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BlueFastening Systems

Ultrasonic measurement technology

Measuring preload in the original application

- Measurement on original fasteners
- Measurement of several fastening points
- No additional interface

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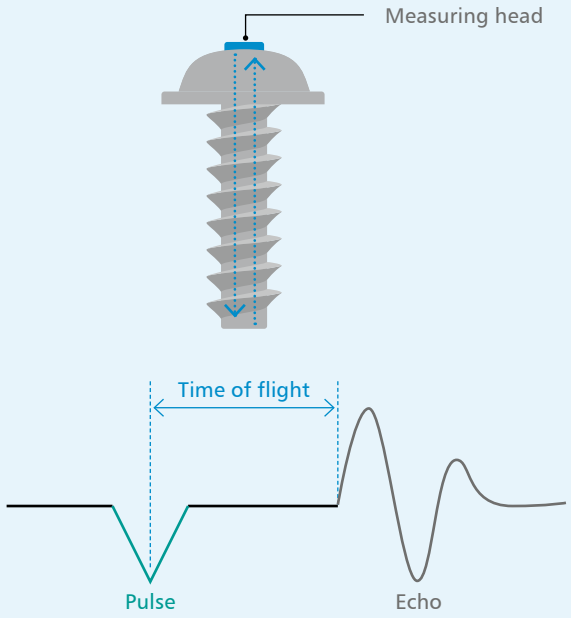
How ultrasonic measurement technology works

Preload ultrasonic measurement is based on the pulse-echo process and it determines the time of flight difference of an ultrasonic pulse induced on a loaded and unloaded screw.



How it works

A piezo element and a measuring instrument induce an ultrasonic pulse at one end of the fastener. The pulse passes through the fastener and is reflected at the other end as an echo. When it courses through the fastener a second time, this echo is recorded by the measuring instrument and the time of flight of the ultrasonic pulse is measured. The time of flight is specific to each fastener and increases linearly by tightening in the elastic area due to its expansion and the acousto-elastic effect that occurs.

By comparing the time of flight under no load (reference time of flight/reference measurement) and after the fastener has been tightened, it is possible – considering further factors as well – to draw conclusions about the preload.

The benefits

- Measurement on original fasteners
- No additional interface
- Measurement of several fastening points
- Long term measurement possible
- Field tests possible

Range of applications

Nominal diameter and clamping length

When supplying the necessary components for set-up and qualification, it is possible in principle to carry out an ultrasonic-based preload force measurement in the following fields of application:

Areas of application	Nominal diameter	Clamping length
Metric thread	≥ 4.0 mm	≥ 1.0 mm
Direct screw fastening of metals	≥ 4.0 mm	≥ 1.0 mm

To check exactly and individually the suitability of this measurement method for each case, detailed information about every component of the investigated fastening point needs to be provided.

Drive size

The following drive sizes are possible to apply the piezo element:

Drive	TORX®	TORXPLUS®	Internal hex
Internal load drive	≥ TX 30	≥ IP 30	≥ SW 3
External load drive	≥ E5	≥ 5EP	≥ SW 7

Other drives on request

Temperature range

The temperature range is restricted by the piezo element used, as below:

Piezo element	Measurement range	Area of application
Piezo	–35°C bis +120°C	–40°C bis +140°C
PMTS*	–40°C bis +180°C	–270°C bis +320°C

* Permanent Mounted Transducer System

Measurement range: Recording measurement signal

Area of application: Resistance of piezo elements / components

Comparison of piezo elements

Piezo element	Piezo	PMTS
Low costs	✓	✗
Short delivery lead time	✓	✗
Temperature-resistant*	✓*	✓
Media-resistant	✗	✓
Corrosion-resistant	✗	✓

* see temperature range summary

Piezo

PMTS: Permanent Mounted Transducer System

Fastener materials

The following fastener materials can be qualified:

- Steel
- Aluminum

Processes carried out on the fastener

To qualify and implement the ultrasonic preload force measurement the following mechanical processes need to be made on the fasteners:

- Plane parallel surface at the head
- Plane parallel surface at the tip
- Apply piezo element

Measurement options

We can make ultrasonic preload measurements in a variety of scenarios:

- A one-time measurement at one or at several fastening points
- Measurement of preload progression at one fastening point over a defined period
- Measurement of preload progression at up to eight fastening points simultaneously over a defined period

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The ARNOLD GROUP

Wherever customers need us.

The ARNOLD GROUP

ARNOLD – this name is internationally renowned for efficient and sustainable fastening systems on the highest level. With a foundation of many years of expertise in the production of intelligent fastening systems and very complex extruded parts, the ARNOLD GROUP has developed over a number of years into a comprehensive supplier and development partner for complex fastening systems. With our positioning of "BlueFastening Systems" this development process will continue under a united and harmonized structure. Engineering, fasteners, and functional parts, together with feeding and processing systems, all from a single source – efficient, sustainable and international.

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