

# PIEZO SENSORS AND TRANSDUCERS

Noliac Group develops and manufactures sensors, transducers, and energy harvesting products based on piezoelectric technology and tailored for custom specifications in a very wide application range.

## Advantages of piezoelectric sensors and transducers:

- Reliable, robust and compact
- Low energy consumption
- Active signal producing component – no powering needed
- Extremely high temperature range
- Linearity over four decades
- Time stable and long lasting
- High frequencies
- Bidirectional electromechanical conversion



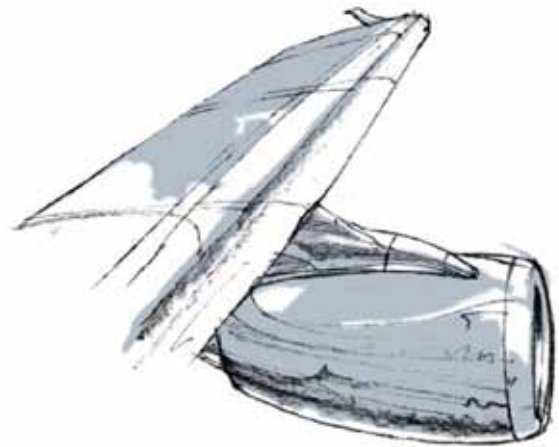
noliac

# PIEZO SENSORS AND TRANSDUCERS

## Piezo sensor and transducer examples

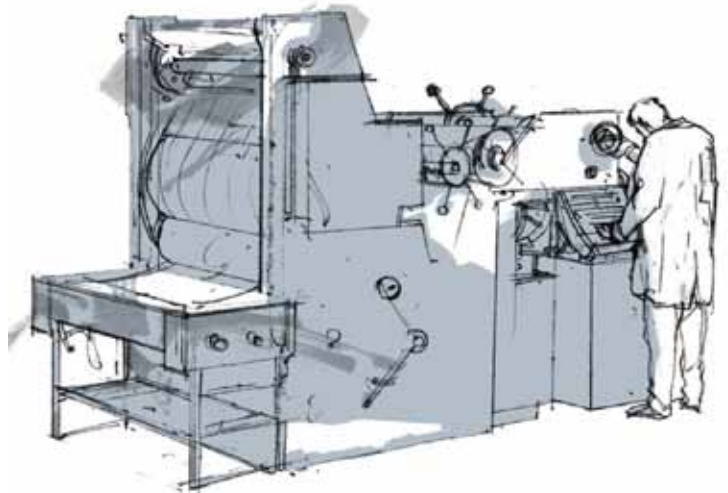
### Piezo sensors

- Accelerometers
- Force sensors
- Shock sensors
- Measurement sensors
- Strain and surface deformation sensors
- Sensors for ballistic testing devices
- Bone microphones
- Microphones



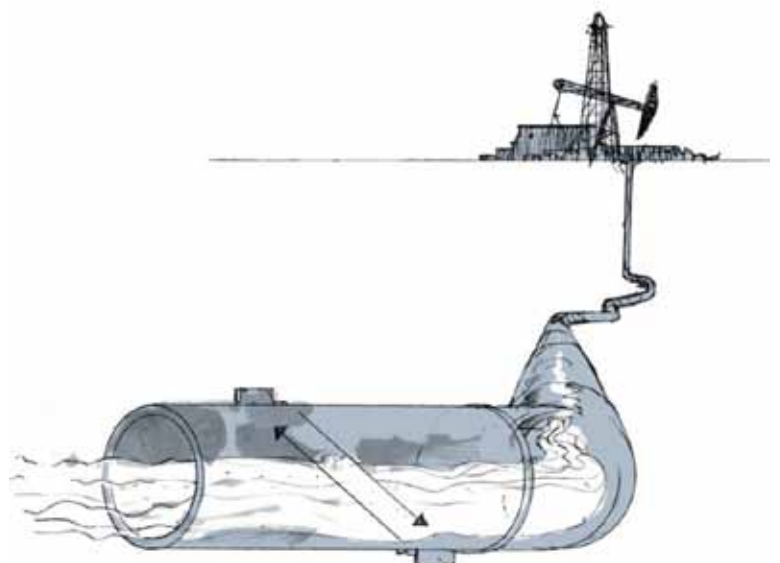
### Piezo transducers

- Distance measurement in air
- Water level measurement
- Flow meters for natural gas
- Water flow meter
- Medical diagnostic
- Dental surgical transducers
- Therapeutically ultrasonic transducers
- Transducers for proximity switches



### Piezo energy harvesting

- Electromechanical converters



## Overview

### Piezo sensors

Noliac is capable of designing, developing and manufacturing different kinds of piezoelectric sensors. The main uses of Noliac sensors are vibration, force and shock measurements.

Noliac utilizes unique Ring Shear TM construction of sensors that improves resistance of sensors to temperature transient and allows using them in very low frequencies. Sensors are also manufactured for ballistic testing equipments and pressure shocks.

A specific category of vibration sensors is bone microphones which are used for communication purposes in noisy environment. They measure vibration of skull instead of sound from mouth and are therefore insensitive to noise in the surroundings. Such sensors are used by fire brigades, police and other law enforcement forces for communication purposes.

### Piezo transducers

Noliac is capable of designing, developing and manufacturing a wide range of ultrasonic transducers. Transducers are e.g. designed for distance measurement, flow meters, medical therapeutically and diagnostic use.

### Energy harvesting

Noliac is capable of designing, developing and manufacturing electromechanical converters based on both the direct piezoelectric and the opposite piezoelectric phenomena.

The multilayer technology allows the component to convert (harvest) mechanical energy and produce electrical energy with low voltage that can be used for direct supply of electronic devices. The energy could be harvested from roads and vehicles, from vibration and deformation forces etc.

# PIEZO SENSORS AND TRANSDUCERS

## Piezo sensors – Accelerometers



Noliac's piezoelectric accelerometers type MH and ME are intended for general use in systems for vibration measurements and machine condition monitoring. They feature low sensitivity to temperature and magnetic field fluctuations, low transverse sensitivity, high resonance frequency and high stability. The measuring value is acceleration in sensor's axis direction.

### PARAMETERS OF STANDARD ACCELEROMETERS

Accelerometer	Output	Charge sensitivity pC/ms <sup>-2</sup>	Sensitivity mV/ms <sup>-2</sup> (mV/g)	Resonance frequency (mounted 180g) (kHz)	Temperature range (°C)	Mass (g)
MH 118	charge/voltage	1	–	32	– 40 to 250	12
MH 119	charge/voltage	1	–	32	– 40 to 250	15
MH 128	charge/voltage	3,16	–	25	– 40 to 250	21
MH 129	charge/voltage	3,16	–	25	– 40 to 250	25
MH 158	voltage	–	–	22	– 40 to 125	68
MH 157	voltage	–	–	32	– 40 to 125	40
ME 155	voltage	–	–	–	– 25 to 100	60
MH 155	charge/voltage	3,16	–	–	– 25 to 100	60
MH 100 Referential	charge/voltage	1	–	32	– 5 to 45	35
MH 164 Acceleration and Shocks	charge/voltage	0,1	–	60	– 40 to 150	8
MH 128U OEM Product	charge/voltage	3,16	–	25	– 40 to 180	10
ME 118	voltage	–	1 (10)	32	– 40 to 125	12
ME119	voltage	–	1 (10)	32	– 40 to 125	15
ME 128	voltage	–	10 (100)	25	– 40 to 125	21
ME 129	voltage	–	10 (100)	25	– 40 to 125	25

# PIEZO SENSORS AND TRANSDUCERS

## Piezo sensors – Bone microphones for helmets



The LD173C is a piezoelectric sensor designed for single-axis vibration measurement. Measured value is acceleration in base axis direction. The sensor is designed for measurement of acoustically invoked vibrations in communication frequency band of audible spectrum. The shape is custom tailored for using as a sensor in osteo-communication system.

### PARAMETERS OF STANDARD BONE MICROPHONE LD173C

Parameter <sup>1</sup>	Unit	Min	Typ.	Max	Remark
Sensitivity at 160 Hz	uA/ms <sup>-2</sup>	0,4			In the testing circuit, against 1V/g
	mV/ms <sup>-2</sup>		2		
	mV/g		20		
	dB		- 34		
Transverse sensitivity	%			5	at 50 Hz
Frequency range (min.)	Hz	20 - 5000			±3 dB
Temperature range	°C	- 40		+85	
Shock resistivity	ms <sup>-2</sup>	1000			100 pulses 10us in three directions
Mass	g		0.8		
Seismic mass	g	0,15			
Sensing element		Piezoceramic			
Sensor design		flexure			
Bias current	uA		25	30	
Power voltage	V	1.3		15	
Output impedance	Ω		4900		

<sup>1</sup> Parameters are obtained in accordance with relevant parts of ISO5347 or ISO16063 standards.

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## Piezo transducers



The UZ250 sensor is a piezoelectric ultrasonic pick-up developed for gas environment. The sensor is designed for pulse radiation in frequency band of 250 kHz. The pick-up consists of a piezoelectric element connected to a small printed board with an internal electronics. EMC (including EDS) protection is achieved by shielding. The main part of the sensor is an ultrasonic transducer. The ultrasonic transducer consists of a damped piezoelectric element and tuned resonance plate. The piezoelectric element is connected to an electronic circuit that consists of a matching circuit, transmitter, and preamplifier. This amplifier transforms small-reflected signal from high impedance piezo to low impedance modulated output voltage.

### PARAMETERS OF STANDARD TRANSDUCER UZ250

Parameter	Unit	Min	Typ.	Max	Remark
Nominal frequency	kHz		250		
Frequency range	kHz		50		
Nominal sensitivity	mV/V		3		For the flat rigid target in 100 mm distance Driving: 5 pulses, 9 V, 2us/2us
Mass	g		4,8	5,3	
Current consumption	mA		1,3	1,6	at 9V
Supply voltage	V	5	9	30	T3, T2 pins
Driving voltage (peak)	V			160	Pulse positive polarity is preferable
Measuring range low limit	mm		50	65	Blind distance after pulse excitation
Measuring range high limit	mm		200		depends of noise level and excitation voltage -could be extended many times
Environmental					
Temperature range	°C	-5		+50	Exceeding temperature limits could cause irreversible changes in sensor parameters.
Ingress protection	—	Sealed, potted			
CE conformity		RoHS			

# PIEZO SENSORS AND TRANSDUCERS

## Piezo energy harvesting



Noliac is capable of designing, developing and manufacturing electromechanical converters based on both the direct piezoelectric and the opposite piezoelectric phenomena.

The multilayer technology allows the component to convert (harvest) mechanical energy and produce electrical energy with low voltage that can be used for direct supply of electronic devices. The energy could be harvested from roads and vehicles, from vibration and deformation forces etc.

### Noliac is capable to design and manufacture

- Mechanical matching circuits for energy converters
- Smart electronic circuits for energy yield optimization when the source of mechanical energy has random character (vibration)
- Electronic converters and circuits for voltage transformation and energy conservation.

