SkuTek Instrumentation

Where Science Meets Industry

FemtoDAQ Kingfisher

10-Channel Digitizer With FPGA and SiPM Bias Supply

The FemtoDAQ Kingfisher is a compact, low cost, ten-channel data acquisition system. It uses a embedded Single Board Computer running Linux for data recording and instrument control. It provides ten digitizer channels, two analog output channels, logic I/O's for connecting to external devices, and a detector bias supply for use with silicon photomultipliers, PIN diodes, and similar detectors.

FemtoDAQ Kingfisher Specifications	
Channel Count	*10 analog channels*
Bit Resolution	*14 bits in each channel, yielding 16,384 discrete ADC values*
ADC Sampling Frequency	*100 MHz*
Coaxial Analog Inputs	*Ten inputs with LEMO (standard), or MCX if requested by the customer. MCX is a "special order" which can add to the lead time. Inputs are terminated with 50 ohms, 1k ohm, or 10k ohms selected with 3-position switches.*
Analog Input Range	*2 volts total, anywhere within the -2 to +2 volt range. For example (-1 to +1 volt), (-2 to 0 volt), or (0 to +2 volt) are valid input ranges.*
Coaxial Analog Outputs	*Two LEMO outputs with synthesized analog signals with -2 to +2 volt range can render a choice of internal FPGA signals. Default channel A: any input*

	signal. Default channel B: an arbitrary waveform with 81.92 us duration.
Detector Bias Output	*Detector bias from +11 to + 85 volts @ 4 mA max is available on the back panel MCX coax connector.*
Logic Inputs With Coax Connectors	*Four LEMO logic inputs with either NIM or LVCMOS levels selected with a switch. Functions are defined in firmware. Default configuration: trigger in, veto in, time stamp clear in, pulse-per-second (PPS) in.*
Logic Outputs With Coax Connectors	*Four LEMO logic outputs with either NIM or LVCMOS levels selected with a switch. Functions are defined in firmware. Default configuration: trigger / busy out, pulse-per-second (PPS) out. Two outputs are TBD.*
Trigger Modes	*Level-0: internal trigger in each channel. Level-1 default: OR of the channel triggers, ORed with external logic input trigger. Advanced trigger developed on customer request: any logic function of the above.*
Noise Suppression in the Channel Trigger	*Each analog channel is equipped with user – defined filter between 0 ns (no filter) and 160 ns, followed by a differential comparator in each channel. This is Equivalent to a Timing Filter Amplifier followed by a discriminator in each channel.*
External Trigger Input	*LEMO coax input with with either NIM or LVCMOS logic levels. External trigger can "generate an event" at any time.*
Auxiliary "Noise Trigger"	*The embedded CPU can issue "any time trigger" to record noise waveforms.*
Real-Time Pulse Processing	*For each event, firmware will measure the input pulse height in each channel, differentiated trigger pulse height, hit multiplicity, pulse summation of all inputs, time stamp, and other pulse-related quantities. Please inquire about the details.*
Multichannel Analyzer (MCA) Mode	*Histogram of pulse height with 4k bins for each channel. Baseline subtraction and amplitude scaling by 1, 2, or 4 in each histogram. In order to maximize the throughput, waveforms are not recorded in the MCA mode.*

Waveform Digitizer Mode	*While the unit is not in the MCA mode, it can record waveforms of input signals of up to 8192 samples, which is up to 81.92 µs @100 MHz sampling.*
Event-by-event files	*Event by event files can be recorded in either ASCII or binary formats. The files will contain pulse heights, time stamps, pulse shape parameters, etc. Optionally, the files can also record event-by-event waveforms. Please inquire about the details of the file format and content.*
Programming	*Comprehensive software library is available to users free of charge. Users can develop their own programs in either Python or C to perform custom data processing, write their own recording procedures, perform either periodic or time – triggered data acquisition tasks, etc.*
Customizations	*We can customize the instrument to user's needs under a contract. Note that the users can avoid this cost when they customize the software themselves.*
Internal Clock	*When the external clock is not used, the unit will generate its own, highly stable internal reference clock using a quartz stabilized oscillator.*
Clock Synchronization Input	*Dedicated clock input to synchronize the internal clock to an external high precision 10 MHz reference provided by commercial GPS or White Rabbit. Internal clock will be used when this input is not connected.*
Clock Output	*Two copies of the 10 MHz clock, phase locked to the original.*
Data Recording Options	*Data files, waveforms, histograms, and settings can be written to an internal SD card, a memory stick, or to the remote disks mounted over Networked File System (NFS). A number of options are available because the instrument is running a modern Debian Linux. Our instrument can do anything what Linux can do. Please inquire about the details.*
Event Format	*The event format named GREAT is descended from and compatible with the standard format adopted by GRETA. Description is available on request.*
Physical Dimensions (cm)	*Benchtop box shown in the photograph. Its size is*

	similar to a VME board.
Weight	*About 1 kg*
Additional Interfaces	*One RJ45 for 100M Ethernet. One mini-USB for the 100M Ethernet-over-USB. One full size USB for an optional memory stick to record data files.*
Power	*5 volt DC Barrel Jack*
User Interface	*(1) Web-based interface with no installation required. The instrument is serving its own web page over regular Ethernet or Ethernet-over-USB. (2) Python scripts used for GUI-less operation driven by Python commands or Jupyter.*
Internal Operating System	*Debian Linux*
Multiple Unit Synchronization	*Timestamps and triggers can be synchronized across multiple units, using the logic inputs and outputs. This method can be also used for connecting Kingfishers with DAQ systems from third party vendors. Please inquire about the details.*
Real Time Event Building	*Kingfisher can build its events in real time, using the internal Level-1 trigger criteria (e.g., coincidences among inputs). It can also use external NIM logic pulses. The externally strobed events will be written to the time stamped event files and processed offline.*

We are a small company dedicated to serving physics researchers worldwide. We specialize in high-speed Data Acquisition systems and Digital Pulse Processing electronics. Our product line comprises the whole data acquisition chain: detectors, digitizers, firmware pulse processing, and data management for scientific big-data applications.