

# Streamlining multi-site aerospace validation & production test systems

*A world-renowned player in the aerospace industry was seeking to streamline development and production of its avionics LRUs (line replaceable units) at multiple sites, by specifying a new test system architecture that addressed both the design verification and production test functions. Pickering Interfaces, a specialist in modular switching solutions for test, was approached by partner and test bench development expert, LGM Engineering, one of the systems integrators bidding on the project, to collaborate on the switching and cabling requirements for the new system. In this case study, Michael Crespin, Sales Director for the Mediterranean region at Pickering Interfaces and François Cheritel, Test Bench Project Manager at LGM Engineering explain how their companies' close cooperation resulted in a hybrid PXI and LXI architecture that delivered the required industry-standard, flexible switching in a compact, cost-effective solution.*

**The primary strategy of the avionics company's programme was to use reliable, industry-standard test and measurement resources to deliver compact, flexible, integrated solutions that were easy-to-use and sustainable over a long period – typically 15 to 20 years. To cover all of the required existing and potential future testing requirements, the system architecture needed to be highly flexible, in order to allow various instruments to be switched to each LRU input/output channel – over 400 points in total. The ability to inject simulated faults (for instance, short and open circuits) at all of these connections was also required.**

The PXI platform, which is supported by over 60 suppliers worldwide, was the preferred option for the test system architecture, due to its flexibility and widespread acceptance by the aerospace industry. In technical discussions



with LGM Engineering, Pickering presented both its PXI BRIC large matrix family and modular fault insertion solutions. However, due to the large size of the matrix required (over 1,700 2-wire cross-points) and the end customer's test system size and budget constraints, it was determined that one of Pickering's LXI matrix offerings would potentially be a more appropriate solution.

The ideal product selected was Pickering's high-density LXI 4x448 2-pole switch matrix, with dual internal analogue buses and integrated self-test (model: 60-556-027), housed in a compact 1U, 19" rack-mount enclosure. The unit is fitted with high-quality electro-mechanical relays rated at 2A/60W/300V.

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Figure 1. Pickering Interface's model 60-556-027 2-pole switch matrix, with dual internal analogue buses & integrated self-test



Figure 2. Pickering's 60-106 modular chassis suits portable & space-restricted rack-mount applications

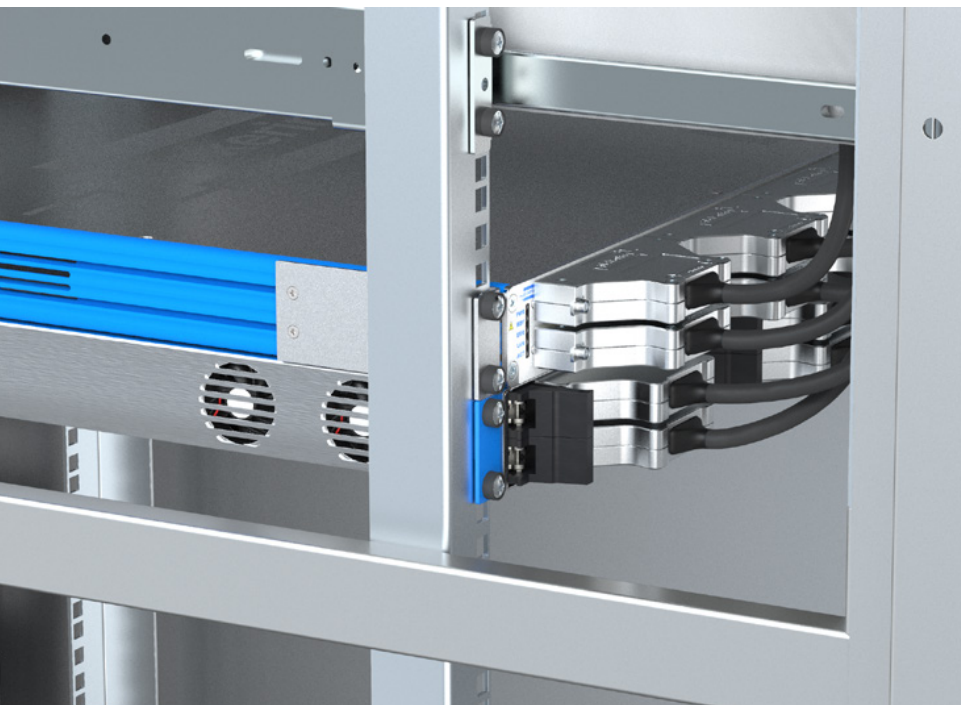


Figure 3. Pickering's free online Cable Design Tool is a simple & efficient way of creating custom cabling solutions

Pickering Interfaces & LGM Engineering partnered to design and build a hybrid PXI & LXI architecture that delivered the required industry-standard, flexible switching in a compact, cost-effective solution.

The high density 60-556 matrix is constructed from 64x4 sub-assemblies, allowing it to be supplied in sizes from 192 to 512 X connections, in increments of 64. The Y axis of each sub-matrix can be connected to one of two analogue buses (dual analogue bus), which can be used to maximise bandwidth by disconnecting unused stub matrices from the bus in use. They also provide configuration flexibility, by giving the potential to divide the 60-556 into two independent matrices, whose size can be set in increments of 64 X connections. Designed in accordance with LXI Standard 1.4, the 60-556 is programmable via the LAN interface using Pickering's generic switch driver. Standard (W3C) web browsers can be used to change the configuration and access the soft front panels. The 60-556 is ideal for situations where a simple start-up is required, and for applications requiring control over large distances. A x8 way Y axis version (60-556) is also available.

The Built-In Relay Self-Test (BIRST) facility provides a quick and easy way of finding relay failures. No test equipment is required: simply unplug the connectors, launch the BIRST application and the tool will run a diagnostic test that will find all relays with faulty contacts. This matrix is also supported by eBIRST. These tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

In configuring the avionics LRUs test system architecture, Pickering also proposed its PXI fault injection modules (model: 40-190B-002) to simulate possible LRU channel failures for the required design validation/verification testing. Available with 74, 64 or 32 channels, the 40-190B-002 can insert three different fault conditions between the test fixture and the equipment under test: open-circuit; short-circuit between UUT (unit under test) connections; and short-circuit to other signals, such as power, ignition and ground, via a fault insertion bus. Through-relays on each channel enable signals to the UUT to be held open-circuit. Fault insertion buses allow any channel to be shorted to any other channel, also enabling connection to an external fault condition. The 40-190B-002 is available with either one or two fault buses. A four-channel multiplexer on each bus allows an external signal, such as power, ignition

or ground, to be selected as the fault condition. Additionally, switched signal lines (Monitor1 & Monitor2) allow direct monitoring of the fault buses with a DMM (digital multimeter).

To minimise test system rack space, these modular instruments were housed in Pickering's LXI/USB 1U six-slot chassis (model: 60-106-001), as the size of the original test cabinet could not accommodate any additional 4U PXI chassis. Pickering's 60-106 modular chassis suits portable and space-restricted rack-mount applications. It is also available with built-in scan list sequencing and triggering (model 60-106-002). The chassis supports from one to six Pickering PXI 3U modules; the portfolio of over 1,000 module types including programmable resistors, matrices, multiplexers, general purpose relays, RF switches and fault insertion units. Possible systems include switching matrices up to 4,608 crosspoints (three 40-558 BRIC2s, occupying three pairs of slots) or up to 108 channels of programmable resistor/sensor emulation (six 40-295 18-channel resistor modules, occupying six slots). USB-compatible and LXI-compliant interfaces enable the chassis to be controlled directly through standard interfaces found on most PCs, allowing for a very cost-effective route into the modular test and measurement market. The option of a Wi-Fi dongle is useful for control from mobile devices via HTML5 SFP. The chassis can be controlled through built-in software drivers.

This hybrid PXI and LXI architecture described – proposed by Pickering and LGM Engineering – delivered the required industry-standard, flexible switching solution in a compact, cost-effective package.

For the external interconnection to the test system, Virginia Panel's mass interconnect solutions were chosen, because of the



Figure 4. The aerospace production test system

flexibility and reliability of the interface between the test system and LRU. By using Pickering's online graphical Cable Design Tool, in collaboration with the end customer, LGM Engineering's engineers were able to design and supply all the required cables for the test system, incorporating all the Pickering and other vendors' resources.

Because Pickering Interfaces fully understands the importance of high performance, reliable interconnection between the component parts of a test system and DUT (device under test), the company established its own in-house connectivity division, which manufactures a comprehensive range of over 1,200 high quality cable and connector solutions to support its modular switching and simulation product lines. There are times, however, when a standard cable assembly is not suitable, and there is a need for specialised connectors and wire types, or specific harness wiring. Pickering's free online Cable Design Tool is a simple and efficient way of creating these custom cabling solutions.

### A highly positive collaboration

Thanks to the close relationship between Pickering Interfaces and LGM Engineering, the companies were successful in their bid, demonstrating real benefits over competing options. LGM Engineering designed the test system, completed the wiring of the cabinet and developed all the application software. This was facilitated by Pickering's easy-to-use common driver interface, which is a feature of the company's PXI and LXI products, together with comprehensive Soft Front Panels for manual control and debug.

### Multi-site & multi-function test bench: validation & production

The avionics customer will use the test systems developed by the collaboration between Pickering and LGM Engineering at both its production plant and by its validation/verification teams, which are situated at another location to optimise resources. Because both teams are using similar equipment, information exchange is greatly simplified.

In addition, the same architecture will serve as the backbone for future generations of test systems and validation programmes by the company.

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