Digital piezocone

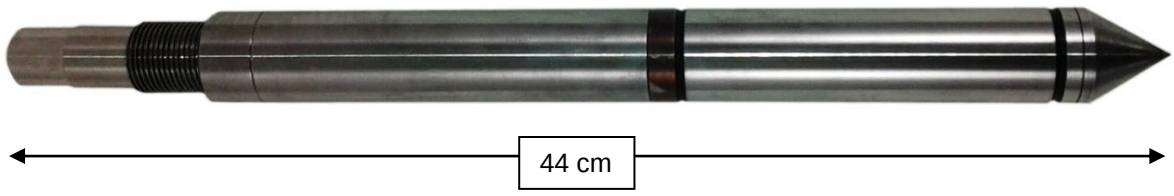
Instrumentation for SCPTU test

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 for many years of development and production, 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 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 kind of pushing system

The system does not require any several 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.

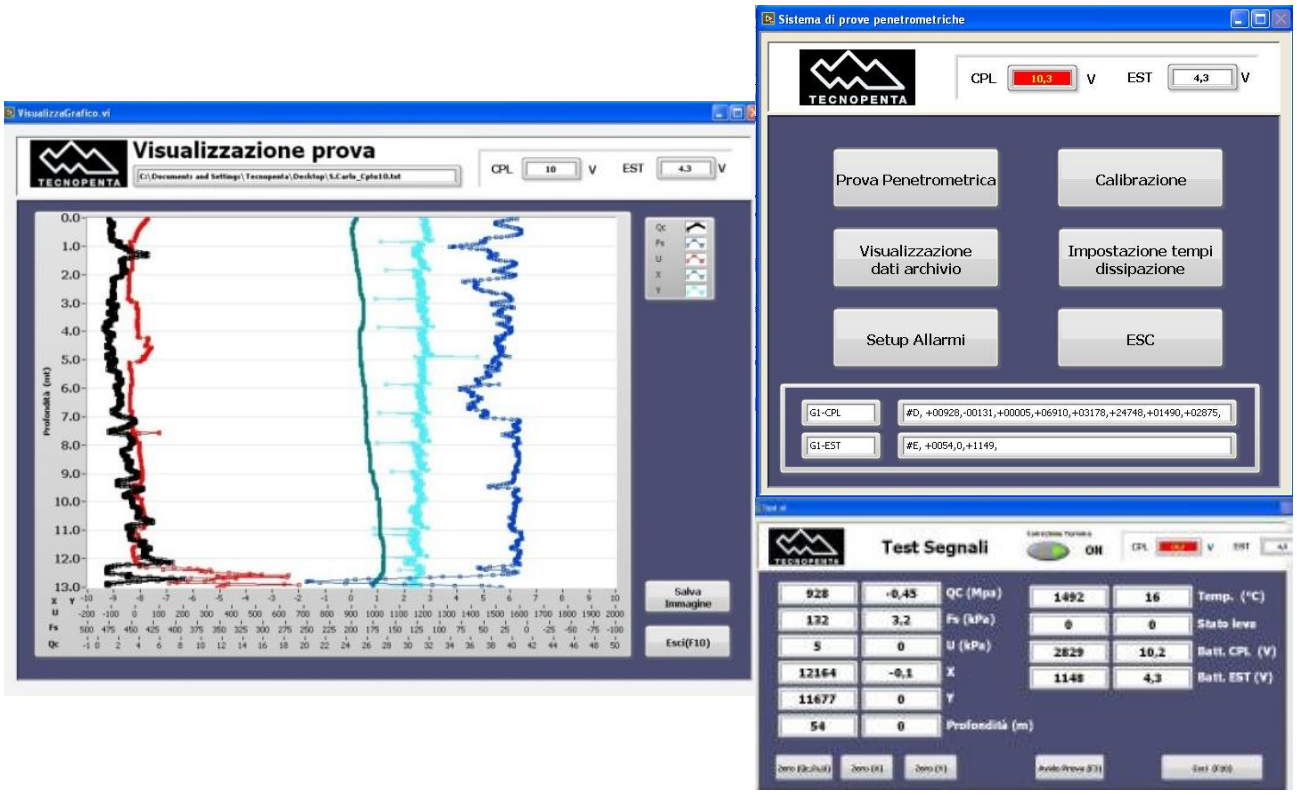
How the measurement works

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 (Qc typical total error less than 1% F.S.; Fs typical total error less than 1% F.S.). The temperature is measured on the load cells and the value is used for the thermal compensation of the electrical signal 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. The button to stop or start the acquisition have to be connected to the G1-EST Blue which communicates with the PC via Bluetooth.

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

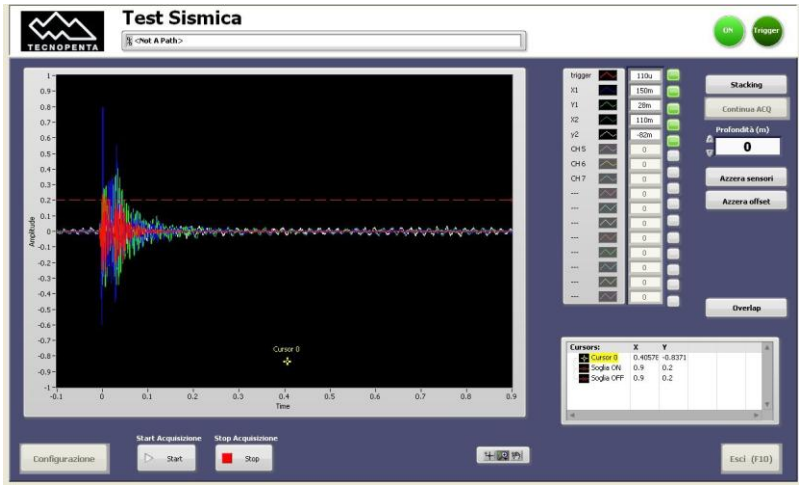
Software

The new software *PuntaD.exe* 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.

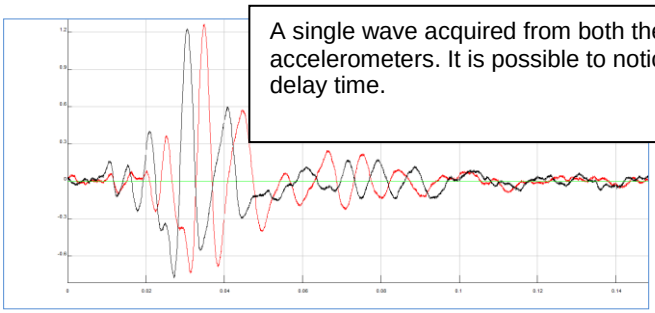


Seismic survey

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 mechanism. 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 Vs (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**.



A single wave acquired from both the accelerometers. It is possible to notice the delay time.

Specifications G1-CPLS D		
Cone tip resistance (Qc)		
Sensor	8 strain gauges 350Ω full bridge	
Background scale	50 MPa	
Sleeve friction (Fs)		
Sensors	8 strain gauges 350Ω full bridge	
Background scale	500 kPa	
Neutral pressure (U)		
Sensor	Piezoresistive pressure transducer	Scale: 30 bar
Filter	Porous bronze, porosity 50 micron; 6 mm height	
Inclination (I)		
Sensor	Inertial MEMS accelerometer 3 axis	
Background scale	±15 degrees	
Temperature		
Sensor	Monolithic with inserted conditioner	
Measurement limits	−50°C to +150 °C	
G1-EST CPL BLue displacement transducer		
Sensor	Potentiometer, 10 rotations of 10 kΩ, range 150 cm (standard)	
Accelerometers		
Sensor	Inertial MEMS 3D accelerometer	+/-2g
Frequency	0 -300Hz (low pass filter at 300 Hz)	
Operating temperature	−40°C to +90°C	
D1-CPL Blue		
Dimensions	polyester 220 x 120 x 90 mm	
Digital output	Via Bluetooth	
Power supply (internal battery)	12 V_{DC}	
Autonomous operation	40hours at 50% of a battery's nominal capacity	
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	
	Digital filters: Low/High/Band Pass, Notch; stacking	
Acquisition	By threshold passing *or* by trigger,	
Data files	CSV, txt	
D1-SISMI 2.0 USB		
Number of input channels	8 analogue to digital, resolution 16 bit;	
Sampling rate (total)	400kHz	
Sampling rate per channel (seismic test)	100kHz	