

Strain and Acceleration Sensors

for high strain dynamic foundation testing and other applications



Strain Transducers and Accelerometers manufactured by Pile Dynamics are reliable, convenient to install and remove, and highly durable. Available in wireless or traditional (cabled) versions.

Accuracy: PDI sensors collect axially accurate signals at high microstrain (strain transducers) and "g" (accelerometers) levels.

Traceability: PDI sensors are traceable to National Institute of Standards and Technology (NIST) specifications. Calibration sheets are furnished with each sensor. Pile Dynamics recommends that sensors be recalibrated at least every two years, in accordance with ASTM D-4945.

Versatility: In addition to collecting data for high strain dynamic foundation testing with the Pile Driving Analyzer® (PDA) system, accelerometers are also used for SPT hammer energy calibration with either the PDA or the SPT Analyzer. SPT hammer calibration also requires a specially instrumented SPT rod (strain gages glued to the rod are used in lieu of strain transducers for this application). PDI strain transducers are compatible with other applications requiring strain measurements, such as static load monitoring and structural monitoring of bridges and other structures.



clockwise from top: wireless transmitter, accelerometer and strain transducer

Smart

All accelerometers and strain transducers include Smart Sensor Technology and send data to a PDA up to 100 m away. The PDA recognizes the sensors, knows to which channel of data acquisition each is connected, and reads their number, calibration, and date of last calibration.



Traditional (cabled)

Some applications, such as SPT hammer calibration and offshore pile driving monitoring, are better suited for sensors that connect to the PDA by cable.



Traditional (cabled) accelerometer and strain transducer



Installation

When used for Dynamic Foundation Testing or Pile Driving Monitoring, accelerometers and strain transducers are bolted to the foundation, usually about 2 to 3 diameters below the top. Strain transducers are attached symmetrically about the neutral axis of the foundation to account for bending effects, and accelerometers are attached near the strain transducers.

Typically two or 4 pairs of sensors are used for routine foundation testing. Attachment procedure varies depending on the type of foundation, but is generally quick:

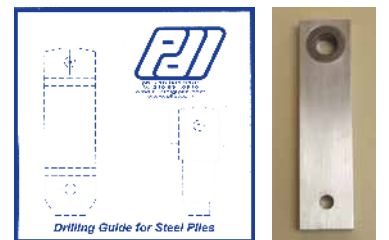
Steel Pipe Piles: Drill and tap holes; magnetic drilling guide available

Steel H Piles: Drill clearance holes and install bolts / nuts

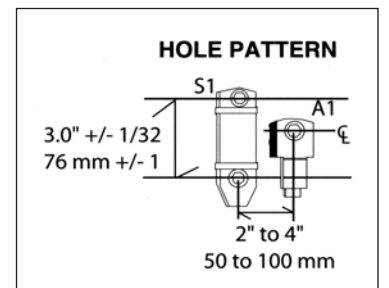
Timber Piles: Drill holes with lag bolts

Concrete Piles and Shafts: drill holes and embed anchors; metal drilling guide available

Drilled shafts, augered cast in place, spiral welded piles and other non uniform foundations: 4 strain transducers are recommended to assess bending stresses along 2 axes.



Drilling guides for steel (upper left) and concrete (upper right) piles make it simple to drill holes for the 6 mm (1/4-20") bolts at the correct spacing.



Quality Assurance for Deep Foundations

Specifications

Piezoelectric (PE) Accelerometer

Mounting: Custom aluminum block (25 x 25 x 25 mm)

Circuit: Integral impedance converting electronics

Cable: Shielded, standard length 900 mm (traditional) or 450 mm (smart)

Sensitivity: Nominally 1.0 mV/g with 10 V.D.C. bias voltage input

Range: 5,000 g (Limit 10,000 g)

Frequency Range: 0.25 to 7000 Hz (resonant freq: > 40 kHz)

Temperature Range: -50° to 120°C operating

Time Constant: At least 1 second

Attachment Method: Bolts to pile

Options: Full waterproofing, extra cable length

Wireless Transmitter

Two Channels of data acquisition

Transmits data from any of these sensor combinations:

- two strain transducers,
- one strain transducer and one piezoresistive (PR) accelerometer
- one strain transducer and one piezoelectric (PE) accelerometer
- two PR accelerometers
- one PR accelerometer and one PE accelerometer

2 channel signal conditioning can be used for strain transducer, PR accelerometer, or PE accelerometer

24 bit A/D converter with 2 channels at up to 20 KHz sample rate per channel

1K, 2K, and 4K data record sizes available – user selectable

Data Transmission: via a standard radio protocol

Radio Transmission Range: up to 100 m

Power: Low power processor and built-in 3.7 V battery for up to 8.5 hours run time during constant data acquisition. Optional extended use battery for up to 24 hours run time.

Size: 175 x 90 x 20.7 mm

Weight: 0.63 Kg

Temperature Range: 0° to 40°C operating, -20° to 65°C storage.

Sensor Protectors:

For driven pile testing, sensors may be installed with the pile on the ground. Sensors can then be protected with Pile Dynamics' Sensor Protectors (as shown on picture to the right) prior to lifting.

Piezoresistive (PR) Accelerometer (Model K)

Mounting: Custom aluminum block (45 x 25 x 30 mm)

Circuit: Full bridge

Cable: Shielded, standard length 900 mm (traditional) or 450 mm (wireless)

Sensitivity: Nominally 0.07 mV/g with 6.4 V.D.C. input

Range: 20,000 g (Limit 30,000 g)

Frequency Range: DC to 4.5 kHz

Temperature Range: -12° to 55°C operating

Attachment Method: Bolts to pile

Options: Extra cable length

Strain Transducer

Effective Gage Length: 76 mm standard

Size: 126 x 35 x 11 mm

Material: Aluminum (Steel option for structural or static testing)

Circuit: Full Wheatstone bridge

Cable: Shielded, standard length 900 mm (traditional) or 450 mm (wireless)

Sensitivity: Nominally 380 μ mV/V

Strain Range: Nominally 3000 μ ϵ

Shock Range: Nominally 5000 g

Natural frequency when attached to foundation: greater than 2000 Hz

Temperature Range: -50° to 120°C operating

Attachment Method: Bolts to pile.

(Optional C-clamps or mounting tabs and adhesive for structural testing)

Options: Full waterproofing, extra cable length, and as embedded transducer with 3 ft (91.4 cm) long #4 (12.7 mm diameter) steel rebar or 4 ft (122 cm) long #5 (15.9 mm diameter) steel rebar (sister bars).



Pile Dynamics, Inc.

30725 Aurora Road
Cleveland, OH 44139 USA

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+1-216-831-6131 info@pile.com www.pile.com