

# VR101

## Vertical Reference Preliminary Specifications

Rev. P-B

Sentera Technology Corporation

The VR101 is a solid-state vertical reference unit in a 40-pin DIP hybrid package with digital output. Low-noise MEMS accelerometers sense accelerations in the x, y and z axes, and three MEMS rate gyros measure the rate of rotation around the x, y and z axes. The fusion of accelerometer and gyro data is performed with a Kalman Filter to provide the optimal estimation of dynamic roll and pitch angles.

### Applications

- Platform stabilization
- Motion Control Systems
- GPS Augmentation
- Attitude Reference Systems

### Features

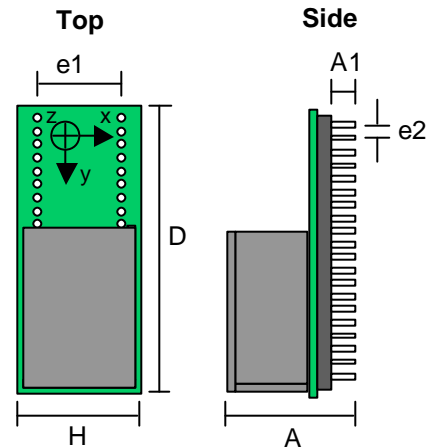
- **Small and Lightweight Package**  
DIP-40 hybrid package allows easy insertion into system-level boards without the need for additional connectors. Weighs less than 20 grams.
- **MEMS Technology**  
Offers fast response at very low power.
- **Fully Calibrated**  
Factory calibrated for offset, scale factor, cross-axis sensitivity and misalignment of each accelerometer and gyro axis. Temperature compensated for improved bias stability. Gyros are compensated for the effects of linear acceleration and vibration.
- **Digital Outputs**  
UART and SPI outputs for easy interfacing with host system or peripherals.
- **Analog Supply Voltage Regulation**  
Works with unregulated voltage supply between 6V to 10V.
- **User-Configurable FIR Filters**  
Customize the bandwidth of the sensors by configuring the FIR filters.

### General Description

Sentera's VR101 uses low-noise MEMS accelerometers and MEMS rate gyros. The VR101's triad of accelerometers measure accelerations in the range of +/- 2g, and the triad of gyros measure rotational rates in the range of +/-150°/sec (+/- 300°/sec version available). With a high sampling rate of 1 KHz and user-configurable FIR filters, the VR101's bandwidth can be easily customized to suit the requirements of the application.

Data fusion of accelerometer and gyro data is performed by a Kalman Filter implemented on the VR101's digital signal processor. The result of the filter is to complement the short term accuracy of the gyros with the long term stability of the accelerometers to achieve the optimal estimation of the dynamic roll and pitch angles.

### Package Drawing



Symbol	Millimeters	Inches
H	23.4	0.92
D	56.4	2.22
A	30.0	1.18
A1	2.8	0.11
e1	15.24	0.600
e2	2.54	0.100

Specification		Remarks
Update Rate (Hz)	64	
Fully Stabilized Data (sec)	< 3	
<b>Attitude</b>		
• Range: Roll, Pitch (°)	±180, ±90	
• Static accuracy (°)	< 1.0	
• Dynamic accuracy (° rms)	< 2.0	See Note 1
• Resolution (°)	< 0.1	
<b>Angular Rate</b>		
• Range: Roll, Pitch, Yaw (°/sec)	±150	±300 version available
• Bias: Roll, Pitch (°/sec)	±1	See Note 2
• Scale Factor Accuracy (%)	< 2	0.5 version available
• Non-linearity (% FS)	0.1	Typical
• Resolution (°/sec)	< 0.025	
• Bandwidth (Hz)	Up to 40Hz	User adjustable. See Note 3
• Random Walk (°/hr <sup>1/2</sup> )	3	Typical
<b>Acceleration</b>		
• Range: X/Y/Z (g)	±2	
• Bias: X/Y/Z (mg)	±10	±5 version available. See Note 2
• Scale Factor Accuracy (%)	< 2	1 version available
• Non-linearity (% FS)	0.5	Typical
• Resolution (mg)	< 0.3	
• Bandwidth (Hz)	Up to 40Hz	User adjustable. See Note 3
• Random Walk (m/s/hr <sup>1/2</sup> )	0.1	Typical
<b>Environment</b>		
• Operating Temperature (°C)	-40 to 85	
• Non-Operating Shock (g)	2000	0.5 ms
<b>Electrical</b>		
• Supply Voltage (V)	6 to 10	Or, 5V regulated.
• Current Consumption (mA)	160	
• Digital Output Format	UART and SPI	

- 1) Preliminary testing shows that dynamic accuracy is typically better than 1°.
- 2) Temperature calibration of bias drift is carried out in the temperature range of 0°C to 50°C. Typically the specified bias limits are maintained throughout the entire operating temperature range of -40°C to 85°C.
- 3) The digital signal processor implements FIR low-pass filters that allow the user to configure individual sensor signal bandwidth. Lowering the bandwidth will improve the sensor noise performance.

An evaluation kit for the VR101 is available. The evaluation kit includes the VR101, a demo system board and RS-232 serial cable. It also includes the PC application for configuring the VR101 and for viewing sensor data.



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