



ANALOG • DIGITAL • SMART

The evolution in sensor technology



Progress. Made by ASC.



Dear Customer,

We are your partner when it comes to high-precision inertial sensors – whether analog, digital or smart. ASC offers an innovative product portfolio for high-end test and measurement, predictive maintenance or condition monitoring applications. Our sensors can be optimally adapted to the requirements of your specific sector – whether railway or automotive, bridge monitoring or renewable energies. In all of these sectors ASC sensor solutions form the basis for innovative products and processes – every day, around the globe.

At ASC you will find an extremely flexible product portfolio of accelerometers, gyroscopes and tilt sensors, as well as inertial measurement units. Have we piqued your curiosity? Feel free to contact us!

ASC Services

At ASC we see our role not only in terms of a manufacturer or vendor but primarily a partner for dedicated testing engineers. As such, we strive to ease the burden on our customers by providing a range of useful services relating to our sensors and measurement engineering in general, thereby making their life that little bit easier.

ASC supplies high-precision inertial sensor solutions for demanding measurement tasks in numerous industries. Our engineers have a deep understanding of a wide variety of applications – for example in the automotive industry, in construction or in logistics. Discover now the diverse options that sensors from ASC offer you.

ASC – smart in motion!

A handwritten signature in blue ink that reads "Renate Bay". The signature is fluid and cursive, with a large loop at the end of the last name.

Renate Bay
CEO

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APPLICATIONS & MARKETS

Custom-tailored inertial sensor solutions for demanding applications

Whether in the development of water vehicles, in crash tests, for monitoring trains or for the navigation of automated guided vehicles: Custom-tailored sensor solutions from ASC are used in numerous demanding test and measurement applications. Engineers value our inertial sensors because they detect smallest vibrations, even from DC up to a wide frequency response range, and locate the position of moving objects with extremely high precision.

What our customers also appreciate about us is the passion and persistence with which we develop new sensor solutions. Our specialists welcome the challenge – in the past 15 years they have designed sensors for numerous applications in cooperation with our customers around the world.

We supply high-quality sensors ideal for virtually any test application, such as:

- Autonomous and semi-autonomous vehicles
- Railway applications according to EN 50155
- Operational stability tests
- Condition monitoring
- Crash tests
- Vehicle dynamics
- Automated guided vehicles
- Driving comfort measurements
- Modal and structural analyses
- Position detection
- Predictive maintenance
- Test bench applications
- Structural health monitoring
- Bridging navigation

Industries



Automotive



Rail transport



Aviation



Agricultural engineering



Construction



Renewable energies



Shipping



Logistics



Industry



ABOUT ASC

Successful worldwide. At home in Germany.

ASC is a leading manufacturer of high-precision inertial sensors. Our success is genuinely founded on customer orientation, because we adapt every sensor to the exact requirements of the particular application. If none of our sensors meet your requirements, we will also be glad to develop a custom tailored sensor solution.

Maximum precision for the highest standards

ASC sensors are available in analog, digital and smart versions. All sensors are designed for high-precision inertial measurements, which makes them popular with engineers throughout the world. Well-known enterprises use our accelerometers, gyroscopes and tilt sensors in extremely demanding applications: For example, they ensure the efficient operation of wind turbines, monitor bridge structures or rail networks and provide valuable data for the design of motor vehicles and ships, as well as for automotive safety. In this way, our products make an important contribution to the functional safety of components, vehicles and machines.

The future starts with ASC sensors

In addition, our inertial sensors and smart sensor systems allow the development of innovative technologies. ASC AiSys® smart sensor systems are ideal for numerous predictive maintenance and condition monitoring applications that would have been inconceivable in the past. Another application is the modeling of digital twins for the optimization of product development cycles, production processes or construction planning. The capability of the sensors to acquire, process and network huge data quantities creates numerous other options for industrial applications. Our analog sensors likewise contribute to technological process on a daily basis – such as our capacitive accelerometers, which are used in shock and vibration tests to measure the durability of high-voltage batteries for electric vehicles, and in numerous tests of ADAS driving systems.



Always a step further

Our engineers develop sensor solutions for the future

Smart sensors systems, for example, which analyse huge data volumes in order to enable AI-based concepts such as the smart factory, smart maintenance and smart shipping.

Represented in all industries

Our technology allows safe and comfortable travel for millions of people worldwide, efficient production processes in manufacturing companies, and optimal output from wind power plants. ASC sensors are used in shipping and aviation as well as in automation technology, rail traffic, at construction sites and in the automotive sector. And those are just a few examples.

Custom solutions are standard to us

ASC will deliver exactly the sensor solution that you need for your application. We offer one-off production of your custom-tailored product, which is something you cannot expect of most manufacturers. Nothing is too much trouble for us: Our specialists always find a way.

The customer is king

At ASC, the focus is on you. Our engineers, customer consultants and sales employees are always open to your requirements, suggestions and criticism. Short distances and production facilities in Germany are your guarantee for a timely response to every request.

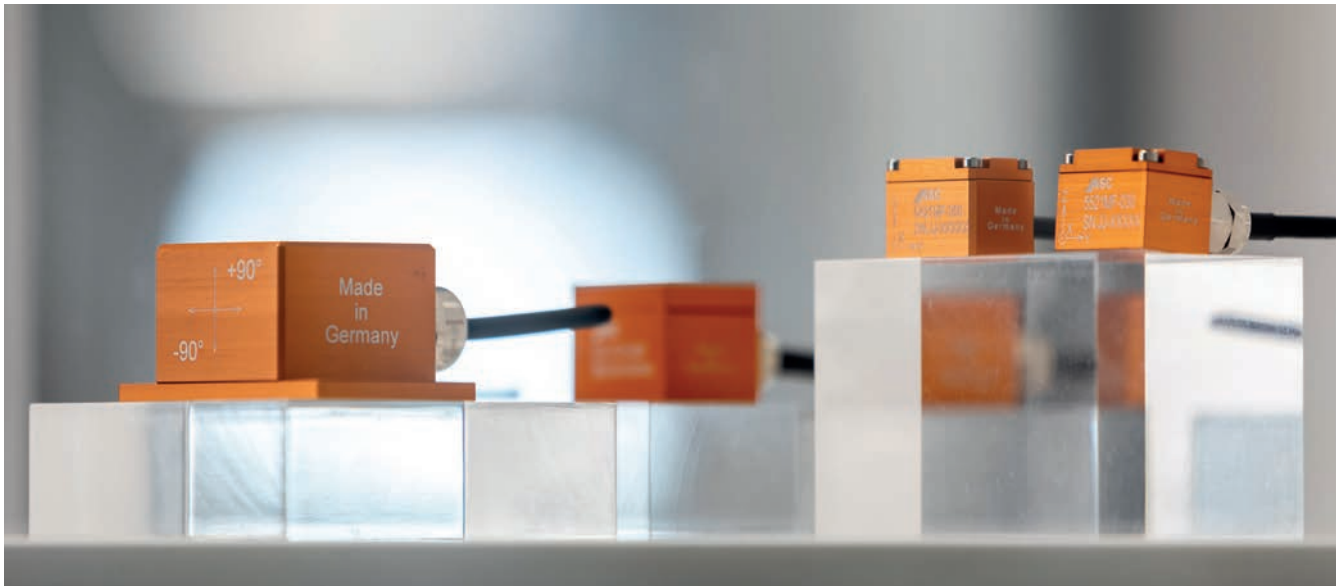
We also offer extensive services – such as calibration and repairs. On request, we can also implement the entire engineering process for your custom-tailored sensor.

Strong partners. Strong business.

Trust and respect are for us basic requirements for successful cooperation. On this basis we established a global network of distributors in 2006, and it is constantly growing. ASC is a strong and reliable partner who offers innovative sensor solutions that can also benefit you.

	Sensor Series	Features	Sensitive Directions	Cable	Operating Temperature	Protection Class	Weight	
Versions	ASC 3511LN	Low Noise for Standard T&M	uniaxial	integrated	-40 to +100 °C	IP65	22 g	
	ASC 4111LN		uniaxial	integrated	-20 to +125 °C	IP67	3 g	
	ASC 4211LN		uniaxial	integrated	-20 to +125 °C	IP67	3 g	
	ASC 4311LN		uniaxial	integrated	-40 to +125 °C	IP65	7 g	
	ASC 4315LN		uniaxial	integrated	-40 to +125 °C	IP65	19 g	
	ASC 4411LN		uniaxial	integrated	-40 to +125 °C	IP67	10 g	
	ASC 4415LN		uniaxial	integrated	-40 to +125 °C	IP67	20 g	
	ASC 5411LN		triaxial	integrated	-40 to +125 °C	IP65	20 g	
	ASC 5415LN		triaxial	integrated	-40 to +100 °C	IP65	40 g	
	ASC 5511LN		triaxial	integrated	-40 to +100 °C	IP67	22 g	
	ASC 5515LN		triaxial	integrated	-40 to +100 °C	IP67	42 g	
	ASC OS-115LN		Low Noise – OS Hermetically Sealed	uniaxial	detachable	-40 to +125 °C	IP68	31 g
	ASC OS-115LN-PG			uniaxial	integrated	-40 to +100 °C	IP68	68 g
	ASC OS-215LN-PG			biaxial	integrated	-40 to +100 °C	IP68	68 g
	ASC OS-315LN-PG		Low Noise – OS Seawater-resistant	triaxial	integrated	-40 to +100 °C	IP68	68 g
ASC OS-115LN	uniaxial	detachable		-15 to +70 °C	IP68	31 g		
ASC OS-115LN-PG	uniaxial	integrated		-15 to +70 °C	IP68	68 g		
ASC OS-215LN-PG	Low Noise – OS Waterproof	biaxial	integrated	-15 to +70 °C	IP68	68 g		
ASC OS-315LN-PG		triaxial	integrated	-15 to +70 °C	IP68	68 g		
ASC OS-115LN		uniaxial	detachable	-55 to +125 °C	IP68	31 g		
ASC OS-115LN-PG	uniaxial	integrated	-40 to +100 °C	IP68	68 g			
Versions	ASC 3521MF	Medium Frequency for Standard T&M	uniaxial	integrated	-40 to +100 °C	IP65	22 g	
	ASC 4221MF		uniaxial	integrated	-20 to +125 °C	IP67	3 g	
	ASC 4321MF		uniaxial	integrated	-40 to +125 °C	IP65	7 g	
	ASC 4325MF		uniaxial	integrated	-40 to +125 °C	IP65	19 g	
	ASC 4421MF		uniaxial	integrated	-40 to +125 °C	IP67	10 g	
	ASC 4425MF		uniaxial	integrated	-40 to +125 °C	IP67	20 g	
	ASC 5421MF		triaxial	integrated	-40 to +125 °C	IP65	20 g	
	ASC 5425MF		triaxial	integrated	-40 to +125 °C	IP65	40 g	
	ASC 5521MF		triaxial	integrated	-40 to +100 °C	IP67	22 g	
	ASC 5525MF		triaxial	integrated	-40 to +100 °C	IP67	42 g	
	ASC OS-125MF		Medium Frequency – OS Hermetically Sealed	uniaxial	detachable	-40 to +125 °C	IP68	31 g
	ASC OS-125MF-PG			uniaxial	integrated	-40 to +100 °C	IP68	68 g
	ASC OS-225MF-PG			biaxial	integrated	-40 to +100 °C	IP68	68 g
	ASC OS-325MF-PG		Medium Frequency – OS Seawater-resistant	triaxial	integrated	-40 to +100 °C	IP68	68 g
	ASC OS-125MF			uniaxial	detachable	-15 to +70 °C	IP68	31 g
ASC OS-125MF-PG	uniaxial	integrated		-15 to +70 °C	IP68	68 g		
ASC OS-225MF-PG	Medium Frequency – OS Waterproof	biaxial	integrated	-15 to +70 °C	IP68	68 g		
ASC OS-325MF-PG		triaxial	integrated	-15 to +70 °C	IP68	68 g		
ASC OS-125MF		uniaxial	detachable	-55 to +125 °C	IP68	31 g		
ASC OS-125MF-PG	uniaxial	integrated	-40 to +100 °C	IP68	68 g			
ASC RAIL-115LN	Special Cable and Cable Gland for Rail Transport	uniaxial	integrated	-40 to +100 °C	IP68	90 g		
ASC RAIL-215LN		biaxial	integrated	-40 to +100 °C	IP68	90 g		
ASC RAIL-315LN		triaxial	integrated	-40 to +100 °C	IP68	90 g		
ASC EQ-1211	Seismic Sensors including Built-in Self-test and temperature output	uniaxial	detachable	-40 to +85 °C	IP65	75 g		
ASC EQ-2211		Biaxial	detachable	-40 to +85 °C	IP65	75 g		
ASC EQ-3211		triaxial	detachable	-40 to +85 °C	IP65	75 g		
ASC EQ-1215		uniaxial	detachable	-40 to +85 °C	IP65	190 g		
ASC EQ-2215		biaxial	detachable	-40 to +85 °C	IP65	190 g		
ASC EQ-3215		triaxial	detachable	-40 to +85 °C	IP65	190 g		
ASC QF-1211		uniaxial	integrated	-40 to +85 °C	IP67	15 g		
ASC ECO-1311	General Industrial Sensors	uniaxial	integrated	-20 to +125 °C	IP68	15 g		
ASC ECO-2311		biaxial	integrated	-20 to +125 °C	IP68	15 g		
ASC ECO-3311		triaxial	integrated	-20 to +125 °C	IP68	15 g		
ASC ECO-CS-1311	Current Output 4...20 mA	uniaxial	integrated	-20 to +80 °C	IP67	65 g		
ASC ECO-CS-2311		biaxial	integrated	-20 to +80 °C	IP67	65 g		
ASC ECO-CS-3311		triaxial	integrated	-20 to +80 °C	IP67	65 g		
ASC CS-1711LN		uniaxial	integrated	-20 to +70 °C	IP67	27 g		
ASC CS-1511LN		biaxial	integrated	-20 to +70 °C	IP67	65 g		
ASC CS-1611LN		triaxial	integrated	-20 to +70 °C	IP67	65 g		

Aluminium
Stainless Steel



ANALOG SENSORS

The perfect solution for every measurement

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output (± 4 V FSO) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz (± 3 dB) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output (± 2.7 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The ASC OS series are based on the LN and MF accelerometers but is developed for the harshest environmental conditions. Therefore, the sensors feature a robust, reliable stainless steel housing (V2A material number 1.4301) with protection class IP68. An optional stainless steel (V4A, seawater resistant, material number 1.4404) is available on request.

The ASC RAIL series is based on LN (Low Noise) accelerometers and provides a reliable stainless-steel housing leading to hermetic sealing and protection class IP68. Due to standard fire protection on railway vehicles the integrated cable gland VariaPro Rail and the cable RADOX TENUIS-TW 600V MM S are used to fabricate the sensors.

The seismic sensors of the ASC EQ series and ASC QF series feature an ultra-low noise level and achieve a resolution of less than 1 μg . They therefore fulfill the requirements of motion class B of seismic measurements. The integrated electronic circuitry enables a differential analog voltage output (± 2.7 V FSO) and flexible power supply voltage from 5 to 40 VDC while also provides a built-in self-test option and a temperature output.

The industrial accelerometers of the ASC ECO series featuring a wide frequency response range from 0 Hz to 2.4 kHz (± 3 dB) and an extremely robust design with shock resistance up to 10,000 g. The integrated electronic circuitry enables a differential analog voltage output (± 2.4 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The industrial accelerometers of the ASC ECO CS series featuring a broadband noise of $< 4.5 \mu\text{A}$ and are used in applications that are requiring extremely long cables (> 100 m) or very high EMC immunity. The integrated electronic circuitry enables a single-ended analog current output of 4-20 mA and flexible power supply voltage from 8 to 25 VDC.

The models of the ASC CS series feature broadband noise of $< 0.65 \mu\text{A}$ and are used in applications that are requiring extremely long cables (> 100 m) or very high EMC immunity. The integrated electronic circuitry enables a single-ended analog current output of 4-20 mA and flexible power supply voltage from 8 to 30 VDC.



MEMS CAPACITIVE ACCELEROMETER

ASC 35 series

UNIAXIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output ($\pm 4\text{ V FSO}$) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz ($\pm 3\text{ dB}$) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output ($\pm 2.7\text{ V FSO}$) and flexible power supply voltage from 5 to 40 VDC.

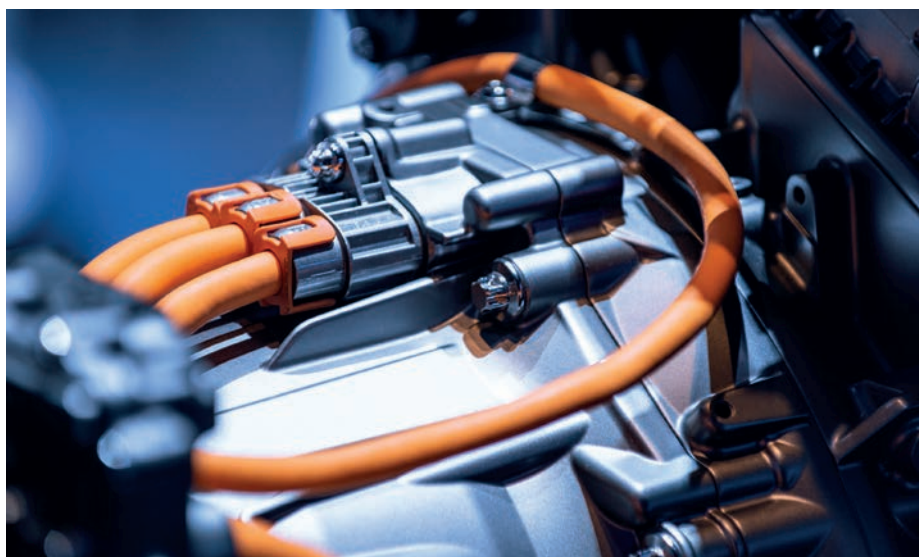
The sensors feature a lightweight, reliable aluminum housing with protection class IP65 and an integrated cable with configurable length and connectors.

Applications

The compact design of uniaxial ASC 35 accelerometers enables numerous possible applications, such as shock and vibration tests regarding operational stability of HV batteries.



Capacitive based accelerometers for operational stability and measurements of the complex HV-battery structures



Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 3511LN	uniaxial	Aluminium	-40 to +100 °C	IP65	22 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	-	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	-	50	100	200	400
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	-	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				-	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				-	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				-	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	-	±20	±40	±80	±160
Shock Limit	g	2000		5000		-	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 3521MF	uniaxial	Aluminium	-40 to +100 °C	IP65	22 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	-	90	54	27	13.5	-
Noise Density	µg/√Hz	10	20	35	-	100	170	340	680	-
Frequency Response Range (±5 %)	Hz	0 to 700	0 to 1150	0 to 2000	-	0 to 2300	0 to 2700	0 to 2900	0 to 2500	-
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)				-	<0.1 (typ) <0.3 (max)			
Power Supply Voltage	V	5 to 40				-	5 to 40			
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)				-	120 (typ) 20 to 220 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	-	±3	±5	±10	±20	-
Shock Limit	g	6000				-	6000			

MEMS CAPACITIVE ACCELEROMETER

ASC 41/42 series

UNIAXIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

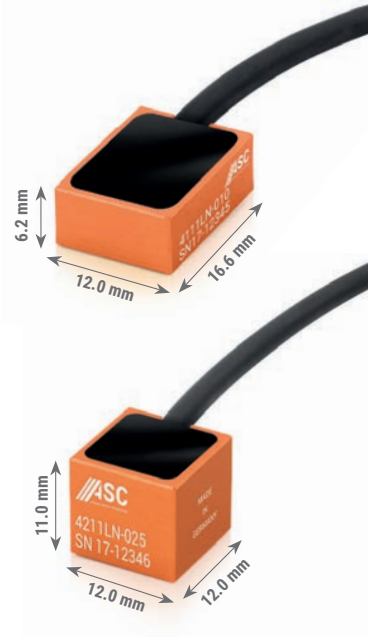
The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output ($\pm 4\text{ V FSO}$) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz ($\pm 3\text{ dB}$) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output ($\pm 2.7\text{ V FSO}$) and flexible power supply voltage from 5 to 40 VDC.

The sensors feature a lightweight, reliable aluminum housing with protection class IP67 and an integrated cable with configurable length and connectors.

Applications

The uniaxial ASC 41 and 42 accelerometers have an ultra-compact design and weigh only 3 grams. This makes them ideal for measuring applications in hard-to-access installations, such as testing the operational stability of automotive components.





Lightweight capacitive based accelerometers for modal and structural analysis of aviation components

Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 4111LN	uniaxial	Aluminium	-20 to +125 °C	IP67	3 g
ASC 4211LN	uniaxial	Aluminium	-20 to +125 °C	IP67	3 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	–	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	–	50	100	200	400
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	–	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				–	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				–	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				–	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	–	±20	±40	±80	±160
Shock Limit	g	2000		5000		–	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 4221MF	uniaxial	Aluminium	-20 to +125 °C	IP67	3 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	–	90	54	27	13.5	–
Noise Density	µg/√Hz	10	20	35	–	100	170	340	680	–
Frequency Response Range (±5 %)	Hz	0 to 700	0 to 1150	0 to 2000	–	0 to 2300	0 to 2700	0 to 2900	0 to 2500	–
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)				–	<0.1 (typ) <0.3 (max)			
Power Supply Voltage	V	5 to 40				–	5 to 40			
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)				–	120 (typ) 20 to 220 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	–	±3	±5	±10	±20	–
Shock Limit	g	6000				–	6000			

MEMS CAPACITIVE ACCELEROMETER

ASC 43 series

UNIAXIAL



MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output (± 4 V FSO) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz (± 3 dB) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output (± 2.7 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The sensors feature a lightweight aluminum housing or a robust stainless steel housing, both with protection class IP65 and an integrated cable with configurable length and connectors.

Applications

The uniaxial accelerometers have a flat design that allows quick and easy mounting, a basic requirement in NVH (noise, vibration, harshness) and test bench applications or for evaluating driving comfort and vehicle dynamics.





Flat design of the capacitive based accelerometers enables operational stability tests and test bench applications

Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 4311LN	uniaxial	Aluminium	-40 to +125 °C	IP65	7 g
ASC 4315LN	uniaxial	Stainless Steel	-40 to +125 °C	IP65	19 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	-	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	-	50	100	200	400
Frequency Response Range (±5 %) Hz		0 to 250	0 to 400	0 to 700	0 to 1300	-	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				-	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				-	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				-	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	-	±20	±40	±80	±160
Shock Limit	g	2000		5000		-	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 4321MF	uniaxial	Aluminium	-40 to +125 °C	IP65	7 g
ASC 4325MF	uniaxial	Stainless Steel	-40 to +125 °C	IP65	19 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	-	90	54	27	13.5	-
Noise Density	µg/√Hz	10	20	35	-	100	170	340	680	-
Frequency Response Range (±5 %) Hz		0 to 700	0 to 1150	0 to 2000	-	0 to 2300	0 to 2700	0 to 2900	0 to 2500	-
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)			-	<0.1 (typ) <0.3 (max)				-
Power Supply Voltage	V	5 to 40			-	5 to 40				-
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)			-	120 (typ) 20 to 220 (max)				-
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	-	±3	±5	±10	±20	-
Shock Limit	g	6000			-	6000				-



MEMS CAPACITIVE ACCELEROMETER

ASC 44 series

UNIAXIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output ($\pm 4 \text{ V FSO}$) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz ($\pm 3 \text{ dB}$) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output ($\pm 2.7 \text{ V FSO}$) and flexible power supply voltage from 5 to 40 VDC.



The sensors feature a lightweight aluminum housing or a robust stainless steel housing, both with protection class IP67 and an integrated cable with configurable length and connectors.

Applications

The uniaxial accelerometers have a flat design that allows quick and easy mounting, a basic requirement in NVH (noise, vibration, harshness) and test bench applications or for evaluating driving comfort and vehicle dynamics.

Measurement of minimal linear motions and low-frequency vibrations for analyzing ride and driving comfort due to capacitive based accelerometers



Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 4411LN	uniaxial	Aluminium	-40 to +125 °C	IP67	10 g
ASC 4415LN	uniaxial	Stainless Steel	-40 to +125 °C	IP67	22 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	–	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	–	50	100	200	400
Frequency Response Range (±5 %) Hz		0 to 250	0 to 400	0 to 700	0 to 1300	–	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				–	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				–	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				–	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	–	±20	±40	±80	±160
Shock Limit	g	2000		5000		–	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 4421MF	uniaxial	Aluminium	-40 to +125 °C	IP67	10 g
ASC 4425MF	uniaxial	Stainless Steel	-40 to +125 °C	IP67	22 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	–	90	54	27	13.5	–
Noise Density	µg/√Hz	10	20	35	–	100	170	340	680	–
Frequency Response Range (±5 %) Hz		0 to 700	0 to 1150	0 to 2000	–	0 to 2300	0 to 2700	0 to 2900	0 to 2500	–
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)			–	<0.1 (typ) <0.3 (max)				–
Power Supply Voltage	V	5 to 40			–	5 to 40				–
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)			–	120 (typ) 20 to 220 (max)				–
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	–	±3	±5	±10	±20	–
Shock Limit	g	6000			–	6000				–

MEMS CAPACITIVE ACCELEROMETER

ASC 54 series

TRIAXIAL



MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

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The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz ($\pm 3 \text{ dB}$) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output ($\pm 2.7 \text{ V FSO}$) and flexible power supply voltage from 5 to 40 VDC.

The sensors feature a lightweight aluminum housing or a robust stainless steel housing, both with protection class IP65 and an integrated cable with configurable length and connectors.

Applications

The triaxial accelerometers enable the detection of smallest acceleration amplitudes in three degrees of freedom, for example for measuring aerodynamic and mass-related imbalances in wind turbines or for evaluation ride comfort in passenger ships.

Increasing efficiency of wind turbines
by measurements of aerodynamic
and mass-related imbalances in rotors

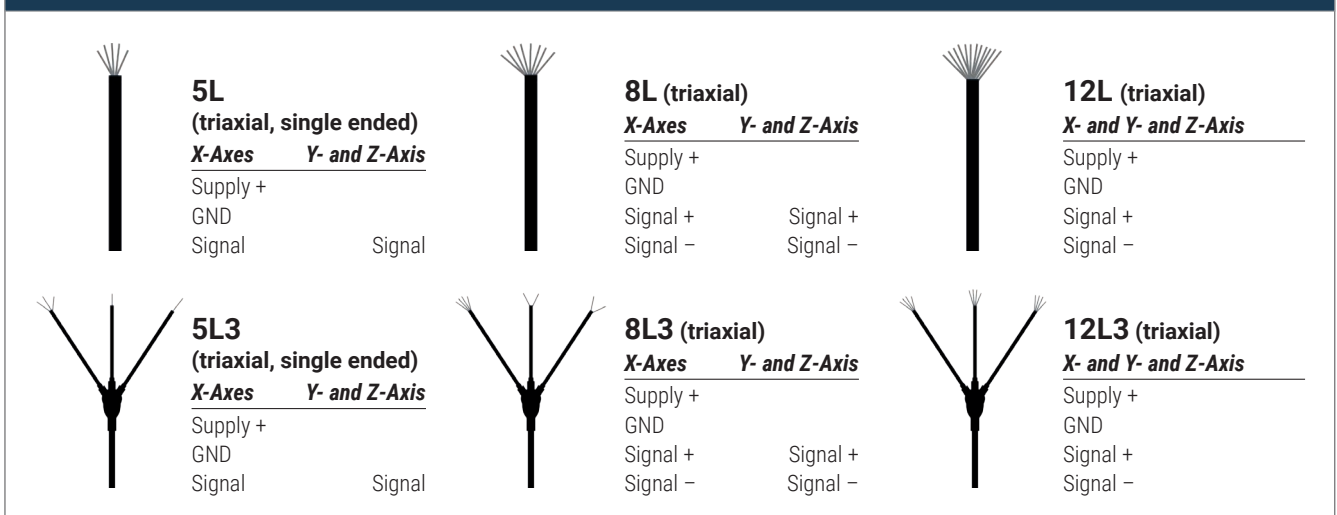
Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 5411LN	triaxial	Aluminium	-40 to +125 °C	IP65	20 g
ASC 5415LN	triaxial	Stainless Steel	-40 to +125 °C	IP65	40 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	–	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	–	50	100	200	400
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	–	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				–	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				–	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				–	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	–	±20	±40	±80	±160
Shock Limit	g	2000		5000		–	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 5421MF	triaxial	Aluminium	-40 to +125 °C	IP65	20 g
ASC 5425MF	triaxial	Stainless Steel	-40 to +125 °C	IP65	40 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	–	90	54	27	13.5	–
Noise Density	µg/√Hz	10	20	35	–	100	170	340	680	–
Frequency Response Range (±5 %)	Hz	0 to 700	0 to 1150	0 to 2000	–	0 to 2300	0 to 2700	0 to 2900	0 to 2500	–
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)				–	<0.1 (typ) <0.3 (max)			
Power Supply Voltage	V	5 to 40				–	5 to 40			
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)				–	120 (typ) 20 to 220 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	–	±3	±5	±10	±20	–
Shock Limit	g	6000		–		6000				–

Cable Configurations ASC 54



MEMS CAPACITIVE ACCELEROMETER

ASC 55 series

TRIAxIAL



MEMS Capacitive Technology

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Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output (± 4 V FSO) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz (± 3 dB) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output (± 2.7 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The sensors feature a lightweight aluminum housing or a robust stainless steel housing, both with protection class IP67 and an integrated cable with configurable length and connectors.

Applications

The triaxial accelerometers enable the detection of smallest accelerations over a wide frequency response range in three degrees of freedom, e.g. for test bench applications, vehicle and road monitoring as well as resonance and flutter tests in aviation.



Capacitive accelerometers enable simplified load assessment method during road and vehicle monitoring

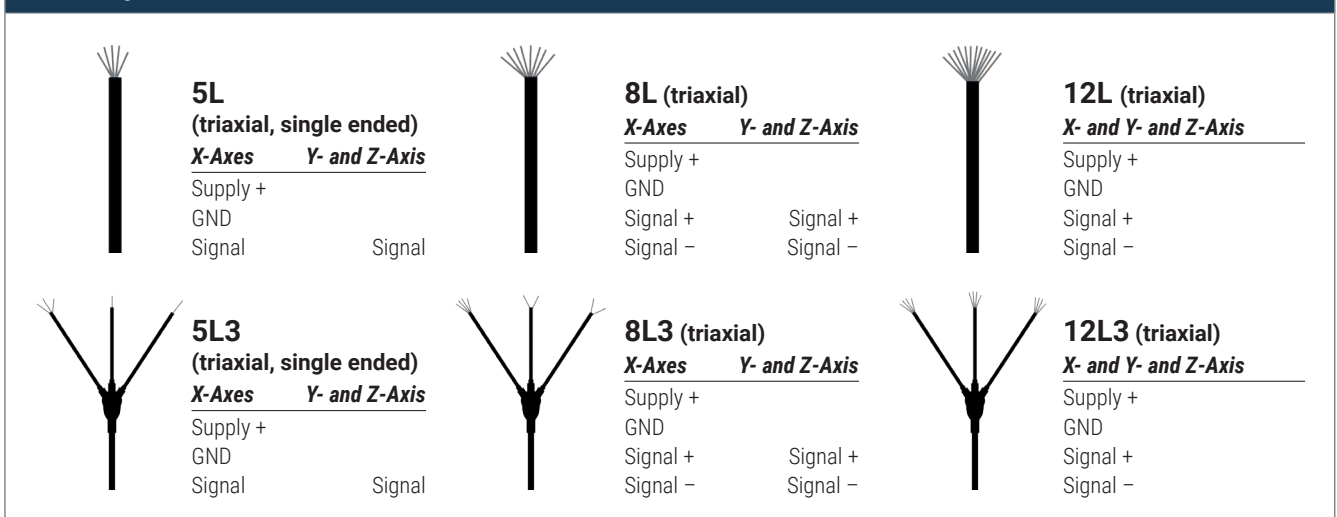
Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 5511LN	triaxial	Aluminium	-40 to +100 °C	IP67	22 g
ASC 5515LN	triaxial	Stainless Steel	-40 to +100 °C	IP67	42 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	-	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	-	50	100	200	400
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	-	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				-	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				-	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				-	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	-	±20	±40	±80	±160
Shock Limit	g	2000		5000		-	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 5521MF	triaxial	Aluminium	-40 to +100 °C	IP67	22 g
ASC 5525MF	triaxial	Stainless Steel	-40 to +100 °C	IP67	42 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	-	90	54	27	13.5	-
Noise Density	µg/√Hz	10	20	35	-	100	170	340	680	-
Frequency Response Range (±5 %)	Hz	0 to 700	0 to 1150	0 to 2000	-	0 to 2300	0 to 2700	0 to 2900	0 to 2500	-
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)				-	<0.1 (typ) <0.3 (max)			
Power Supply Voltage	V	5 to 40				-	5 to 40			
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)				-	120 (typ) 20 to 220 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	-	±3	±5	±10	±20	-
Shock Limit	g	6000		-		6000				-

Cable Configurations ASC 55



MEMS CAPACITIVE ACCELEROMETER

ASC OS series

UNIAXIAL

MEMS Capacitive Technology

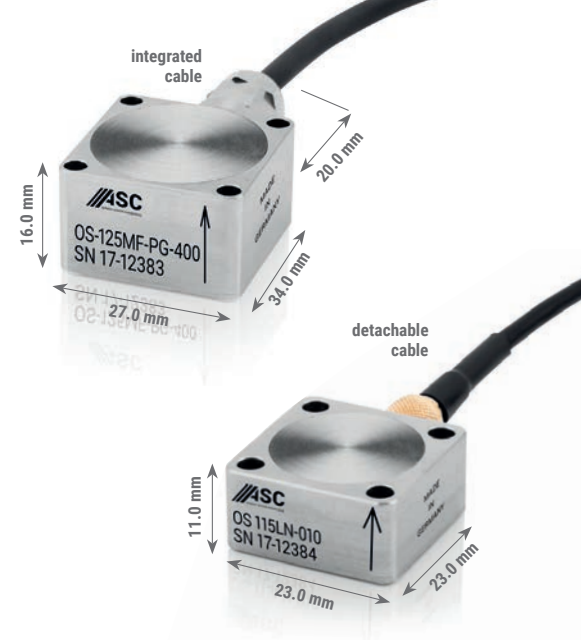
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Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output (± 4 V FSO) and flexible power supply voltage from 6 to 40 VDC.

The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz (± 3 dB) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output (± 2.7 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The sensors feature a robust, reliable stainless steel housing (V2A material number 1.4301) with protection class IP68. An optional stainless steel (V4A, seawater resistant, material number 1.4404) is available on request.



Cables

Furthermore, the accelerometers are fabricated using a detachable or an integrated cable with configurable length and connectors. Depending on the application three different cable materials could be selected:

- Standard cable | 13 gram per meter | PUR | Diameter 3.1 mm
- Cable K1 | 14 gram per meter | PUR | Diameter 3.05 mm | sea water resistance up to +60 °C and 1 bar pressure
- Cable K2 | 15 gram per meter | FEP | Diameter 2.75 mm | waterproof

Applications

The hermetically sealed housing of the accelerometers is ideal for very harsh environmental conditions, e.g. bogie stability tests and monitoring applications in rail transport or condition monitoring of vehicles and their components in the construction sector.

Hermetically sealed and robust stainless steel housing enables applications under harshest environmental conditions



Low Noise (LN)	Sensitive Directions	Housing Material	Cable	Protection Class	Weight
ASC OS-115LN	uniaxial	Stainless Steel	detachable	IP68	31 g
ASC OS-115LN-PG	uniaxial	Stainless Steel	integrated	IP68	68 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	–	80	40	20	10
Noise Density	µg/√Hz	7	12	18	25	–	50	100	200	400
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	–	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				–	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				–	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)				–	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	–	±20	±40	±80	±160
Shock Limit	g	2000		5000		–	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Cable	Protection Class	Weight
ASC OS-125MF	uniaxial	Stainless Steel	detachable	IP68	31 g
ASC OS-125MF-PG	uniaxial	Stainless Steel	integrated	IP68	68 g

Measurement Range	g	±2	±5	±10	±25	±30	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	1350	540	270	–	90	54	27	13.5	–
Noise Density	µg/√Hz	10	20	35	–	100	170	340	680	–
Frequency Response Range (±5 %)	Hz	0 to 700	0 to 1150	0 to 2000	–	0 to 2300	0 to 2700	0 to 2900	0 to 2500	–
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)				–	<0.1 (typ) <0.3 (max)			
Power Supply Voltage	V	5 to 40				–	5 to 40			
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)				–	120 (typ) 20 to 220 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.2	±0.5	±1	–	±3	±5	±10	±20	–
Shock Limit	g	6000				–	6000			

Matching for	Cable Type		Operating Temperature	Weight per meter	Material	Diameter
ASC OS-115LN ASC OS-125MF	Standard	detachable	-40 to +125 °C	13 g	PUR	3.1 mm
	Seawater-resistant (K1)	detachable	-15 to +70 °C	14 g	PUR	3.05 mm
	Waterproof (K2)	detachable	-55 to +125 °C	15 g	FEP	2.75 mm
ASC OS-115LN-PG ASC OS-125MF-PG	Standard	integrated	-40 to +100 °C	30 g	PUR	3.1 mm
	Seawater-resistant (K1)	integrated	-15 to +70 °C	22 g	PUR	3.05 mm
	Waterproof (K2)	integrated	-40 to +100 °C	29 g	FEP	2.75 mm

MEMS CAPACITIVE ACCELEROMETER

ASC OS series

BIAXIAL – TRIAXIAL

MEMS Capacitive Technology

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Description

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The MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 7 kHz ($\pm 3\text{ dB}$) and an extremely robust design with shock resistance up to 6,000 g. The integrated electronic circuitry enables a differential analog voltage output ($\pm 2.7\text{ V FSO}$) and flexible power supply voltage from 5 to 40 VDC.



Low Noise (LN)	Sensitive Directions	Housing Material	Cable	Protection Class	Weight
ASC OS-215LN-PG	biaxial	Stainless Steel	integrated	IP68	68 g
ASC OS-315LN-PG	triaxial	Stainless Steel	integrated	IP68	68 g

Measurement Range	g	± 2	± 5	± 10	± 25	± 30	± 50	± 100	± 200	± 400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	–	80	40	20	10
Noise Density	$\mu\text{g}/\sqrt{\text{Hz}}$	7	12	18	25	–	50	100	200	400
Frequency Response Range ($\pm 5\%$)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	–	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)				–	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	6 to 40				–	6 to 40			
Temp. Coefficient Scale Factor	ppm/K	± 200 (max)				–	± 200 (max)			
Temp. Coefficient Offset (max)	mg/K	± 0.8	± 2	± 4	± 10	–	± 20	± 40	± 80	± 160
Shock Limit	g	2000		5000		–	5000			

Medium Frequency (MF)	Sensitive Directions	Housing Material	Cable	Protection Class	Weight
ASC OS-225MF-PG	biaxial	Stainless Steel	integrated	IP68	68 g
ASC OS-325MF-PG	triaxial	Stainless Steel	integrated	IP68	68 g

Measurement Range	g	± 2	± 5	± 10	± 25	± 30	± 50	± 100	± 200	± 400
Scale Factor (sensitivity)	mV/g	1350	540	270	–	90	54	27	13.5	–
Noise Density	$\mu\text{g}/\sqrt{\text{Hz}}$	10	20	35	–	100	170	340	680	–
Frequency Response Range ($\pm 5\%$)	Hz	0 to 700	0 to 1150	0 to 2000	–	0 to 2300	0 to 2700	0 to 2900	0 to 2500	–
Amplitude Non-Linearity	% FSO	<0.1 (typ) <0.3 (max)				–	<0.1 (typ) <0.3 (max)			
Power Supply Voltage	V	5 to 40				–	5 to 40			
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)				–	120 (typ) 20 to 220 (max)			
Temp. Coefficient Offset (max)	mg/K	± 0.2	± 0.5	± 1	–	± 3	± 5	± 10	± 20	–
Shock Limit	g	6000		–		6000				–



The sensors feature a robust, reliable stainless steel housing (V2A material number 1.4301) with protection class IP68. An optional stainless steel (V4A, seawater resistant, material number 1.4404) is available on request.

Cables

Furthermore, the accelerometers are fabricated an integrated cable with configurable length and connectors. Depending on the application three different cable materials could be selected:

- Standard cable | 30 gram per meter | PUR | Diameter 4.5 mm
- Cable K3 | 22 gram per meter | PUR | Diameter 3.75 mm | sea water resistance up to +60 °C and 1 bar pressure

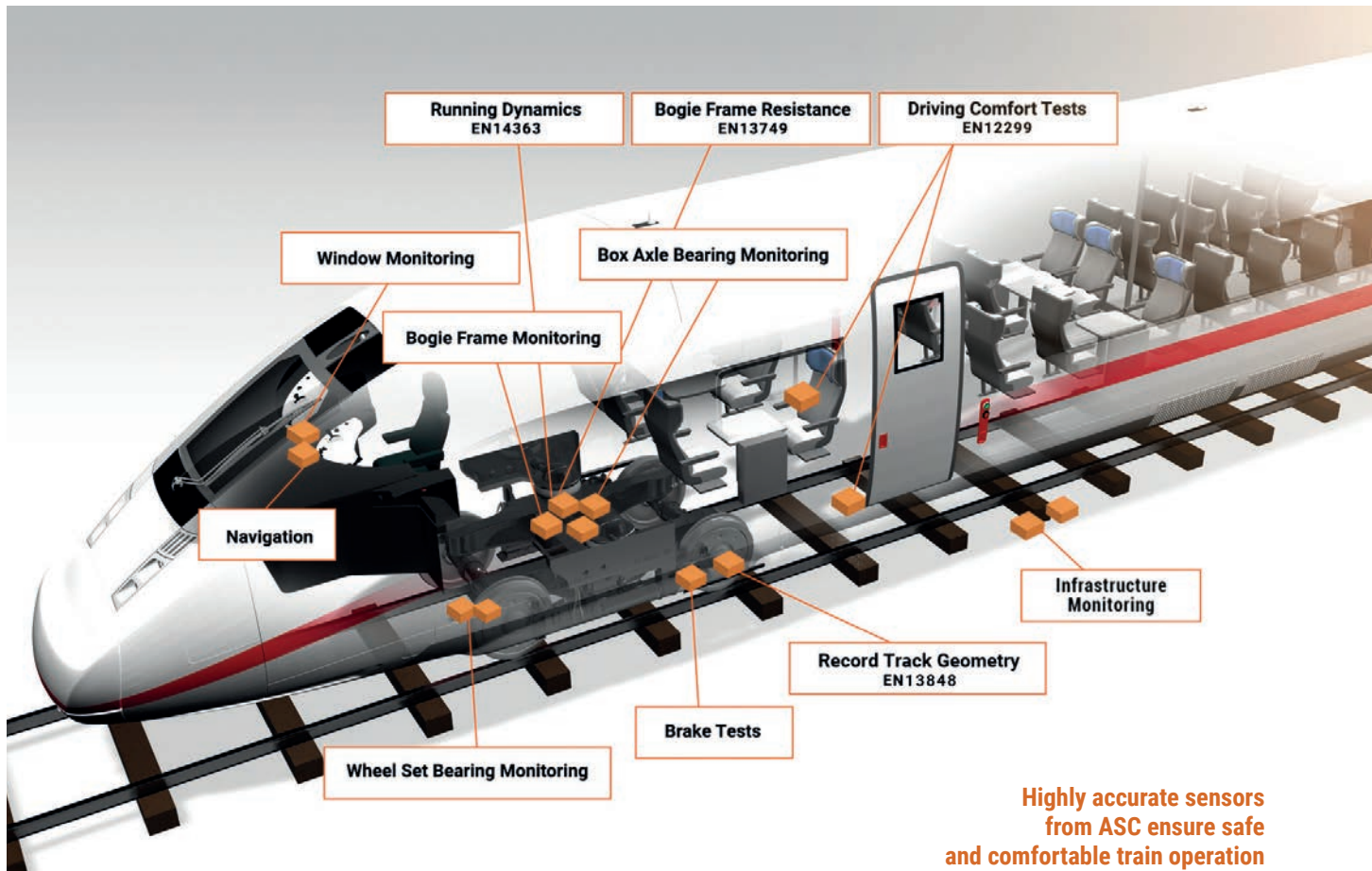
Applications

The hermetically sealed housing of the accelerometers is ideal for very harsh environmental conditions, e.g. bogie stability tests and monitoring applications in rail transport or condition monitoring of vehicles and their components in the construction sector.

ASC OS series feature a hermetically sealed stainless steel housing so they can withstand the harshest ambient conditions, like bogie stability tests



Matching for	Cable Type		Operating Temperature	Weight per meter	Material	Diameter
ASC OS-215LN-PG ASC OS-225MF-PG ASC OS-315LN-PG ASC OS-325MF-PG	Standard	integrated	-40 to +100 °C	30 g	PUR	4.5 mm
	Seawater-resistant (K3)	integrated	-15 to +70 °C	22 g	PUR	3.75 mm



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ASC RAIL series

UNIAXIAL – BIAXIAL – TRIAXIAL

MEMS Capacitive Technology

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Description

The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 400 $\mu\text{g}/\sqrt{\text{Hz}}$ which is essential for demanding measurements of smallest frequencies and amplitudes. The integrated electronic circuitry enables a differential analog voltage output ($\pm 4\text{ V FSO}$) and flexible power supply voltage from 6 to 40 VDC.

The sensors feature a robust and reliable stainless-steel housing (V2A material number 1.4301) leading to hermetic sealing and protection class IP68.

Applications

The application-specific housing of the accelerometers allows reliable operation even in harshest environmental conditions. They are ideally suited for bogie stability tests and monitoring applications of vehicles and their components in the rail transport sector.

Cable and Cable Gland

The cable gland VariaPro Rail was tested according fire protection standards DIN EN 45545-2 and 45545-3.

Furthermore, rail certified and integrated cable RADOX TENUIS-TW 600V MM S complies with the technical requirements of EN 50306 (particularly low temperature and high level of oil and fuel resistance).

It provides a high level of thermal resistance due to standard fire protection on railway vehicles according to:

- DIN 5510-2
- EN 45545-2
- GOST 31565
- NF F 16-101
- NFPA 130
- UNI CEI 11170-3



Low Noise (LN)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC RAIL-115LN	uniaxial	Stainless Steel	-40 to +100 °C	IP68	90 g
ASC RAIL-215LN	biaxial	Stainless Steel	-40 to +100 °C	IP68	90 g
ASC RAIL-315LN	triaxial	Stainless Steel	-40 to +100 °C	IP68	90 g

Measurement Range	g	±2	±5	±10	±25	±50	±100	±200	±400
Scale Factor (sensitivity)	mV/g	2000	800	400	160	80	40	20	10
Noise Density	$\mu\text{g}/\sqrt{\text{Hz}}$	7	12	18	25	50	100	200	400
Frequency Response Range ($\pm 5\%$)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	0 to 1600	0 to 1700	0 to 1900	0 to 2000
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)							
Power Supply Voltage	V	6 to 40							
Temp. Coefficient Scale Factor	ppm/K	±200 (max)							
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±10	±20	±40	±80	±160
Shock Limit	g	2000			5000				



SEISMIC SENSORS

ASC EQ/QF series

UNIAXIAL – BIAxIAL – TRIAXIAL

MEMS Capacitive Technology

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Description

The seismic sensors of the ASC EQ series and ASC QF series feature an ultra-low noise level and achieve a resolution of less than $1 \mu\text{g}$. They therefore fulfill the requirements of motion class B of seismic measurements. The integrated electronic circuitry enables a differential analog voltage output ($\pm 2.7 \text{ V FSO}$) and flexible power supply voltage from 5 to 40 VDC while also provides a built-in self-test option and a temperature output.

The sensors ASC EQ-x211 feature a lightweight aluminum housing and the sensors ASC EQ-x215 provide a robust stainless steel housing, both with protection class IP65 and with detachable cable as well as configurable length and connectors. The accelerometers are available in uniaxial, biaxial and triaxial configuration.

The sensors ASC QF-1211 feature a lightweight aluminum housing with protection class IP67 and an integrated cable as well as configurable length and connectors. The accelerometers are available in uniaxial configuration.

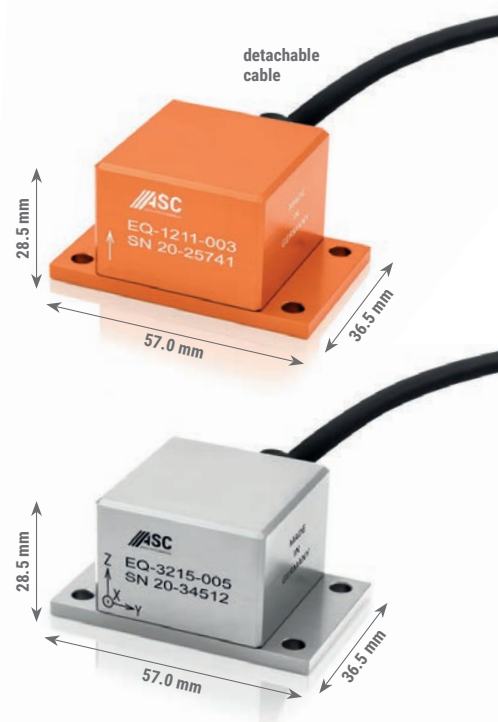
- Built-in self-test option
- Temperature output

Capacitive based accelerometer for seismic measurements due to resolution less than $1 \mu\text{g}$

Applications

The accelerometers of the ASC EQ series are ideally suited to monitor safety-critical components of buildings. This is especially the case in power plants or tunnels, whose structures that are affected by tectonic processes. A basic requirement here is the use of seismic sensors that reliably detect the smallest amplitudes of vibrations.

The flat and compact design of the ASC QF series enables quick and easy mounting which is a basic requirement for reference measurements in numerous applications. Due to the excellent vibration and shock resistance the sensors are also ideally suited for drilling tools like MWD (measurement while drilling) systems.





Capacitive based accelerometers detect the smallest deviations in MWD applications

Seismic Sensors	Sensitive Directions	Housing Material	Cable	Protection Class	Weight
ASC EQ-1211	uniaxial	Aluminium	detachable	IP65	75 g
ASC EQ-2211	biaxial	Aluminium	detachable	IP65	75 g
ASC EQ-3211	triaxial	Aluminium	detachable	IP65	75 g
ASC EQ-1215	uniaxial	Stainless Steel	detachable	IP65	190 g
ASC EQ-2215	biaxial	Stainless Steel	detachable	IP65	190 g
ASC EQ-3215	triaxial	Stainless Steel	detachable	IP65	190 g
ASC QF-1211	uniaxial	Aluminium	integrated	IP67	15 g

Measurement Range	(g)	±3	±5
Scale Factor (sensitivity)	mV/g	900	540
Noise Density	µg/√Hz	0.7	1.2
Frequency Response Range (±5 %)	Hz	0 to 550	0 to 700
Amplitude Non-Linearity	% FSO	<0.3 (typ) <1 (max)	
Power Supply Voltage	V	5 to 40	
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)	
Temp. Coefficient Offset (max)	mg/K	±0.3	±1.2
Operating Temperature Range	°C	-40 to +85	
Shock Limit	g _{pk}	1500	

Cable Configurations ASC EQ



6L (uniaxial)
X- or Y- or Z-Axis
Supply +
GND
Self-Test
Signal +
Signal -
Temperature



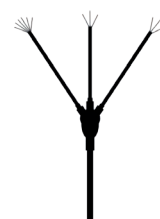
9L (biaxial)
X-Axes Y- or Z-Axis
Supply +
GND
Self-Test
Signal + Signal +
Signal - Signal -
Temperature Temperature



12L (triaxial)
X-Axes Y- and Z-Axis
Supply +
GND
Self-Test
Signal + Signal +
Signal - Signal -
Temperature Temperature



9L2 (biaxial)
X-Axes Y- or Z-Axis
Supply +
GND
Self-Test
Signal + Signal +
Signal - Signal -
Temperature Temperature



12L3 (triaxial)
X-Axes Y- and Z-Axis
Supply +
GND
Self-Test
Signal + Signal +
Signal - Signal -
Temperature Temperature

MEMS CAPACITIVE ACCELEROMETER

ASC ECO series

UNIAXIAL – BIAxIAL – TRIAXIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The industrial accelerometers of the ASC ECO series featuring a wide frequency response range from 0 Hz to 2.4 kHz (± 3 dB) and an extremely robust design with shock resistance up to 10,000 g. The integrated electronic circuitry enables a differential analog voltage output (± 2.4 V FSO) and flexible power supply voltage from 5 to 40 VDC.

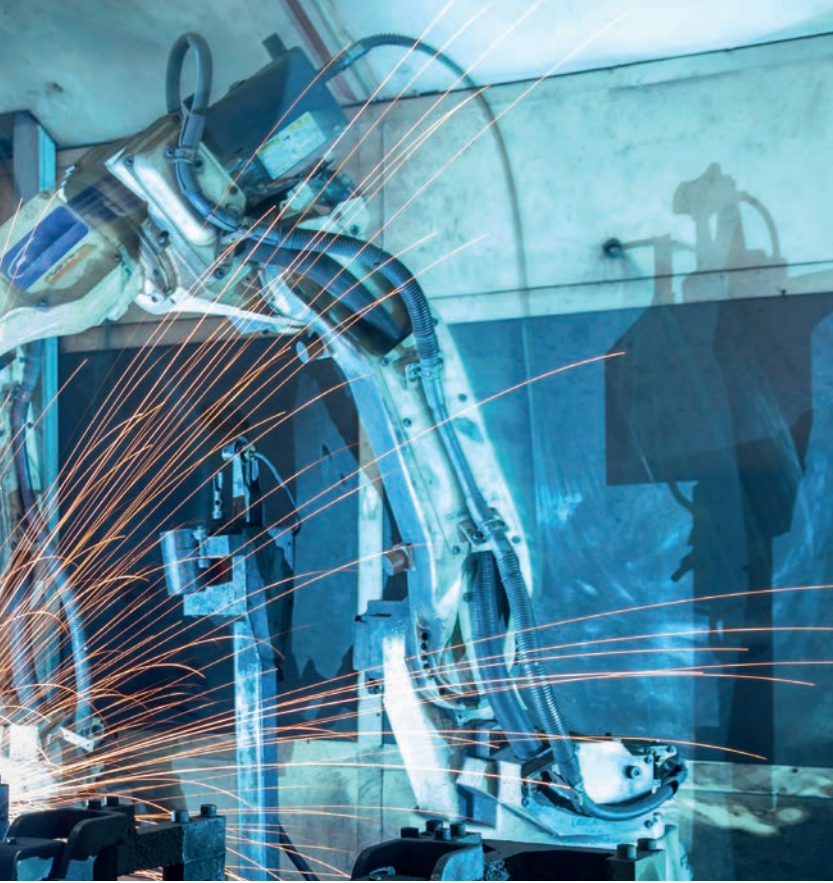
The sensors feature a lightweight, reliable aluminum housing with protection class IP68 and an integrated cable with configurable length and connectors.

Applications

The accelerometers feature a flat design that allows quick and easy mounting. This makes them ideal for measuring applications in hard-to-access installations, e.g. condition monitoring systems.



Condition monitoring of industrial machinery due to compact capacitive based accelerometers



Industrial Sensors	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC ECO-1311	uniaxial	Aluminium	-20 to +125 °C	IP68	15 g
ASC ECO-2311	biaxial	Aluminium	-20 to +125 °C	IP68	15 g
ASC ECO-3311	triaxial	Aluminium	-20 to +125 °C	IP68	15 g

Measurement Range	(g)	±2	±4	±8	±10	±20	±40
Scale Factor (sensitivity)	mV/g	1200	600	300	240	120	60
Noise Density	µg/√Hz	22.5	25	30	75	80	90
Frequency Response Range (±5 %)	Hz	0 to 1000					
Amplitude Non-Linearity	% FSO	0.1	0.4	1.1	0.1	0.5	1.3
Power Supply Voltage	V	5 to 40					
Temp. Coefficient Scale Factor	ppm/K	±100 (typ)					
Temp. Coefficient Offset (max)	mg/K	±0.1 (typ) ±0.15 (max)			±0.2 (typ) ±0.75 (max)		
Shock Limit	g _{pk}	5000			10000		

Cable Configurations ASC ECO



4L (uniaxial)
X- or Y- or Z-Axis
 Supply +
 GND
 Signal +
 Signal -



6L (biaxial)
X-Axes Y- or Z-Axis
 Supply +
 GND
 Signal + Signal +
 Signal - Signal -



8L (triaxial)
X-Axes Y- and Z-Axis
 Supply +
 GND
 Signal + Signal +
 Signal - Signal -



6L2 (biaxial)
X-Axes Y- or Z-Axis
 Supply +
 GND
 Signal + Signal +
 Signal - Signal -



8L3 (triaxial)
X-Axes Y- and Z-Axis
 Supply +
 GND
 Signal + Signal +
 Signal - Signal -

MEMS CAPACITIVE ACCELEROMETER

ASC ECO CS series

UNIAXIAL – BIAxIAL – TRIAXIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

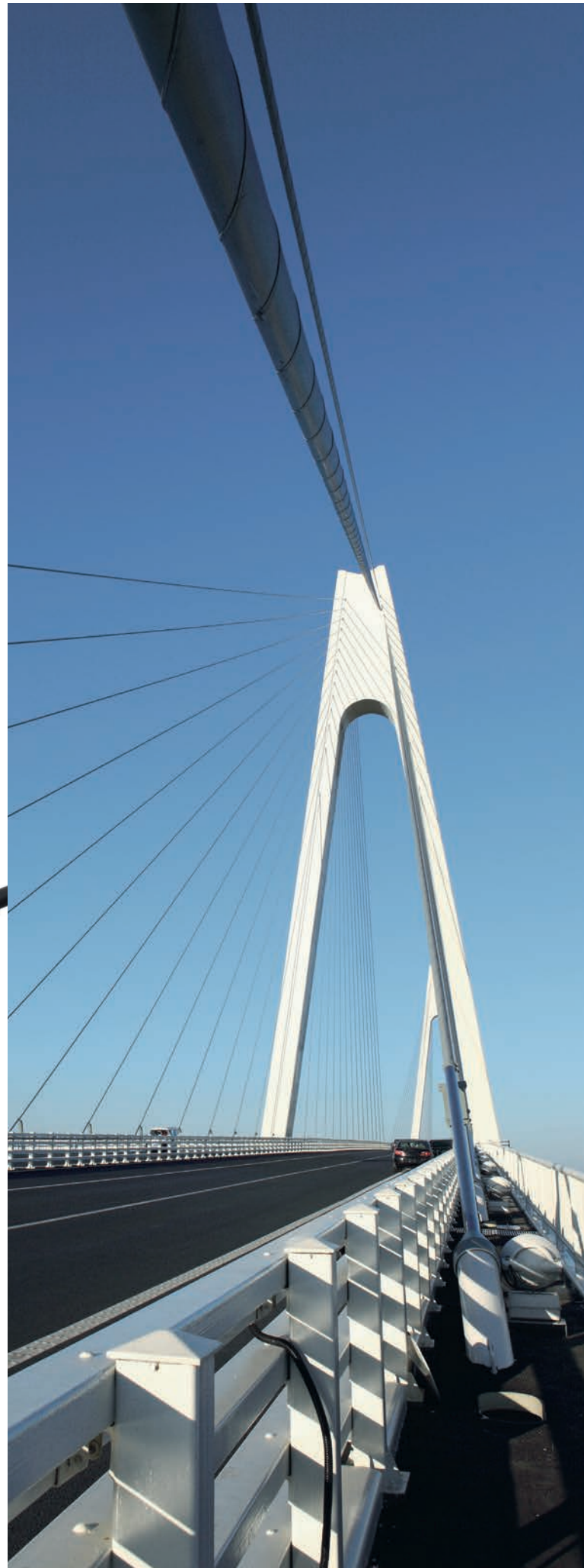
The industrial accelerometers of the ASC ECO CS series featuring a broadband noise of $<4.5 \mu\text{A}$ and are used in applications that are requiring extremely long cables ($>100 \text{ m}$) or very high EMC immunity. The integrated electronic circuitry enables a single-ended analog current output of 4-20 mA and flexible power supply voltage from 8 to 25 VDC. The sensors feature a lightweight, reliable aluminum housing with protection class IP67 and an integrated cable with configurable length and connectors.

Applications

Due to their loss-free signal transmission, even in the case of very long cables, the sensors of the ASC ECO CS series are also used in civil engineering applications, such as infrastructure monitoring in rail transport or structural analysis of bridges.



**Current output of 4-20 mA
enables very long
cables in structural health
monitoring applications**

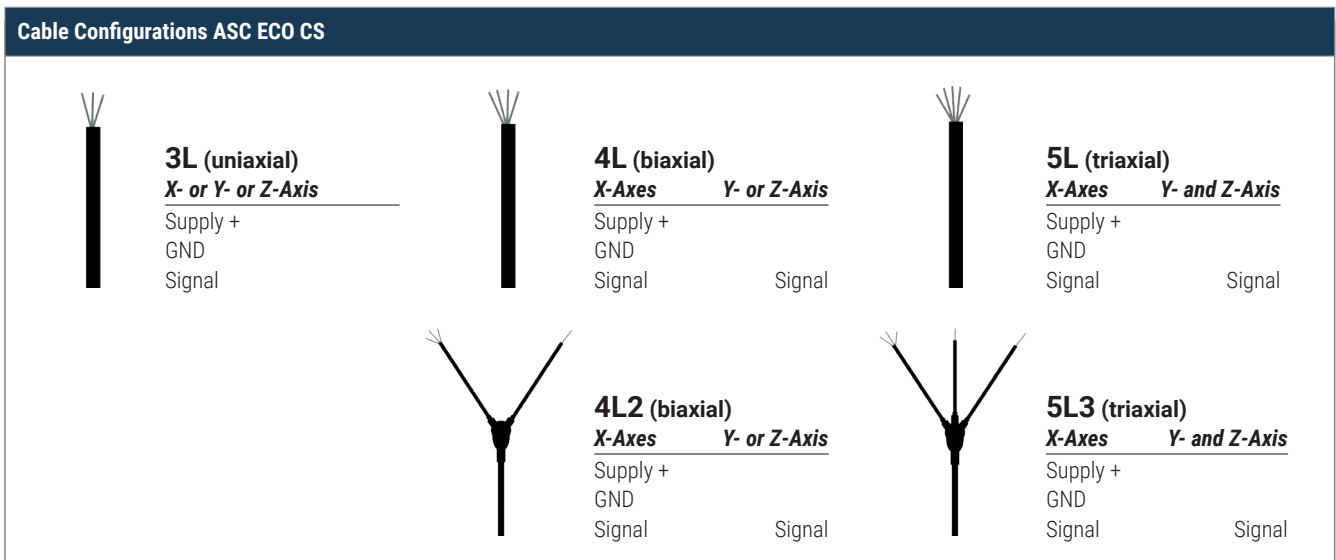




Current output of 4-20 mA provides very high EMC immunity

Industrial Sensors	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC ECO CS-1311	uniaxial	Aluminium	-20 to +80 °C	IP67	75 g
ASC ECO CS-2311	biaxial	Aluminium	-20 to +80 °C	IP67	75 g
ASC ECO CS-3311	triaxial	Aluminium	-20 to +80 °C	IP67	75 g

Measurement Range	(g)	±2	±4	±8	±10	±20	±40
Scale Factor (sensitivity)	mA/g	4	2	1	0.8	0.4	0.2
Noise Density	µg/√Hz	35	40	50	120	130	145
Frequency Response Range (±5 %)	Hz	0 to 1000					
Amplitude Non-Linearity	% FSO	0.1	0.4	1.1	0.1	0.5	1.3
Power Supply Voltage	V	8 to 25					
Temp. Coefficient Scale Factor	ppm/K	±100 (typ)					
Temp. Coefficient Offset (max)	mg/K	±0.1 (typ) ±0.15 (max)			±0.2 (typ) ±0.75 (max)		
Shock Limit	g _{pk}	5000			10000		



MEMS CAPACITIVE ACCELEROMETER

ASC CS series

UNIAXIAL – BIAxIAL – TRIAXIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

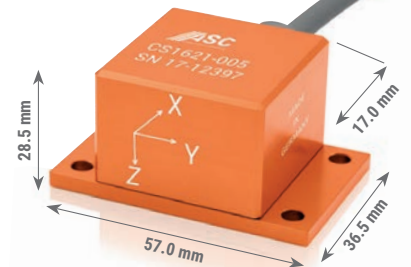
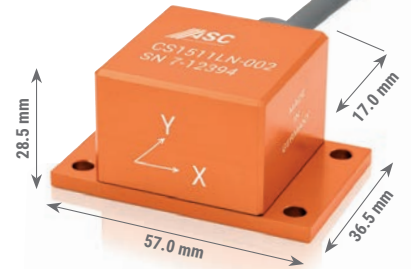
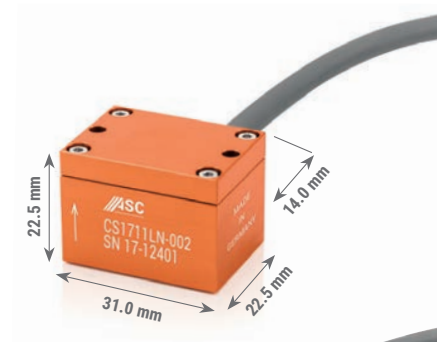
Description

The models of the ASC CS series feature broadband noise of $<0.65 \mu\text{A}$ and are used in applications that are requiring extremely long cables ($>100 \text{ m}$) or very high EMC immunity. The integrated electronic circuitry enables a single-ended analog current output of 4-20 mA and flexible power supply voltage from 8 to 30 VDC.

The sensors feature a lightweight, reliable aluminum housing with protection class IP67 and an integrated cable with configurable length and connectors.

Applications

Due to their loss-free signal transmission, even in the case of very long cables, the sensors of the ASC CS series are used in continuous condition monitoring and structural health monitoring (SHM), such as infrastructure monitoring in rail transport or structural analysis of bridges.



ASC CS series is used to monitor the world's largest sea bridge since 2018: Hong Kong-Zhuhai Macau bridge



LN (Low Noise)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC CS-1711LN	uniaxial	Aluminium	-20 to +70 °C	IP67	27 g
ASC CS-1511LN	biaxial	Aluminium	-20 to +70 °C	IP67	35 g
ASC CS-1611LN	triaxial	Aluminium	-20 to +70 °C	IP67	65 g

Measurement Range	(g)	±2	±5	±10	±50
Scale Factor (sensitivity)	mV/g	4.0	1.6	0.8	0.16
Noise Density	µg/√Hz	10	15	20	100
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1600
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)			
Power Supply Voltage	V	8 to 30			
Temp. Coefficient Scale Factor	ppm/K	±200 (max)			
Temp. Coefficient Offset (max)	mg/K	±0.8	±2	±4	±20
Shock Limit	g _{pk}	2000		5000	



MEMS PIEZORESISTIVE ACCELEROMETER

ASC 6C/7C series

UNIAXIAL – TRIAXIAL



MEMS Piezoresistive Technology

The key components in piezoresistive accelerometers are high-quality micro-electro mechanical systems (MEMS) that are fabricated from piezoresistive silicon. A bending due to external forces causes deformation of the resistors, leading to a change in its resistance. The resistors are configured into a Wheatstone bridge circuit, which provides a change of the voltage output signal that is proportional to acceleration. This technology also enables the measurement of dynamic or static and constant accelerations. Furthermore, very high measurement ranges are achievable due to the mechanical design.

Description

The uniaxial ASC 61C1, ASC 62C1, ASC 66C1 and the triaxial ASC 74C1, ASC 75C1, ASC 76C1 feature a wide dynamic range from 0 Hz to 2.5 kHz and very high impact resistance up to 5,000 g. For even higher impact test the uniaxial ASC 66C2 features a wider dynamic range from 0 Hz to 4 kHz and outstanding impact resistance up to 10,000 g. In addition, for all accelerometers the lightweight design allows its use in applications where the mass load of the test structures has to be minimized.

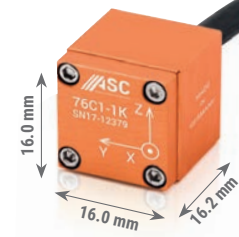
The sensors feature a lightweight, reliable aluminum housing in different form factors with protection class IP65 or IP67. All accelerometers are equipped with an integrated cable with configurable length and connectors.

Applications

Piezoresistive accelerometers are used in high-impact and shock applications such as side and frontal impact tests in the automotive sector. With a measuring range of up to 2,000 g or up to 6,000 g they therefore belong to the category of ASC crash sensors, which can be configured with TEDS and EQX data.



Whenever very high impact tests, pulse or shock measurements such as crash tests in automotive industry are required



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High Impact Sensors	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 61C1	uniaxial	Aluminium	-20 to +80 °C	IP67	3 g
ASC 62C1	uniaxial	Aluminium	-20 to +80 °C	IP67	3 g
ASC 66C1	uniaxial	Aluminium	-20 to +80 °C	IP65	5 g
ASC 66C2	uniaxial	Aluminium	-40 to +100 °C	IP65	5 g
ASC 74C1	triaxial	Aluminium	-20 to +80 °C	IP65	16 g
ASC 75C1	triaxial	Aluminium	-20 to +80 °C	IP65	13 g
ASC 76C1	triaxial	Aluminium	-20 to +80 °C	IP65	12 g

Measurement Range	(g)	±500	±1000	±2000	±6000 (ASC 66C2)
Scale Factor (sensitivity)	mV/g	0.4	0.15	0.13	0.1
Frequency Response Range (±5 %)	Hz	0 to 250	0 to 400	0 to 700	0 to 1600
Amplitude Non-Linearity	% FSO		<1		<2
Power Supply Voltage	V		3 to 10		3 to 10
Shock Limit	g _{pk}		5000		10000

IEPE ACCELEROMETER

ASC P series

UNIAXIAL – TRIAXIAL

IEPE Technology

IEPE accelerometers are based on the piezoelectric effect, where an input acceleration causes a force on the seismic mass which leads to a proportional charge generation within the ceramic PZT material. The IEPE (integrated electronics piezo-electric) circuitry features the conversion of the charge to an analog voltage output signal. As opposed to capacitive accelerometers this signal has a high-pass characteristic, which enables highly dynamic measurements with a very high bandwidth of up to 10 kHz ($\pm 10\%$) even without the detection of static DC components.

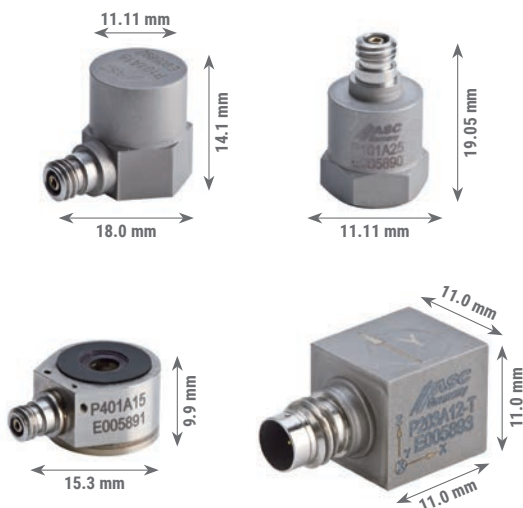
Description

Piezoelectric accelerometers are based on PZT ceramic and feature a built-in preamplifier and a charge to voltage converter. The accelerometers providing a high full-scale output voltage of ± 5 V and low broadband noise. The sensors operate on a constant current supply and use a two-wire coaxial cable (uniaxial) or four-wire cable (triaxial) for power input and signal output.

The uniaxial accelerometers feature a robust stainless steel housing. The triaxial sensors are based on a very lightweight titanium housing while the sensor ASC P203A11 provides an additional anodized aluminum cover for case isolation. All types are offering protection class IP68, different mounting options and a detachable cable with configurable length and connectors.

Applications

The piezoelectric accelerometers featuring a compact and lightweight design. They therefore, ideally suited for test and measurement applications such as modal and structural analyses in the automotive and aviation sectors, where a basic requirement is lightweight high-frequency accelerometers for minimizing the mass load on the test structures.



Safe landing and take-off due to ground resonance measurements in helicopters



Regular modal and structural analyses of aircraft and their components

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ENGINEERING

T&M IEPE Sensors	Sensitive Directions	Housing Material	Connector	Isolation	Weight
ASC P101A15	uniaxial	Stainless Steel	Side 10-32 UNF coaxial	Case grounded	8.6 g
ASC P101A25	uniaxial	Stainless Steel	Top 10-32 UNF coaxial	Case grounded	7.3 g
ASC P401	uniaxial	Stainless Steel	Side 10-32 UNF coaxial	Case isolated	11 g
ASC P203A11	triaxial	Aluminium	Side 4-pin Microtech ¼-28"	Case isolated	7.3 g
ASC P203A12	triaxial	Titanium	Side 4-pin Microtech ¼-28"	Case grounded	6 g

Measurement Range	g	P101				P401			P203			
		±50	±100	±500	±1000	±50	±100	±500	±50	±100	±500	±2000
Scale Factor (sensitivity)	mV/g	100	50	10	5	100	50	10	100	50	10	2.5
Frequency Response Range (±5 %)	Hz	0.3 to 10000				0.5 to 15000			1 to 9000			
Broadband Noise (max)	mg	0.4 to 1.4				1.0 to 2.5			0.4 to 3.2			
Constant Supply Current	mA	2 to 10				2 to 20			2 to 10			
Operating Temperature Range	°C	-55 to +125				-55 to +150			-55 to +125			
Shock Limit	g	5000				5000			5000			
Protection Class		IP68				IP68			IP68			

IEPE ACCELEROMETER

ASC P series

UNIAXIAL – TRIAXIAL

IEPE Technology

IEPE accelerometers are based on the piezoelectric effect, where an input acceleration causes a force on the seismic mass which leads to a proportional charge generation within the ceramic PZT material. The IEPE (integrated electronics piezo-electric) circuitry features the conversion of the charge to an analog voltage output signal. As opposed to capacitive accelerometers this signal has a high-pass characteristic, which enables highly dynamic measurements with a very high bandwidth of up to 16 kHz ($\pm 10\%$) even without the detection of static DC components.

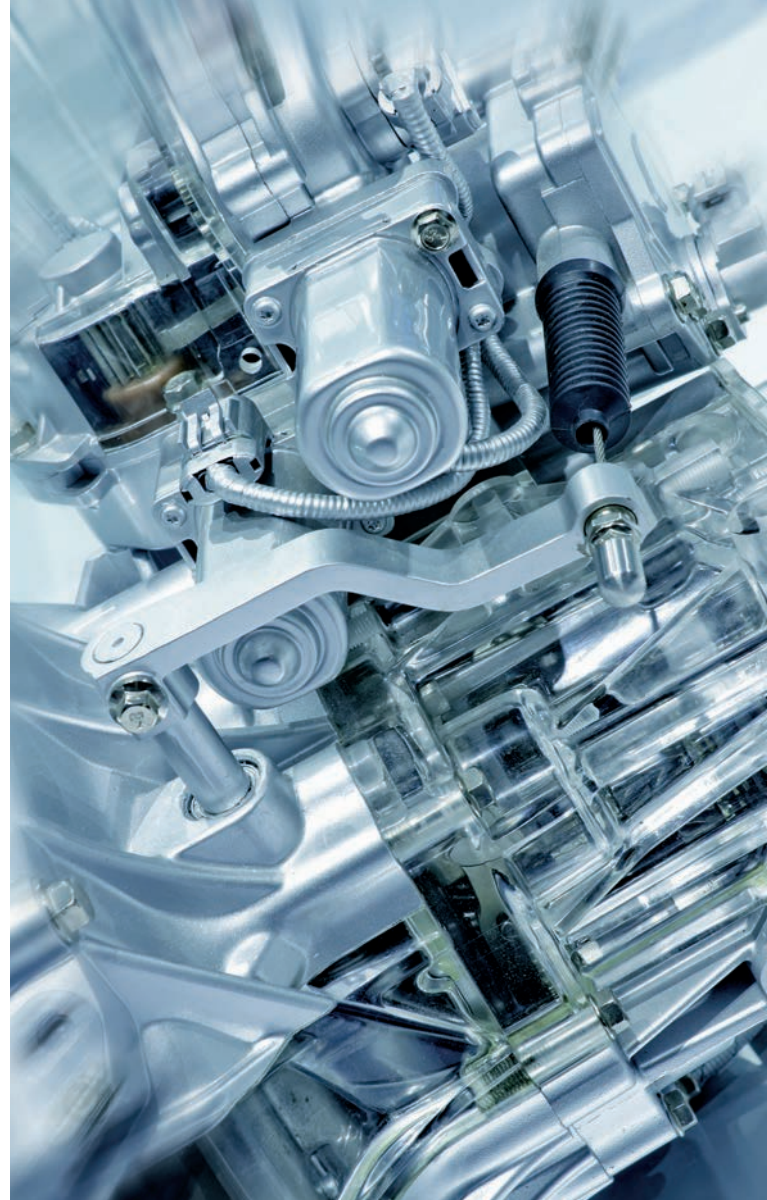
Description

Piezoelectric accelerometers are based on PZT ceramic and feature a built-in preamplifier and a charge to voltage converter. The industrial accelerometers providing a very high fullscale output voltage of $\pm 8\text{ V}$ and low broadband noise of $<100\ \mu\text{g}$. The sensors operate on a constant current supply and use a two-wire coaxial cable (uniaxial) or four-wire cable (triaxial) for power input and signal output.

The accelerometers feature a robust stainless steel housing with protection class IP68 (uniaxial) or IP67 (triaxial), different mounting options and a detachable cable with configurable length and connectors.

Applications

The uniaxial piezoelectric accelerometers ASC P311A15 and ASC P311A25 are based on the compression principle, which make them ideal for applications with continuous loads such as vibrations or high-amplitude impacts, e. g. for testing of operation stability in rail vehicles. The uniaxial piezoelectric accelerometers ASC P311K-A15, ASC P311K-A25 and ASC P311PK-A15 as well as the triaxial ASC P313P-A15 are based on the shear principle. They are ideal suited for industrial applications: condition monitoring of wind turbines and their components as well as predictive maintenance of machinery as part of the smart factory.



Condition monitoring and vibration analyses in factories are always based on IEPE accelerometers, because they are compact, robust and designed for customization



Especially IEPE accelerometers based on the compression principle are ideal for applications with ongoing loads, such as high-amplitude vibrations or impacts



Industrial IEPE Sensors	Sensitive Directions	Housing Material	Connector	Technology	Weight
ASC P311A15	uniaxial	Stainless Steel	Side 2-pin MS or M12	Compression	185 g
ASC P311A25	uniaxial	Stainless Steel	Top 2-pin MS or M12	Compression	106 g
ASC P311K-A15	uniaxial	Stainless Steel	Side 2-pin MS or M12	Shear	135 g
ASC P311K-A25	uniaxial	Stainless Steel	Top 2-pin MS or M12	Shear	52 g
ASC P311PK-A15	uniaxial	Stainless Steel	Side 2-pin MS or M12	Shear	83 g
ASC P313P-A15	triaxial	Stainless Steel	Side 4-pin M12	Shear	235 g

Measurement Range	g	ASC P311A15 ASC P311A25						ASC P311K-A15 ASC P311K-A25					
		±16	±32	±80	±160	±250	±800	±16	±32	±80	±160	±250	±800
Scale Factor (sensitivity)	mV/g	500	250	100	50	30	10	500	250	100	50	30	10
Frequency Response Range (±5 %) Hz		2 to 10000						2 to 14000					
Frequency Response Range (±3 dB) Hz		0.8 to 15000						0.8 to 19000					
Broadband Noise (max)	mg	0.1						0.1					
Constant Supply Current	mA	0.5 to 8						0.5 to 8					
Operating Temperature Range	°C	-40 to +150						-55 to +150					
Shock Limit	g	5000						5000					
Protection Class		IP68						IP68					

Measurement Range	g	ASC P311PK-A15						ASC P313P-A15					
		-	-	±80	-	-	±800	±16	±32	±80	±160	±250	±800
Scale Factor (sensitivity)	mV/g	-	-	100	-	-	10	500	250	100	50	30	10
Frequency Response Range (±5 %) Hz		2 to 14000						2 to 10000					
Frequency Response Range (±3 dB) Hz		0.8 to 19000						0.8 to 15000					
Broadband Noise (max)	mg	0.1						0.1					
Constant Supply Current	mA	0.5 to 8						0.5 to 8					
Operating Temperature Range	°C	-55 to +130						-55 to +150					
Shock Limit	g	5000						5000					
Protection Class		IP68						IP67					

Low-frequency aerodynamic tower tilting, wave induced influences, hydrodynamic forces and seismic movement of the sea bed can be measured optimally with capacitive based tilt sensors



MEMS CAPACITIVE TILT SENSORS

ASC TS series

UNIAXIAL – BIAXIAL

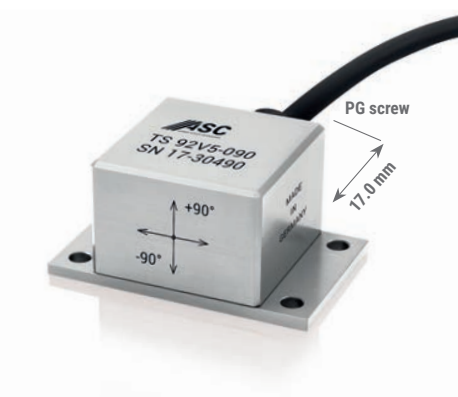
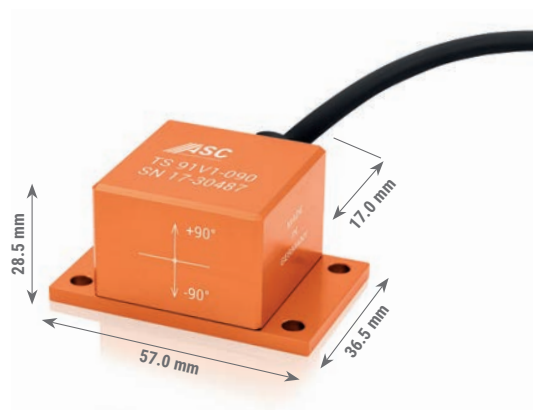
MEMS Capacitive Technology

The key components in capacitive tilt sensors are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This technology enables the measurement of static (DC) and constant accelerations, like the gravity vector of the Earth. By measuring the acceleration (within ± 1 g) the tilt between the sensitive direction of the sensor and the horizon is calculated by trigonometric principles. Other advantages of capacitive tilt sensors are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The tilt sensors feature a resolution of $<0.001^\circ$. In addition, the long-term stability of the scale factor (± 500 ppm) and bias ($\pm 0.2^\circ$) are a basic requirement for the demands of condition and structural health monitoring applications. The integrated electronic circuitry enables a quasi-differential analog voltage output (± 2.0 V FSO) and flexible power supply voltage from 6 to 40 VDC.

The sensor ASC TS-9xV1 features a lightweight aluminium housing with protection class IP67 and the sensor ASC TS-9xV5 provides a robust stainless steel housing with protection class IP68, both with an integrated cable with configurable length and connectors.



Applications

Their outstanding resolution and long-term stability make these tilt sensors ideal for the detection of tower swaying, for track alignment and axle alignment, compensation of truck chassis or angular positioning of machine tools.

Tilt Sensors (TS)	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC TS-91V1	uniaxial	Aluminium	-30 to +125 °C	IP67	78 g
ASC TS-92V1	biaxial	Aluminium	-30 to +125 °C	IP67	78 g
ASC TS-91V5	uniaxial	Stainless Steel	-30 to +125 °C	IP68	192 g
ASC TS-92V5	biaxial	Stainless Steel	-30 to +125 °C	IP68	192 g

Measurement Range	$^\circ$	$\pm 15; \pm 90$
Scale Factor (sensitivity)	mV/g	2000
Noise Density	$^\circ/\sqrt{\text{Hz}}$	<0.001
Resolution	$^\circ$	0.001
Bandwidth ($\pm 5\%$)	Hz	0 to 250
Amplitude Non-Linearity	% FSO	<0.25 (max)
Power Supply Voltage	V	6 to 40
Temp. Coefficient Scale Factor	ppm/K	± 200 (max)
Temp. Coefficient Offset (max)	$^\circ/\text{K}$	± 0.05 (max)
Long-term Scale Factor Stability	ppm	500 (typ) 1000 (max)
Long-term Offset Stability	$^\circ$	0.2 (typ) 0.5 (max)
Shock Limit	g	2000

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INDUSTRIAL GRADE GYROSCOPES

ASC Gyro RAIL series

UNIAXIAL – BIAXIAL – TRIAXIAL

MEMS Vibrating Ring Technology

The key components in industrial grade gyroscopes are high-quality micro-electromechanical systems (MEMS) that feature excellent long-term stability and reliability. The design of the micro-mechanical silicon structures makes the gyroscopes extremely insensitive to external impacts and vibrations. They are therefore ideal suited for use in harsh environmental conditions.

Description

Due to their high performance, the gyroscopes fulfill the requirements of industrial grade applications with respect to the maximum achievable precision. The integrated electronic circuitry enables a single-ended, analog voltage output (0.66 to 2.64 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The sensors feature a robust and reliable stainless-steel housing (V2A material number 1.4301) leading to hermetic sealing and protection class IP68.

Applications

The application-specific housing of the accelerometers allows reliable operation even in harshest environmental conditions. They are ideally suited for dynamic roll, pitch and yaw angle measurements and monitoring applications of vehicles and their components in the rail transport sector.

Cable and Cable Gland

The cable gland VariaPro Rail was tested according fire protection standards DIN EN 45545-2 and 45545-3.

Furthermore, rail certified and integrated cable RADOX TENUIS-TW 600V MM S complies with the technical requirements of EN 50306 (particularly low temperature and high level of oil and fuel resistance).

It provides a high level of thermal resistance due to standard fire protection on railway vehicles according to:

- DIN 5510-2
- EN 45545-2
- GOST 31565
- NF F 16-101
- NFPA 130
- UNI CEI 11170-3





Continuous condition monitoring of railway infrastructure also includes measurement of the track geometry in curves according to EN 13848

Industrial Grade Gyroscopes	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC RAIL-271	uniaxial	Stainless Steel	-40 to +85 °C	IP68	90 g
ASC RAIL-272	biaxial	Stainless Steel	-40 to +85 °C	IP68	90 g
ASC RAIL-273	triaxial	Stainless Steel	-40 to +85 °C	IP68	90 g

Measurement Range	°/s	±75	±150	±300	±900
Scale Factor (sensitivity)	mV/°/s	13.2	6.6	3.3	1.1
Rate Noise Density	°/s/√Hz	0.018 (typ) 0.025 (max)			
Bandwidth (±3 dB)	Hz	150			
Amplitude Non-Linearity	% FSO	<0.06 (typ) <0.15 (max)			
Bias Stability	°/hr	12			
Angular Random Walk	°/√hr	0.2			
Power Supply Voltage	V	5 to 40			
Scale Factor Error over Temp. Range	%	±0.5 (typ) ±1.5 (max)			
Offset (bias) Error over Temp. Range	°/s	±1.0 (typ) ±3.0 (max)			
Shock Limit	g	500 (operating, 1 ms) 10000 (survival, 0.1 ms)			

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INDUSTRIAL GRADE GYROSCOPES

ASC Gyro 27 series

UNIAXIAL – TRIAXIAL

MEMS Vibrating Ring Technology

The key components in industrial grade gyroscopes are high-quality micro-electromechanical systems (MEMS) that feature excellent long-term stability and reliability. The design of the micro-mechanical silicon structures makes the gyroscopes extremely insensitive to external impacts and vibrations. They are therefore ideal suited for use in harsh environmental conditions.

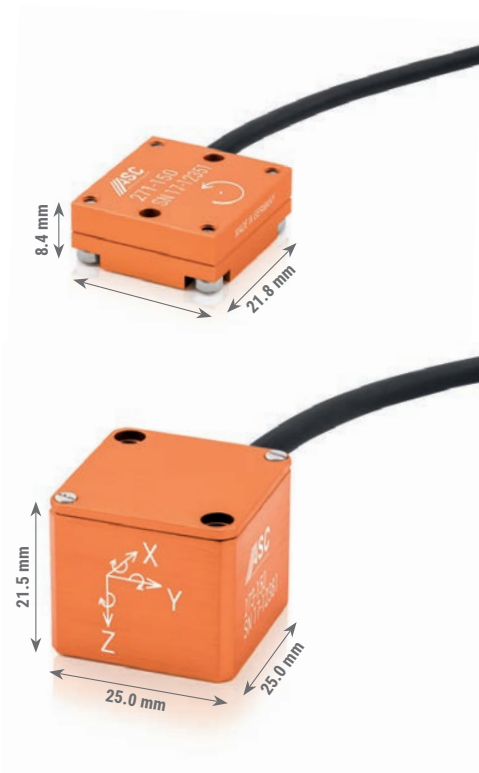
Description

Due to their high performance, the gyroscopes fulfill the requirements of industrial grade applications with respect to the maximum achievable precision. The integrated electronic circuitry enables a single-ended, analog voltage output (0.66 to 2.64 V FSO) and flexible power supply voltage from 5 to 40 VDC.

The uniaxial gyroscopes ASC 271 and triaxial gyroscopes ASC 273 feature a lightweight, reliable aluminum housing and an integrated cable with configurable length and connectors. Furthermore, the ASC 271 provides a protection class IP65 while the ASC 273 provides a protection class IP67.

Applications

Ideal applications are dynamic roll, pitch and yaw angle measurements in motor vehicles, ships and aircraft, as well as monitoring of vehicle dynamics in AGVs (automated guided vehicles) or the orientation of UAVs (unmanned aerial vehicles) in smart agriculture.



Industrial Grade Gyroscopes	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 271	uniaxial	Aluminium	-40 to +85 °C	IP65	10 g
ASC 273	triaxial	Aluminium	-40 to +85 °C	IP67	35 g

Measurement Range	°/s	±75	±150	±300	±900
Scale Factor (sensitivity)	mV/°/s	13.2	6.6	3.3	1.1
Rate Noise Density	°/s/√Hz	0.018 (typ) 0.025 (max)			
Bandwidth (±3 dB)	Hz	150			
Amplitude Non-Linearity	% FSO	<0.06 (typ) <0.15 (max)			
Bias Stability	°/hr	12			
Angular Random Walk	°/√hr	0.2			
Power Supply Voltage	V	5 to 40			
Scale Factor Error over Temp. Range	%	±0.5 (typ) ±1.5 (max)			
Offset (bias) Error over Temp. Range	°/s	±1.0 (typ) ±3.0 (max)			
Shock Limit	g	500 (operating, 1 ms) 10000 (survival, 0.1 ms)			



ANALOG

DIGITAL

SMART

ACCESSORIES

CALIBRATION

ENGINEERING

Gyroscopes from ASC enable reliable vehicle dynamics as well as precise navigation of AGVs to ensure the smooth flow of materials in harbor areas

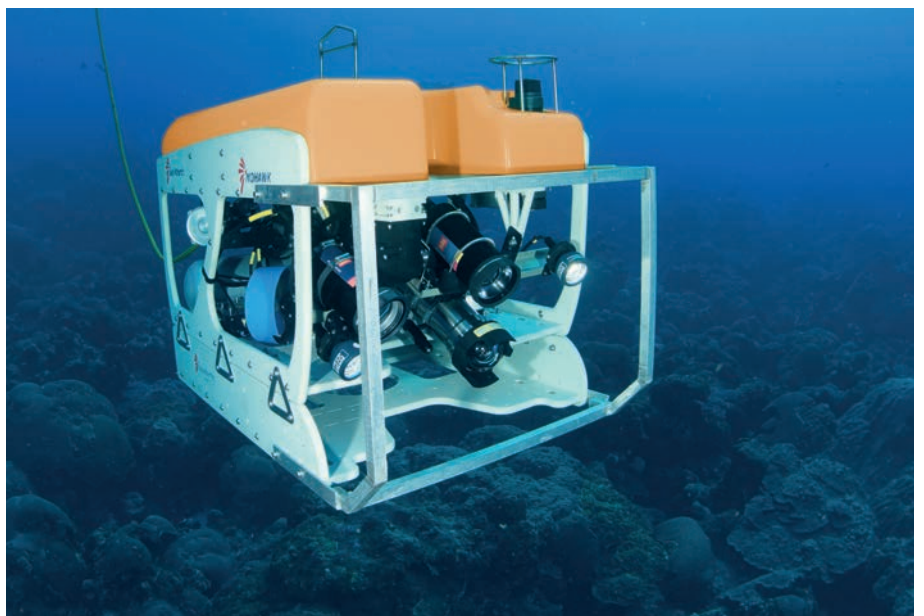


Detection and avoiding of torsional vibrations by performing vehicle dynamic tests



Ensuring operational safety due to measuring the angular acceleration of wind turbine blades

Underwater vehicles or remotely controlled diving robots also benefit from inertial measurement systems, because GNSS signals are not available even in shallow waters and magnetometers are disturbed by the metal walls of the craft



TACTICAL GRADE GYROSCOPES

ASC Gyro 28 series

UNIAXIAL – TRIAXIAL

MEMS Vibrating Ring Technology

The key components in industrial grade gyroscopes are high-quality micro-electromechanical systems (MEMS) that feature excellent long-term stability and reliability. The design of the micro-mechanical silicon structures makes the gyroscopes extremely insensitive to external impacts and vibrations. They are therefore ideal suited for use in harsh environmental conditions.

Description

Due to their very high performance, the gyroscopes fulfill the requirements of tactical grade applications with respect to the maximum achievable precision, which otherwise can be achieved only with fiber optic gyroscopes (FOG). The integrated electronic circuitry enables a very low noise quasi-differential analog voltage output (± 2.0 V FSO) and flexible power supply voltage from 8 to 30 VDC.

The uniaxial gyroscopes ASC 281 and triaxial gyroscopes ASC 283 feature a lightweight, reliable aluminum housing with protection class IP65 and a detachable cable with configurable length and connectors.

Applications

The excellent bias stability of these gyroscopes allows their use in applications such as gyro compassing, attitude heading reference systems AHRS or for orientation of underwater ROVs (remotely operated vehicles). Furthermore, as component of inertial systems the gyroscopes enable high-precision position measurements and bridging navigation in numerous areas of application, such as automated guided vehicles, ship guidance and control, robots, rail vehicles or aircraft systems.



Tactical Grade Gyroscopes	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC 281	uniaxial	Aluminium	-40 to +85 °C	IP65	80 g
ASC 283	triaxial	Aluminium	-40 to +85 °C	IP65	250 g

Measurement Range	°/s	±10	±25	±100	±200	±400
Scale Factor (sensitivity)	mV/°/s	200	80	20	10	5
Rate Noise Density	°/s/√Hz	0.007	0.007	0.012	0.012	0.012
Bandwidth (±3 dB)	Hz	50	50	100	100	100
Amplitude Non-Linearity	% FSO	<0.02 (typ) <0.05 (max)				
Bias Stability	°/hr	0.03	0.04	0.04	0.05	0.10
Angular Random Walk	°/√hr	0.005	0.006	0.006	0.008	0.010
Power Supply Voltage	V	8 to 30				
Scale Factor Error over Temp. Range	%	±0.15 (typ) ±0.50 (max)		±0.30 (typ) ±0.50 (max)		
Offset (bias) Error over Temp. Range	°/s	±0.10 (typ) ±0.20 (max)		±0.15 (typ) ±0.25 (max)		
Shock Limit	g	1000 (powered, 1 ms)				

ANALOG

DIGITAL

SMART

ACCESSORIES

CALIBRATION

ENGINEERING

MEMS INERTIAL MEASUREMENT UNIT (IMU)

ASC IMU 7

INDUSTRIAL GRADE IMUS

MEMS Capacitive Accelerometers and Vibrating Ring Technology as a 6-DOF System

ASC's analog inertial measurement units are based on three accelerometers and three gyroscopes that are integrated in a single housing. The modular concept allows to adapt all IMUs to the exact requirements of the application. Two different types of accelerometer series (Low Noise and Medium Frequency) are available and ideal measurement ranges for the accelerometers and gyroscopes are selectable and combinable. The design of the micro-mechanical silicon structures makes the IMU extremely insensitive to external impacts and vibrations. They are therefore ideal suited for use in harsh environmental conditions.

Description

The ASC IMU 7 features high bias stability and low angular random walk leading to industrial grade performance for detecting the smallest linear accelerations and angular rates. The LN (Low Noise) accelerometers provide an outstanding noise performance from 7 to 50 $\mu\text{g}/\sqrt{\text{Hz}}$

while the MF (Medium Frequency) accelerometers provide a wide frequency response range from 0 Hz to 4.5 kHz (± 3 dB). The integrated electronic circuitry enables separate analog voltage outputs for all 6 degrees of freedom and flexible power supply voltage from 5 (LN) or 6 (MF) to 40 VDC.

The IMU feature a lightweight, reliable aluminum housing with protection class IP65 and a detachable connector cable with configurable length and connectors.

Applications

The compact design of the ASC IMU 7 allows its use in applications for evaluating the driving dynamics of ships, trains or motor vehicles. IMUs are also used in automated guided vehicles (AGV), where they help to optimize curve speed and to control driving performance.



Industrial Grade IMUs	Power Supply Voltage	Housing Material	Operating Temperature	Protection Class	Weight
ASC IMU 7 LN	6 to 40 V	Aluminium	-40 to +85 °C	IP65	26 g
ASC IMU 7 MF	5 to 40 V	Aluminium	-40 to +85 °C	IP65	26 g

Accelerometers	ASC IMU 7 LN					ASC IMU 7 MF						
	Measurement Range	g	± 2	± 5	± 10	± 25	± 50	± 2	± 5	± 10	± 25	± 50
Scale Factor (sensitivity)	mV/g	2000	800	400	160	80	1350	540	270	90	54	
Noise Density	$\mu\text{g}/\sqrt{\text{Hz}}$	7	12	18	25	50	10	20	35	100	170	
Frequency Response Range ($\pm 5\%$)	Hz	0 to 250	0 to 400	0 to 700	0 to 1300	0 to 1600	0 to 700	0 to 1150	0 to 2000	0 to 2300	0 to 2700	
Amplitude Non-Linearity	% FSO	<0.15 (typ) <0.5 (max)					<0.1 (typ) <0.3 (max)					
Temp. Coefficient Scale Factor	ppm/K	± 200 (max)					120 (typ) 20 to 220 (max)					
Temp. Coefficient Offset (max)	mg/K	± 0.8	± 2	± 4	± 10	± 20	± 0.2	± 0.5	± 1	± 3	± 5	
Shock Limit	g	2000		5000			6000					

Gyroscopes	ASC IMU 7 LN				ASC IMU 7 MF			
	Measurement Range	$^{\circ}/\text{s}$	± 75	± 150	± 300	± 900		
Scale Factor (sensitivity)	mV/ $^{\circ}/\text{s}$	13.2		6.6		3.3		1.1
Rate Noise Density	$^{\circ}/\text{s}/\sqrt{\text{Hz}}$	0.018 (typ) 0.025 (max)						
Bandwidth (± 3 dB)	Hz	150						
Amplitude Non-Linearity	% FSO	<0.06 (typ) <0.15 (max)						
Bias Stability	$^{\circ}/\text{hr}$	12						
Angular Random Walk	$^{\circ}/\sqrt{\text{hr}}$	0.2						
Scale Factor Error over Temp. Range	%	± 0.5 (typ) ± 1.5 (max)						
Offset (bias) Error over Temp. Range	$^{\circ}/\text{s}$	± 1.0 (typ) ± 3.0 (max)						
Shock Limit	g	500 (operating, 1 ms) 10000 (survival, 0.1 ms)						



Cable Configurations ASC IMU 7



11L X-Y-Z-Axis

	Accelerometer	Gyroscope
Supply +	Signal +	Signal +
GND	Signal -	



14L2

X-Axes Accelerometer	Y-Z-Axis Accelerometer	X-Y-Z-Axis Gyroscope
Supply +	Signal +	Signal +
GND	Signal -	GND
Signal +		
Signal -		



11L2

X-Axes Accelerometer	Y-Z-Axis Accelerometer	X-Y-Z-Axis Gyroscope
Supply +	Signal +	Signal +
GND	Signal -	
Signal +		
Signal -		



14L3 - BNC-Banana

X-Y-Z-Axis	Accelerometer	Gyroscope
Supply +	Signal +	Signal +
GND	Signal -	GND
Shield		

It has never been easier to define your IMU regarding application-specific requirements in characterizing vehicle dynamics and driving comfort





MEMS INERTIAL MEASUREMENT UNIT (IMU)

ASC IMU 8

TACTICAL GRADE IMUS

MEMS Capacitive Accelerometers and Vibrating Ring Technology as a 6-DOF System

ASC's analog inertial measurement units are based on three accelerometers and three gyroscopes that are integrated in a single housing. The modular concept allows to adapt all IMUs to the exact requirements of the application. Ideal measurement ranges for the accelerometers and gyroscopes are selectable and combinable. The low noise and excellent long-term stability ensure reliable measurement of position changes in all 6 degrees of freedom, with high repeatability. Differential analog signal output also gives users maximum data processing flexibility.

Description

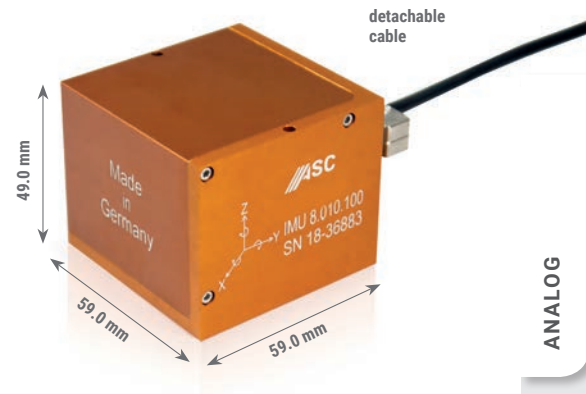
The ASC IMU 8 features outstanding bias stability and angular random walk leading to tactical grade performance for detecting the smallest linear accelerations and angular rates. The integrated electronic circuitry enables separate analog voltage outputs for all 6 degrees of freedom and flexible power supply voltage from 8 to 30 VDC. The ASC IMU 8 features outstanding in-run bias stability ($<45 \mu\text{g}$) of the integrated accelerometers. In addition, the gyroscopes providing FOG-like performance based on minimum angular random walk of $<0.01 \text{ }^\circ/\text{hr}$ and a bias stability of $<0.1 \text{ }^\circ/\text{hr}$.

ADAS are key technologies for autonomous driving and IMUs are used to acquire vehicle information during driving tests

The IMU feature a lightweight, reliable aluminum housing with protection class IP65 and a detachable connector cable with configurable length and connectors.

Applications

The ASC IMU 8 enables high-precision position measurements and bridging navigation in numerous areas of application, such as automated guided vehicles, ship guidance and control, robots, rail vehicles or aircraft systems.



FOG-like performance enables numerous applications where tactical grade bias stabilities are required

Tactical Grade IMUs	Power Supply Voltage	Housing Material	Operating Temperature	Protection Class	Weight
ASC IMU 8	8 to 30 V	Aluminium	-40 to +85 °C	IP65	260 g

Accelerometers			± 2 *	± 5 *	± 10 *	± 16	± 30
Measurement Range	g						
Scale Factor (sensitivity)	mV/g		1350	540	270	170	90
Noise Density	$\mu\text{g}/\sqrt{\text{Hz}}$		10	20	35	55	105
Frequency Response Range ($\pm 5\%$)	Hz	0 to 150					
Amplitude Non-Linearity	% FSO	<0.3 (typ) <1.0 (max)					
In-run Bias Stability	μg		3	7.5	15	25	45
Temp. Coefficient Scale Factor	ppm/K	120 (typ) 20 to 220 (max)					
Temp. Coefficient Offset (max)	mg/K		± 0.1	± 0.2	± 0.4	± 0.6	± 1.2
Shock Limit	g	1500 (single shock, 0.2 ms, 6 directions)					

Gyroscopes			± 10	± 25	± 100	± 200	± 400
Measurement Range	$^{\circ}/\text{s}$						
Scale Factor (sensitivity)	$\text{mV}/^{\circ}/\text{s}$		200	80	20	10	5
Rate Noise Density	$^{\circ}/\text{s}/\sqrt{\text{Hz}}$		0.007			0.012	
Bandwidth (± 3 dB)	Hz		50			100	
Amplitude Non-Linearity	% FSO	<0.02 (typ) <0.05 (max)					
Bias Stability	$^{\circ}/\text{hr}$		0.03	0.04	0.04	0.05	0.10
Angular Random Walk	$^{\circ}/\sqrt{\text{hr}}$		0.005	0.006	0.006	0.008	0.010
Scale Factor Error over Temp. Range	%		± 0.15 (typ) ± 0.50 (max)			± 0.30 (typ) ± 0.50 (max)	
Offset (bias) Error over Temp. Range	$^{\circ}/\text{s}$		± 0.10 (typ) ± 0.20 (max)			± 0.15 (typ) ± 0.25 (max)	
Shock Limit	g	1000 (powered, 1 ms)					

* Based on high-end specification of the ASC IMU 8, please note that an export license is required for the accelerometer's measurement ranges ± 2 g, ± 5 g and ± 10 g due to dual use category 7A101. Please contact us for further information.



Benefits and features of digital sensors

An external data acquisition system is mandatory when analog sensors are implemented in different applications. However, an external data acquisition system is unnecessary due to already integrated analog to digital conversion circuitry, which reduces the overall solution cost.

One of the digital sensors main advantages is their robust anti-interference ability, making them ideal in industries and harsh environments with high electromagnetic radiation. The solid electromagnetic compatibility enables the digital sensors to send undistorted and reliable measurement data over longer distances. Furthermore, since digital sensors have a memory for data storage and unique sensor-Ids, the status of each sensor can be checked respectively after multiple sensors are connected in the BUS-system to facilitate fault diagnosis. The diagnostic data delivers the detailed status of the sensor, such as if a sensor element is defect or if an error occurred in data transmission (e.g. fault or overloaded in CAN-BUS).

With the status information provided by the digital accelerometer sensor, the whole system is more robust and efficient because the data provides the customer with a more comprehensive inspection of the system operation. In addition to the reliable measurement data and status information capabilities, digital sensors allow cheap and easy integration in industrial and embedded computers (programmable logic controllers) and implementation of IoT and big data applications.



DIGITAL SENSORS AND INTERFACE

The clever solution in digital measurement

ASC GmbH provides low-noise, industrial-grade digital accelerometers via communication interfaces like CAN, RS232, and USB. ASC DiSens® series support different user-friendly device configuration commands, making them suitable for various applications. For example, the ability to configure sampling frequency and the corresponding digital low pass filter, setting the sensor's measurement range or storing calibration data.

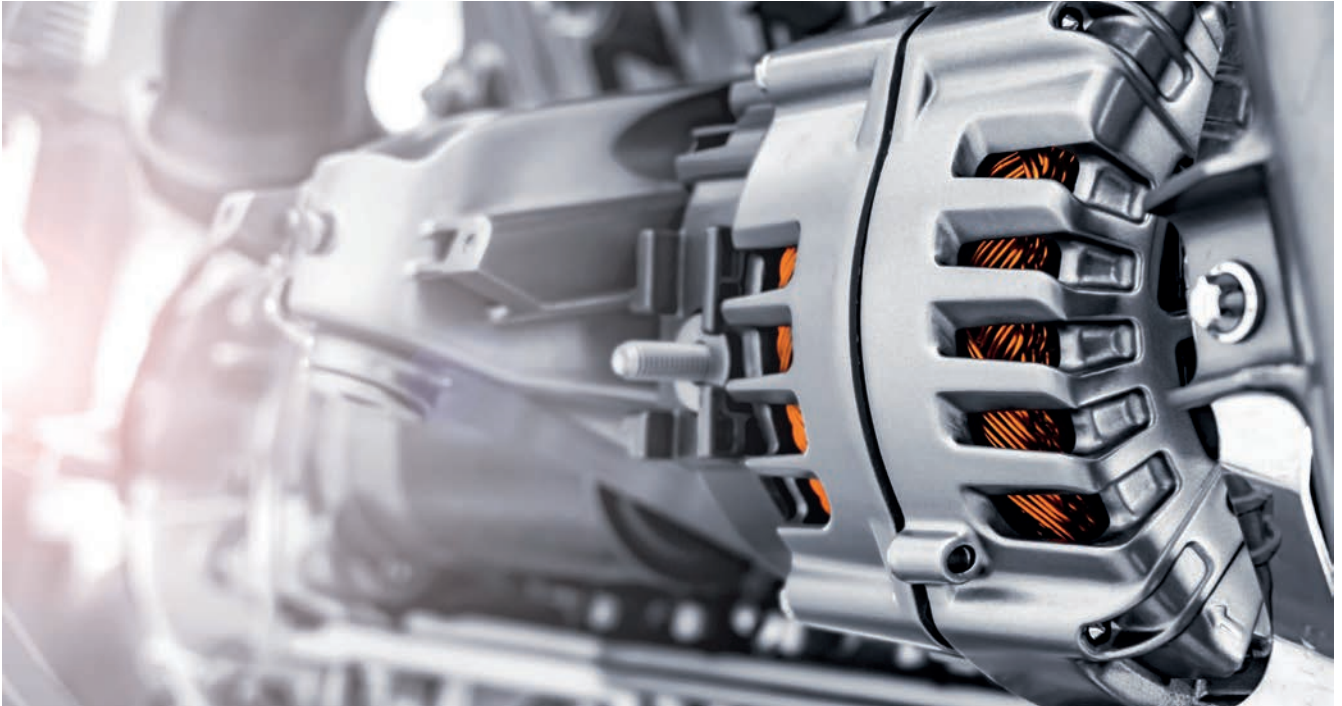
Damages and aging of bridges or infrastructure are leading to roadworks, traffic obstructions or road closures. However, continuous condition monitoring of buildings by means of inertial sensors is also known as structural health monitoring (SHM). These measurements provide valuable information both for construction calculations and for regular safety inspections of critical building components. Maximum precision and reproducibility of measurements are the requirements of sensors in SHM systems – especially with a view toward long-term monitoring of seasonal or cyclical influences, and also the detection of overloads or material defects.

For this reason the ASC DiSens® EQ was developed in a customized project for bridge monitoring. The sensor is based on the analog ASC EQ-series and is extended with a very high accurate analog-digital converter and digital processing unit with USB interface. That means,

the triaxial, digital sensor combines sensor technology and data acquisition in one system, features an ultra low noise level and achieves a resolution of less than 1 μg .

Already implemented filter settings enabling a sampling rate of 500 Hz at a 3dB-corner frequency of 80 Hz leading to an outstanding ENOB of around 20 bits. Furthermore, there is an option for external synchronization of the devices.

- **Combining sensor technology and data acquisition in one system**
- **Reliable data transmission over long distances**
- **User friendly device configuration and diagnostic**



DIGITAL SENSORS AND INTERFACE

ASC DiSens® ECO series

TRIAxIAL

MEMS Capacitive Technology

The key components in capacitive accelerometers are high-quality micro-electro-mechanical systems (MEMS) that feature excellent long-term stability and reliability. This proven technology enables the measurement of static (DC) and constant as well as dynamic (AC) accelerations. Other advantages of accelerometers based on capacitive operating principle are their outstanding temperature stability, excellent response behavior and achievable resolution.

Description

The digital accelerometers of type ASC DiSens® ECO featuring an extremely robust design which leads to a shock resistance up to 10,000 g. The integrated electronic circuitry enables the digital interfaces USB, CAN or RS232 as well as a flexible power supply voltage from 5 to 30 VDC. The sensors of the ASC DiSens® ECO series provide already implemented filter settings enabling a sampling rate of up to 4 kHz at a 3dB-corner frequency of 1 kHz.

The sensors feature a lightweight, reliable aluminum housing with protection class IP67 and a detachable cable with configurable length and connectors.

Applications

The triaxial accelerometers allow quick and easy mounting. Due to several options for digital interfaces and filter settings the ASC DiSens® ECO series is ideally suited for condition monitoring and industrial applications.

equipped with detachable cable based on the selected interface



- User friendly configuration of filter settings and measurement ranges
- Enables the use of long cables
- Use in applications with electromagnetic interference



Impacts of up to 400 g can be expected, especially in rail applications. This can lead to overload with analog sensors, which affects post processing, as valuable measurement data is cut off or signal shapes are deformed. The ASC DiSens® ECO accelerometers therefore have already implemented filter settings to adapt data rate and cut-off frequency to the respective measurement task

Digital Sensors and Interface	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC DiSens® ECO-3321-CAN	triaxial	Aluminium	-40 to +85 °C	IP67	80 g
ASC DiSens® ECO-3321-RS232	triaxial	Aluminium	-40 to +85 °C	IP67	80 g

Configurable Measurement Range	(g)	±2			±4			±8			±10			±20			±40		
		Scale Factor (sensitivity)	Noise Density	Sample Rate	Corresponding 3dB-Corner Frequency	Amplitude Non-Linearity	Power Supply Voltage	Temp. Coefficient Scale Factor	Temp. Coefficient Offset (max)	Shock Limit	Scale Factor (sensitivity)	Noise Density	Sample Rate	Corresponding 3dB-Corner Frequency	Amplitude Non-Linearity	Power Supply Voltage	Temp. Coefficient Scale Factor	Temp. Coefficient Offset (max)	Shock Limit
	LSB/g	256000	128000	64000	51200	25600	12800												
	µg/√Hz	22.5	25	30	75	80	90												
	Hz	3.906 to 4000			3.906 to 4000			3.906 to 4000			3.906 to 4000			3.906 to 4000			3.906 to 4000		
	Hz	0.977 to 1000			0.977 to 1000			0.977 to 1000			0.977 to 1000			0.977 to 1000			0.977 to 1000		
	% FSO	0.1	0.8	1.6	0.1	0.5	1.3												
	V	5 to 30			5 to 30			5 to 30			5 to 30			5 to 30			5 to 30		
	ppm/K	±100 (typ)			±100 (typ)			±100 (typ)			±100 (typ)			±100 (typ)			±100 (typ)		
	mg/K	±0.1 (typ) ±0.15 (max)			±0.2 (typ) ±0.75 (max)			±0.2 (typ) ±0.75 (max)			±0.2 (typ) ±0.75 (max)			±0.2 (typ) ±0.75 (max)			±0.2 (typ) ±0.75 (max)		
	g _{pk}	5000			10000			10000			10000			10000			10000		



System monitoring of cranes, floating dredgers or angular alignment for solar collectors

DIGITAL FLUIDIC TILT SENSOR

ASC TSF

UNIAXIAL

Fluidic Tilt Sensor Technology

The fluidic tilt sensors are using the physical effect that the surface of liquids is always aligned exactly horizontally due to gravity. By means of a suitable electrode arrangement, the angle between the sensors and the horizontal is capacitively measured with a dielectric liquid.

Description

The integrated electronic circuitry of the ASC TSF ensures a flexible power supply voltage from 9 to 32 VDC. The analog measurement data is internally digitized and available via the CAN/CANopen interface. Due to internal compensation, the uniaxial tilt sensor features accuracy of better than 0.15° over complete measurement range of 360° and a temperature range from -40 °C to +85 °C, with a resolution of 0.01°. The tilt sensors feature a robust and reliable aluminum housing with protection class IP67 and a standard 5-pin M12 CAN connector.

Applications

The easy integration makes the tilt sensors especially suitable for system monitoring of cranes and construction machines, as well as the orientation of solar collectors and agricultural vehicles in the field.



- Accurate measurements due to static principle
- Internal compensation over operating measurement and temperature range
- Configurable settings using CAN interface
- Already calculated angle output

Digital Fluidic Tilt Sensor	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC TSF-360-CAN	uniaxial	Aluminium	-40 to +85 °C	IP67	80 g

Measurement Range	°	360
Accuracy (over temp. range +10 °C to +40 °C)	°	<0.10
Accuracy (over temp. range -40 °C to +85 °C)	°	<0.15
Resolution	°	<0.01
Baud Rate (options, selectable)	kbit/s	10 20 50 100 125 250 500
Power Supply Voltage	V	9 to 32

DIGITAL

SMART

ACCESSORIES

CALIBRATION

ENGINEERING



- **ADJUSTMENTS**
Flexibility in configuration of filter settings and measurement ranges to fulfill application specific requirements
- **PRE-PROCESSING**
Mathematical operations to calculate average and standard deviation over configurable time
- **ANALYZING**
Frequency analysis due to internal Fast Fourier Transformation (FFT) and alarming functionality due to threshold detection
- **ALGORITHMS**
Calculating and output of velocity and displacement based on the acceleration data and internal algorithms for offset and drift compensation
- **DATA PROCESSING**
Customized implementation of algorithms due to APIs allows data and trend analysis as well as anomaly recognition based on domain specific know-how



SMART SENSOR SYSTEMS

The revolution in sensor technology

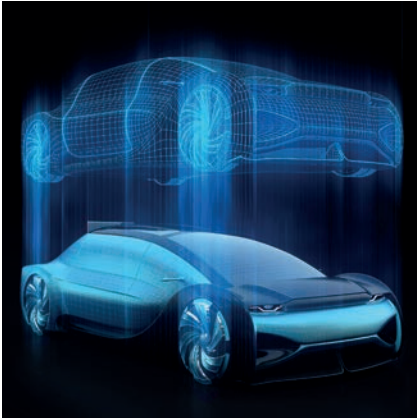
What makes a sensor system smart?

Analog measurement technology and experience from many applications are the basis for the implementation of the ASC AiSys® smart sensor systems. The functional modular system is based on proven hardware components - for example reliable sensor elements for the determination of acceleration and/or angular velocity as well as the housing and cable assembly adapted to the harsh environmental conditions. Furthermore, additional electronics for analog-to-digital conversion and standardized interfaces are integrated.

The main feature of the sensor systems, however, is their ability to evaluate the acquired data and extract predefined feature vectors. The ASC AiSys® smart sensor systems provide information and the user takes care of which information is visualized and required for the corresponding users. Data security is always up to the user and APIs (programming interfaces) enable the integrating of customer-specific algorithms.

ASC also develops algorithms that allow speed and displacement to be calculated on the ASC AiSys® smart sensor system. This has already been successfully implemented in a project to develop a sensor-based intelligent monitoring system for wind turbines. The aim was to calculate the tower deflection from the measured accelerations in order to determine wear types and aging processes. In addition to the numerical integrations, it is necessary to compensate static offset components and drift-dependent components by means of frequency analyses. All calculation steps were carried out completely on the smart sensor system and can be adapted to specific applications.

The basis for new technologies



Digital Twin

A digital twin is the virtual model of a real physical object. It connects the real and virtual world. Digital twins are brought alive by real sensor data, which exactly determine working conditions or machine positions, for example. Interconnection of the two worlds and analysis of the data collected by the sensors enables early detection and elimination of problems in product development and utilization. This makes it possible to prevent machine and system failures and to develop new products without expensive physical prototypes.

Smart sensor systems ASC AiSys® are converting the acquired raw data to information. Those information are accessible by Digital Twins through flexible interfaces. Due to the integration of functionalities and features regarding data analyses directly in the smart sensor systems ASC AiSys® the overall system is significantly simplified.



Artificial Intelligence (AI)

Artificial intelligence helps to understand complex contexts and to describe them in mathematical equations. AI makes it possible to analyze large data volumes and, for example, to automatically create rules for optimal control processes. Smart sensors have the capability to analyze feature vectors and to make decisions independently. This results in decentralized systems in which single sensor nodes operate independently of each other, yet are linked together to optimize processes.

The smart sensor systems ASC AiSys® are optimally adapted to the requirements of artificial intelligence. They combine intelligent analysis with communication!



Monitoring Solutions

The basic concept of predictive maintenance is quite simple: Early detection of critical changes can prevent dangerous situations before damage occurs. This requires knowledge of the relevant parameters, as well as continuous monitoring and comparison with target values. ASC sensors provide the high-precision and reliable measurements needed to achieve this.

The better the data quality, the more reliable the prediction!
Machine learning and artificial intelligence reveal the features that are necessary for early detection of damage. During normal operation the digital twin then provides the information needed to determine whether processes are within the optimal range and when maintenance has to be planned.

Benefits

- Better planning of servicing and maintenance concepts
- Sustainable optimization of spare parts management
- Substantially higher system availability
- Significant reduction of life cycle costs
- Distinctly higher productivity and efficiency

Flexible programming and high data quality make the smart sensor system ASC AiSys® ideal for use in predictive maintenance.



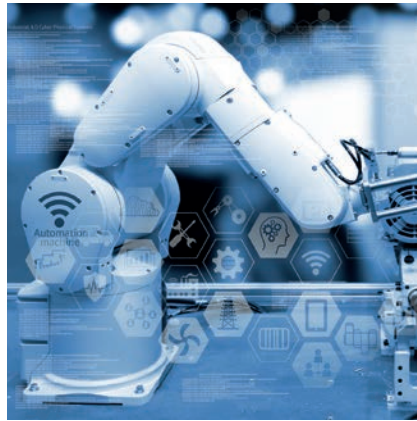
Digital Rail

The modernization of the infrastructure and the railway vehicles is a basic requirement in order to optimize track capacities and handle the increasing volume of traffic. However, the digitization of the rail systems requires reliable and intelligent sensor solutions. With its smart sensor systems ASC AiSys®, ASC offers the right answer to these challenges.

The smart sensor system ASC AiSys® combine the complete measuring task in one single system and are based on a modular concept. This includes the integrated hardware components – like reliable and proven sensor elements for determining an acceleration and/or angular velocity, the housing which is adapted to the harsh environmental conditions as well as bidirectional, wireless or wired data communication with a large number of standardized interfaces. Furthermore, the modular concept also includes the flexibly combinable software components and algorithms in order to be able to analyze and evaluate the preprocessed measurement data and feature vectors directly on the smart sensor.

Smart monitoring solutions that are working in real time not only identifying the actual conditions of railway vehicles and infrastructure. Using self-learning algorithms, predictive analyses are done to describe the progress of future material weaknesses.

Thanks to the ASC's smart sensors maintenance tasks can be scheduled and performed much more efficiently!



Smart Factory

A smart factory uses numerous new technologies. However, this is relevant not only for the production process within a factory, but for the entire company. In addition to using a digital twin with predictive maintenance to boost system availability, there are many other applications, such as virtual initial operation: Virtual initial operation makes it possible to install and test a factory or system in a simulated environment. The system's digital twin makes all the information available as if the system were operating in reality. All processes can therefore be designed and tested prior to actual initial operation. In addition, employees can be trained in advance and acquainted with operation of the system. This enables a seamless switch to operation of the actual system, without the need for a transition period. Smart sensors provide fundamental data for this process: In simulation mode the sensors can deliver predefined measurements with appropriate analyses in order to simulate diverse situations for operation of the system. Afterwards, the smart sensors measure real values again, without having to replace or modify the sensors.

Smart sensors from ASC provide system parameters in real time! The current condition of systems and of the entire factory is therefore transparent at all times.



Smart Shipping

Predictive maintenance also represents a technological step in shipping. Especially container ships are powered by giant engines, which – once they are started – cannot be shut down again. Very early damage detection is extremely important for the planning of repairs. Since smart sensors enable precise identification of damage, this facilitates organization of the necessary replacement parts.

But the sensors also measure and process operating parameters and ambient conditions such as temperature, wind and sea state with the help of artificial intelligence. The result is optimal long-term adaptation of operating parameters, which also significantly reduces fuel consumption.

Smart sensor systems ASC AiSys®, with their robust design, high measuring accuracy and flexibility, offer the ideal basis for increased efficiency and availability!



SMART SENSOR SYSTEMS

ASC AiSys® ECO series

TRIAXIAL

Smart Sensor Systems Technology

Smart sensor systems play a central part in digitization and networking: They enable the basis for numerous monitoring solutions and innovative applications. Based on a modular concept, which contains the complete measuring task from the acquisition of physical input values, through the implementation of complex decision algorithms, to the analysis of the extracted, application-specific feature vectors in one compact sensor system.

Description

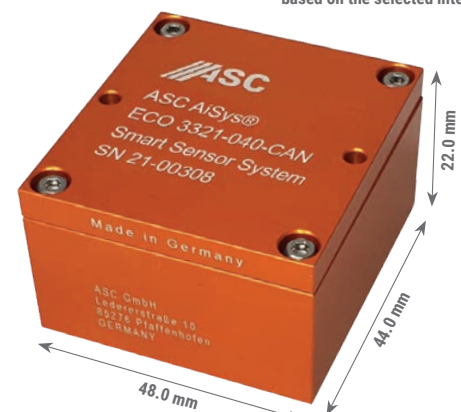
The smart sensor systems ASC AiSys® ECO 3321 are based on proven MEMS technology and capacitive operating principle. Furthermore, the integrated electronic circuitry enables acquisition and real-time analysis of accelerations. The acquired data are internally processed while FIR and IIR filters as well as algorithms for extracting feature vectors are already preconfigured. Digitalized g-values and results of frequency analyses are accessible by a CAN oder RS232 interface which also provide an alarming option based on threshold detection. Further functionalities could be easily implemented due to a modular concept of hardware and firmware components.

The smart sensor systems feature a lightweight, reliable aluminum housing with protection class IP67 and a detachable cable with configurable length and connectors.

Applications

The smart sensor systems ASC AiSys® ECO 3321 monitor the properties and behavior of components, vehicles, machines or infrastructures and are used for condition monitoring in real time. Furthermore, those systems are ideally suited to merge historical and current data and using this to determine the future development of the critical parameters. Especially, these analyzes enable predictive maintenance solutions but are also used in digital twins which help to automate process flows and thus make them more efficient.

equipped with detachable cable based on the selected interface





Especially, structural health monitoring of bridges is based on determination of critical vibration velocity and the calculation of the displacement which is proportional to the stress of the components

- User friendly configuration of filter settings and measurement ranges
- Frequency analysis due to internal Fast Fourier Transformation (FFT)
- Mathematical operations to calculate average and standard deviation over configurable time
- Calculating and output of velocity and displacement based on the acceleration data and internal algorithm for offset and drift compensation

Smart Sensor Systems	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC AiSys® ECO 3321-CAN	triaxial	Aluminium	-40 to +85 °C	IP67	80 g
ASC AiSys® ECO 3321-RS232	triaxial	Aluminium	-40 to +85 °C	IP67	80 g

Configurable Measurement Range	(g)	±2	±4	±8	±10	±20	±40
Noise Density	µg/√Hz	22.5	25	30	75	80	90
Sample Rate	Hz	3.906 to 4000			3.906 to 4000		
Corresponding 3dB-Corner Frequency	Hz	0.977 to 1000			0.977 to 1000		
Amplitude Non-Linearity	% FSO	0.1	0.8	1.6	0.1	0.5	1.3
Power Supply Voltage	V	5 to 40			5 to 40		
Temp. Coefficient Scale Factor	ppm/K	±100 (typ)			±100 (typ)		
Temp. Coefficient Offset (max)	mg/K	±0.1 (typ) ±0.15 (max)			±0.2 (typ) ±0.75 (max)		
Shock Limit	g _{pk}	5000			10000		

ASC AiSys[®] VibroTherm[®] series

TRIAxIAL

Smart Sensor Systems Technology

Smart sensor systems play a central part in digitization and networking: They enable the basis for numerous monitoring solutions and innovative applications. Based on a modular concept, which contains the complete measuring task from the acquisition of physical input values, through the implementation of complex decision algorithms, to the analysis of the extracted, application-specific feature vectors in one compact sensor system.

Description

The smart sensor systems ASC AiSys[®] VibroTherm[®] are based on proven MEMS technology and capacitive operating principle. Furthermore, the integrated electronic circuitry enables time-synchronous acquisition and analysis of accelerations and temperature. The acquired data are internally processed while FIR and IIR filters as well as algorithms for extracting feature vectors are already preconfigured. Digitalized g-values, results of frequency analyses and temperature information are accessible by a CAN bus interface which also provides an alarming option based on threshold detection. Further functionalities could be easily implemented due to a modular concept of hardware and firmware components.

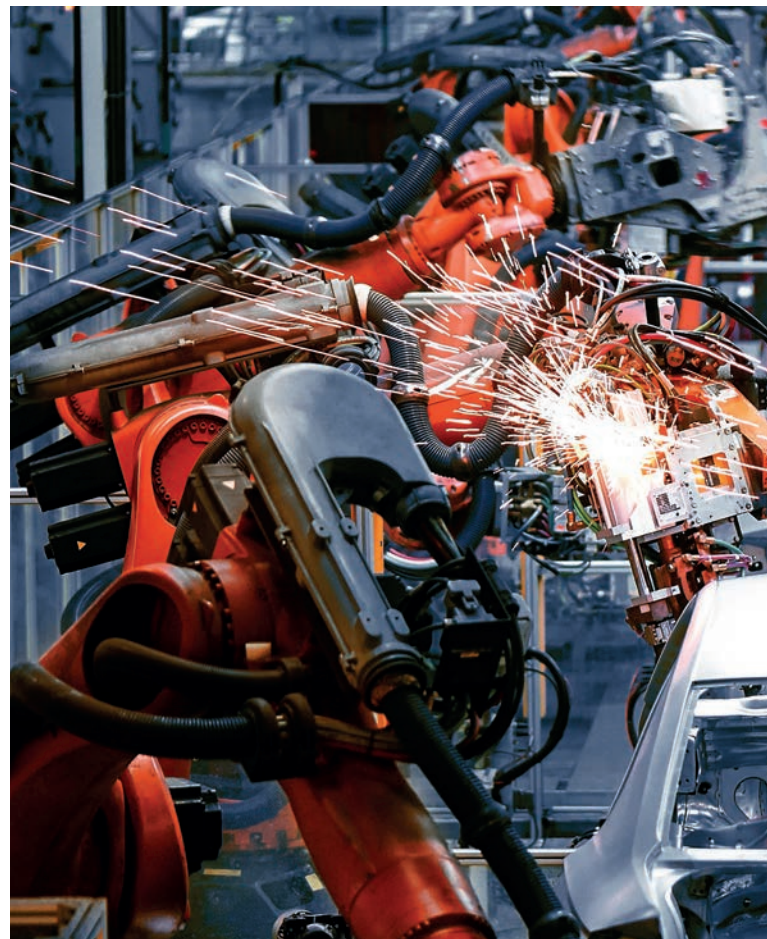
The smart sensor systems feature a lightweight, reliable aluminum housing with protection class IP68 and an integrated cable with configurable length as well as a standardized CAN bus interface including already assembled DSUB connector at the cable end.

Applications

The smart sensor systems ASC AiSys[®] VibroTherm[®] monitor the properties and behavior of components, vehicles or machines, especially when critical vibrations as well as oil temperatures on motors, bearings or gears have to be acquired and analyzed synchronously. Therefore, those systems are ideally suited for condition monitoring in real time. However, the real intelligence consists in merging the historical and current data and using this to determine the future development of the critical parameters. Especially, these analyzes enable predictive maintenance solutions but are also used in digital twins which help to automate process flows and thus make them more efficient.

Features of the Temperature Measurement

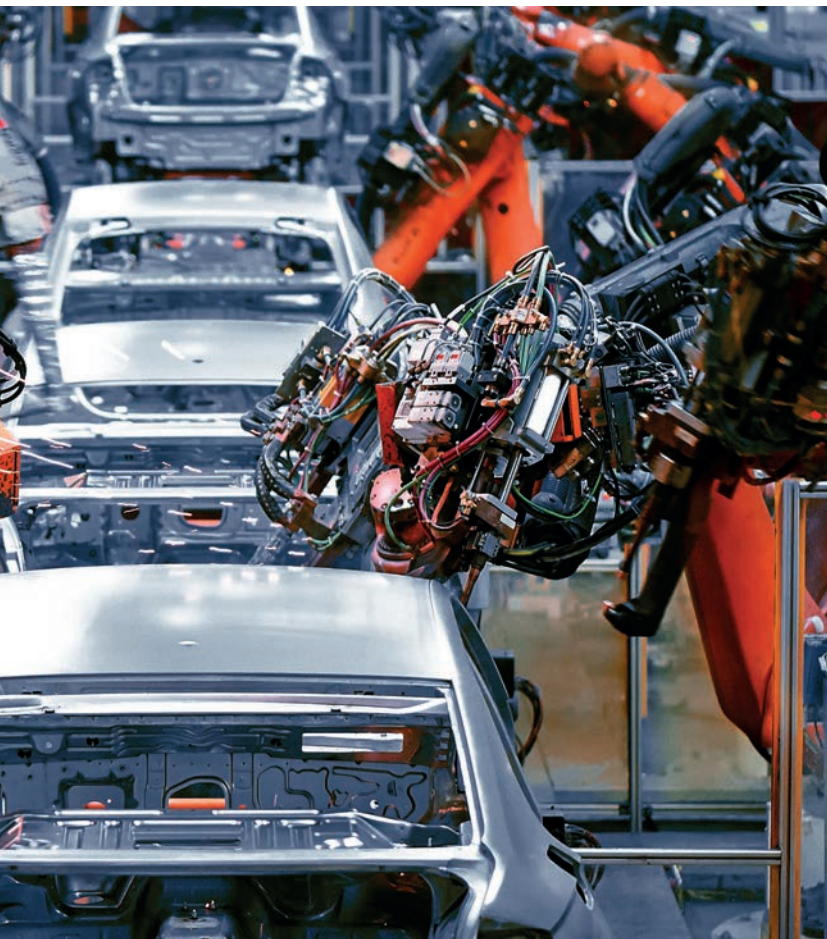
- Single or dual Pt100 measuring resistors
- Measurement range from -40 °C to +125 °C
- Sampling rate 50 Hz
- Resolution 15 bit
- Protective sleeve with a diameter between 5 mm to 12 mm
- Shielded connecting line in 2-, 3- or 4-wire connections
- Fire behavior according to DIN EN 45545
- Shock and vibration resistant according to DIN EN 61373 cat. 3



Direct connection to the control system to enable real time condition monitoring solutions for Industry 4.0 applications

Smart Sensor Systems	Sensitive Directions	Housing Material	Operating Temperature	Protection Class	Weight
ASC AiSys® VibroTherm®	triaxial	Aluminium	-20 to +85 °C	IP68	80 g







Configurable Measurement Range	(g)	±2	±4	±8	±10	±20	±40
Noise Density	µg/√Hz	22.5	25	30	75	80	90
Sample Rate	Hz	3.906 to 4000			3.906 to 4000		
Corresponding 3dB-Corner Frequency	Hz	0.977 to 1000			0.977 to 1000		
Amplitude Non-Linearity	% FSO	0.1	0.8	1.6	0.1	0.5	1.3
Power Supply Voltage	V	5 to 40			5 to 40		
Temp. Coefficient Scale Factor	ppm/K	±100 (typ)			±100 (typ)		
Temp. Coefficient Offset (max)	mg/K	±0.1 (typ) ±0.15 (max)			±0.2 (typ) ±0.75 (max)		
Shock Limit	g _{pk}	5000			10000		






- **User friendly configuration of filter settings and measurement ranges**
- **Frequency analysis due to internal Fast Fourier Transformation (FFT)**
- **Mathematical operations to calculate average and standard deviation over configurable time**
- **Synchronized acquisition of vibrations and temperature for early failure detection and avoiding unplanned downtimes**

ACCESSORIES

Mounting Plates and Blocks

Mounting Plates	Compatible with	Description	Material	Art. Nr.	L x W x H in mm
	ASC 44 series ASC IMU series	ASC Mounting Plate 44/IMU	Aluminium	10499	30 x 25 x 7
	ASC 54 series ASC 55 series ASC 43 series	ASC Mounting Plate 54/55/43	Aluminium	10491	25 x 23 x 7
	ASC 54 series ASC 55 series	ASC Mounting Plate 54/55	POM	13354	25 x 17 x 7
	ASC 75 series	ASC Mounting Plate 75	Aluminium	12483	22 x 15 x 7
	ASC OS series	ASC Mounting Plate 115PG/125PG/215/315	Stainless steel	13422	30 x 30 x 10
	ASC OS series	ASC Mounting Plate 115/125	Stainless steel	14749	25 x 25 x 7

Mounting Blocks	Compatible with	Description	Material	Art. Nr.	L x W x H in mm
	ASC 44 series	ASC Mounting Block 44, triaxial	Aluminium	10604	27 x 27 x 27
	ASC 43 series	ASC Mounting Block 43, triaxial	Aluminium	10508	23 x 23 x 25
	ASC OS series	ASC Mounting Block for ASC OS series incl. 12 strews M3x20	Aluminium	15145	37 x 41 x 27

Safety precaution

Safety precaution for installing and operating

Handling, electrical connections, mounting or any other work performed at the sensor must be carried out by authorized experts only. Appropriate safety precautions must be taken to exclude any risk of personal injury and damage to operating equipment as a result of a sensor malfunction.

Handling

The sensors and sensor systems are packaged in reliable housings to protect the sensing elements and integrated electronic components from the ambient environment. However, poor handling of the product can lead to damages that may not be visible and cause electrical failure or reliability issues. Handle the component with caution:

- Avoid shocks and impacts on the housing, such as dropping the sensor on hard surface
- Never move the sensor by pulling the cable
- Make sure that the sensor is used within the specified environmental conditions
- Transport and store the sensor in its original or similar packaging
- The sensor should be mounted on a stable flat surface with all screws tightened or other mounting options
- When adhesives are used to mount the sensors, please select the corresponding products according to
 - permanent or removable mounting
 - ambient temperature range
 - quality of the mounting surface
- Avoid any deformation during mounting the sensor
- Mounting tolerances may have an influence on the measured result

Electrical

ASC's inertial sensors are working with many established data acquisition systems. However, make sure that a proper DAQ is used, for the corresponding operation principle of the sensor. Furthermore, suitable precautions shall be employed during all phases of shipment, handling and operating:

- Active sensor pins are susceptible to damage due to electrostatic discharge (ESD)
- Make sure that the sensor is used within the specified electrical conditions
- Check all electrical connections prior to initial setup of the sensor
- Completely shield the sensor and connecting cable
- Do not perform any electrical modifications at the sensor
- Do not perform any adaptations on the wiring or connectors while the device under power
- Never plug or unplug the electrical connection while the sensor is under power
- When a certain pin is not used during operation, make sure that the pin is insulated

Quality

We have a quality management system according to ISO 9001:2015.

The Deutsche Akkreditierungsstelle GmbH (DAkkS) has awarded to our calibration laboratory the DIN EN ISO/IEC 17025:2018 accreditation for calibrations and has confirmed our competence to perform calibrations in the field of mechanical acceleration measurements. The registration number of the certificate is **D-K-18110-01-00**.

All ASC products are -compliant.

ASC CALIBRATION SERVICE

We calibrate your inertial sensors – with reliability and precision

Sensors have to be calibrated at regular intervals to ensure high-precision measurements in the long term.

Our calibration lab is accredited in accordance with DIN EN ISO/IEC 17025:2018 for the measurement of acceleration – for both sinus and shock calibration.

We calibrate accelerometers and vibration sensors of all manufacturers, regardless of the technology:

- Capacitive accelerometers
- Piezoelectric accelerometers (IEPE)
- Piezoresistive accelerometers

Our specialists also calibrate rod potentiometers and cable position sensors, as well as – in cooperation with partners – gyroscopes and tilt sensors.

The ASC calibration lab offers

- Factory calibrations
- DAkkS calibrations in accordance with Directive DKD-R 3-1 for acceleration

Our professional calibration guarantees the quality of your sensors!

On request we will be glad to remind you of the next scheduled calibration.

Would you like us to calibrate your sensors?

Our calibration lab employees use a modern spectra calibration system for all calibrations of sensors for acceleration measurement. We test your sensors in accordance with the DKD-R 3-1 guideline and issue a detailed calibration certificate. For both factory and DAkkS calibrations, this certificate contains information regarding the frequency response and measurement uncertainties in addition to the measured scale factor coefficients.

If you decide for a DAkkS calibration, the certificate proves the traceability to national standards as required by the family of standards DIN EN ISO 9000 and DIN EN ISO/IEC 17025.



For rod potentiometers and cable position sensors we offer factory calibrations.

Gyroscopes and tilt sensors are calibrated by our partners, both as factory calibrations and DAkkS calibrations.

Ask us about your calibration requirement and we will send you an offer for your sensor. If you have special requests, such as how your sensor should be calibrated, custom calibration ranges are also available, of course.

Do you have any questions about our calibration service?

Feel free to contact our calibration lab director Sonja Bernhardt.
E-Mail: calibration@asc-sensors.de
Phone: +49 8441 786547-0



Our calibration service at a glance

Calibration procedure	DAkKS accredited calibration	Factory calibration
Traceability	Certificate proves the traceability to national standards as required by the family of standards DIN EN 9000 and DIN EN ISO/IEC 17025	Certificate doesn't prove the traceability to national standards
Low-frequency sinus calibration		
Calibration method	DKD-R 3-1 Blatt 3 Stand 05/2020	DKD-R 3-1 Blatt 3 Stand 05/2020
Frequency range	0.4 Hz to 160 Hz	0.4 Hz to 160 Hz
Measurement range	0.5 m/s ² to 20 m/s ²	0.5 m/s ² to 20 m/s ²
Frequency support points	Based on 1/3 octave	Based on 1/2 octave
Number of measuring cycles	6	3
Medium-frequency sinus calibration		
Calibration method	DKD-R 3-1 Blatt 3 Stand 05/2020	DKD-R 3-1 Blatt 3 Stand 05/2020
Frequency range	5 Hz to 10 kHz	5 Hz to 10 kHz
Measurement range	10 m/s ² to 300 m/s ²	10 m/s ² to 300 m/s ²
Frequency support points	Based on 1/3 octave	Based on 1/2 octave
Number of measuring cycles	6	3
Pendulum shock calibration		
Calibration method	DKD-R 3-1 Blatt 2 Stand 04/2019	DKD-R 3-1 Blatt 2 Stand 04/2019
Measurement range	300 m/s ² to 2000 m/s ²	300 m/s ² to 2000 m/s ²
Support points	At 20 g intervals	At 40 g intervals
Number of measuring cycles	1	1
Rod potentiometers and cable position sensors	not accredited for length calibration	0 – 600 mm



ENGINEERING

Our customers get not only a sensor, but an individual complete sensor solution for their application

The choice of suitable inertial sensors is a challenge even for experienced measurement engineers. Our experts will be glad to assist you.

Which sensor is best suited?

Often it is not immediately clear which sensor type is needed for the measurements of the particular application. The specialists at ASC have extensive industry expertise and know what is important in choosing a sensor.

What are the different sensor technologies?

Whether analog, digital or smart: every application requires a different technology. We will help you to find the right sensor solution for your application.

Which measurement range do I need?

Are you unsure about the measurement range needed for your application? Our engineers will analyze the application with your help and then define the ideal parameters.

Are you looking for a customized solution?

Our goal is to offer you the optimal sensor for your application. We will therefore be glad to develop an entirely new solution for you. If desired, we can implement the entire engineering process – from planning through to the finalized sensor.

Always there for you, in person

At ASC you always have the same contact person, whom you can reach quickly and directly. Whenever you want information or a consultation: we take the time to assist you!

Do you require a personal consultation?

Together we will find the optimal solution for your testing or monitoring application.

Feel free to contact us. We will be glad to assist you with detailed and individual advice.

E-Mail: service@asc-sensors.de

Phone: +49 8441 786547-35



ASC's team of engineers are glad to make their competence available to you in the design and implementation of development and research projects. We provide advice and support during the planning and operational project management phases.

If the functionality of a standard sensor is not sufficient for your needs, we will gladly develop a custom solution for you.

As the customer you are always up to date on the current stage of development

The first step is to jointly conduct a requirements analysis to define the requirements of the overall system. This includes not only the sensors, but also data communication and data analysis. In the design and development phase that follows, we apply an iterative approach, which results in close coordination with you throughout development. This ensures early detection of changes in the requirements and their integration in the development process. Our job involves implementation of numerous development steps, for both hardware and software!

„ASC is participating regularly on R&D projects to ensure a high grade of innovation.“

CONTACT

Nothing is more important for us than dialog with people interested in our measurement solutions and company. Test us. We will be delighted to hear from you.

Please contact our customer service representative if you have any questions concerning our products and solutions:

sales@asc-sensors.de
+49 8441 786547-49

Please contact our HR manager if you have any questions about working for ASC.

bewerbung@asc-sensors.de
+49 8441 786547-40

The company's management team will happily answer any questions about the company and possible partnerships.

management@asc-sensors.de
+49 8441 786547-42

If you are a journalist and require information or material, please contact:

press@asc-sensors.de
+49 8441 786547-40

SALES PARTNERS

The ASC accelerometers, gyros, tilt sensors and IMUs are manufactured in Pfaffenhofen, Germany, and used worldwide.

Orders from Germany, Austria and Switzerland are handled directly at our headquarter in Pfaffenhofen, Germany.

If you are ordering from another country, please contact one of our sales partners in your region. We have chosen our partners with great care.

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