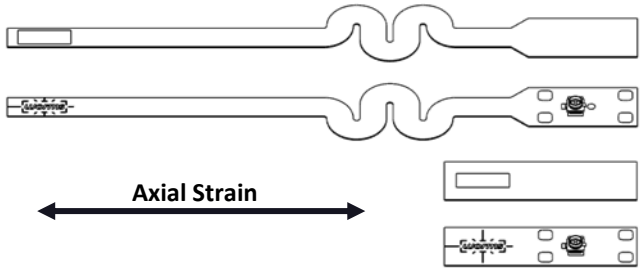
Dragonfly® DGF-UNI-AA204xx-10
Piezoelectric unidirectional strain sensor

Description

The piezoelectric Dragonfly® sensor measures dynamic and quasistatic strain. The large bandwidth and high dynamic range enable an exceptionally wide scope of characterization with a single sensor.



REACH RoHS CE

Features

- Unidirectional strain sensor
- High sensitivity
- Low noise
- High dynamic range
- Wide frequency range
- Flexible & conformable
- Plug & Play
- No power supply required
- Lead-free

Sectors

- Energy
- Aerospace
- Automotive
- Civil Engineering
- Industry 4.0
- Food Industry
- Healthcare
- Transportation
- Naval Industry
- Mining Industry

Applications

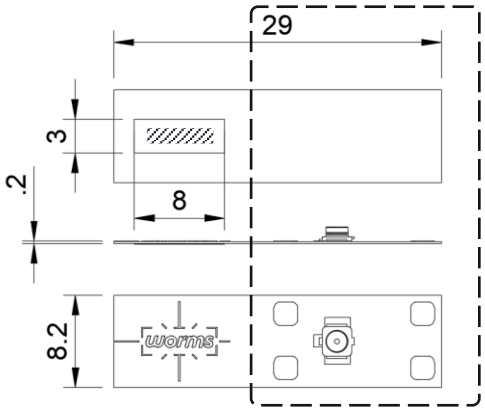
- Vibration analysis: diagnosis, modal analysis, product development, design validation, material characterization
- Monitoring (SHM, CBM): life-span optimization, predictive maintenance, decision making, tension rod surveillance, wear monitoring
- Event detection: shocks, crack initiation, fatigue failure, leaks, cavitation
- Quality and process control: in-operation control, safety, yield optimization
- Dynamic weighing, counting, load identification,
- Human-Machine Interfaces: touch sensitive hard surfaces, gesture recognition

Technical data

	Conditions	Parameter	DGF-UNI-AA204xx-10	Units
Charge mode	Temperature 25°C	Charge sensitivity	-17.0 ±10%	pC/με
	Temperature [-55°C to +40°C]	Temperature sensitivity	200±150	ppm/K
	DAQ: Kistler 5167A charge amplifier	Bandwidth	[<0.01 to >45k]	Hz
		RMS noise [0.1 to 10] Hz	3.4(1)	nε
		RMS noise [10 to 20k] Hz	5.0(1)	nε
Voltage mode	Temperature 25°C	Voltage sensitivity	-2.70 ±10%	mV/με
	Temperature [-55°C to +40°C]	Temperature sensitivity	-500±160	ppm/K
	DAQ: Dewesoft 43A referenced voltage input. Input impedance 10MΩ	Bandwidth	[2.9 to >100k]	Hz
		RMS noise [0.1 to 10] Hz	46(1)	nε
		RMS noise [10 to 20k] Hz	5.2(1)	nε
General parameters	Temperature [-55°C to +40°C]	Transverse sensitivity |Kt|	<4	%
		Measurement range	± 3000	με
		Non-linearity	<1	%
	sinus @1kHz, 1Vp-p, 25°C	Capacitance Cp	6.3 ±10%	nF
		Parallel resistance Rp	>50	MΩ
		Series resistance Rs	<1	Ohm
		Operating temperature range	[-55 to +140]	°C
	±1000 με	Fatigue life	>8M	Cycles
		Weight	0.1	g
		Connector	UFL / IPEX1	
Absolute Max. ratings		Maximum generated voltage	30	V
		Maximum applied voltage	30	V
	Exposure duration 4h	Maximum temperature	150	°C
		Minimum bending radius	2	cm

(1) Dragonfly® noise is several orders of magnitude below DAQ noise. Thus, the measured noise corresponds to the DAQ input noise. Noise has been measured in a controlled environment. Measured values could vary depending on DAQ and measurement environment.

Dimensions (mm)



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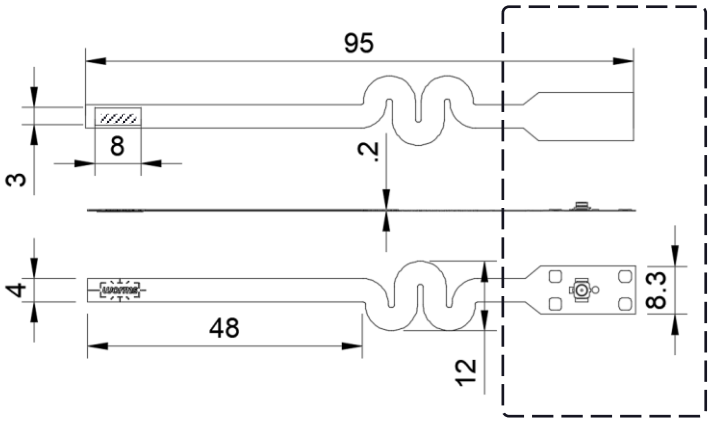


DGF-UNI-AA20406-10

Handling area Piezo active area

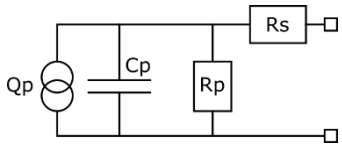
Handling Recommendations

- It is highly recommended to refer to the Dragonfly® User Manual for the installation : http://www.wormsensing.com/downloads
- Avoid contact with the active area before mounting. Manipulate the device using the recommended handling area.
- Avoid bending or applying localized pressure to the sensor.

Electrical model

The sensor behaves as a charge generator Qp, in parallel with a capacitor Cp and a leakage resistor Rp. The internal wiring adds a small series resistor Rs.

Sensor electrical schematic



Signal conditioning & bandwidth

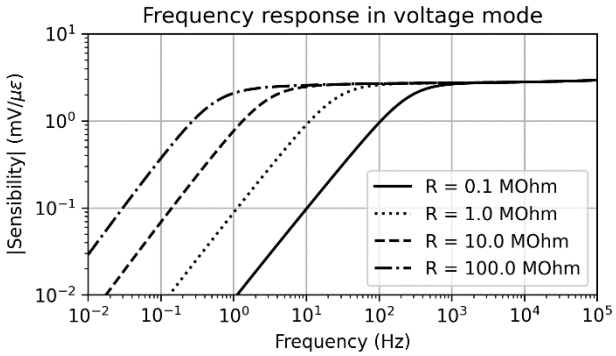
The sensor is passive and does not require any power supply. It can be operated either in charge or voltage mode depending on the application.

Charge mode (using a charge amplifier):

Charge mode is highly recommended for very low frequency measurements. The cut-off frequency is determined by the charge amplifier itself and can be as low as 0.01Hz.

Voltage mode (direct measurement):

The acquisition device's finite input impedance R will limit the minimum measurable frequency.



Sensitivity

The Dragonfly® sensitivity is calibrated by a 4-point bending test on a steel bar with a Poisson's ratio ν_0 = 0.27.

The transverse sensitivity ratio Kt is the ratio of the sensitivity in the transverse direction over the sensitivity in the axial direction.

The Dragonfly® output signal in a bi-axial strain used either in charge or voltage mode is given by the following equation:

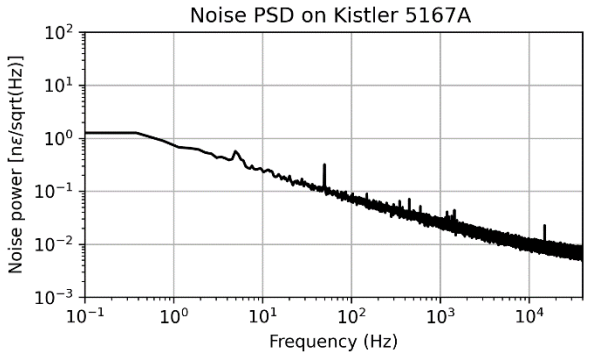
$$\text{output} = \frac{s}{1 - K_t \nu_0}(\epsilon_a + K_t \epsilon_t)$$

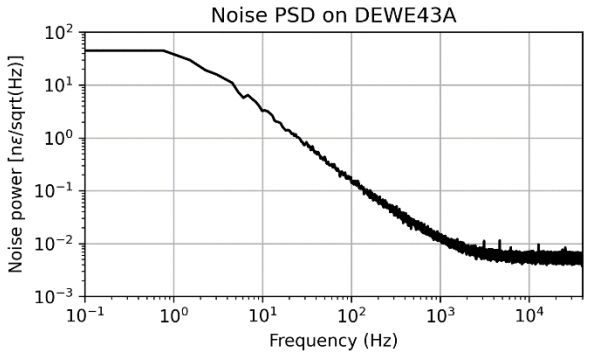
s = sensitivity
Kt = transverse sensitivity ratio
ν_0 = 0.27
ϵ_a = axial strain
ϵ_t = transverse strain

Minimal measurable strain

The minimal measurable strain depends on the acquisition system noise PSD integrated over its bandwidth. In both charge and voltage mode, the noise at low frequency is driven by 1/f flicker noise.

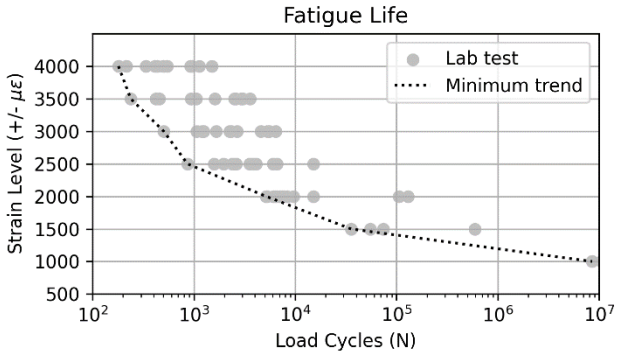
- The wider the bandwidth, the higher the RMS noise.
- The lower the cutoff frequency, the higher the RMS noise.





Fatigue life

The minimal number of load cycles that Dragonfly® can withstand depends on the applied dynamic strain level. The sensor is considered to have failed if its sensitivity is outside of the specifications.

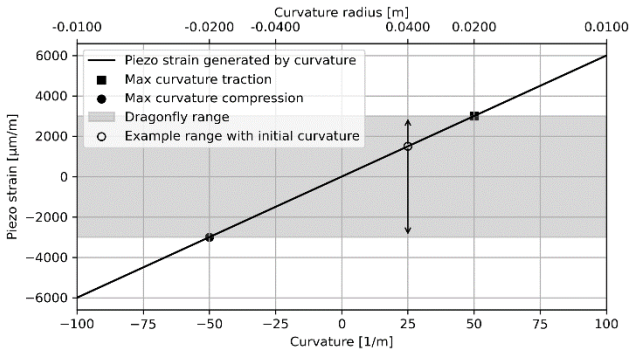


Bending radius

Static bending applied to Dragonfly® impacts its measurement range. The sensitive element is designed to sustain ±3000 με and static bending induces a static strain which added to the dynamic strain must not exceed ±3000 με.

The following figure shows static strain vs. bending radius with an example of the available measurement range for a 40mm static bending radius.

Positive bending radius means Dragonfly® is stuck on a concave surface.



Reference selection

The below nomenclature helps you select the correct reference:

DGF-UNI-ii204ff-10

ii		ff	
Interface type		**Flex size**	
AA	Passive	05	short
W1	IEPE 1mV/με	06	long
W2	IEPE 10mV/με		
W3	IEPE 100mV/με		