

Andalé Data Recorder

High Speed Data Recording and Playback System up to 8 GB/s



FEATURES

- Turnkey, High-Speed Data Acquisition + Storage
- Rugged Portable, ATX Mid Tower, or Rackmount configurations
- SSD or hard drive arrays
- Internal 4 to 288 TB Hard Disk Array
- Up to 8000 MB/s sustained-performance from analog or digital XMC I/O module to standard OS disk files
- Expandable to even larger storage options via 6U chassis or JBOD
- Custom configurations for any capacity and speed are available upon request
- Intel Core i7-4790K CPU and 16GB DDR4 Memory
- Supports all Innovative XMC and FMC I/O module features including triggering and timing features. Log anything from RF receivers to industrial control signals.
- Rugged ATX enclosure with integrated cooling
- Autonomous or Network-controlled operation via named-pipe connections

APPLICATIONS

- High-Speed Recording/Playback
- Laboratory or factory instrumentation

DESCRIPTION

Andalé (pronounced on'-duh-lay) is a powerful data logging system which directly controls an NTFS disk subsystem to support gap-free storage or playback of analog or digital signals acquired using the Innovative XMC or FMC modules. The included logging software moves data in real-time between the analog or digital I/O peripherals on any Innovative XMC or FMC module to/from dedicated SATA drives with minimal intervention from application software or the operating system.

A dedicated PCI Express RAID subsystem interfaces to conventional hard disk or solid state drives supporting guaranteed data flow rates up to 8000 MB/s, sustained. File sizes are limited only by the amount of disk storage available. Up to 288 terabytes of storage are available in the standard configurations; Even larger storage is supported via 6U chassis or external JBOD enclosures. Custom configurations of any speed and capacity combination are available and will be quoted upon request. Call Innovative for details.

A multitude of analog/digital I/O interfaces are available through optional XMC or FMC modules as shown in the table below. Up to three XMC and/or FMC modules may be simultaneously installed and operated in each chassis.

SOFTWARE

- Turnkey Data Recorder software
- Supplied BinView data viewer allows rapid display and analysis of huge data sets in time or frequency domain
- Operates under Microsoft Windows
- C/C++ API supporting custom application development
- Runs all standard XMC and FMC module application software
- Turnkey applications provided - No custom device drivers or software required

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Andalé Data Recorder

ORDERING INFORMATION

Product	Part Number	Description
COMMON SPECIFICATIONS		
<ul style="list-style-type: none"> • Intel Core i7-4790K Quad Core 4.0 GHz CPU with Intel HD Graphics 4600 • 16GB 2133 DDR4 Memory • ASUS Maximus VI Extreme Motherboard • 5 x PCIe 3.0/2.0 x16 (x16 or dual x8 or x8/x16/x8 or x8/x16/x8/x8) • 1 x PCIe 2.0 x4 • 1 x mini-PCIe 2.0 x1 • PCI-E x8 Gen3 RAID Controller Card 		
Andalé Recording System	90036-100A	24 TB hard drive array on 4U Rackmount chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 2400 MB/s with burst rates up to 4000MB/s.
	90036-100B	48 TB hard drive array on 4U Rackmount chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 2400 MB/s with burst rates up to 4000MB/s.
	90036-100C	72 TB hard drive array on 4U Rackmount chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 2400 MB/s with burst rates up to 4000MB/s.
	90036-100D	96 TB hard drive array on 4U Rackmount chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 2400 MB/s with burst rates up to 4000MB/s.
	90036-100E	288 TB hard drive array on 4U Rackmount chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 2400 MB/s with burst rates up to 4000MB/s.
	90036-101A	6 TB SSD array on on ATX Mid Tower chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-101B	12 TB SSD array on ATX Mid Tower chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-101C	24 TB SSD array on ATX Mid Tower chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-101D	48 TB SSD array on ATX Mid Tower chassis with 24 hot swap drive bays, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-102A	Rugged Portable 4 TB SSD array, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-102B	Rugged Portable 8 TB SSD array, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-102C	Rugged Portable 16 TB SSD array, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .
	90036-102D	Rugged Portable 32 TB SSD array, turnkey logging software and C++ libraries for X-Series XMC modules Sustained rates of 8000 MB/s .

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Product	Part Number	Description
Desktop XMC to PCIe adapter	80173-0	PCIe to XMCE Adapter Board (eight lane) for X3 or X5 modules
	80172-0	Single-Lane PCIe to XMCE Adapter Board for X3-modules only
X6-1000M	80280-0	XMC Module with Two 1 GSPS 12-bit A/Ds, Two 1 GSPS 16-bit DACs, Virtex 6 FPGA, 4 GB Memory and PCIe
X6-250M	80279-0	XMC Module with Eight 250 MSPS 14-bit A/Ds, Virtex6 FPGA, and 4 GB Memory and PCIe
X6-400M	80270-0	XMC Module with Two 400/500 MSPS A/Ds, Two 500 MSPS DACs, Virtex6 FPGA, 4 GB Memory and PCIe
X6-GSPS	80264-0	XMC Module with Two 1.8 GSPS, 12-bit A/Ds, Virtex6 FPGA, 4 GB Memory and PCIe
X6-RX	80245-0	XMC Module - Four 160 MSPS 16-bit A/Ds & Virtex-6 FPGA, 4 GB Memory and PCIe
PEX6-COP	80284-0	FPGA co-processor card that integrates a Virtex6 FPGA computing core with an industry-standard FMC IO module on a three quarter-length PCI Express desktop or server card
FMC-1000	80325-0	The FMC-1000 is a high speed digitizing and signal generation FMC I/O module featuring two 14-bit 1250 MSPS A/D channels and two 16-bit 1250 MSPS D/A channels supported by sample clock and triggering features.
FMC-250	80315-0	The FMC-250 is a high speed digitizing and signal generation FMC IO module featuring two 16-bit 250 MSPS A/D channels and two 16-bit 1200 MSPS D/A channels supported by sample clock and triggering features
FMC-310	80320-0	The FMC-310 is a high speed digitizing and signal generation FMC IO module featuring four 16-bit 310 MSPS A/D channels supported by sample clock and triggering features
FMC-500	80281-0	The FMC-500 is a high speed digitizing and signal generation FMC I/O module featuring two 14-bit 500MSPS A/D channels and two 16-bit 1230 MSPS D/A channels supported by ultra-low jitter sample clock and triggering features
FMC-SERVO	80339-0	The FMC-SERVO module features eight simultaneously sampling A/D and DACs. Eight 16-bit A/D channels and eight 16-bit D/A channels supported by sample clock and triggering features. Low latency SAR A/D and fast-settling DACs support real-time servo control applications

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ABSOLUTE MAXIMUM RATINGS

!Exposure to conditions exceeding these ratings may cause damage!

Parameter	Min	Max	Units	Details
Supply Voltage	+110	+230	Vac	
Supply Current	1.87	3	Amp	
ESD Rating	-	1k	V	Human Body Model

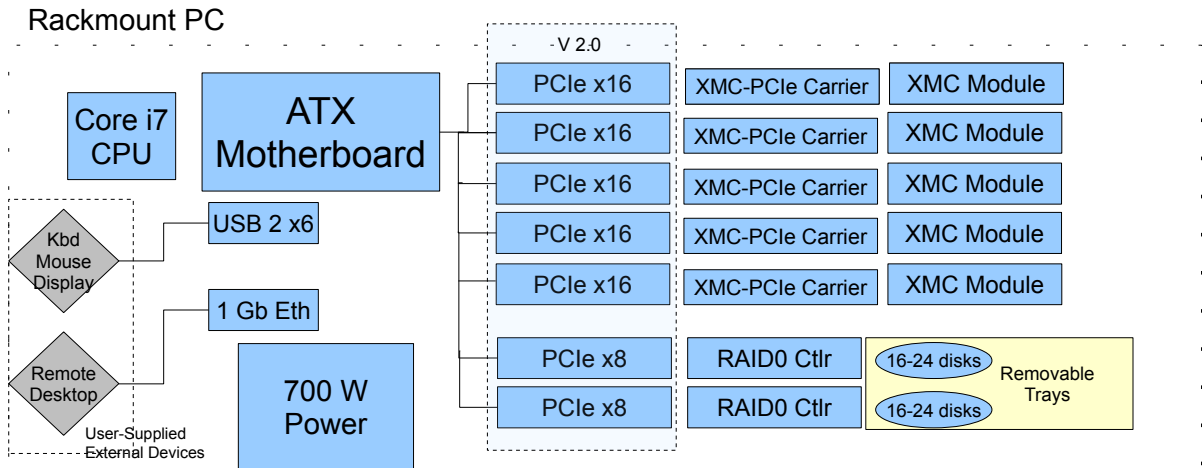
CONDITIONS

Parameter	Min	Typ	Max	Units	Details
Forced Air Cooling	4	6	-	inches	Clearance required around unit to allow internal forced-air cooling to operate properly

Part Number	Max Power Consumption	Weight	Dimensions	Operating Temperature	Storage Temperature
90036-100A	355W	35 kg / 77 lbs	19" (W) X 25.5"(D) X 7" (H)	5 C to 40 C	-10 C to 60 C
90036-100B	355W	41 kg / 90 lbs	19" (W) X 25.5"(D) X 7" (H)	5 C to 40 C	-10 C to 60 C
90036-100C	355W	41 kg / 90 lbs	19" (W) X 25.5"(D) X 7" (H)	5 C to 40 C	-10 C to 60 C
90036-100D	355W	41 kg / 90 lbs	19" (W) X 25.5"(D) X 7" (H)	5 C to 40 C	-10 C to 60 C
90036-100E	437W	45 kg / 99 lbs	19" (W) X 25.5"(D) X 7" (H)	5 C to 40 C	-10 C to 60 C
90036-101A	342W	20 kg / 43 lbs	8.3" (W) X 17.7"(D) X 19.1" (H)	5 C to 50 C	-10 C to 60 C
90036-101B	342W	20 kg / 43 lbs	8.3" (W) X 17.7"(D) X 19.1" (H)	5 C to 50 C	-10 C to 60 C
90036-101C	342W	20 kg / 43 lbs	8.3" (W) X 17.7"(D) X 19.1" (H)	5 C to 50 C	-10 C to 60 C
90036-101D	342W	20 kg / 43 lbs	8.3" (W) X 17.7"(D) X 19.1" (H)	5 C to 50 C	-10 C to 60 C
90036-102A	285W	13 kg / 29 lbs	16" (W) X 6.88"(D) X 13" (H)	5 C to 50 C	-40 C to 65C
90036-102B	285W	13 kg / 29 lbs	16" (W) X 6.88"(D) X 13" (H)	5 C to 50 C	-40 C to 65C
90036-102C	285W	13 kg / 29 lbs	16" (W) X 6.88"(D) X 13" (H)	5 C to 50 C	-40 C to 65C
90036-102D	285W	13 kg / 29 lbs	16" (W) X 6.88"(D) X 13" (H)	5 C to 50 C	-40 C to 65C

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Figure 1. Andalé Block Diagram



Architecture and Features

Andalé is built atop the mature [Malibu Software Libraries](#). Innovative's high-performance real-time control and data acquisition framework. Malibu is written in portable C++, and uses the exceptional [Intel Performance Primitives](#) to achieve outstanding performance in the area of native signal processing and data movement on x86-class host PCs.

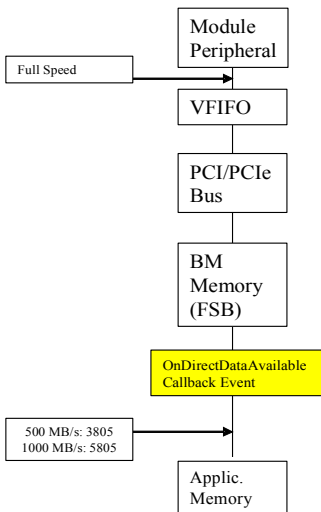


Figure 2. Block Diagram of Data Flow from XMC to Host Memory

Data flow within Andalé is illustrated in Figure 1, left. Tiered buffering insures data integrity, even under a non-deterministic operating system such as Windows or Linux. Analog or digital data acquired via the module peripherals flows into a large virtual FIFO implemented within on-board DDR on-module memory controlled by the FPGA firmware. 4MB, 1 GB or 4 GB of onboard FIFO memory is implemented on-module for the X3/X5/X6-series modules, respectively.

As data accumulates within the FIFO, the on-board logic automatically bus-masters data blocks into PC system memory at the maximum rate sustainable by the PCI Express interface – 3400 MB/s for the X6/FMC-modules.

Immediately after a buffer is transferred to system memory, an interrupt routine within Malibu notifies the Andalé software subsystem, which initiates an in-place, write-to-disk operation to the RAID0 disk controller, eliminating superfluous and expensive memory copy operations.

All disk transactions are implemented using 64-bit file operations, allowing contiguous storage limited only by the size of the array. Support routines written in C++ are available to simplify access to the resulting huge data files within custom user applications.

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The turnkey application software provided with Andalé supports the ability to start and stop recording in response to software commands or external signals, log up to a specified file size and to analyze data stored in standard files for post-processing, meeting the most common system requirements without the need for software modification or customization.

Alternately, C/C++-savvy end-users can build a custom data logger/player application in short-order using the supplied Andalé support libraries which are compatible with Qt Creator and MSVC C++ 2013.

The Andalé Data Recording System combines the simple yet powerful Andalé software, a dedicated, ultra-performance SATA/SAS hard disk /controller and the Malibu Development Environment. The Malibu libraries provide full-featured support for all XMC module features, allowing users to customize the turnkey data logger source code or to create an entirely custom data recording or playback software application. Malibu has been crafted and optimized for high-speed data movement and management. It contains hundreds of reusable software building blocks (called C++ objects) which enable the user to quickly and easily perform calculations to suit a particular application. For example, components permitting optimized filtering or Fourier transformations are provided. File utilities to allow creation, editing and deletion of the raw binary data files are also included as components.

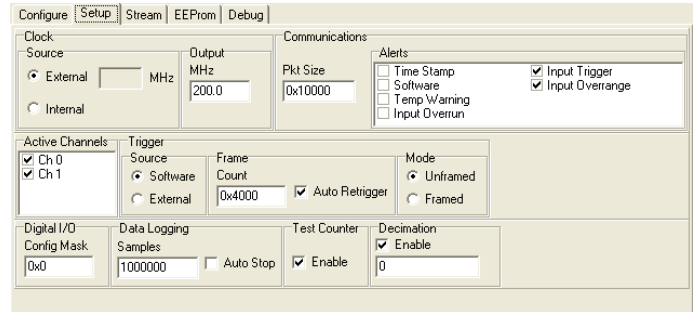


Figure 3. All module-specific configuration settings are supported

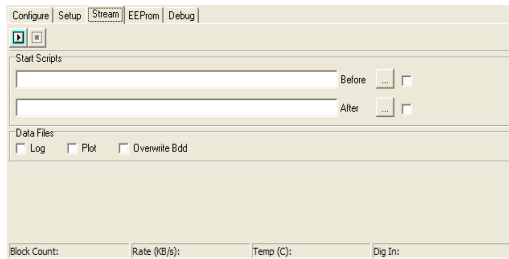


Figure 4. Data is logged in standard NTFS files, expediting analysis

The dedicated SATA RAID0 disk subsystem (call Innovative Integration for available sizes) stores the data in raw binary format to achieve the highest possible throughput (this drive should not be used as a standard OS system drive since recording performance could be compromised). Archived data can be opened and analyzed as a standard, 64-bit file for post-processing or can be viewed and analyzed in-place with the supplied raw binary data viewer, BinView, which supports graphical and tabular time/frequency-domain data display plus statistical analysis (SINAD, SFDR, THD, STDEV, MIN, MAX, etc.). Numerous Andalé library functions are supplied to facilitate in-situ analysis and conversion.

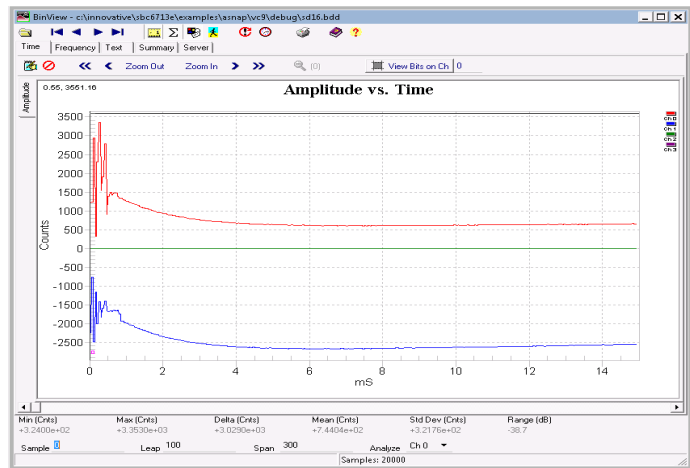


Figure 5. Binview binary file viewer applet

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XMC/FMC Modules

Plug XMC or FMC modules into Andalé to build your custom, turnkey data logging instrument. Innovative Integration offers an array of ultra-performance, PCI Express XMC modules to create your solution.

X6-1000M - Two 1 GSPS 12-bit A/Ds, Two 1 GSPS 16-bit DACs, Virtex 6 FPGA, 4 GB Memory and PCIe



X61000m

X6-250M - Eight 250 MSPS 14-bit A/Ds, Virtex6 FPGA, and 4 GB Memory and PCIe



X6250m

X6-400M - Two 400/500 MSPS A/Ds, Two 500 MSPS DACs, Virtex6 FPGA, 4 GB Memory and PCIe



X6400m

X6-GSPS - Two 1.8 GSPS, 12-bit A/Ds, Virtex6 FPGA, 4 GB Memory and PCIe



X6GSPS

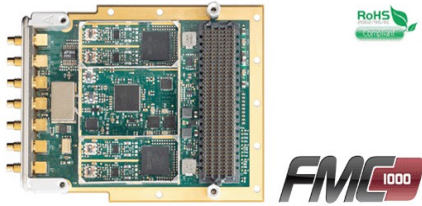
X6-RX - Four 160 MSPS 16-bit A/Ds & Virtex-6 FPGA, 4 GB Memory and PCIe



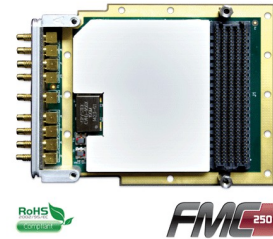
X6rx

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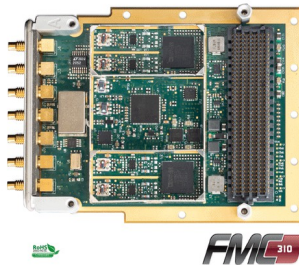
FMC-1000 - two 14-bit 1250 MSPS A/D channels and two 16-bit 1250 MSPS D/A channels



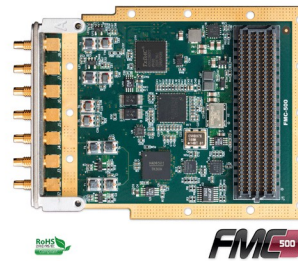
FMC-250 - two 14-bit 1250 MSPS A/D channels and two 16-bit 1250 MSPS D/A channels



FMC-310 - four 16-bit 310 MSPS A/D channels



FMC-500 - two 14-bit 500MSPS A/D channels and two 16-bit 1230 MSPS D/A channels



FMC-SERVO - Eight 16-bit A/D channels and eight 16-bit D/A channels



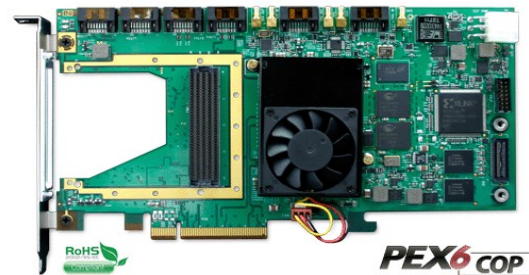
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Module Carriers

XMC and FMC modules are electrically-equivalent to standard desktop PCI Express cards. However, they adhere to the XMC and FMC module rather than the standard desktop PCIe card mechanical specifications. Consequently, use of one of the adapter cards listed below is required to allow use of an XMC or FMC module within the ATX motherboard within the Andalé chassis.



Optional 8-Lane XMC to PCI Express Adapter Card, P/N 80259-0



Optional 8-Lane FMC to PCI Express Adapter Card, P/N 80284-0

The 80259 8-lane adapter should be used when using X6-series modules and 80284 8-lane adapter should be used when using FMC modules. Eight PCI-E lanes are required in order to achieve rated throughput.

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