

Keysight Technologies

Automotive Body and Safety Electronics Test

Reference Solution

Solution Brochure

Halve the time to functional test insights with a compact, integrated one-box test solution with built-in auto electronics signal and load simulations, complete with a test sequencer and automotive hardware library software.



Unlocking Measurement Insights



Introduction

There is an ever increasing need to meet worldwide governmental automotive safety goals like zero accidents by automotive manufacturers. As a result, there is a race to create autonomous vehicles among auto manufacturers. To achieve this, more and more automotive electronics safety features need to be implemented in vehicles to meet that goal.

Furthermore, there is an ever growing demand for more creature comfort features to be incorporated into vehicles, culminating to a higher content of body and safety electronics being incorporated into our vehicles in the present and foreseeable future.

Coupled with the need to cut down on product development and manufacturing lifecycle time, automotive electronics suppliers are faced with the need to halve their time to design, integrate and support electronics functional test systems.

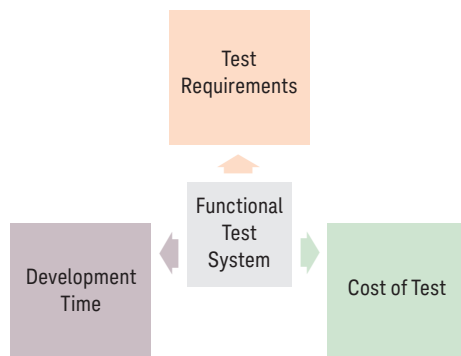
This solution brochure describes Keysight Technologies' PXI-based reference solution for automotive electronics body and safety functional test systems. It provides automotive electronics suppliers with a solution to halve their time to design, integrate and implement their electronics functional test systems.

Body and Safety Electronics Functional Test – Design, Integration and Implementation Challenges

With the need to incorporate more and more electronics content to support autonomously driven vehicles and ever increasing demand for more creature comfort features, automotive electronics suppliers have had to design more complex electronics control units (ECU) with multiple features converged into them.

Automotive electronics applications are unique compared to general industrial electronics tests in that they operate in high voltage and current environments and require support for voltage and current switching, load simulation and measurement in high voltage and current ranges.

Coupled with the need to reduce test system design, integration and deployment time, as well as costs, which are all inversely related, automotive electronics suppliers are in a quandary as to how to solve these challenges.



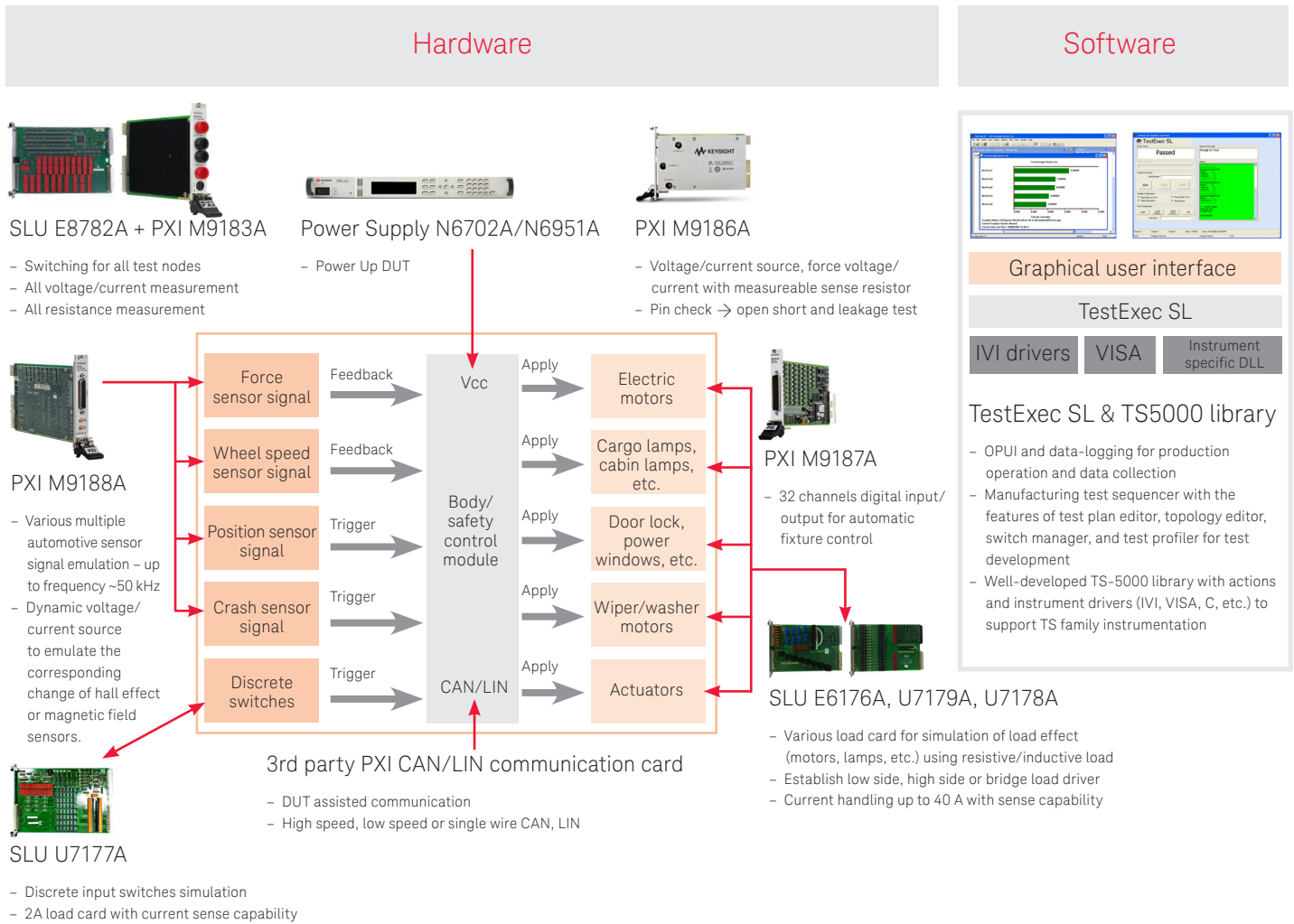
Key challenges and needs faced by test system architects

- Development of custom switching and load simulation solutions that support high voltage and current ranges while reducing system design, implementation and deployment timelines
- Reducing the cost of test while providing a highly flexible test platform to support automotive body and safety ECUs in a high mix, low volume manufacturing environment
- Reducing the electronics functional test platform footprint to optimize floor space utilization.

To address these test challenges, the automotive body and safety electronics reference solution provides manufacturers with a PXI-based test platform with an integrated modular switch and load solution that is designed from the ground up to support high voltage and current switching and load simulation. Furthermore, it comes with a test sequencer and hardware libraries for the solution, halving the time to design, integrate and deploy functional test solutions.

With its wide range of PXI instruments, pin matrix and load cards that are designed for automotive electronics test, manufacturers are able to use it to establish a standard platform that provides the flexibility to mix and match to a high variance of ECUs while maintaining a standard set of hardware, thus lowering the total cost of test for their manufacturing test needs.

Reference Solution Architecture



Reference solution features and benefits

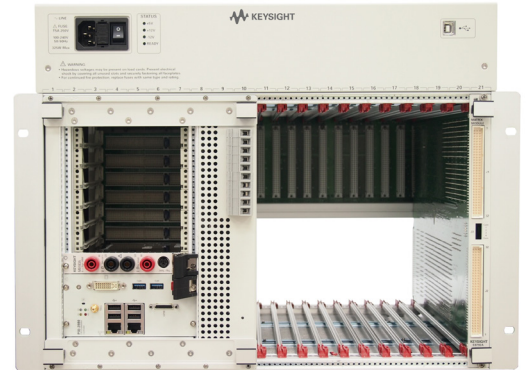
<ul style="list-style-type: none"> - High current switching up to 40 A with flyback protection - Forced current testing of up to 100 V/20 mA or 16 V/200 mA sourced 	<p>Standardization of switching and load solution and enabling current monitoring</p>
<ul style="list-style-type: none"> - Multi-sensor simulation up to +30 V with 20 mA current source - Digital multimeter with 6.5 digit resolution, 15,000 readings/s and floating isolation of up to 300 V - 32-channel (multiplexed) DAQ with 5 V & 100 V input voltage support, 16-bit resolution and 250 kS/s per channel sampling rate 	<p>PXI-based instruments that connect directly to the device under test (DUT), eliminating custom circuit design & implementation costs and halving the system design, implementation and deployment time and costs</p>
<ul style="list-style-type: none"> - Manufacturing test sequencer with automotive application libraries 	<p>Accelerated test development time</p>
<ul style="list-style-type: none"> - One-box solution integrated with controller, PXI instrumentation & switch I/O 	<p>Space optimization on racks, system in a box</p>

Hardware Configuration

Keysight TS-8989 PXI Functional Test System

www.keysight.com/find/ts8989

The TS-8989 PXI functional test system provides users with an integrated 8-slot PXI chassis and 11-slot high voltage and current switch and load solution. Due to its compact footprint - 483.85 (W) x 372.06 (H) x 543.14 (D) mm - it can be used as a benchtop box or integrated into a rack. Its switching solution supports up to 64x4 per matrix card and switching speeds of up to 300 us, providing users with the ability to perform multiple signal and load routing. Its load simulation solution supports up to 40 A, 8-channels per load card with current sense and flyback protection capabilities, enabling connections to internal and externally defined loads (resistive, capacitive and inductive) for load simulation (e.g. motor) and providing flexibility for implementing Pull Up/Down Loads, Bridge Loads and Multiplexing Loads.



The table below provides the different load card solutions available for the TS-8989 PXI Functional test system.

Function	E6175A	E6176A	E6177A	U7177A	E6178B	N9377A	N9378A	N9379A	U7178A	U7179A
Number of Channels (maximum)	8	16	24	24	8	16, dual load	24, quad load	48, dual load	8	16
Number of channels – unshared relays	4	16	24	24	8	16	24	48	8	16
Maximun current per channel	7.5 A (15 A peak)	7.5 A (15 A peak)	3 A	3 A	30 A	7.5 A (15A peak)	2 A	2 A	40 A	15 A
Current measuring with sense resister	Yes	Yes	No	Yes	No	Yes	No	No	No	Yes
Current measuring with current transducer	Yes	No	No	No	Yes	No	No	No	Yes	No
Flyback protection available (user installed)	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Engineered for application	Inductive Load	Common Load	Low current	Low Current	High Current	High current, dual-load	Low current, quad load	Low current, quad load	High Current	High Current

- Switch Power Supplies
- High Side and Low Side Drivers
- Bridge Loads
- Fused
- Current Sense Capability
- Custom Loads Removable from

Keysight M9183A PXI Digital Multimeter, 6½ digit, Enhanced Performance

www.keysight.com/find/m9183a

The Keysight M9183A is a 6½-digit PXI digital multimeter that measures common parameters such as DCV, DCI, ACV, ACI, 2- and 4-wire resistance, frequency, capacitance, and temperature. It offers 40 ppm basic DCV measurement accuracy, excellent noise rejection, and handles inputs of up to 300 V.

Additionally, the Keysight M9183A provides basic DC source-measure (SMU) capabilities in addition to duty cycle and pulse width measurements. With a maximum measurement rate of 15,000 readings/second, the M9183A delivers the highest transactional measurement speeds in its class. These fast readings translate into higher test-system throughput and lower cost of test.



Keysight M9188A Dynamic D/A Converter, 16-channels, 16-Bit, Unipolar, 30 V/20 mA

www.keysight.com/find/m9188a

M9188A is a PXI, 1-slot unipolar dynamic DAC with 16 channels capable of supplying typical waveforms at high voltages. High voltage test requirements, such as for engine electronic control unit test, are addressed with the M9188A's output voltage of 0 V to +30 V, preventing the need for additional signal conditioning circuits. The M9188A's dynamic current source signal up to +20 mA eliminates the need for additional current transformers or source measure units (SMUs) for tests requiring current source signals.



Keysight M9186A PXI Isolated Single Channel Voltage/Current Source, 100V

www.keysight.com/find/m9186a

The M9186A 2-slot, PXI V/I source module enables the sourcing of a voltage or current to perform measurements on the resultant current or voltage through another module. It consists of two separate amplifiers – one low voltage and one high voltage – that share a common output connection. Both amplifiers can sense the amount of current flowing while forcing a constant voltage. A unique safety interlock feature automatically disables the high-voltage amplifier and opens all relays when the interlock circuit is broken, providing protection to the device under test during the presence of high voltages.



Keysight M9216A PXI 32-channel High Voltage Data Acquisition

www.keysight.com/find/m9216a

The M9216A is a high-voltage data acquisition module that allows simultaneous measurement of eight channels of positive voltages ranging from 1 mV to 100 V. Each channel in the module comes with concurrent 5 V and 100 V measurement ranges – each channel capable of acquiring digital signals that fluctuate between very low and very high voltage levels without switching ranges and doing separate measurements. The built-in 4 to 8 multiplexer enables 32 measurement ports to be connected to the 8 acquisition channels expanding it to a full 32-channel acquisition module. The fast parallel voltage level measurements with guaranteed accuracy is ideal for automotive applications. The 16-bit ADC enhances resolution and accuracy.



Keysight M9185A PXI 8/16-Channel Isolated D/A Converter

www.keysight.com/find/m9185a

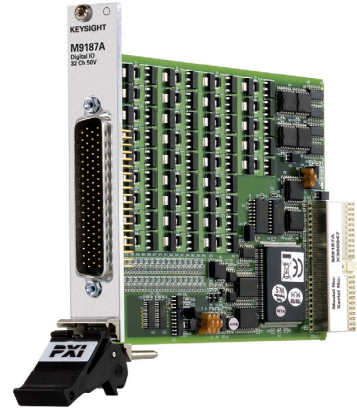
The M9185A is a fully independent, isolated digital/analog converter (D/A converter) that is capable of supplying high voltage levels in parallel of up to 8 or 16 channels. Each channel is able to output up to 16 V as stimulus signals to device under tests (DUTs). The M9185A also provides a built-in SENSE mechanism, which detects output voltage levels and feeds the information to the circuitry of the converter to compensate for the voltage drop at the receiving end of a DUT. This feature ensures the accuracy of the stimulus signals being provided to the DUT for better test performance.



Keysight M9187A PXI Digital I/O

www.keysight.com/find/m9187a

The M9187A digital I/O control module has 32 input/output channels. The input channels can be used for comparing inputs to user-defined thresholds between 0.3 and 50 V, with 12.5 mV setting resolution. Each input is protected up to 100 V. The 32 output channels can drive high or low outputs, and are capable of sourcing 0.4 A from the high-side or sink 0.5 A from the low-side of each channel. These outputs are protected against over-voltage or over-current conditions.



Keysight N6700B Low-Profile Modular Power System Mainframe, 400 W, 4 Slots

www.keysight.com/find/n6700b

The Keysight N6700B is a 400 W 1U high, 4-slot modular power system mainframe that accepts from 1 to 4 N6700 series DC power modules in any combination. Modules are ordered separately. The N6700B offers GPIB, LAN, and USB, interfaces standard, and LXI compliance. Select from more than 20 different DC power modules, ranging in capability from basic to high precision, and in power from 20 - 300 W.



Keysight N6702A Low-Profile Modular Power System Mainframe, 1200 W, 4 Slots

www.keysight.com/find/n6702a

The Keysight N6702A is a 1200 W 1U high, 4-slot modular power system mainframe that accepts from 1 to 4 N6700 series DC power modules in any combination. Modules are ordered separately. The N6700B offers GPIB, LAN, and USB, interfaces standard, and LXI compliance. Select from more than 20 different DC power modules, ranging in capability from basic to high precision, and in power from 20 - 300 W.



Keysight N6972A Advanced Power System - DC Power Supply, 40 V, 50 A, 2000 W

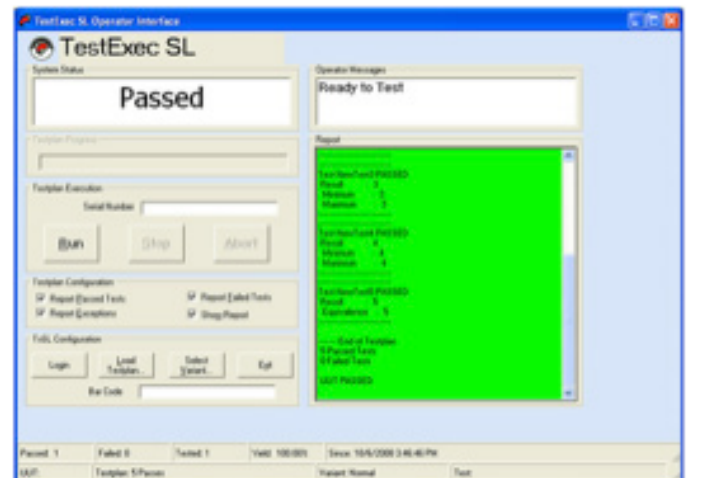
The Keysight N6972A Advanced Power System is a 2 kW DC power supply that delivers a new level in power supply performance and versatility enabled by Keysight's exclusive VersaPower architecture. The APS was designed to help you overcome your toughest power test challenges by delivering industry-leading specifications and innovative features in an integrated solution for advanced automated test equipment (ATE) power testing needs.



Keysight TestExec SL Software

www.keysight.com/find/testexec

Keysight Technologies' TestExec SL is a customizable, flexible test executive developed specifically for electronics manufacturing functional test applications across multiple industries. This off-the-shelf test executive empowers test developers with a fully customizable operator interface, open architecture for multiple instrument integration, flexible test sequencing, easy debugging tools and provisions for line integration in most manufacturing test environments. TestExec SL boosts productivity, offers unique advantages for test automation and is unbeaten for ease of use. With the new release of TestExec SL 7.1, you can now utilize the multithreading feature to improve execution throughput and reduce idle time.



Sample Reference Solution configuration for an Air Bag Control ECU

Option No	Description	Qty
U8989A	TS-8989 PXI Functional Test System	1
U8989A-ATO	TS-8989 PXI Functional Test System (ATO)	1
U8989A-OC-CONTROLLER	Controller Option Class	
U8989A-PC1	TS-5000 Industrial PC Controller - Core i5-2400 3.1GHz Processor, 8GB RAM, 500GB HDD, No DVD-RW and FDD with Windows 7 64-bit, TxSL Rev 7, TS-5000 Rev 7 and PCIe-8560/PXI-8565 PCIe-to-PXI expansion kit	1
U8989A-OC-PINCRD	Pin Card option class	
E8782A-FG	TS-5400 SLU PIN CARD WITH INSTRUMENTATION MATRIX_24 instrument , 40 measurement	1
E8783A-FG	TS-5400 SLU PIN CARD_64x4 Measurement Matrix	1
U8989A-OC-PXIMOD	PXI Instruments Option Class	
U8989A-311	M9183A PXI DMM and cable	1
U8989A-340	M9186A V/I Source and Cable	1
U8989A-337	Dynamic DAC M9188A, 16-channels, 16-bit, unipolar 30V/20mA with option UK6 and cable	1
U8989A-OC-SLUCRD	SLU Cards Option Class	
N9377A-FG	Dual-load loadcard for 16 channel	4
N9378A-FG	Low resistance Loadcard for 24 Channel	2
U8989A-OC-WIRING	Cable Management Option Class	
U8989A-I01	Universal Instrumentation Routing card	1
U8989A-I02	Breakout IO Card	1
U8989A-R02	Pin Matrix/Load Card Strain Relief Bracket	9
U8989A-OC-COMBO	Combo Option Class	
U8972A-CL1	SLU slot filler	1
U8989A-CL2	PXI Chassis slot filler	4
E6198B-CP1	SLU Rear Filler Panel	1
U8989A-CL3	LCD monitor filler (packaging)	1
	Power supplies	
N6702A	Low-Profile Modular Power System Mainframe 1200 W, GPIB, LAN, USB, LXI	1
N6773A	DC Power Module 20V, 15A, 300W	2
	Controller options	
E2235D-041	4-port serial adapter (Rocketport) with comm. speeds up to 921Kbps	1

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