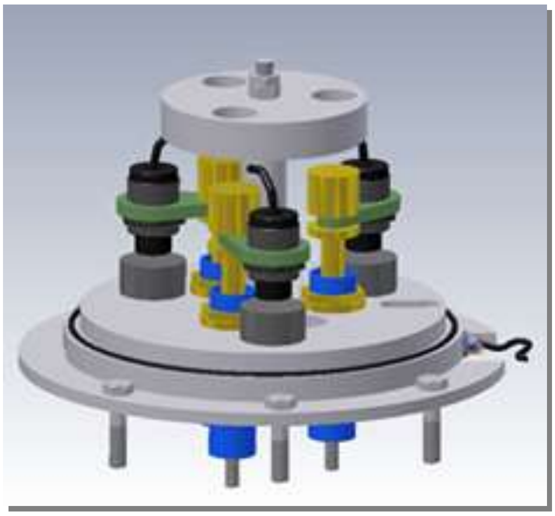
LONG-BASE EXTENSOMETER (ROCKMETER)



Long base extensometers are mainly used to monitor vertical or horizontal deformations occurring to many civil engineering projects such as embankments, foundations, dams, tunnels, diaphragm walls, instrumented piles, etc.

The measurement is made by the changing distance between the sensing head, placed in an easily accessible location, and a deep reference anchoring point firmly fixed at the bottom of a dam foundation, tunnel extrados, etc.

In its standard configuration this extensometer can consist of one to six measuring bases, or with a larger number of measuring bases upon demand.

The maximum size for the borehole is 140mm for the six-base model. (standard size 100 mm).

The long base extensometer is essentially made of the following components:

- *Sensing head.*
- *Measuring base with outer protection pipe.*
- *Deep bottom anchoring point.*
- *Measuring readout (dial-gauge and/or electrical transducers).*

Measurement is taken on the sensing head and is made by detecting the distance between the head (rigidly fixed to the surface of the construction being monitored) and the inner rod which is rigidly fixed to the extensometer deep anchoring point.

In short. the inner rod linking the deep bottom anchoring point to the surface may also be used as an excellent topographic reference system.

The inner rod is protected against soil friction by an external sleeve pipe. Should any deformation occur, a relative displacement between the sensing head and the deep anchoring point is produced and measured.

Generally the sensing head is anchored to an accessible point and houses the measuring base and the displacement transducer.

Extensometers can be manufactured as different models depending on type of rock or soil and on the method of installation.

This purpose is to form a solid connection between the anchoring point and the surrounding soil or rock so as to link the reference from the deepest point in the structure to the external reader. Fig. 1 shows an example of how extensometers can be used in a tunnel.

These extensometers can be used with excellent results in reinforced earth structures such as embankments, dikes, retaining walls, etc.

Fig. 2 shows the monitoring scheme of an embankment by means of long base extensometers. In this particular case 4 extensometers are used: 2 being horizontal and 2 vertical.

Extensometer "A" supplies the absolute reference to extensometer "D" which supplies the displacement value of the embankment plane. The other two extensometers supply the value of horizontal deformations occurring to the slopes.

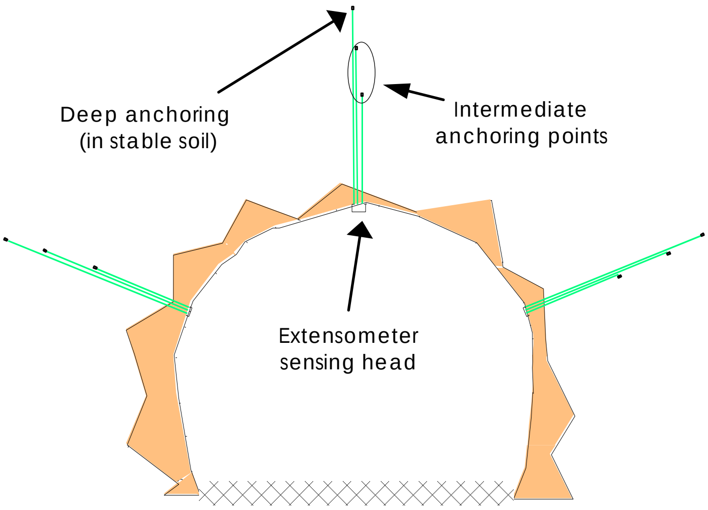


Fig. 1

MEASUREMENT PROCEDURE

Measurements from the extensometers can be achieved in two ways: by manual readings by a dial gauge or automatically by an electrical displacement transducer with no need to access the sensing head.

The latter method requires a higher investment at the beginning, but gives better results—in terms of quality and reliability—in the long run.

In addition, the use of electrical transducers allows automatic measurement acquisition by means of specific computerised data units. By so doing extensometers can be included in wider and more complex automatic control monitoring networks.

This will allow significant data banks to be automatically generated and implemented in the course of time.

AGISCO develops, manufactures and installs three different models of extensometer:

- EBL/X/MA is used for manual readings from a calliper scale.
- EBL/X/IA and EBL/X/PA are automatic readers and differ only in the type of transducer
- EBL/X/IA uses an inductive contactless sensor.
- EBL/X/PA uses a wired potentiometer.

The measuring base consists of a steel rod protected by an outer PVC sleeve pipe to keep the rod free from any soil friction.

Every 2 m the measuring base is equipped with lubricated spacers, made from antifriction material, to prevent from any friction between the rod and the outer sleeve pipe.

The sensing head is waterproof at both ends, up to several meters depth. In addition the connecting rod is sheathed in PVC (fig. 3). This allows installation of the extensometer anywhere, even in drain wells below ground.

Figure 4 shows a sketch of the extensometer . In red are showed the antifriction devices.

This model is largely used to measure ground settlement and may be an excellent alternative to common settlement gauges. In fact, it offers much higher accuracy and the potential for automated measurement.

When used for measuring settlement, this instrument usually works under compression where the deepest end carries the load for the entire

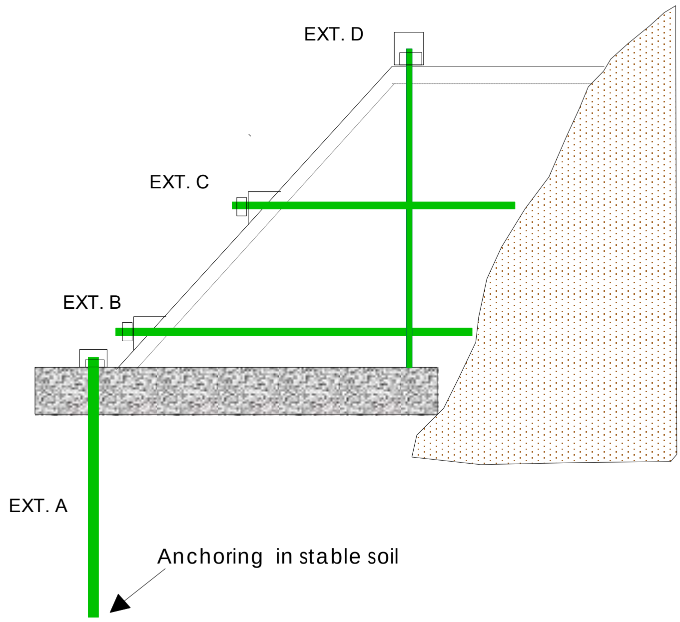


Fig. 2

system. The sensing measuring head tends to be crushed back towards the anchoring point thus forcing the outer sleeve pipe compress.

Friction between the outer sleeve pipe and the inner rod must be removed or errors in the data will occur.

This is the reason why many cheap extensometers are not suitable for used as settlement gauges. To solve the problem our model is equipped with special spacers, specifically designed to remove any friction.

Advantages offered by this extensometer model may be summarised as:

a) *Easy installation.*

b) *Frictionless readings for superior data.*

c) *System installation can be carried out with any inclination from vertical to horizontal according to need.*

d) *Choice outer sleeve pipe in PVC or steel according to use.*

e) *Long lasting reliability.*

f) *Mechanically robust.*

g) *High adjustable inner rod.*

h) *Waterproof measuring head.*

i) *High precision contactless displacement transducers.*

j) *Permanent ability for making manual readings from a calliper scale.*

k) *Standard electrical output (4-20 mA) suits most commercially available reading systems, both manual and automatic.*

l) *Low cost.*

Anchoring in stable soil

N°. x BASES STEEL EXTENSOMETER WITH SPACERS

This model is similar to the one above. The difference lies in the number of measuring bases and type of transducer in use.

This model is equipped with up to 6 measuring bases each with its own anchoring point. The length of the deepest base depends on the size of the displacement to be monitored. This requires anchorage in a deep stable area so as to avoid minor vibrations.

The availability of several different measuring bases allows more accurate and detailed detection of displacements. This is another reason why the extensometer can replace common settlement gauges with greater advantages.

Last but not least, the exceptional capability of the extensometer to work under any compression condition allows accurate and reliable measurements with any inclination and, above all, any displacement direction.

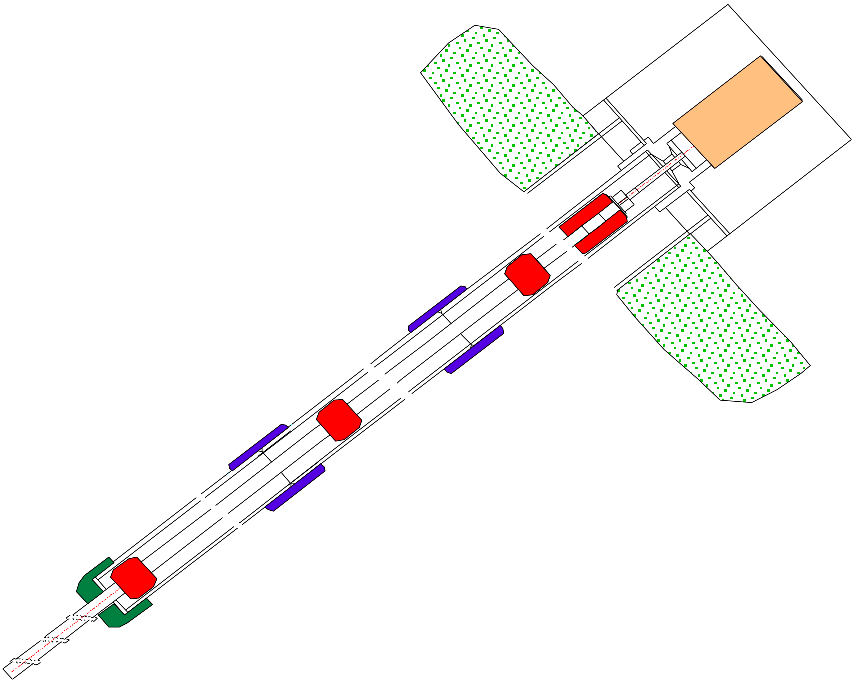


Fig. 4

TECHNICAL SPECIFICATIONS

LONG BASE EXTENSOMETER	
Stroke	8, 15, 50 mm and more
Transducer	Contactless inductive-type
Accuracy	0.01 mm
Supply	12 / 24 Vdc
Output	4 ÷ 20 mA
Working temperature	-20 ÷ +50°C
Number of bases	From 1 to 6 special version on request

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