

PUNDIT

Purpose

The **PUNDIT** (Portable Ultrasonic Nondestructive Digital Indicating Tester) is used to measure the propagation speed of a pulse of ultrasonic longitudinal stress waves. The ultrasonic pulse velocity (UPV) that is determined can be used for the following applications:

- Evaluating the uniformity of concrete within a structural member
- Locating internal voids and cracks
- Estimating severity of deterioration
- Estimating depth of fire damaged concrete
- Evaluating effectiveness of crack repairs
- Identifying anomalous regions for invasive sampling with drilled cores
- Estimating early-age strength (with correlation)

Principle

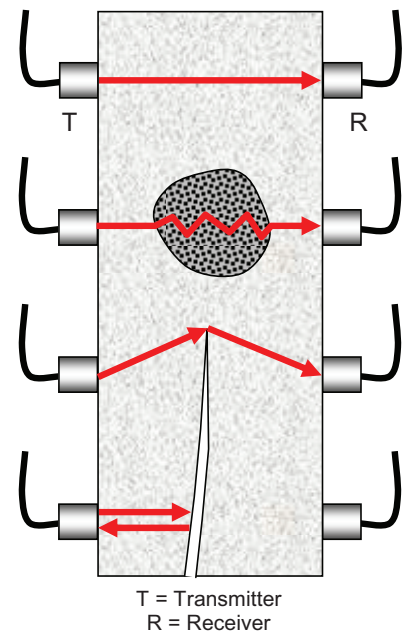


A pulse of ultrasonic (> 20 kHz) longitudinal stress waves is introduced into one surface of a concrete member by a transducer coupled to the surface with a coupling gel or grease. The pulse travels through the concrete and is received by a similar transducer coupled on the opposite surface. The transit time of the pulse is determined by the instrument. The distance between the transducers is divided by the transit time to obtain the pulse velocity. The longitudinal pulse velocity, C_p , of an elastic solid is a function of the elastic constants (modulus of elasticity, E , and Poisson's ratio, ν) and the density, ρ .

$$C_p = \sqrt{\frac{E(1-\nu)}{\rho(1+\nu)(1-2\nu)}}$$

The UPV test method is governed by various standards including ASTM C597, BS 1881:203, and EN 12504-4. The test method is totally nondestructive and it is possible to repeat the test at the same point at different times to determine changes of UPV with time.

The figure to the right illustrates different conditions that may be encountered when testing an element. At the top, the path between the transducers is through solid concrete, and the travel time would be the shortest. Below that is the case where there is an internal pocket of porous concrete, such as honeycombed concrete. The pulse is scattered as it travels through the contiguous portions of the honeycombed concrete. As a result, the travel path is longer and the pulse travel time is longer. This results in a reduced pulse velocity. In the next case, the transducers are located so that the direct travel path is near the edge of a crack. The pulse cannot travel across a concrete-air interface, but it is able to travel from the transmitter to the receiver by diffraction at the crack edge. Because the travel path is longer than the distance between the transducers, the apparent pulse velocity is lower than through sound concrete. In the lowermost case, the pulse is reflected completely by the crack, and travel time is not measurable.



Precision and Accuracy

The UPV test is highly repeatable. For tests of sound concrete, the coefficient of variation for repeated measurements at the same location is 2 %. The accuracy of the pulse velocity is a direct function of the accuracy of the measured distance between the transducer faces. The **PUNDIT** instruments have a transit time resolution of 0.1 μ s.

Two models are available: The **PUNDIT Plus** and the **PUNDIT 7**. Both instruments are capable of investigating the structural integrity of concrete, ceramics and refractory, timber and other materials. They include the following features:

- Light, portable, rugged, simple to operate
- Rechargeable battery and 110/240 VAC 50/60 Hz power supply
- Large, highly visible LCD display
- RS232 and oscilloscope outputs
- Largest range of transducer options (24 kHz to 1 MHz)
- Designed for laboratory or field operation

PUNDIT Plus



Key features:

- Auto ranging transit time display; up to 9999 μ s
- Programmable trigger rate
- Wide range of pulse repetition frequency
- Measure transit time, pulse velocity, and elastic modulus
- Three transmitter voltage options; 250 V, 500 V, or 1.2 kV
- Data transferrable to Excel® spreadsheet

PUNDIT Plus Ordering Numbers

Item	Order #
PUNDIT Plus with data conversion software for downloading to Excel®	PP-1010
AC power cord	PP-1020
Two 54-kHz transducers (transmitter and receiver)	PP-1030
Two 3.7 m cables	PP-1050
Couplant (250 mL bottle)	PP-1060
Operating manual (CD ROM)	PP-1070
Optional	
Attaché case	PP-1080

PUNDIT 7



Key Features:

- Auto ranging transit time display: up to 6.553 ms transit time
- Signal level bar graph
- On screen display of test settings
- Remote control by PC through RS232 port
- Four transmitter voltage options: 250 V, 500 V, 750 V, or 1 kV
- Wide range of pulse repetition frequency, up to 100 Hz
- Built-in rechargeable batteries
- Auto detecting of AC power supply
- Built-in handle also functions as stand for bench or field use

PUNDIT 7 Ordering Numbers

Item	Order #
PUNDIT 7	P7-2010
AC power cord	P7-2020
Two 54-kHz transducers (transmitter and receiver)	P7-2030
Verification bar	P7-2040
Two 3 m cables and serial cable	P7-2050
Couplant (250 mL bottle)	P7-2060
Operating manual (CD-ROM)	P7-2070
Optional	
Carrying case for easy use on-site	P7-2090



A range of amplifiers and attenuators are available to cover a variety of applications. Also, cables up to 30 m in length can be ordered, along with different coupling fluids to suit various applications.

Optional Transducers

Transducers with resonant frequencies from 24 kHz to 1 MHz are available, including wheel probes for continuous testing in the field or in a production environment. Use lower frequencies for large, dense, and heterogeneous test objects and higher frequencies for smaller, less dense and more homogeneous test objects. General guidelines are:

Concrete:	24 to 150 kHz	Graphite:	200 kHz to 1 MHz
Timber:	150 to 220 kHz	Cast iron:	1 MHz
Ceramics:	24 to 220 kHz		



Order #	Frequency	Nominal Dimensions
UTR24KHZ	24 kHz	50 mm dia × 96 mm long.
UTR37KHZ	37 kHz	50 mm dia × 50 mm long.
UTR54KHZ	54 kHz	50 mm dia × 38 mm long.
UTR82KHZ	82 kHz	33 mm dia × 34 mm long.
UTR150KHZ	150 kHz	25 mm dia × 34 mm long.
UTR200KHZ	200 kHz	20 mm dia × 34 mm long.
UTR220KHZ	220 kHz	6 mm dia tip, 13 mm dia body, 60 mm long (including connector)
UTR500KHZ	500 kHz	6 mm dia tip, 13mm dia body, 60 mm long (including connector)
UTR1MHZ	1 MHz	15 mm dia × 67 mm long (including connector).

Operating temperature range for transducers is 0 to 70 °C.

A waterproofed option is available on the 24, 37, 54 kHz transducers by special order for applications requiring use in wet conditions or immersion up to 1 m depth

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