Wire Extensometer

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STRUMENTI E MISURE GEOTECNICHE
E STRUTTURALI

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WARNINGS

This instrument must be utilized only for the application it has been designed for, OTR declines all responsability for any improper use;

Do not let slide the steel rope quickly;

Do not use the instrument near potentially explosive gases;

During the installation phase, disconnect the instrument from measuring devices or from any device connected to the AC power supply;

Use protective gloves;

Furthermore

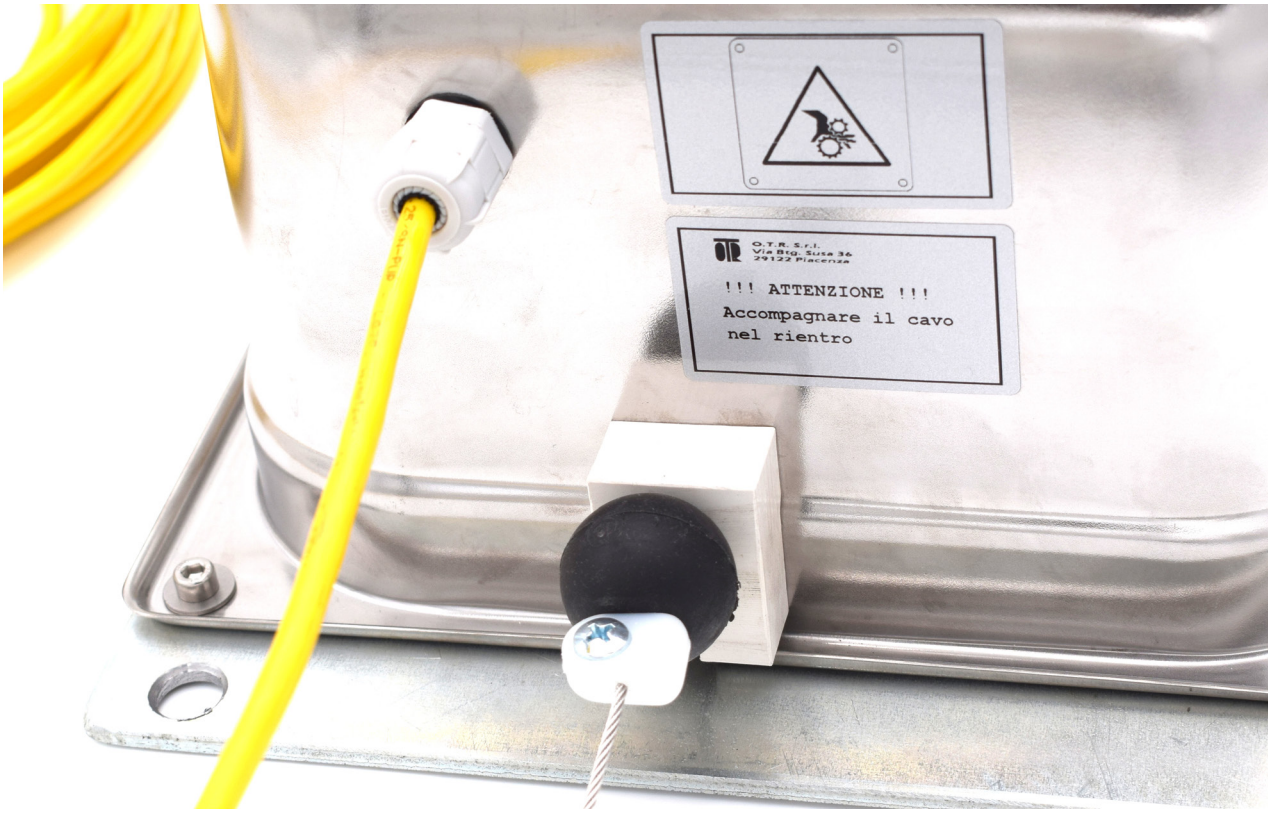
- Do not open the instrument, contact the manufacturer for checks and repairs;
- Keep out of reach of children;
- Don't instal it with wet hands;
- Use surge arresters for installations with unprotected cables longer than 30 meters..
- Clean the instrument and its cable with alcohol or water, do not use acetone or aggressive liquids for plastics or labels;

Cause the steel rope can be tensioned up to 5-10 Kg be careful about:

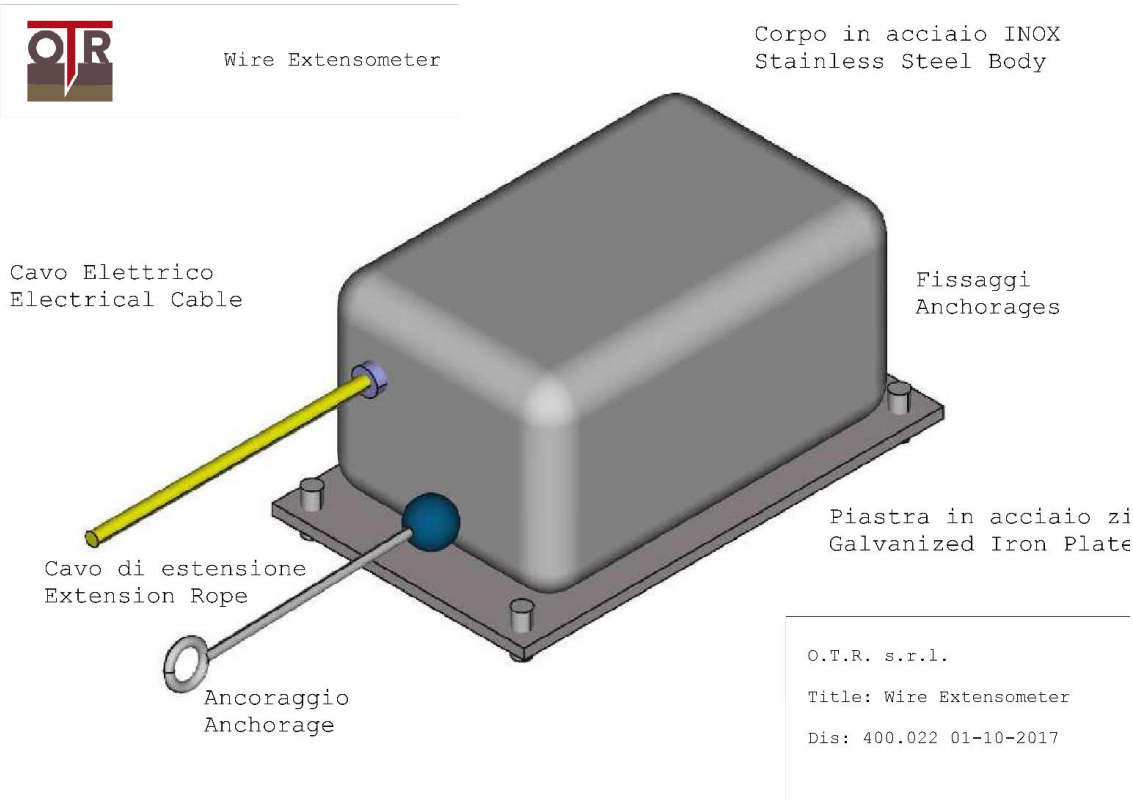
- Do not let slide the steel rope quickly towards the instrument but slowly accompany, the steel rope could be abrasive for the hands;
- Handel the steel rope always with protectivengloves;
- Do not open the instrument, steel rope inside is is tensioned;
- Before connecting the rope to the fixing/anchorage be sure that this can stand a tension of at least 5-10 Kg for long time;
- Install the steel rope inside a conduit or a protective plastic tube. In this case if the anchor should fail or accidental be tampered this precaution will avoid that the rope slide free quickly towards the sensor

Applications

Wire Extensometer is suited for the measurement of large displacements between two anchor points located up to 30 m apart. They are used for monitoring: movements associated with landslides in soil, monitoring the movement in unstable fractures in rock masses, slopes in landslide



Description



Wire extensometer consists of a box containing a tensioner for a stainless steel wire and a rotating pulley. Pulley rotation is read by a rotating potentiometer.
Standard steel cable has a 2 meters mechanical range but it can be prolonged if needed. The other reference point is anchored to the free end of the cable. A wire connects device to readout unit.

Identification

Each device is labelled with:

- Serial Number (reported in calibration chart);
- Model;
- Full Scale

Specifiche Tecniche

Material	Stainless steel, Aluminium, Galvanized Iron
Material (wire)	Stainless steel
Full Scale	250 mm continuous up to 2 m
Output	4-20 mA or potentiometric

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Installation

Once you have identified which points are to be monitored, you need to install both device containing rotative potentiometer, and an anchor for the opposite end of the wire. Steel cable can be up to 20 meters long; it is tensioned by a mechanical tensioner with a range of 2 meters. Tensioning strength, up to 8 kg, reduces catenary effect of the cable.

Relative shift of one of the two measured points puts pulley in rotation. Rotating potentiometer therefore reads a shifted value. A total 240 mm linear shift is translated into a full potentiometer rotation. Rotating potentiometer has a blind angle of about 4-5°, therefore every 240mm there is a blind spot 4-5 mm long. After that readings return to zero and increase to 240mm again, until a maximum 2000 mm displacement is reached.

To install device please follow these steps:

- In soft ground, make 50x50x50 cm concrete shafts at the measured points to fix both device and anchor. In rock, fix equipment with dowels
- Connect wire to anchor, using additional steel wire (diameter 1.5 mm) .
- Connect electric wire to datalogger or readout unit.
- Adjust pulley starting point, based on range and predictable shift of measured points;
- Adjust wire tension, following tensioner instructions;
- Manually pull wire, in order to check signal variations (sign and entity);
- Save electric values of initial configuration;
- Protect steel wire with proper casing (like a metallic tube 0 100–300 mm) against snow, ice, animals, branches or rocks, etc.)

Protect electric wire too from damages by mens of an external sheath. Electric wires can be prolonged without signal loss, if a wterproof junction is correctly applied.

Readouts

Sensor can be read by means of manual or automatic readers. OTR Geotester 2 can read and display on screen values in electrical unit of measure or physical unit, if configured. For further details about how to use cond configure a Geotester 2, please refer to Geotester 2 manual.

Taking Measurements

Wire extensometer can be read with a datalogger or a manual readout unit:
Signals can be o different type, depending on converter type (you can get a mV or a mA output).

Displacement transducer with mV output:

Red wire	= + 15 volt
Black wire	= GND
Green wire	= Loop
Shield	= Protective earth of datalogger

Displacement transducer with 4-20mA output:

Red wire	= + 15 volt
Black wire	= Loop
Shield	= Protective earth of datalogger

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Data Processing

- By reading sensor output you get a mA or mV output , proportional to the relative shift of the two measured point.

Calculations & Formulas

Conversion from electric to physical units (mm)

Displacement = Distance change between the two measured points (in mm);
L = Initial distance, or "zero reading";
L1 = Current distance

S = Conversion factor (in mA/mm) (it can be found on calibration report);
ΔL = change of wire length, due to temperature.

To compute a precise ΔL, you need to apply a formula contining the linear expansion factor for the material your wire is made of. Expansion factor indicates how much (in percentage) a material extends if temperature rises.

Example: stainless steel factor = 0,000017 = 1.7 * 10 ^ -5 [mm/mm °C]

ΔL[mm] can be derived by multiplying wire length [mm], expansion factor [mm/mm °C] and degrees of temperature change [°C].

Displacement [mm] = (L1 - L)/S ±ΔL