

DRIVVEN

Automotive Control & Data Acquisition Solutions

Price List Q4 2009

Prices subject to change without notice

Prices set for immediate to NET30 payment terms. Prices are increased by 1.5% per month for longer terms.

Description	Part Number	Cost	Availability
AD Combo Module Kit - Standard	D000003	\$1495.00	Now
VR/Hall Module Kit - Standard	D000015	\$1495.00	Now
AD Combo and VR/Hall module custom configuration	N/A	\$295.00	Now
Spark Driver Module Kit	D000012	\$1495.00	Now
Port Fuel Injection Driver Module Kit	D000006	\$1995.00	Now
Direct Injector Driver Module Kit (Supports GDI & CRI solenoid injectors) (Some piezo injectors are supported)	D000020	\$1995.00	Now
Engine Synchronous TTL Output Module Kit	D000022	\$1495.00	Now
Engine Position Tracking (EPT) VI – Encoder pattern	D000035	\$1495.00	Now
Engine Position Tracking (EPT) VI – N-M pattern	D000031	\$1495.00	Now
Engine Position Tracking (EPT) VI – N+1 pattern	D000033	\$1495.00	Now
Engine Position Tracking (EPT) VI – Chrys. 36-4 pattern	D000037	\$1495.00	Now
Custom Engine Position Tracking VI	D000039	\$4995.00	Now
Low Side Driver Module Kit	D000030	\$1495.00	Now
Electronic Throttle Driver Module Kit	D000017	\$1495.00	Now
O2 Sensor Module Kit (Wide-range) (includes Bosch LSU 4.2 sensor, cable, bung, plug)	D000025	\$1495.00	Now
O2 Sensor Module Kit (Switching) (Includes 4-wire switching sensor, pigtail, bung, plug)	D000026	\$1495.00	Now
Additional Bosch LSU 4.2 sensor, cable, bung, plug	D000027	\$195.00	Now
Additional 4-wire switching sensor, pigtail, bung, plug	D000028	\$195.00	Now
NOx Sensor Module Kit (1-Ch)	D000018	\$3995.00	Now
NOx Sensor Module Kit (2-Ch)	D000019	\$5995.00	Now
Stand Alone Direct Injector Driver Systems			
3 Channel	D000103	\$7295.00	Now
6 Channel	D000100	\$9895.00	Now
9 Channel	D000101	\$12995.00	Now
12 Channel	D000102	\$15495.00	Now
CalVIEW Calibration Toolkit for LabVIEW	D000053	\$995.00	Now
Drivven Combustion Analysis Toolkit for LabVIEW (DCAT)	D000051	\$14,995.00	Now
Drivven PXI-based hardware system for DCAT ⁽²⁾ (Can be further customized for engine control)	D000054	\$39,995.00	Now
Drivven USB DAQ Combustion Analysis Toolkit (µDCAT) ⁽³⁾	D000055	\$8995.00	Now
DCM-R1 Drivven Control Module for Research/Race	D000117	\$7995.00	Q1 2010
Premium Support Plan: 1 Year, Unlimited, 2 named Contacts ⁽⁴⁾	D000303	\$5000	Now
Essential Support Plan: 10 incidents / 10 hours ⁽⁴⁾	D000302	\$1000	Now
On Site Support Visit: 1 Engineer, 1 Week, Domestic Travel Included ⁽⁵⁾	D000307	\$8500	Now

Notes:

- 1.) Academic discounts of 10% are available
- 2.) DCAT Hardware system includes:
 - a. 19-inch rack mount hardware with internal 4-slot PXI chassis
 - b. NI-8106 RT Controller, NI-7811 1M Gate FPGA Card, NI-6123 8-Channel S-Series Card
 - c. 6-Channel single/differential digital input for crank encoder and cam signals
 - d. Drivven DCAT & CalVIEW licenses (1-year service), LabVIEW software not included
- 3.) µDCAT system includes precompiled DCAT application and NI USB-6251 DAQ device
- 4.) 30-Day unlimited support and one year software maintenance is provided for all products.
- 5.) Shorter site visits are also available

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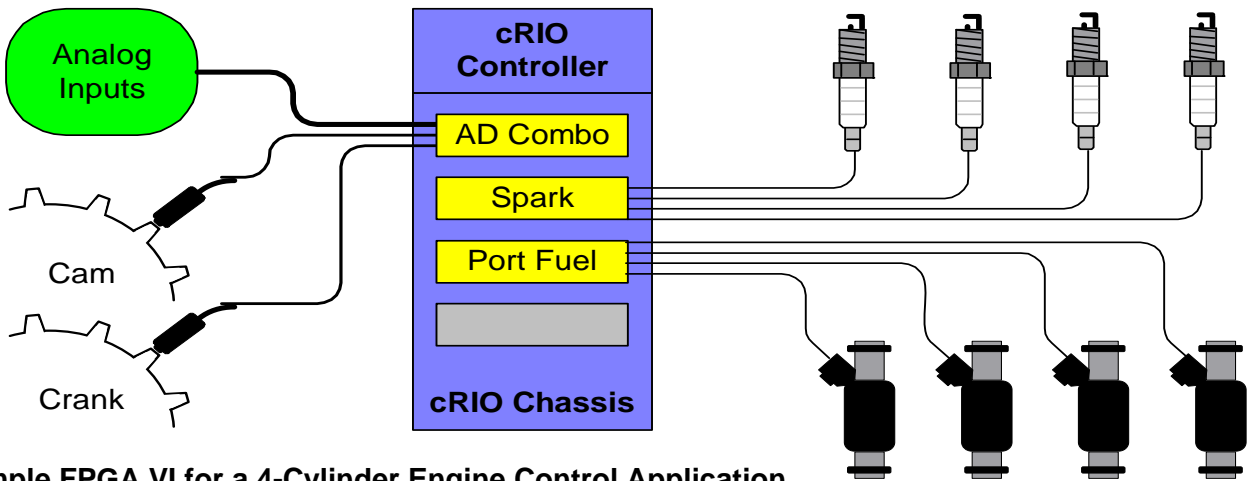
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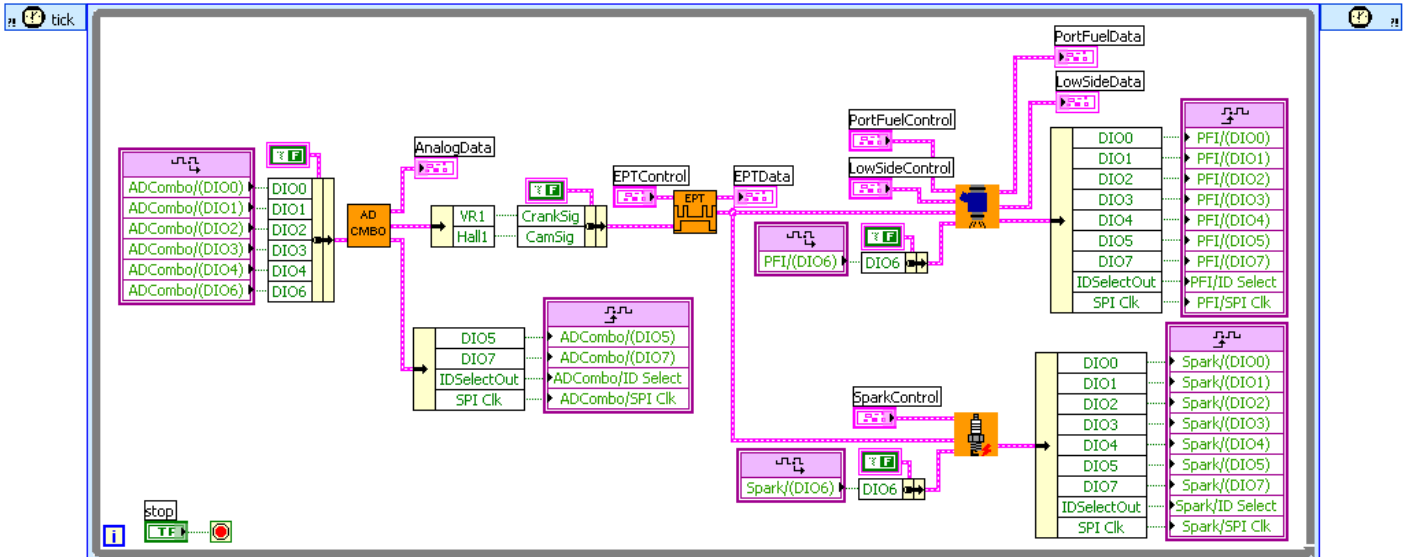
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<p>AD Combo Module Kit</p> <p>21 Analog Inputs</p> <ul style="list-style-type: none"> • 12 Bits, 4KS/s per channel • Optional pull up/down • Optional divide • Anti-aliasing filter • Over-voltage protection <p>2 VR Inputs</p> <ul style="list-style-type: none"> • +/- 150V range • Adaptive threshold <p>2 Hall Inputs</p> <ul style="list-style-type: none"> • Optional pull up/down • Optional divide • Over-voltage protection 	<p>Engine Position Tracking LabVIEW FPGA VI</p> <p>Tracks angular crankshaft position</p> <p>Receives signals from</p> <ul style="list-style-type: none"> • VR/Hall module • AD Combo module • Other digital input hardware <p>Supervises</p> <ul style="list-style-type: none"> • Port Fuel Injector Driver • Spark Driver • Diesel Injector Driver • Engine Synchronous TTL <p>Patterns Supported</p> <ul style="list-style-type: none"> • N-M • N+1 • Encoder • Chrysler 36-4 	<p>PFI Module Kit</p> <p>4 Port Fuel Injector Drivers</p> <ul style="list-style-type: none"> • Peak & hold (4A/1A) • Short circuit protection • Fault detection <p>4 Low Side Switches</p> <ul style="list-style-type: none"> • 1.2A continuous • Short circuit protection • Fault detection <p>LabVIEW FPGA VI</p> <ul style="list-style-type: none"> • Interfaces with EPT • Controls injection angle and time • 0-100% PWM on low side 	<p>Spark Module Kit</p> <p>8 Low Side Spark Drivers</p> <ul style="list-style-type: none"> • Drives inductive coils <p>LabVIEW FPGA VI</p> <ul style="list-style-type: none"> • Interfaces with EPT • Precisely controls dwell and spark timing • Automatically compensates for speed changes • Conventional and wasted spark modes • Optional multiplexed operation to save FPGA space
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Example FPGA VI for a 4-Cylinder Engine Control Application



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O2 Sensor Module Kit

2-Ch Wide Band Sensors

- Heater control
- Fault detection
- Custom fuel calibration

4 Ch Narrow Band Sensors

- Fault detection

Kit Includes

- cRIO module
- 1 sensor (wide or narrow)
- Sensor cable
- Sensor bung/plug

VR / Hall Module Kit

6-Ch Selectable as VR or Hall

VR Inputs

- +/- 150V range
- Adaptive threshold

Hall Inputs

- Optional pull up/down
- Optional divide
- Over-voltage protection

Lowside Driver Module Kit

4-Ch Peak/Hold Lowside Switches

- 2A continuous (2 channels)
- Programmable peak / hold
- Short circuit protection
- Fault detection

4-Ch General Purpose Lowside Switches

- 1.2A continuous
- Short circuit protection
- Fault detection

Software

- 20-bit, 0-100% PWM control

NOx Sensor Module Kit

- CAN-based real-time NOx and O2 measurement
- 1 or 2 channels
- Update rate: 50msec

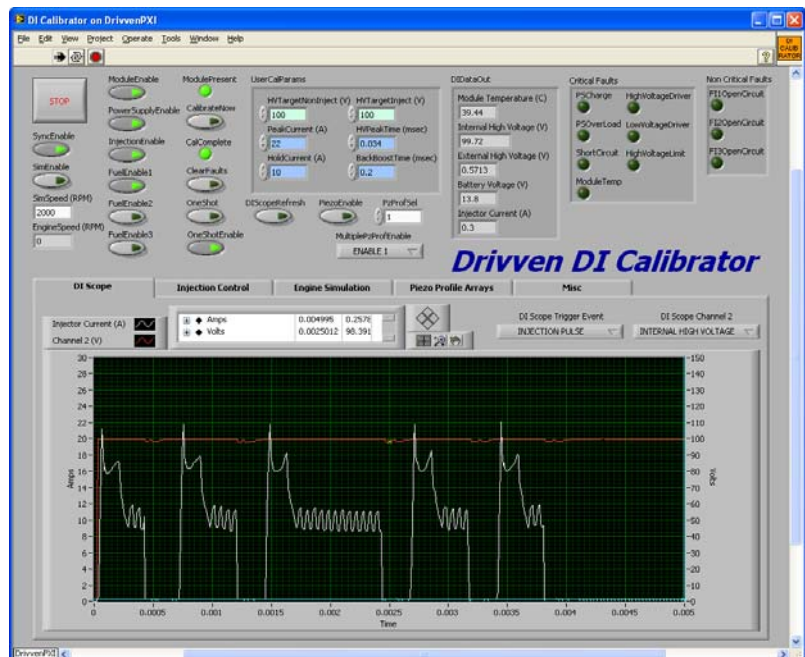
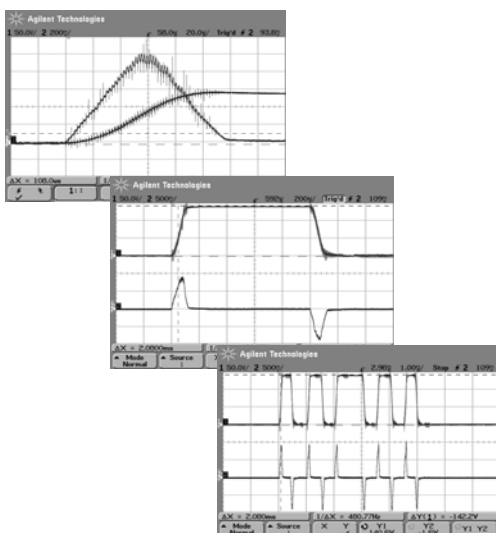
Electronic Throttle Driver Module Kit

- 2-Ch h-bridge driver
- Diagnostics and short circuit protection
- LabVIEW FPGA and RT VI for throttle position control

Diesel and Gasoline Direct Injector Driver Module Kit

3-Ch Inductive or 2-Ch Piezo DI Driver

- Up to 150V internal boost power supply
- Up to 30A Peak Current / 15A Hold Current
- Optional external input for high voltage supply
- Diagnostics and circuit protection
- Current profile calibration utility included
- Supervised by Engine Position Tracking VIs
- Supports stand-alone operation for interfacing to external controller



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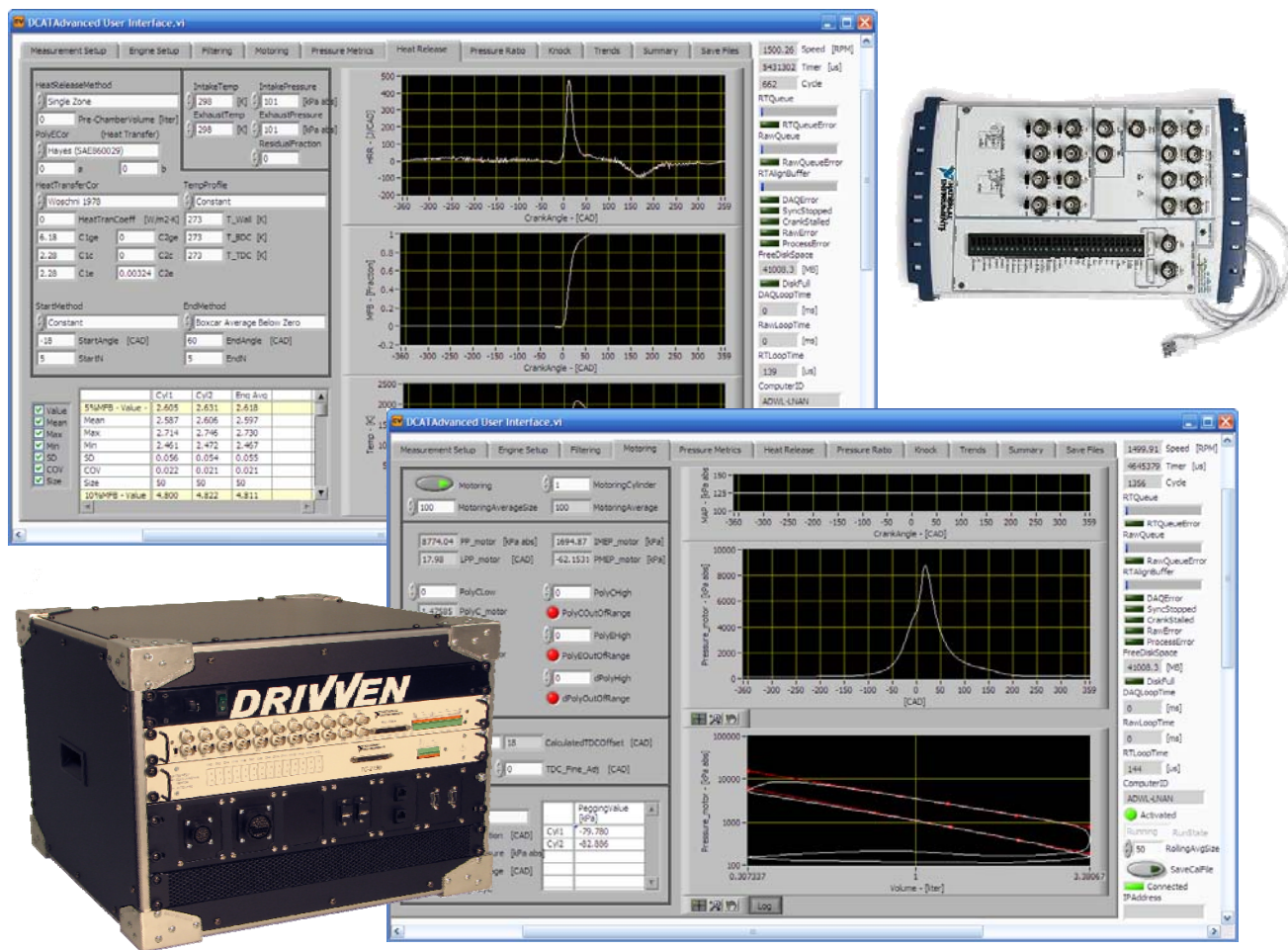
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Driven Combustion Analysis Toolkit (DCAT), μ DCAT and Next-Cycle Control

The Driven Combustion Analysis Toolkit is a unique LabVIEW-based toolkit enabling users to integrate sophisticated combustion analysis and logging with engine control applications. The toolkit includes over 100 custom analysis functions, front panel controls and utilities including data streaming to disk, pre-processing, heat release and pressure metrics, summary data reporting and logging, post-processing, and knock and noise analysis. DCAT leverages R-Series (FPGA) and S-Series (simultaneous analog sampling) cards from National Instruments to supervise engine position tracking and synchronization of data collection and processing.

The DCAT example application may be used stand-alone, or integrated with an engine control application. DCAT users may insert additional custom analysis and decision blocks for unique test and control applications. Next-Cycle engine-control applications are made possible by a unique collection of functions for calculating critical analysis parameters in time for use in the next engine cycle. A DCAT post-processing application is also included which utilizes the same toolkit.

Driven also offers a low cost combustion analysis application (μ DCAT) for interfacing with portable USB DAQ devices from National Instruments, such as USB-6251 and CompactDAQ.



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Driven Control Module (DCM) for Engine Research and Racing Applications

Estimated Release Date: Q1 2010 Estimated Cost: \$7995

Features

- LabVIEW programmable using NI LabVIEW Embedded for ARM Microcontrollers
- Compatible with Driven CalVIEW Calibration Toolkit
- 266MHz 32-bit ARM9 CPU with floating point (NXP LPC3250)
- 1.2M Gate FPGA for all I/O processing (Spartan3E)
- 6-Ch / 10-Ch. direct injector driver unit
 - Bipolar mode (up to 6-Ch.)
 - Drives latest technology direct-acting piezo injectors
 - Full H-Bridge topology
 - Non-multiplexed, independent control
 - Unipolar mode (up to 10-Ch.)
 - Drives conventional solenoid and piezo direct injectors
 - Two multiplexed banks (5-Ch. each)
 - 250V boost power supply
 - Multi-level current control for solenoid injectors
 - Multi-level voltage control for piezo injectors
 - Multiple injection pulses per engine cycle
- 6-Ch. Port Fuel Injector (PFI) driver unit
 - Multi-level current control per pulse
 - Supports low-side PWM actuation of solenoid valves
- 1-Ch. high-side switch for Main Power Relay (MPR) control
- 8-Ch. high-speed differential digital I/O, RS-485 compatible
- 5-Ch. VR/Hall engine position sensor input unit
- 16-Ch. 12-bit analog input unit
- 2-Ch. sensor power output unit
- 2-Ch. wide-band Bosch LSU-4.2 oxygen sensor controller unit
- 1-Ch. CAN 2.0B
- Ethernet for standard calibration and display interface
- Dedicated key-switch input for boot-power
- Over-voltage, under-voltage, short-circuit and reverse-battery protection
- Ambient operating temperature range: -40 °C to 105 °C

DCM-R1 Kit Contents

- DCM-R1 Controller
- Driven CalVIEW license (full)
- Driven low level design blocks for processor and FPGA (includes EPT)
- Latest Driven engine control examples

Third Party Development Tools

- LabVIEW Embedded Module for ARM Microcontrollers (\$8999)
- Altium Designer for Schematic Programming of Spartan3E FPGA (\$995)

Applications

- Slave I/O for NI PXI RT controllers
- Diesel or GDI driver unit for existing OEM and race PFI engine controllers
- Full authority research or racing engine control
- Research and testing of next generation injectors

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Turn-Key Engine Control and Combustion Analysis Systems

Driven offers complete turn-key engineering services for state-of-the-art engine control and combustion analysis systems installed in engine test cells or vehicles. Driven works closely with customers to understand the goals of their engine research and development project and then recommends the Driven and NI products that will provide the best solution for their budget. Turn-Key projects typically follow the outline below. Contact Driven with your project goals.

- 1.) **Project Specification:** Customer provides Driven with the goals of the project and the sensors and actuators involved.
- 2.) **Choose a Hardware Platform:** Driven will determine the hardware platform required in order to carry out the project goals and support the desired I/O. A simple engine set-point controller will typically only require a CompactRIO controller platform. However, a research-oriented control system for algorithm development and combustion analysis will require a PXI platform with a high performance RT controller with multiple DAQ cards. At a minimum Driven will provide an accurate quote for only the hardware and software products required for the customer to build their own desired system. The hardware and software platform cost ranges from \$20K to \$60K.
- 3.) **Engineering Services:** Driven can offer addition engineering services to help the customer achieve their goals even quicker and with confidence.
 - a.) **Enclosure:** Driven offers custom 19" rack enclosure systems for the Driven and NI hardware. These enclosures are internally wired and documented. They are typically AC powered and provide circular connectors on the front for all I/O interfacing. Spare rack spaces can be provided for future I/O growth. Custom 19" rack enclosures add approximately \$20K to the total system cost.
 - b.) **Harness:** Typically, customers are performing research with an existing OEM engine. Since Driven is providing a full authority engine controller, the OEM ECU is removed, but the OEM harness is still useful. Driven can provide a custom adapter harness between the 19" rack and the OEM harness while preserving continued use of the OEM ECU. A Custom adapter harness adds approximately \$5K to the cost of the enclosure.
 - c.) **Reverse Engineering:** In some cases, it is required to calibrate an engine close to the factory calibration in order to have a baseline to compare against further research. Deriving the steady state factory engine calibration requires recording large amounts of data while running the engine with the OEM ECU. This data must then be converted to the appropriate algorithms and tables for the new controller. Reverse engineering efforts add approximately \$25K to \$50K to the total system cost.
 - d.) **Control Application Development:** Driven can draw on years of engine research expertise to develop a flexible, full authority, open-source engine control and combustion analysis application tailored to the specific project engine. These applications are bench tested at Driven's facility for proper operation and then reviewed with the customer. Further debugging may be required while running the actual engine. Application development by Driven adds approximately \$15K to \$20K to the total system cost.
 - e.) **Onsite Support:** Driven will travel to the customer's site to assist with getting the engine running, developing and debugging control algorithms, calibration and training. Site visits are typically 5 days with one Driven engineer. Site support visits are quoted at a flat fee and include travel. A domestic 5-day site visit is \$8K.



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About Driven

Driven, Inc, of San Antonio, Texas, has provided automotive control and data acquisition solutions for research and production applications since 2003. Driven's partnership with National Instruments has led to a new standard of engine and vehicle electronics development systems. These systems combine Driven's automotive electronics design expertise with National Instruments' cutting edge software and hardware products such as LabVIEW, LabVIEW Real-Time targeted to PXI and cRIO computing systems, RIO enabled hardware featuring FPGA technology for critical timing of digital I/O, high speed analog I/O, and signal conditioning.

The Driven team has drawn on years of FPGA-based automotive electronics experience to create a toolkit of hardware I/O modules and software for RIO covering a wide variety of engine management tasks such as engine position tracking and engine synchronous fuel and spark control. The underlying IP cores of these VIs can be ported directly to production FPGA-based engine management systems.

Using the latest National Instruments products, Driven provides full authority engine control, analysis and display capabilities. In real-time, the system can call models written in LabVIEW, C and MATLAB (Simulink / Stateflow). It can also simultaneously perform combustion analysis and feedback for next-cycle control algorithms. This eliminates the difficult task of synchronizing recorded data and control parameters between multiple stand-alone systems.

Practical turn-key systems not only require software and computing power, but also sensors, actuators, drive electronics, wiring harnesses, and the expertise to bring it all together. Driven can provide custom, turn-key development systems in customer test cells or provide engine and vehicle toolkits for every level of engine development.



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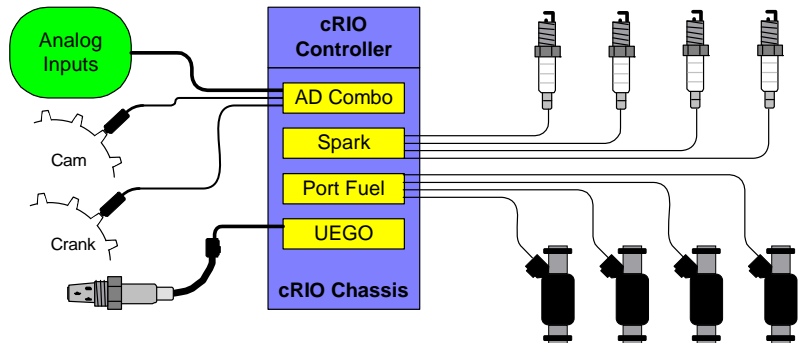
Example Engine Control Systems

Prices subject to change without notice

Hardware and software requirements for prototyping 4-cylinder engine controller

- Full authority control of a small high performance four-cylinder engine
- Create custom engine control algorithms, models, and calibrations in LabVIEW
- Replacement of a factory ECU with compact dimensions

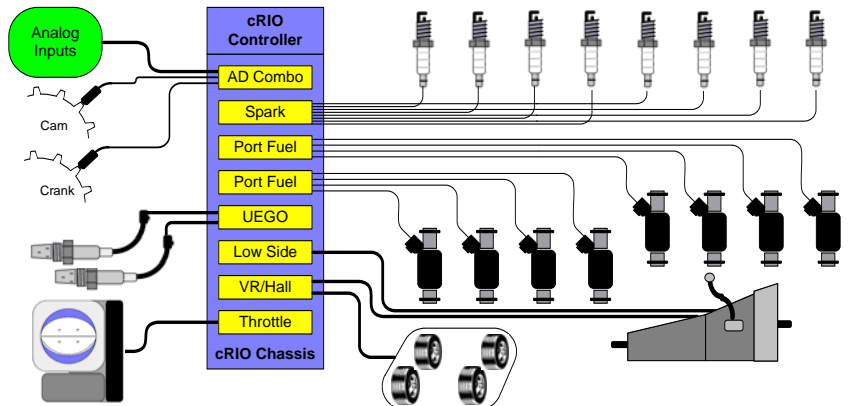
Product	Part Number	Price
AD Combo Module	D000003	\$1,495
Spark Driver Module	D000012	\$1,495
PFI Driver Module	D000006	\$1,995
O2 Sensor Module	D000025	\$1,495
EPT VI	D00003X	\$1,495
cRIO Chassis	cRIO-9111	\$999
cRIO Controller	cRIO-9012	\$1,599
LabVIEW		\$2,599
LabVIEW RT		\$2,599
LabVIEW FPGA		\$2,599
Drivven Total:	\$7,975	NI Hw:\$2,598 NI Sw: \$7,797
System Total:	\$18,370	



Hardware and software requirements for prototyping 8-cylinder engine and vehicle controller

Full authority control of engine & vehicle

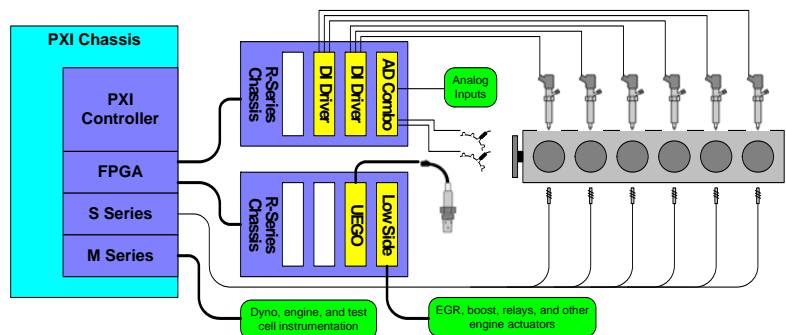
Product	Part Number	Price
AD Combo Module	D000003	\$1,495
Spark Driver Module	D000012	\$1,495
PFI Driver Module x 2	D000006	\$3,990
O2 Sensor Module	D000025	\$1,495
LS Driver Module	D000030	\$1,495
VR/Hall	D000015	\$1,495
Throttle Driver	D000017	\$1,495
EPT VI	D00003X	\$1,495
cRIO Chassis	cRIO-9114	\$2,299
cRIO Controller	cRIO-9014	\$2,699
LabVIEW		\$2,599
LabVIEW RT		\$2,599
LabVIEW FPGA		\$2,599
Drivven Total:	\$14,455	NI Hw: \$4,998 NI Sw: \$7,797
System Total:	\$27,250	



Hardware and software requirements for prototyping high-end research diesel engine controller

- I/O platform appropriate for creating a six cylinder diesel engine controller research platform
- Capable of complete engine test cell automation
- Integrated real-time combustion analysis and next-cycle control (optional)

Product	Part Number	Price
AD Combo Module	D000003	\$1,495
O2 Sensor Module	D000025	\$1,495
Low Side Driver Module	D000030	\$1,495
Diesel Driver Module x 2	D000020	\$3,990
EPT VI	D00003X	\$1,495
DCAT (optional)	D000051	\$14,995
PXI Chassis (4-slot)	PXI-1031	\$999
PXI RT Controller (Duo)	PXI-8106	\$4599
PXI FPGA Card	PXI-7811R	\$1599
R-Series Exp. & Cable X 2	cRIO-9151	\$796
M-series Card & Cable	PXI-6221	\$1217
S-Series Card & Cable	PXI-6123	\$3167
LabVIEW		\$2,599
LabVIEW RT		\$2,599
LabVIEW FPGA		\$2,599
Drivven Total:	\$24,965	NI Hw: \$12,377 NI Sw: \$7,797
System Total	\$30,144 (\$45,139 with DCAT)	



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