ACRA Control KAD/EBM/101/B/00

1-Channel Ethernet Bus Monitor Parser Module - Conformal Coated

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KAD/EBM/101

Ethernet bus monitor parser - 1ch

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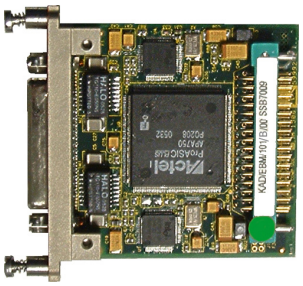

Key Features

- Monitors a single 100BaseTx IEEE 802.3u standard compatible Ethernet interface
- Coherently parses and classifies Internet Protocol v4 (IPv4) packets up to 1,500 bytes and tags for up to 254 different flows and one catchall flow
- Support flow identification on selected frame fields (8 x 16-bit fields) such as Ethernet MAC addresses, IP addresses, Layer 3 (UDP/TCP) fields, and Layer 4 application layer field, such as Stream Identifiers

Applications

- Monitoring, recording, diagnosis and troubleshooting of Ethernet network traffic

Overview

The KAD/EBM/101 is designed to accept Fast Ethernet (100BaseTX) traffic, then parse it and distribute it to other Acra KAM-500 modules.

Ethernet traffic is parsed on the IP layer. The KAD/EBM/101 can classify traffic using 8 × 16-bit frame fields such as MAC addresses, IP addresses, IP length, protocol type (UDP/TCP), UDP, or TCP port numbers. Up to 254 unique flows can be identified, where a flow represents a stream of information from a specific source to a specific destination. The identification is based on the classification parameters with optional masking. All other traffic, excluding network management traffic such as ARP and ICMP-PING, is optionally discarded or else monitored via parser slot-ID 254. Broadcast ARP requests and ICMP-PING requests are replied to. Flows are tagged with timestamps and packet count. The KAD/EBM/101 can optionally operate in a promiscuous mode, which allows it to observe all traffic on the link, not only packets that are addressed to it.

The KAD/EBM/101 also features valid and error frame counters as well as error detection on Ethernet and IP layers.

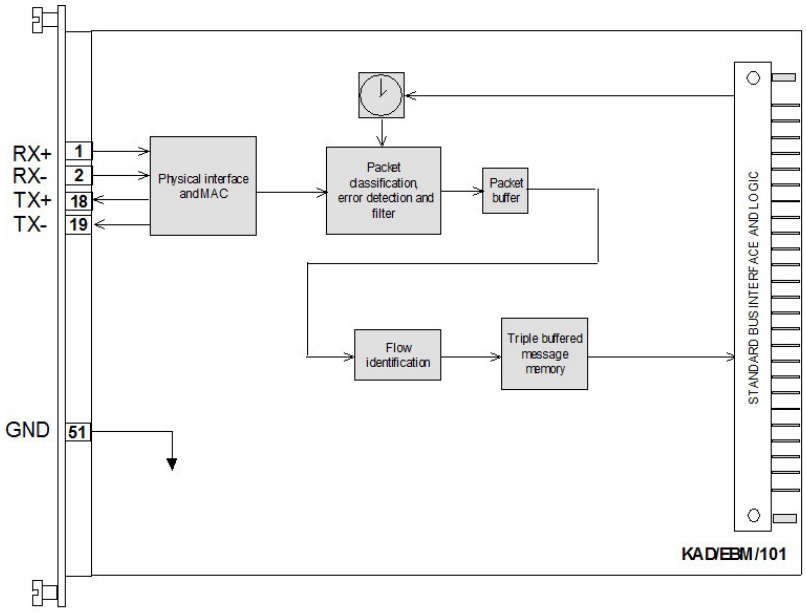

Figure 1: Single Ethernet link frame parser

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					
	–	75	–	g	
	–	2.65	–	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	Msps	Maximum combined access rate for read and write.
Power consumption					
+5V	205	–	369	mA	
±7V	0	–	0	mA	
±12V	0	–	0	mA	
total power	1.03	–	1.85	W	Particular combinations of chassis and Acra KAM-500 modules may have power or current limitations. For details, see *TEC/NOT/016 - Power dissipation, TEC/NOT/049 - Power estimation*, and the relevant chassis data sheet.
Environmental ratings					See Environmental Qualification Handbook.
operating temperature	-40	–	85	°C	Chassis base/side plate temperature.
storage temperature	-55	–	105	°C	

TABLE 2	Ethernet interface				
PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITION/DETAILS
Inputs/outputs	–	–	1	–	IEEE 802.3 compatible -100BaesTX operation only.

Setting up the KAD/EBM/101

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/EBM/101/B	KAD/EBM/101/B	The instrument part reference.
SerialNumber	FA1234	FA1234	Unique name for each module.
Settings	-	-	-
Traffic Type	IENA Generic iNET-X	iNET-X	Choose which set of parser settings to use.
Operating Mode	Promiscuous Non-promiscuous	Non-promiscuous	Promiscuous mode allows monitoring of all network traffic. Non-promiscuous mode filters out traffic other than that addressed to module's MAC Address including broadcast traffic. The allowed values are Promiscuous and Non-promiscuous.
Network Mode	Static	Static	-
Network Management Discard	True False	False	Disabling allows processing of received Broadcast-ARP-/PING- requests and generation of appropriate response packets. Also all Broadcast-ARP-/PING- requests are rooted to parser slot 254. If set to Enabled all Broadcast-ARP-/PING- requests are discarded.
IP Address	0.0.0.0 to 255.255.255.255	0.0.0.0	IP address of module, required to generate Broadcast-ARP/PING-response, that is, if Network Management Discard is Disabled.
MAC Address	00-00-00-00-00-00 to FF-FF-FF-FF-FF-FF	00-00-00-00-00-00	Ethernet address of module, required to generate Broadcast-ARP/PING-response, that is, if Network Management Discard is Disabled. Also required if Operating Mode is Non-promiscuous.
Route Unclassified Packets	True False	True	If set to true, all unclassified traffic is routed to catchall parser slot
VLAN Support	True False	False	Enabling allows parser slot to skip over VLAN packet headers, if present, to classify traffic on basis of IP and UDP/TCP packet header fields.
Settings Generic Parsing	-	-	Select packet offset locations for generic parsing.
Classifier Offset(0)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier
Classifier Offset(1)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier
Classifier Offset(2)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier

SETUP DATA	CHOICE	DEFAULT	NOTES
Classifier Offset(3)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier
Classifier Offset(4)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier
Classifier Offset(5)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier.
Classifier Offset(6)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier.
Classifier Offset(7)	UTF-8 String Regular Expression: ^(?:75[0-8]|7[0-4][0-9]|[0-6]?[0-9][0-9]?|Not Used)$	Not Used	Word offset into Ethernet frame to use as classifier.
Settings IENA Parsing	-	-	Select header fields to be used for parsing IENA traffic.
Source IP Address (IENA)	True False	False	Parse on Source IP Address (note: uses two classifications).
Source UDP Port (IENA)	True False	False	Parse on Source UDP Port number.
Source MAC Address (IENA)	True False	False	Parse on Source MAC Address (note: uses three classifications).
Destination IP Address (IENA)	True False	False	Parse on Destination IP Address (note: uses two classifications).
Destination UDP Port (IENA)	True False	False	Parse on Destination UDP Port number.
Destination MAC Address (IENA)	True False	False	Parse on Destination MAC Address (note: uses three classifications).
Key (IENA)	True False	False	Parse on IENA Key.
Settings iNET-X Parsing	-	-	Select header fields to be used for parsing iNET-X traffic.
Source IP Address (iNET-X)	True False	False	Parse on Source IP Address (note: uses two classifications).
Source UDP Port (iNET-X)	True False	False	Parse on Source UDP Port number.
Source MAC Address (iNET-X)	True False	False	Parse on Source MAC Address (note: uses three classifications).
Destination IP Address (iNET-X)	True False	False	Parse on Destination IP Address (note: uses 2 classifications).
Destination UDP Port (iNET-X)	True False	False	Parse on Destination UDP Port number.
Destination MAC Address (iNET-X)	True False	False	Parse on Destination MAC Address (note: uses 3three classifications).
Stream ID (iNET-X)	True False	False	Parse on iNET-X Stream ID.

SETUP DATA	CHOICE	DEFAULT	NOTES
Channels	-	-	-
Ethernet Ethernet Input	-	-	-
Processes	-	-	-
Parser(253:0)	-	-	Parser slots for classified packages.
Catchall-Parser	-	-	Parser slot for unclassified packages (excluding network management traffic).
Packet-Filter(1023:0)	-	-	Specifies packet filtering rules.
Settings	-	-	-
Destination IP Address	0.0.0.0 to 255.255.255.255	192.168.2.1	Specifies the destination IP Address the incoming packets should be filtered on

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[15:1] Reserved - Reserved for future use. R(0) Error Code - Enter description here 0: Error, link is not connected. 1: No error.
FrameCount Frame count on the network link.	Count	OffsetBinary	16	R[15:0]
Parser(253:0) Parameters				
MessageCount Received frame count in the parser slot.	Count	OffsetBinary	16	R[15:0]
MessageSize Received frame size in bytes.	Unitless	OffsetBinary	16	R[15:0]
MessageStatus Status of IP packets parsed.	BitVector	BitVector	16	R[15:0] R[15:3] Reserved R(2) IP Header Checksum - IP Header Checksum Status 0: Good IP Header Checksum 1: Bad IP Header Checksum R(1) IP Version - IP version check 0: IP version is IPv4 1: IP version is not IPv4 R(0) Reserved
MessageIrigTime48 48 bit wide IRIG time word	BitVector	BitVector	48	R[47:0]
MessageTimeHi Hours and minutes at the start of first received 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 at the start of first received bit.	Second	BCD	16	R[31:16] R(15) Reserved - Reserved for future use R[14:8] Seconds - Seconds 0 to 59 R[7:0] Centiseconds - Centiseconds 0 to 99
MessageTimeMicro Microseconds at the start of first received bit.	Second	BCD	16	R[15:0] R[15:0] Microseconds - Microseconds 0 to 9999

NAME/DESCRIPTION	BASE UNIT	DATA FORMAT	BITS	REGISTER DEFINITION
MessageInfo Information about parsed message.	BitVector	BitVector	16	R[15:0] R(15) Empty 1: This parser slot has not been written to yet. R(14) Stale 1: The message in this parser slot has been read before. R(13) Skipped 1: The message in this parser slot overwrote another message that had not been read. R[12:0] Reserved
Catchall-Parser Parameters				
MessageCount Received frame count in the parser slot.	Count	OffsetBinary	16	R[15:0]
MessageSize Received frame size in bytes.	Unitless	OffsetBinary	16	R[15:0]
MessageStatus Status of IP packets parsed.	BitVector	BitVector	16	R[15:0] R[15:3] Reserved R(2) IP Header Checksum - IP Header Checksum Status 0: Good IP Header Checksum 1: Bad IP Header Checksum R(1) IP Version - IP version check 0: IP version is IPv4 1: IP version is not IPv4 R(0) Reserved
MessageIrigTime48 48 bit wide IRIG time word	BitVector	BitVector	48	R[47:0]
MessageTimeHi Hours and minutes at the start of first received 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 at the start of first received bit.	Second	BCD	16	R[31:16] R(15) Reserved - Reserved for future use. R[14:8] Seconds - Seconds 0 to 59 R[7:0] Centiseconds - Centiseconds 0 to 99
MessageTimeMicro Microseconds at the start of first received bit.	Second	BCD	16	R[15:0] R[15:0] Microseconds - Microseconds 0 to 9999
MessageData(757:0) Data captured from Ethernet frames.	BitVector	BitVector	16	R[15:0]

NAME/DESCRIPTION	BASE UNIT	DATA FORMAT	BITS	REGISTER DEFINITION
MessageInfo Information about parsed message.	BitVector	BitVector	16	R[15:0] R(15) Empty 1: This parser slot has not been written to yet. R(14) Stale 1: The message in this parser slot has been read before. R(13) Skipped 1: The message in this parser slot overwrote another message that had not been read. R[12:0] Reserved

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/EBM/101

The KAD/EBM/101 can be used to parse and classify IP packets, which are transported over an Ethernet network link. Ethernet traffic rates up to 100Mbps bandwidth are supported.

100BaseTX physical layer medium is defined as 100Ω CAT5 UTP cable. Link auto-negotiation is supported to establish full-/half-duplex modes.

Monitoring network traffic via a passive network tap

The KAD/EBM/101 monitors true full-duplex traffic per link in real-time.

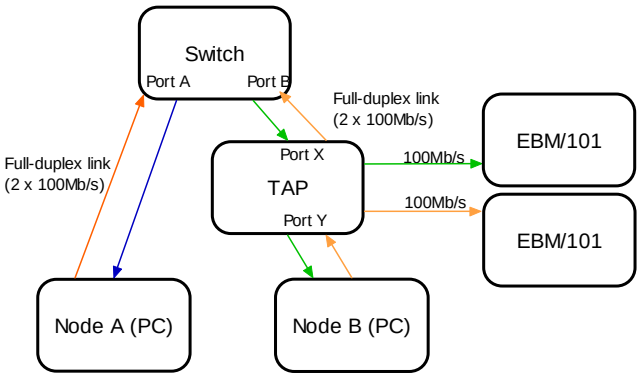

Figure 2: Ethernet monitoring via tap

Monitoring network traffic via a switch

The KAD/EBM/101 can monitor filtered traffic as managed by the switch. Ethernet packets can be delayed, reordered, or even lost in the switch.

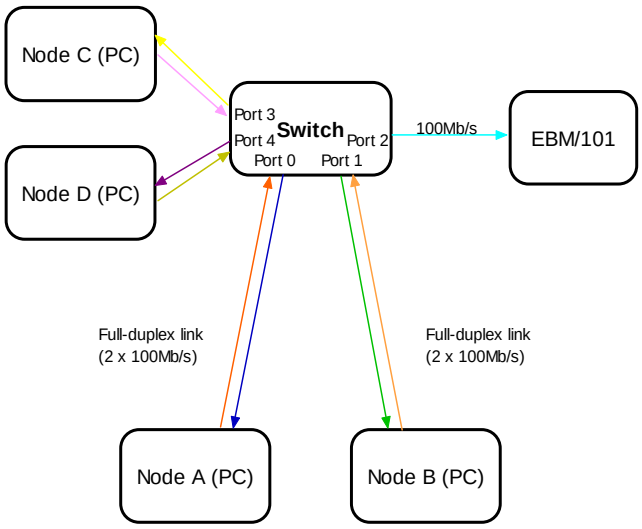

Figure 3: Ethernet monitoring via switch

A managed switch can be used to filter traffic to the switch port connecting to the KAD/EBM/101.

Unmanaged switches may require the switch port connecting to the KAD/EBM/101 to be stimulated via PING request/reply packets to prevent the switch port from dropping an inactive link. Unmanaged switches may not forward all traffic to the switch port connecting to the KAD/EBM/101.

Monitoring unfiltered traffic via a hub

The KAD/EBM/101 monitors unfiltered traffic at the common star point established by the hub. Ethernet packets cannot be delayed or filtered in the hub. However, hubs should not be used to monitor full-duplex Ethernet links, as operation is restricted to half-duplex mode only, thus making hubs susceptible to collisions, which results in frames with errors.

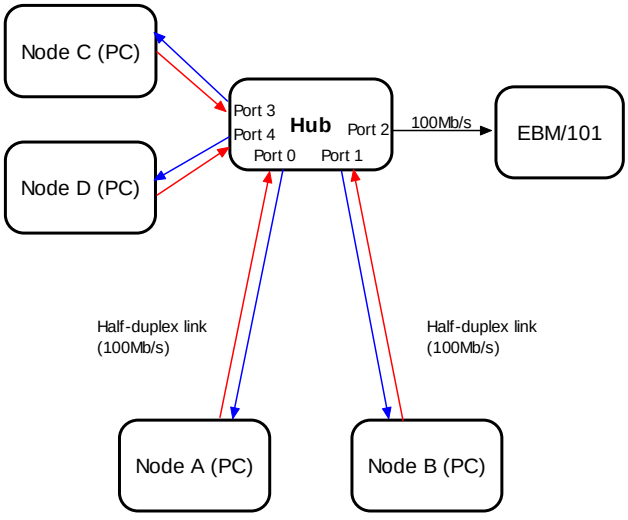

Figure 4: Ethernet monitoring via hub

KAD/EBM/101 limitations

Broadcast-ARP and PING packets addressed to the KAD/EBM/101 receive a reply only if the KAD/EBM/101 is connected to the network via a switch or hub, but not via a tap.

NOTE: The KAD/EBM/101 does not reply to a PING request if the PING buffer size is not 32 bytes (Windows default size). Non-Windows operating systems, for example Linux and UNIX®, may have a default size which is not 32 bytes, in which case the KAD/EBM/101 does not reply. To ensure the EBM/101 can reply to a PING request, the PING buffer size must be set to 32 bytes using the PING command switch -l 32.

NOTE: The KAD/EBM/101 might not be able to reply to a PING request from a UNIX workstation. The KAD/EBM/101 is expecting the Target MAC Address field in the Broadcast-ARP-Request frame to contain 00-00-00-00-00-00. The Broadcast-ARP-Request from UNIX may set this field to FF-FF-FF-FF-FF-FF, such that the KAD/EBM/101 rejects the Broadcast-ARP-Request and does not reply. Without successful ARP it is impossible for PING to work.

NOTE: The KAD/EBM/101 does not respond to Unicast-ARP requests. That is, Broadcast-ARP must be used.

A combination of high data rate (more than 85Mbps) and small packets (less than 112 bytes) can lead to packet loss (0.5%) due to a hardware FIFO overflow. Lower average data rates may also experience packet loss if the peak burst rate exceeds 85Mbps. Packet loss can be reduced by setting up the instrumentation such that packets of no interest to the user, (that is, which are not classified to user-specified parser slots) are discarded rather than being classified to the catchall parser slot.

Packet classification example:

IP Packets can be classified into any of 254 unique parser slots on the basis of frame/packet header field values and/or data. Eight fields may be specified within the Ethernet frame, where each field has 16-bit size and granularity.

- The KAD/EBM/101 is being used to monitor packets using a switch, where the switch has been set up to forward all IP packets received on ports A/B/C/D to the KAD/EBM/101 via port L, but not traffic received on ports E/F/G. Thus the switch is performing a very coarse filtering of data.
- The traffic to be monitored is dialog involving Node-A (connected to port A) and the other nodes connected to ports B/C/D.
- TCP and UDP traffic is monitored.
- The network is configured with static IP addresses, that is the IP address is predetermined and known (as opposed to dynamic IP addressing where a server allocates addresses to the network nodes using Dynamic Host Configuration Protocol [DHCP]). The IP address of Node-A is 192.168.1.55 (on a Windows PC the IP address can be determined from DOS shell using the command ipconfig /all).
- It is not essential to know the Ethernet MAC address (or Physical address) of Node-A or any of the nodes with which it is communicating, as the IP address is a unique identifier for the node on the network.

In this example:

The KAD/EBM/101 is set up to filter packets sent by Node-A, and packets destined to Node-A.

- Packets sent by Node-A have the field IP Source address = 192.168.1.55.
- Packets destined to Node-A have the field IP Destination address = 192.168.1.55.
- 192.168.1.55 is a 32-bit number represented in hex notation as $C0A80137_{16}$.
- The IP Source address field is located within an Ethernet frame in 16-bit fields 13 and 14.
- The IP Destination address field is located within an Ethernet frame in 16-bit fields 15 and 16.
- TCP traffic is distinguished by the 8-bit IP Protocol Field = 06_{16}.
- UDP traffic is distinguished by the 8-bit IP Protocol Field = 11_{16}.
- The IP Protocol field is located within an Ethernet frame in the lower byte of 16-bit field 11.

Thus the KAD/EBM/101 may be configured as follows:

- UDP traffic sent from Node-A is routed to parser slot 0.
- UDP traffic sent to Node-A is routed to parser slot 1.
- TCP traffic sent from Node-A is routed to parser slot 2.
- TCP traffic sent to Node-A is routed to parser slot 3.

In this case, five Ethernet frame fields (fields 11/13/14/15/16) are classified as follows:

- xx11/C0A8/0137/xxxx/xxxx => route to parser slot 0
- xx11/xxxx/xxxx/C0A8/0137 => route to parser slot 1
- xx06/C0A8/0137/xxxx/xxxx => route to parser slot 2
- xx06/xxxx/xxxx/C0A8/0137 => route to parser slot 3

Or, alternatively, the KAD/EBM/101 may be configured as follows:

- UDP traffic sent to or from Node-A is routed to parser slot 0.
- TCP traffic sent to or from Node-A is routed to parser slot 1.

In this case, five Ethernet frame fields (fields 11/13/14/15/16) are classified as follows:

- xx11/C0A8/0137/xxxx/xxxx => route to parser slot 0
- xx11/xxxx/xxxx/C0A8/0137 => route to parser slot 0
- xx06/C0A8/0137/xxxx/xxxx => route to parser slot 1
- xx06/xxxx/xxxx/C0A8/0137 => route to parser slot 1

This is a simple example classifying data packets using only five of the eight available fields. More complicated classification is possible, using for example the Ethernet MAC addresses in the case where IP addresses are not predetermined (in a network where a server allocates IP addresses using the DHCP protocol), or using fields to distinguish between higher-layer protocol packets such as HTTP (web browser traffic) or FTP (file transfer).

TABLE 3	Values of OffsetIndex_Words	
FIELD NAME	OFFSET IF VLAN DISABLED	OFFSET IF VLAN ENABLED
Destination MAC address, word 0	0	0
Destination MAC address, word 1	1	1
Destination MAC address, word 2	2	2
Source MAC address, word 0	3	3
Source MAC address, word 1	4	4
Source MAC address, word 2	5	5
Frame type	6	8
VLAN priority/ID	N/A	7
IP version/IHL/ToS	7	9
IP packet size	8	10
IP ID	9	11
IP flags and fragment offset	10	12
IP TTL and protocol	11	13
IP header checksum	12	14
Source IP address, word 0	13	15
Source IP address, word 1	14	16
Destination IP address, word 0	15	17

TABLE 3	Values of OffsetIndex_Words	
FIELD NAME	OFFSET IF VLAN DISABLED	OFFSET IF VLAN ENABLED
Destination IP address, word 1	16	18
Source port no.	17	19
Destination port no.	18	20
UDP Length; TCP seq word 0	19	21
UDP CSum; TCP seq word 1	20	22
IENA key; TCP Ack word 0	21	23
IENA size; TCP Ack word 1	22	24
iNET-X Stream ID word 0, IENA date 0; TCP offset/flag	23	25
iNET-X Stream ID word 1, IENA date 1; TCP window	24	26
IENA date 2; TCP Csum	25	27
IENA status; TCP urgent Ptr	26	28
IENA Seq; TCP Options (or TCP Data 0)	27	29

A664P7 monitoring

A664P7 defines the use of a deterministic Ethernet network as an avionic data bus. Since the KAD/EBM/101 is an Ethernet packet parser, care must be taken using the KAD/EBM/101 as an A664P7 destination end-system. A KAD/ARR/101 may be used to check the sequencing and remove the redundancy between the two source networks.

Connector pinout of the KAD/EBM/101

PIN	NAME	SEE SPECIFICATIONS TABLE	COMMENT
1	RX+	Ethernet interface	
2	RX-	Ethernet interface	
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	DNC		Do not connect
13	DNC		Do not connect
14	DNC		Do not connect
15	DNC		Do not connect
16	DNC		Do not connect
17	DNC		Do not connect
18	TX+	Ethernet interface	
19	TX-	Ethernet interface	
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	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	GND	Internal ground	
52	CHASSIS	Chassis	

Ordering information

PART NUMBER	DESCRIPTION
KAD/EBM/101/B	Ethernet bus monitor parser - 1ch

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/EBM/101/B	Acra KAM-500 backplane standard bus interface firmware, upgraded to the latest standard; without this upgrade, bit errors at temperature could occur	Recommended for new programs
KAD/EBM/101	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
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/HBK/002	Environmental Qualification Handbook
DOC/MAN/018	KSM-500 Databook
DOC/MAN/030	DAS Studio 3 User Manual
TEC/NOT/016	Power dissipation
TEC/NOT/046	Using the KAD/EBM/101
TEC/NOT/049	Power estimation