

**LABORATORY: CNR ISPC Stone LAB**

**NAME OF THE INSTRUMENT**

Instrumentation for ultrasonic velocity measurement (PUNDIT PL-200 and PUNDIT PD8050)

**GENERAL DESCRIPTION:**

The instrumentation includes two measuring devices:

- PUNDIT PL-200, equipped with transducers of different frequencies
- PUNDIT PD8050 with pulse-echo technology and multi-channel array-type transducer.

The PUNDIT PL 200 enables ultrasonic velocity measurement within the material being transmitted. The PUNDIT PD 8050 is an ultrasonic tomograph that operates in pulse-echo mode allowing S-wave velocity measurements, and defects and inhomogeneities detection, returning the two- and three-dimensional images.

**TECHNICAL DESCRIPTION PUNDIT PL 200:**

The PUNDIT PL-200 instrument is equipped with transducers of different frequencies:

- 2 transducers 24 kHz
- 2 transducers 150 kHz
- 2 transducers 250 kHz
- 2 transducers 500 kHz
- 2 54kHz exponential transducers

Bandwidth 20 to 500 kHz, Measurement resolution 0.1 us, Pulse voltage  $\pm 100$  to  $\pm 450$  V (UPV), Receiver Gain 1 to 10,000x (0 to 80 dB) Transducer nominal frequency 24 to 500 kHz.

**TECHNICAL DESCRIPTION PUNDIT PD8050:**

Bandwidth 20 - 80 kHz, Technology Multi-channel Ultrasonic Pulse Echo, Measuring Resolution 1 us, Pulse Voltage  $\pm 50$  to  $\pm 150$  V (UPE), Receiver Gain 1 to 10.000 (0 to 80 dB).

The PUNDIT PD8050 instrumentation, combined with the PUNDIT PL-200 instrumentation, enables:

- The measurements in "Pulse Echo" mode for checking the presence of defects in homogeneous samples of natural and artificial stone elements through an Array-type transducer with Multi-channel Ultrasonic Pulse Echo technology
- The measurement of S-wave velocity within the material and determination of the thickness of the material with known S-wave velocity
- The transmission ultrasonic velocity measurements with transducers of different frequencies (24 kHz, 54 kHz, 150 kHz, 250 kHz, 500 kHz, 54 kHz exponential) to analyze stone materials of different characteristics and sizes.

The ultrasonic velocity is related to the physical/mechanical characteristics of the materials and therefore its estimation makes it possible to compare the characteristics of different materials, evaluate the effect of consolidation treatments and the extent of degradation/alteration processes.



**FURTHER INFORMATION:**

- ASTM D 2845 – Standard Test Method for Laboratory Determination of Pulse Velocities and Ultrasonic Elastic Constants of Rock
- ISRM – Aydin A., Upgraded ISRM Suggested Method for Determining Sound Velocity by Ultrasonic Pulse Transmission Technique: *Rock Mech Rock Eng* (2014) 47:255-259, DOI: 10.1997/s00603-013-0454-z.
- UNI EN 12504-4:2021 Testing concrete in structures - Part 4: Determination of ultrasonic pulse velocity.
- UNI EN 14579:2005 Natural stone test methods - Determination of sound speed propagation.
- Misak, L., Corbett, D., & Grantham, M. (2019). Comparison of 2D and 3D ultrasonic pulse echo imaging techniques for structural assessment. In *MATEC Web of Conferences* (Vol. 289, p. 06003). EDP Sciences.

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