THE WORLD STANDARD IN FLIGHT TEST INSTRUMENTATION

ACRA CONTROL

KAM-500 Product Guide

April 2008

www.acracontrol.com

ISO 9001:2000 QUALITY

The world standard in Flight Test Instrumentation

ACRA CONTROL manufactures high-performance, cost-effective data acquisition systems for the global aerospace and transportation industries. These include fixed and rotary-wing aircraft, space vehicles and UAVs in more than 40 countries.

ACRA CONTROL supports flagship programs such as Boeing Delta-II Launcher, Airbus A380, Eurofighter Typhoon, ARJ-21 and the SuperJet100 Regional Jet. Many more rely on KAM-500 accuracy, flexibility and innovative design for testing today's most advanced aircraft and systems.

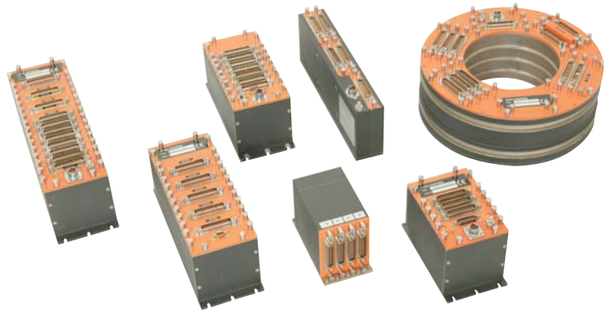
KAM-500

KAM-500 is the most flexible airborne digital data acquisition system available to engineers in the world today. It combines high reliability with high performance in a compact modular system. Advanced signal conditioning, avionics bus monitoring, video/audio compression, integrated data logging and multiple output formats are supported within a single unit or master/slave network-distributed system.

KAM-500 does far more than produce IRIG-106 compatible PCM streams. Its modular architecture can transform any KAM-500 system to operate in many roles for example; network node, remote terminal, video/audio mixer and solid-state recorder.

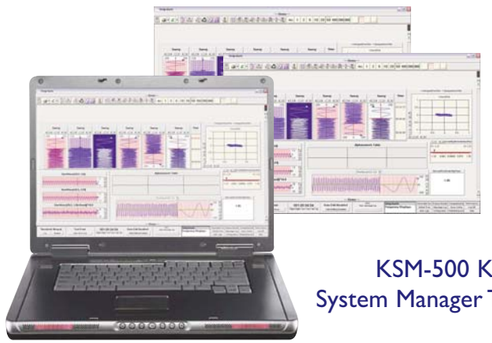
A KAM-500 system is typically made up of one or more chassis and an array of acquisition and output modules.

Product Overview



KAM-500 Data Acquisition Systems

Video Compression



KSM-500 KAM System Manager Tool Suite

Data Recording

The KAM-500 Advantage

Modularity & Flexibility

A key concept behind KAM-500 is "any module, any slot, any chassis" i.e. you can take any combination of modules and place them in any slot of a chassis. KAM-500 is configured and programmed using ACRA CONTROL supporting software KSM-500. An added benefit of this flexibility is that modules or chassis can be individually replaced, minimizing inventory requirements. If additional output or acquisition modules are required, you simply plug those modules into any available slots, reprogram the system using KSM-500 software and it is ready to go.

Digital Architecture

KAM-500 has been designed with a digital architecture that delivers a number of key advantages:

- The elimination of crosstalk inherent in analog multiplexed systems.
- Every analog channel has its own anti-aliasing filter, A-D converter and programmable digital filter.
- The location of modules is open i.e. no restrictions are placed on the position of modules within a chassis.
- Any module can be a data sink (e.g. PCM transmitter, solid-state memory) or a data source (e.g. A/D, bus monitor) or both (e.g. 1553 RT, BIT module).
- Isochronous sampling across the entire system.
- All modules have access to all data transferred over the backplane.

Chassis

There are a number of KAM-500 chassis to choose from, ranging from 3 to 13 user slots and in various geometries. All chassis are constructed with a rugged aluminum housing. Inside the chassis are a power supply unit (PSU) and a digital backplane. The backplane is the backbone of the KAM-500 digital architecture and supports throughput of up to 8Msps with 16 bits per sample. The onboard PSU accepts aircraft power (18-40Vdc). All modules within a chassis are powered from the PSU. For a list of the chassis options available please consult the selection guide at the back of this brochure.

Modules

The KAM-500 digital architecture strategy is continued throughout all modules maintaining consistent high operational performance. A high level of parts commonality between modules and the use of monolithic devices underpins the reliability of KAM-500.

Flexible Sample Rates

Through the use of high speed oversampling Analog/Digital Converters, and advanced digital filtering techniques the user has complete control when defining sample rates.

Multiple Output Types

KAM-500 is capable of outputting data in PCM, Ethernet, ARINC-429, MIL-STD-1553 formats, and logging data to solid-state flash memory simultaneously. The rates at which parameters can be output / stored can be different for each output / memory module.

No Adjustment Required

There are no potentiometers, trim resistors, switches or jumpers in KAM-500 systems, minimizing time and temperature drift effects. No multiplexers are used in KAM-500 eliminating channel crosstalk. These design rules ensure consistent high levels of measurement accuracy.

Works Once, Works Always

KAM-500 is based around a very simple idea – the acquisition cycle. Finite state machines are implemented on fixed function FPGAs (Field Programmable Gate Array), not software dependent microprocessors. Hardware performs reliably and in a completely deterministic manner. The FPGA is configured to repeatedly perform the same set of actions, this set of actions is called the 'Acquisition cycle'. For example, during every acquisition cycle, a channel might be sampled 10 times and DAC outputs updated. In the event of a power glitch corrupting the DAC output, the KAM-500 will update it on the next acquisition cycle, fixing the problem.

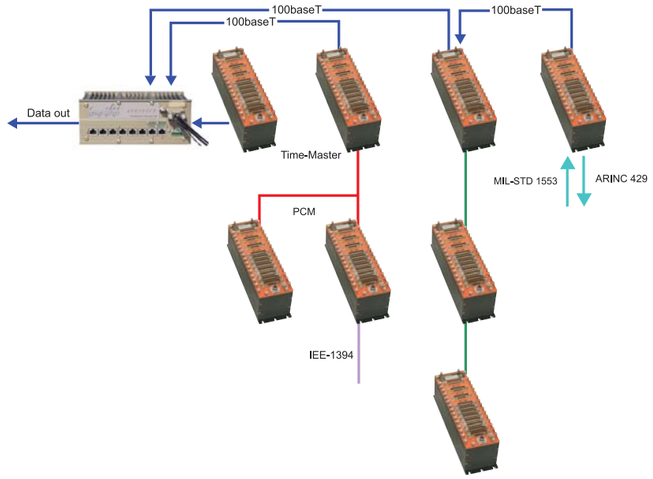
Programming KAM-500

Programming a KAM-500 system requires a PC running KSM-500 suite of software tools, and a programming connection. KAM-500 can be programmed over Ethernet or using a proprietary programming interface. Programming via Ethernet requires the BCU/105 controller module, or the combination of ETH/101 (Ethernet) and BCU/101 PCM encoder modules. Using the proprietary programming interface, the BCU/101 and SAM/DEC/007 PCM decoder/programmer is required.

KAM-500 as Network Node

Increasingly, networks are not just being monitored by acquisition systems, but are being used to re-define the data transport within high performance data acquisition systems. Networking is a fundamental part of the KAM-500 'DNA'. ACRA CONTROL has developed reliable high performance Ethernet interface modules that allow KAM-500 distributed systems to be interconnected on an Ethernet network.

With the BCU/105 backplane controller, KAM-500 becomes an Ethernet network node and fully IEEE-1588 compliant, meaning all data across all DAUs is synchronized to better than 30ns using Precision Time Protocol (PTP). All setup, data acquisition and synchronization is done over this single Ethernet connection. Standard Ethernet switches can be used in a data acquisition network, thus eliminating the need for custom-built 'master control units' or 'intelligent multiplexers' which can cost an order of magnitude more.



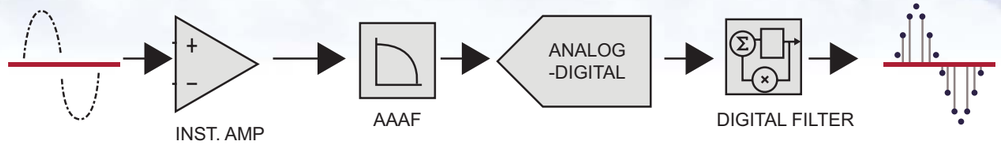
KAM-500 as Bus Monitor

KAM-500 bus monitoring modules typically feature some or all of the following tasks: user defined message parsing, 100% message 'snarfing', time tagging, and the provision of global parameters.

- Parsing is the process of extracting coherent data from a message payload. This data is placed into defined words within the transport packet. Stale or missed data is marked in those defined transport packet words.
- "Snarfing" also known as all-bus monitoring applies filtering to incoming payloads and fills defined words in the transport packet as they arrive, however no missed or stale data is marked.
- Any bus being monitored is asynchronous to the KAM-500 acquisition cycle. It is therefore essential to time-tag bus message payloads referencing them to the acquisition cycle.
- Global parameters are available at all times and report module and bus status via the transport packet.

KAM-500 offers a range of avionics bus monitoring modules that are listed in the module selection guide.

KAM-500 Analog Data Acquisition



KAM-500 can support up to 624 single-ended channels in a single, stand-alone 13-user-slot chassis. For distributed systems the number of channels increases to thousands.

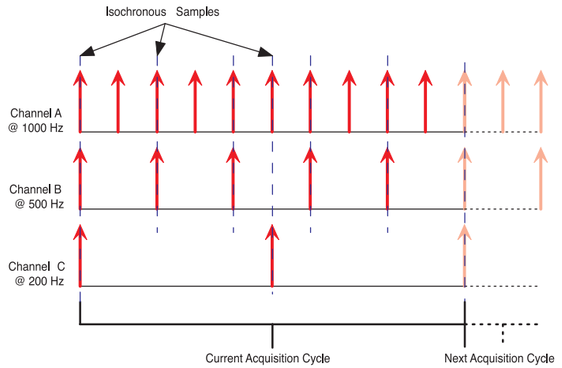
All KAM-500 analog modules share the following features:

- One ADC for each channel, facilitating isochronous sampling. Every analog channel, even in a distributed system can be sampled at exactly the same instant in time, making time correlation of events in post processing trivial. With one ADC per channel the choice of ADC can be tailored to suit the accuracy and bandwidth requirements of the particular sensor or application.
- Analog circuitry is minimal and incoming signals are digitized early in the signal chain. This reduces the effects of temperature and noise that are normally inherent to analog systems.
- Once in digital form, filtering is applied using FIR and IIR techniques. Digital filtering is used for accuracy and repeatability as well as immunity temperature effects. Analog modules utilize a digital implementation of an 8th order Butterworth filter with programmable cut-off frequency for each channel. Typical analog bandwidth is 6kHz.

ACRA CONTROL has already brought to market a broad range of analog modules that cover virtually every type of sensor / input requirement. Typical options include programmable gain, excitation, offset and sample rates. Please consult the analog module selection guide in this brochure for more details.

KAM-500 and Time

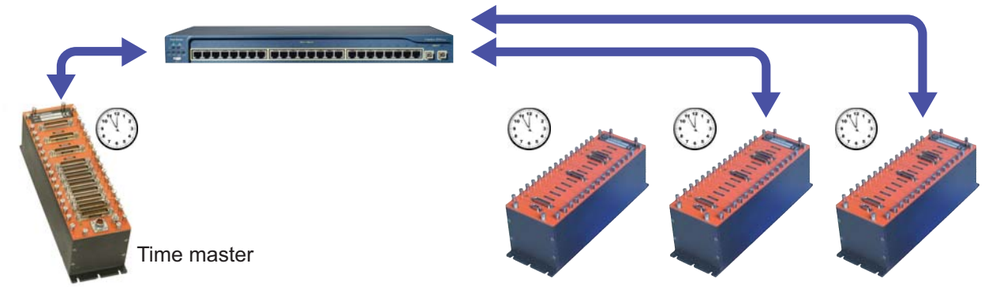
KAM-500 has been designed so that time correlation of sampled data, be it from analog or digital sources, is straightforward. This is achieved using isochronous sampling and time code seeding. Parameters sampled at the same rate can be sampled at exactly the same point in time. This is referred to as isochronous sampling. This simultaneous sampling holds true for all modules in all chassis for a system. With isochronous samples, it is unnecessary to realign or interpolate samples during analysis.



If no real-time clock, or time synchronization module is present in the system, then the system time is relative to the start of the first acquisition cycle of the master chassis. All other chassis in distributed system are synchronized to that time. Any card in a distributed system can use seeded time in order to time stamp parameters and bus activity. ACRA CONTROL provides multiple options for time code generation and synchronization to external sources, outlined in the modules selection guide.

KAM-500 as Grandmaster

Using IEEE-1588 (Precision Time Protocol) each network node (KAM-500 with BCU/105 as backplane controller) has an onboard local clock. The network itself has a grand-master clock. Each node receives the correct time from the grand master, and calculates the transmission delay between themselves and the master. This results in synchronization to typically 30nS.



KAM-500 and GPS

With the introduction of the TCG/102 dual functionality, specifically time code generation and GPS data acquisition have been implemented in one module. As well as extracting time information from the incoming GPS signal, navigational information is also stored in registers on the module. The internal GPS receiver allows users to acquire parameters for altitude, velocity, heading, latitude and longitude.

KAM-500 and Video

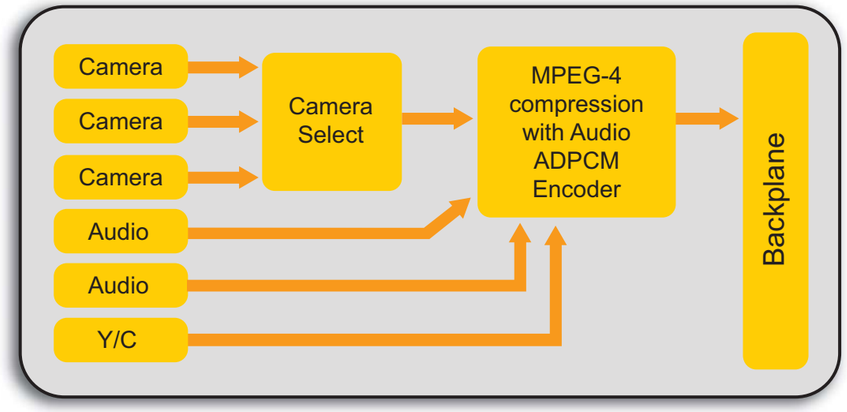
The VID/103 video module uses MPEG-4 video compression algorithms, allowing users to optimise the trade-off between video quality and available bandwidth. The video module has 3 multiplexed camera inputs and one compression engine. 2 audio channels are compressed with the active video stream. Where multiple video signals need to be acquired, simply add additional video compression modules to your KAM-500 system.

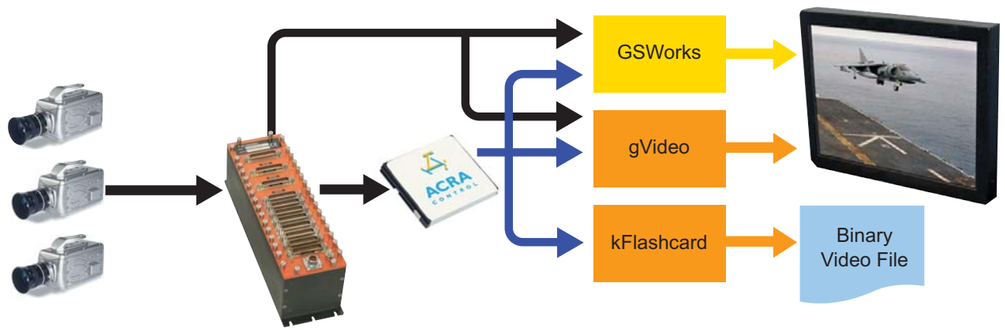
Users can optimise bit rate (kbps) frame rate (fps), size and P frame to I frame ratio (P:I) to suit bandwidth/quality requirements. Increasing P:I ratio decreases bandwidth requirement, whereas increasing the frame rate increases bandwidth.

Resolution	Frame Rate	MPEG-4 Bit Rate Min./Max.
CIF	1	64K/100Kbps
CIF	15	750K/1.0Mbps
CIF	30	1.0M/1.5Mbps
2CIF	15	1.0M/1.5Mbps
2CIF	30	2.0M/2.5Mbps
D1	15	2.0M/2.5Mbps
D1	30	4.0M/4.5Mbps

DVD | 256kbps 30fps All I | 256kbps 15fps P:I=15:1

GSWorks gVideo and kFlashcard can all be used to decode and analyze acquired video data. GSWorks and gVideo accept streamed data from KAM-500 via Ethernet or an IRIG-106 PCM decoder. GSWorks and gVideo can also display recorded video from Compact flash KFlashcard can be used to produce video files or to erase acquired data.



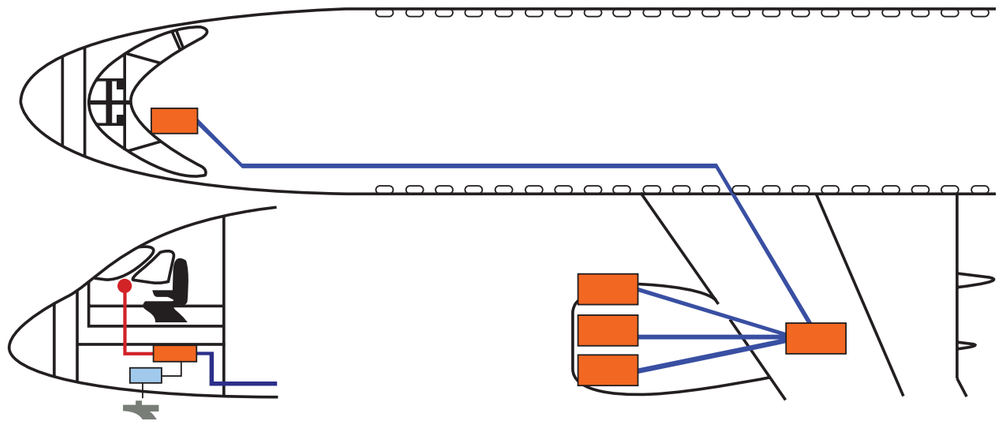


KAM-500 and Built In Test

Applications such as Operational Loads Measurement Systems (OLMS) or Health and Usage Monitoring Systems (HUMS) may require that the KAM-500 system is installed and operating for long periods away from direct human contact. It is therefore very important to remotely determine the operational status of the data acquisition equipment. To this end ACRA CONTROL has created the Built-In Test (BIT) module. The BIT/101 uses window functions to examine parameters in digital or analog format. Non-configurable window functions continuously monitor +/-12V, +/-7V, +5V, chassis internal and external temperature. The BIT/101 allows users to create window functions each allowing users to examine up to 32 parameters, and from this produce a 4-bit output. 110 user-defined window functions can be created. Analog window functions are defined using minimum and maximum thresholds. Digital window functions use a 16bit mask. Logs of errors are retained on board the BIT/101 and can include time tagging. Examples of window function operation include:

- MEM full / %full / empty status.
- BUS register status.
- Analog channels are between defined minimum and maximum thresholds.

The BIT/101 has several different output options; buffered TTL, buffered LED, "Doll's eye" driver, and RS-422. The illustration below shows a typical scenario with KAD/BIT/101 monitoring a distributed KAM-500. The BIT/101 can provide simultaneous flight crew notification and data transmission to an RF downlink.

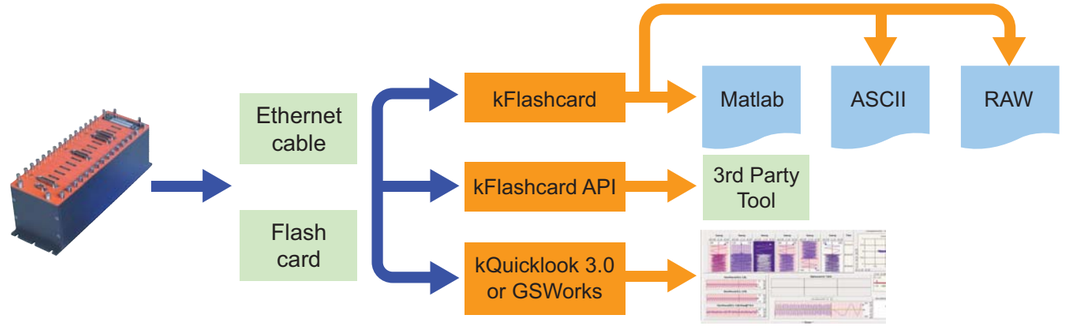


KAM-500 as Solid State Recorder

The versatility and flexibility of the KAM-500 is enhanced by its ability to provide solid-state data recording capability. The KAM-500 recording solution features the latest in Rugged Compact Flash memory with an operational temperature range of -40°C to +85°C, and capacities up to 24 GB. Where the KAM-500 is physically accessible, the MEM/003 allows the user to remove the Compact Flash card in order to download the data via a USB card reader. In a space limited location, or where the KAM-500 is situated in a hard to access location, the MEM/004 allows the user to download their data via an Ethernet connection directly to their PC. The MEM/003 or MEM/004 can be inserted into any KAM-500 system together with any combination of data acquisition and bus monitoring modules, making it the ideal stand-alone airborne recorder.

Continuous recording capability using 24GB Compact Flash

Acquisition cycle	0.01	s
No. of Parameters	1000	16bit
Card size	24	GB
Recording time	67	Hours



KSM-500

The KAM-500 System Manager is a suite of integrated tools designed to provide an easy to use yet powerful interface to the functionality of KAM-500 hardware. Running on the industry standard Microsoft Windows platform, KSM-500 provides a graphical view of the available hardware.
Each tool is capable of being used independently, but all the tools share data using a common file format-XidML.

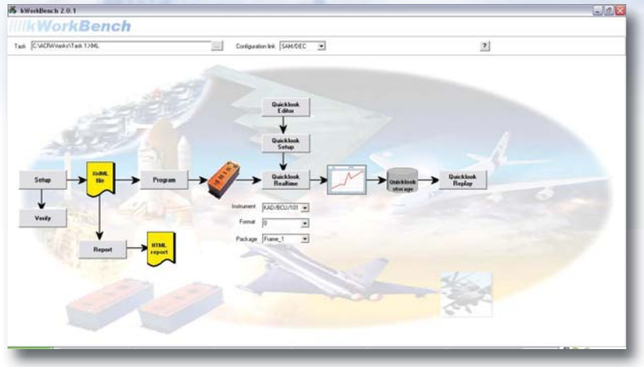
What is XidML?

XidML is an XML method for storing data in a highly structured form. XidML (eXtensible Instrumentation Data exchange Mark-up Language) describes on how data is acquired, processed and packaged for transmission, storage or reproduction. The primary objective of XidML is to store and exchange complex instrumentation information, between multiple vendors and user-groups gathering thousands of parameters. For more details on XidML and a copy of the specification, please see www.xidml.org.

KAM-500

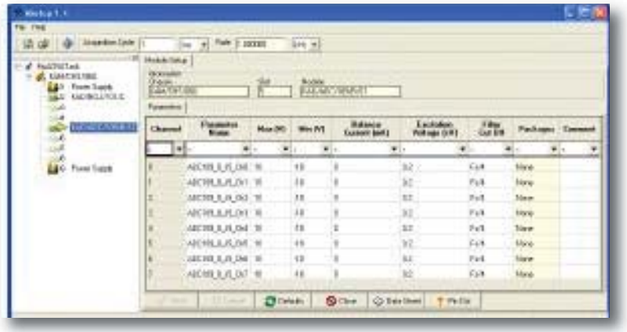
kWorkbench

Workflow tool for KSM-500.
Provides users with an integrated system, and easy navigation to KSM-500 suite of tools.



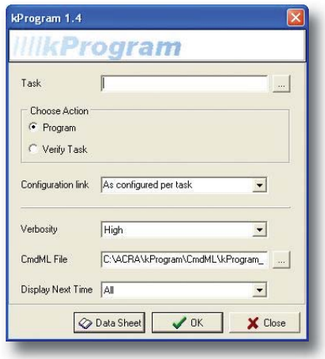
kSetup

KAM-500 configuration / editing tool.
Allows users to create and define Tasks representing KAM-500 instrumentation. Task Explorer allows the user to visualize a Task through a standard windows tree view. Tasks are constructed with chassis and modules. Module setup panels allow the user to define parameter settings for each module in the system. kSetup outputs the meta-data (XidML) for user configurations.



kProgram

Hardware Programming Tool
Programs KAM-500 based on user defined setup configuration. kProgram can verify and program instrumentation based on task information expressed in XidML. kProgram verifies that the data throughput and sequencing requirements described can be realized on the available instrumentation. Once verified modules are then programmed. Programming is not performed if the verification step fails.

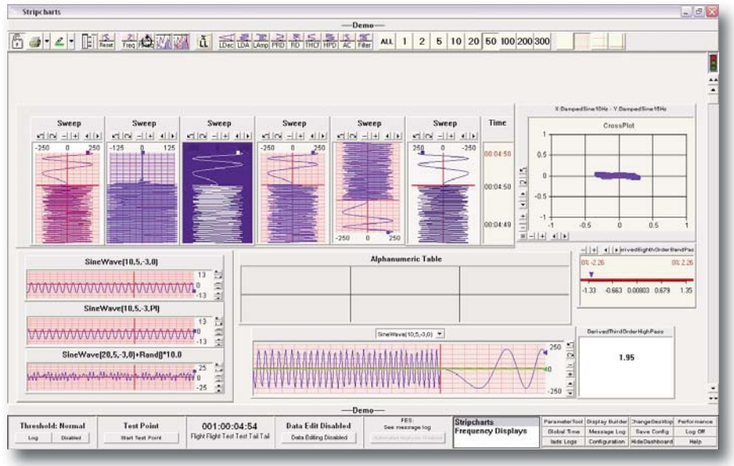


kQuickLook 3.0

Real time data Display Tool
kQuicklook 3.0 uses XidML to provide real-time display of streamed data from Ethernet or IRIG-106 PCM sources. Alternatively it can display recorded data from memory modules.
kQuicklook 3.0 allows data to be viewed on user-defined displays. Intuitive controls allow users to create multiple displays and to perform detailed time domain analysis. A broad range of displays are provided as standard including:

- Strip charts (Horizontal and Vertical)
- Annunciators
- Alphanumeric displays
- Control plots.

kQuicklook 3.0 is a subset of GSWorks.



Other Tools in the KSM-500 Suite...

- **kFlashCard**
  Used to prepare Compact Flash cards for use with KAM-500 memory modules, and to download data once recorded

- **kFlashCard** API
  Programming interface enabling customer to create their own tools to download data from Compact Flash cards used with KAM-500 memory modules.

- **kDiscover**
  Identifies and lists all KAM-500 hardware that is powered-up and connected to the PC, producing a HTML report with module and chassis names, part and serial numbers

Module Selection Guide

With a large selection of modules available to meet your data acquisition needs, finding the right one for the job is important.To help you, this module selection guide breaks down the available KAM-500 modules according to their intended application. For analog modules we've provided a selection matrix, and more detailed module specifications to help you with your choice. If you can't find what you're looking for here, please contact ACRA CONTROL so that we can help you with your requirements.

Chassis

CHS/03U	3 user slot KAM-500 chassis and power supplies
CHS/04L	4 user slot 'brick' KAM-500 chassis and power supplies
CHS/06U	6 user slot KAM-500 chassis and power supplies
CHS/09U	9 user slot KAM-500 chassis and power supplies
CHS/12R	12 user slot annular KAM-500 chassis and power supplies for helicopter rotors
CHS/13U	13 user slot KAM-500 chassis and power supplies
CHS/03F	3 user slot KAM-500 chassis and power supplies for space limited applications
CHS/05F	5 user slot KAM-500 chassis and power supplies for space limited applications

Bus Monitoring

ARI/001	8 channel ARINC-429 bus monitor, with 100% snarfing or user defined message parsing
ARI/103	1 channel ARINC-573 bus monitor with user defined message parsing
CBM/101	4 channel x 2.5 MHz Cross-channel Data Link (CCDL) bus monitor
DEC/003	2 channel IRIG-106 PCM decoder/merger
EBM/101	1 channel Ethernet (10/100 Base-T) bus monitor with user defined message parsing
FBM/001	1 channel Fiber-optic bus monitor, for use on an FCS bus
FBM/102	1 channel IEEE1394 (FireWire) bus monitor with user defined message parsing
MSB/001	Dual redundant MIL-STD 1553 bus monitor with 100% snarfing and user defined message parsing
MSB/103	Dual redundant MIL-STD 1553 bus monitor with Mode Code 17 and user defined message parsing
PBM/001	8 channel Panavia bus monitor, with 100% snarfing or user defined message parsing
PBM/002	A parser for the MC (and ENMC) link
SBM/001	Dual redundant STANAG-3910 bus monitor, with 100% snarfing or user defined message parsing

Serial

SDI/001	8 channel serial data input module with programmable clock output
UAR/102	4 channel serial (RS-232/RS-422) bus monitor with 100% snarfing or user defined message parsing

Discrete & Digital

DPI/002	16K x 16 bit external dual port RAM Reader, supporting ASCB-D and S8256 type interfaces.
DSI/002	24 channel discrete inputs with counters/timers and event time-tagging suitable for square waves.
DSI/003	24 channel discrete inputs with counters/timers and event time-tagging suitable for sine/square and low-level signals

Video & Voice

VDC/001	2 channel CVSD voice to digital converter
VID/001	Single-channel video interface to external video encoder
VID/103	3 channel MPEG video encoder, supporting NTSC/PAL programmable compression & output options

Data Storage

MEM/003	Compact Flash (CF) memory based memory module. CF card is removable to extract the data
MEM/004	Compact Flash (CF) memory based memory module. Data is downloaded via an Ethernet connection

Time & GPS

RTC/003	Real-time clock generator with memory status outputs
TCG/001	Analog & Digital IRIG-B time code reader and generator
TCG/102	Analog & Digital IRIG-B time code generator based on GPS source

Built-In Test

BIT/101	KAM-500 Continuous Built-In Test module with window function checking for system parameters

Output Options

ARI/002	1 channel ARINC-429 bus transmitter module, using any parameter as part of user defined messages
BCU/105	KAM-500 backplane controller and packet generator for Ethernet
DAC/001	8 channel analog and 16 channel digital output module
ETH/101	10/100 Base-T Ethernet interface for programming KAM-500 and outputting acquired data
ENC/005	IRIG-106 PCM Encoder with flexible frame structure, at up to 20 Mbps
ENC/106	IRIG-106 PCM Encoder with flexible frame structure, at up to 20 Mbps, including pre-modulation filter

Analog Module Selection Guide

Module	Channels	Accuracy (±% FSR)	Max Samples /channel \ sec	Bandwidth (Hz)	Analog Gains	Digital Gain	Excitation	Application Guide: Voltage	Current	Temperature	Strain	Vibration	Position	Pressure	3 Phase Power	Notes
																Examples of Signal Sources
ADC/002	2	0.25	100k	12.5k	Fixed 10,100	1-4	Fixed ±5V, max 15mA/ch	●						●		Microphones, Pressure transducers
ADC/008	3+3	0.3	20	1k	Variable 1, 10	1	n/a								●	Three Phase power supplies
ADC/010	2	0.25	100k	20k	1,10,100	1	n/a	●								Differential voltage sources
ADC/011	48	0.3	8.5k	600	Fixed 0.25, 1	1-4	n/a	●								Single ended voltage sources
ADC/012	24	0.3	17.5k	1.22k	Fixed 0.25,1,10 or 100	1-4	n/a	●								Differential voltage sources
ADC/014	16	0.2	26k	1.87k	Fixed 1,10, 100 or 400	1-4	0 - ±5.1V, 15mA/ch				●					Full-, half, quarter-bridge strain gages
ADC/105	8	1.2 *1	24k	6k	Variable 1,10,100, 1000	1-4	n/a	●								Differential voltage sources
ADC/106	6+2	1.2 *1	24k	6k	Variable 1,10	1-4	Fixed 3.6mA/ch					●				ICP type accelerometers
ADC/109/QB	8	1.2 *1	24k	6k	Variable 1,10,100, 1000	1-4	0 - 14.5mA/ch				●					Quarter-bridge strain gages (120 or 350 Ohm)
ADC/109/S1	8	1.2 *1	24k	6k	Variable 1,10,100, 1000	1-4	±5.1V, 30mA/ch						●	●		Full-, half, quarter-bridge strain gages, pressure sensors, DC accelerometers, potentiometers
ADC/109/S2	8	1.2 *1	24k	6k	Variable 1,10,100, 1000	1-4	±5.1V, 30mA/ch				●					Full-, half, quarter-bridge strain gages
ADC/113	16	0.35	12k	3k	Fixed	1	1 - 2mA/ch			●						PT100 temperature sensors
ADC/116	12	0.4	12k	3k	Fixed	1,2,4,8	Fixed 3.6mA/ch					●				ICP type accelerometers
ADC/117	8	1.2 *1	24k	6k	Variable 1,10,100, 1000	1-4	0 - 20mA/ch				●					Full-, half, quarter-bridge strain gages
ADC/118	12	0.42 *2	12k	3k	Fixed 1,10 or 100	1-4	0 - ±5.1V, 30mA/ch				●					Full-, half, quarter-bridge strain gages
ADC/120	12	0.42 *2	12k	3k	Fixed 1,10 or 100	1-4	0 - ±5.1V, 30mA/ch	●						●		Full-, half, quarter-bridge strain gages, pressure sensors, DC accelerometers, potentiometers
CDC/002	24	1 *3	17.5k	1.1k	n/a	1	n/a		●							Differential-ended current channels
CDC/101/300	4	0.4	24k	300	Variable 1,10	1-4	n/a					●				Piezoelectric accelerometers
CDC/101/6k	4	0.4	24k	6k	Variable 1,10	1-4	n/a					●				Piezoelectric accelerometers
LDC/101/5k	4	1.25	24k	6k	n/a	1	3Vrms 25mA/ch						●			LVDT and RVDT sensors
LDC/10/10k	4	1.25	24k	6k	n/a	1	3Vrms 25mA/ch						●			LVDT and RVDT sensors
MDC/001	8x64	0.25	300	n/a	Variable 1,10,100, 1000	1	n/a							●		Interfacing to analogue pressure scanners
MDC/002	2x64 +2	0.25	195	n/a	Variable 1, 2, 4	1	0.5 or 2.5mA							●		Interfacing to Scanivalve analogue pressure scanners with temperature compensation sensor
MDC/103	2x64 +2	0.25	312.5	n/a	Variable 1, 2, 4	1	5V(50ma) or 12v(120mA)							●		Interfacing to Esterline analogue pressure scanners with temperature compensation sensor
SDC/001	2	5 min of arc	25k	n/a	n/a	1	n/a									Synchro sensors
TDC/001	16	0.25	26k	1800	Fixed	1-4	Fixed 5V			●						Thermistor temperature sensors
TDC/002	15 +1 ref	0.3	512	40	Fixed	1-4	n/a			●						Thermocouples (k, J, E, R, S, T)
TDC/004	12	0.2 *4	512	40	Fixed	1	1 - 2mA/ch			●						PT100 temperature sensors
TDC/005	15 +1 ref	0.75	512	40	Fixed	1	12VDC for reference			●						Thermocouples (B,E,K, J, E, R, S, T,T99)
TDC/006	15	3 *5	2.5k	n/a	n/a	1	n/a			●						Thermocouples (K, T)

*1 Combined Analog and digital Gain = 4000.Very small temperature drift of the resistors on the module cause additional constant error of ±90µe. *2 Combined DC & Excitation Error. *3 4-20mA range. *4 post calibration. *5 after post processing data

Operational Specifications

Electrical Specifications

Input Voltage	18-40 VDC, 28 VDC (typical) *1
Power	1.5 - 3 W per module (excludes excitation)
Efficiency	75% (typical)
Note	Power supplies are designed to meet requirements of MIL-STD-704E

Configurations

Chassis Size	3, 4, 5, 6, 9,12, 13 user slots
System Size	Up to 64 synchronous chassis per system
Output Options	IRIG-106 PCM, 100 Base-T Ethernet, Auxiliary PCM with Pre-Mod. Filter, Digital & voltage drivers, ARINC 429/573/717, MIL-STD-1553, CAIS controller (consult factory for details)
Throughput	Up to 2 MS/s.
System setup	Supported with the KSM-500 tool suite running on Microsoft Windows 2000 or XP, minimum of 512MB recommended, and 1GHz processor.
KSM Tool Suite	kSetup, kValidate, kProgram, kQuicklook 3.0, kDiscover, kFlashCard, kWorkBench and kTimeseed, are supplied as part of the standard KSM-500 tool suite

Analog Modules

Sampling	1 ADC per channel allowing simultaneous sampling across a multi-chassis distributed system. ADC is 14 or 16 bit.
Filtering	Fixed Analog Anti-Alias filter followed by flexible Digital FIR/IIR filtering
Gain/Offset	Fixed or variable analog gain (module dependant), additional gain/offset options provided digitally
Bridge Balance	Programmable output available on strain gage modules to inject current directly into bridge to offset bridge output
Note	Analog modules are factory calibrated and do not require periodic calibration

GPS (TCG/102)

Inputs	1 x Active antenna
GPS Receiver	L1 Band
GPS Registers	Status, Latitude, Longitude, Heading, Velocity, Altitude
Navigation Datum	WGS-84

IRIG Time

Codes	Accepts and generates IRIG time with 1µ S resolution. Provides 1pps, and 10 pps outputs. In absence of IRIG source, output drifts at 3pmm (-40 to +85°C)
RTC	Battery backed real-time clock available. 3ppm drift when powered, 100ppm drift unpowered
Note	Programmable tone output also available

Video & Audio (VID/103)

Inputs	One of three channels of composite video or 1 channel of Y/C NTSC/PAL. 2 channels of line audio
Outputs	MPEG 4 compressed video, and ADPCM audio data in an MPEG2 transport stream. MPEG4 P frame-I frame ratio is variable
Bit Rate	From 64 kbps upto 10 Mbps
Note	Provides Gen Lock outputs for two cameras, and includes Built-In self test with test picture

Ethernet Output

Format	Output packets are UDP datagrams, with up to 32 kSamples per packet. Up to 256 different packets can be defined, each with different unicast or multi-cast destination addresses. Packet fragmentation is supported.
Throughput	Up to 2MS/s
Buffer	Up to 400ms of data buffering
Output	Two Full-duplex Fast Ethernet (100 Base-T) outputs, the second being a mirror of the first for redundancy
Note	Ethernet module can also program distributed KAM-500 chassis from PC.

PCM Encoder

Format	Size up to 256kWords per major frame, up to 512 minor frames/major
Multi-Format	Up to 15 different PCM formats can be programmed, and switched between during acquisition
Bit Rates	Up to 20Mbit/second
PCM Codes	NRZ-L/M/S, BiØ-L/M/S, RZ, RNRZ-L(11/13/15/17) DM-M/S
Word Size	Programmable word size, 4 to 64 bits
Sync Strategy	SFID, FCC, URC

Mechanical Specifications - KAM-500 Chassis *3

Module	User Slots	Type	PSU	PSU connector	Notes	Width		Height		Length		Weight Base Units *2	
CHS/03F	3	Std	Base Mounted		no +/- 7v for Space saving application	2.52"	(64mm)	3.31"	(84mm)	4.78"	(122mm)	1.14lbs	(0.6kg)
CHS/05F*5	5	Std	Base Mounted	6-way Bayonet	no +/- 7v for Space saving application	4"	(101mm)	4"	(101mm)	4.62"	(118mm)	1.9lbs	(0.864kg)
CHS/04L	4	Brick	Std	6-way Bayonet		3.15"	(80mm)	3.7"	(94mm)	5.51"	(140mm)	2.62lbs	(1.2kg)
CHS/03U	3	Std	Std	6-way Bayonet		1.57"	(40mm)	3.7"	(94mm)	9.53"	(242mm)	3.75lbs	(1.7kg)
CHS/06U	6	Std	Std	6-way Bayonet		3.15"	(80mm)	3.7"	(94mm)	7.17"	(182mm)	3.5lbs	(1.6kg)
CHS/09U	9	Std	Std	6-way Bayonet		3.15"	(80mm)	3.7"	(94mm)	8.82"	(224mm)	4.6lbs	(2.1kg)
CHS/12R	12	Annular	Std	6-way Bayonet		9.84"	(250mm)*4	3.35"	(85mm)	n/a	*4	8.01lbs	(3.6kg)
CHS/13U	13	Std	Std	6-way Bayonet		3.15"	(80mm)	3.7"	(94mm)	11.02"	(280mm)	5.5lbs	(2.5kg)

Notes
*1 Input voltage is for all chassis except KAM/CHS/03F which is 28 - 50 VDC
*2 Chassis unit includes control/power supply modules; for all other modules add approximately 0.18lbs (0.08kg) per module
*3 For special form factors please contact ACRA CONTROL
*4 This is an annular (ring) chassis, the width in this case corresponds to the diameter.
*5 Dimensions do not include addition of annular ring baseplate

Environmental Specifications

Operating Temperature
MIL-STD-810F Methods 501.4 and 502.4 Procedure II
-40°C to 85°C, at least 4 hours after stabilization

Storage Temperature
MIL-STD-810F Methods 501.4 and 502.4 Procedure I
-55°C to 105°C, at least 4 hours after stabilization

Altitude
MIL-STD-810F
Method 500.4 Procedure II
Maximum pressure of 115Kpa (1150mbar) and a minimum pressure of 3.6Kpa (36mbar)

Rapid Decompression
MIL-STD-810F Method 500.4 Procedure III room ambient to 3.6Kpa at a rate of 218Kpa/minute (2180mbar/min.)

Explosive Decompression
MIL-STD-810F Method 500.4 Procedure IV
unit unpowered and a pressure change from 2,438m (8000ft) to 12,192m (40,000ft) was achieved in 78.4ms

Shock
MIL-STD-810F Method 516.5 Procedure V - modified
100g, 11ms, terminal peak sawtooth 12 (two in each direction of three mutually perpendicular axes)

Sinusoidal Vibration
MIL-STD-810F Method 514.5 Procedure I
Frequency Range 10 - 2000Hz
Amplitude 10g
Sweep rate One octave per minute

Random Vibration
MIL-STD-810F Method 514.5 Procedure I
60 minutes per axis Random Endurance, 17grms
0.04g2/Hz from 15 to 89.2Hz
4dB/octave from 89.2 to 300Hz
0.2g2/Hz from 300 to 1000Hz
-6dB/octave from 1000 to 2000Hz
10 minutes per axis Random Endurance, 33grms
Frequency range 15-2000Hz
Spectrum 0.04g2/Hz from 15 to 30.7Hz
4dB/octave from 30.7 to 300Hz
0.83g2/Hz from 300 to 1000Hz
-6dB/octave from 1000 to 2000Hz

Acceleration Operational
MIL-STD-810F Method 513.5 Procedure II
16.5 in each direction of three mutually perpendicular axes
Duration Minimum of one minute in each direction

Water Ingress (Drip Test)
MIL-STD-810F Method 506.4 Procedure III
Precipitation rate 280l/m2/hr.
Duration 45 minutes, divided equally between three faces (one side, one end and one top)

Humidity
MIL-STD-810F Method 507.4
Upper temperature 60°C
Intermediate temperature 30°C
Lower temperature 20°C
Relative humidity 95% (>85%during temperature reduction)
Dwell times Four hours at each level
Cycle duration 24 hours
Number of cycles: Five

EMI/EMC
MIL-STD-461E
CE101 (30Hz to 10kHz)
CE102 (10kHz to 10MHz)
CS101 (30Hz to 150kHz)
CS114 (30Hz to 150kHz)
CS115
CS116 (10kHz to 100MHz)
RE102 (10kHz to 18GHz)
RS103 (10kHz to 1GHz, 70V/m)
RS103 (400MHz to 18GHz 200V/m)
BS3G100 Part 2, Section 2
Magnetic influence, compass safe distance

ESD
EN61000-4-2:1995
Contact discharge Level 4, 8kV
Air discharge Level 4, 15kV

Electrical Bonding and Insulation
BS3G100, Part 4 Electrical insulation test, high voltage test
BS3G100, Part 4 Electrical insulation test, insulation resistance test
BS3G100, Part 4 Electrical insulation test, leakage current measurements

Contamination Testing
BS 3G 100, Part 2, section 3, subsection 3.12
Class A for Occasional Contamination
70 °C, for 93 hours

Fluids tested include
Propan-2-Ol
Ethylene Glycol (50% v/v in water)
AVTUR F-34
Aeroshell Turbine Oil 308
Aeroshell Fluid 31
Aeroshell F31
MIL-PRF-23699-F

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