

Jet and Rocket Engine Test System

Flexible, Accurate, and Safe Data Acquisition and Control

DESIGN IMPLEMENTATION

V I Engineering has developed a highly accurate, fast response data acquisition and control system for Jet and Rocket Engine Test facilities. Designed for world-class propulsion laboratories, this robust and reliable platform is capable of managing engine test articles, while protecting expensive equipment with a four (4) ms response time to alarm conditions.

HARDWARE

V I Engineering's unique design for distributed, deterministic, real time data acquisition and control provides a high level of system performance while minimizing the risk to valuable and expensive test articles. Six LabVIEW RT controllers are used to implement data acquisition and control. They are;

- ◆ Two controllers collect data from the analog and digital input channels, and the accelerometers.
- ◆ A master controller implements alarm checking and sequence execution for 192 digital outputs.
- ◆ A slave controller performs watchdog monitoring of the master controller.
- ◆ An additional controller streams data to disk and communicates via TCP/IP to the Host GUI.
- ◆ A redundant controller is available for support.

DATA ANALYSIS

- ◆ Data logging is configurable within each test mode.
- ◆ Post-test Quick Looks provide immediate test results feedback.
- ◆ Data files can be exported to TDM format for in-depth analysis with DIAdem™.

Qty	COTS Instrumentation and Hardware	Part Number
6	National Instruments PXI Controller	NI PXI-8196
3	Digital Out	NI PXI-6512
4	Dynamic Signal Acquisition for Accelerometer & Pressure Inputs	NI PXI-4472
3	Multifunction Analog Input	NI PXI-6250 M
1	Digital Input	NI PXI-6511
1	Strain Gage Conditioning	NI SCXI-1520
12	Analog Input with Isolation	NI SCXI-1125

SOFTWARE

For the software architecture, V I Engineering selected LabVIEW™ implemented with Graphical Object Oriented Programming (GOOP) techniques. The GOOP methodology provides many specific advantages, including:

- ◆ Modularity and module independence - the best possible architecture for cost-effective scalability and long term maintainability.
- ◆ The easiest and most dependable method for unit, sub-module and systems testing during integration and validation.

DATA ACQUISITION & CONTROL

- ◆ Deterministic data acquisition for up to 288 channels at 1 - 32 KHz per channel, with aggregate sampling rate of up to 1.7 MS/s.
- ◆ Control of up to 192 outputs at 1 KHz.
- ◆ Time-based or event driven test sequence control with 1 ms resolution and optional timeouts.
- ◆ Data simulation is provided for verifying test sequences before test article ignition. (cold flow simulation).

SAFETY & ALARMS

- ◆ Flexible alarm capability, user defined during schedule set-up
- ◆ Signals compared to limits for user-specified scans at full sampling rate.
- ◆ Multiple alarm clauses may be combined to form compound states.
- ◆ Coast-down schedule after alarm detection.



KEY BENEFITS

- ◆ Protection for expensive test articles from redundant watchdog controller and Four (4) ms response time to alarm conditions.
- ◆ Highly accurate, distributed control via Six (6) National Instruments' PXI chassis, provides dependable calibration, deterministic performance, and repeatable results.
- ◆ Workflow automation and test parameters database maximizes productivity, facilitates traceability, back tracking and easy re-runs.
- ◆ Powerful and flexible reporting capabilities including "Quick Look," dynamic graphical outputs and extensive automated analysis.
- ◆ Easily accommodates a wide variety of test sequences, alarm conditions, transducer types, and data generation requirements.
- ◆ Cold-flow/pre-ignition simulation.
- ◆ Enterprise-wide data access.



Complete Test and Measurement Solutions that Exceed Expectations

Specifications

Control	
Digital Output Capacity	192 DO available with default and failsafe states, up to 24 VDC isolated
Response	< 4 ms response to analog data transitions and process abort buttons
Resolution, Jitter	1 ms
Redundancy	Slave controller failover in < 10 ms to shutdown schedule execution
Data Acquisition	
Analog Input Channels	Net analog input capability of 1.7 MS/s
Analog Capacity	Up to 32 channels at 32 kHz, 24 bit resolution with full bandwidth anti-aliasing. Up to 96 channels of voltage or TC sensors sampled at 2 kHz, analog filtered at 4 Hz or 10 kHz Up to 64 channels of voltage or bridge transducers sampled at 4 kHz, analog filtered at 10,100,1000, or 10 kHz Up to 32 channels at 8 kHz of voltage or bridge transducers sampled at 8 KHz, analog filtered at 10,100,1000, or 10 KHz
Supported Transducers	
Accelerometers	IEPE, 4 mA integrated excitation capability
Pressure Sensors	350 Ohm bridge transducers, up to 10 V excitation
Thermocouples (x Type)	Types R, J, K, S, T with cold junction compensation
Flow, etc	Conditioned +/-10V signals
Calibration	Can be performed in situ or data manually entered from cal sheets. Hardware self-cal implemented to built-in reference voltages to improve accuracy between external cal.
Digital Input Channels	
Digital Capacity	64 DI, 2-24 VDC (isolated)
Sampling Rate	1 KHz
Timing synchronization	IRIG-B timestamp
Data Logging	Options include full sampling rate or as multiples of once every ms (for example, 1kHz, 500 Hz, 100 Hz, etc.) Different test modes (Idle, Pre-Test, Test) have separate logging rates
Test Sequences	
Events	Sequences are time or event-based Events can be defined as a logical combination of up to 20 clauses Clauses can be simple (channel > value) or redundant transducers (2/3 within tolerance and > limit)
Alarms	Alarms include: Events (see above) Digital Inputs (process abort) Set point timeouts (failure to achieve an event within a duration) Valve timeouts (failure to get a digital input indication within a duration)
Run-Time GUI	Can be customized for facility layout 5 Hz updates for all channels A subset can be served over intranet Remote (intranet) calibration capability Traceable transducer calibration, test configuration, and test run database Automatic report generation in DIAdem

V I Engineering

V I Engineering is an experienced systems integrator that provides automated test and measurement systems, engineering information management, and LabVIEW productivity tools to Fortune 500 customers in the automotive, life sciences, manufacturing, and aerospace industries. We are also a leading Select Integrator in National Instrument's Alliance program.

VISTA

VISTA is V I Engineering's branded line of software tools, process consulting, and advanced design training that improves programming productivity and quality through the implementation of software engineering best practices for the development, management, and release of LabVIEW and TestStand applications of any size.

ENGINEERING INFORMATION MANAGEMENT

The EIM team provides software solutions that improve the efficiency of Test Planning, Execution, Analysis, and Document Management. Clients gain productivity through automated reporting, and fast, easy access to all their engineering intelligence.

CUSTOM FABRICATED TEST HARDWARE

With the addition of experienced hardware engineers, V I Engineering now designs and fabricates a wide range of PCBs and fixtures. Plus, our new 3,000 sq. ft. build area allows us to fully assemble and validate almost all types of automated testing equipment in-house.

Locations

Corporate Offices

27300 Haggerty Rd. Suite F-10
Farmington Hill, Michigan 48331
248-489-1200

4463 White Bear Parkway Suite 102
White Bear Lake, Minnesota 55110
651-484-1332

7155 Shadeland Station
Indianapolis, Indiana 46256
317-596-0720

www.viengineering.com • 877.889.4300 • email: sales@viengineering.com



VI ENGINEERING, INC.
VALUE • INTEGRITY

For more information visit our new web site at viengineering.com