

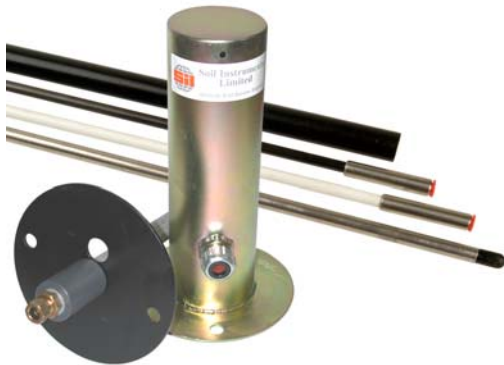
Applications

The monitoring of rock and soil movements including

- Relaxation of rock around tunnels and other underground openings
- Foundation settlements
- Monitoring of subsidence.
- Control of natural and cut slopes, quarry and mining excavations.
- Displacements of retaining walls, bridges piers and abutments
- Monitoring of in situ tests.

Operating Principle

The single rod extensometer employs a rod, anchored at one end of a drillhole, passing into a reference tube fixed in the drillhole collar. Relative movement between the end anchor and the reference tube is measured with either a dial depth gauge or a vibrating wire displacement transducer inserted through the reference tube and registering on to the free end of the rod. A range adjustment screw fitted to the end of the rod extends the reading range beyond that of the depth gauge. Multiple rod installations monitor displacements at various depths using rods of varying length. Several single rod units may be installed in close proximity in drillholes of small diameter; alternatively several rods may be installed radially in a single large hole. of each rod within its sleeve.



Rod extensometer head with cover and choice of rods

Each rod individually isolated by a plastic sleeve. The complete assembly is grouted in place, fixing the anchors to the rock or soil but allowing free movement. A multipoint reference housing receives all rods from the one drillhole installation. Facilities are available for manual or remote read-out and data logging. Rod extensometer units can, when required, be surface mounted, for example to measure displacements across tension cracks or joints, and can be buried in fill or cast in concrete.



Rod extensometer complete with anchor points (displayed on stand)

Rod Extensometer

Advantages and Limitations

- Reliable, accurate, simple to install and read
- Free from creep, kinking and other inaccuracies associated with tensioned wire systems.
- The simple single rod instrument is ideal for safety monitoring during construction activities.
- Monitoring and control of construction by the New Austrian Tunnelling Method (NATM).
- Can be connected to Vibrating Wire displacement transducers for remote reading and data logging.
- Up to 8 rods per drillhole with manual readout or 6 with vibrating wire displacement transducers.
- Drillholes 38mm for single rod installation and 75-100mm for multiple rod installations.
- Installation in drillholes or boreholes at any orientation or can be cast in concrete, surface mounted or buried in fill.
- Operating lengths in excess 100m possible.
- Reset range adjustment up 150mm
- Temperature change has a measurable effect on the readings due to change in length of the extensometer rod. Refer to table of coefficients of expansion for the available rod materials.



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**DATA SHEET
E10**

Specification

Anchors Rods and Sleeves

E10-1.1 Groutable Anchor Unit for cement grouting in single or multiple installations comprising zinc plated mild steel ragged anchor threaded to accept extensometer rods 2.1 to 2.6. Supplied with PVC extension tube to accept protective sleeves

E10-1.20 Hydraulic Anchor Unit for use in soft rocks and soils. Both single acting and double acting, suitable for boreholes from 75mm to 200mm dia.

Extensometer Rods

Extensometer rods are available in lengths of 1,2 and 3m manufactured from stainless steel, glass fibre or carbon fibre. Selection of rods is dependent on type of installation and the importance of temperature effects.

E10-2.1 to 2.3 Stainless Steel

Extensometer Rods, 8mm diameter with male and female threaded ends. Supplied in 1, 2 and 3m lengths

E10-2.4 to 2.6 Glass Fibre

Extensometer Rods, 6mm diameter with male and female threaded ends. Supplied in 1, 2 and 3m lengths.

E10-2.10 to 2.12 Protective Sleeves, location fit over extensometer rods E- 2.1 to 2.6, comprising PVC tubes 11mm o.d., 10.5mm i.d., flush coupled for bonding with PVC adhesive. Supplied in 1, 2 and 3m lengths.

E-2.13 Range Adjustment Unit for use with extensometer rods E- 2.1 to 2.6, comprising stainless steel tube with internal thread to receive the extensometer rod at one end and brass adjustment stud at the other end providing up to 150mm adjustment. Supplied with adaptor sleeve to connect to last rod (glass fibre or carbon fibre).

E-2.14 Rod Adjustment Stud, used when establishing final length of stainless steel rod string. Comprising 1m length M6 stainless steel threaded rod with two end adaptors and two centralising collars. The stud is cut to length, end adaptors and collars fixed with metal adhesive

Head Fixtures

E10-3.1 Single Rod Reference

Head for manual readout comprising zinc plated mild steel tube 22.5mm o.d., 300mm long, fitted with PVC adaptor at one end to receive protective sleeves E-2.10 to 2.11 and stainless steel location adaptor at other end to accept depth gauge E- 6.1 or 6.2.

The reference head is supplied with 150mm dia. mounting plate with holes for fixing, grouting and air bleed tubes.

E10-3.2 Single Rod Reference

Head for remote readout, identical to E-3.1 but with different stainless steel location adaptor to accept Vibrating Wire Displacement Transducer E-6.3 or 6.4, supplied with protective cover.

E10-3.3 Multiple Rod Reference

Head for manual readout, comprising zinc plated mild steel datum tube/flange fitted with aluminium alloy datum adaptor plate and protective cover. The 300mm long datum tube, 73mm o.d., locates in the drillhole collar (minimum 75mm dia. drillhole) and the flange is fixed with three expanding shell fixing studs. The datum adaptor plate incorporates numbered stainless steel reference bushes to accurately locate depth gauge E-6.1 or 6.2 and is interchangeable with sleeve support/clamp unit. Dimensions, overall length 350mm, flange dia. 220mm, protective cover height above flange plate 40mm. Maximum number of rods, 8 for down-hole installations and 7 for up-hole installations where an air bleed/grout return pipe replaces one sleeve.

E10-3.4 Multiple Rod Reference

Head for remote readout. Identical to E- 2.3 but with different datum adaptor plate to accommodate Vibrating Wire Displacement Transducers E-6.3 or 6.4 and protective cover incorporating cable gland for multicore cable Dimensions, overall length 580mm, protective cover height above flange 270mm.. Maximum number of rods, 6 for down-hole installations and 5 for up-hole installations.

Readout Equipment

E10-6.1 Dial Depth Gauge

comprising 75mm dia. dial with stainless steel boss to locate in the reference bushes of reference heads E-2.1 and 2.3. The dial gauge plunger is fitted with a flat anvil to locate on

hemispherical end of range adjustment unit E-2.14. Range 50mm, resolution 0.01mm. Supplied in case, complete with calibration reference tube.

E10-6.2 Electronic Depth Gauge with LCD digital readout with metric and imperial output, and zero set facility. Range 25mm, resolution 0.01mm. Supplied in case complete with calibration reference bar

E10-6.3 and 6.4 Vibrating Wire Displacement Transducers

comprising stainless steel body incorporating a vibrating wire element, electromagnetic pulsing and sensing unit with overvoltage surge arrester, displacement rod and tension spring. Fitted with 1m of cable (longer lengths fitted to suit customer requirements).

Dimensions, coil housing diameter 19mm. push rod tube diameter 9.5mm

RO-1-VW-1 or 2 Portable Vibrating Wire Readout/Logger

for use with Vibrating Wire Displacement transducers Readout in engineering units. User interface via 4 x 4 tactile membrane keypad and large backlit alphanumeric display to enter vibrating wire and logging parameters.

Date and time stamped logging, RS-232-C serial port for data transfer

CMOS design with sleep mode to minimise power consumption. Storage capacity 12000 readings minimum.

Rechargeable nickel metal hydride battery, Auto switch off.

Dimensions 320 x 200 x 140mm, weight 4.0kg.

Readout System	Range mm	Sensitivity mm	Accuracy % FSD
Dial Depth Gauge	50	0.01	0.05
Digital Depth Gauge	25	0.01	0.03
V W Transducer± 25 mm	50	0.1	0.1
V W Transducer± 50mm	100	0.1	0.2



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Issue 1
2004