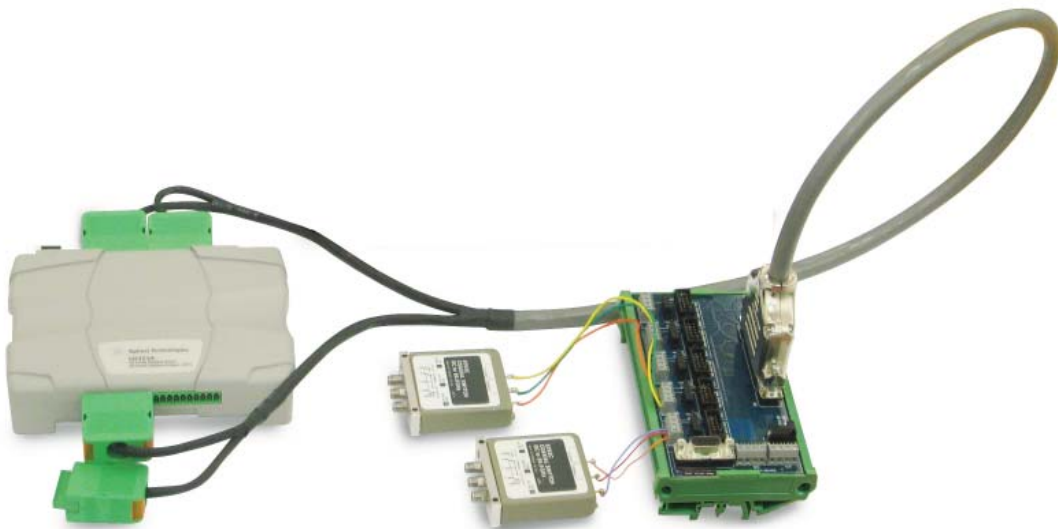**Agilent**

Creating a Small, Low-cost RF Switching System

Digital I/O module provides a cost-effective alternative for small test systems

Application Note

Agilent Technologies

Introduction

In RF test systems, switching is used for a wide variety of signal-routing applications. Four types of switching are commonly used to accelerate automated testing:

• Routing multiple signal sources to one output
• Routing multiple input signals to one measurement instrument
• Inserting and removing a device in a signal path
• Providing matrix switching of multiple inputs and outputs

One common application is lifetime testing of mobile phones. This requires the application of continuous electrical stress while measuring a mobile phone's electrical characteristics.

Versatile RF switching also enables the following flexible test configurations shown in Figure 1.

i.   Use a single instrument to measure multiple devices under test (DUTs)
ii. Use multiple instruments connected to different test points on the same DUT
iii. Use multiple instruments to test multiple DUTs

When designing an RF test system, the application itself helps determine the tradeoffs between cost and performance in the RF switch components: the switch modules and accompanying connectors and cables. In a typical complex test system, the many connectors and cables can cause the RF switch system to become a huge and messy subsystem. For small and simple test systems, the Agilent RF switch driver solution ensures a neat and clean configuration.

The Agilent U2121A is a USB-based digital I/O module that provides a cost-effective alternative for switch control in small test systems. When coupled with the optional RF switch driver, the USB-based digital I/O module can control and monitor up to five RF switches, including some of Agilent's most popular RF/microwave switches, listed below:

• N181x series SPDT switches[1]
• 8762/3/4 series SPDT switches (screw terminal)[1]
• 8765x coaxial switches[1]

The Agilent U2121A-based solution can also control any other switch that matches its electrical specifications.

To meet a variety of needs, each channel accommodates three types of switch terminals: flat ribbon cable connector, DIP solder terminal strip, and discrete wire socket. On any individual channel, just one terminal type can be used at a time. However, different types can be used across the five channels.

---

[1] Supports 24 VDC voltage supply, 120 mA current only.

i. Single instrument – multiple DUTs   ii. Multiple instruments – single DUT   iii. Multiple instruments – multiple DUTs
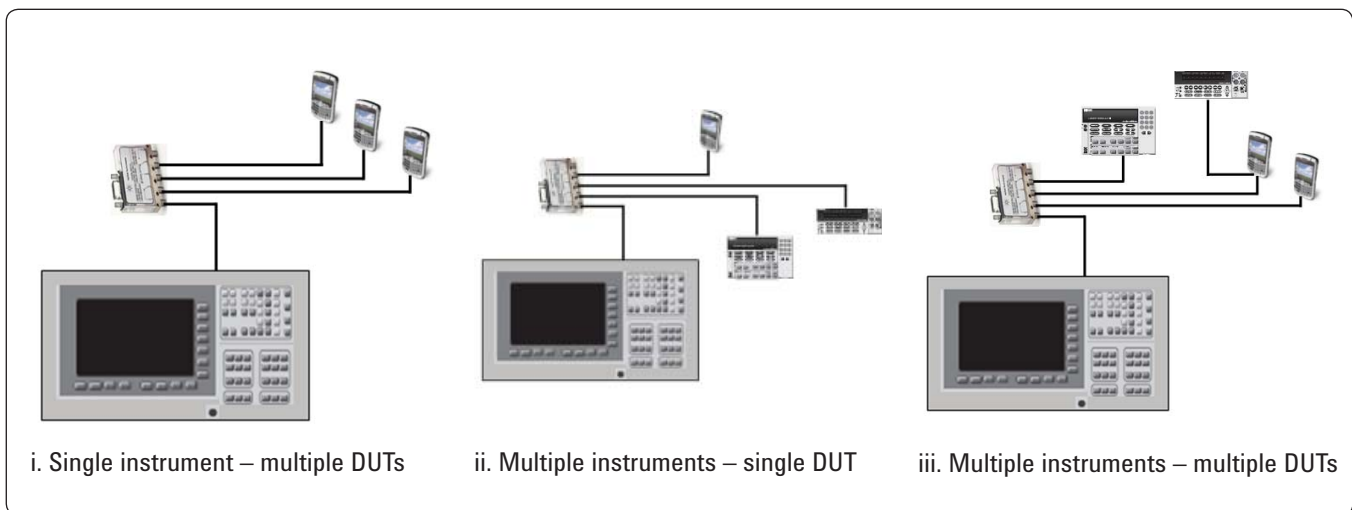
Figure 1. Examples of RF switching configurations

The RF Switch Driver

A single RF switch driver can be connected to the U2121A using the standard 37-pin D-Sub datacomm cable. The U2121A module is connected to the tester or workstation through a USB cable as shown in Figure 2.

The RF switch driver provides digital outputs that drive relay coils and digital inputs that can read the position of switch contacts. The board is designed to drive coils continuously or with programmable-width pulses. Continuously driving fail-safe switches typically requires a significant amount of current to energize a coil (100 mA to 300 mA for each 24-V coil). The RF switch driver can drive a total of 1 A continuously. This is sufficient to support fail-safe and latching-relay switches, providing greater flexibility in the selection of the best switch for your specific application.
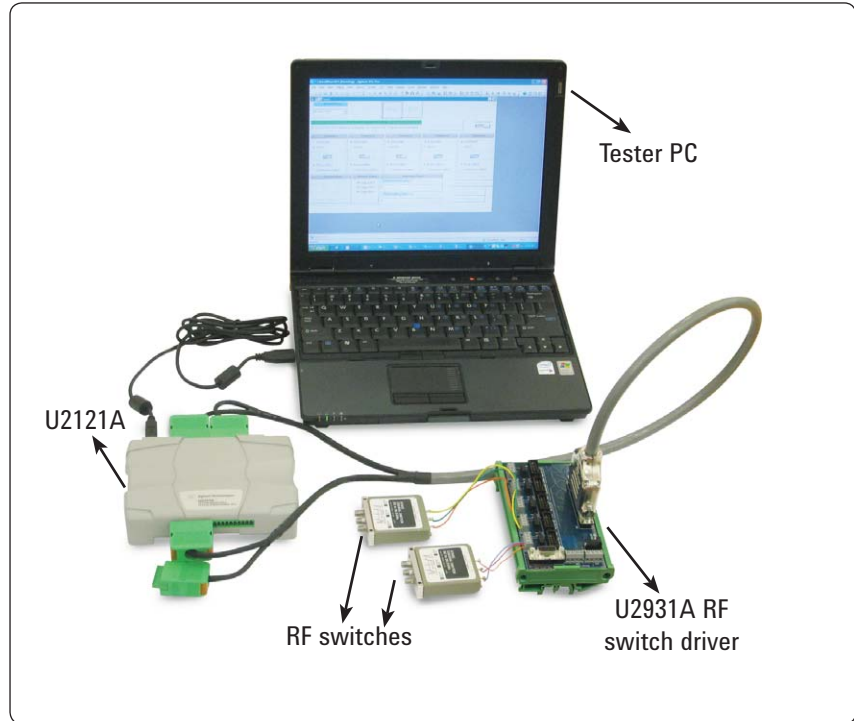
Figure 2. Example of a general RF test system

Programmatic Control

To automate switching through the total solution, programmatic control plays a vital role. The example shown in Figure 3 is written in Agilent VEE Pro 8.5 and runs in Agilent VEE Runtime, which is bundled with the RF switch driver. The simple and intuitive interface is designed to let you easily control and monitor up to five channels in a switch module.
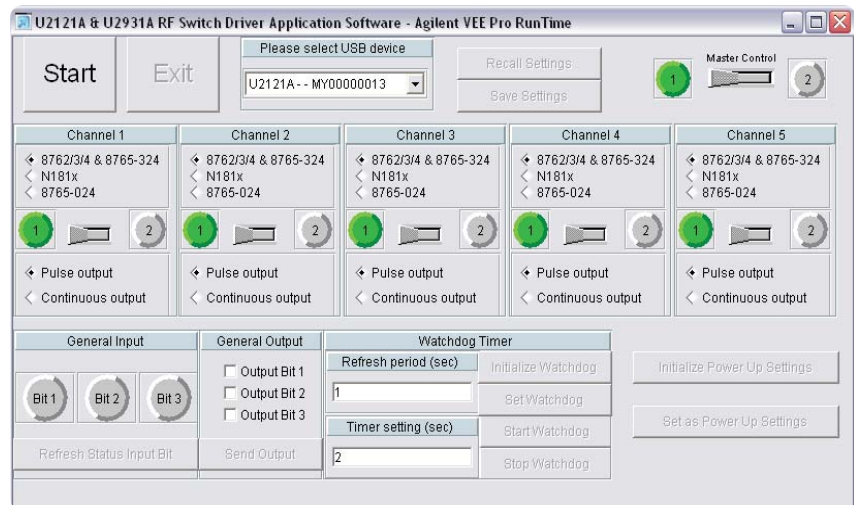
Figure 3. VEE Runtime control panel for the RF switch driver

Recommended Applications

This solution is a good fit for R&D and design-validation applications that typically require a few switches and a few instruments in a simple, compact test system. Several testing applications are possible:

• Mobile phones
• Bluetooth headsets
• Cordless phones
• Medical electronics
• Broadband CATV
• Radar systems

Conclusion

The Agilent U2121A-based solution is a cost-effective, easy-to-use, and convenient way to implement RF switching in small test systems for a variety of applications. The simplified installation, operation of the digital I/O card, and the breakout module allow straightforward control of small RF switching systems. This helps you to quickly create simple yet cost-effective RF switching systems.

Agilent Technologies