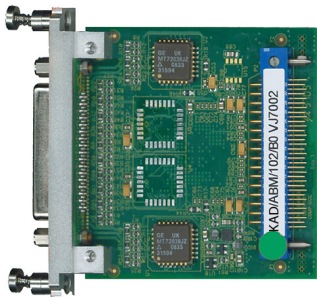


KAD/ABM/102

ARINC-429 bus monitor parser/packetizer - 8ch

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Key Features

- Monitors up to eight ARINC-429 busses
- Coherently parses traffic and tags for up to 4095 messages
- Aperiodic transmission of packetized ARINC-429 messages including tags as iNET-X parser-aligned payload structures
- Detects five types of errors
- Word counter for each bus

Applications

- ARINC-429 monitoring and recording

Overview

The KAD/ABM/102 is an ARINC-429 bus monitor which combines the capabilities of a coherent message parser with the flexibility of an iNET-X packetizer and an error-detection function, on a single module.

The parser parses up to 4,095 words and their associated time and status tags. Each message has a stale bit (word read before) and a skipped bit (buffer overwritten). Messages can be parsed based on their bus number, label, SDI and/or SSM fields.

Every ARINC-429 message received from each of the eight busses is captured and packetized, along with time tags and a bus tag, with other received messages in a packetizer buffer. The packetizer contents can be assembled into Ethernet frames by an iNET-X controller or transmitter, for example a KAD/BCU/140, for transmission over Ethernet. The module can generate a single packet per input bus or packetize messages from all the active busses into a single packet stream.

To ensure efficient use of bandwidth, packets are only generated once a threshold amount has been stored (a maximum of 84 received messages are stored in each packet). Additionally, a programmable timeout ensures that smaller packets are generated even during periods of low activity on the bus, thereby allowing real-time analysis and processing of acquired messages. When there is no traffic, no packets are generated.

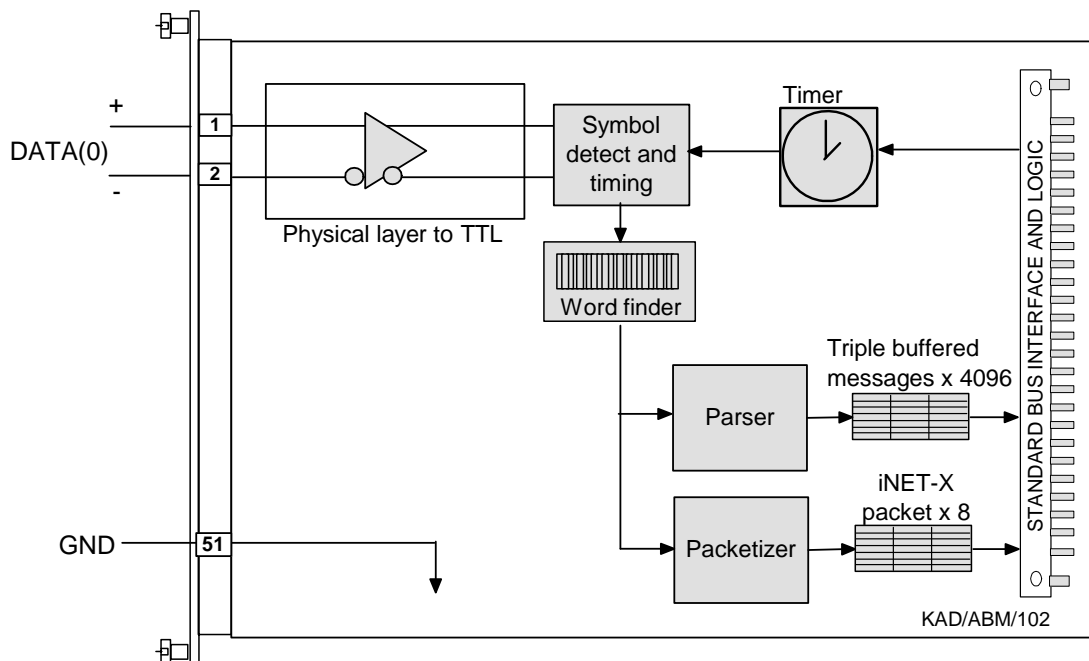


Figure 1: Primary bus monitor on the KAD/ABM/102

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						
	–	70	–	g		
	–	2.47	–	oz	Design metric is grams.	
Height above chassis					For recommended clearance requirements see the <i>CON/KAD/002/CP</i> data sheet.	
bare connector	–	–	11	mm		
bare connector	–	–	0.43	in.	Design metric is millimeters.	
Access rate	–	–	2	Mbps	Maximum combined access rate for read and write.	
Power consumption						
+5V	80	–	100	mA		
±7V	0	–	0	mA		
±12V	0	–	0	mA		
total power	0.4	–	0.5	W	Particular combinations of chassis and Acra KAM-500 modules may have power or current limitations. For details, see <i>TEC/NOT/016 - Power dissipation</i> , <i>TEC/NOT/049 - Power estimation</i> , and the relevant chassis data sheet.	
Environmental ratings					See <i>Environmental Qualification Handbook</i> .	
operating temperature	-40	–	85	°C	Chassis base/side plate temperature.	
storage temperature	-55	–	105	°C		

TABLE 2		ARINC-429 inputs				
PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITION/DETAILS	
Inputs	–	–	8	–	ARINC-429 part 1 receiver compatible.	
Signaling rate						
DATA	12.5	–	100	kbps	Signalling rate is either 12.5, 50 or 100kbps.	

Setting up the KAD/ABM/102

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

Instrument settings

SETUP DATA	CHOICE	DEFAULT	NOTES
Manufacturer	-	-	-
Name	ACRA CONTROL	ACRA CONTROL	Name of manufacturer.
PartReference	KAD/ABM/102/B	KAD/ABM/102/B	The instrument part reference.
SerialNumber	FA1234	FA1234	Unique name for each module.
Settings	-	-	-
Packetization	Individual Combined	Individual	Packetization is set per channel or per instrument.
Processes	-	-	-
Parser(4094:0)	-	-	Parser definitions.
Catchall-Parser	-	-	Parser definitions.
Channels	-	-	-
ARINC-429-In(7:0) ARINC-429 Input	-	-	Represents a typical ARINC-429 bus monitor channel configuration.
Settings	-	-	-
Check For Parity	True False	False	Indicates whether parity should be checked.
Bit Rate	100e3 50e3 12.5e3	12.5e3	Specifies the number of bits transmitted per second.
Settings Packetizer	-	-	-
Stream Id	00 to FFFFFFFF	FFFFFFF	iNET-X stream ID for selected channel if a packet is generated via the assertion of Packetization Enabled. This setting is only supported in DAS Studio 3.
Packetization Enabled	True False	False	Enables the transmission of an iNET-X packet containing the contents of this channel if an iNET-X transmitter is present in the chassis. This setting is only supported in DAS Studio 3.
Packet Size	200 to 511	511	Size of packet buffer in words.
Packet Timeout	10 to 1500	50	Generates a packet when the oldest data recorded is this old (ms).
ARINC-429-In-Combined ARINC-429 Input	-	-	Represents all eight ARINC-429 channels combined into one iNET-X packetizer.
Settings	-	-	-
Settings Packetizer	-	-	-
Stream Id	00 to FFFFFFFF	FFFFFFF	iNET-X stream ID for selected channel if a packet is generated via the assertion of Packetization Enabled. This setting is only supported in DAS Studio 3.

SETUP DATA	CHOICE	DEFAULT	NOTES
Packetization Enabled	True False	False	Enables the transmission of an iNET-X packet containing the contents of this channel if an iNET-X transmitter is present in the chassis. This setting is only supported in DAS Studio 3.
Packet Size	200 to 511	511	Size of packet buffer in words.
Packet Timeout	10 to 1500	50	Generates a packet when the oldest data recorded is this old (ms).

Parameter definitions

NAME/DESCRIPTION	BASE UNIT	DATA FORMAT	BITS	REGISTER DEFINITION
Global Parameters				
Report Reports the status of the module.	BitVector	BitVector	16	R[15:0] R(15) FreshError - An error occurred since last read. R[14:7] Reserved R[6:4] Bus - Indicates the bus the error occurred on. R[3:0] ErrorCode - Indicates the error that occurred last. 0000: BadBit. 0001: NotEnoughBits. 0010: TooManyBits. 0011: Reserved for future use. 0100: ParityError. 0101: Invalid Label, SSM or SDI. 1000: Reset occurred since last read.
Parser(4094:0) Parameters				
MessageCount A copy of WordCount when message was received.	Count	OffsetBinary	16	R[15:0] R[15:0] MessageCount
MessageIrigTime48 48-bit wide IRIG time word.	BitVector	BitVector	48	R[47:0]
MessageTimeHi Hours and minutes time midway through first transmitted bit.	BitVector	BitVector	16	R[47:32] R[15:13] Reserved - Reserved for future use. R[12:7] Hours - BCD Hours 0 to 23. R[6:0] Minutes - BCD Minutes 0 to 59.
MessageTimeLo Seconds and centiseconds time midway through first transmitted bit.	BitVector	BitVector	16	R[31:16] R(15) Reserved - Reserved for future use. R[14:8] Seconds - BCD Seconds 0 to 59. R[7:0] Centiseconds - BCD Centiseconds 0 to 99.
MessageTimeMicro Microsecond time midway through first transmitted bit.	Second	BCD	16	R[15:0] R[15:0] Microseconds - BCD Microseconds 0 to 9999.
Catchall-Parser Parameters				
MessageCount A copy of WordCount when message was received.	Count	OffsetBinary	16	R[15:0]

NAME/DESCRIPTION	BASE UNIT	DATA FORMAT	BITS	REGISTER DEFINITION
MessageDataStyleA SSM, Data, SDI, Parity and message info.	BitVector	BitVector	32	R[31:0] R[31:30] SSM - Sign/Status Matrix. R[29:11] Data - Data Word. R[10:9] SDI - Source Destination Identifier. R(8) Empty - This parser slot has not been written to yet. R(7) Stale - This parser slot has been read before. R(6) Skipped - This parser slot has been overwritten. R[5:3] Bus - The bus the message was received on. R[2:1] Reserved R(0) Parity - The parity bit received.
MessageDataStyleB Parity, SSM, Data, Bus, SDI and message info.	BitVector	BitVector	32	R[31:0] R(31) Parity R[30:29] SSM - Sign/Status Matrix. R[28:20] Data[18:10] - Bits 18 to 10 of the Data Word. R[19:17] Bus - The bus the message was received on. R(16) Reserved R[15:6] Data[9:0] - Bits 9 to 0 of the Data Word. R[5:4] SDI - Source Destination Identifier. R(3) Empty - This parser slot has not been written to yet. R(2) Stale - This parser slot has been read before. R(1) Skipped - This parser slot has been over written. R(0) Reserved
MessageIrigTime48 48-bit wide IRIG time word.	BitVector	BitVector	48	R[47:0]
MessageTimeHi Hours and minutes time midway through first transmitted bit.	BitVector	BitVector	16	R[47:32] R[15:13] Reserved - Reserved for future use. R[12:7] Hours - BCD Hours 0 to 23. R[6:0] Minutes - BCD Minutes 0 to 59.
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MessageTimeMicro Microsecond time midway through first transmitted bit.	Second	BCD	16	R[15:0] R[15:0] Microseconds - BCD Microseconds 0 to 9999.
ARINC-429-In(7:0) Parameters				
WordCount A count of valid ARINC-429 messages received on the bus.	Count	OffsetBinary	16	R[15:0]

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

Getting the most from the KAD/ABM/102

For a detailed description on iNET-X packets, see *TEC/NOT/067 - IENA and iNET-X packet payload formats*.

KAD/ABM/102 packet formats

The KAD/ABM/102 can output packet payloads formatted for insertion into iNET-X systems.

iNET-X parser-aligned packet format

There is a diverse range of avionic bus technologies for which traffic may be captured, for example, MIL-STD-1553 or ARINC-429. The generalized iNET-X payload structure for parser-aligned packets is shown in the following figure.

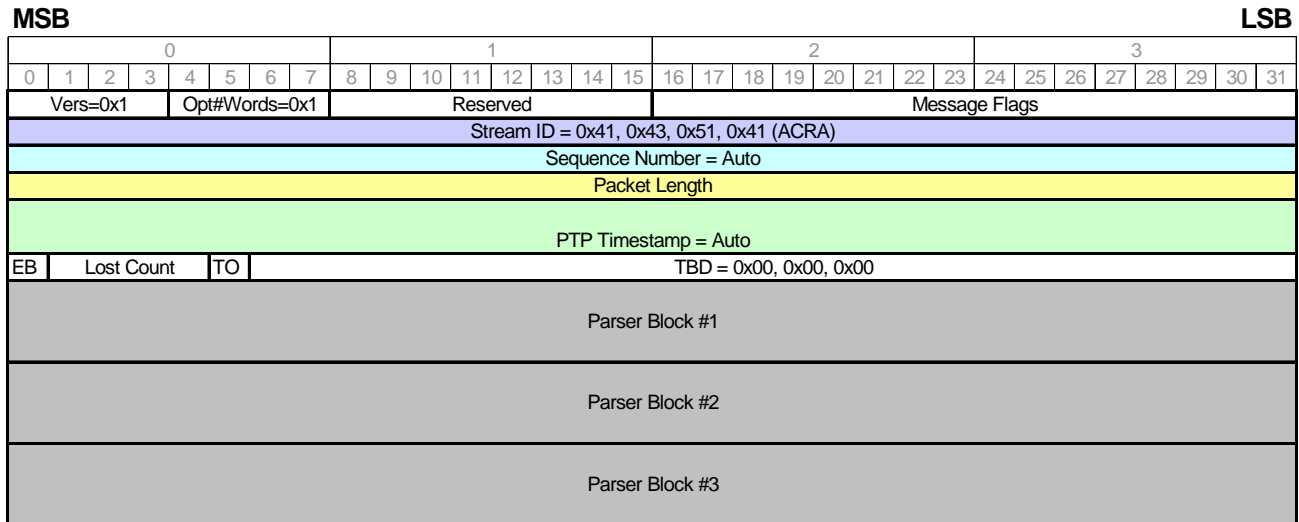


Figure 2: Generalized parser-aligned iNET-X packet

As messages are captured on the bus, they are formatted in a parser block. Each parser block begins with a 4-byte parser info word, followed by a 4-byte elapsed time tag and the message data shown in the following figure.

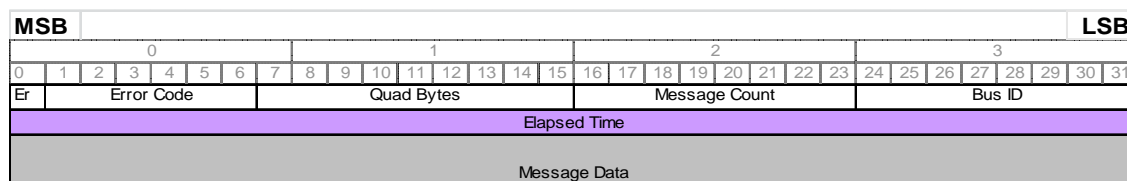


Figure 3: iNET-X parser block

A parser block consists of the following fields:

- Parser info word (4 bytes): metadata providing information about the health and status of the message.
 - + Bit (0): indicates that an error occurred
 - + Bits [1:6]: error codes
 - + Bits [7:15]: number of quad bytes. This relates to the length of the parser info word, elapsed time tag, and the message data and padding (N x 4 bytes). For example, a 4-byte message captured from a given bus has a quad-byte value of 3, that is 12 bytes that includes 4 bytes parser info word, 4 bytes elapsed time, and 4 bytes bus message data.
 - + Bits [16:23]: message counter. This is a message counter that relates to the messages contained in the payload. The message counter increments for each message contained in the packet payload and continues to increment across consecutive packets. The message counter resets and wraps around to 0 once it has reached the maximum message count of 0xFF.
 - + Bits [24:31]: Bus ID corresponds to the physical bus number on the module, that is from 0 to 7.

- Elapsed time tag (4 bytes): time tag as an unsigned offset in nanoseconds that is added to the base PTP timestamp in the iNET-X header.
- Message (N x 4 bytes): captured bus traffic, padded if necessary to end on 4-byte boundary.

Example iNET-X parser-aligned packet format for ARINC-429

The KAD/ABM/102 is an eight-channel ARINC-429 bus monitor. Traffic captured on each of the ARINC-429 busses is placed in an iNET-X parser-aligned packet (see the following figure) where each bus has its own unique Stream ID. When Combined Packetization is selected, messages from all busses are placed in a single stream of packets, with a single Stream ID. The bus ID field identifies on which bus a message was received.

As ARINC messages arrive, they are tagged with a 4-byte parser info word and a 4-byte elapsed time word, followed by the 4-byte ARINC message. The parser info word identifies properties of the ARINC-429 message (such as the message counter and the ID of the bus on which the message was received) and marks the health of the message using an error bit and an error code.

The PTP timestamp in the iNET-X packet header is fixed when a packet is opened for writing and is used as the base timestamp for the whole packet. The PTP timestamp for each ARINC message in the packet can be calculated by adding the elapsed time to this base timestamp. Directly following the elapsed time field is the ARINC-429 message.

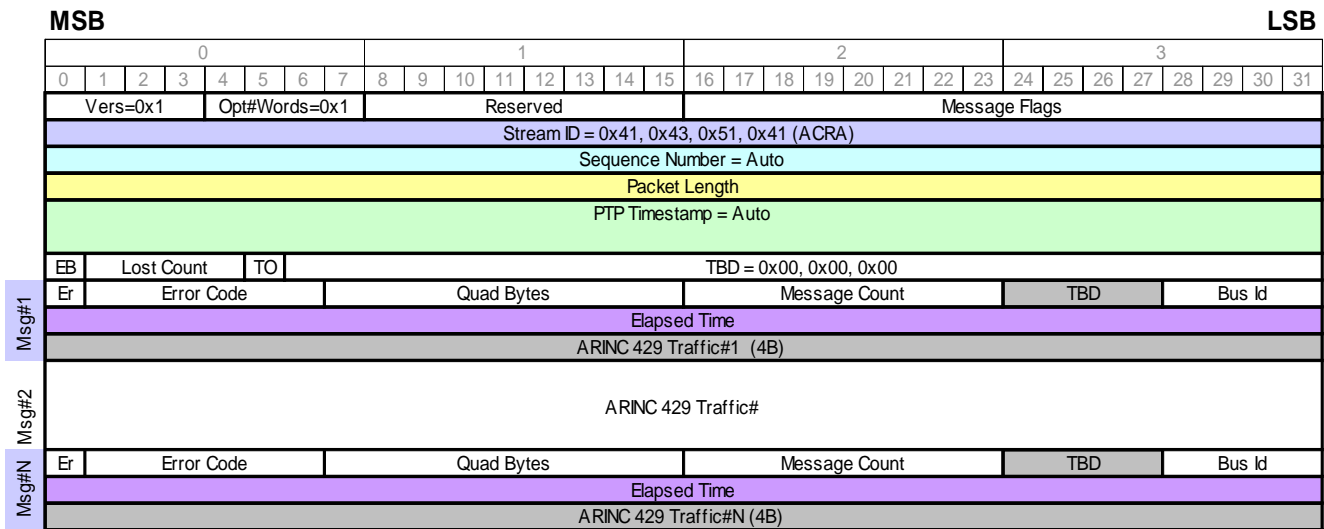


Figure 4: ARINC-429 iNET-X parser-aligned packet

For example, to facilitate real-time processing, the minimum payload size of an ARINC-429 packet is given as 1,008 bytes for a given default high-speed bus bit-rate of 100kbps, allowing for 84 ARINC 12-byte blocks to be carried in a single packet. This results in a maximum packet rate of 34 packets per second since the traffic on the bus may be asynchronous. The transmission properties for a 100kbps ARINC bus are summarized in the the following table.

TRANSMISSION PROPERTY	VALUE
ARINC-429 packet payload size (bytes)	1,008 bytes (84 ARINC message blocks of 12 bytes per ARINC block)
Total Ethernet frame length (bytes)	1,082 bytes MAC header 14 bytes + IP 20 bytes + UDP 8 bytes + iNET-X 28 bytes + ARINC-429 data + MAC frame check sequence 4 bytes
Packet rate (packets per second)	34
Total number of ARINC messages per packet	84 ARINC blocks
Total bit-rate (kbps)	294.3

Packetizer error codes for the KAD/ABM/102

An error in the incoming traffic is recorded by replacing the message data in the parser-aligned message with null data (32 zero bits) and setting the error bit and code in the iNET-X headers of the packet and the message. The error bit in the iNET-X packet header indicates that at least one of the parser blocks contains an error. The Most Significant Bit (MSB)—Er bit—of the errored parser block's header is set, and can be used during post-processing, to filter/drop these error messages.

The following table lists the error codes that can occur in the Error Code field in the parser info word in the parser block.

TABLE 4		Error codes
CODE ¹	DESCRIPTION	
0x0	Bad bit	
0x1	Not enough bits in word	
0x2	Too many bits in word	
0x3	Reserved for future use	
0x4	Parity error (if enabled)	
0x5	Invalid label, SSM or SDI	
0x6 to 0x3F	Reserved for future use	

1. Error codes are in hexadecimal.

Packetizer message counter

Each parser-aligned block contains a message counter. On the KAD/ABM/102, the counter starts from zero at the beginning of every packet, while on the KAD/ABM/102/B it starts from zero at power-up. That is, it does not reset to zero at the start of each packet.

The first parser-aligned block contains a counter, one count higher than the count in the last parser-aligned block of the last iNET-X packet.

Connector pinout of the KAD/ABM/102

PIN	NAME	SEE SPECIFICATIONS TABLE	COMMENT
1	DATA(0)+	ARINC-429 inputs	ARINC-429 bus
2	DATA(0)-	ARINC-429 inputs	ARINC-429 bus
3	DATA(1)+	ARINC-429 inputs	ARINC-429 bus
4	DATA(1)-	ARINC-429 inputs	ARINC-429 bus
5	DATA(2)+	ARINC-429 inputs	ARINC-429 bus
6	DATA(2)-	ARINC-429 inputs	ARINC-429 bus
7	DATA(3)+	ARINC-429 inputs	ARINC-429 bus
8	DATA(3)-	ARINC-429 inputs	ARINC-429 bus
9	DATA(4)+	ARINC-429 inputs	ARINC-429 bus
10	DATA(4)-	ARINC-429 inputs	ARINC-429 bus
11	DATA(5)+	ARINC-429 inputs	ARINC-429 bus
12	DATA(5)-	ARINC-429 inputs	ARINC-429 bus
13	DATA(6)+	ARINC-429 inputs	ARINC-429 bus
14	DATA(6)-	ARINC-429 inputs	ARINC-429 bus
15	DATA(7)+	ARINC-429 inputs	ARINC-429 bus
16	DATA(7)-	ARINC-429 inputs	ARINC-429 bus
17	DNC		Do not connect
18	DNC		Do not connect
19	DNC		Do not connect
20	DNC		Do not connect
21	DNC		Do not connect
22	DNC		Do not connect
23	DNC		Do not connect
24	DNC		Do not connect
25	DNC		Do not connect
26	DNC		Do not connect
27	DNC		Do not connect
28	DNC		Do not connect
29	DNC		Do not connect
30	DNC		Do not connect
31	DNC		Do not connect
32	DNC		Do not connect
33	GND	Internal ground	
34	GND	Internal ground	
35	GND	Internal ground	
36	GND	Internal ground	
37	GND	Internal ground	
38	GND	Internal ground	
39	GND	Internal ground	
40	GND	Internal ground	
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	GND	Internal ground	
52	CHASSIS	Chassis	

Ordering information

PART NUMBER	DESCRIPTION
KAD/ABM/102/B	ARINC-429 bus monitor parser/packetizer - 8ch

By default, the standard mating connector, CON/KAD/002/CP, 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).

Revision history

REVISION	DIFFERENCES	STATUS
KAD/ABM/102/B	Upgraded ARINC-429 bus monitor with parser and packetizer	Recommended for new programs
KAD/ABM/102	First release	Not recommended for new programs

Supporting software

SOFTWARE	DETAILS
DAS Studio 3	User interface for setup and management of data acquisition, network switches, recorders and ground stations in an integrated environment

Related documentation

DOCUMENT	DETAILS
DOC/DBK/001	Acra KAM-500 Databook
DOC/HBK/002	Environmental Qualification Handbook
DOC/MAN/030	DAS Studio 3 User Manual
TEC/NOT/006	ARINC-429
TEC/NOT/051	Ethernet frames, Wireshark® and FAT32
TEC/NOT/067	IENA and iNET-X packet payload formats