

Digital piezocone G1-CPLS D

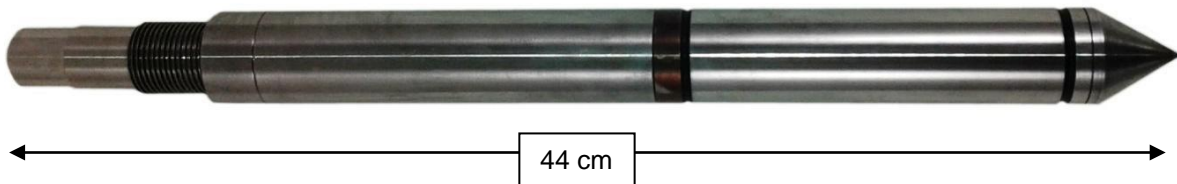
Instrumentation for SCPTU test

G1-CPLS D is the latest release of the famous G1-CPLS equipment to perform SCPTU geotechnical survey. It contains all the technology and the knowledge acquired by Tecnopenta, in a shorter case.

The built in sensors are able to measure during the penetration the following parameters:

- **Qc** (Tip resistance)
- **Fs** (sleeve friction)
- **U** (pore water pressure)
- **Inclination (XY)**
- **Rate of penetration**
- **Temperature**

All the cones made by Tecnopenta are equipped with a seismic accelerometer, that allows to perform seismic survey with the **Vs30** calculation.



The whole system is composed by:

- G1-CPLS D [Digital piezocone]
- D1-CPL Blue [Bluetooth acquisition unit]
- G1-EST CPL Blue [Bluetooth extensometer to measure the rate of penetration]
- High resistant cable to connect G1-CPLS D and D1-CPL Blue
- Data acquisition software [developed in LabView environment]
- Accessories to adapt the system to all the kinds of pushing systems

The system does not require any modification of the pushing system. Generally the only thing to do is to mount the G1-EST Blue just below the beam that holds the pistons.

How the measurement works

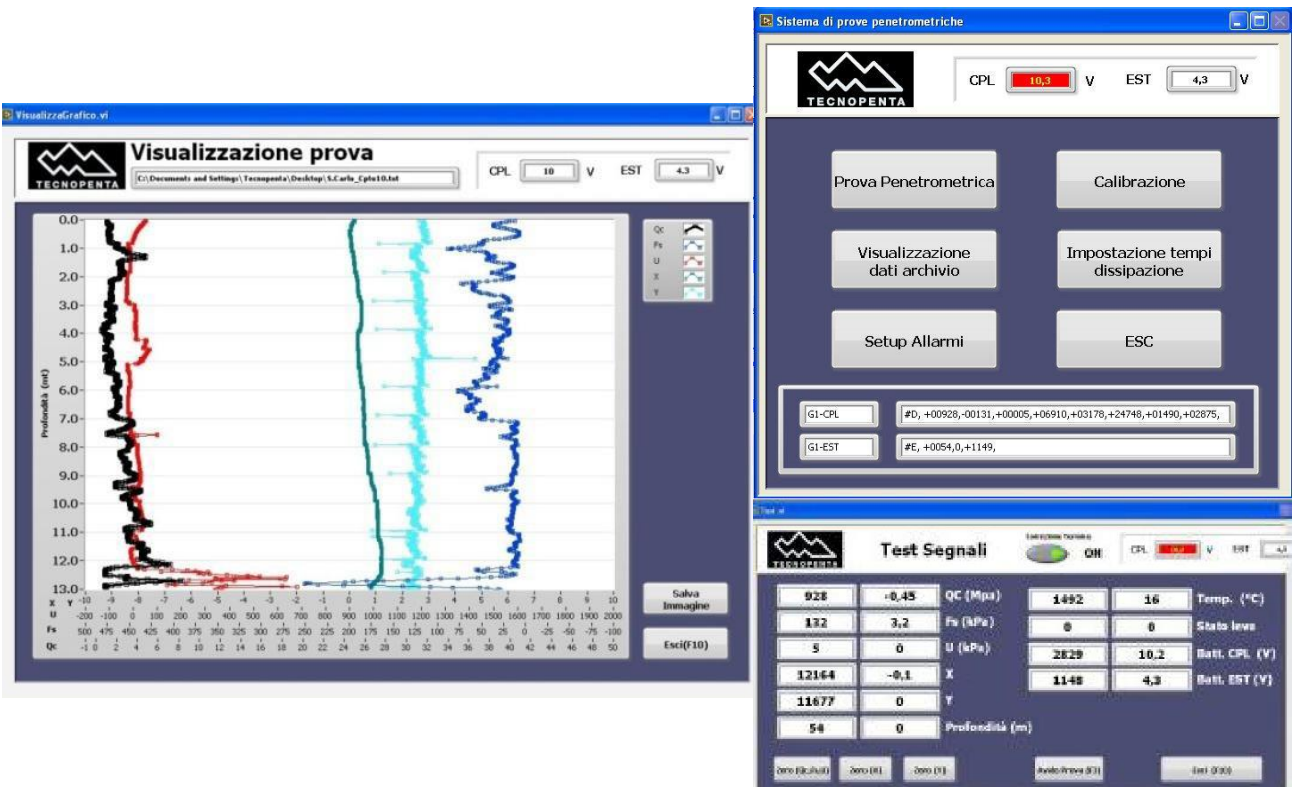
The tip resistance and the sleeve friction are measured by two load cells equipped with high precision strain gauges. The bridges are designed to reduce the effect of load eccentricity (Q_c typical total error less than 1% F.S.; F_s typical total error less than 1% F.S.). The temperature is measured on the load cells and is used to perform thermal compensation of the electrical signals coming from the strain gauges. Moreover the thermal profile can be used secondly to perform further elaborations. The pore water pressure is measured by an high precision pressure transducer (typical total error less than 0.1% F.S.). The piezocone is provided with two kinds of tip in order to allow to use two techniques to transmit the pressure from the pore to the transducer: the first one uses silicone oil as agent of transmission so it features a bronze or plastic porous filter saturated with the oil. The second one uses lithium grease to transmit the pressure. This second technique makes the saturation of the piezocone easier and permits to avoid to use the filters. The inclination value comes from a double axis accelerometer which is used also to perform seismic survey (similar to a down hole). The depth is measured by a displacement transducer (G1-EST Blue) with a full scale length of 150 cm, connected to a button to stop or start the acquisition. D1-CPL Blue and G1-EST Blue communicate with the PC as Bluetooth devices.



The picture above shows how the data are transmitted. Notice that the data are acquired and stored by the computer via the software **PuntaD**.

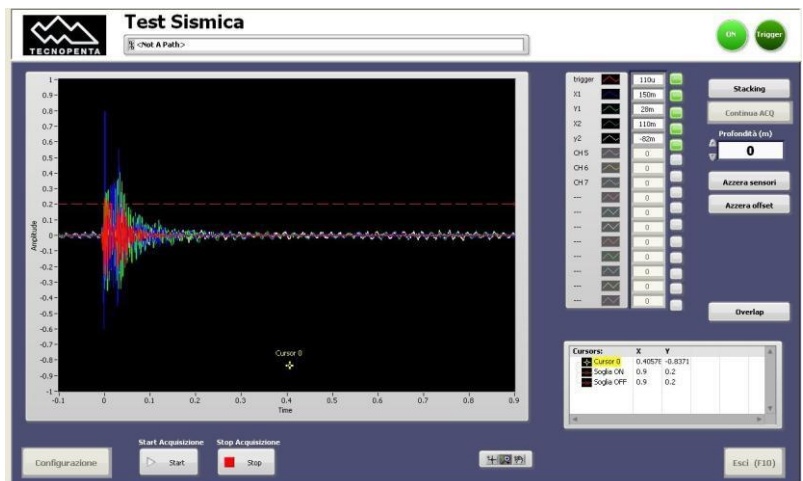
Software

The new software **PuntaD** is able to detect and automatically connect to the PC the Bluetooth devices of our SCPTU system, G1-EST Blue and D1-CPL Blue. It allows to perform classical CPTU, dissipation tests, visualize the data of a previous test, adjust the electrical zero value of the sensors, set alarm thresholds before the CPTU test, visualize the data during the survey and store the data in an ASCII format.



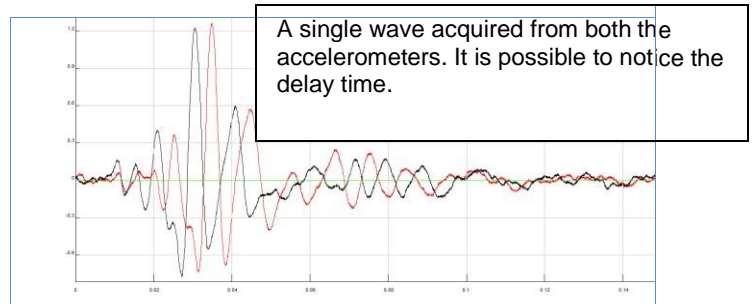
Seismic survey

The seismic survey with the piezocone G1-CPLS D are managed by the software **SISMICA**, which provides everything is needed to perform successful tests. SISMICA allows to visualize the waves after the acquisition and it is possible to choose different triggering mechanisms. Moreover it is possible to acquire for a chosen time interval and with different sampling rate. SISMICA features a **stacking** function which allows to sum progressively different generations of waves. After the test it



is possible to analyze the signals and to determine the V_s (Shear waves velocity).

It is available a special version of the piezocone named G1-CPLS TI that features, in addition to the standard sensors, two seismic accelerometers placed at 1 m distance from each other. This configuration allows to perform seismic survey with the **true interval method**.



Specifications G1-CPLS D	
Cone tip resistance (Q_c)	
Sensor	8 strain gauges 350 Ω full bridge
Background scale	50 MPa
Sleeve friction (F_s)	
Sensors	8 strain gauges 350 Ω full bridge
Background scale	500 kPa
Neutral pressure (U)	
Sensor	Piezoresistive pressure transducer
Filter	Scale: 30 bar
Inclination (I)	
Sensor	Porous bronze, porosity 50 micron; 6 mm height
Background scale	
Temperature	
Sensor	Inertial MEMS accelerometer 3 axis
Measurement limits	± 15 degrees
G1-EST CPL Blue displacement transducer	
Sensor	Monolithic with inserted conditioner
Accelerometers	Measurement limits -50 $^{\circ}$ C to +150 $^{\circ}$ C
Sensor	G1-EST CPL Blue displacement transducer
Frequency	Potentiometer, 10 rotations of 10 k Ω , range 150 cm (standard)
Operating temperature	
D1-CPL Blue	
Sensor	Inertial MEMS 3D accelerometer
Dimensions	+/-2g
Digital output	0 -300Hz (low pass filter at 300 Hz)
Power supply (internal battery)	-40 $^{\circ}$ C to +90 $^{\circ}$ C
Autonomous operation	
Cable	
Sheating	Polyurethane, RAL 1021 orange
Conductors	10 x 0.35 mm ²
SW-SISMICA	
Amplification and filtering	Software adjustable amplification from 1 to 1000
Acquisition	Digital filters: Low/High/Band Pass, Notch; stacking
Data files	By threshold passing <i>or</i> by trigger,
D1-SISMI 2.0 USB	
Number of input channels	CSV, txt
Sampling rate (total)	8 analogue to digital, resolution 16 bit;
Sampling rate per channel (seismic test)	400kHz
	100kHz

ID	Quantity	Description
G1-CPLS D	1	Seismic piezocone. With acquisition of Qc, Fs, U, temperature, rate of penetration and seismic wave (Vs30)
D1-CPLS Blue	1	Bluetooth acquisition unit with rechargeable internal battery
G1-EST Blue	1	Depth measurer
SW-CPL Blue	1	Software for CPTU acquisition
SW-SISMI	1	Software for seismic acquisition
G2-BOX CONE	1	Protective casing for equipment
G2-RAC-CPL	1	Metal connection between piezocone and rod
G2-SAT	1	Equipment to perform pressure measurement with oil and porous filters
SE-Taratura CPL D	1	Calibration certificate
CV-CPL XX	1	50 m cable from piezocone to D1-CPL blue