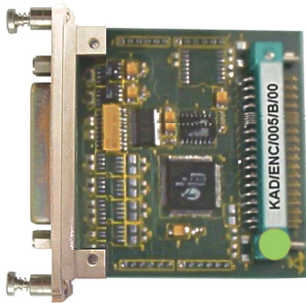


# KAD/ENC/005

IRIG-106 PCM encoder - 1ch



## Overview

The KAD/ENC/005 is used to encode data from any Acra KAM-500 module in an IRIG-106 Ch.4 PCM stream. Frame configuration is versatile and fully IRIG-106 compliant.

Parameters to be transmitted are stored in predefined locations in RAM. Each parameter has a word definition that includes the location in RAM, bits per word, MSB sent first/last and parity. This definition controls the RAM reader and the parallel-to-serial converter.

The KAD/ENC/005 has differential ended (RS-422) outputs for data and clock along with buffered TTL outputs for NRZ-L and the four bit/word/minor-frame/major-frame pulses.

Multiple KAD/ENC/005 modules can be included in an Acra KAM-500 system and parameters can be sent to some or all of the encoders. For example, a system can have two encoders using different codes, data rates, word lengths and frame lengths. The only restriction is that an integral number of major frames be transmitted per acquisition cycle.

## Key Features

- 100% IRIG-106 compliant
- Fully software programmable
- Up to 14 PCM codes at up to 16Mbps
- 2 to 32K words per major frame
- 1 to 8K words per minor frame
- 4 to 64 bits per word (programmable word by word)
- Odd, even or no parity (programmable word by word)
- Supports any sync. word and sub-frame strategy

## Applications

- Encode data in IRIG-106 Ch.4 PCM stream

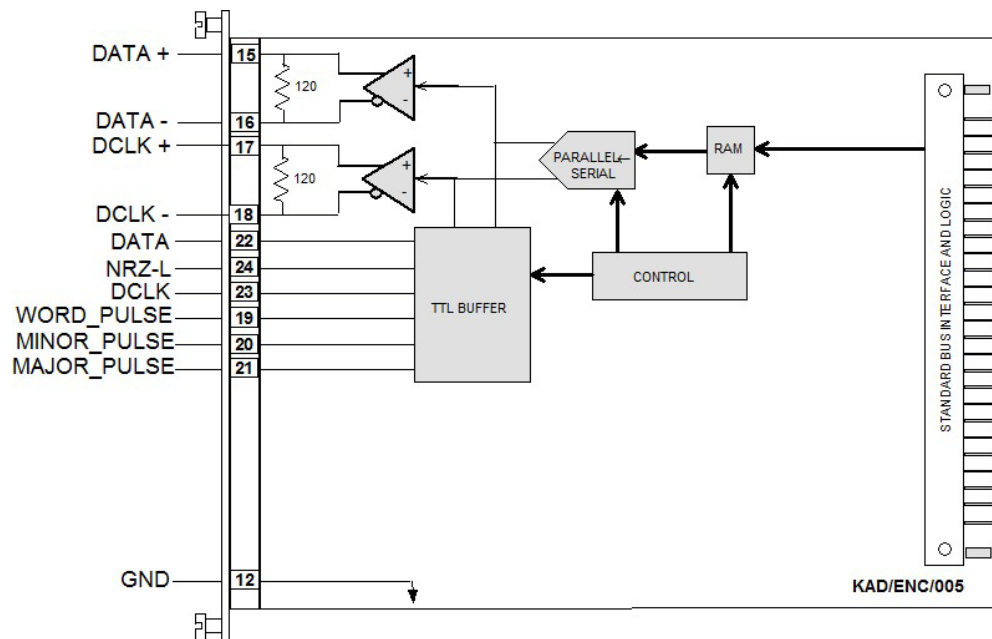


Figure 1: KAD/ENC/005 block diagram

## Specifications

All values provided in the following specification tables are valid within the operating temperature range specified under “Environmental ratings” in the “General specifications” table.

TABLE 1		General specifications				
PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITION/DETAILS	
Slots	–	–	1	–	Can be placed in any user-slot in any combination.	
Mass						
	–	60	–	g		
	–	2.12	–	oz	Design metric is grams.	
Height above chassis					For recommended clearance requirements see the CON/KAD/002/CP data sheet.	
bare connector	–	–	11	mm		
bare connector	–	–	0.43	in.	Design metric is millimeters.	
Access rate	–	–	2	Msp/s	Maximum combined access rate for read and write.	
Power consumption						
+5V	320	–	400	mA		
±7V	0	–	0	mA		
±12V	0	–	0	mA		
total power	1.6	–	2	W		
Environmental ratings					See <i>Environmental Qualifications Handbook</i> .	
operating temperature	-40	–	85	°C	Chassis base/side plate temperature.	
storage temperature	-55	–	105	°C		

TABLE 2		RS-422 outputs				
PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITION/DETAILS	
Outputs	–	–	2	–		
Signaling rate						
DATA+	–	–	16	Mbps		
DCLK+	–	–	16	MHz		
Output voltage						
absolute operating range	-14	–	14	V	Absolute voltage of the operating signal must stay within this range.	
logic 0	–	–	-2	V	$V_{0+} - V_{0-}; R_{LOAD} = 100\Omega$ .	
logic 1	2	–	–	V	$V_{0+} - V_{0-}; R_{LOAD} = 100\Omega$ .	
common mode voltage	–	–	3	V		
short circuit current	–	–	250	mA		
short circuit duration	$\infty$	–	–	s		
ESD protection	-2	–	2	kV	Human Body Model.	
Output resistance	–	40	–	$\Omega$		

**TABLE 3** B TTL outputs

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITION/DETAILS
Outputs	-	-	6	-	
Signaling rate					
WORD PULSE	-	-	4	MHz	
MINOR PULSE	-	-	4	MHz	
MAJOR PULSE	-	-	2	MHz	
DATA	-	-	16	Mbps	
DCLK	-	-	16	MHz	
NRZ-L	-	-	16	Mbps	
Output voltage					
logic 0	-	-	0.55	V	Sinking 0.1mA.
logic 1	3	-	-	V	Sourcing 0.1mA.
short circuit current	-	-	50	mA	To GND.
short circuit duration	$\infty$	-	-	s	To GND. Only one output may be shorted at a time.
Output resistance	100	-	-	$\Omega$	

## Setting up the KAD/ENC/005

All module setup can be defined in XML using XidML® schemas (see <http://www.xidml.org>).

SET-UP DATA	CHOICES	DEFAULT/EXAMPLE	NOTES
Name	Fixed Data	FIXED_DATA	–
Base Unit	Unitless	<b>Unitless</b>	–
maximum	FFFF <sub>16</sub>	<b>AAAA</b> <sub>16</sub>	–
minimum	0	<b>0</b>	–
Data Format	Binary	Binary	–
Size In Bits	1 to 16	<b>16</b>	–

**NOTE:** It is recommended that names are less than 20 characters, have no white space or contain any of the following five characters "/><.\.

### Setting up instrumentation

SET-UP DATA	CHOICES	DEFAULT/EXAMPLE	NOTES
Manufacturer			
name	ACRA CONTROL	ACRA CONTROL	–
part reference	KAD/ENC/005/B	KAD/ENC/005/B	ACRA CONTROL part number.
serial number	Fixed 6 characters	FE1234	Unique number for each module.
Sub location	1 to 80 characters	MyDAU	Name of DAU.
slot	3 to N	3	The DAU slot the module fits into. First user-module goes into slot 3, where N is the number of user-slots +2 in the DAU.
InterConnect	No character limit	TTL_PCMDDataLink	InterConnect associates a named datalink with a physical IRIG PCM stream.

### Setting up packages

SET-UP DATA	CHOICES	DEFAULT/EXAMPLE	NOTES
Synchronous	Sync, Async	–	In asynchronous operation, the CVT of the encoder is triple-buffered to enable the PCM transmission to be independent of the KAM-500 acquisition cycle. In synchronous operation, it is dependent on the KAM-500 acquisition cycle.
Packages per acquisition cycle	–	1	The number of major frames per acquisition cycle.
Data link reference	No character limit	TTL_PCMDDataLink	A named datalink.
Major frame Properties			
default parity	Odd, Even, None	None	Parity can be changed for particular words.
default data bits per word	4 to 64k	4	Default number of bits per word can be changed for particular words later on.
minor frames per major frame	1 to 8192	1	Sets the number of minor frames in a major frame.
bits per minor frame	1 to 65535	–	Shows the first bit index of the first occurrence of this parameter in the frame. It is set when the parameter is placed.

SET-UP DATA	CHOICES	DEFAULT/EXAMPLE	NOTES
Synchronization strategy			
sync word	4 to 64 bits	1111.1110.0110.1011 0010.1000.0100.0000	Enter the sync word as hexadecimal. Synchronization bits is the number of bits in the synchronization word. In the XidML file the sync word pattern is binary. Minimal word length is 4 bits for bit-rates of 8MHz and less, for higher bit-rates it is Bitrate[MHz]/2. For example, 32bit sync word FE6B28406
Modulation			
PCM code	NRZ-L, RZ, BIØ-L, NRZ-S, NRZ-M, BIØ-M, BIØ-S, RNRZ-L(15)	–	Code used for bit transmission, the options are dependent on the modules used.
DCLK phase	0/1	–	Shifts the data clock in phase by 180°.
PCM polarity	True/False	–	Shifts the PCM by 180°.
sync word	27 choices	–	Hexadecimal pattern that is the sync word, this can be any pattern with a trailing 'h', and enters Synchronization bits which is the number of bits in the synchronization word. In the XidML file the sync word pattern is binary.
Content			
parameter	no character limit	P1	–
minor frame number	0 to 1029	0	–
minor frame offset words	–	–	–
occurrences	–	–	–
most significant bit	First/Last	First	MSB transmitted can be changed for particular words.

## Getting the most from the KAD/ENC/005

The table below displays the bit-rates available between 16Mbps and 2Mbps. There are over one million lower frequencies available, and, at 1Mbps, the granularity is better than 2%.

16.0000	14.0000	13.3333	12.8000	12.0000	11.2000
10.6667	10.0000	9.6000	9.3333	9.1429	8.0000
7.1111	7.0000	6.8571	6.6667	6.4000	6.2222
6.0000	5.8182	5.7143	5.6000	5.3333	5.0909
5.0000	4.9231	4.8000	4.6667	4.5714	4.4444
4.3636	4.3077	4.2667	4.0000	3.7647	3.7333
3.6923	3.6364	3.5556	3.5000	3.4286	3.3684
3.3333	3.2941	3.2000	3.1111	3.0769	3.0476
3.0000	2.9474	2.9091	2.8571	2.8235	2.8000
2.7826	2.6667	2.5600	2.5455	2.5263	2.5000
2.4615	2.4348	2.4000	2.3704	2.3529	2.3333
2.2857	2.2400	2.2222	2.2069	2.1818	2.1538
2.1333	2.1053	2.0870	2.0741	2.0645	2.0000

The following figure shows the timing for the various outputs

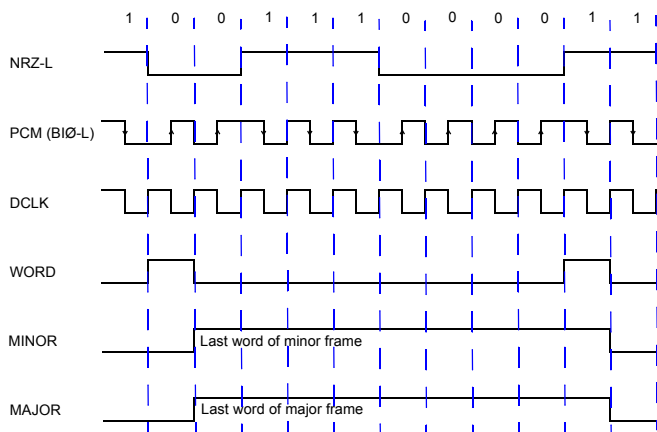


Figure 2: Output timing

Even though the KAD/ENC/005 allows varied word lengths and non-standard commutation (that is, samples of a specific parameter not evenly spaced in the PCM frame), many third-party decommutators do not. We recommend using a default word length (for example, 16 bits) and evenly spaced commutation.

The acquisition cycle and asynchronous PCM frames are fully independent. Therefore, if an asynchronous frame has a transmission time less than the acquisition cycle there will be a repeat of parameters. Similarly, if the asynchronous

transmission is longer than the acquisition cycle, some acquisition cycles will occasionally be skipped.

The asynchronous frame has full flexibility over the number of minor frames in a major frame. Coherency applies only to the major frame.

### Input registers

The KAD/ENC/005 has a 16-bit wide transmission buffer of 32K registers in synchronous mode and 8K registers in asynchronous mode. The encoder can concatenate multiple registers to form words up to 64 bits long. However, if a register is transmitted, at least 4 bits from that register must be sent.

In synchronous operation, a single register can be used for multiple parameters or multiple instances of the same parameter. In asynchronous operation, the PCM frame can be transmitted as soon as the transmission buffer is ready.

The origin of each word must be specified in the PCM stream, with fill data used for unspecified locations. The location of the parameter in the buffer is transparent to the user.

### Minimum word transmit time

The minimum word transmit time is  $1\mu\text{s}$  for the KAD/ENC/005. Therefore at 4Mbps the minimum word size is 4 bits ( $4\text{Mbps} \times 1\mu\text{s} = 4\text{ bits}$ ).

For example, a 16-bit parameter fragmented into two 12 bit subframes, the 4-bit LSB has also to be considered in the minimum word transmit time. 4Mbps is the limitation for this PCM structure.

## Connector pinout of the KAD/ENC/005

PIN	NAME	SEE SPECIFICATIONS TABLE	COMMENT
1	DNC		Do not connect
2	DNC		Do not connect
3	DNC		Do not connect
4	DNC		Do not connect
5	DNC		Do not connect
6	DNC		Do not connect
7	DNC		Do not connect
8	DNC		Do not connect
9	DNC		Do not connect
10	DNC		Do not connect
11	DNC		Do not connect
12	GND	Acra KAM-500 internal ground	
13	GND	Acra KAM-500 internal ground	
14	DNC		Do not connect
15	DATA+	RS-422 outputs	PCM output; internally terminated with 120Ω
16	DATA-	RS-422 outputs	PCM output; internally terminated with 120Ω
17	DCLK+	RS-422 outputs	Bit clock for PCM; internally terminated with 120Ω
18	DCLK-	RS-422 outputs	Bit clock for PCM; high for last half of bit
19	WORD_PULSE	BTTL outputs	Indicates end of word; high for last bit of word
20	MINOR_PULSE	BTTL outputs	Indicates end of minor frame; high for last word of minor frame
21	MAJOR_PULSE	BTTL outputs	Indicates end of major frame; high for last word of major frame
22	DATA	BTTL outputs	PCM output
23	DCLK	BTTL outputs	Bit clock for PCM; high for last half of bit
24	NRZ_L	BTTL outputs	Non-return to zero (level) data
25	DNC		Do not connect
26	DNC		Do not connect
27	GND	Acra KAM-500 internal ground	
28	GND	Acra KAM-500 internal ground	
29	DNC		Do not connect
30	DNC		Do not connect
31	DNC		Do not connect
32	DNC		Do not connect
33	DNC		Do not connect
34	DNC		Do not connect
35	DNC		Do not connect
36	DNC		Do not connect
37	DNC		Do not connect
38	DNC		Do not connect
39	DNC		Do not connect
40	DNC		Do not connect
41	DNC		Do not connect
42	DNC		Do not connect
43	DNC		Do not connect
44	DNC		Do not connect
45	DNC		Do not connect
46	DNC		Do not connect
47	DNC		Do not connect
48	DNC		Do not connect
49	DNC		Do not connect
50	DNC		Do not connect
51	DNC		Do not connect
52	CHASSIS	Acra KAM-500 chassis	Double density connector only

## Ordering information

PART NUMBER	DESCRIPTION
KAD/ENC/005/B	IRIG-106 PCM encoder - 1ch (with 52-way double-density connector)
KAM/ENC/005/B	IRIG-106 PCM encoder - 1ch (with 51-way micro-miniature connector)

By default, the standard mating connector (CON/KAD/002/CP for KAD modules; or ACC/CON/008/04 for KAM modules), is included with each module in the shipment. Its part number will be added to the Confirmation of Order unless an alternative option is specified (see the *Cables* data sheet). In this data sheet, KAD/ENC/005 refers to both the KAD and KAM version of the module.

## Revision history

REVISION	DIFFERENCES	STATUS
KAD/ENC/005/B	Allows asynchronous operation	Recommended for new programs
KAD/ENC/005	First release	Not recommended for new programs

## Supporting software

SOFTWARE	DETAILS
KSM-500	This module is supported by the KSM-500 suite of software tools

## Related documentation

DOCUMENT	DETAILS
DOC/DBK/001	Acra KAM-500 Databook
DOC/GBK/002	Environmental Qualification Handbook
DOC/MAN/018	KSM-500 Databook
TEC/NOT/027	IRIG 106-96 Chapter 4
TEC/NOT/035	Rules of PCM placement