Niksar

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SYSTEM DESIGN and INTEGRATION

Company Overview

- Started 1991
- Projects span industrial and military sectors
- Specialist in ATE involving RF, vision, measurement and control systems
- Analysis, Design, Build, Install and Support activities
- National Instruments Alliance partner
- www.niksar.com.au

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Sample Projects

USING
NATIONAL INSTRUMENTS
TECHNOLOGY

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Sumitomo Wiring Systems Australia

In-line full functional testing of automotive console

Use of Test Stand and LabVIEW with NI Peripheral Interfaces

Included assembly jig connectors & automated ATE connector engagement

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Holden Engine Operations

(Port Melbourne)

Non-destructive
(Ultrasonic) Casting
Nodularity Tester

Using NI High Speed Digitiser & DIO and LabVIEW software environment

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RLM Systems (Melbourne)

Jindalee
Over-the-Horizon Radar
Network (JORN)

Automatic Test Equipment for Radar Receivers Using NI LabVIEW and peripheral interfaces

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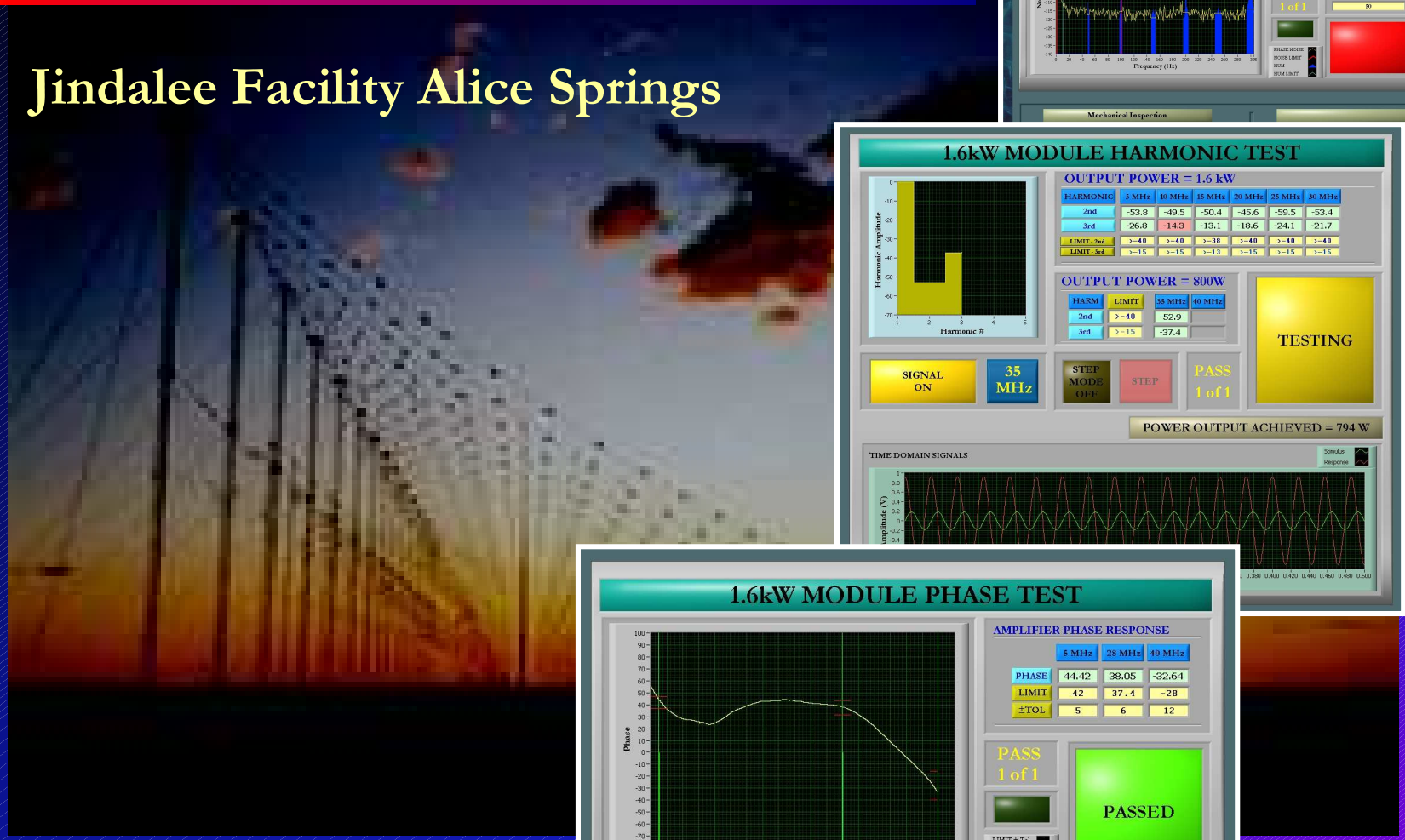
JFAS RF System Tester

Jindalee Facility Alice Springs



SELECTED MILITARY PROJECTS

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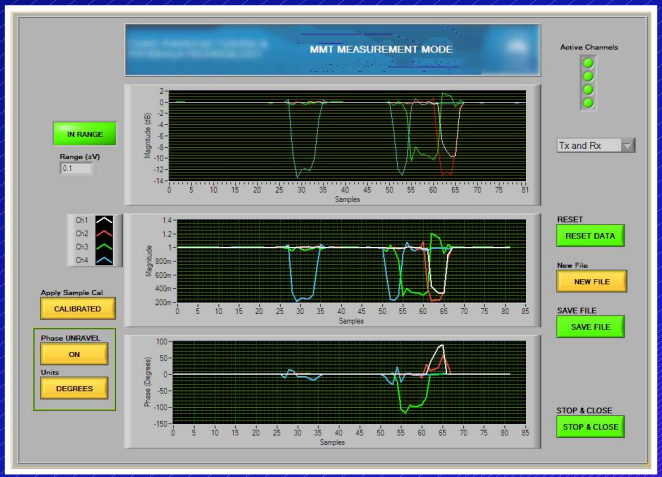
Microwave Materials Tester

X-band system using:

- High Performance (18 bit) DAQ
- High Speed Digital Waveform Generator
- High Speed X-Band Signal Commutating
- Analogue RF Signal Processing



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Modern Automotive Engine Control #1

Modern automotive engines are managed electronically by systems that provide "Full Authority Digital Engine Controls"

Engines are fitted with actuators and sensors to monitor and control functioning.

Advantages are:

- **greater efficiency**
- **increased power**
- **better response to driver input**
- **greater reliability**
- **less pollution**
- **in-built diagnostics**

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Modern Automotive Engine Control #2

Current production engines have many integrated systems with functions including:

Electronic activation and control of

- throttle
- valve timing & lift
- fuel injection
- ignition timing
- inlet manifold configuration
- pre-ignition or detonation detection

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Modern Automotive Engine Control #3

This level of control requires sensors to measure many aspects of the engine's environment including:

- accelerator pedal position
- engine temperature
- oil temperature/pressure/condition
- air pressures, temperatures & flow
- engine speed
- exhaust gas (O_2)
- crankshaft position
- knock sensing

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Modern Automotive Engine Control #4

Control requires actuators to set the position of physical items, to set the timing of critical events and modulate fluid flows:

- throttle positioning
- inlet manifold geometry variation
- fuel injector regulation
- valve lifters & cam shaft angles
- ignition sequencing/timing

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Modern Automotive Engine Control #5

All of these are used by the Engine Control Module (ECM):

- to manage the operation of the engine over the entire range of operating conditions, using
- electrical connections via a wiring harness and connectors
- to the ECM in the vehicle that contains the electronics, software and processor

The characteristics and correct functioning of the wiring harness, electronic sensors and actuators is tested by an automatic Engine Harness Tester (EHT).

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The EHT Challenges

- A total of up to 60 different tests on any one engine harness
- DC V, 2- & 4-wire Resistance, Capacitance, Current and Pulse Width Modulated (PWM) signals
- Multiplexed connections, ATE to sensors and actuators
- Connection via a (robust) branched 96-way wiring loom
- Different engine variants (varying equipment complements)
- Many different sensors & connection configurations
- Provision of controlled actuator power and measurement excitation.
- Continually test the connection system and harness for short circuits.
- All tests to be done within 10 seconds

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Niksar Solution Overview

Test functionality based on PXI-bus interface modules, with test controller based on an industrial computer connected via MXI-4 interface:

- **NI PXI Chassis : MXI-4 Controller**
- **High performance DMM : PXI-4072 (6½ digit, high conv rate)**
- **Multifunction DAQ card : PXI-6229M**
- **Low level Multiplexer : PXI- 2530 (high density)**

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Solution Overview (cont.)

Electrical Tests conducted on the Engine Harness/Electronics include:

- Hi Z 2-Wire resistance tests
- Capacitance tests
- 2-Wire resistance tests
- Medium and low current Diode tests
- Low resistance 4-wire resistance measurement

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Solution Overview (cont.)

Medium and high level current switching:

- NI PCI 6509 DIO for relay control
- NI ER-16 and ER-8 Relay modules
- Some ER-8/16 relays driving DIN-rail contactors for higher currents
- Power Supply programming and control via serial communications port

4-wire resistance measurement for tests for loom/cable resistance compensation:

- NI PXI- 2530 multiplexer and Switch Management Toolkit allows rapid dynamic configuration changes
- Hardware handshaking between the Multiplexer and DMM to obtain accurate/consistent (single-shot) measurements quickly

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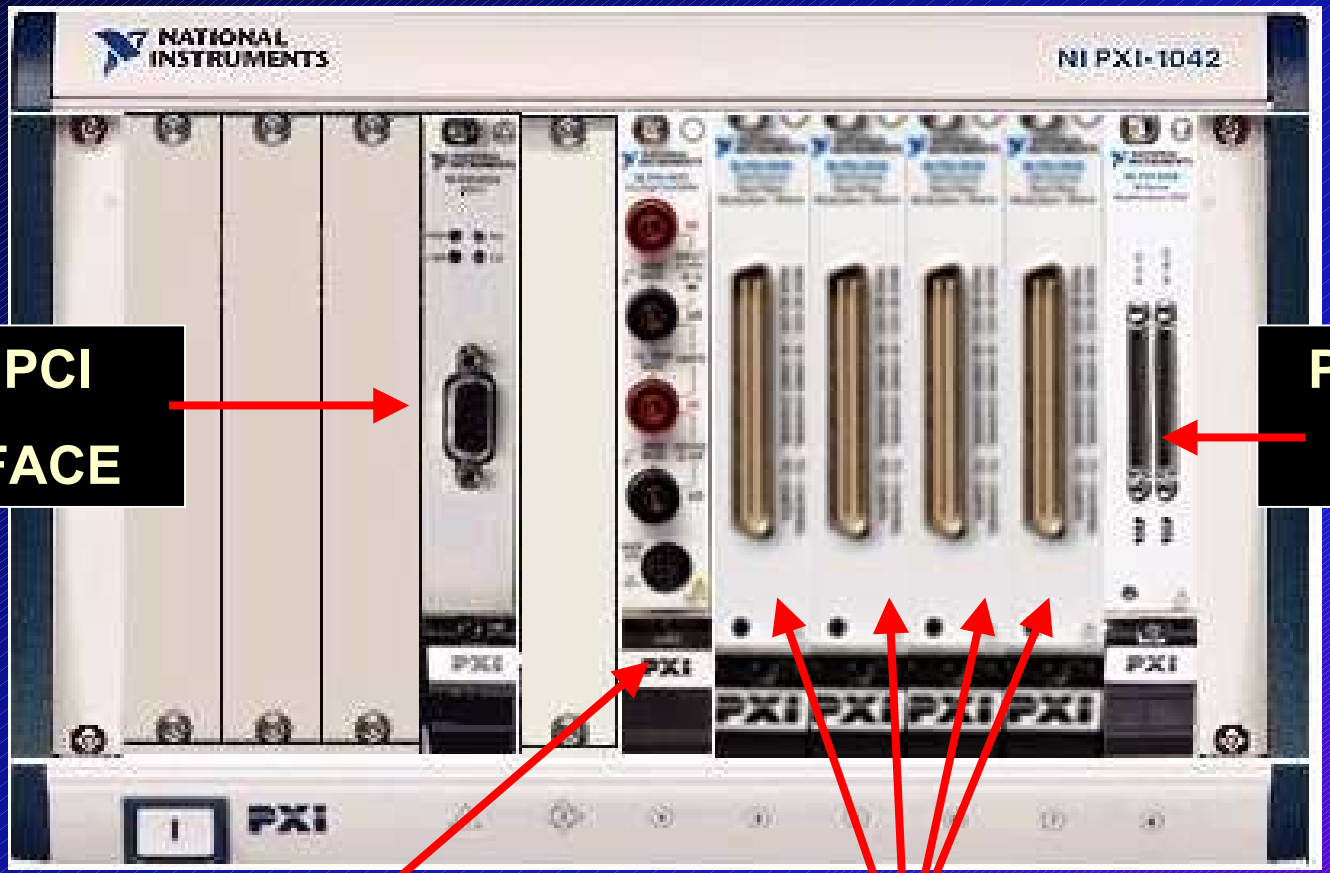
Niksar Solution Overview - Hardware



MXI-4 PCI INTERFACE

PXI-6229M DAQ

PXI-4072 DMM

PXI-2530 HIGH DENSITY MULTIPLEXERS

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Niksar Solution Overview - Hardware

Flex DMM - a Multifunction device :

- 6½-digit digital multimeter
- 1.8 MS/s isolated digitizer
- 10- to 23-bit flexible resolution

Provides a wide range of measurement types . . . .

- DC Voltage
- 2- and 4-Wire resistance
- Diode voltage (100µA and 1mA)
- Capacitance and Inductance
- Frequency and Period (not used for EHT)

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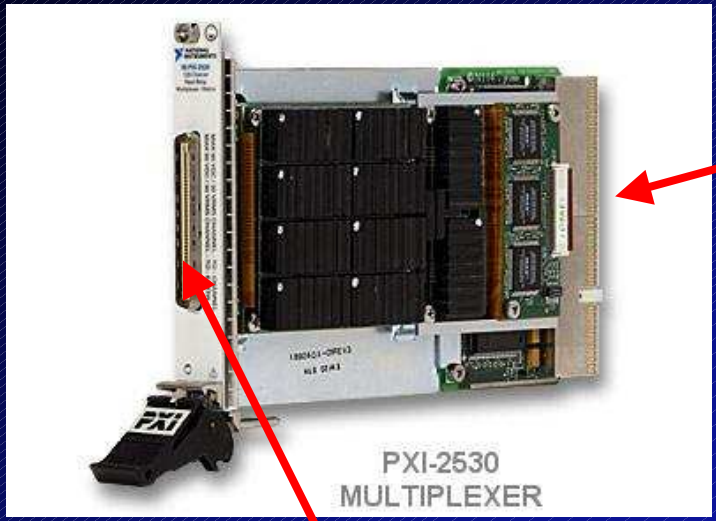
Niksar Solution Overview - Hardware



PXI-2530 Multiplexer

A good 'front-end' for measurement devices such as . . . .

NI PXI-4072 61/2-digit FlexDMM.

Wide range of Connectivity Configurations:

- 128x1 (1-wire)
- 64x1 (2-wire)
- 32x1 (4-wire)
- 8 banks of 16x1 (1-wire)
- Matrix 4x32 (1-wire) & 4x16 (2-wire)
- Matrix 8x16 (1-wire)

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Niksar Solution Overview - Hardware

M Series DAQ - Multifunction device :

- 32 Analogue voltage input channels
- 16 bit digitiser resolution
- 4 Analogue voltage outputs
- 32 Channels DIO

Provides:

- Controlled voltage source for excitation
- ADC for short circuit detection
- Bi-directional digital interface to a production line PLC

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Niksar Solution Overview - Hardware

PCI Bus DIO Module:

- 96 Bi-directional DIO lines for
- TTL, CMOS, and 5 V logic levels
- 24mA current-drive capability

Provides:

- Relay switching of signals via NI ER16/8 relay modules
- Relay control of resistive load bank (pull-up/down)
- Relay drivers for sources up to 10 Amp using industrial relays

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Niksar Solution Overview - Software

System functionality and personality designed using National Instruments' software:

- NI LabVIEW V8
- NI State Diagram Toolkit
- NI Switch Executive - Switch Management Software
- NI Database Connectivity Toolkit

Other proprietary software:

- Microsoft SQL Server

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Niksar Solution Overview - Screens

Some User Interface screens

View Results Mode

EHT - OVERALL TEST RESULTS

Production Mode

EHT : Turbo

EUN 012345678912345
SPN 10
HARNESS 0987654321
TEST RETRIES 0004 REWORK COUNT 0

REWORK
FINISH
Remove Connectors
MAIN MENU
VIEW CONFIG
VIEW RESULTS

Production Mode

EHT : Turbo

EXIT MODE

IGNITION COILS
OIL PRESSURE SENSOR
BAROMETRIC PRESSURE
FUEL INJECTORS
CANISTER PURGE VALVE
FUEL RAIL PRESSURE
KNOCK SENSORS
COOLANT TEMP SENSOR
CAM SHAFT SENSORS
OIL LEVEL SWITCH
SPEED SENSOR
ETC

T R STD

EUN 012345678912345
SPN 10
HARNESS 0987654321
TEST RETRIES 0004 REWORK COUNT 1

QuickViewResults.vi

COMPONENT ID	TEST NAME	VALUE	RESULT

PASS
CLOSE RESULTS

SUB TEST MODE
STANDARD TEST : FUEL INJECTORS
REWORK
FINISH
Remove Connectors
MAIN MENU
VIEW CONFIG
VIEW RESULTS

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Niksar Solution Overview - ATE Control

Test configurations:

Each variant's test configuration is easily managed:

- Each procedure is set up in a Configuration Database System
- Manual editing used to alter the test process
- Replication to produce a new variant
- Password protection

Test results:

- Detailed results of each test written to database

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Niksar Solution Overview - ATE Control

Scope of Tests:

- Number of Variants : 17
- Components per UUT : 30
- Different Component Groups : 23
- Different Component Types : 15/engine (typ)
- Component Count : 40
- Tests per Component : 1 to 4
- Different MUX Connections : 70/engine (typ)

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Niksar Solution Overview - UUT Connect

System in-service consistency and robustness enhanced using:

- Work fatigue-resistant cable harnesses
- Machined Acetal connector blocks
- UUT connector probing with spring probes
- High tensile flexible cable strain relief
- High density 'ZIF' connectors to couple harnesses to ATE

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Niksar Solution Benefits

Compared with a 'traditional' approach, Niksar Australia's approach offered:

- ***Compact*** physical configuration
- ***Flexibility*** of measurement capability
- ***Rapid control and interaction*** with the instrumentation for circuit switching, analysis and extraction of report data
- ***Ready expansion*** of test plans
- ***Easy addition*** of new test plans

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Niksar Solution Benefits

In service, this approach achieved:

- ***Test Cycle Timing Budget:***
  - UUT arrival at test station : 10 sec
  - Operator connecting to UUT : 10 sec
  - ATE configuration for variant : 5 sec
  - Conduct & record all tests : 5 sec
  - Operator disconnection of UUT : 10 sec
  - UUT move out of station : 10 sec
- ***Robustness and Stability:***
  - Reliable and consistent operation
  - UUT Tests to date : well in excess of 100,000

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FIN

QUESTIONS?

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