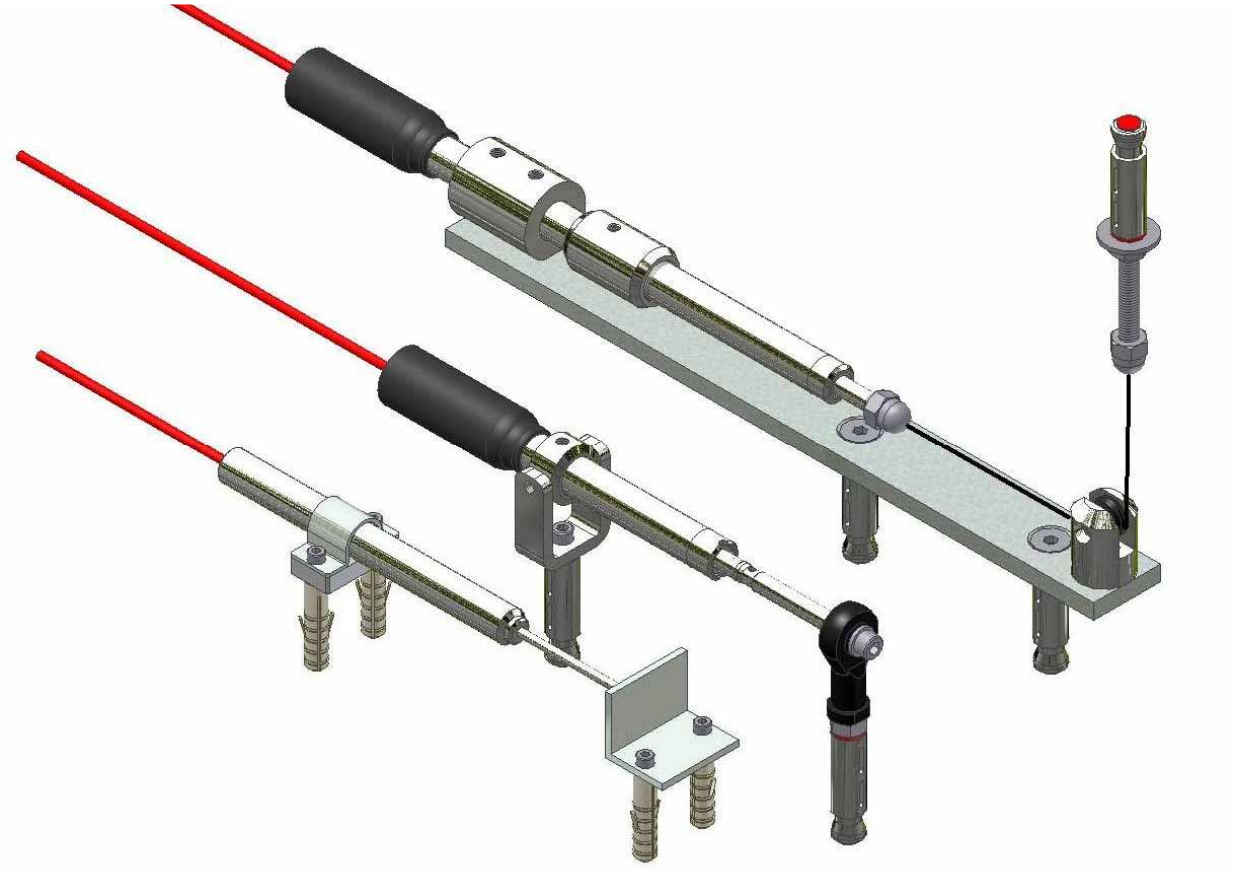
ELECTRICAL CRACKMETERS

User Manual



INDEX

Notes on the use of product

For a safe and efficient use of the instrument, please read carefully the following instructions before starting any operation.

Any use of the instrument other then the one described in this manual shall be considered at user's full responsibility.
The same applies for any unauthorized modifications.
In addition to the hereby listed standards, the user must comply with the provisions of the current legislation on the matter of personal safety and health of persons in the workplace.
SISGEO is not responsible for any trouble, breakdowns, accidents etc.. due to the lack of knowledge and/or confidence (or non-compliance with) with the requirements contained in this manual.

Check that the instrument has not been damaged during the transport.
Verify that the package includes all items as well as any requested optional accessories; if anything is missing, please promptly contact the manufacturer.
The user must strictly follow all the operations described in this manual.
Maintenance or repair of the instrument is allowed only to authorized operators.
These operators must be physically and intellectually suitable.
For information about instrument or order spare parts request, please always specify data written on the identification label.
When replacing parts, always use ORIGINAL SPARE PARTS.
The manufacturer reserves the right to make changes without prior notice for any technical or commercial requests.
We'll try anyway to keep the manuals updated in order to reflect product's revisions/updates.

Symbols

This symbol will be used used to catch reader's attention on the manual:

Pay special attention to the following instruction.

Identification

Instruments can be identified

- From a production lot number (written on the Compliance Certificate)
- From a serial number *(s/n)* engraved indelibly on the instrument
- From a label on the instrument
- From a label on the cable

Introduction

Electrical crackmeters measure the linear displacements between two sides of a joint or a crack.

They are called CRACKMETERS if installed across civil and industrial constructions, historic and artistic buildings and to measure the cracks of an unstable rock mass.

Instead, they are called JOINTMETERS or DEFORMOMETERS if they are installed across concrete and structural joints, construction joints in buildings or to measure rock mass displacements.

Description

ELECTRICAL CRACKMETER

Consists in:

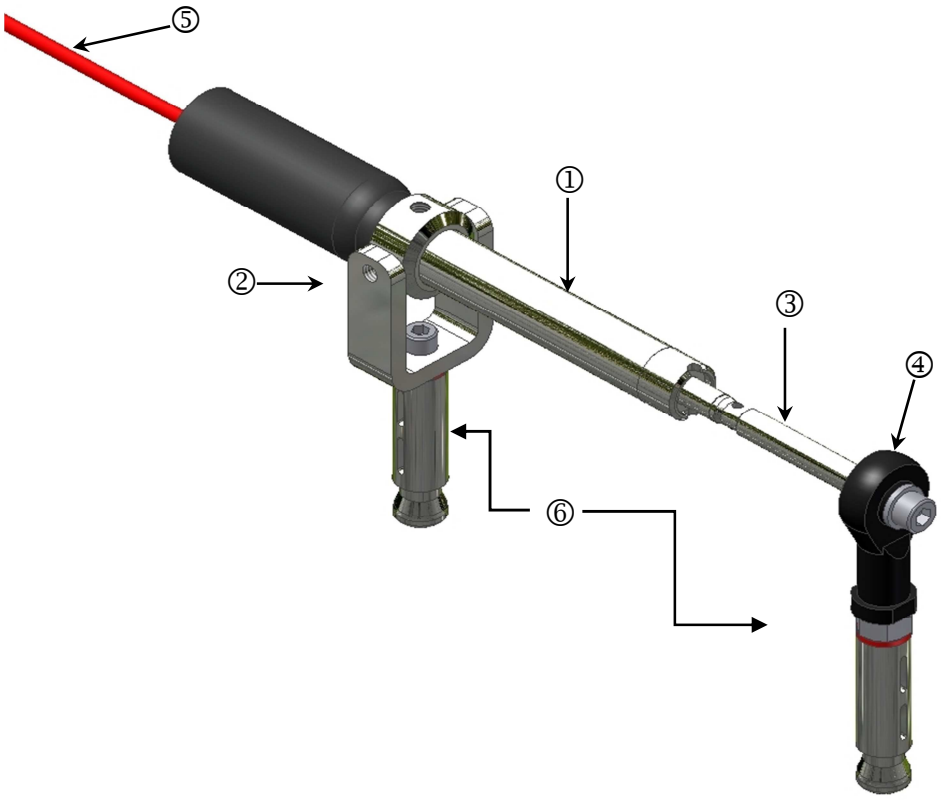
① Stainless steel body with an internal sensor (potentiometric or vibrating wire)

② Anchor adjustable support;

③ Stainless steel measuring rod, connected to a swivel bearing ④;

⑤ Electrical cable to connect the crackmeter to the readout;

⑥ Nr. 2 expansion anchor



The measuring rod, anchored at one side of the crack, will move according to the displacements, so that the crackmeter' s signal will change.

Electric crackmeter shall be used when the displacement happens along a principal direction, so that the measuring rod can be correctly turned.

The swivel bearings allows, anyway, off-axis movements.

For special installation are available:

- 150 mm pre-assembled stainless steel extension rod to increase the length between the anchors.
- Fixing plates for 2D (X,Y) and 3D (X, Y e Z) installations.

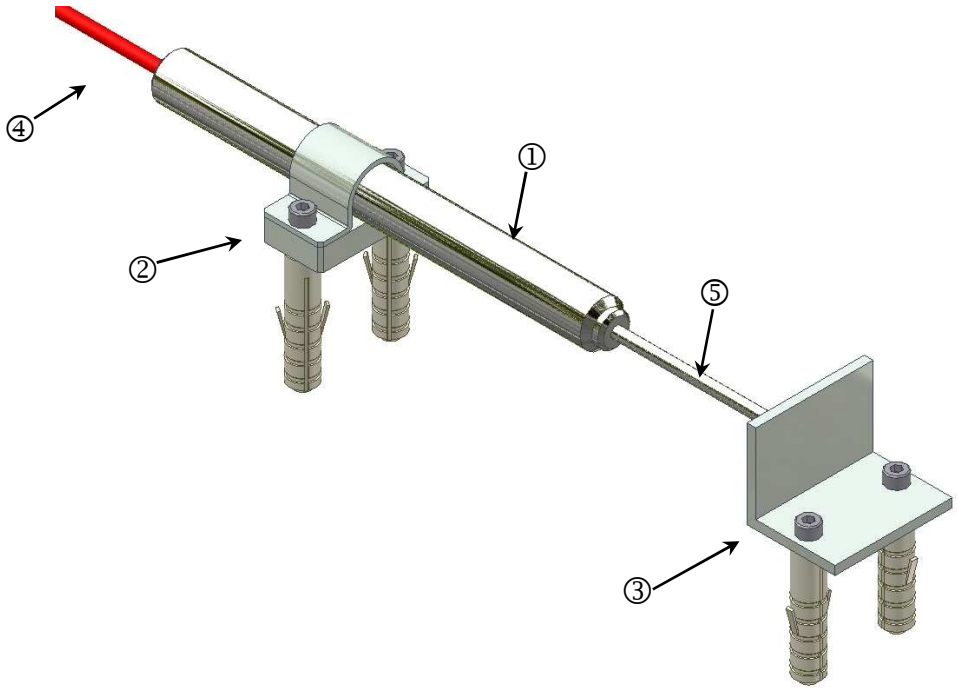
FISSURE METER

The fissure meter is used for installations on monuments or quality buildings.

It has a limited visual impact, and the appearance has been carefully studied to minimize its size.

It consists of:

① Stainless steel body with potentiometric internal sensor;
② Anchor adjustable support with expansion anchors;
③ Reference surface, with expansion anchors;
④ Electrical cable for the connection of the instrument to the readout;
⑤ Measuring rod



ELECTRICAL DEFORMOMETER

The electrical deformometer is used to monitor the displacement between two distant opposite surfaces.

It consists of:

① Stainless steel body with the internal potentiometric or vibrating wire sensor;

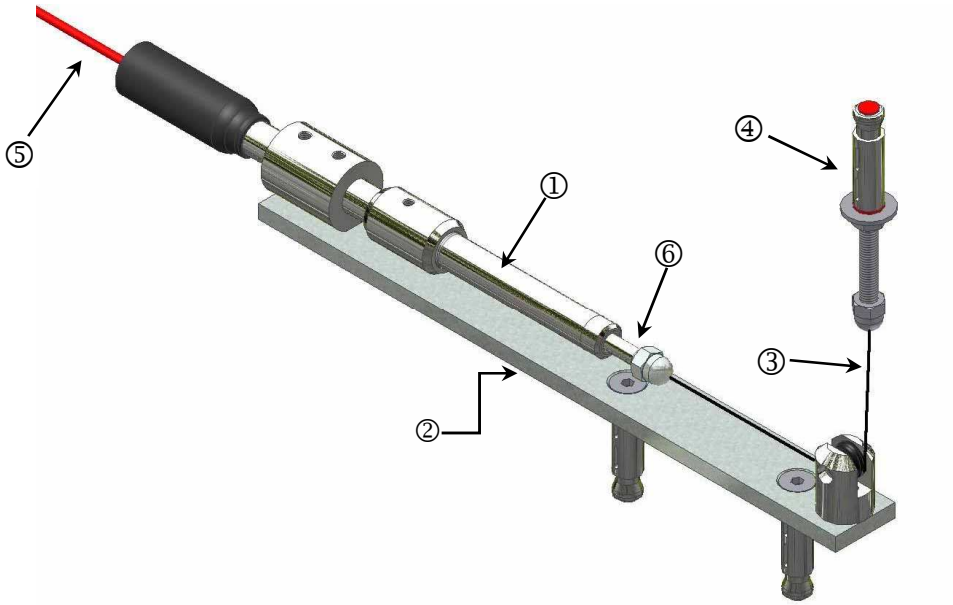
② Mounting plate for the wall fixing. The sensor body and the pulley are fixed on the plate;

③ Kevlar rope;

④ Opposite anchor for Kevlar rope;

⑤ Electrical cable to connect the deformometer to the readout;

⑥ Measuring rod



Preliminary checks

Before to install we advise to:

- Check instrument integrity and that all components had been shipped;
- Perform a check reading with a readout referring to the table in "Taking measurements", moving slowly the measuring rod. The values have to be similar to the ones reported in the calibration certificate, and agree with the convention in "Data processing".

Needed tools (not supplied):

Crackmeter	Fissure meter	Electrical deformometer
Allen key SW3 and SW5	Allen key SW3	Allen key SW3 and SW5
Spanner n.13		
Drill with bit 14mm	Drill with bit 9mm	Drill with bit 14mm
Threadlocker (i.e.Loctite)		

Installation

CRACKMETER

The instrument is supplied pre-assembled.

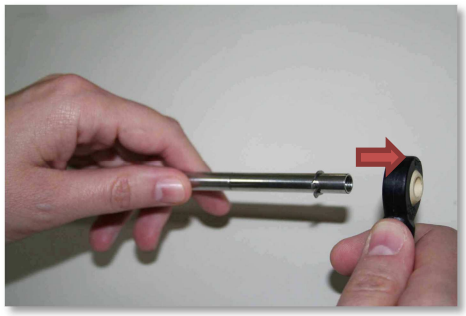
For the installation please consider the instrument direction compared to the expected displacement.

The holes must be in whole material and far enough from the crack.

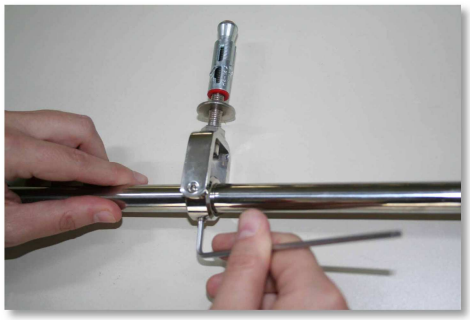
The anchor distance is not binding since the steel body position can be adjusted in the support.

To install please proceed as follows:

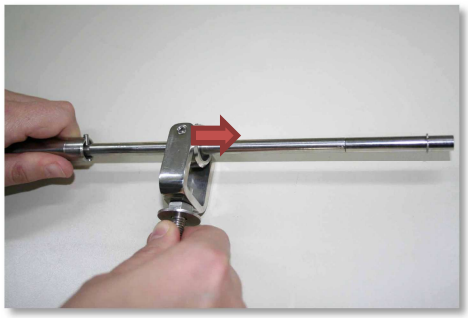
Unscrew the swivel bearing's allen screw with the SW5 allen key.



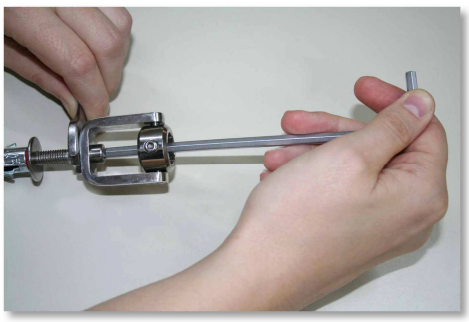
Pull out the swivel bearing.



Loose the screw of the adjustable support with the SW3 allen key



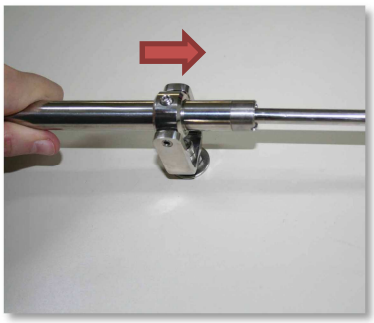
Pull out the adjustable support



Unscrew and remove the allen screw that blocks the adjustable support to the expansion anchor.

Drill the ∅14mm holes and fix the plugs.

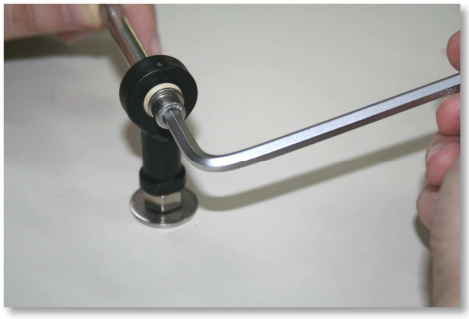
Fix the adjustable support with allen screw using the threadlocker.



Insert the steel body in the adjustable support ring.

Place and fix the swivel bearing

Insert the measuring rod in the swivel bearing



Fix the allen screw

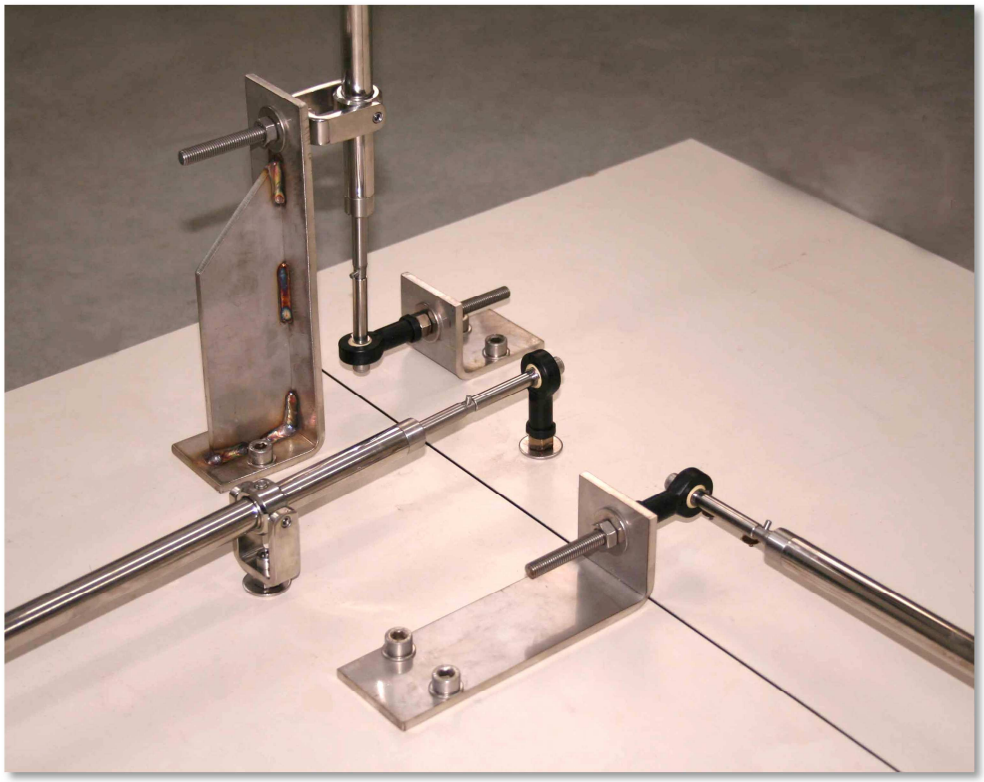
Connect the readout. Pull out the steel body until you reach the choosen position (i.e. at middle range).
Tight the fixing screw.

Note: the possibility to adjust the crackmeter is useful during the work: if the sensor is all the way down at the top or bottom full scale, it can be moved and then proceed with the measurements.

3D ELECTRIC CRACKMETER

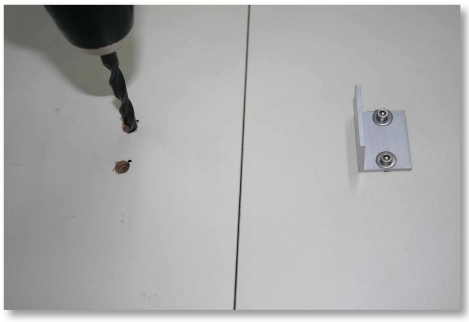
When is necessary to measure the displacements along 3 axis, the crackmeter will be installed on supports as shown in the picture.

The supports shall be mounted so that they won't be in conflict and allow the orthogonal movements.

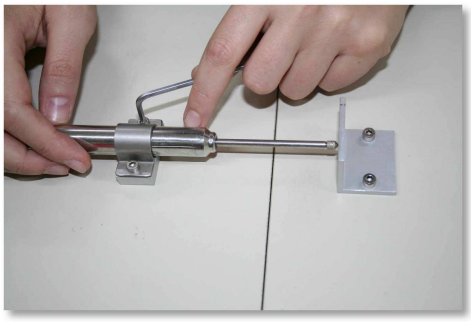


FISSURE METER

To install please proceed as follows:



Mark the instrument's position and drill two ∅9 mm. holes. Repeat for the support.



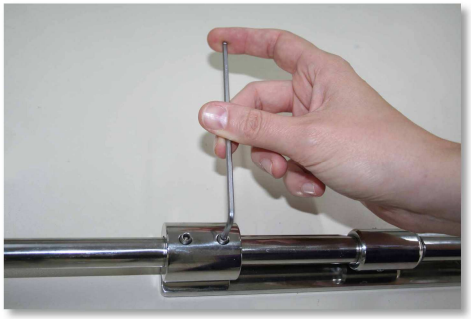
Fix the support and the fissure meter tightening the allen screws. Be careful to check that the steel body is in the right position using a readout (i.e. middle range if the displacement could be in both directions)

Note: the possibility to adjust the fissure meter is useful during the work: if the sensor is all the way down at the top or bottom full scale, it can be moved and then proceed with the measurements.

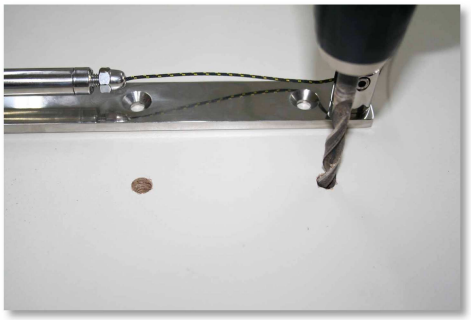
ELECTRIC DEFORMOMETER

The instrument is supplied pre-assembled.

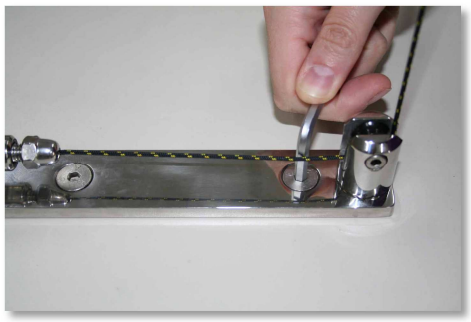
To install please proceed as follows:



Loosen the screws in order to move the body and free the holes

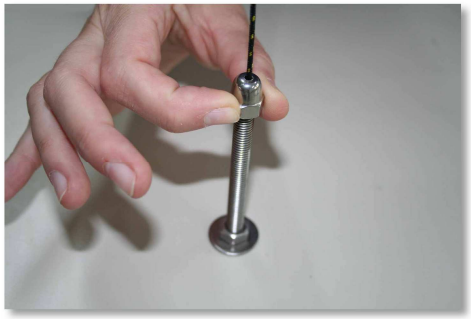


Using the mounting plate as a mounting jig, mark and drill two ø 14mm holes



Insert the exapnsion anchors in the hole. Fix the mounting plate using the SW5 allen key

Drill a ∅14mm hole for the cable's anchor plug and tighten it with wrench nr.13



The kevlar rope should be cut as long as the installation requires. Screw the nut on the anchor. Be careful: don't twist the kevlar rope.

Take a control reading to set the sensor (for example middle scale). To adjust, unscrew the blocking screws with SW3 allen key and move the rod until reaching the wanted position.

Note: the possibility to adjust the fissure meter is useful during the work: if the sensor is all the way down at the top or bottom full scale, it can be moved and then proceed with the measurements.

Taking measurements

Manual measures are taken by means of a manual readout, connecting the conductors to the readout according to the following table:

Potentiometric (mA output) LP	Red	+ Loop
	Black	- Loop
Vibrating wire sensors (VW)	Red	VW
	Black	VW
	White	Thermistor
	Green	Thermistor
V/V output	Red	+ Vcc
	Black	GND
	White	+ Out

LP= linear potentiometer

Note: to obtain reliable measurements, with mA instruments, we advise to respect a warm up time not less than 10 seconds.

Automatic measures are taken connecting the crackmeter to an Acquisition Data System.

Data processing

The following formulas allow to convert the electric measurements into engineer values:

Linear factor ➔ $\mathbf{L_{eng} = L_{elec}/S\ [mm]}$

Polynomial factors ➔ $\mathbf{L_{eng} = (L_{elec}^2 \times A) + (L_{elec} \times B) + C\ [mm]}$

L_{eng} = engineering reading
L_{elec} = electric reading
S = sensitivity factor
A, B, C = polynomial conversion factors

S, A, B, C factors are stated on DTE Calibration Report

With regard to the measuring range (rod position) of DTE transducers herewith follows the table with the nominal values for both VW and LP DTEs:

Rod position	**Nominal values**		
	VW	LP	V/V
Max extension	**9000Digit**	**4mA**	**0 V/V**
Max compression	**2500Digit**	**20mA**	**1 V/V**

The exercise readings refer to the initial reading (zero reading).

$$\mathbf{D = L_i - L_0}$$

D= Displacement
L_0 = Zero reading
L_i = Exercise reading

Zero reading shall be taken carefully once the installation is performed and the instrument is in operating conditions.

Example

CRACKMETER range 50mm (mA readings)
S = 0.32051 mA/mm
A = -6.984 E-04 , B = 3.137 E+00 , C = -1.264 E+01
L_0 = 12.050 mA , L_1 = 16.048 mA ($L_1 > L_o$ ➔ Compression)

Using:
Linear factor (L_1-L_0)/S : (*16.048 – 12.050)/0.32051 = 12.47mm*
Polynomial Factor [(L_1^2 x A)+(L_1x B)+C] – [(L_0^2 x A)+(L_0x B)+C]= *37.522–25.0590=12.46mm*

For the **electric deformometer** shall be considered the Kevlar's rope length variation due to the temperature.

So:

$$\mathbf{D= (L_i- L_0)/S + \Delta A}$$

where:

ΔA = rope's length variation

$$\mathbf{\Delta A = \lambda \Delta t\, A_0}$$

Where:

λ= -2.3 10^{-6} mm/mm/°C (kevlar's coefficent of linear expansion)

$\Delta t = t_i - t_0$

A_0= rope length

Troubleshooting

	Problem	Possible cause	Solution
VW	**Measure not stable**	Instrument out of range	Take the instrument back within its range
		Shield not connected	Connect the shield
		Electromagnetic fields generated by engines, generator, antennas, welders or high voltage lines nearby	Identify and remove the cause. Shield the signal cable.
		Datalogger grounding not well done	Provide efficient grounding
	Wire not detected	Cable cut	Repair the cable. Cable splicing kit available at SISGEO.
		Cable damaged	Measure VW (coil) resistance by portable Ohmmeter. Acceptable values are in the range of 150Ω±15%.
		Wiring not correct	Make proper wiring
V/V	**Measure not stable Measure 0 mA Measure over range**	Wiring not correct	Make proper wiring
		Cable cut/damaged	Repair the cable. Cable splicing kit available at SISGEO.
LP mA	**Measure not stable Measure 0 mA Measure over range**	Wiring not correct	Make proper wiring
		Cable cut/damaged	Repair the cable. Cable splicing kit available at SISGEO.

In the electric deformometer shall be checked the cable: it should always be in tension and undamaged.

Maintenance

After-sales assistance for calibrations, maintenance and repairs, is performed by Sisgeo's service department.
The authorization of shipment shall be activated by RMA "Return Manufacturer Authorization". Fill in the RMA module clicking on:

http://www.sisgeo.com/en/assistance/repairs/

Send back the instrument/equipment with the complete accessories, using suitable packaging, or, even better, the original ones.
The shipping costs shall be covered by the sender.

Please return to the following address with suitable delivery document:

SISGEO S.r.l.
Via F.Serpero, 4/F1
20060 MASATE (MI)

On the delivery document is mandatory to indicate the RMA code received.

Technical assistance e-mail: assistance@sisgeo.com