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DRIVESHAFT/AXLE ON-TRACK TORQUE MEASUREMENT

CONTINUOUS HIGH-SPEED TORQUE MEASUREMENTS FOR VEHICLE PERFORMANCE TESTING

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Application: Driveshaft/axle on-track torque measurement

Continuous high speed torque measurements for vehicle performance testing. Dynamometer-like data retrieval while on-track.

Industry: Race Industry / Motorsports

Product: AT-5000 EasyApp™, AT-4400

Parameters measured: Torque (directly measured via strain gages)

Overview: On-track dynamometer-like performance torque data can be easily added to on-vehicle measurements recorded by standard data acquisition systems including AIM, CDS Competition Data Systems, Dewetron, MoTeC, National Instruments/ IOtech, Pi Research, Racepak/MSD, Race Technology, Sakura, and many others. This technique uses high speed on-driveshaft continuous digital wireless strain gage measurements to measure average and high bandwidth torque phenomena.

The AT-5000 EasyApp is a battery powered telemetry system. It powers a shaft mounted strain gage, amplifies and filters the torque signal from the strain gage, digitizes the data, and RF transmits the data off-shaft to a nearby pickup loop. A vehicle mounted receiver reconstructs the data as analog voltages that can be easily displayed and recorded. The telemetry is robust, and is small enough to fit most vehicles, including ATVs, open wheel F1, Champ, Indycar, as well as Sprint, stock car/ NASCAR, drag racing, and even Karts.

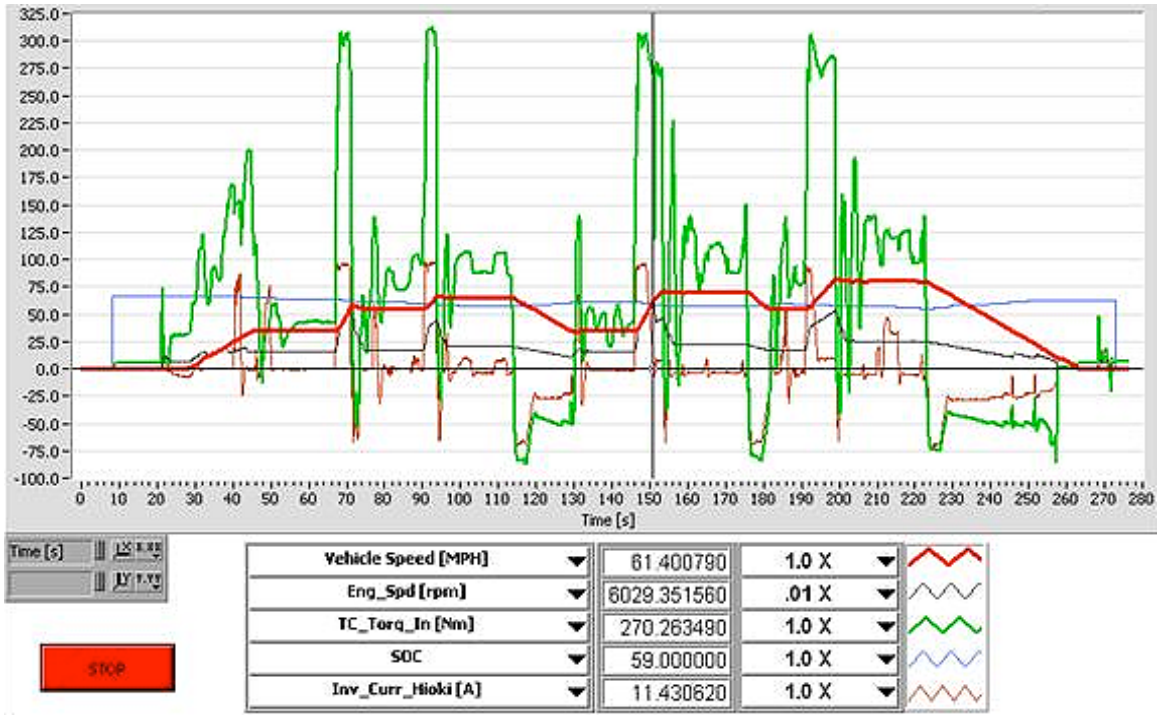
Benefits include:

- Actual dyno-like data torque is directly measured on axles and driveshafts. The data can be displayed in the vehicle as well as recorded during a race or road test (see data below).
- Fast phenomena – such as piston firing, gear mesh, wheel skip/driveshaft wind-up torque spikes – can be captured and are easily seen as a result of high speed sampling (7812 samples/second for the Ch. A unit, and 11718 samples per second for the Ch. B transmitter).
- Torque can be added to existing RPM measurements to display/ record horsepower delivered to the driveshaft. Once per rev RPM can be retrieved from the AT-5000 receiver.
- High RPM/ High G force torque measurements are also available—The AT-5000 EasyApp system is capable of high g-forces; contact Accumetrics for details.
- Connection of the rotating measurement electronics to the axle or shaft is easy -- through a fast-tightening robust aramid fiber strap.
- Accurate data can be taken even in high EMI environments through the use of our noise resistant digital telemetry. No interference is typically seen from ignition, variable frequency motors, drills, etc. as a result of the closely coupled digital data.
- Anti-aliased data provides high quality properly sampled strain gage information.
- Precision measurements provide high accuracy with a low noise floor.
- No slip rings are used; there is nothing to wear out or maintain.

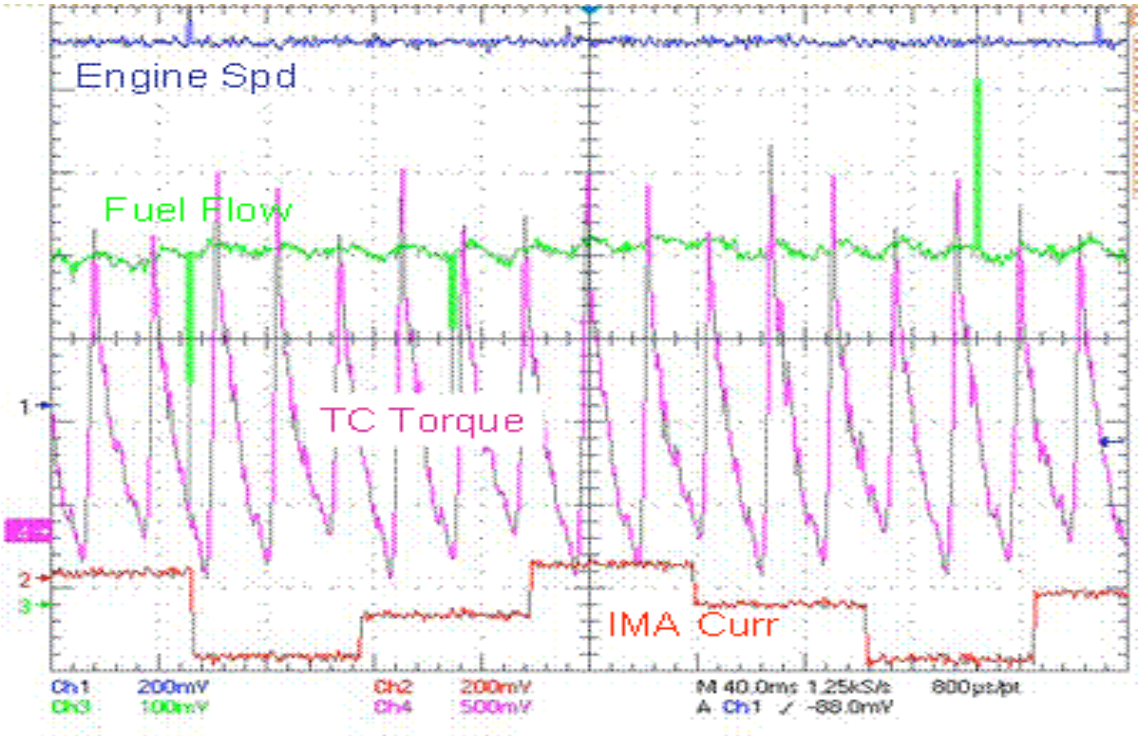
Applying the AT-5000 EasyApp is straightforward:

1) Glue a strain gage to the surface of a driveshaft, yoke, axle, or other rotating part.
    - Strain gages are resistive elements that change values in response to torque signals ranging from very small amplitudes all the way up to levels leading to shaft fracture. Strain gages cost about $50 USD, and can be obtained from Vishay Micro-Measurements and other sources. Strain gage service companies (PCB Load & Torque Farmington Hills MI, for instance) can be contracted to do this service, as well as provide calibration.
2) Apply an AT-5000 EasyApp transmitter to the driveshaft with an aramid fiber strap by tightening the two 10-32 screws, and aligning the transmitter with the mid-point of the strap. This requires only an Allen wrench and takes as little as 3 minutes.
3) Tie-wrap or body tape a pickup loop around the shaft somewhere relatively close to the transmitter.
4) Connect the output 0 +/- 10 volt reconstructed analog torque signal directly to your data acquisition system.

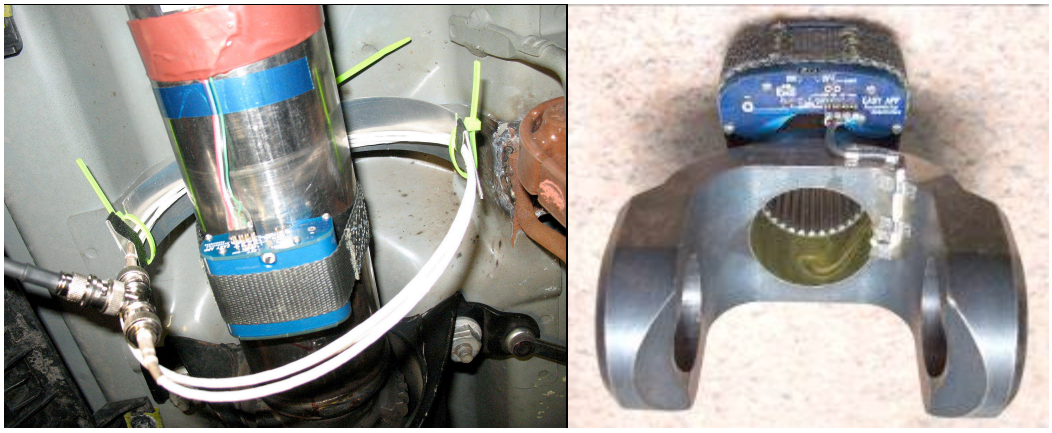
Note: Accumetrics telemetry products generally provide output signals that can show high frequency shaft dynamics (gear mesh, piston firing, and torsional vibration). Your recording should ideally sample fast enough to capture the full DC to 1 kHz signal. If this isn't possible, or if you only want to see the slower response dyno-like curve data, use front end anti-alias filtering before (or in) your data acquisition system to avoid undersampling by the data acquisition. Data acquisition systems should sample more than 2000 samples/second to properly acquire and show the full frequency content data from an AT-5 system, and even higher sampling rates for displaying time domain information. Note: if your data acquisition system can't anti-alias filter, we can provide simple telemetry receiver output filtering to diminish the output data response to match the lower speed sampling of your data acquisition systems if desired.



Hybrid vehicle torque data views (about 4 seconds of data from a Hybrid Accord.)
Courtesy Teledyne Instruments, Argonne National Labs—AT-4400 telemetry data

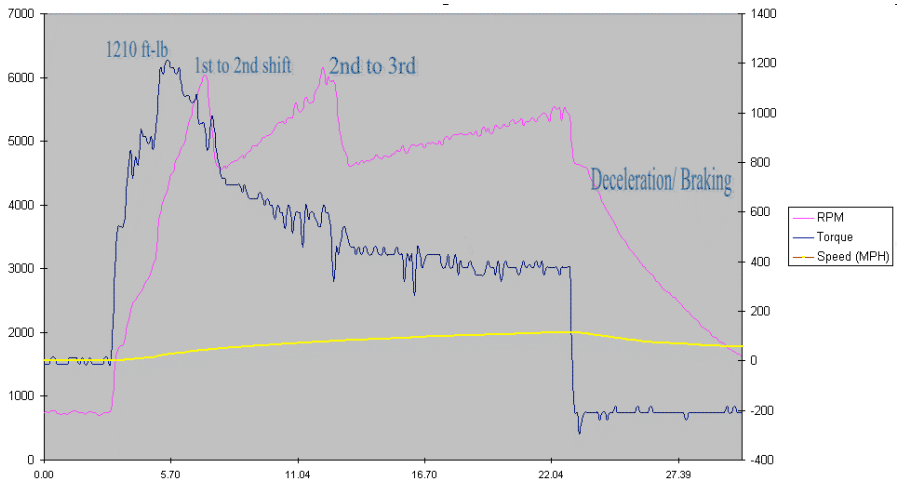


Hybrid vehicle torque data views
(0.4 seconds of data from a Hybrid Accord. Note the piston firing torque spikes above.)
Courtesy Teledyne Instruments, Argonne National Labs—AT-4400 telemetry data

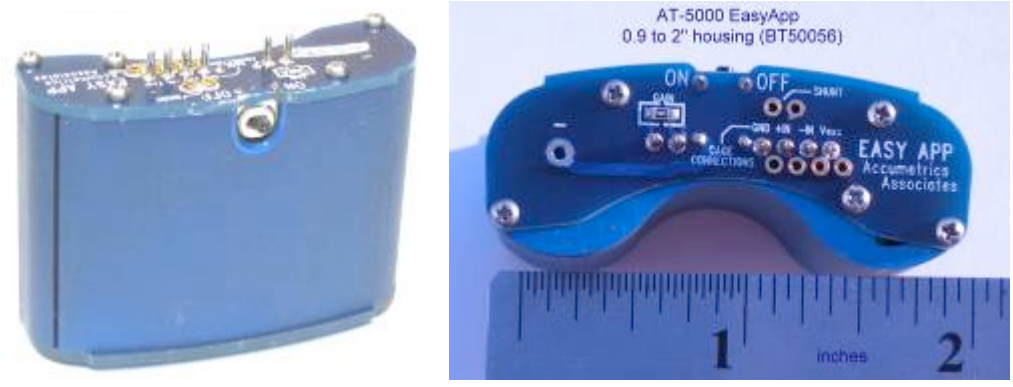


AT-5000 EasyApp driveshaft and yoke mounting

AT-5000 EasyApp truck driveshaft installation with Flexible Loop pickup



Caprice Stock Car (data sampled slowly via on-board 8 bit resolution computer)



Large and small AT-5000 EasyApp housings

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