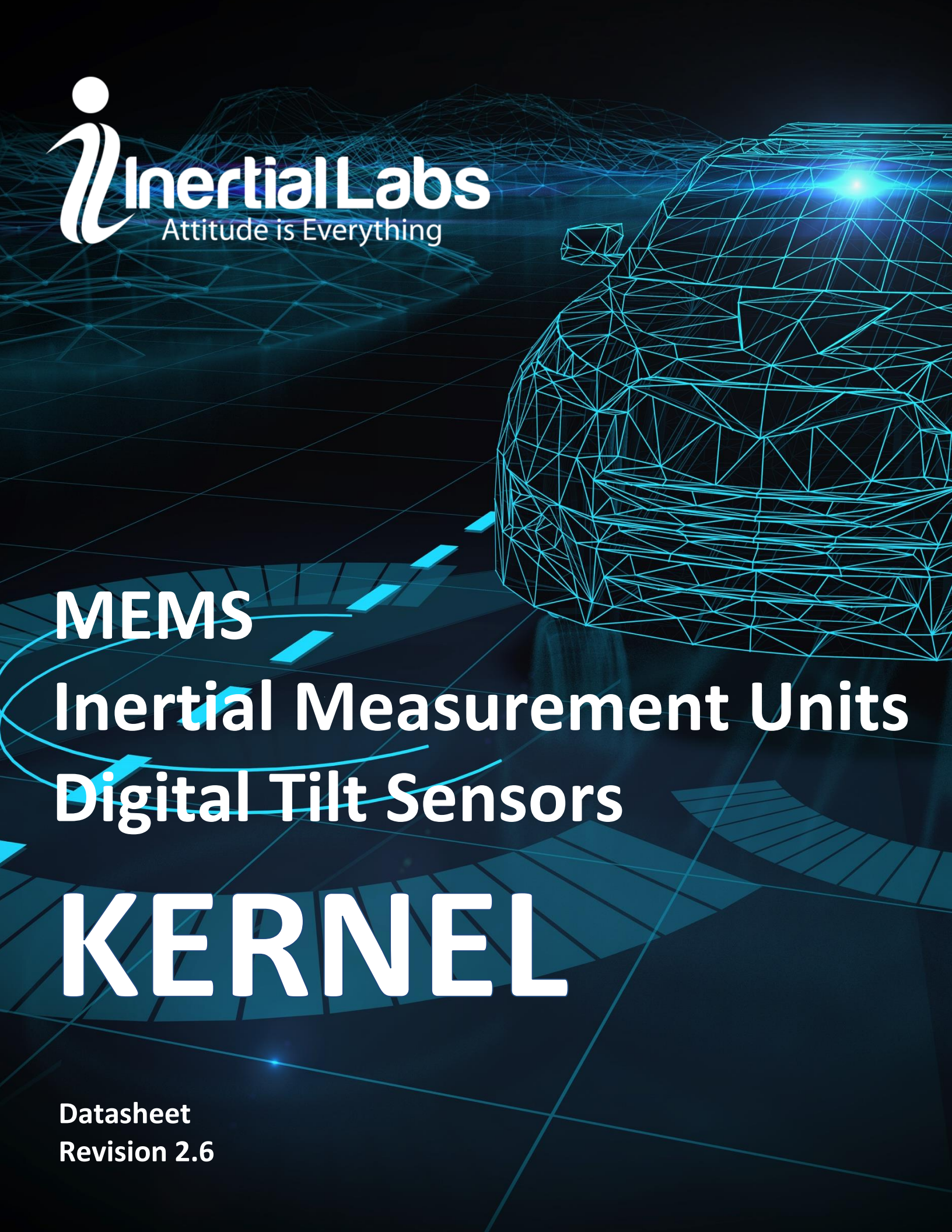


MEMS
Inertial Measurement Units
Digital Tilt Sensors

KERNEL

Datasheet
Revision 2.6

The **Inertial Labs MEMS KERNEL Inertial Measurement Units & Digital Tilt Sensors** are the latest addition to the Inertial Labs Advanced Miniature MEMS sensor-based family. Revolutionary due to its very compact, self-contained strapdown, industrial-grade Inertial Measurement Systems that measures linear accelerations and angular rates with three-axis MEMS accelerometers and three-axis MEMS gyroscopes. Angular rates and accelerations are determined with low noise and very good repeatability for both motionless and dynamic applications.

KERNEL-100
(26 x 19 x 8 mm)

KERNEL-300
(26 x 19 x 12 mm)

The **Inertial Labs KERNEL-100 & KERNEL-300** are the breakthrough, fully integrated inertial solution that combines the latest MEMS sensor technologies. Fully calibrated, temperature compensated, mathematically aligned to an orthogonal coordinate system, the IMU contains up to 1.5 deg/hr Bias in-run stability gyroscopes and 5 ug Bias in-run stability accelerometers with very low noise and high reliability.

Continuous Built-in Test (BIT), configurable communications protocols, electromagnetic interference (EMI) protection, and flexible input power requirements make the **Inertial Labs KERNEL** easy to use in a wide range of higher order integrated system applications.

The **Inertial Labs KERNEL** models were designed for applications, like:

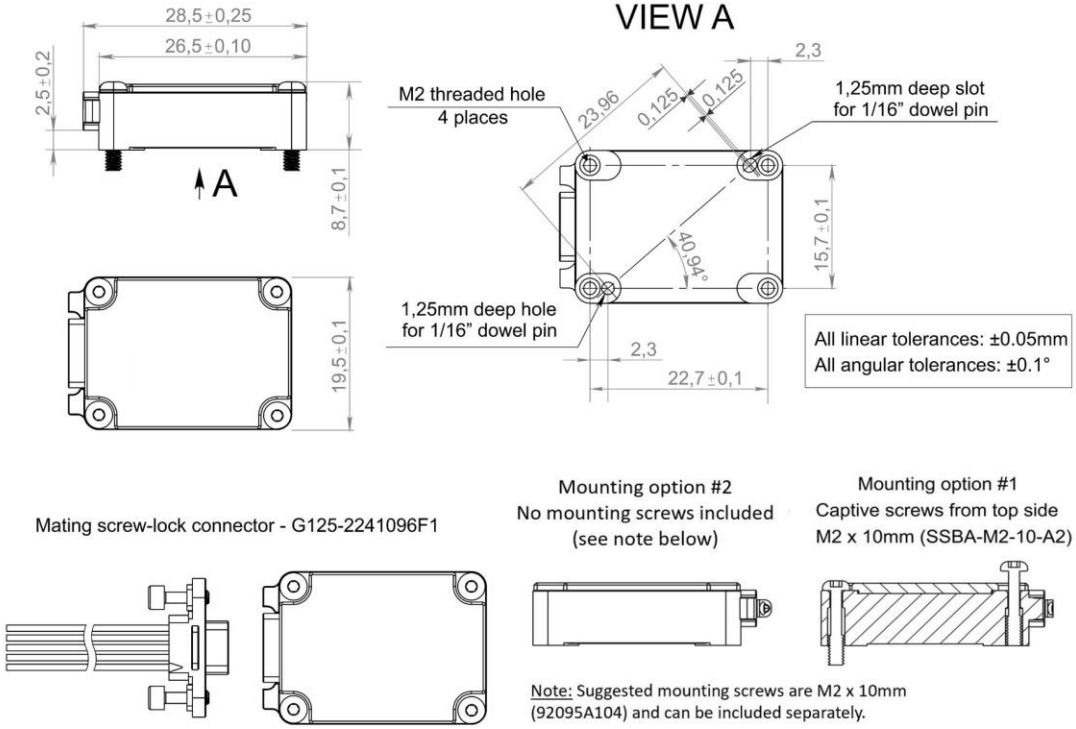
- Autonomous vehicles
- Antenna and Line of Sight Stabilization Systems
- Passengers trains acceleration / deceleration and jerking systems
- Motion Reference Units (MRU) and Motion Control Sensors (MCS)
- Gimbals, EOC/IR, platforms orientation and stabilization
- GPS-Aided Inertial Navigation Systems (INS)
- Attitude and Heading Reference Systems (AHRS)
- Land vehicles navigation and motion analysis
- Buoy or Racing Boat Motion Monitoring
- UAV & AUV/ROV navigation and control

Parameter	KERNEL-100	KERNEL-300
GYROSCOPES		
Measurement range	±2000 deg/sec	±2000 deg/sec
Gyroscopes Bias in-run stability	2 deg/hr	1.5 deg/hr
Gyroscopes Noise - Angular Random Walk	0.38 deg/√hr	0.08 deg/√hr
ACCELEROMETERS		
Measurement range	up to ±40 g	up to ±40 g
Accelerometers Bias in-run stability	0.01 mg	0.005 mg
Accelerometers Noise - Velocity Random Walk	0.018 m/sec/√hr	0.015 m/sec/√hr
PITCH & ROLL ACCURACY	0.05 deg	0.02 deg

	Parameter	Units	KERNEL-100 & KERNEL-300	
GENERAL	Output signals		Pitch, Roll, Accelerations, Angular Rates, Temperature, Synch	
	Color of Enclosure		Black	
	Update rate (IMU data)	Hz	2000 (4000 under development)	
	Update rate (Pitch & Roll data)	Hz	2000	
	Start-up time	sec	<0.02	
	Full Accuracy Data (Warm-up Time)	sec	<0.05	
	Latency	milli sec	<1	
	Pitch & Roll	**Units**	**KERNEL-100**	**KERNEL-300**
PERFORMANCE	Data rate	Hz	2000	2000
	Range: Pitch	deg	±90	±90
	Range: Roll	deg	±180	±180
	Angular Resolution	deg	0.01	0.01
	Static Accuracy, RMS	deg, 1σ	0.05	0.02
	Dynamic Accuracy, RMS	deg, 1σ	0.08	0.03
	Gyroscopes	**Units**	**KERNEL-100**	**KERNEL-300**
	Measurement range	deg/sec	±2000	±2000
	Bandwidth (-3dB)	Hz, 1σ	260	260
	Data update rate	Hz	2000	2000
	Bias in-run stability (Allan Variance, RMS)	deg/hr, 1σ	2	1.5
	Bias repeatability (turn-on to turn-on, RMS)	deg/hr, 1σ	20	15
	Bias instability (over temperature range, RMS)	deg/hr, 1σ	72	36
	SF accuracy (over temperature range)	ppm, 1σ	1000	1000
	Noise. Angular Random Walk (ARW)	deg/√hr, 1σ	0.38	0.08
	Non-linearity	ppm, 1σ	350	200
	Axis misalignment	mrad, 1σ	0.15	0.15
	Accelerometers	**Units**	**KERNEL-100**	**KERNEL-300**
	Measurement range	g	±8 / ±15 / ±40	±8 / ±15 / ±40
	Bandwidth (-3dB)	Hz, 1σ	260	260
	Data update rate	Hz, 1σ	2000	2000
	Bias in-run stability (RMS, Allan Variance)	mg, 1σ	0.01 / 0.03 / 0.05	0.005 / 0.02 / 0.03
	Bias instability (in temperature range, RMS)	mg, 1σ	0.7 / 1.1 / 1.5	0.5 / 0.7 / 1.2
	Bias one-year repeatability	mg, 1σ	1.5 / 2.0 / 2.5	1.0 / 1.3 / 1.5
	SF accuracy (over temperature range)	ppm, 1σ	500 / 700 / 850	150 / 300 / 500
	SF one-year repeatability	ppm, 1σ	800 / 1400 / 1700	500 / 1300 / 1500
	Noise. Velocity Random Walk (VRW)	m/sec/√hr, 1σ	0.02 / 0.045 / 0.06	0.015 / 0.035 / 0.015
	Non-linearity	ppm, 1σ	340 / 800 / 1000	150 / 150 / 1000
	Axis misalignment	mrad, 1σ	0.15 / 0.15 / 0.2	0.1 / 0.1 / 0.15
	Environment	**Units**	**KERNEL-100 / KERNEL-300**	
ELECTRICAL & MECHANICAL	Mechanical shock (MIL-STD-810G)	g	1500	
	Vibration (MIL-STD-810G)	gRMS, Hz	8, 10 – 2000	
	Operating temperature	deg C	-40 to +85	
	Storage temperature	deg C	-50 to +90	
	Low pressure	Pa, min	1750, 30	
	MTBF (G_M @+65degC, operational)	hours	100,000	
	Life time (operational)	years	10	
	Life time (storage)	years	17	
	Electrical	**Units**	**KERNEL-100 / KERNEL-300**	
	Supply voltage	V DC	4 to 15	
	Power consumption	Watts	0.365 @ 5V	
	Output Interface	-	RS-422 (default), RS-232 (under development)	
	Output data format	-	Binary, ASCII (in GUI)	
	EMC/EMI/ESD		MIL-STD-461G	
	Physical	**Units**	**KERNEL-100**	**KERNEL-300**
	Size	mm	26.5 x 19.5 x 8.5	26.5 x 19.5 x 12
	Weight	grams	7	20

1σ specifications are manufactured to a controlled 3σ standard.

KERNEL-100 Mechanical Interface Descriptions



KERNEL-100 Electrical Interface Descriptions

Mating Option #2

1	POWER	Power Supply Input
2	RESERV	Reserved for future
3	RESERV	Reserved for future
4	RS422-A	RS-422 Non-Inverting Input
5	RS422-B	RS-422 Inverting Input
6	GROUND	Power Supply Return
7	TOV	Time of validity output (by request)
8	EXTRIG	External trigger input (by request)
9	RS422-Y	RS-422 Non-Inverting Output
10	RS422-Z	RS-422 Inverting Output

KERNEL-100 Part Number Description

Model	Gyroscope	Accel	Calibration	Connector	Color	Version	Interface
KERNEL-100	G2000	A8	TGA	C12	B	V1	1
KERNEL-300		A15		C22			2 (default)
		A40					

- G2000: Gyroscopes measurement range = ±2000 deg/sec
- A8: Accelerometers measurement range = ±8 g
- A15: Accelerometers measurement range = ±15 g
- A40: Accelerometers measurement range = ±40 g
- TGA: Gyroscopes and Accelerometers are calibrated over temperature range
- C12: Aluminum case, mounting option #1 mating option #2 (Captive screws; reference mechanical drawing)
- C22: Aluminum case, mounting option #2 mating option #2 (No screws included; reference mechanical drawing)
- B: Color – Black
- V1: Version 1
- VX.1: RS-232 interface (under development)
- VX.2: RS-422 interface (default)

Example: KERNEL-100-G2000-A15-TGA-C12-B-V1.2