

## Application Note



## Abstract

Demanding applications in process automation, power generation and public transport require extensive device burn-in to minimize early defect rates. Test engineers in the power generation and large drive control business must often test 100% of the printed circuit board assemblies before integrating them into complex products. The efficiency of a burn-in test process is key to the management of overall cost of test. An efficient burn-in test system design takes into consideration instrument selection, programming, and a creative approach to power management. This application overview will discuss the complexities of burn-in test and the solution created by LXinstruments, a Keysight Technologies, Inc. solutions partner, based on the Keysight 34980A switch/measure unit.

## Introduction

To maximize the reliability of complex systems used in applications such as process automation, power generation and public transport, burn-in test is essential to identify early defects. In many cases, burn-in test will be applied to all of the circuit boards or devices used in these systems.

For accelerated life testing, the burn-in test procedures will be executed in an environmental chamber where the temperature of the device under test (DUT) can be cycled over many hours. The DUTs may be tested passively or actively. In both cases, power is applied; but, when testing actively, the device is also exercised with a test routine.

The provision of individual power supplies for each DUT can be very costly and requires considerable physical space; however, sharing a common power supply between all or a group of DUTs risks losing test time and data if an early failure in one DUT compromises the power supply to the rest.

The solution developed by LXinstruments is to create a modular multiplexed architecture, based on the Keysight 34945A breadboard module for the 34980A Multifunction Switch/Measurement Unit, which allows the DUT's to be switched between common power supplies. This solution is fully scalable allowing it to cater to a varying number of DUTs, reducing the cost and physical space required.



Figure 1. The LXinstruments Burn-In Test System with the Keysight 34980A Switch/Measure Unit.

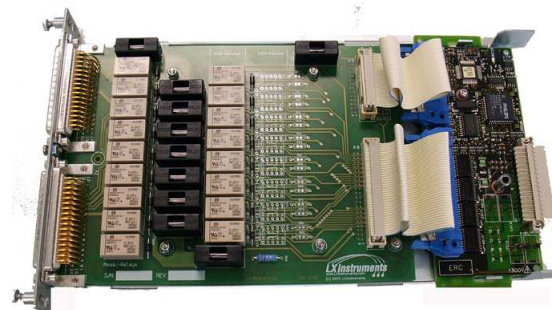


Figure 2. Keysight 34959A breadboard module with LXinstruments circuitry.

## Solution

The Keysight 34980A Multifunction Switch/Measure Unit is a flexible, reliable switching and data acquisition platform. The Keysight 34959A breadboard module can be used to create custom designs inside the 34980A mainframe. The breadboard module provides access to +12 and +5V supplies, 16 GPIO ports, and 32 relay drive lines and can be programmed using standard read and write commands in SCPI. The module faceplate has cutouts for the most common connectors.

LXinstruments uses the Keysight 34959A breadboard module to implement a custom designed multiplexer for use in its range of burn-in test systems. The multiplexer allows individual DUTs to be switched between common power supplies. It provides 8 channels of power supply multiplexing within one slot of the Keysight 34980A mainframe and up to 64 channels in one 34980A mainframe. All of the power supplies can be switched individually with up to 3 different supply voltages allowed. The supply currents for each power supply can be measured individually.

In order to manage the in-rush currents experienced when the DUTs are initially switched on, the system provides for two consecutive phases: first, the system turns all of the devices on and off individually to identify any failing DUTs, second, it turns on each device in sequence to minimize the instantaneous in-rush currents.

By using a multiplex architecture in its burn-in test solutions LXinstruments can optimize the number of power supplies required to test multiple DUT's while eliminating the risks associated with sharing supplies between multiple devices.



Figure 3. Keysight 34959A breadboard module.

## Solution details

The power supply multiplexer utilizes the capabilities of the Keysight 34959A breadboard module to provide 8 channels of multiplexing in one 34980A mainframe slot. It provides a high-switch count using mechanical armature relays; each channel is fused. The multiplexer is programmed using SCPI ASCII commands, and allows direct control, using the 34980A web browser interface.

The maximum DC voltage that can be hot switched is 30 volts; the maximum AC voltage is 50 volts. Total continuous current is 2 amps with maximum peak current of 3.5 amps. The maximum total current per module (8 channels) is 16 amps. The multiplexer incorporates 5 amp slow fuses which can be exchanged for lower current versions for different applications.

LXinstruments can also provide an alternative version of the breadboard module that uses FET switches and faster electronic fuses with programmable trip levels.

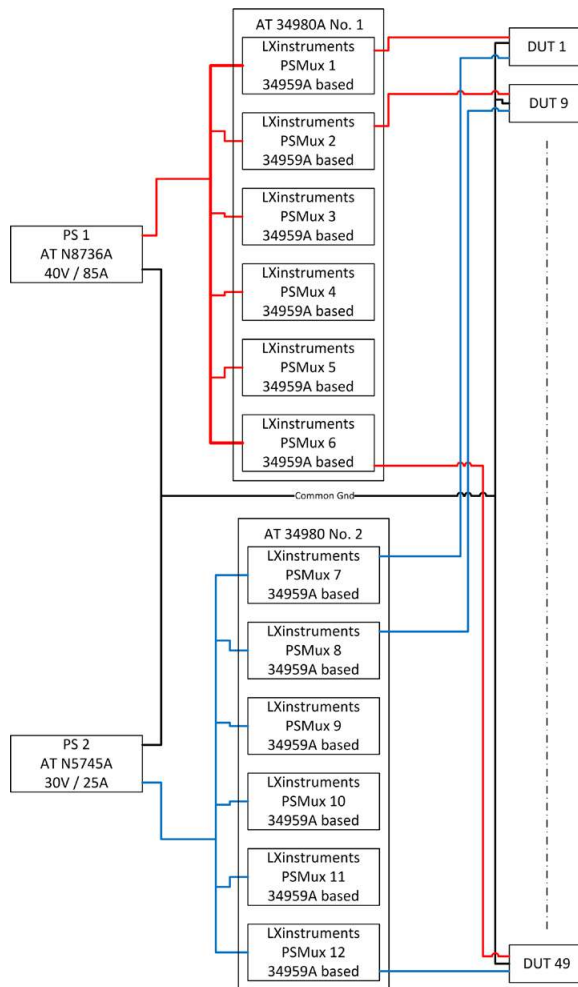
LXinstruments has extensive experience using the Keysight 34959A breadboard module in applications including:

- Control of pneumatic valve clusters (using the relay drive capability of the module).
- Implementation of test system digital I/O functionality at, for example, 24V volts for PLC communication lines, control of indicating lights, read out of mechanical switches and proximity sensors, etc.
- Implementation of customer specific switch topologies.



Figure 4. The Keysight 34980A Multifunction Switch/Measure Mainframe and Modules.

## Solution block diagram



Power supply mux example 48 channels, 2 voltages

Figure 5. The Keysight 34980A Multiplexer and LX Instruments Burn-In Test System block diagram.

## Why the Keysight 34959A breadboard?

LX Instruments chose the Keysight 34980A as the switch and measurement platform for its burn-in systems for the following reasons:

- The Keysight 34959A breadboard module provides a cost effective means of integrating custom circuitry. All of the facilities required for ASCII programmable functionality are provided by the breadboard module leaving only the custom circuits to be developed.
- With a LAN interface, it is very easy to build a scalable solution. If more channels than available in one mainframe are required, a second unit can be added by connecting it via the LAN interface.
- The 34980A is highly cost effective in its own right; the individual modules provide more real estate than is available in a PXI system.
- The modularity of the mainframe and modules with robust terminal blocks and wiring offers flexibility to expand the test system and to lower service costs.
- The web browser interface makes it easy to provide remote support for the systems (LX Instruments has systems installed worldwide).
- Standardization on the 34980A makes it easier for customers to provide a set of spare units especially when customers have multiple systems installed.
- Keysight provides calibration and maintenance service worldwide.

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