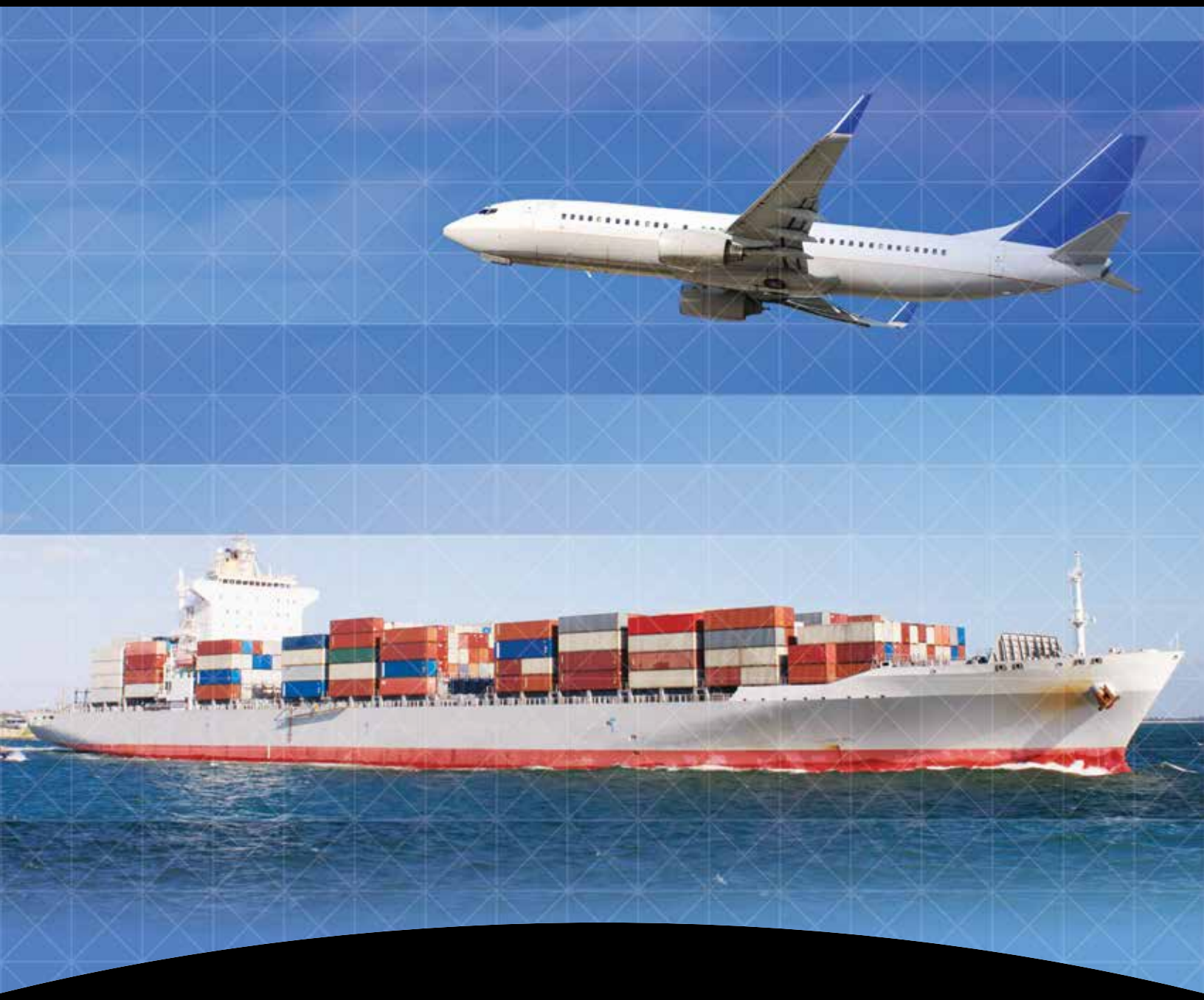
Inertial Navigation Sensors

Honeywell



Precision Accelerometers for Aerospace, Marine and Industrial

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Inertial navigation systems are critical to aircraft navigation; space and satellite navigation; surface and underwater vehicle navigation; and missiles and munition navigation. Additionally, inertial systems provide key orientation information for measurement-while-drilling* (MWD); precision pointing and altitude determination for vehicles; platform stabilization; and target location and surveying. Cost effective, robust, and reliable accelerometers able to perform in the requisite environment are critical elements of these navigation systems.

Honeywell provides a portfolio of precision accelerometers with performance, at an affordable price, to meet our customers' needs.

Honeywell Accelerometer Benefits:

- Industry leading accelerometer performance at a competitive price
- Unparalleled domain knowledge
- Demonstrated reliability and robustness

* Specific product information about Honeywell's accelerometers for Energy Services, including MWD, may be found in *"Precision Accelerometers for Energy Applications"*.

Q-Flex® Accelerometers

Honeywell's precision accelerometers are based on its patented Q-Flex® etched quartz flexure seismic system. An amorphous quartz proof-mass structure provides excellent bias, scale factor, and axis alignment stability. The integral electronics develops an acceleration-proportional output current providing both static and dynamic acceleration measurements. By use of a customer supplied output load resistor, appropriately scaled for the acceleration range of the application, the output current can be converted into a voltage. Q-Flex® accelerometers are available in several models designed to meet application needs.

Q-Flex® QA650/QA700/QA750 Accelerometer

For Q-Flex technology in an economical package, Honeywell produces the QA650/QA700/QA750 for industrial grade applications including: automotive test instrumentation, braking system deceleration, bridge and building sway and tilt monitoring, industrial and robotic control, land vehicle navigation, subway and high-speed train ride comfort control, and offshore drilling platform motion monitoring.

Performance Characteristics			
Performance	**QA650**	**QA700**	**QA750**
Input Range [g]	±30	±30	±30
Bias [mg]	<15	<8	<8
– One-year Composite Repeatability [µg]	<2500	<1200	<1000
– Temperature Sensitivity [µg/°C]	<100	<70	<60
Scale Factor [mA/g]	1.20 to 1.40	1.23 to 1.43	1.20 to 1.40
– One-year Composite Repeatability [ppm]	<2500	<1200	<1000
– Temperature Sensitivity [ppm/°C]	<200	<200	<190
Axis Misalignment [µrad]	<15000	<2000	<7000
Vibration Rectification [µg/g²rms]	<100 (50-500 Hz)	<50 (50-200 Hz)	<60 (50-100 Hz)
Intrinsic Noise [µg-rms]	<3000 (0-10,000 Hz)	<1500 (0-10,000 Hz)	<1500 (0-10,000 Hz)
Environmental			
Operating Temperature Range [°C]	-55 to +96	-55 to +95	-55 to +95
Shock [g]	100	250	200
Vibration Peak Sine [Hz]	25 @ 30-500 Hz	25 @ 30-500 Hz	20 @ 30-500 Hz
Resolution/Threshold [µg]	<10	<1	<1
Bandwidth [Hz]	>300	>300	>300
Thermal Modeling			
	YES	-01 NO; -02 YES	-01 NO; -02 YES
Electrical			
Quiescent Current per Supply [mA]	<16	<16	<16
Quiescent Power [mW] @ ±15 VDC	<480	<480	<480
Input Voltage	±13 to ±18	±13 to ±18	±13 to ±18
Physical			
Weight [g]	51 Nominal, 65 Max.	46	52.5
Diameter below mounting surface [in.]	Ø1.045 ±0.005	Ø1.07 ±0.01	Ø1.07 ±0.01
Height - bottom to mounting surface [in.]	0.617 Max.	0.660 Max.	0.600 Max.
Case Material [Stainless Steel]	300 Series	300 Series	300 Series

Q-Flex® QA2000 Accelerometer

As the inertial navigation standard by which others are measured, Honeywell produces the QA2000. It is the predominant sensor used in today's commercial and military aircraft strap-down inertial navigation systems. The long-term repeatability and superior reliability characteristics of the QA2000 make it the best value inertial-grade accelerometer available on the market today.

Features

- Excellent turn-on repeatability performance
- Environmentally rugged
- Analog output
- Field-adjustable range
- Three fastener precision mounting flange
- Internal temperature sensor for thermal compensation
- Dual built-in self-test

Performance Characteristics			
Performance	**QA2000-030**	**QA2000-020**	**QA2000-010**
Input Range [g]	±60	±60	±60
Bias [mg]	<4	<4	<4
– One-year Repeatability [µg]	<160	<220	<550
– Temperature Sensitivity [µg/°C]	<30	<30	<30
Scale Factor [mA/g]	1.20 to 1.46	1.20 to 1.46	1.20 to 1.46
– One-year Repeatability [ppm]	<310	<500	<600
– Temperature Sensitivity [ppm/°C]	<180	<180	<180
Axis Misalignment [µrad]	<2000 µrad	<2000 µrad	<2000 µrad
– One-year Repeatability [µrad]	<100 µrad	<100 µrad	<100 µrad
Vibration Rectification [µg/g²rms]	<20 (50-500 Hz)	<40 (50-500 Hz)	<40 (50-500 Hz)
	<60 (500-2000 Hz)	<60 (500-2000 Hz)	<150 (500-2000 Hz)
Intrinsic Noise [µg-rms]	<7 (0-10 Hz)	<7 (0-10 Hz)	<7 (0-10 Hz)
	<70 (10-500 Hz)	<70 (10-500 Hz)	<70 (10-500 Hz)
	<1500 (500-10,000 Hz)	<1500 (500-10,000 Hz)	<1500 (500-10,000 Hz)
Environmental	**QA2000-030**	**QA2000-020**	**QA2000-010**
Operating Temperature Range [°C]	-55 to +95	-55 to +95	-55 to +95
Shock [g]	250	250	250
Vibration Peak Sine [g]	15 @ 20-2000 Hz	15 @ 20-2000 Hz	15 @ 20-2000 Hz
Resolution/Threshold [µg]	<1	<1	<1
Bandwidth [Hz]	>300	>300	>300
Thermal Modeling	**QA2000-030**	**QA2000-020**	**QA2000-010**
	YES	YES	YES
Electrical	**QA2000-030**	**QA2000-020**	**QA2000-010**
Quiescent Current per Supply [mA]	<16	<16	<16
Quiescent Power [mA] @ ±15 VDC	<480	<480	<480
Electrical Interface	Temp Sensor	Temp Sensor	Temp Sensor
	Voltage Self Test	Voltage Self Test	Voltage Self Test
	Current Self Test	Current Self Test	Current Self Test
	Power/Signal Ground	Power/Signal Ground	Power/Signal Ground
	-10 VDC Output +10 VDC Output	-10 VDC Output +10 VDC Output	-10 VDC Output +10 VDC Output
Input Voltage	±13 to ±28	±13 to ±28	±13 to ±28
Physical	**QA2000-030**	**QA2000-020**	**QA2000-010**
Weight [g]	71±4	71±4	71±4
Diameter below mounting surface [in.]	Ø1.005 Max.	Ø1.005 Max.	Ø1.005 Max.
Height - bottom to mounting surface [in.]	0.585 Max.	0.585 Max.	0.585 Max.
Case Material [Stainless Steel]	300 Series	300 Series	300 Series

Q-Flex® QA3000 Accelerometer

For the highest inertial navigation-grade performance available in today's market, Honeywell produces the Q-Flex® QA3000. Built on the same production line as the industry-standard QA2000 Accelerometer, the QA3000 Accelerometer has the same inherent quality, reliability, and long-term performance characteristics of the QA2000 Accelerometer. Primary applications include spacecraft navigation and control systems.

Performance Characteristics			
Performance	**QA3000-030**	**QA3000-020**	**QA3000-010**
Input Range [g]	±60	±60	±60
Bias [mg]	<4	<4	<4
– One-year Repeatability [µg]	<40	<80	<125
– Temperature Sensitivity [µg/°C]	<15	<15	<25
Scale Factor [mA/g]	1.20 to 1.46	1.20 to 1.46	1.20 to 1.46
– One-year Repeatability [ppm]	<80	<160	<250
– Temperature Sensitivity [ppm/°C]	<120	<120	<120
Axis Misalignment [µrad]	<1000	<1000	<1500
– One-year Repeatability [µrad]	<70	<80	<100
Vibration Rectification [µg/g²rms]	<10 (50-500 Hz)	<15 (50-500 Hz)	<20 (50-500 Hz)
	<35 (500-2000 Hz)	<40 (500-2000 Hz)	<50 (500-2000 Hz)
Intrinsic Noise [µg-rms]	<7 (0-10 Hz)	<7 (0-10 Hz)	<7 (0-10 Hz)
	<70 (10-500 Hz)	<70 (10-500 Hz)	<70 (10-500 Hz)
	<1500 (500-10,000 Hz)	<1500 (500-10,000 Hz)	<1500 (500-10,000 Hz)
Environmental	**QA3000-030**	**QA3000-020**	**QA3000-010**
Operating Temperature Range [°C]	-28 to +78	-55 to +95	-55 to +95
Shock [g]	100	150	150
Vibration Peak Sine [g]	15 @ 20-2000 Hz	15 @ 20-2000 Hz	15 @ 20-2000 Hz
Resolution/Threshold [µg]	<1	<1	<1
Bandwidth [Hz]	>300	>300	>300
Thermal Modeling	**QA3000-030**	**QA3000-020**	**QA3000-010**
	YES	YES	YES
Electrical	**QA3000-030**	**QA3000-020**	**QA3000-010**
Quiescent Current per Supply [mA]	<16	<16	<16
Quiescent Power [mA] @ ±15 VDC	<480	<480	<480
Electrical Interface	Temp Sensor	Temp Sensor	Temp Sensor
	Voltage Self Test	Voltage Self Test	Voltage Self Test
	Current Self Test	Current Self Test	Current Self Test
	Power/Signal Ground	Power/Signal Ground	Power/Signal Ground
	-10 VDC Output +10 VDC Output	-10 VDC Output +10 VDC Output	-10 VDC Output +10 VDC Output
Input Voltage	±13 to ±28	±13 to ±28	±13 to ±28
Physical	**QA3000-030**	**QA3000-020**	**QA3000-010**
Weight [g]	71±4	71±4	71±4
Diameter below mounting surface [in.]	Ø1.005 Max.	Ø1.005 Max.	Ø1.005 Max.
Height - bottom to mounting surface [in.]	0.585 Max.	0.585 Max.	0.585 Max.
Case Material [Stainless Steel]	300 Series	300 Series	300 Series

Accelerex RBA500 Accelerometer

For a frequency output sensor, Honeywell produces the Accelerex RBA500 accelerometer. It is primarily used to supplement GPS navigation systems. It is a good choice where frequency output, high-g, small size, low power, and light weight are necessary.

Features

- Frequency output for direct interface to digital electronics
- High-g capability
- Integral 2 fastener mounting flange
- Hermetically sealed case
- Internal temperature sensor for thermal compensation

Performance Characteristics	
Performance	**RBA500**
Input Range [g]	±70
Bias	
– One-year Repeatability [mg]	<4
Scale Factor [Hz/g]	80
– One-year Repeatability [ppm]	<450
Axis Misalignment [µrad]	<12
– One-year Repeatability [µrad]	<400
Resolution/Threshold [µg]	<1
Bandwidth [Hz]	>400
Environmental	
Operating Temperature Range [°C]	-55 to +105
Shock [g]	250
Vibration [Hz]	20 g, peak, DC-2000
Electrical	
Input Voltage	+14 to +16 VDC
Current [mA]	<5
Power [mW] @ ±15 VDC	<75
Physical	
Weight [g]	12
Size [in.]	0.80 dia. x 0.42 high
Case Material	Stainless Steel

Our History

Honeywell has been a recognized world leader in Inertial Sensors, including accelerometers, for more than 100 years. Our precision accelerometers have been the industry standard since the early 1980s and are used across a wide number of applications, including aircraft navigation; space and satellite navigation; missile and munition navigation; surface and underwater navigation; marine navigation; as well as measurement-while-drilling and numerous industrial applications.

Why Honeywell?

- Over 100 years of inertial sensor experience
- Delivery of more than 1M tactical grade accelerometers and over 600K navigation grade accelerometers
- Proven performance in more than 100K INS systems for commercial and military aircraft
- Proven performance in more than 300K tactical IMUs
- Advanced manufacturing, production and material processes
- Extensive domain knowledge in navigation
- Proven in aircraft, missile, satellite, surface, MWD, UAV, UUV, guided munition and other applications

Global Network of Support Services

Honeywell's comprehensive support network, spanning the Americas, Europe, Middle East, Africa, Asia and the South Pacific, delivers fully integrated service solutions and 24/7/365 support to meet the needs of the aerospace industry. As a world leader of aviation aftermarket services, Honeywell provides the knowledge and resources to take care of all your service needs – whenever and wherever you require maintenance and repair services.

Find out more

For more information about Honeywell's Inertial Sensors, please visit **aerospace.honeywell.com/accelerometers** or contact us at **InertialSensors@honeywell.com.**

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