Adrienne Electronics Corporation

"AEC PRODUCT FAMILY SELECTOR GUIDE"

Introduction:
Adrienne Electronics Corporation (AEC) has been designing and selling
electronic products for the television equipment industry since 1986. We have
many years of experience delivering high-quality products for a reasonable
price. One problem(?) with having so many products is that sometimes it can
be time-consuming and frustrating for customers to decide which AEC product is
best for their application(s). Here we attempt to explain key differences
between our various current product families, so that you can first determine
which AEC product family will best fit your needs. You can then use our
"Short Form Catalog & Price List" (PDF) to determine which model within the
selected product family to order.

PC Plug-In Boards:
All of our PC plug-in board products are designed for standard Intel/AMD PC
motherboards. At present there are the following choices, each of which has a
separate section within this document:

    a) PCI-TC family of PCI bus plug-in boards.
    b) PCIe-TC family of PCI Express bus plug-in boards.
    c) AEC-IUSB family of "Internal USB" boards.
    d) PCIeSDV family of PCI Express bus plug-in boards for Digital Video.

External USB Products:
All of our external USB products at present are 12Mbps USB 1.1 "full speed"
products. They also work well (at 12Mbps) with standard USB 2.0 ports:

    a) USB-TC family of external USB time code products.
    b) AEC-XUSB family of external USB time code products.

External RS232/RS422 Products:
At present we have both our older (extensive) AEC-BOX product family, plus the
"AEC-µBOX-2" play speed LTC reader with RS232/RS422 I/O, including Sony VTR
emulator software. See ordering guide for further details.

Legacy AEC-BOX Products:
First introduced beginning in 1990, these are "modem-sized" boxes which
perform unique interfaces between Sony VTR's, Ampex VTR's, analog LTC, analog
VITC, RS232, and RS422. Due to component shortages, availability is limited
for some of these products. These products do not meet current RoHS
regulations regarding lead content (could be a problem in Europe). In many
cases these are the only products in the world which solve certain problems,
such as making an Ampex serial VTR "look like" a Sony serial VTR, or providing
a Sony serial interface for older parallel remote VTR's. See our website at
<www.adrielec.com> for further details.

Software Interface Notes:
Our PCI-TC, USB-TC, and PCIe-TC product families all share the same basic 256-byte DPRAM memory interface, which makes it easy for application software to interface to all three product families with minimal (if any) changes. This is a very simple interface which has served us well for many years, but said interface only supports one analog LTC reader, plus one analog VITC reader, plus one analog LTC/VITC generator, and our newer products need more interface options (such as up to four LTC readers in a single product).

Our newer PCIeSDV, AEC-IUSB, and AEC-XUSB (and future) product families all use a new "modular" memory interface which supports multiple instances of multiple functional modules. From a hardware standpoint, this is still basically the same DPRAM memory interface used on our older products. But from a software standpoint, the DPRAM memory is now divided up into a single "base block", plus one or more "function blocks". For example, a 4-channel LTC reader product would have a base block, plus four(4) separate LTC reader memory blocks, all within the same DPRAM memory space. It isn't really complicated, it's just different. User software must first "discover" how many functional blocks are present (via a simple algorithm), and the block type(s) present, after which said software will work equally well with our PCIeSDV, AEC-IUSB, and AEC-XUSB (and future) product families.

In conclusion, if you are developing a new product, we suggest considering the use of our new product families if possible, because of their flexible and powerful DPRAM layout, but the older product families are still fully available if you need them.

PCIeSDV Product Family: (advance information)
The AEC "PCIeSDV" product family is expected to be released (finally) in late 2015. The primary goal of this product family is to provide a 3G/HD/SD Serial Digital Video (SDV) interface to PCI Express bus computers. Multiple instances of analog LTC readers, analog LTC generators, SDV inputs, SDV outputs, and some analog IRIG capabilities are designed into the product, but at present the design details and documentation and drivers are still being completed. These boards are relatively expensive because of high parts costs and the many technical challenges involved, but they are generally less expensive than the few available solutions from other companies. Hardware interrupts are supported if needed. Includes an input signal status LED. Available with both "full-height" and "low-profile" PC brackets. See our ordering guide for available products, and please check back with us periodically for new and exciting PCIeSDV product releases.

PCI-TC Product Family:
The AEC "PCI-TC" product family was introduced in 2000, and replaced all of our older ISA board products. It includes our PCI-LTC, PCI-VITC, and PCI-VLTC product sub-families, all of which were designed for analog LTC and analog video/VITC. It remains our fastest PC plug-in board product, because 32-bit read and write operations take much less than 1us (significantly faster than the PCI Express bus). The hardware interface is a 256-byte block of DPRAM in I/O memory space. Most applications which work with our PCI-TC products also work with our PCIe-TC and USB-TC products, because they all share the same basic DPRAM memory map. Hardware interrupts are supported if needed. Available with "full-height" PC brackets only. See ordering guide for further details.

PCIe-TC Product Family:
The AEC "PCIe-TC" product family was introduced in 2008, to provide PCI Express equivalents to our PCI-TC products, but with limited support for analog VITC, which was rapidly disappearing in favor of digital video. It includes our PCIe-LTC and PCIe-VLTC product sub-families, which were designed for analog LTC and analog video/VITC. The hardware interface uses a SDIO serial interface chip to access a 256-byte block of DPRAM on the board. Most applications which work with our PCIe-TC products also work with our PCI-TC and USB-TC products, because they all share the same basic DPRAM memory map. Hardware interrupts are supported if needed. Includes an input signal status LED. Available with both "full-height" and "low-profile" PC brackets. See ordering guide for further details.

Comparison of PCI-TC with PCIe-TC:
1) The PCI interface is inherently faster than the PCI Express interface for the simple 32-bit read/write operations which are used by our products. This frequently does not make any difference, because the 2400bps LTC data rate is slow when compared to both the PCI and PCI Express bus speeds.
2) PCI-TC products use a 256-byte block of I/O memory space. PCIe-TC products use a more complicated SDIO interface chip to access the 256-byte block of DPRAM on the board. This hardware difference usually only matters to device driver software. If you are using our Windows driver software, you will see no software interface difference between PCI-TC and PCIe-TC.
3) PCI-TC products use "full-height" PC brackets only.
   PCIe-TC products can use both "full-height" and "low-profile" PC brackets.
4) PCIe-TC products include an input signal status LED which can be very useful for diagnosing connection and signal problems.
5) Both use the same basic 256-byte DPRAM memory map, which makes it very easy for application software to interface to both product families (and also the USB-TC product family).

General Timing Comparison of USB Products with PC-Bus Products:

Every read/write operation with an AEC USB device inherently takes 1-2ms, because full-speed USB devices are only allowed to send or receive one packet within every 1ms USB "frame". It doesn't matter if the USB device is "internal" (AEC-IUSB) or "external" (USB-TC and AEC-XUSB), they are all USB devices. The time measurement accuracy is also 1-2ms for the same reasons.

Every read/write operation with a PC-bus (PCI-TC or PCIe-TC or PCIeSDV) product only takes 1-2us, exclusive of operating system (OS) delays. The time measurement accuracy is also (in theory) 1-2us, for the same reasons.

So to first order, our PC-bus products are about 1000 times faster than (and more timing-accurate than) our USB-bus products. Whether or not these timing differences matter in your application depends upon your application.

To further complicate timing considerations, our modern AEC-IUSB and AEC-XUSB products have optional "buffered read" capabilities which can vastly improve performance. For example, when a new time code frame arrives, the AEC device can automatically send a data packet to the device driver software, which buffers the new data internally. The next time application software requests "buffered time code", the most recent time code data is returned immediately by the driver, without having to query the AEC USB device at all. So while there remains an inherent 1-2ms latency from end-of-frame to "driver data ready", application software can optionally read the buffered AEC USB device data within about 2us instead of 2ms. This is a dramatic (1000:1) performance improvement.

Please note that these timing estimates are exclusive of operating system (OS) delays, which we have no control over. When we started AEC in 1986, the Microsoft DOS operating system was king, and an application could read a 32-bit time code value directly from one of our ISA time code boards in less than 1us. Modern operating systems are vastly more complex, and support multitasking, and as a result are often much slower despite the vastly improved hardware. Modern operating systems periodically wander off and perform system maintenance tasks, and/or switch to some other application code within the system, which sometimes takes so long that one or more time code frames get missed. This is an important system design consideration which we have no control over. A true "real-time" operating system is often required. The selection of one AEC product family over another makes no difference in this respect.

<u>USB-TC Product Family:</u>
The "USB-TC" product family was introduced in 2003. It includes our USB-LTC and USB-21VL product sub-families for analog LTC and analog video/VITC, plus our USB-IRIG product sub-family for analog IRIG. These are small (2.8" x 4.4") and rugged external boxes which connect to a host PC via a standard USB cable (included). Perfect for laptop PC's and other situations where no internal PCI or PCI Express slot is available. Most applications which work with our USB-TC products also work with our PCI-TC and PCIe-TC products, because they all share the same basic DPRAM memory map. Hardware interrupts are not available. See ordering guide for further details.

<u>AEC-XUSB Product Family:</u> (advance information)
The "AEC-XUSB" ("eXternal USB") product family is presently still under development. These products use the same small enclosure as our existing USB-TC and AEC-µBOX-2 products, but use the newer "modular memory" DPRAM interface. Various combinations of analog LTC readers, analog LTC generators, analog IRIG, RS232, RS422, and GPIO are expected, all with a micro-USB interface. Stay tuned for details.

<u>AEC-IUSB Product Family:</u>
The "AEC-IUSB" ("Internal USB") product family was released in early 2015. The primary goal of this product family is to provide time code products which "look like" PCIe-TC products from the outside of a PC (they use the exact same connectors and PC brackets), but which connect to a motherboard USB connector instead of the PCI Express bus. The result is a lower cost product which will appeal to some customers where the longer timing delays of USB products are acceptable. This is also a good solution for situations where a PC bracket opening is available, but no PCI or PCI Express connector is available. Due to more advanced manufacturing techniques (smaller device geometries), the AEC-IUSB product family will eventually include many combinations of functions which are not supported by the PCIe-TC product family. See ordering guide for further details, and please check back with us periodically for new and exciting AEC-IUSB product releases.

<u>Document Summary and Contact Information:</u>
Adrienne Electronics Corporation (AEC) has been designing and selling a wide variety of very reliable and cost-effective electronic products for the television equipment industry since 1986. Our longevity is a testament to our products and their performance over time. This document contains information which should help you determine which AEC product families best suit your application(s). Please visit our website at <www.adrielec.com> for additional information, including full product literature and ordering information.