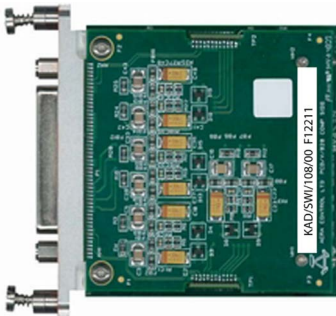


KAD/SWI/108

Ethernet switch (Xbar) - 4 port

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Key Features

- Four 10/100Mbps Ethernet ports over copper wiring
- Configurable Xbar static forwarding table and user-selectable filter pass/reject selection criteria
- IEEE 1588-2004 Precision Time Protocol version 1 (PTPv1) transparency
- Live at power-on (configured static internal routing; no MAC address dynamic learning time delay)

Applications

- Airborne interconnection for data acquisition units, network data recorders, network tap, and onboard data processing stations in an Ethernet environment

Overview

The KAD/SWI/108 is an Ethernet switch designed for operating in harsh environments. The KAD/SWI/108 ports feature auto MDI/MDIX supporting straight-through or cross-over cables.

The KAD/SWI/108 has a store-and-forward Xbar switching fabric that is configured via a static forwarding table to define how incoming Ethernet frames received on a given port are forwarded to the output of one or more egress ports.

The output of each port has filtering capabilities allowing for selective forwarding of Ethernet frames to the connected end node. The KAD/SWI/108 can filter traffic using 8 x 16-bit frame fields such as MAC addresses, IP addresses, IP length, protocol type (UDP/TCP), UDP or TCP port numbers, with optional masking. Filtering options include generic user-configurable field selection, IENA, and iNET-X. Moreover, the filter can be configured for pass or reject selection criteria.

The KAD/SWI/108 does not retransmit Ethernet frames which are received with Frame Check Sequence errors.

Backplane registers provide visibility of network activity including packets received and transmitted per port as well as packets dropped due to buffer overflows.

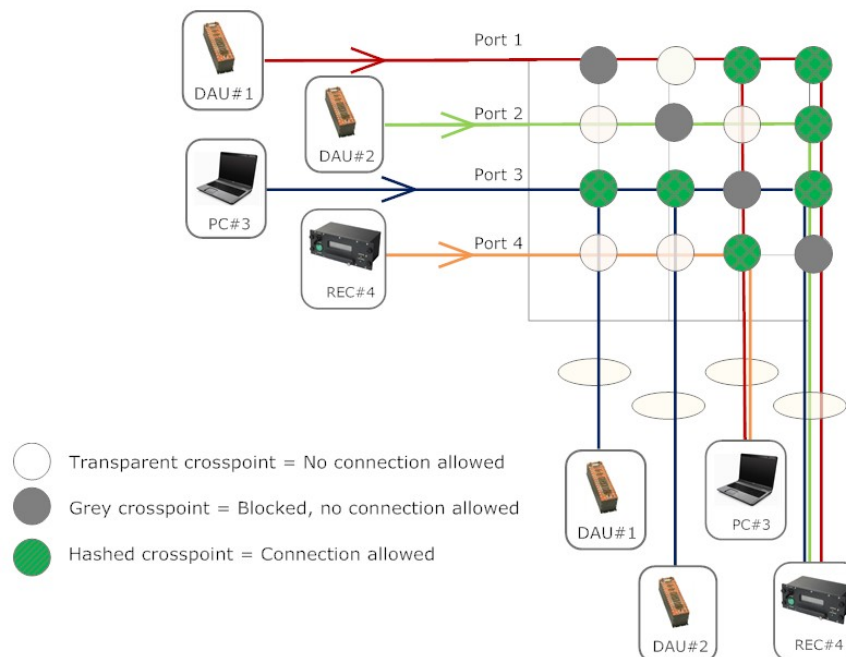


Figure 1: KAD/SWI/108 typical configuration

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						
	–	90	–	g		
	–	3.2	–	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	Msp/s	Maximum combined access rate for read and write.	
Power consumption						
+5V	427	–	585	mA		
±7V	0	–	0	mA		
±12V	0	–	0	mA		
total power	2.14	–	2.93	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.	
Throughput						
100BaseTX	–	–	64	Mbps	64Mbps throughput for 100Mbps for each defined aggregator port.	
10BaseT	–	–	6.4	Mbps	6.4Mbps throughput for 10Mbps for each defined aggregator port.	
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		Ethernet interface				
PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITION/DETAILS	
Inputs/outputs	–	–	4	–	IEEE 802.3 compatible.	

Setting up the KAD/SWI/108

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/SWI/108	KAD/SWI/108	The instrument part reference.
SerialNumber	FA1234	FA1234	Unique name for each module.
Settings Filtering	-	-	-
Filtering Mode	None Output Port Cross Point	None	-
VLAN Support	True False	False	-
Settings Filtering Classifiers	-	-	-
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 for field used for filter.
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 for field used for filter.
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 for field used for filter.
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 for field used for filter.
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 for field used for filter.
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 for field used for filter.

SETUP DATA	CHOICE	DEFAULT	NOTES
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 for field used for filter.
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 for field used for filter.
Channels	-	-	-
Switch-Port(4:1) Ethernet bi-directional	-	-	Standard port with configurable speed, routing, and filtering.
Settings Forwarding	-	-	Defines the port forwarding scheme.
Forwarded To	0 to F	F	Bitmap value defining which port packets are forwarded to. Port 1 corresponds to the LSB. A value of 0xB means forwarding to ports 1, 2 and 4
Settings Ethernet	-	-	Defines the port's configurable Ethernet characteristics.
Port Speed	100BASE-TX 10BASE-T	100BASE-TX	Selects the port's link speed.
Port Mode	Auto-negotiate connection Force connection	Auto-negotiate connection	Selects the link connection mode of this port.
Processes	-	-	-
Switch-Port(4:1)	-	-	Filtering
Settings	-	-	-
Strategy	Allow Block	Block	-

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[15:8] Reserved - Reserved for future use. R(7) Error port 4 half-duplex connection - Error, port 4 connection is half-duplex. 1: Error, port 4 connection is half-duplex. 0: No error, port 4 connection is full-duplex. R(6) Error port 3 half-duplex connection - Error, port 3 connection is half-duplex. 1: Error, port 3 connection is half-duplex. 0: No error, port 3 connection is full-duplex. R(5) Error port 2 half-duplex connection - Error, port 2 connection is half-duplex. 1: Error, port 2 connection is half-duplex. 0: No error, port 2 connection is full-duplex. R(4) Error port 1 half-duplex connection - Error, port 1 connection is half-duplex. 1: Error, port 1 connection is half-duplex. 0: No error, port 1 connection is full-duplex. R(3) Error port 4 not connected - Error, port 4 is not connected. 1: Error, port 4 is not connected. 0: No error. R(2) Error port 3 not connected - Error, port 3 is not connected. 1: Error, port 3 is not connected. 0: No error. R(1) Error port 2 not connected - Error, port 2 is not connected. 1: Error, port 2 is not connected. 0: No error. R(0) Error port 1 not connected - Error, port 1 is not connected. 1: Error, port 1 is not connected. 0: No error.
TypeNumber Type Number of the module	BitVector	BitVector	16	R[15:0]
Switch-Port(4:1) Parameters				
RxPktCnt Number of packets received in the last second on this port.	Count	OffsetBinary	16	R[15:0]
RxErrCnt Number of packets received with errors in the last second on this port.	Count	OffsetBinary	16	R[15:0]

NAME/DESCRIPTION	BASE UNIT	DATA FORMAT	BITS	REGISTER DEFINITION
RxDropCnt Number of received packets dropped in the last second from the Input Queue buffer for this port due to overflow of the buffer. RxDropCnt does not increment for a disconnected port.	Count	OffsetBinary	16	R[15:0]
TxDropCnt Number of packets dropped in the last second from the Output Queue buffer for this port due to overflow of the buffer. TxDropCnt does not increment for a disconnected port.	Count	OffsetBinary	16	R[15:0]
TxPktCnt Number of packets transmitted in the last second on this port.	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/SWI/108

Auto MDI/MDIX only operates with Port Mode set to Auto-negotiate connection.

WARNING: All network connections in use during any loss of power recover automatically when power is resumed. However, traffic through the tap connection is interrupted during a power outage. We recommend that the KAD/SWI/108 is not used to tap a critical network link.

Inter-connecting KAD/SWI/108 modules

When connecting a KAD/SWI/108 module to another KAD/SWI/108 module it is necessary to configure the Port Mode setting for the inter-connecting Ethernet link to Auto-negotiate Connection. This configuration setting must be set for the inter-connecting port in both KAD/SWI/108 modules.

RxDropCnt and TxDropCnt definitions

RxDropCnt measures any loss of packets from the Input Queue for the port due to buffer overflow. It does not count packets which are received from a disconnected port.

TxDropCnt measures any loss of packets from the Output Queue for the port due to buffer overflow. It does not count packets which are transmitted out of a disconnected port.

Static forwarding

The KAD/SWI/108 is configured with a static forwarding table whereby Ethernet frames received on an input port can be forwarded to any output port on the switch, although loop back from receive to transmit of the same port is not supported. The static forwarding table defines the allowed routing between the ports on the switch.

NOTE: Xbar switching fabric technology allows static forwarding tables and filters to be defined. This enables you to define custom port configurations and forward incoming Ethernet frames to multiple destinations for simultaneous telemetry, real-time monitoring and recording.

Example

Consider the following typical configuration (see Figure 2 on page 8) where the KAD/SWI/108 has two DAUs connected on ports 1, and 2, (labelled DAU#1 and DAU#2 respectively), a laptop (labelled PC#3) connected on port 3, and a network recorder (labelled REC#4) connected on port 4.

Having connected the devices to the KAD/SWI/108, the forwarding configuration between these devices is defined. The following table summarizes a typical forwarding configuration. In this example, all Ethernet frames transmitted by the two DAUs are forwarded to the network recorder (REC#4), and to the laptop (PC#3). Only the Ethernet frames transmitted by DAU#1 are forwarded to the laptop (PC#3). Frames from the laptop are forwarded to equipment connected to all ports. Frames from the network recorder are only forwarded to the laptop, PC#3, connected on port 3.

TABLE 3 KAD/SWI/108 forwarding example		
PORT NUMBER	CONNECTED INPUT DEVICE	FORWARD ETHERNET INPUT TO OUTPUT PORTS
1	DAU#1	PC#3, REC#4
2	DAU#2	REC#4
3	PC#3	DAU#1, DAU#2, REC#4
4	REC#4	PC#3

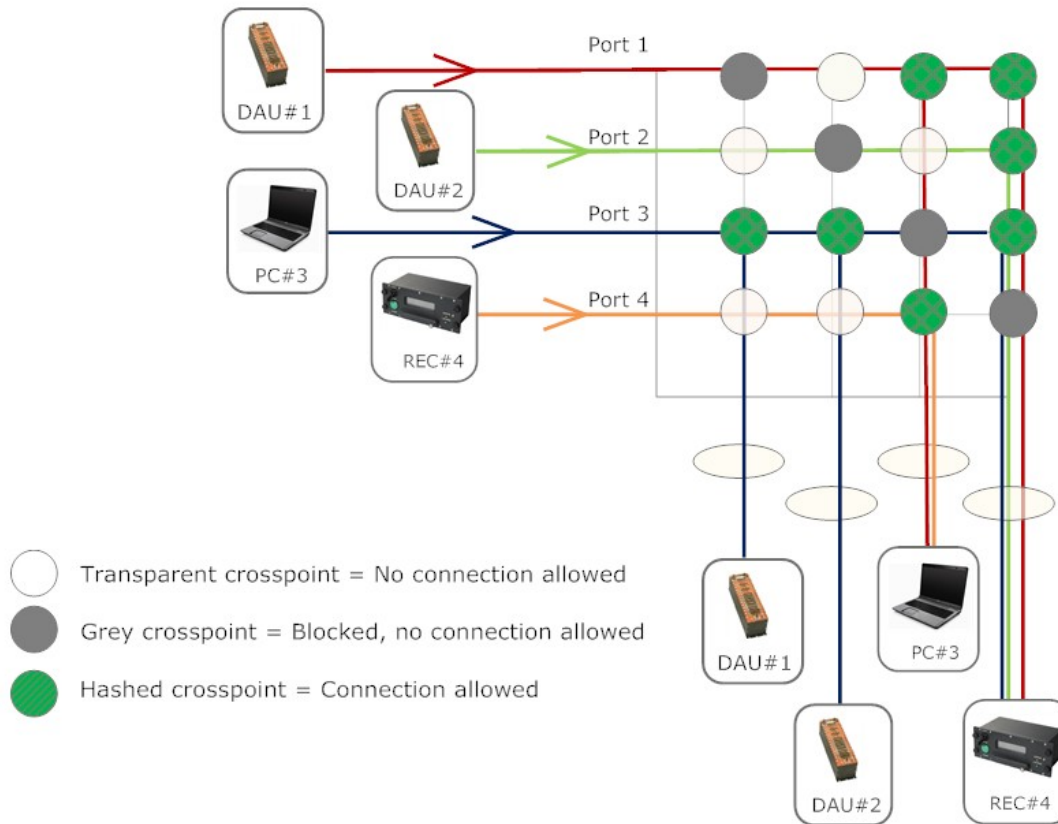


Figure 2: KAD/SWI//108 typical configuration

The previous figure illustrates the configuration of the Xbar switching fabric required to realize this forwarding configuration between the connected devices. The Xbar fabric comprises a fully interconnected matrix of crosspoints between the input and output lines. Ethernet frames received on a given port are never forwarded on itself, as indicated by the grey crosspoint, however Ethernet frames can potentially be forwarded to one or more ports as shown by the transparent crosspoints. A transparent crosspoint indicates a possible forwarding path or inter-connection between devices connected to the KAD/SWI/108. For example, Ethernet frames transmitted by DAU#1 connected on port 1 are never forwarded back to itself as shown by the grey crosspoint. However the Ethernet frames transmitted by DAU#1 are forwarded to REC#4 (the recorder) and PC#3 (the laptop). This allowed forwarding configuration is illustrated by the hashed crosspoints in the figure, whilst the transparent crosspoints indicate unused and therefore blocked crosspoints or forwarding paths.

PTP packets

The KAD/SWI/108 does not make exceptions for routing of PTP packets; they are treated like any other packet type. Therefore, if you block any traffic between ports it also applies to PTP packets.

Filtering

To allow for selective forwarding of Ethernet frames to the connected end nodes, the KAD/SWI/108 has filtering capabilities.

Filter configuration

The filter may be defined as either pass-through or reject. If the filter is set to pass-through, only Ethernet frames with fields which match the filter configuration (Generic, IENA or iNET-X fields) are forwarded. Conversely, if the filter is set to reject, Ethernet frames with those fields are not forwarded.

Packet filtering example

IP Packets can be filtered 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 traffic to be monitored is dialog involving node 1 (connected to port 1) and the other nodes connected to ports 2/3/4.
- TCP and UDP traffic are 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 1 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 1 or any of the nodes with which it is communicating, as the IP address is a unique identifier for the node on the network.

NOTE: Up to eight filter fields can be specified when configuring the KAD/SWI/108. These filter fields can be located anywhere in the packet. Unexpected results can occur when filter fields are located within the body of a packet and packets which are shorter than the filter field location are received. Under these circumstances the shorter packet can be filtered unexpectedly.

In this example, the KAD/SWI/108 is set up to filter packets sent by node 1, and packets destined for node 1.

- For packets sent by node 1, the IP source address field displays a value of 192.168.1.55.
- For packets destined for node 1, the IP destination address field displays a value of 192.168.1.55.
- 192.168.1.55 is a 32-bit number represented in hex notation as C0A80137₁₆.
- 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 can be identified when 06₁₆ is displayed in the 8-bit IP protocol field.
- UDP traffic can be identified when 11₁₆ is displayed in the 8-bit IP protocol field.
- The IP protocol field is located within an Ethernet frame in the lower byte of 16-bit field 11.

Thus the KAD/SWI/108 may be configured as follows:

- UDP traffic sent from node 1 is routed to port 2.
- UDP traffic sent to node 1 is routed to port 1.
- TCP traffic sent from node 1 is routed to port 3.
- TCP traffic sent to node 1 is routed to port 1.

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

- xx11/C0A8/0137/xxxx/xxxx => route to port 2
- xx11/xxxx/xxxx/C0A8/0137 => route to port 1
- xx06/C0A8/0137/xxxx/xxxx => route to port 3
- xx06/xxxx/xxxx/C0A8/0137 => route to port 1

This is a simple example classifying data packets using only five of the eight available fields. More complicated filtering 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).

FIELD NAME	VALUES OF OFFSETINDEX_WORDS
FIELD NAME	OFFSET
Destination MAC address, word 0	0
Destination MAC address, word 1	1
Destination MAC address, word 2	2
Source MAC address, word 0	3
Source MAC address, word 1	4
Source MAC address, word 2	5
Frame type	6
IP version/IHL/ToS	7
IP packet size	8
IP ID	9
IP flags and fragment offset	10
IP TTL and protocol	11
IP header checksum	12
Source IP address, word 0	13
Source IP address, word 1	14
Destination IP address, word 0	15
Destination IP address, word 1	16
Source port no.	17
Destination port no.	18

TABLE 4	Values of OffsetIndex_Words
FIELD NAME	OFFSET
UDP Length; TCP seq word 0	19
UDP CSum; TCP seq word 1	20
IENA key; TCP Ack word 0	21
IENA size; TCP Ack word 1	22
iNET-X Stream ID word 0, IENA date 0; TCP offset/flags	23
iNET-X Stream ID word 1, IENA date 1; TCP window	24
iNET-X Stream ID word 2, IENA date 2; TCP Csum	25
IENA status; TCP urgent Ptr	26
IENA Seq; TCP Options (or TCP Data 0)	27

Connector pinout of the KAD/SWI/108

PIN	NAME	SEE SPECIFICATIONS TABLE	COMMENT
1	DNC		Do not connect
2	DNC		Do not connect
3	RX(1)-	Ethernet interface	Port 1, 10BaseT/100BaseTX
4	RX(1)+	Ethernet interface	Port 1, 10BaseT/100BaseTX
5	TX(1)-	Ethernet interface	Port 1, 10BaseT/100BaseTX
6	TX(1)+	Ethernet interface	Port 1, 10BaseT/100BaseTX
7	DNC		Do not connect
8	DNC		Do not connect
9	CHASSIS	Chassis	
10	DNC		Do not connect
11	DNC		Do not connect
12	RX(2)-	Ethernet interface	Port 2, 10BaseT/100BaseTX
13	RX(2)+	Ethernet interface	Port 2, 10BaseT/100BaseTX
14	TX(2)-	Ethernet interface	Port 2, 10BaseT/100BaseTX
15	TX(2)+	Ethernet interface	Port 2, 10BaseT/100BaseTX
16	DNC		Do not connect
17	DNC		Do not connect
18	DNC		Do not connect
19	DNC		Do not connect
20	DNC		Do not connect
21	RX(3)-	Ethernet interface	Port 3, 10BaseT/100BaseTX
22	RX(3)+	Ethernet interface	Port 3, 10BaseT/100BaseTX
23	TX(3)-	Ethernet interface	Port 3, 10BaseT/100BaseTX
24	TX(3)+	Ethernet interface	Port 3, 10BaseT/100BaseTX
25	DNC		Do not connect
26	DNC		Do not connect
27	CHASSIS	Chassis	
28	DNC		Do not connect
29	DNC		Do not connect
30	RX(4)-	Ethernet interface	Port 4, 10BaseT/100BaseTX
31	RX(4)+	Ethernet interface	Port 4, 10BaseT/100BaseTX
32	TX(4)-	Ethernet interface	Port 4, 10BaseT/100BaseTX
33	TX(4)+	Ethernet interface	Port 4, 10BaseT/100BaseTX
34	DNC		Do not connect
35	DNC		Do not connect
36	CHASSIS	Chassis	
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	CHASSIS	Chassis	
51	GND	Internal ground	
52	CHASSIS	Chassis	

Ordering information

PART NUMBER	DESCRIPTION
KAD/SWI/108	Ethernet switch (Xbar) - 4 port

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 *Network Cables* data sheet). Additional items must be ordered separately; refer to Related products for options.

Revision history

REVISION	DIFFERENCES	STATUS
KAD/SWI/108	First release	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 products

MODULE	DETAILS
NET/CON/018	100/1000BaseT flexible Ethernet interface cable (4x30cm long) terminated with KAD connector used with KAD/SWI/108 and /107
NET/CON/022	4 x 0.3m male micro-miniature, circular to KAD Ethernet cable for KAD/SWI/108

Related documentation

DOCUMENT	DETAILS
DOC/DBK/001	Acra KAM-500 Databook
DOC/MAN/018	KSM-500 Databook
DOC/GBK/002	Environmental Qualification Handbook
DOC/MAN/030	DAS Studio 3 User Manual
TEC/NOT/016	Power dissipation
TEC/NOT/049	Power estimation