3DMCV7
High Performance OEM IMU/AHRS and IMU/AR
**3DMCV7 Overview**

The 3DMCV7 offers tactical grade inertial performance in the smallest and lightest OEM package yet. It is available in IMU/AHRS (attitude and heading reference system) and IMU/AR (attitude reference) options. Each 3DMCV7 is individually calibrated for optimal performance over a wide range of operating conditions.

Parker’s Auto-Adaptive Extended Kalman Filter has been designed from the ground up to deliver consistently reliable results in even the most challenging environments.

Cutting-edge orientation algorithms, advanced internal time management, and a flexible event triggering system put the 3DMCV7 in a league of its own when it comes to price versus performance.

*Percentage improvement comparisons are relative to the 3DMCV5.*

**AHRS option only**

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### 3DMCV7 System Architecture

![3DMCV7 System Architecture Diagram](image)

**SENSORS**
- Accelerometer
- Gyroscope
- Magnetometer**
- Pressure Sensor

**SENSOR PREPROCESSING**
- Temperature Compensation
- Signal Processing
- Time Synchronization

**DATA PROCESSING**
- Extended Kalman Filter
- Complementary Filter
- Sensor Integration

**CALCULATED OUTPUTS**
- EKF Attitude
- CF Attitude
- Delta Theta/Velocity
- Sensor Data

**COMMS INTERFACE**
- USB
- UART

**GPIO INTERFACE**
- Event In/Out
- Time Sync In/Out
- PPS In/Out

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*Continuous Built-In-Test*

[1.5°/hr Gyro Bias Instability]
[Low Latency]
[Wide-Range Temperature Calibration]
[Superior Vibration Rejection]
[Extended Kalman Filter (EKF)]
[Adjustable Sampling Rates (Up to 1KHz)]
[Adjustable Range (Accel & Gyro)]
[External Clock Synchronization]
[Custom Event Trigger System]
3DM CV7 Key Features

Precision Timing

- Extensive time synchronization optimization for time alignment with external sensors, such as cameras or LiDAR
- Precision data timestamping and low latency output optimized for time-critical control applications
- 1 KHz output data rate for all channels

Extended Kalman Filter for Orientation Estimation

- Integrated vibration identification and rejection
- IMU bias error tracking improves performance over traditional complementary filters
- Reduces attitude error due to linear acceleration
- Integrated magnetometer allows for absolute heading tracking (AHRS-only)

IMU

- Tactical grade gyro (1.5°/hour bias instability)
- User-adjustable gyro and accel ranges
- Calibrated over full temperature range
- Complete digital calibration report available for each unit
- Continuous Built-In-Test for integrity monitoring

Integration

- Factory supported ROS1 and ROS2 driver
- Multi-language (C++, Python, Matlab, LabVIEW) software communications library simplifies custom software development
- Connectivity kit and USB support allows for rapid prototyping

SWaP-C

- Smaller size, lower power than previous generations
- Optimized for low cost, volume production OEM applications
- Aluminum mounting frame improves performance over solder-down modules by isolating sensitive MEMS components from board stresses
3DMCV7 Specifications

**IMU**

<table>
<thead>
<tr>
<th></th>
<th>Accelerometer</th>
<th>Gyroscope</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range (user-selectable)</strong></td>
<td>±: 4g, 8g, 16g</td>
<td>±: 250°/s, 500°/s, 1000°/s</td>
</tr>
<tr>
<td><strong>Random walk</strong></td>
<td>30 µg/√Hz</td>
<td>8.5°/h/√Hz</td>
</tr>
<tr>
<td><strong>Bias instability</strong></td>
<td>18 µg</td>
<td>1.5°/h</td>
</tr>
<tr>
<td><strong>Gain temperature hysteresis</strong></td>
<td>125 ppm</td>
<td>1000 ppm</td>
</tr>
<tr>
<td><strong>Bias temperature hysteresis</strong></td>
<td>0.6 mg</td>
<td>0.04°/s</td>
</tr>
<tr>
<td><strong>Bias repeatability¹</strong></td>
<td>40 µg</td>
<td>0.004°/s</td>
</tr>
</tbody>
</table>

**Interface**

<table>
<thead>
<tr>
<th><strong>Connector</strong></th>
<th>Samtec FTS-105 (2x5)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communications interface</strong></td>
<td>UART (TTL), USB</td>
</tr>
<tr>
<td><strong>Data output rate</strong></td>
<td>1 to 1000 Hz</td>
</tr>
<tr>
<td><strong>I/O</strong></td>
<td>4x GPIO</td>
</tr>
<tr>
<td><strong>GPIO Functions</strong></td>
<td>Event triggering, PPS input/output</td>
</tr>
</tbody>
</table>

**Physical and Electrical**

<table>
<thead>
<tr>
<th><strong>Weight</strong></th>
<th>8.3g</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>38 mm x 24 mm x 8.6 mm</td>
</tr>
<tr>
<td><strong>Power Consumption</strong></td>
<td>230mW (typical), 280mW (max)</td>
</tr>
<tr>
<td><strong>Operating voltage</strong></td>
<td>3.2 to 5.2 VDC</td>
</tr>
<tr>
<td><strong>GPIO Voltage</strong></td>
<td>3V (5V tolerant)</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>-40° to 85°C</td>
</tr>
<tr>
<td><strong>MTBF</strong></td>
<td>2,002,026 hours (Telcordia method, GM/35C)</td>
</tr>
</tbody>
</table>

**Attitude Performance**

<table>
<thead>
<tr>
<th><strong>Roll/pitch (static)</strong></th>
<th>0.25°</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roll/pitch (dynamic)²</strong></td>
<td>0.5°</td>
</tr>
<tr>
<td><strong>Heading¹ (static, AHRS only)</strong></td>
<td>0.5°</td>
</tr>
<tr>
<td><strong>Heading²³ (dynamic, AHRS only)</strong></td>
<td>2°</td>
</tr>
</tbody>
</table>

**Additional Sensors**

<table>
<thead>
<tr>
<th><strong>Range</strong></th>
<th><strong>Part Number</strong></th>
<th><strong>Description</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnetometer (AHRS Only)</strong></td>
<td>± 8G</td>
<td></td>
</tr>
<tr>
<td><strong>Pressure Sensor</strong></td>
<td>260 to 1260 mbar</td>
<td></td>
</tr>
</tbody>
</table>

³Turn on to turn on, <24 hours
²Automotive conditions, vehicle dynamics dependent
³Magnetic heading, with valid declination, magnetic environment, and hard/soft iron calibration
SensorConnect is PC software for sensor configuration and data collection. Configure inertial parameters, device settings, data channels, and sample rates.

Visualize massive amounts of data instantly using built-in intelligent data collection and graphing algorithms. Create immersive dashboards with rich data visualization.

**MSCL™ & APIs**

The MicroStrain Communication Library simplifies writing code to interact with our sensors. MSCL is our open-sourced API, readily available and fully-documented on GitHub, featuring valuable tools such as full documentation, example code, and a quick start guide.

Byte-level data communication protocols are available in the DCP section of our user manual.

**ROS**

MicroStrain offers an open source, license-free (MIT License) series of drivers specifically designed and tested for Robot Operating System (ROS).

Use ROS for building and simulating robotics applications, unmanned ground vehicles (UGVs) and simultaneous localization and mapping (SLAM).