

EMI Resistant Vehicle Torque Data via Digital Telemetry

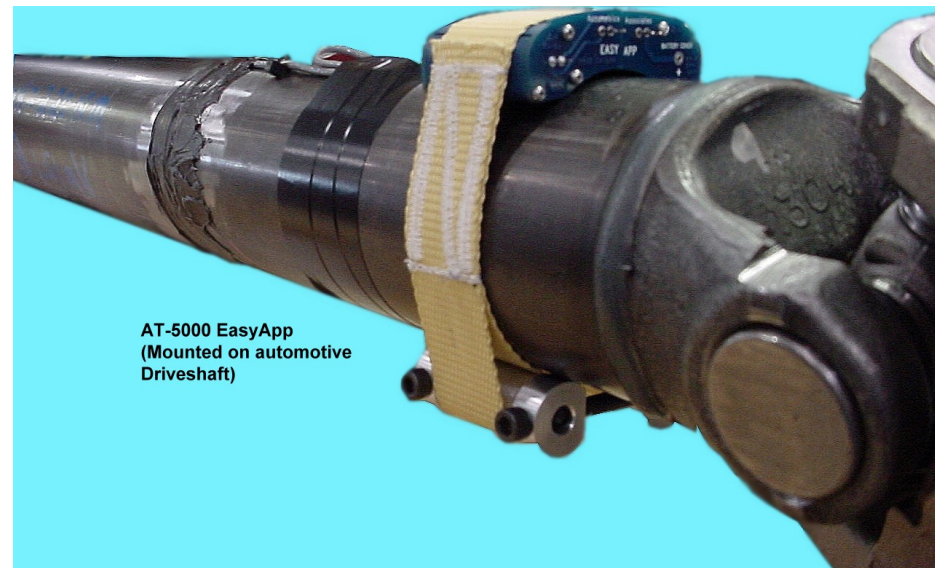
Automotive Test Expo 2006



By Mark Klein

Director of Sales and Marketing

Accumetrics Associates, Inc.

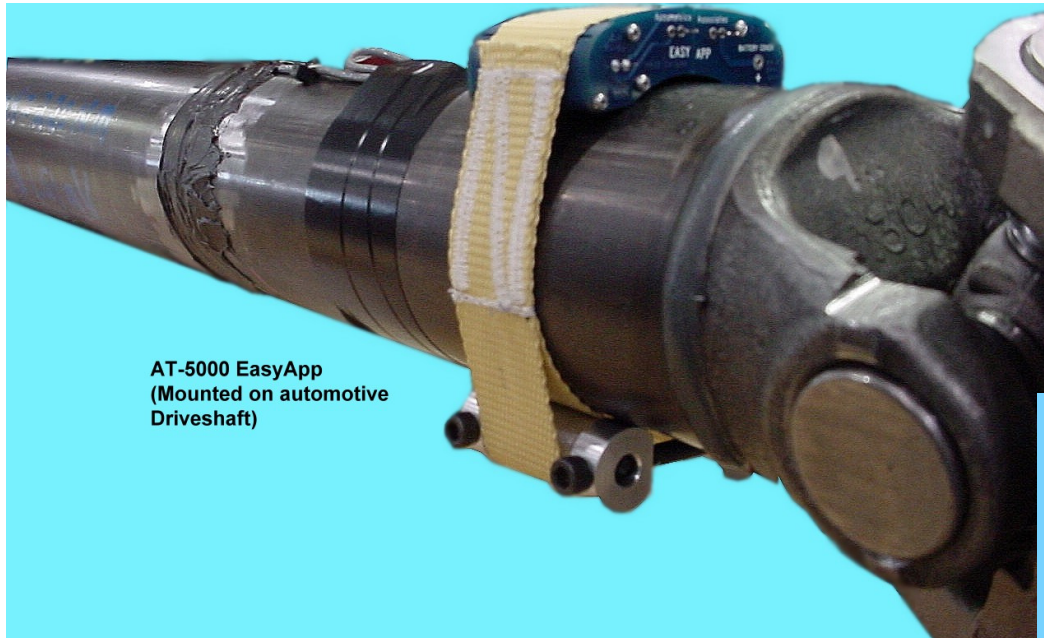


AT-5000 EasyApp
(Mounted on automotive Driveshaft)

About Accumetrics

- ▶ **Founded in 1991**
- ▶ **World leader in rotor telemetry, we pioneered the use of digital techniques**
- ▶ **Supplier of the world's largest and most complex rotor telemetry systems**
- ▶ **Major Markets include:**
 - **Transportation Systems**
 - **Power Systems**
 - **Heavy Industrial**
 - **Defense**
 - **Aerospace Industries**

What do we measure on rotors?



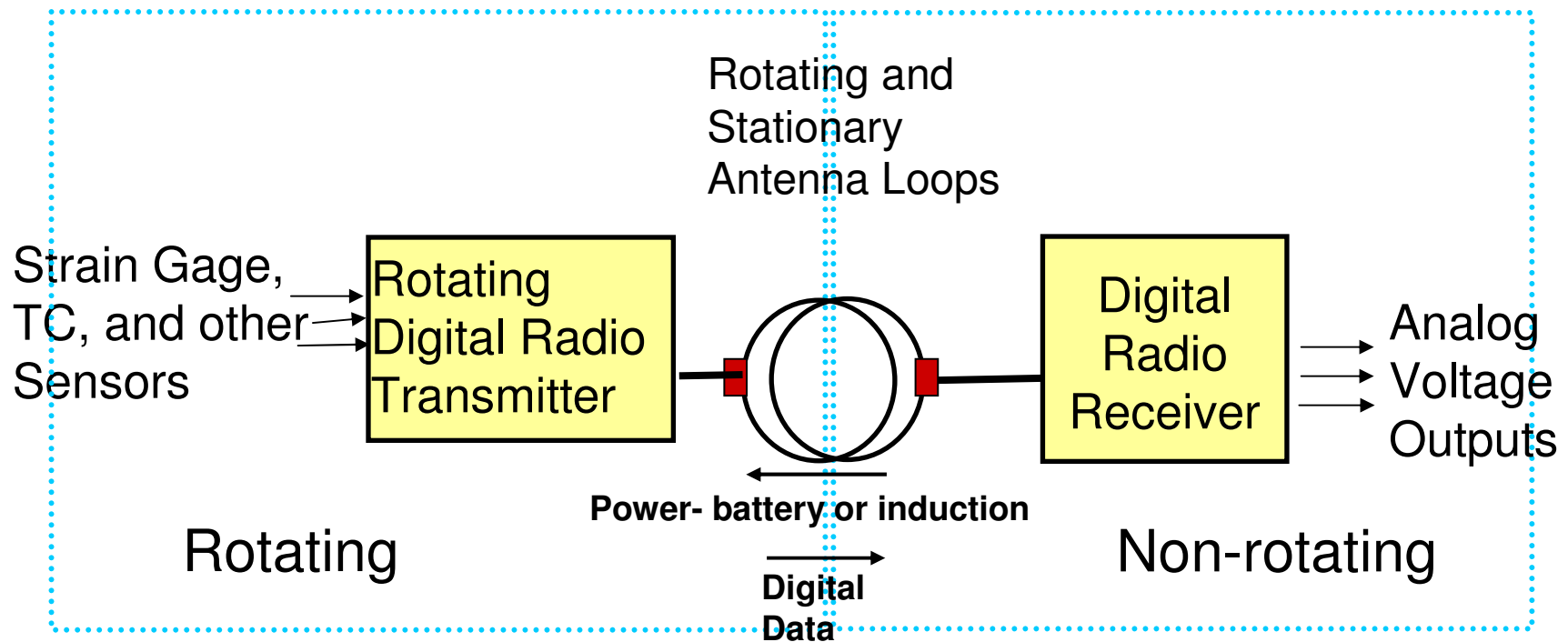
AT-5000 EasyApp
(Mounted on automotive
Driveshaft)

**Torque,
Temperature,
Acceleration,
Pressures,
Voltage/ Current**



**AT-7000: 64 strain
gages and 24
thermocouples**

Rotor Telemetry: the Wireless Acquisition of Sensor Measurements from Rotating Applications



Why use Telemetry?

Telemetry replaces slip rings with non-contact, localized measurement of signals directly on shaft.

- No long wire lengths acting as antennas for EMI noise**
- No mechanical contacts interfering with low level signals**
- No maintenance / wearout issues**

Hybrid Vehicle Rotating Shaft Data Concerns

- ▶ **Data interference from large electromagnetic fields**

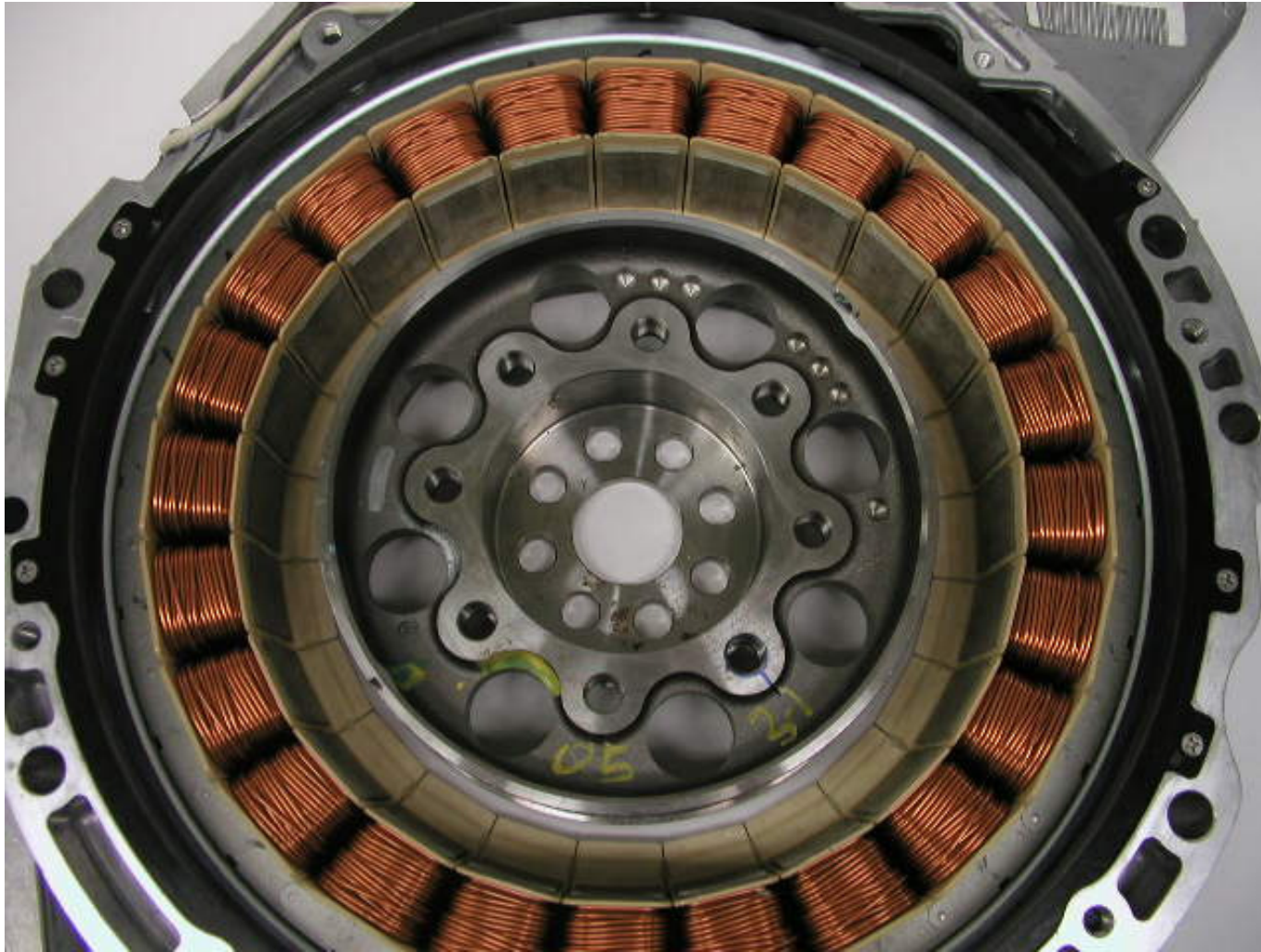
- ▶ **... and the normal concerns for sensor data retrieval on rotating shafts:**
 - G-forces
 - Temperature
 - Sensor wiring and interconnections
 - Tight packaging constraints

Why Use Digital Telemetry?

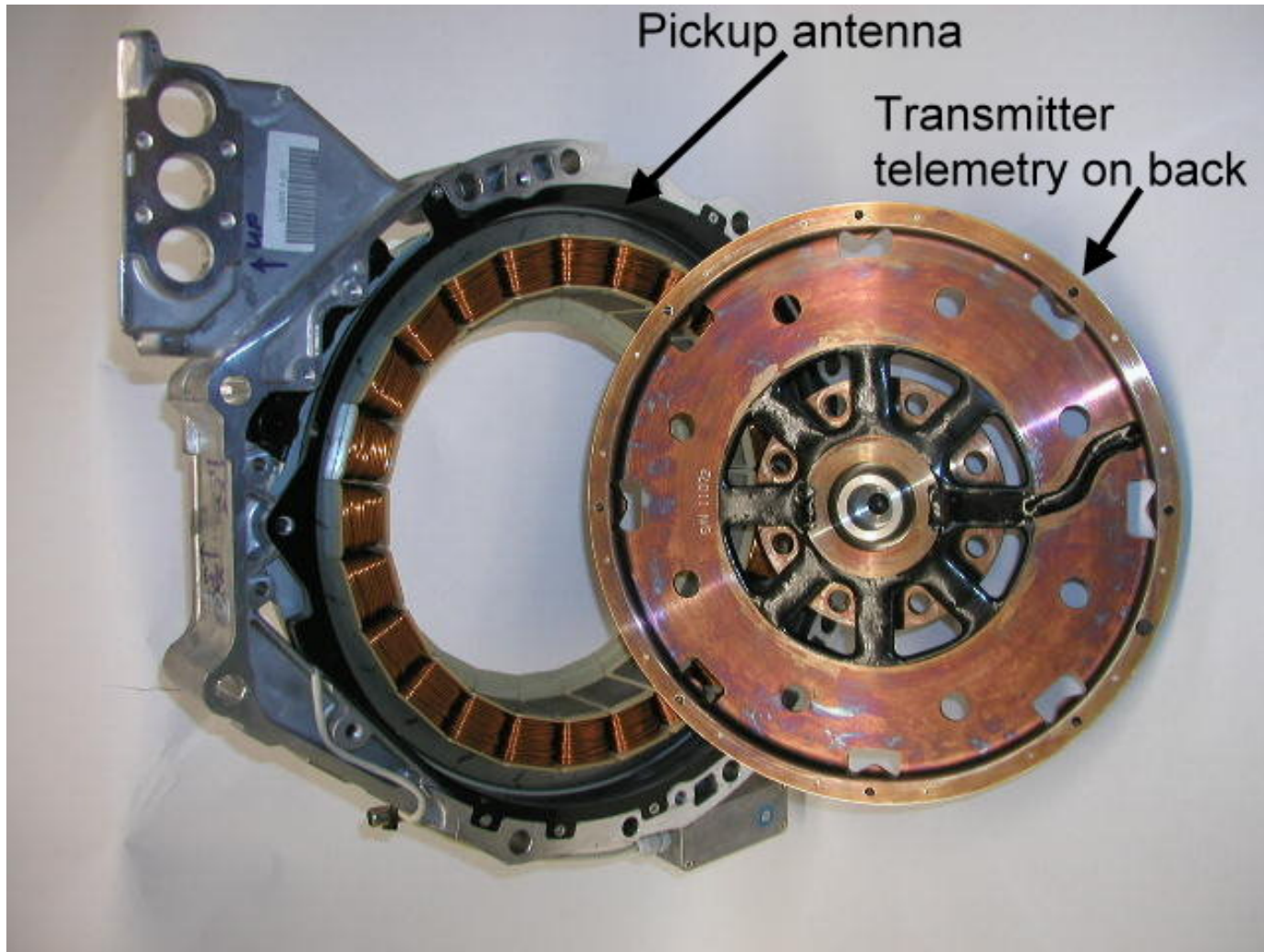
Digital Telemetry provides:

- Robust, dependable data: little or no dropout or radio interference, low noise floor, high accuracy (in comparison to legacy FM transmission telemetry using pulse width modulation)
- High signal integrity is provided—sensor signal is amplified, filtered, and digitized on rotor, locking in signal quality
- High immunity to data interference from EMI when close coupled digital data transmission is used

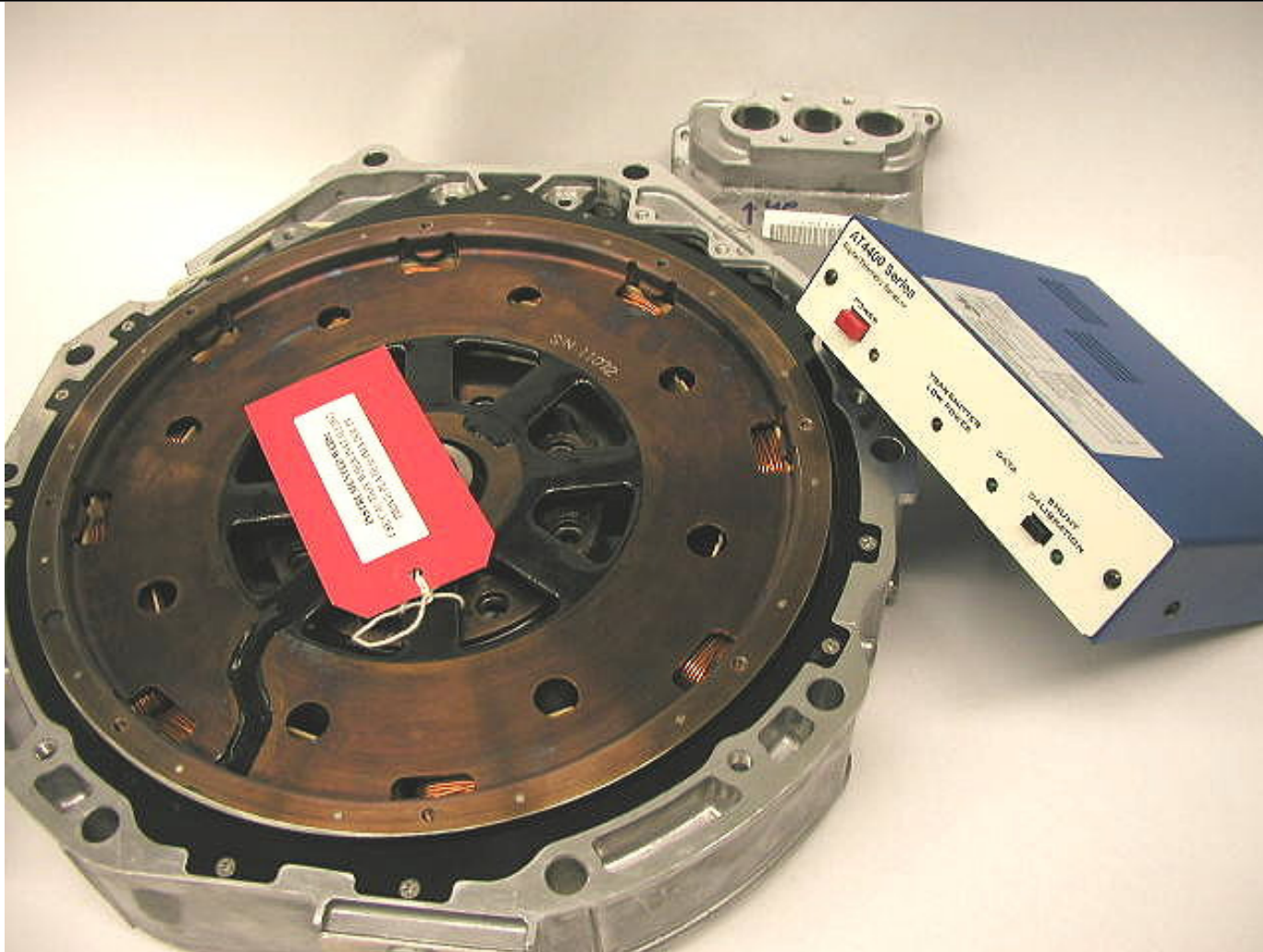
Honda Accord Electric Motor- Pictures and data courtesy of Argonne National Labs and Teledyne Instruments



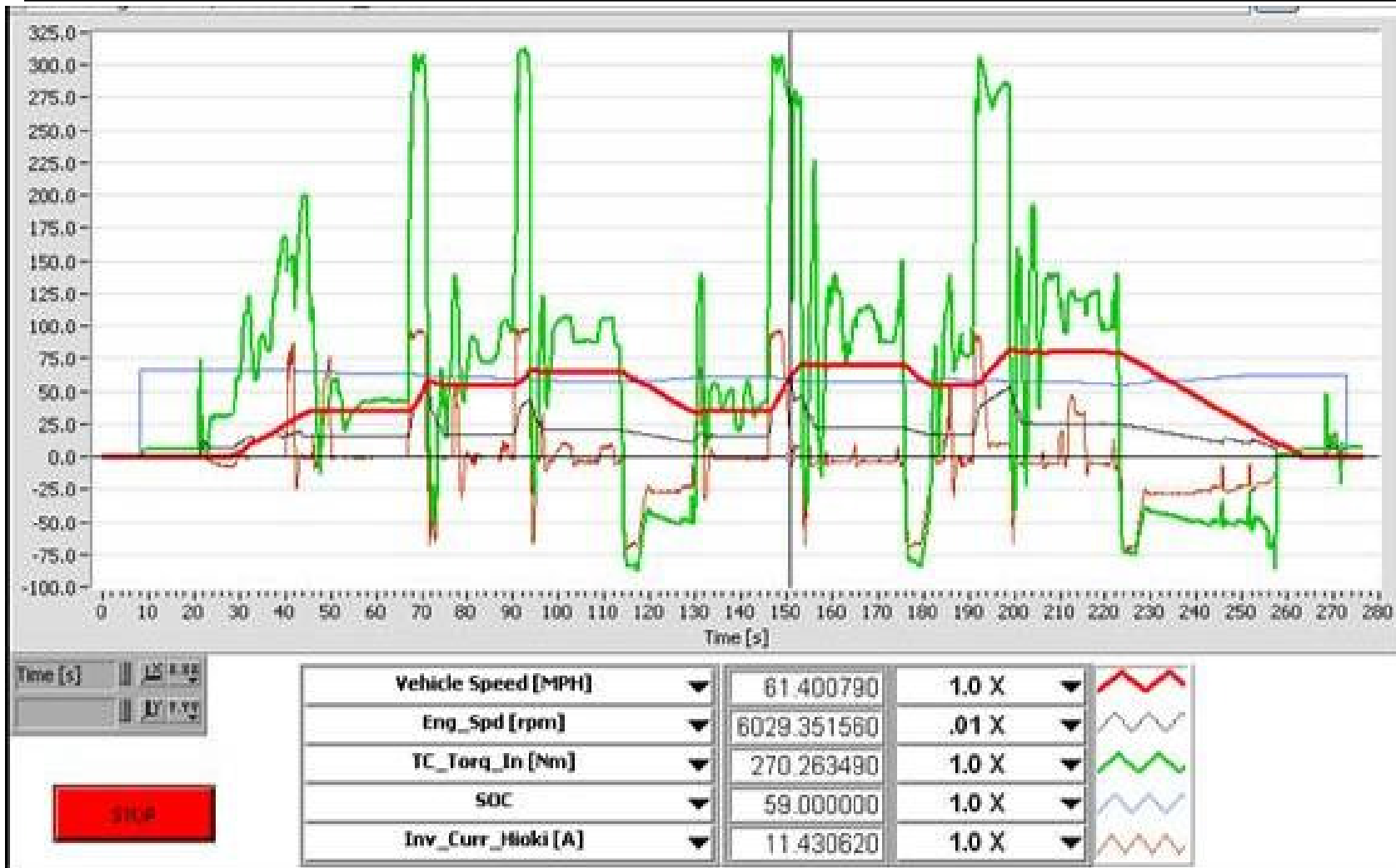
Teledyne flywheel (torque converter/flexplate) transducer with Accumetrics transmitter telemetry



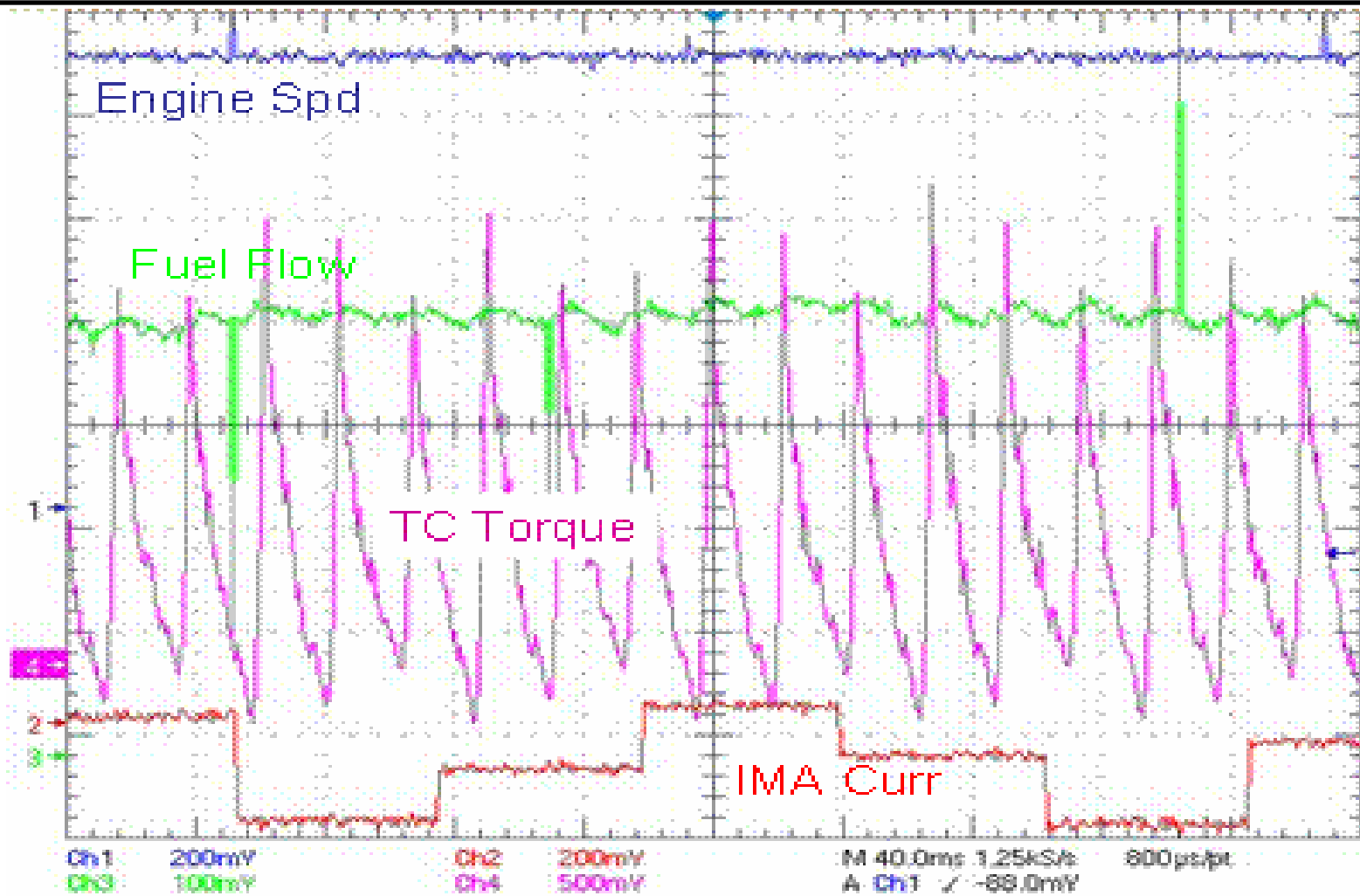
Teledyne Instruments flywheel transducer for torsional loads, with Accumetrics telemetry receiver



Hybrid Accord Flywheel Data- electric motor and engine combined torque



Accord Torque (piston pulses shown)



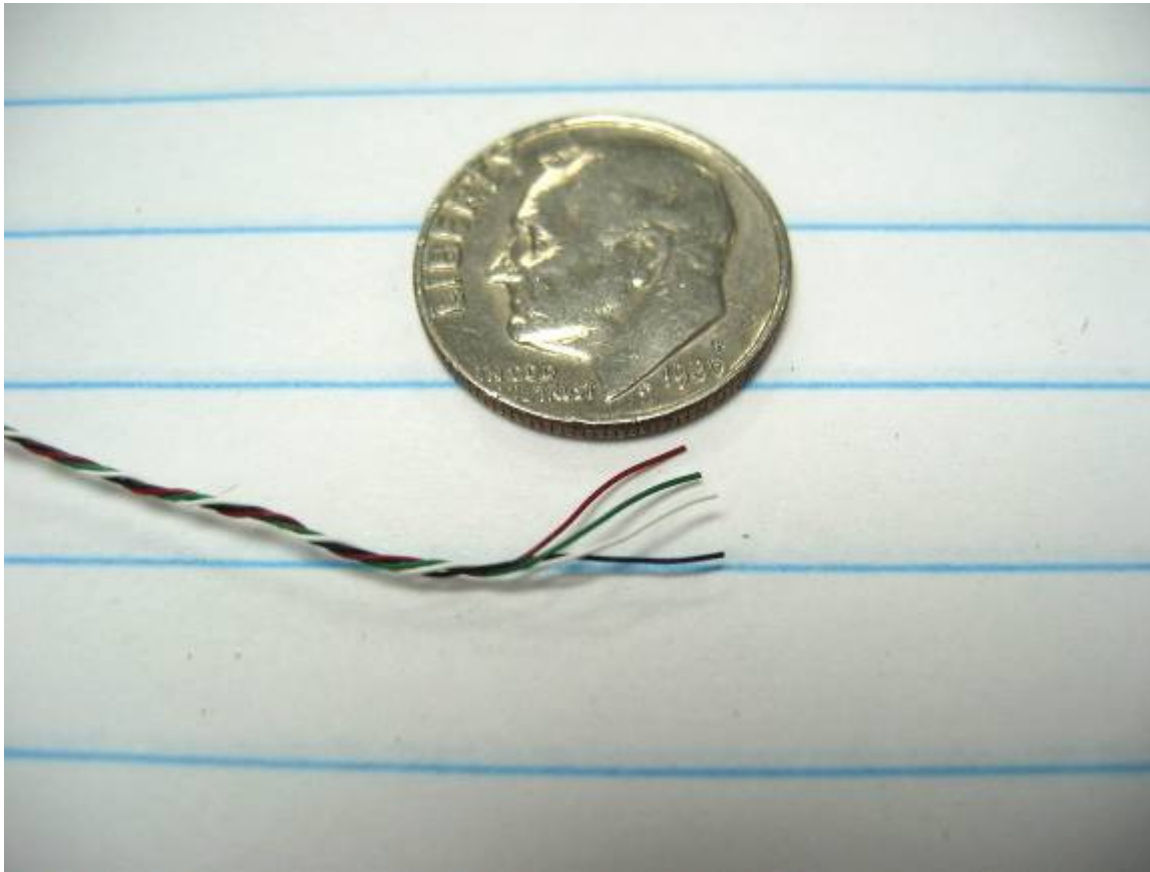
EMI Testing

- ▶ Results of EMI susceptibility testing by a government lab:
 - When our induction design was exposed to controlled RF EMI in an EMC chamber, our ability to withstand EMI was at least an order of magnitude better than legacy equipment.
 - Our product was chosen for use near high power variable frequency drive motors for new electric drive ships
 - See Website paper: “**EMI Immunity of Accumetrics Digital Telemetry**”
www.accumetrix.com

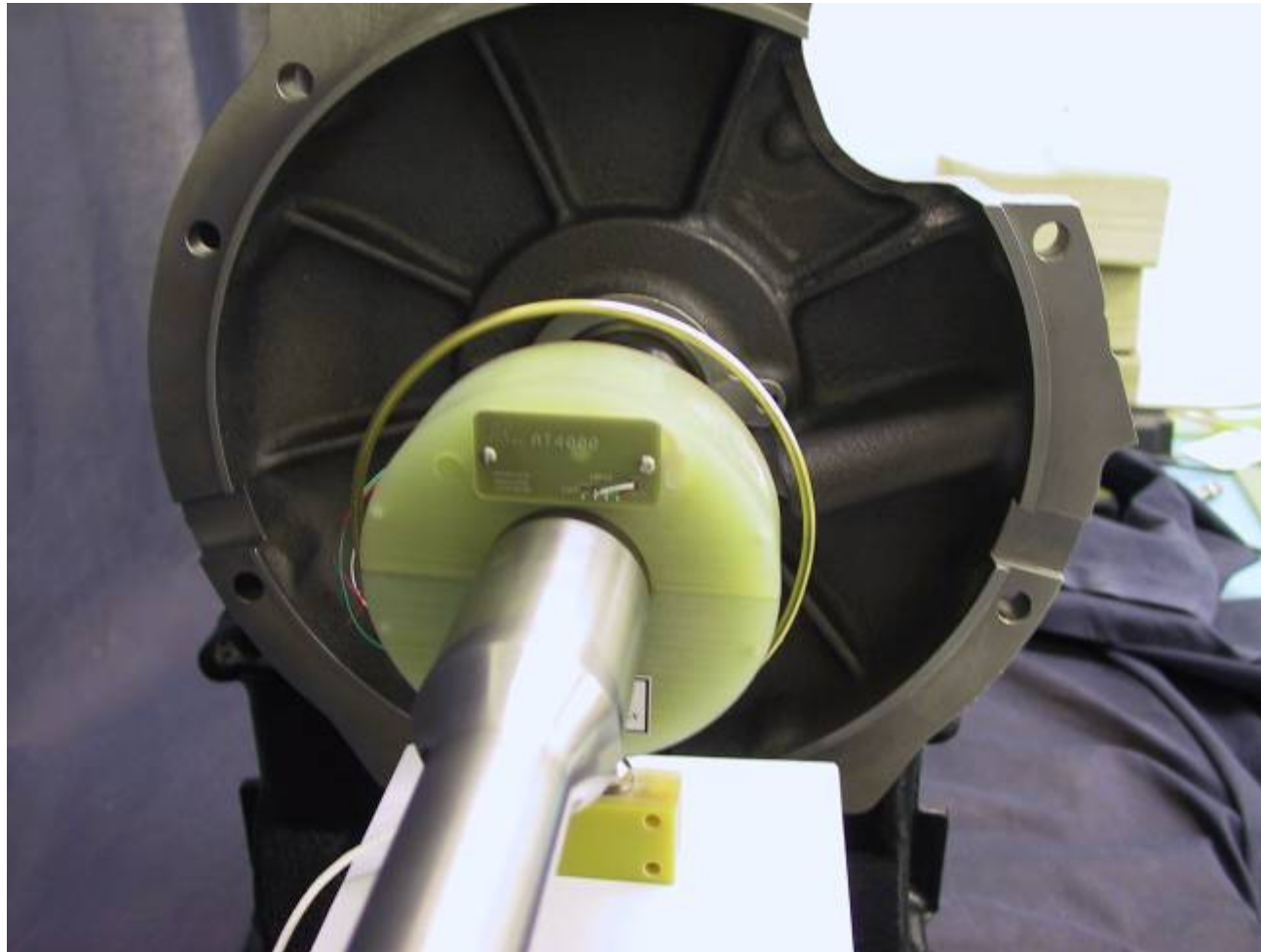
Minimizing Noise pickup-- Twisted gage wires

Vishay MicroMeasurements twisted strain gage wire shown below

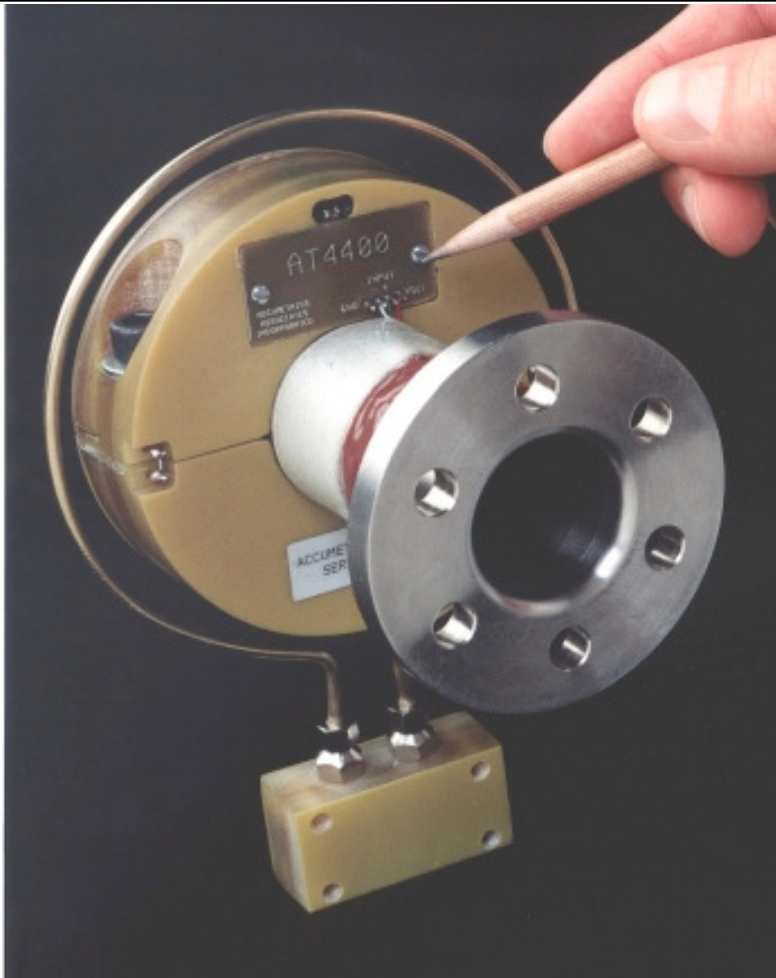
Also of interest: Inter-8 Weave <http://www.magnetic-shield.com/products/cables.html>



Induction powered torque system

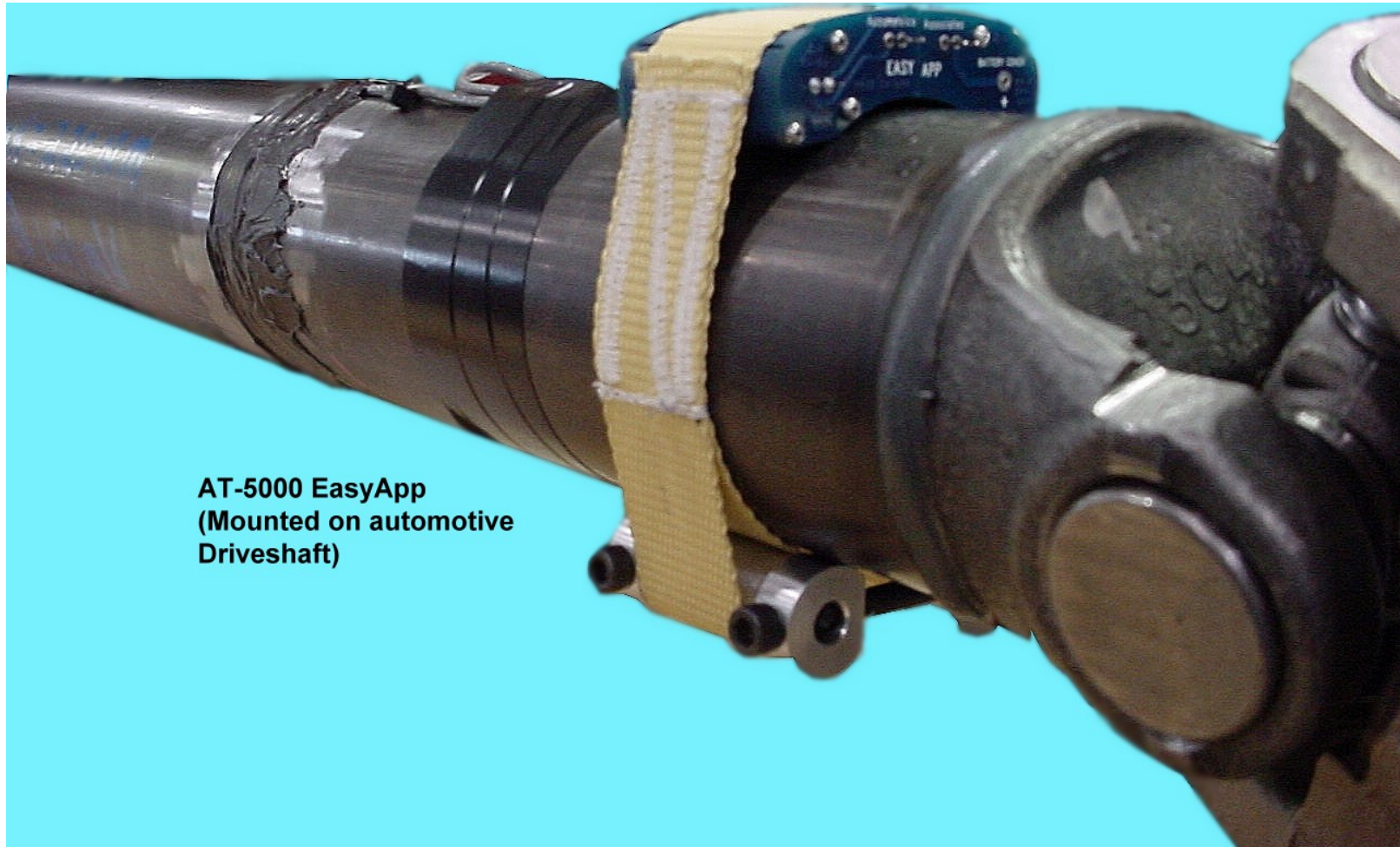


Induction Powered – single channel



- ▶ **AT-4400**
 - 16 bit Torque Telemetry System
 - Up to 10 kHz bandwidth
 - 26485 samples/ sec

Torque on driveshaft– Kevlar strap attachment

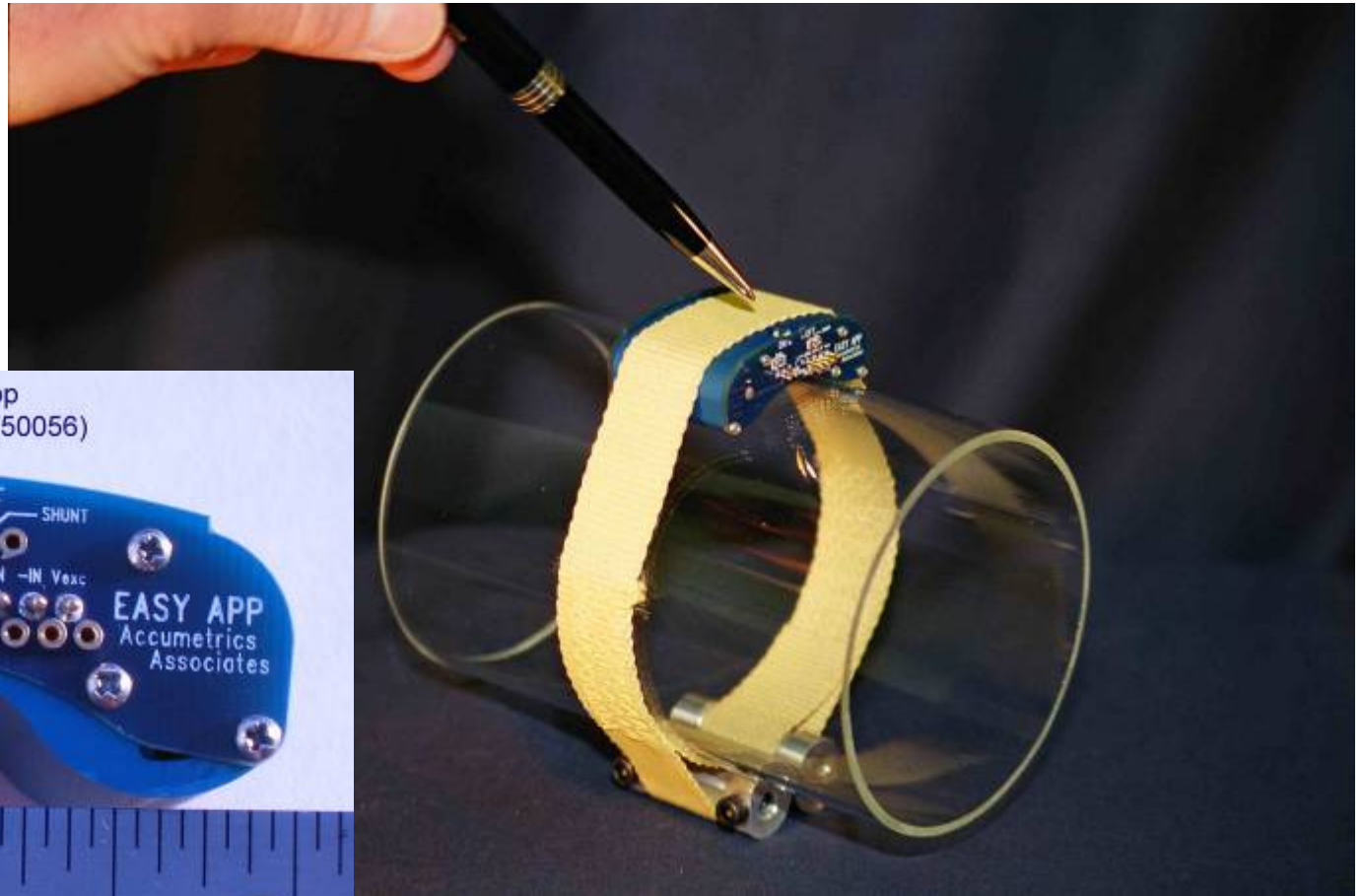


AT-5000 EasyApp
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Battery Powered- single channel

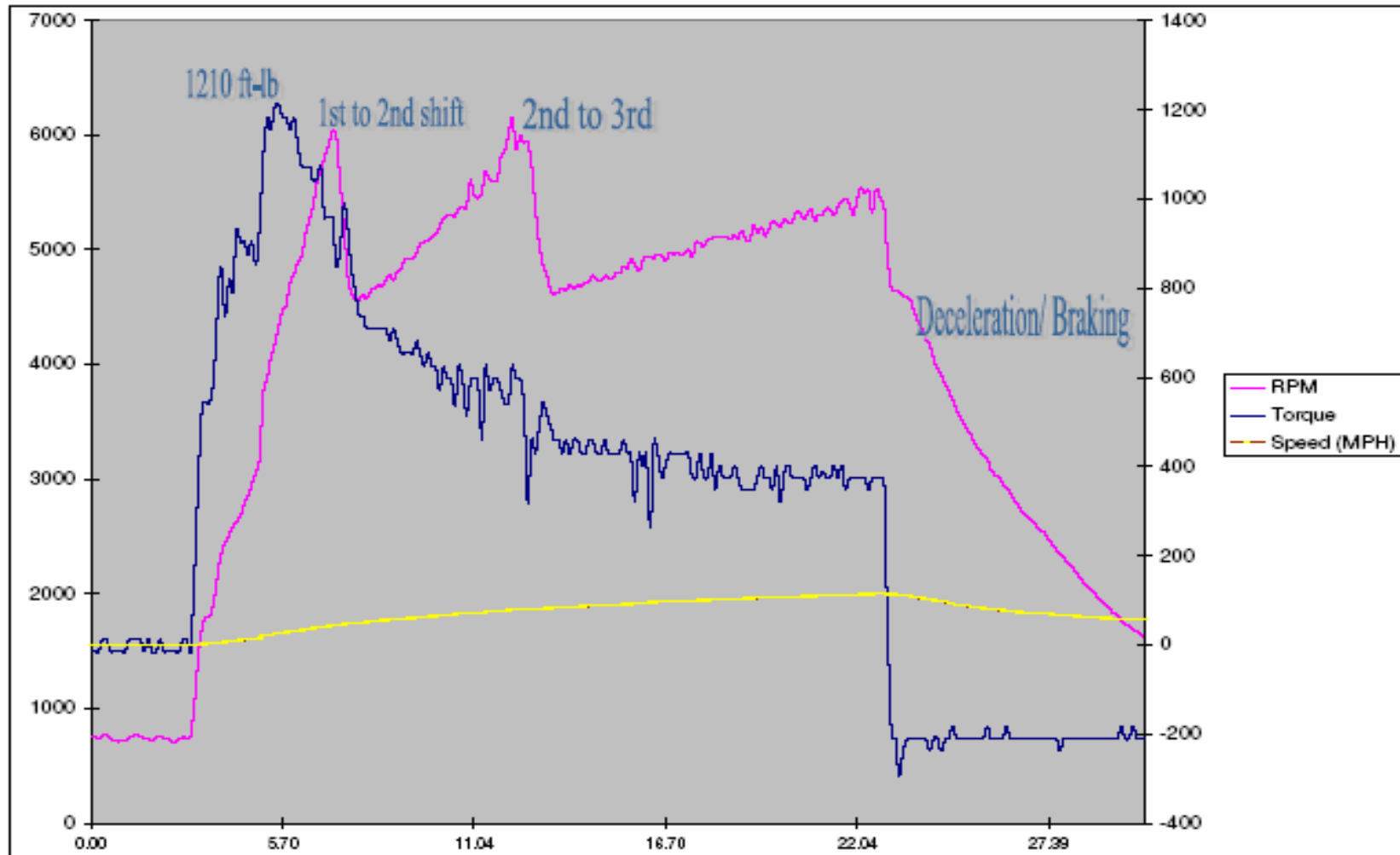
AT-5000
EasyApp™

Kevlar Strap
Applied System

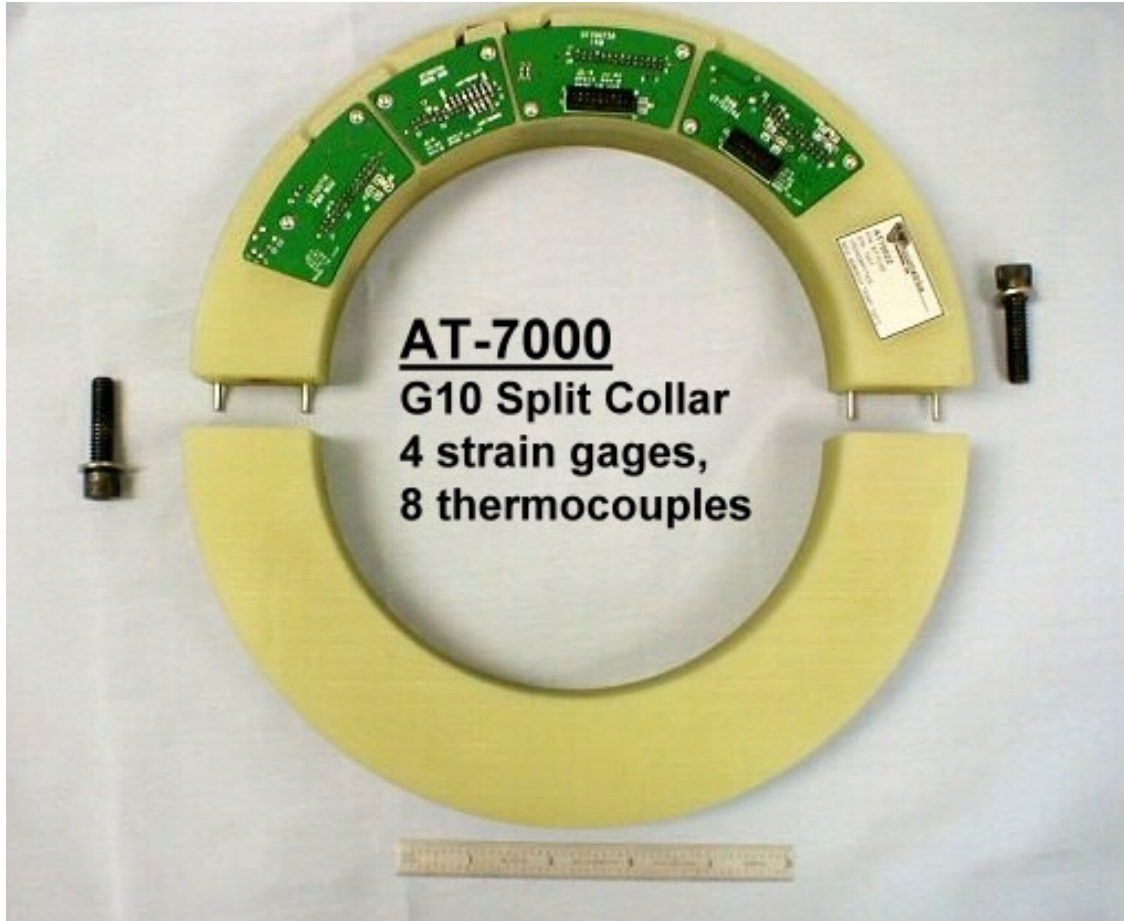


On the road/ track "Dyno" data

-AT-5000 EasyApp data from a Chevy Caprice (data slowly sampled with on-board 8 bit computer)



Induction Powered- Multiple Channel



AT-7000

- Same EMI resistant digital capability as AT-4400
- Modular Structure: (Mix and Match sensor inputs)
- Up to 88 channels

Thanks!



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