

# Penn State Formula SAE Team takes the track again...

## MicroStrain sensors are right there with them!

### INDUSTRY CHALLENGE:

The Formula SAE program is an engineering design competition for undergraduate and graduate students with the objective of developing and building a small Formula-style race car and participating in the annual Formula SAE competition at Michigan International Speedway. At this competition, teams from all over the world are judged in both static and dynamic events including: cost, design, business, acceleration, autocross, and a grueling endurance race. The competition provides students with an opportunity to apply their engineering, organizational, and communication skills in an industry-like setting.



For the second year in a row, LORD MicroStrain is proud to be among their sponsors. Our Torque-Link product is used to monitor drive shaft stress, and verify that they're not getting 'torque steering' effects. While MicroStrain's SG link 200'S provide critical strain data on suspension elements. As PSU designs their new car for the 2020 campaign, it's critical to control weight, and carbon fiber is playing an increasing role, in place of metal. Lighter cars accelerate better, and they want to out-accelerate the competition! MicroStrain's MV5-AR inertial measurement unit is used to get real time data on the car's behavior under dynamic loads, providing feedback for fine tuning suspension and chassis elements

**THE TEAM:** Formula SAE promotes careers and excellence in engineering, as it encompasses all aspects of the automotive industry. Students are involved in research, design, manufacturing, testing, developing, marketing, management and finance. Formula SAE takes students out of the classroom and allows them to apply textbook theories to real work experiences.



**APPLICATION:** Brock Hinton, the team's CEO, observed that "the torque-Link-200 enables us to monitor half-shaft torque and induced inertial loads. This allows us to deal with "torque steering", where applying engine power causes the car to turn slightly. We're also trying to determine 'weak-links' in our drive train to see what needs to be beefed up."



Braden Heilman, the PSU team's Chief Technical Officer, observed that "the SG-link-200 wireless strain gauges allow us to evaluate suspension stresses, and adjust suspension geometry". In addition, he observed that the MV5-AR inertial sensor gives us a dynamic understanding of the car's suspension responses."



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# Product Review: Inertial and Torque Measurements in race cars



The **MV5-AR gyro-stabilized inclinometer** delivers precision measurements of dynamic inclination, acceleration, and angular rate in challenging environments such as those encountered by heavy-duty construction, off-highway, agriculture, and trucking industries.

The **MV5-AR** utilizes the power of a sophisticated Auto-Adaptive Extended Kalman Filter (EKF) to remove errors associated with vibration, sudden linear motions, and quake, resulting in a true reading of inclination under all conditions.

MicroStrain's state-of-the-art temperature compensation and calibration assures error-free performance over the full operational temperature range. The compact size, wide 4.5 to 36 V power range, IP68/IP69K rating, and CAN J1939 or CANopen communications protocol make the MV5-AR a single part solution for a full range of vehicle sizes and applications.

The **Torque-Link-200** allows users to transform standard driveshafts into wireless torque transducers by application of one strain bridge. The node supports high resolution, low noise data collection from 1 differential input channel at a sample rate up to 1 kHz. An integrated hall effect sensor enables reporting of RPM and total pulses allowing for the derivation of real-time power in torque applications



The **SG-LINK-200** is a three-channel wireless sensor in a rugged, weatherproof enclosure. It includes onboard filtering, and analog to digital converter, for precise measurement of a large range of sensor types. These include strain gages, load cells, pressure transducers, and accelerometers. The PSU team chose the OEM version, to build into their custom enclosure.

For more information about Penn State's Formula SAE team and program, contact Brock Hinton. ([pennstate.fsae@gmail.com](mailto:pennstate.fsae@gmail.com))



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