

Integrating AXIe and PXI into a Single Test System

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There are a growing set of products based on [AXIe](#), ATCA Extensions for Instrumentation. In many ways AXIe is a supersized version of PXI, a modular architecture that also employs PCIe (PCI Express) but offers larger board area, power, and cooling. For all these reasons it is often referred to as the “big brother” of PXI.

AXIe’s format is optimized for horizontally placed modules, with airflow moving efficiently from one side of a rack to the other. This enables power dissipation of 200 watts per slot. The deeper format also allows large single board instrument designs that sport high speed digital and analog circuitry without facing the signal integrity issues presented by multi-board designs. All these factors combine to give AXIe very favorable power and circuit density per rack inch. These are key factors why [TEv](#), [Agilent](#), and [Guzik](#) have deployed high speed digital, digitizers, and arbitrary wave generators on AXIe.

While AXIe brings these advantages to the market, it is still a young standard and has a fraction of the product breadth of PXI. This is particularly true for general purpose instrumentation and switching. PXI is sufficient for many, if not most, instrument types and has wide industry adoption. But what if you wish to use some of the high performance AXIe instruments along with your PXI instruments? Fortunately, users don’t have to choose between one and the other and can integrate both into a test system, using the product capabilities of each. AXIe, being the big brother of PXI, integrates easily with PXI instruments.

The key to this is to simply deploy a PXI chassis and an AXIe chassis. Normally, system integrators are reluctant to choose two different chassis formats, avoiding the scenario of two half-empty mainframes. Fortunately, that is not an issue in this case. AXIe’s horizontal format allows the deployment of very small chassis supporting a low number of slots. This means few slots, if any, need to go to waste. The most common configurations for rack mounted or bench systems are 2-slot and 5-slot chassis. Even with AXIe’s large format, a 2-slot chassis is half the rack height of a PXI chassis and a 5-slot chassis is the same size. Often, AXIe is delivering functionality that would have required a second PXI chassis, if not more, so there’s no penalty in total rack space. Due to AXIe’s board and power density advantages noted above, there can even be a size advantage. Other times AXIe may be delivering measurements that simply are not available in any other formats, modular or traditional. In any case, AXIe’s horizontal format allows just enough slots and rack height to complement a PXI system.

So, after you have the two chassis, what kind of controller or interface architecture is needed to combine AXIe and PXI? In many ways the choices are similar to combining two PXI chassis together. In a recent article [Hardware Elements of Integrating a PXI System](#), I described the controller choices for PXI and the tradeoffs between them. They are essentially the same for AXIe, or combinations of the two.

Using an external controller

A PXI chassis can be controlled from an external computer or laptop by inserting a Cable PCIe interface card into the controller and cabling to the chassis. It is exactly the same for AXIe. When AXIe and PXI are deployed together it is necessary to insert two Cable PCIe interface cards into the external controller, one for each chassis. This is similar to deploying two PXI chassis using two interface cards. The AXIe-2 software specification delivers a high degree of compatibility with PXI, allowing a single resource manager to configure and control both systems. To the resource manager, the AXIe system appears as an additional PXI system, using the same PXI calls.

Using an embedded PXI controller

Embedded controllers offer smaller size and tighter integration. Though the form factor is different from an external controller, the software is identical. The backplane interface is viewed the same as a Cable PCIe interface card. If you have chosen to deploy a PXI chassis with an embedded controller, you can still add AXIe. Most embedded controllers have a PCIe slot for peripheral cards. Just plug a Cable PCIe interface card into the slot, and cable to the AXIe chassis as you would from an external controller.

Using an embedded AXIe controller

AXIe gives the user the same embedded or external controller choices that exist in PXI. Similar to the above example, a user would insert a Cable PCIe card into an embedded AXIe controller, and connect to the PXI chassis using Cable PCIe.

AXIe uses similar instrument drivers to those found with PXI, typically IVI-C and LabVIEW. Once the controller configuration is chosen and installed, the instrument drivers are deployed just as they are with a PXI system. From a software perspective it is difficult to tell the two apart.

Since AXIe and PXI are both card-modular systems with the instruments and controllers connecting off of the front of the chassis, cabling is straight forward between the two chassis. This is true not only for Cable PCIe connections, but also for any signals or synchronization between the two. When placed on top of each other, their densities allow very short cable lengths.

Is this just theoretical? Not at all. TEv and [Aeroflex](#) offer semiconductor test

solutions that combine AXIe and PXI. Agilent combines their M9703A digitizer with PXI signal conditioning for phased array antenna test. The possibilities are increasing quickly.

In the future there may be more options for integrating the two formats, either through extenders or carriers. But the current options already allow robust combinations of PXI and AXIe that can be deployed today.