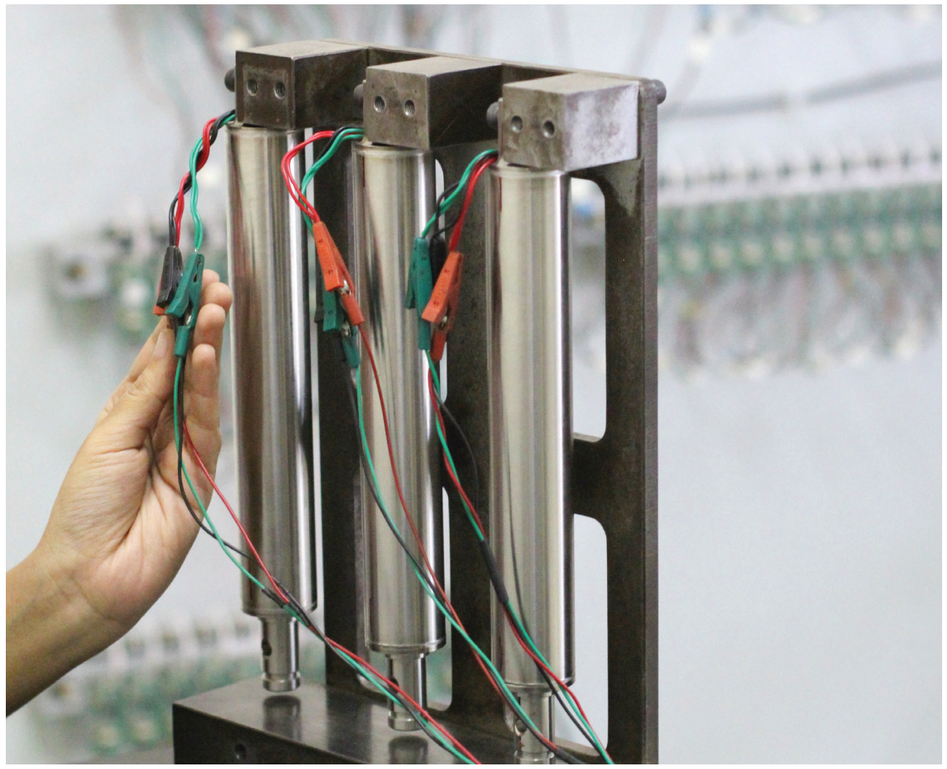
Measuring Anchor

EMA-11 measuring anchor, also known as rock bolt extensometer, is used to determine load exerted on rock bolts. It is a precision instrument designed to evaluate anchor system forces and their distribution within the length of the bolt and hence its safety and effectiveness. A digital caliper/micrometer depth gage with a resolution of 0.01 mm is used to take readings. An electrical head assembly consisting of four potentiometric sensors is optionally available for electrical output.

SPECIFICATIONS

		Electrical measurement	
Length	3, 4, 6 m	Loading capacity	250 kN
Fixed points	4	Range	± 5 mm
Borehole diameter	51 mm	Resolution	0.01 mm
Anchor diameter	26.7 mm standard	Enclosure	IP 65

TILT METER



Model EAN-95MW

Wireless tilt meter

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	± 15°
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

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
Accuracy[1]	± 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)

[1]As tested under laboratory conditions.

Model EAN-91M/EAN-93M

Tilt Meter

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

Portable Tilt Meter

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

MEMS 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.

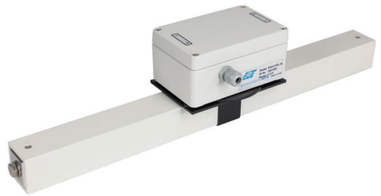
Model EAN-91M-B (Analog) & Model EAN-93M-B (Digital)

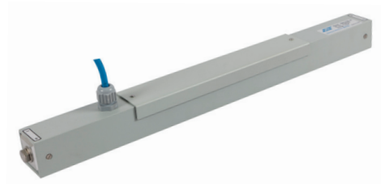
EAN-91M-B and EAN-93M-B beam sensors consists of model EAN-91M and EAN-93M tilt meter (with SDI-12 digital interface) enclosure fixed on to a beam (1, 2 or 3 m long) respectively.

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





Electrolytic Uniaxial Tilt Meters & Beam Sensors

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 System

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.

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 ϕ x 685 mm long (excluding wheel arm)
Probe Weight	1.4 kg (3 lb)
Cable	6 mm ϕ, 2 core kevlar reinforced polyurethane sheathed
Cable reel upto 100 m (330 ft)	300 mm ϕ (flange)
100-200 m (330-650 ft)	380 mm ϕ (flange)

Model EAN-26M-H
Horizontal Inclinometer System

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

Model EAN-52M
In-Place Inclinometer System

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 System

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 vertic 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

Model EAN-61MS
3D In-Place Inclinometer with Settlement (IPIS) System

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 neeeds 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

READ-OUT UNIT

Model EDI-54V

Portable Vibrating Wire Indicator/Datalogger

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, freuqency^2, 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 ϕ 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 ϕ 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 ϕ (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 ϕ (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.

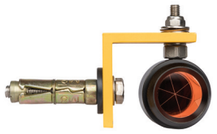
Model ERT-10P2

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 range[1]	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

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.

SEISMOMETER & WEATHER STATION

DIGITAL STRONG MOTION ACCELEROMETER

Model EADA-350F

Encardio-rite model EADA-350F is a compact and robust digital triaxial strong motion accelerometer (SMA) with an exceptional performance, suitable for local and regional recording and for earthquakes engineering applications. The unit is manufactured by Encardio-rite in India under license from Gaiacode, UK.

The force feedback accelerometer is based on a truly rectilinear suspension system. The analogue accelerometer has an extremely large dynamic range of ›150 dB and an 8 channel 24 bit acquisition system is incorporated to exploit the full dynamic range of the sensor. Full-scale low and high gain sensitivity is digitally user-adjustable from ±0.5 g to ±4.0 g on individual channels of the digitizer. The sensor is housed in an 'O' ring sealed hard anodized water proof proven aluminium case with IP68 protection, making it an incredibly robust instrument.

BROADBAND SEISMOMETER

Gaiacode, UK

Encardio rite is sole agent in India of Gaiacode, UK for its low-noise broadband seismometers (with dynamic range ≥145 dB @ 1 Hz), mid-range broadband seismometers (with dynamic range ≥134 dB @ 1 Hz), digitizers and networking equipment. The seismometers are based on orthogonal three axis low noise sensor modules with double nested feedback loop topology. The suspension system is based on the principles of "elastica". The seismometers are portable rugged units, housed in hard anodized aluminium casing with "O" ring seals giving it IP68 protection.

Gaiacode offers a range of data acquisition modules to support its sensors. The digitisers are available in standalone packages or integrated into the sensors. Multi-channel digitisers are also available with low noise, low power consumption and a range of features.

AUTOMATIC WEATHER STATION

Model EAWS-101

Encardio-rite model EAWS-101 automatic web based weather monitoring station provides a precise, reliable and cost effective means of recording meteorological data. Encardio-rite offers weather system with standard sensors for essential parameters as briefly outlined below:

Rain gage: Model ERG-200/201 tipping bucket type rain gage with stainless steel housing.

Wind speed and direction sensor: Model EWV-101S three cup anemometer wind speed sensor along with Model EWV-101D wind direction sensor with dynamically balanced wind vane (coupled to a low torque potentiometer) to give precise wind velocity.

Relative humidity & temperature: Model EWH-101T performs both relative humidity & temperature measurement (with Pt 100). The multi plate radiation shield protects the sensors from direct and reflected solar radiation, thus minimizing error.

Data logger: Provides unattended monitoring & recording.

Other sensors are also available on request. Encardio-rite sensors have an excellent reputation for providing precise results even in the most demanding environment of condition.

The weather station can be configured based on parameters to be measured or sensors required. It handles all data processing requirements, starting with collection and storage of data, performing required calculations on data, presenting results in graphical and numerical format and generating alarm messages. It also has option to monitor meteorological data remotely from an internet connected computer.

GLOBAL PRESENCE

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YEARS OF EXPERTISE

We forsee the future

We know how to navigate change

We evolve. We lead

Geographies don't limit us

We hold hands going the extra mile

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