

# Tilt Compensated Digital Compass

## ***INNALABS<sup>®</sup> MC-D***

### **Datasheet**

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The Innalabs® Tilt Compensated Digital Compass (MC-D) is a high-performance strapdown system that determines the full angular orientation of any vehicle or other carrier in the 3D space. The Innalabs® MC-D estimates vehicle orientation angles with a high accuracy for both motionless and moving vehicles. Also short magnetic disturbances do not influence the Innalabs® MC-D heading accuracy. Specially designed software allows simple field calibration of the Innalabs® MC-D to eliminate magnetic deviations caused by soft- and hard-iron materials of a vehicle.

#### FEATURES

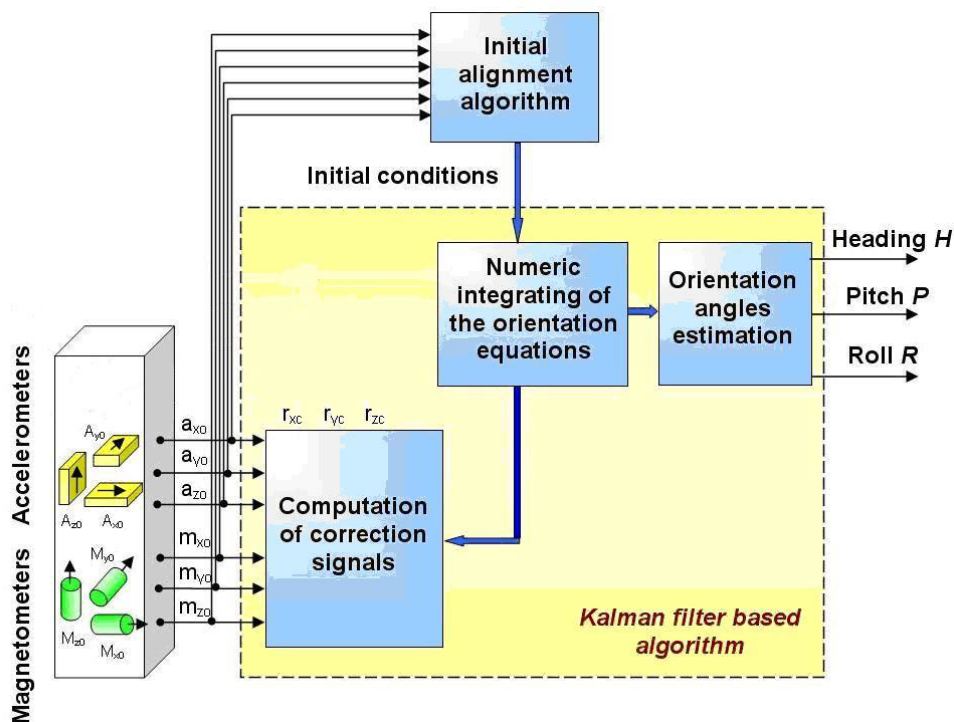
- Real-time high-accuracy roll, pitch and heading angles in dynamic environment
- 3-axis fluxgate magnetometer and accelerometer outputs
- Fully compensated over wide temperature range
- Small dimensions
- Low power consumption
- Shock & vibration resistant
- Environmentally sealed case
- RS-232 serial outputs (USB outputs are optional)

#### APPLICATIONS

- Land vehicle control
- Remotely operated vehicles
- Avionics systems
- Marine vehicles
- Platform stabilization
- Robotics



The Innalabs® MC-D has a sensor unit that consists of three accelerometers and a high-accuracy triaxial fluxgate magnetometer. The vehicle orientation angles (heading, pitch and roll) are calculated through special integration of outputs. The accelerometers are used to determine initial attitude of the MC-D and to correct. The magnetometers are used to determine initial alignment of the MC-D in azimuth and to correct.



Innalabs® MC-D Block Diagram

## SPECIFICATIONS

	Parameter	Value	Comments
<b>Heading</b>			
	Accuracy	0.25° RMS	Dip < 75°, Tilt < 70°
	Repeatability	±0.25°	
	Resolution	0.03°	
	Units	degrees	
<b>Pitch and Roll</b>			
	Range	Pitch±89°, Roll±180°	
	Accuracy	±0.2°	
	Repeatability	±0.2°	
	Resolution	0.02°	
	Units	degrees	
<b>Magnetic Field</b>			
	Dynamic Range	±0.8 Gauss	
	Resolution	0.05 mGauss	
<b>Electrical</b>			
	Supply Voltage	+5.5 to +6.5 VDC	
	Power	110 mA @ 6 VDC	
<b>Interface</b>			
	Serial	RS-232	
	Baud Rate	115200	
	Standard	NMEA 0183 / binary	
	Update Modes	Continuous/on request	(1 to 100) Hz, User selectable
<b>Physical</b>			
	Weight	190 g	Titanium case
	Dimensions	127 x 31 x 29 mm 5.0" x 1.2" x 1.1"	With mounting lugs and connector
<b>Environment</b>			
	Operating Temp	-40 to 70 °C	
	Storage Temp	-50 to 80 °C	
	Shock (operating)	15g, 11ms, half sine wave	Mil-Std 810E. Method 516.4
	Vibration (operating)	10-50 Hz, 0.075mm 55-500 Hz 1.0g	Mil-Std 810E. Method 514.4
<b>Manufacturing</b>			
		IP40	

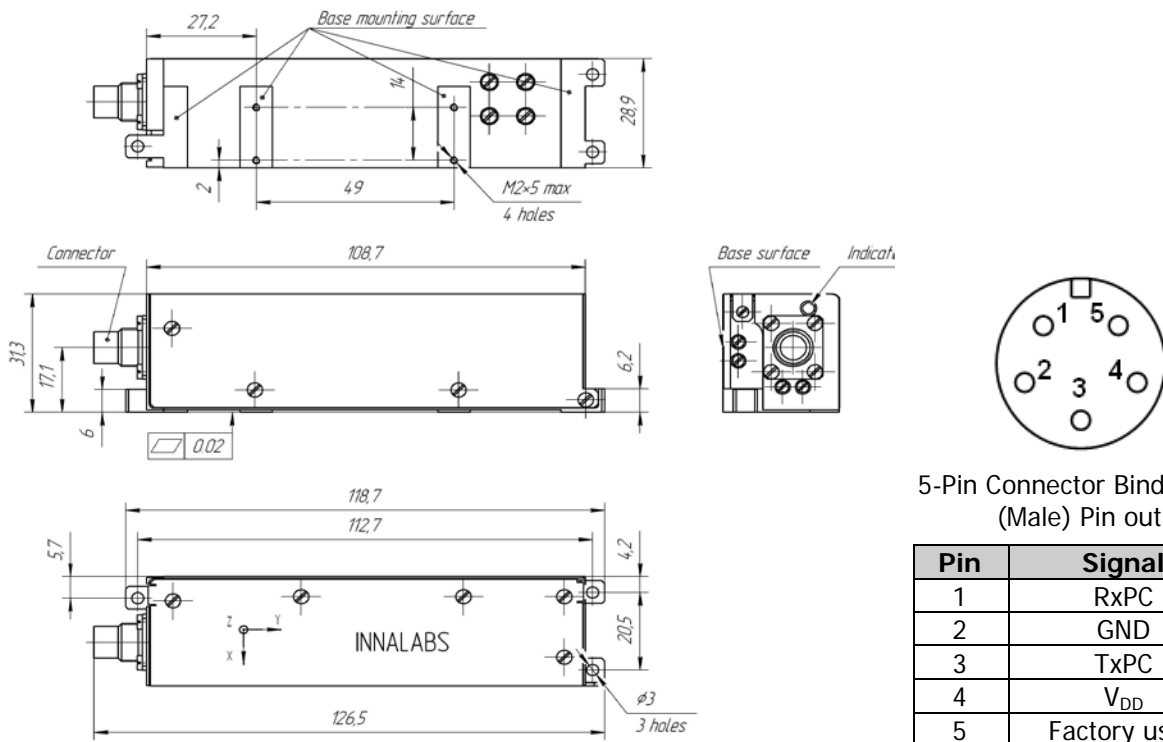
**Notes:**

- (1) including time of initial alignment, it may be decreased on request;
- (2) in homogeneous magnetic environment, for magnetic latitude up to  $\pm 65$  deg;
- (3) root mean square error (1 sigma), may depend on type of motion;
- (4) depends on material of the MC-D case.

The high accuracy of the Innalabs® MC-D is provided by (a) accurate calibration of all MC-D sensors over the whole temperature range after manufacturing of each MC-D; (b) automatic field calibration to compensate hard and soft iron influence on the MC-D magnetometers; and (c) the use of sophisticated algorithms to determine stabilized roll, pitch and heading angles both in static and dynamic conditions.

The Innalabs® MC-D accelerometers are calibrated on a positioning table (PT) that provides the MC-D accurate positioning with respect to the horizon plane. The PT also provides accurate positioning of the MC-D in tests to evaluate its attitude static accuracy. The test plate of the PT with the MC-D mounted on it is located in a temperature chamber. This provides temperature calibration of the MC-D accelerometers and testing of the MC-D attitude accuracy over the whole temperature range. The MC-D magnetometers are calibrated in a special nonmagnetic test area (the deviation of the magnetic field intensity of the test area from the Earth magnetic field is less than 0.01%) using 3-axes Helmholtz coils with a nonmagnetic temperature chamber inside. This equipment provides both accurate magnetometer calibration and test of the MC-D heading accuracy over the temperature range. Also a special nonmagnetic theodolite is used to test the MC-D heading accuracy in the real Earth magnetic field environment.

The Innalabs® MC-D software takes into account the influence of the carrier object soft and hard iron on the heading angle accuracy. For this purpose, a field calibration procedure of the MC-D magnetometers is provided. This calibration does not require any additional equipment, but it requires turns of the carrier object where the MC-D is mounted. Both 2D and 3D calibrations are supported (when carrier object should rotated in horizon plane only or along all 3 axes).



5-Pin Connector Binder 719  
(Male) Pin out

Pin	Signal
1	RxPC
2	GND
3	TxPC
4	V <sub>DD</sub>
5	Factory used