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# Allnamics - PDA
# Pile Driving Monitoring & Analysis

## Wireless monitoring equipment for Pile Driving Analysis
## Monitoring and trouble shooting of the pile installation process


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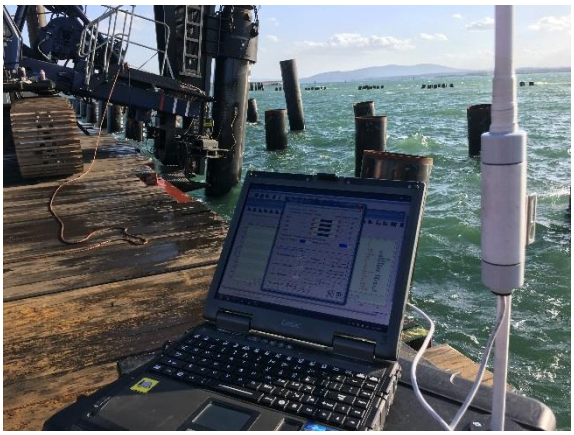
## KEY BENEFITS

- Wireless transmitting data by Wi-Fi or as a standalone recording device
- High resolution, easy to operate
- Intelligent sensors & real time sensor control
- Option of AllWave Signal Matching for DLT
- Supported by the Allnamics team with more than 50 years of experience
- Possibility to export signals for dynamic load testing, fatigue analysis and way more
- Sleep function to delay start of monitoring with hours, days or weeks
- Optimised for use by civil, geotechnical and foundations engineers
- Extensive reporting options to PDF and MS Word format
- In compliance with international standards (ASTM, EuroCode, etc.)

Complete set of PDA equipment and tools in transport case (29 cm x 45 cm x 55 cm, 15 kg)

## PILE DRIVING ANALYSIS (PDA VS DLT)

The total process of pile installation during driving can be monitored with the Allnamics PDA set. PDA stand for pile driving analysis or pile driving monitoring. Parameters of hammer, pile and soil can be monitored to optimize the pile driving process and hammer efficiency, the condition of the pile cushioning, to avoid problems i.e. by limit the pile stresses in both



Monitoring during driving with the wireless monitoring equipment of Allnamics

compression and tension, to monitor the behaviour of the soil, entrance in or passing of soil layers and to control the performance related to drivability studies and soil investigations.

The same monitoring set-up can be used for Dynamic Load Testing (or High Strain Dynamic Testing), when the precast pile is redriven after a set-up period, or when an impact is given on cast-in-situ piles. Elaboration of the signals by the Signal Matching technique of AllWave-DLT lead to prediction of the static load-settlement behaviour (DLT).

Pile Driving Analysis (or PDA) reduces the risk of damage to both the pile and the hammer and allows the contractor to drive the pile efficiently to the optimum or required depth.

## WORKING PRINCIPLES

Two combined sensor sets, each consisting out an acceleration and a strain sensor, are bolted to the pile near the pile top. Sensors are connected to the PDR, the data acquisition unit. Signals are send wireless to the monitoring field

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The powerful wireless PDR: Specially designed for measuring in rough site conditions, internal storage of data and data transmission without cables

laptop to minimize interaction with the driving operations. By measuring accelerations and strain, stress waves are captured. The signals are processed and analysed to assess the driving parameters.

## PDR WIRELESS DATA ACQUISITION

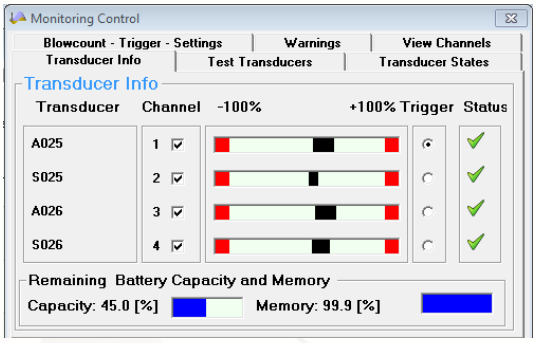
Allnamics has developed a state-of-the-art multi-purpose monitoring system, the PDR. Designed by a multi-disciplinary design team, the PDR meets the pile testing requirements on the construction site in every respect. Options include continuous monitoring and storage on the internal drive of strain and acceleration during pile driving (PDA) and single blow registration for Dynamic Load Testing (DLT) during re-strike. Data collected for DLT can be exported for further analysis with AllWave-DLT signal matching software.

The use of Allnamics' PDR is not limited to Pile Driving Analysis. When other intelligent sensors with USID (load cells, accelerometers) are connected, the PDR can monitor during Rapid Load Testing, e.g. Statnamic™, Stat*Rapid*™. Other monitoring options of the PDR are available as well (SIT, SLT, DLT, PDA and VDA).

## SENSORS

Each measuring system includes two combined sensors for measuring strain and accelerations. Per combined sensor only two holes have to be drilled. The sensors are delivered with a multipurpose template. This template is used for protection of the sensors during transport and for mounting. It is also used as a drilling template ensuring the exact positions of the holes to be drilled. Finally it contains all necessary mounting materials (i.e bolts and LN key).

Combined acceleration- and strain transducers, protected in the multipurpose (drilling)template, mounted to the pile with two holes only




Continuous monitoring of the sensor status. Checks during mounting, standby and during monitoring for optimal support of the testing engineer

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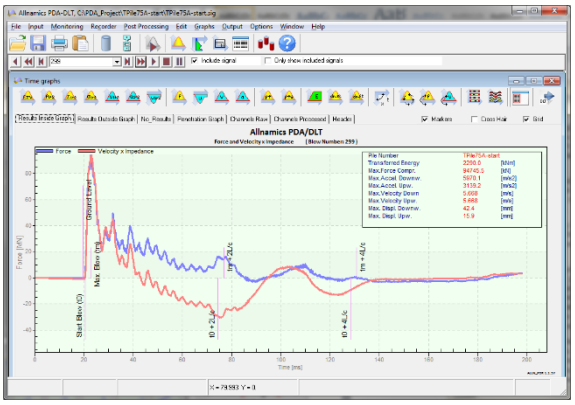
The mounting of the sensors is directly controlled by the PDR. During mounting the performance of the sensors is continuously measured ensuring stress free instrumentation.

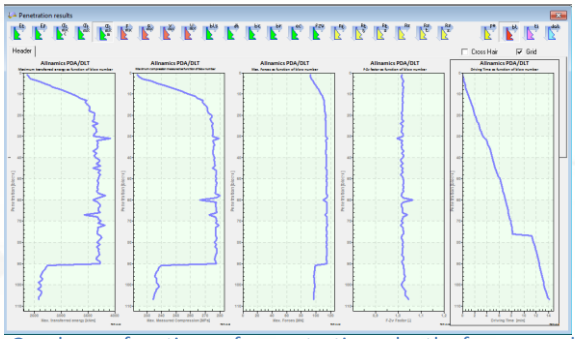
The status of the sensors is continuously monitored before and during monitoring. On screen the condition of all sensors is presented real-time.



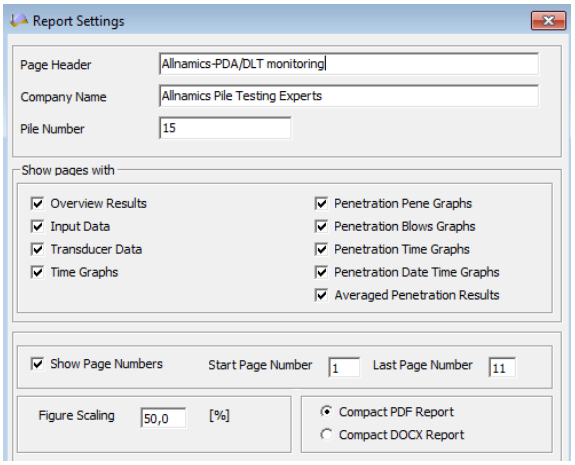
Processed signals: measured strain to forces, measured accelerations to velocity times impedance

## REPORTING RESULTS

The PDA-DLT Software provides live graphical and numerical results of each blow as well as various quantities as a function of penetration. Restults can be easily reported by making use of the copy-paste method, or more easly, using the report generator.



Graph as function of penetration depth for several parameters for hammer, pile and soil




Reports can be generated automatically with extensive options for personalizing the layouts.

## ALLWAVE SIGNAL MATCHING

When the measured signals are part of a pile load test to determine pile capacity, the signals have to be analysed with AllWave-DLT software. AllWave is a Wave Equation Program based on the method of characteristics for one-dimensional stress waves and offers the possibility to simulate the soil behaviour according to various soil models (TNO, Smith and Randolph).

During the Signal Matching process the soil model is adjusted until a good match between the calculated and measured upward travelling wave is obtained. The upward travelling wave contains information on the interaction between soil and pile shaft and toe.

The initial soil model, based on the soil investigation results. CPT's, SPT's and other, can be imported digitally or digitized using the AllWave Soil Digitizer. Manual input of soil layers and soil parameters is possible as well.

The Signal Matching process is supported by several utilities, including AutoMatching.

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## FEATURES PDA-SET

- PDR, high speed data acquisition system
- 4 universal channels (for strain, acceleration, velocity, force, displacement, and more)
- Easy upgrade to 8 universal channel monitoring
- Wireless Wi-Fi connection to a Windows PC laptop. Alternative data communication through ethernet or analogue cable
- Free selection of trigger channel (1 to 4) or external trigger
- Free selectable pre-trigger period/buffer size and trigger delay
- Adjustable sample rate up to 48 kHz per channel
- Resolution 24 bit A/D conversion
- In compliance with EMC, ESD, ASTM D4945
- Basic unit accuracy < 0.3%FS
- THD 102 dB
- Automatic balancing and signal conditioning
- Internal Solid State recorder with 4 Gb memory for signal backup and standalone recording
- 6 hrs operational battery life (up to 30 days standby)
- Class IP66 housing
- Fully compatible with intelligent combined transducers (USID)

Combined sensors to be used on both steel and concrete piles, easy to mount with two bolts each only

- Robust design with easy magnetic stowaway system for excess cable
- Dimensions: 220 x 200 x 100 mm (9 x 8 x 4 in)
- Weight: 1.8 kg
- High speed internet LAN-100, IEEE 802.3, 100 Mb/s, and WiFi IEEE802.11
- Operates in metric SI or Imperial/US units
- Support multiple languages (English, German, Spanish, other on request)
- Software program for monitoring, processing and reporting included
- Integrated test box (to automatically check the transducers during mounting

## About Allnamics

Allnamics acts as an independent consultant for geotechnical engineering and piling works (including design and pile installation monitoring and supervision), provides its clients with general consultancy in foundation diagnostics as well as training and assistance in using Allnamics pile testing hardware and software (including driveability prediction analysis and signal matching).

Allnamics assists clients in trouble shooting of complex project situations. Additionally, Allnamics organizes courses and seminars to introduce clients into the theory, practice and interpretation of foundation diagnostics using its experience from world-wide case histories since 1972.

Additional information on Allnamics can be found on allnamics.com.

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