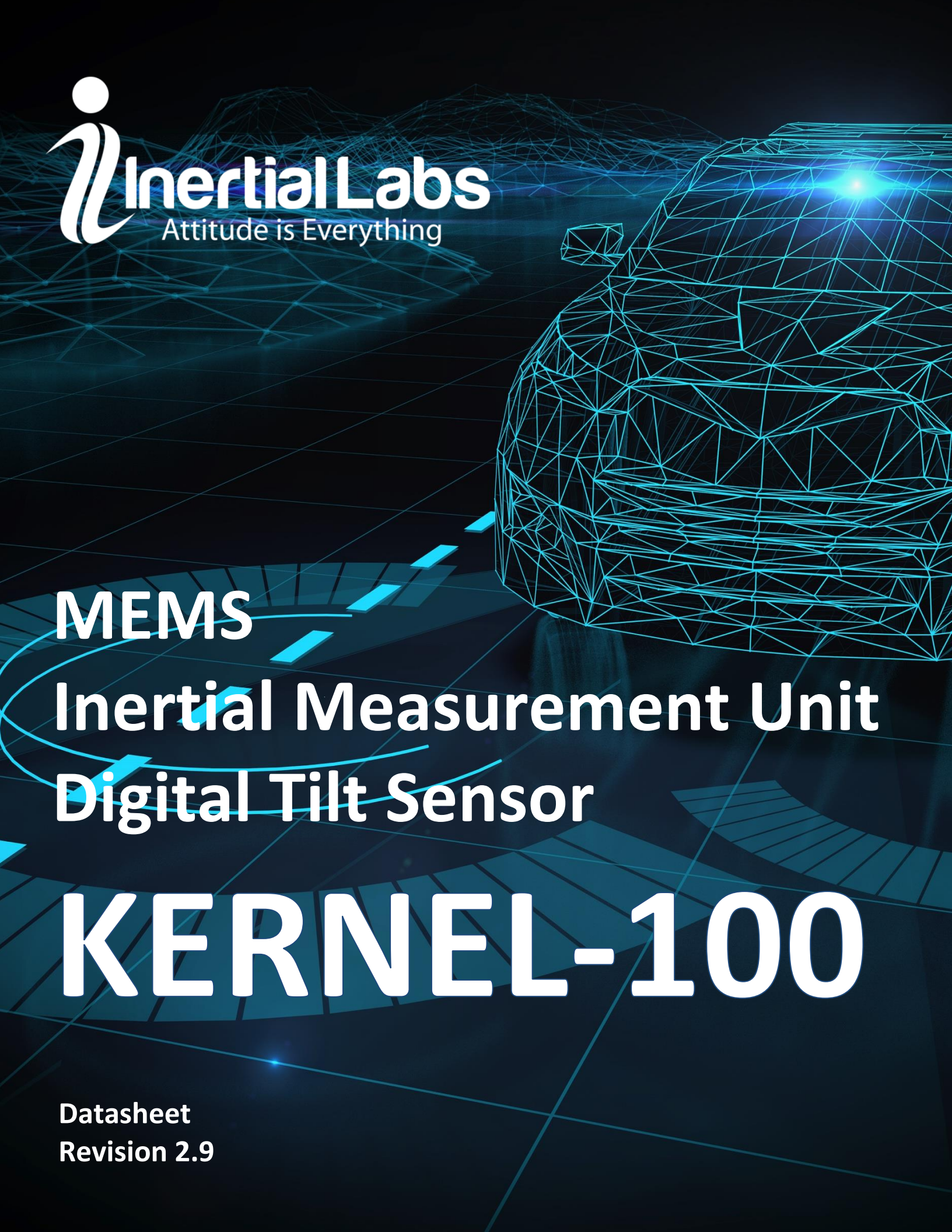


MEMS
Inertial Measurement Unit
Digital Tilt Sensor

KERNEL-100

Datasheet
Revision 2.9

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.

The **Inertial Labs KERNEL-100** is 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 2 deg/hr Bias in-run stability gyroscopes and 0.01 mg Bias in-run stability accelerometers with very low noise and high reliability.

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

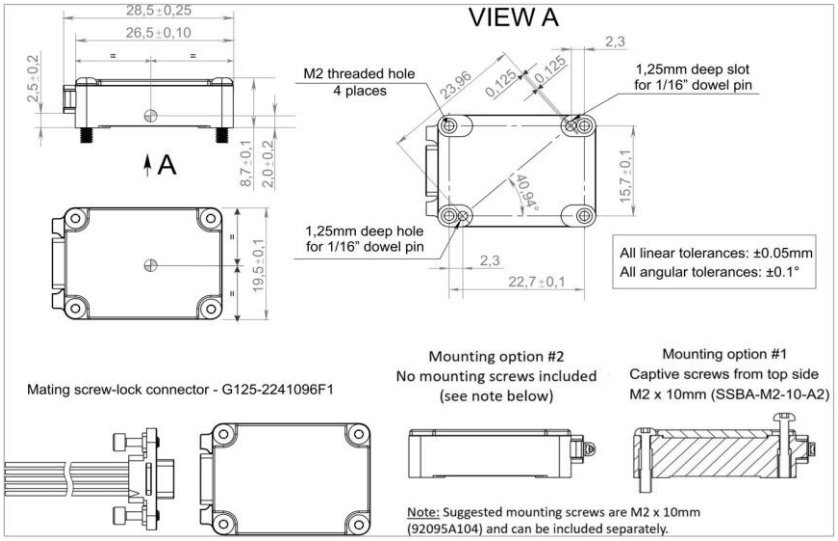
The **Inertial Labs KERNEL** models were designed for applications, like:

- 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
GYROSCOPES	
Measurement range	±2000 deg/sec
Gyroscopes Bias in-run stability	2 deg/hr
Gyroscopes Bias instability (over temperature range)	72 deg/hr
Gyroscopes Noise - Angular Random Walk	0.38 deg/√hr
ACCELEROMETERS	
Measurement range	±8 g
Accelerometers Bias in-run stability	0.01 mg
Accelerometers Bias instability (over temperature range)	0.7 mg
Accelerometers Noise - Velocity Random Walk	0.02 m/sec/√hr
PITCH & ROLL ACCURACY	0.05 deg

	Parameter	Units	KERNEL-100	
GENERAL	Output signals		Pitch, Roll, Accelerations, Angular Rates, Temperature, Synch	
	Color of Enclosure		Black	
	Update rate (IMU data)	Hz	2000	
	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**	
PERFORMANCE	Data rate	Hz	2000	
	Range: Pitch	deg	±90	
	Range: Roll	deg	±180	
	Angular Resolution	deg	0.01	
	Static Accuracy, RMS	deg, 1σ	0.05	
	Dynamic Accuracy, RMS	deg, 1σ	0.08	
	Gyroscopes	**Units**	**KERNEL-100**	
	Measurement range	deg/sec	±2000	
	Bandwidth (-3dB)	Hz, 1σ	260	
	Data update rate	Hz	2000	
	Bias in-run stability (Allan Variance, RMS)	deg/hr, 1σ	2	
	Bias repeatability (turn-on to turn-on, RMS)	deg/hr, 1σ	20	
	Bias instability (over temperature range, RMS)	deg/hr, 1σ	72	
	SF accuracy (over temperature range)	ppm, 1σ	1000	
	Noise. Angular Random Walk (ARW)	deg/√hr, 1σ	0.38	
	Non-linearity	ppm, 1σ	350	
	Axis misalignment	mrad, 1σ	0.5	
	Accelerometers	**Units**	**KERNEL-100**	
	Measurement range	g	±8 / ±15 / ±40	
	Bandwidth (-3dB)	Hz, 1σ	260	
	Data update rate	Hz, 1σ	2000	
	Bias in-run stability (RMS, Allan Variance)	mg, 1σ	0.01 / 0.03 / 0.05	
	Bias instability (in temperature range, RMS)	mg, 1σ	0.7 / 1.1 / 1.5	
	Bias one-year repeatability	mg, 1σ	1.5 / 2.0 / 2.5	
	SF accuracy (over temperature range)	ppm, 1σ	500 / 700 / 850	
	SF one-year repeatability	ppm, 1σ	800 / 1400 / 1700	
	Noise. Velocity Random Walk (VRW)	m/sec/√hr, 1σ	0.02 / 0.045 / 0.06	
	Non-linearity	ppm, 1σ	340 / 800 / 1000	
	Axis misalignment	mrad, 1σ	0.5	
	Environment	**Units**	**KERNEL-100**	
ELECTRICAL &	Mechanical shock (MIL-STD-810G)	g, msec	400 g, 0.1 ms	
	Vibration (MIL-STD-810G)	g RMS, Hz	8, 10 – 2000	
	Operating temperature	deg C	-40 to +85	
	Storage temperature	deg C	-50 to +90	
	Low pressure	Pa, min	1750, 30	
	Humidity	%	up to 95	
	MTBF (G_M @+65degC, operational)	hours	100,000	
	Life time (operational)	years	10	
	Life time (storage)	years	17	
	Electrical	**Units**	**KERNEL-100**	
	Supply voltage	V DC	4 to 15	
	Power consumption	Watts	0.365 @ 5V	
	Output Interface	-	RS-422	
	Output data format	-	Binary, ASCII (in GUI)	
	Physical	**Units**	**KERNEL-100**	**KERNEL-100-OEM**
	Size	mm	28.5 x 19.5 x 8.5	27.1 x 17 x 4.9
	Weight	grams	7	4

KERNEL-100 Mechanical Interface Descriptions

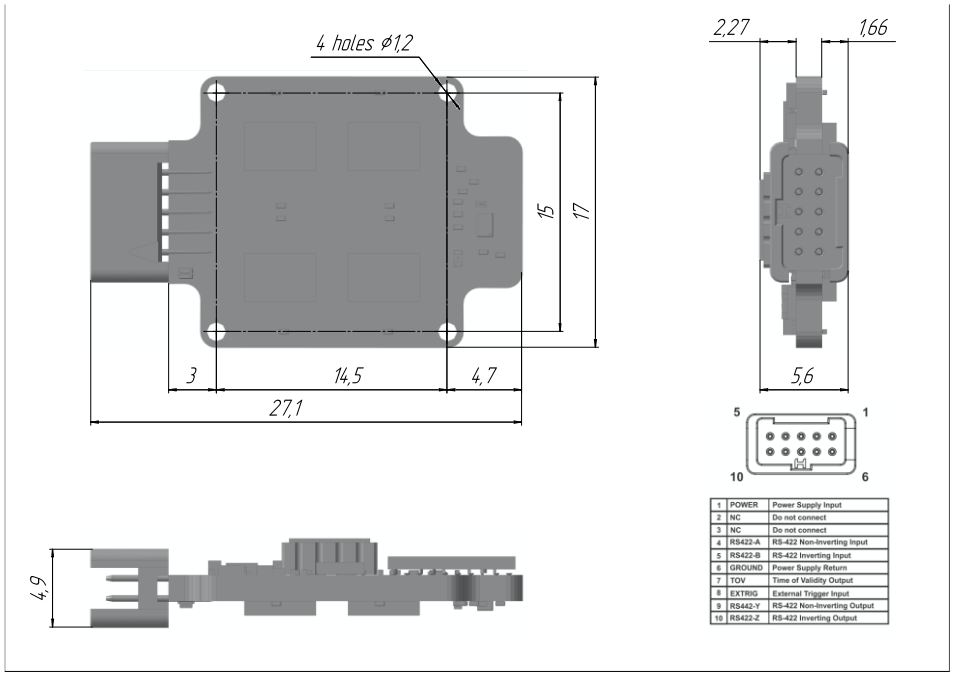


Electrical Interface Descriptions

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-OEM Mechanical and Electrical Interfaces Descriptions



KERNEL-100 and KERNEL-100-OEM Part Numbers Description

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

Model	Gyroscope	Accel	Calibration	Connector	Version	Interface
KERNEL-100-OEM	G2000	A8	TGA	C0	V1	2
		A15				
		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
- C0: OEM version, mating option 2 (No screws included; reference mechanical drawing)
- 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.2: RS-422 interface

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

Example: KERNEL-100-OEM-G2000-A15-TGA-C0-V1.2