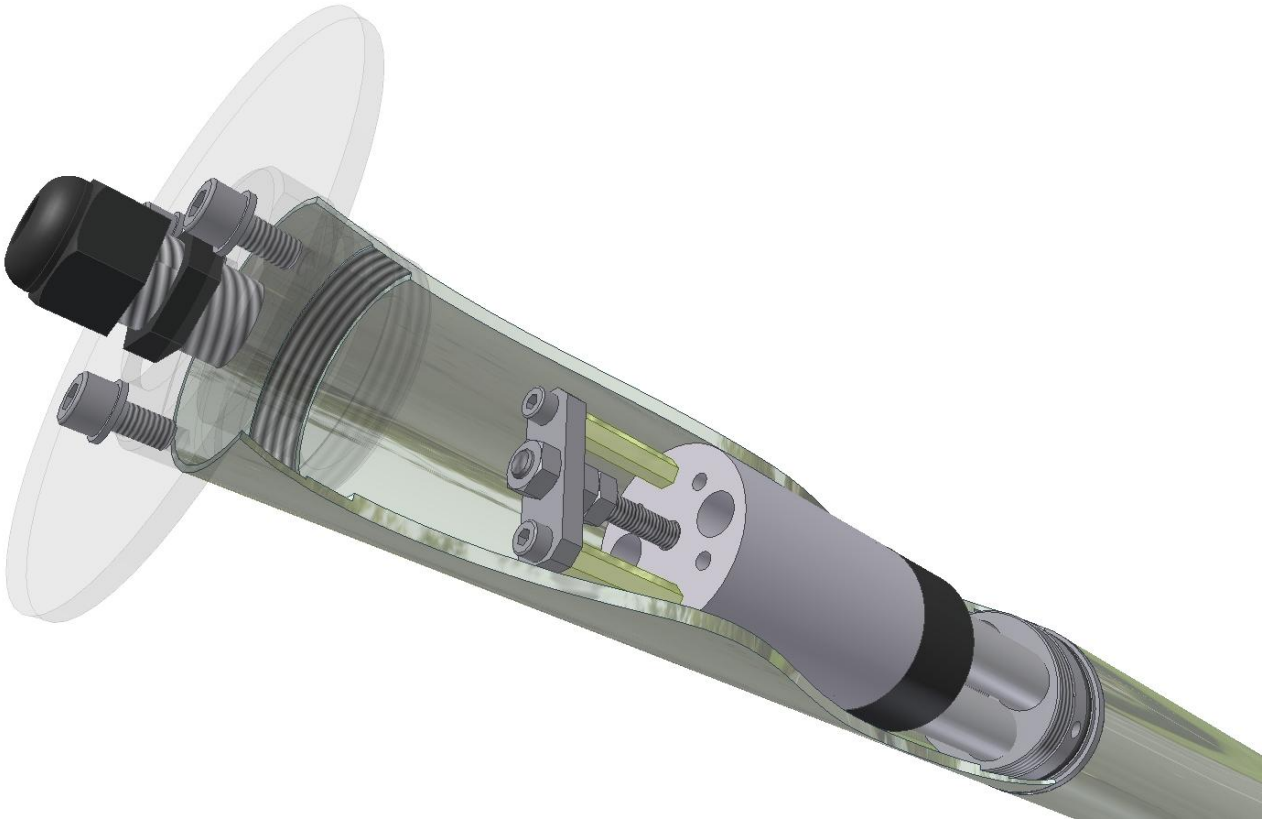
MEXID

MINIATURE BOREHOLE EXTENSOMETER

User's Manual



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Notes on the use of product

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

Any use of the product 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 product 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 device 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.

Disposal

According to the European Standard 2002/96/CE, the device must be disposed in a proper manner.

The recyclable materials within the device shall be collected by the user, in order to avoid the environmental pollution.

For further information, please contact your dealer or local waste disposal service.

This product must be disposed in a collection point for electronic components recycling.

Incorrect disposal by the user could be subject to fines.

Symbols

Below are the symbols used to catch reader's attention on the manual:

Warning! These operation must be performed from specialized personnel!

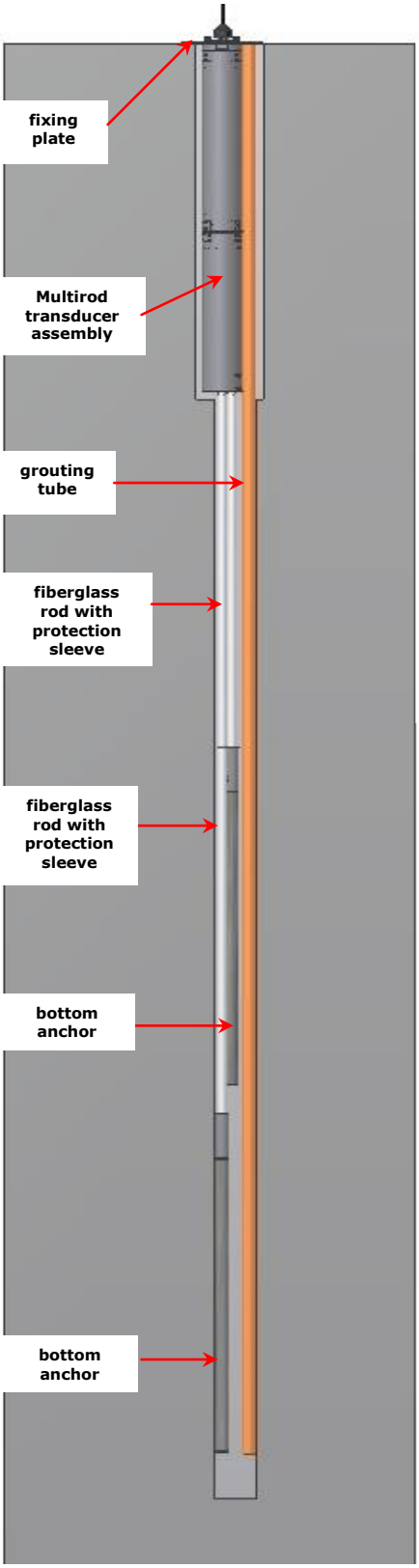
Pay particular attention to the following instruction.

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

Description



MEXID is a small diameter electric transducers' multi-rod extensometer for application in stable and open boreholes.
The system consists of:

- multirod head assembly (50mm OD) equipped with 2, 3 or 4 linear built-in displacement transducers (DTE) and multicore cable,
- fibre-glass measuring rods with nylon sleeve,
- groutable anchors.

MEXID is fully preassembled at factory with the measuring rods supplied at the fixed lengths.
The longest rod is identified as #1, the other rods are numbered clockwise by decreasing lengths.
Both vibrating wire (VW) and linear potentiometer (LP) transducers (DTE) are available with 50mm and 150mm range pre-set at 50% of the full scale.
Grouting tube is supplied separately.

Preliminary checks

MEXID shall be installed in a stable and open borehole.
The use of a temporary protection casing is possible but very delicate because the system has to be fixed/set at the surface.
Suitable diameter is BQ borehole size (46/55mm). For the first meter the borehole shall be enlarged up to 75mm since the grouting tubes will be used.

Before starting installation is recommended to:

- check the integrity of the instrument and if all the components have been delivered correctly;
- take control readings by portable readout (i.e. CRD400).

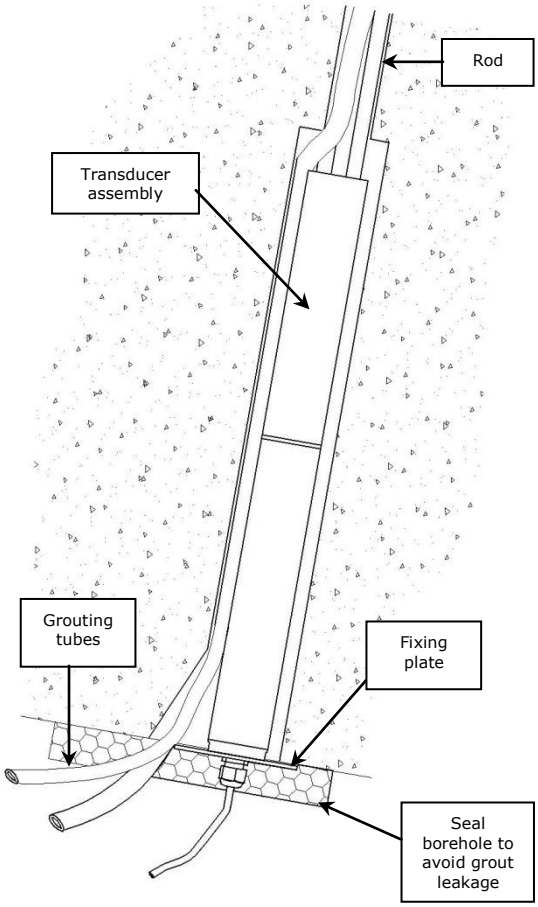
Useful tools (metric):

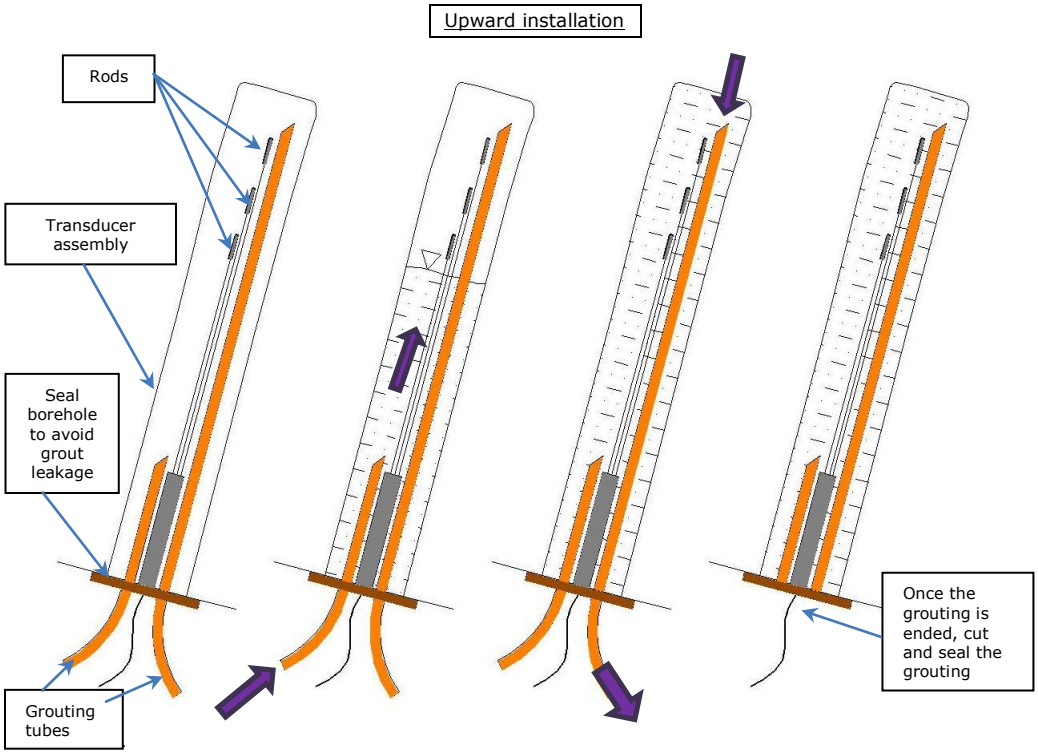
- Allen keys n° 3, 4, 6
- Spanner n° 20, 24, 46
- Wrench n° 10

Installation

Phase 1: Grouting

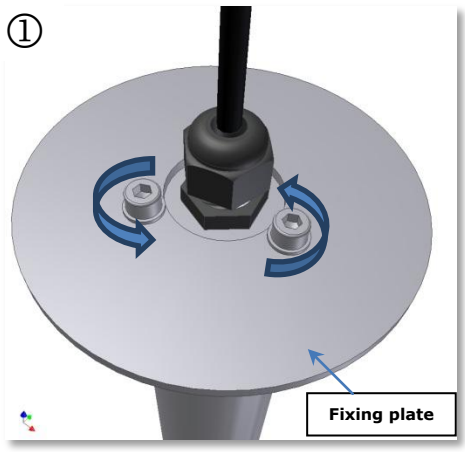
Grouting tubes (orange) are supplied separately.
The two grouting tubes shall be cut to the desired lengths: the shorter shall be approx 1.5m long; the longest 2m over the longest rod.
Fix the longest grouting tube to the rod with adhesive tape.



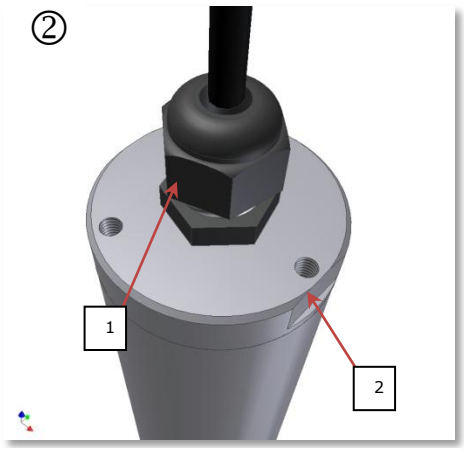


Phase 2 : Release of the transducer assembly

MEXID is supplied with the transducers "blocked" in order to prevent rod movements during grouting. In order to "unlock" the transducers follow the sequence 1 to 7.



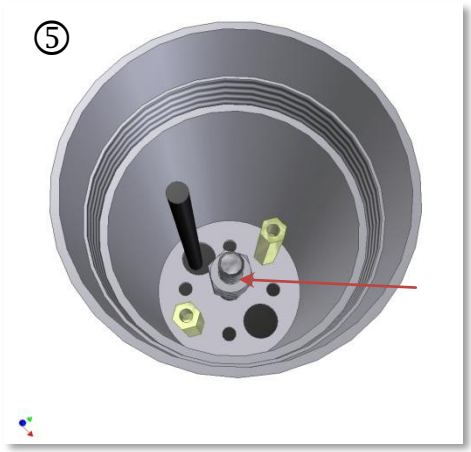
Once the grout hardened, remove the fixing plate unscrewing the three screws with allen key nr.4



Release the cable gland (1) with the spanner nr.20 or 24 and unscrew the threaded cap (2) using the spanner nr. 46.
Warning: don't twist the cable.

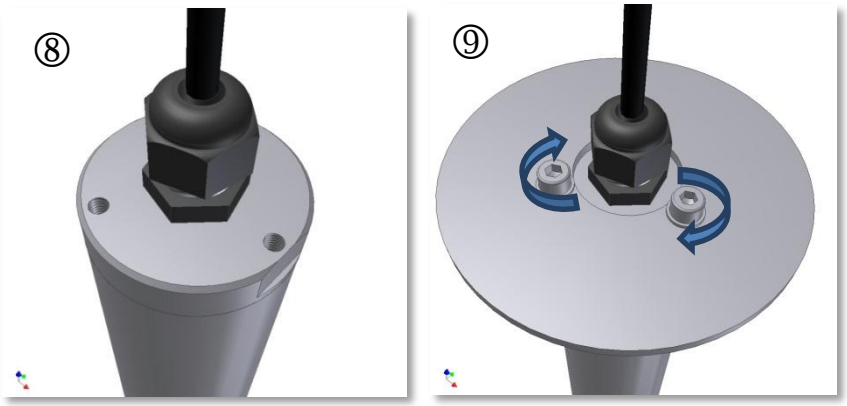
Remove the M6 nut using the wrench n.10

Extract the plate removing the two screws with allen key nr.3



Turn the threaded rod by wrench nr. 10 counterclockwise and remove it.

Once extracted the threaded rod, lock the M8x12 screw with the bonded washer - supplied with MEXID separately - for waterproofing.



Close MEXID screwing the threaded cap, fix plate by screws and tight the cable gland.

Wiring

MEXID is available with:

- Vibrating wire transducer assembly (VW DTE assembly)
- Linear potentiometer transducer assembly (LP DTE assembly)

Herewith follows the wiring scheme for both VW and LP (4-20mA current loop) assembly for 2-fold DTE, 3-fold DTE and 4-fold DTE assembly:

2-FOLD DTE ASSEMBLY			
Function	**Rod #1**	**Rod #2**	**Thermistor**
VW / +Loop	Red	Yellow	
VW / -Loop	Black	Blue	
Temp.			White
Temp.			Green

3-FOLD DTE ASSEMBLY				
	Rod #1	**Rod #2**	**Rod #3**	**Thermistor**
VW / +Loop	Red	Black	Brown	
VW / -Loop	Red-white	Black-white	Brown-white	
Temp.				Green
Temp.				Green-white
Temp. (spare)				Blue
Temp. (spare)				Blue-white

4-FOLD DTE ASSEMBLY					
	Rod #1	**Rod #2**	**Rod #3**	**Rod #4**	**Thermistor**
VW / +Loop	Red	Black	Brown	Yellow	
VW / -Loop	Red-white	Black-white	Brown-white	Yellow-White	
Temp.					Green
Temp.					Green-white
Temp. (spare)					Blue
Temp. (spare)					Blue-white

3-fold and 4-fold DTE assembly are equipped with two thermistors, one of them considered as a spare.

Taking measurements

Manual measurements are carried out by portable readout (i.e. SISGEO CRD-400, New Leonardo) connecting the cable wires to the readout flying cable clips.
Please refer to the above wiring scheme and readout manual for wiring instructions.

MEXID allows automatic measurements by means of SISGEO ADK-100 data acquisition system or any other suitable datalogger.
Please refer to the above wiring scheme for wiring instructions.

For further information please refer to readout and/or ADK-100 user manual.

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:

DTE rod position	**Nominal values**	
	VW	LP
Max extension	**9000Dg**	**4mA**
Max compression	**2500Dg**	**20mA**

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

$$\mathbf{L_i - L_0}$$

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

LP DTE 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 $[(L_1^2 \times A)+(L_1 \times B)+C] - [(L_0^2 \times A)+(L_0 \times B)+C]$= *37.522–25.0590=12.46mm*

Temperature Reading
Using readout units such as SISGEO CRD-400, New Leonardo, temperature will be displayed directly in °C (degrees Celsius); if the resistance value is read, the conversion formula or the table in Appendix 1 can be used.

Troubleshooting

MEXID is a fully assembled instrument and DTE replacement/maintenance is not allowed. Checks of malfunctioning are limited to the following:

	Problem	Possible cause	Solution
VW DTE TRANSDUCER	**Measure not stable**	DTE shaft out of range	None
		Cable 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
LP DTE	**Measure not stable**	Wiring not correct	Make proper wiring
	Measure 0 mA	Wiring not correct	Make proper wiring
	Measure over range	Wiring not correct	Make proper wiring

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

Appendix 1

THERMISTOR TEMPERATURE CONVERSION

Resistance to temperature equation:

$$T = \frac{1}{A + B(LnR) + C(LnR)^3} - 273.2$$

Where:
T= temperature in °C
LnR= natural Log of the thermistor resistance
A= 1.4051×10^{-3} (coefficents calculated over the -50 to +70°C span)
B= 2.369×10^{-4}
C=1.019×10^{-7}

Ohms	Temp	Ohms	Temp	Ohms	Temp	Ohms	Temp
16.60K	-10	5971	10	2417	30	1081	50
15.72K	-9	5692	11	2317	31	1040	51
14.90K	-8	5427	12	2221	32	1002	52
14.12K	-7	5177	13	2130	33	965.0	53
13.39K	-6	4939	14	2042	34	929.6	54
12.70K	-5	4714	15	1959	35	895.8	55
12.05K	-4	4500	16	1880	36	863.3	56
11.44K	-3	4297	17	1805	37	832.2	57
10.86K	-2	4105	18	1733	38	802.3	58
10.31K	-1	3922	19	1664	39	773.7	59
9796	0	3784	20	1598	40	746.3	60
9310	-1	3583	21	1535	41	719.9	61
8851	2	3426	22	1475	42	694.7	62
8417	3	3277	23	1418	43	670.4	63
8006	4	3135	24	1363	44	647.1	64
7618	5	3000	25	1310	45	624.7	65
7252	6	2872	26	1260	46	603.3	66
6905	7	2750	27	1212	47	582.6	67
6576	8	2633	28	1167	48	562.8	68
6265	9	2523	29	1123	49	543.7	69
						525.4	70

Appendix 2 V/V LP DTE ASSEMBLY

DTE assembly equipped with Linear Potentiometer having V/V signal output.

Wiring

2-FOLD DTE ASSEMBLY		
Function	**Rod #1**	**Rod #2**
+ Vcc	Red	White
Signal	Blue	Yellow
GND	Black	Green

3-FOLD DTE ASSEMBLY			
Function	**Rod #1**	**Rod #2**	**Rod#3**
+ Vcc	Red	Black	Brown
Signal	Red-White	Black-White	Brown-White
GND	Blue	Yellow	Grey

4-FOLD DTE ASSEMBLY				
Function	**Rod #1**	**Rod #2**	**Rod#3**	**Rod #4**
+ Vcc	Red	Black	Brown	Yellow
Signal	Red-White	Black-White	Brown-White	Yellow-White
GND	Blue	Yellow	Grey	Pink

For manual readings use CRD-400 **only** with V/V LP interface. Please select "voltage" on main menu.
Connect the clips (A,B,C) to the colored cable wires as reported in the following table:

2-FOLD DTE ASSEMBLY		
CRD-400 clips	**Rod #1**	**Rod #2**
A	Red	White
C	Blue	Yellow
B	Black	Green

3-FOLD DTE ASSEMBLY			
CRD-400 clips	**Rod #1**	**Rod #2**	**Rod#3**
A	Red	Black	Brown
C	Red-White	Black-White	Brown-White
B	Blue	Yellow	Grey

4-FOLD DTE ASSEMBLY				
CRD-400 clips	**Rod #1**	**Rod #2**	**Rod#3**	**Rod #4**
A	Red	Black	Brown	Yellow
C	Red-White	Black-White	Brown-White	Yellow-White
B	Blue	Yellow	Grey	Pink