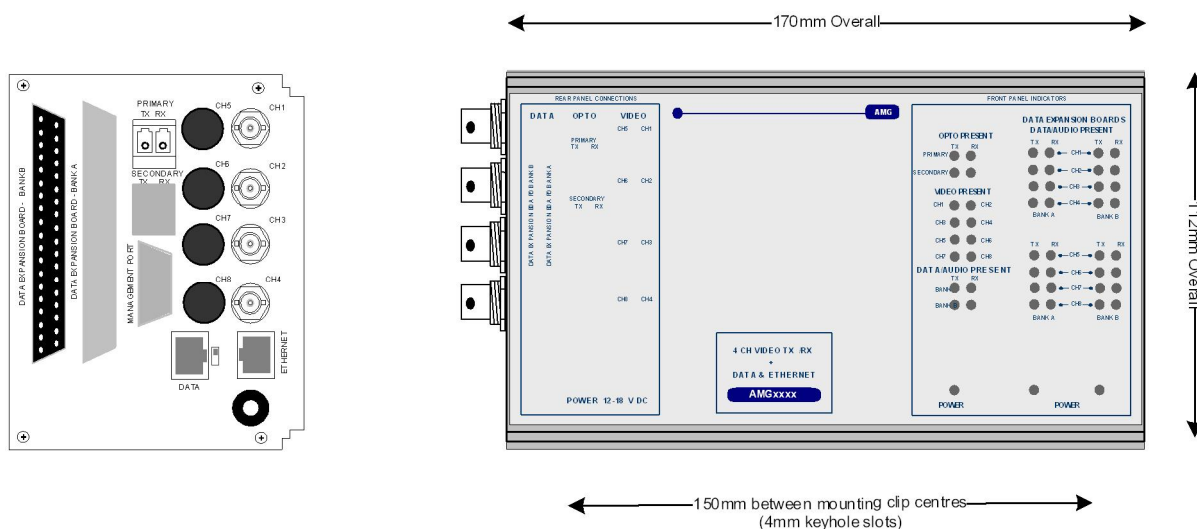# 4 Channel Video Insert Unit with up to 9 Bi-directional Data and Audio Channels plus Ethernet for a Singlemode Dual Fibre ring

The **AMG3747BE** is a standalone four channel video insert unit designed to transmit four video signals onto a dual fibre optical fibre ring. It also provides 9 bi-directional data/audio channels via a low speed data interface, plus full duplex 100BaseT Ethernet connectivity around the ring. Eight of the data/audio channel interfaces, whether RS-232, RS-422, RS-485, 20mA, TTL, Contact Closure, Lonworks or Audio, are defined at manufacture by the addition of daughter boards fitted onto the Data Expansion Board B.

The **AMG3747BE** is designed to be powered using an **AMG2003** standalone power supply.

The **AMG3747BE** is designed to operate with **AMG3788E** or rackmount equivalent **AMG3788ER** eight channel video and data receive unit. The receive unit will 'drop off' up to eight video channels which are being transmitted around the fibre ring from eight single channel insert units or an equivelant number of multi-channel units.

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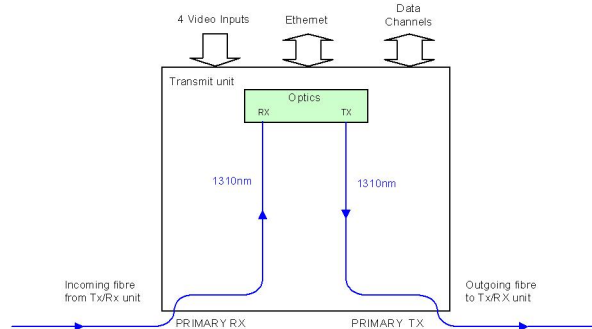AMG3747BE Instruction Sheet
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Introduction

Unit Functional Schematic

The **AMG3747BE** transmits and receives the optical signals to/from a primary optical channel.

The optical channel is transmitted on a single optical fibre around the ring in one direction and operates at a single wavelength.

The primary channel operates on 1310nm.

The **AMG3747BE** receives and drops off data & Ethernet signals transmitted from an **AMG3788E** receiver. It then inserts video, data and Ethernet signals onto the outgoing optical signal.

As each unit regenerates the optical signal, the optical dynamic range between each optically connected node is 17dB.

Video Input Channel Configuration

At the **AMG3747BE** or rackmount **AMG3747BER** insert unit, video signals present at the BNC inputs can be inserted on one to eight video channels transmitted on the optical fibre. The first video channel number of each insert unit is set by the rotary switch on the front panel of the unit.

It is normal to set each insert unit to a different channel number. If the same number is used twice, an insert unit connected 'down stream' on the primary optical route will 'over-write' any coincident video channels coming from the previous insert unit and those video signals will be lost.

The switch channel numbers 1 to 8, correspond to video channels 1-8. Unused switch channel numbers 0 & 9 duplicate video channel selections 1 & 8 respectively. i.e. setting switch to position 0 or 1 selects video channel 1 and setting switch to position 8 or 9 selects channel 8.

Optical Connection

The **AMG3747BE** or rackmount **AMG3747BER** is designed to be connected in a ring or point to point system.

In a ring system, single, dual and four channel insert units respectively can be combined to make up an 8 channel video transmission system as illustrated below.

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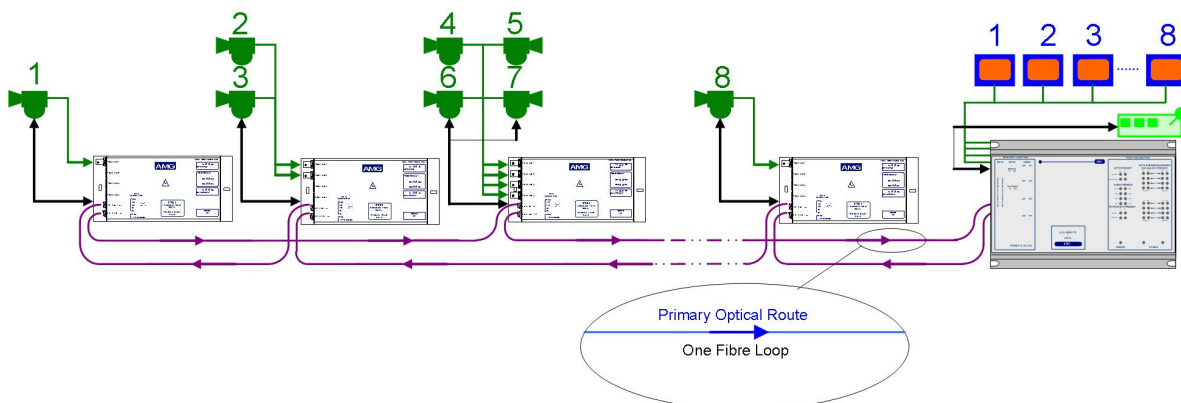
Connections

Video Input Connections

No. of channels.................................. 4
Connector .... 75 ohm BNC Socket.
Input Impedance................................. 75 ohm terminated.
Input Level .... 1 volt p-p nominal
Frequency Response .... 10Hz to 7MHz.

Optical Connections

PRIMARY OPTO OUT
Connector .... LC/PC
Optical Fibre .... One fibre - Singlemode

Primary Optical Launch Power............ -5dBm
Wavelength.. 1310nm

Primary Optical Sensitivity.................. -22dBm
Wavelength.. 1310nm

Power Connection

Connector Type.................................. 2.1mm screw lock long power jack – centre positive
Connector Partno. .... Switchcraft S761K, AMG G16125-00
Supply Voltage .... 13.5 to 18.0 Volts DC.
Maximum Power .... 15 Watts

Ethernet Connection

Ethernet Data Connector RJ45
Interface.. Auto-negotiation up to 100BASE-TX full duplex
Ethernet Data Rate............................ Maximum 50Mbits/s total Ethernet traffic on fibre

Data and Audio Channel Connections

Total No. of Data Channels .... 9 channels

DATA CHANNEL A
Data Channel A .... 1 channel
Data Connector RJ45

Channel A Interface   On Board Data Interface – RS232, RS422 or RS485. Selected by slide switch
below RJ45 connector.
       RS232 – switch position - high (closest to BNC connections)
       RS422 – switch position – middle
       RS485 – switch position – low (furthest from BNC connections)

DATA BANK B
Data/Audio Channels – BANK A .... Not Used
Data/Audio Channels – BANK B .... 8 channels
Connector .... 37-way D-Type female connector - shielded.
Connections....................................... See appropriate section for connection and configuration details

For the data or audio channels to be present, appropriate data daughter boards must be fitted onto the
data expansion board slots.

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Data and Audio Channel Configuration

Data and Audio Channels

The **AMG3747BE** and rackmount equivalent **AMG3747BER** sends and receives data to/from Channel A and Bank B. Channel A is a single data interface selectable by the user with the slide switch on the rear panel. Bank B carries up to 8 channels of data / audio, the physical interface of which is determined by fitment of AMG data or audio daughter boards onto the B Channel data expansion board slots.

Channel A Data

When multiple **AMG3747BE** insert units are connected in a fibre ring together with an AMG rackmount receiver, the type of receiver will determine whether the Channel A data transmitted from each insert unit is combined at the receiver or kept separate as individual data channels.

Similarly the type of receiver determines whether Channel A data transmitted from the receiver is sent separately to each individual insert unit, or broadcast at the same time to all insert units.

An AMG receiver fitted with a single data Channel A interface (RJ45) will combine every Channel A data received from all insert units. The receiver logically OR's the Channel A data signals together to produce a single output for the Channel A data. Similarly, data transmitted from the receiver on Channel A will be sent to all insert units connected in the ring.

Alternatively, an **AMG3788E** or **AMG3788E** receiver fitted with a Bank A data expansion card will send and receive Channel A data separately to each individual insert unit. The data channel number will be determined by the video channel number selected by the video channel selection switch at the insert unit.

Bank B Data

Multiple **AMG3747BE** insert units are typically connected in a fibre ring together with an **AMG3788E** receiver or **AMG3788ER** rackmount receiver which is also fitted with a Bank B data expansion card. In this configuration, the individual Bank B data Channels (1-8) transmitted from each insert unit are combined at the receiver. For each Bank B data Channel (1-8), the receiver logically OR's the data signals together from each insert unit to produce a single data output for each B data Channel (1-8).

Similarly, Channel B (1-8) data transmitted from the receiver will be sent simultaneously to all insert units connected in the ring.

Note: If audio daughter boards are fitted, the audio signal will only broadcast simplex from the receiver to the insert units. The audio signal will not go from the insert units to the receiver.

Data Channel A Configuration

Channel A is always present and allows for a RS232, RS422 (full duplex, four wire) or RS485 (half duplex, two wire) interface depending on the position of the switch located above the RJ45 connector. The switch signifies the presence of the X16004 Low Speed Data/Audio Interface Board. If there are LED's present on the RJ45 connector then an X16003 Ethernet Interface Board is fitted.

The data input for both the RS485 and the RS422 modes detects a tri-state input condition by monitoring the differential voltage level across the input. A differential level below 600mV positive or negative will be detected as a tri-state condition. A level above 600mV positive or negative will be detected as a logic 1 or logic zero respectively. It is important therefore to terminate the RS485 bus or the RS422 input bus using 120Ω if a pre-bias is present on the RS485 or RS422 bus.

A large number of third party equipment manufacturers apply a pre-bias on their RS485 bus. This pre-bias is applied by pulling one arm of the RS485 bus high (+5 volts) and the other arm low (0 volts)

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using high value resistors within the third party equipment. In order to ensure that the AMG equipment detects a tri-state condition, then these resistors should have a value above 5kΩ. If the third party bias resistors are less the 750Ω the bus can be double or triple terminated as required to ensure that a tri-state level is detected.

Note: The Data Channel A is shipped from the factory set up for RS485 operation unless otherwise requested.

Data Interface Connections Channel A

RJ45 Pin No.	Channel A			Cat 5/6 Cable Colour Code T568B
	RS485 [switch low]	RS422 [switch mid]	RS232 [switch high]	
1		IN + (A)	GND	White/orange
2		IN - (B)	IN	Orange
3				White/green
4				Blue
5				White/blue
6				Green
7	IN/OUT + (A)	OUT + (A)	N/A	White/brown
8	IN/OUT - (B)	OUT - (B)	OUT	Brown

Note: (A) or (B) in brackets in above table refers to RS485 / RS422 data specification, not Channel A, Channel B.

Bank B Data

Data Bank B channels are operational when fitted with appropriate daughter boards.

Data Interface Daughter Board Options

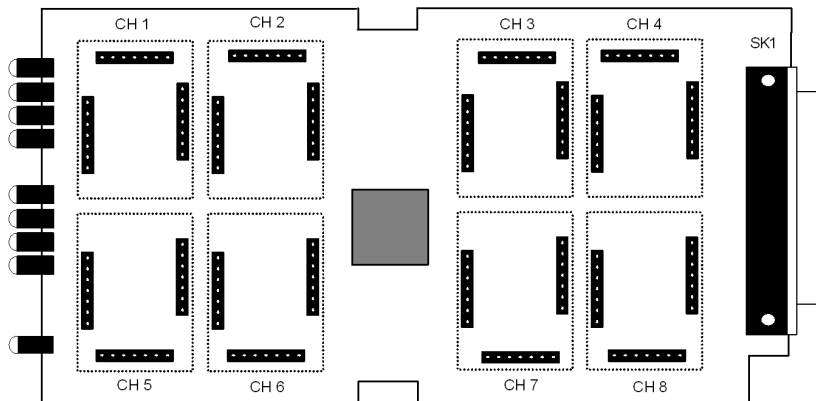The data interface daughter board options are as follows:

Option Code 'x'	Part No.	Description
0	X12542	4 Wire Audio Interface Daughter Board
1	X04057	RS422/485 Data Interface Daughter Board
2	X04049	RS232 Data Interface Daughter Board
3	X04058	20mA Current Loop Data Interface Daughter Board
4	X12579	TTL Data Interface Daughter Board
5	X12578	Contact Closure Data Interface Daughter Board
6	X13038	FTT10A Echelon Lonworks Data Interface Daughter Board

Data and Audio Channel Configuration

The data expansion board slots are accessed by removing the AMG unit from its case. A data channel is active when a daughter board is installed in the required data channel slot. Each data interface board enables one bi-directional channel.

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Daughter Board Layout

The channel slots are as follows:

Data and Audio Daughter Board Fitting Instruction

The data and audio daughter boards pushed on to the pin headers mounted on the data expansion boards. Ensure that the connectors are lined up correctly and not offset before pushing firmly in place. Note that the data and audio channel numbers are associated with each slot. This allocates the pin numbers on the rear panel connector together with the front panel LED indicators.

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Data and Audio Connections Bank B

The BANK B data/audio channels pin connections on the rear panel connectors are as follows:

Pin No.	Description	Bank
1	Audio/Data CH1 IN + (A)	B
2	Audio/Data CH1 IN - (B)	B
3	Audio/Data CH2 IN + (A)	B
4	Audio/Data CH2 IN - (B)	B
5	Audio/Data CH3 IN + (A)	B
6	Audio/Data CH3 IN - (B)	B
7	Audio/Data CH4 IN + (A)	B
8	Audio/Data CH4 IN - (B)	B
9	GND	B
10	GND	B
11	GND	B
12	Audio/Data CH5 IN + (A)	B
13	Audio/Data CH5 IN - (B)	B
14	Audio/Data CH6 IN + (A)	B
15	Audio/Data CH6 IN - (B)	B
16	Audio/Data CH7 IN + (A)	B
17	Audio/Data CH7 IN - (B)	B
18	Audio/Data CH8 IN + (A)	B
19	Audio/Data CH8 IN - (B)	B
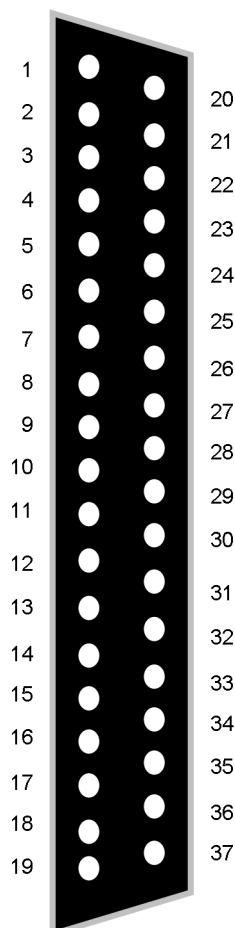
Pin No.	Description	Bank
20	Audio/Data CH1 OUT + (A)	B
21	Audio/Data CH1 OUT - (B)	B
22	Audio/Data CH2 OUT + (A)	B
23	Audio/Data CH2 OUT - (B)	B
24	Audio/Data CH3 OUT + (A)	B
25	Audio/Data CH3 OUT - (B)	B
26	Audio/Data CH4 OUT + (A)	B
27	Audio/Data CH4 OUT - (B)	B
28	GND	B
29	GND	B
30	Audio/Data CH5 OUT + (A)	B
31	Audio/Data CH5 OUT - (B)	B
32	Audio/Data CH6 OUT + (A)	B
33	Audio/Data CH6 OUT - (B)	B
34	Audio/Data CH7 OUT + (A)	B
35	Audio/Data CH7 OUT - (B)	B
36	Audio/Data CH8 OUT + (A)	B
37	Audio/Data CH8 OUT - (B)	B

Note: (A) or (B) in brackets in above table refers to RS485/RS422 data specification not Bank A, B.

See Data or Audio Daughter Board Instruction Sheet for meaning of Audio/Data IN+, Audio/Data IN-Audio/Data OUT+, and Audio/Data OUT- for each data type.

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Front Panel Indicators

Power LED

Power	Green	-	unit powered
	Off	-	no power applied to unit

Video Input LED's

Video Present CH1-4	Green	-	video signal present on input BNC
	R/G	-	channel present but no video on I/P BNC

Fibre Optic LED's

Primary Opto Sync TX	Green	-	optical channel transmitting
	Off	-	optical channel not transmitting
Primary Opto Sync RX	Green	-	optical channel receiving
	Org	-	optical channel receiving but not sync.
	Off	-	optical channel not transmitting

Low Speed Data LEDs

Channel A

Data Present TX (RS485 or RS422)	Green	-	logic zero (+V, -V) present on IN+, IN-
	Red	-	logic one (-V,V+) present on IN+, IN-
	Off	-	tri-state off or no connection on IN+, IN-
Data Present TX (RS232)	Green	-	logic zero (+V) present on input IN+
	Red	-	logic transitions present on input IN+
	Off	-	logic one (-V) present on input IN+

This represents the data signals being transmitted on the optical fibre

Data Present RX (RS485 or RS422)	Green	-	logic zero (+V,-V) present on OUT+, OUT-
	Red	-	logic one (-V,+V) present on OUT+, OUT-
	Off	-	tri-state off or no connection on OUT+, OUT-
Data Present RX (RS232)	Green	-	logic zero (+V) present on OUT+
	Red	-	logic transitions present on OUT+
	Off	-	logic one (-V) present on OUT+

This represents the data signals being received on the optical fibre

BANK B (When RS232 data daughter board fitted)

Data Present CH1-8 TX	Green	-	logic zero (+V) present on IN+
	Red	-	logic transitions present on IN+
	Off	-	logic one (-V) present on IN+

This represents the data signals being transmitted on the optical fibre

Data Present CH1-8 RX	Green	-	logic zero (+V) present on OUT+
	Red	-	logic transitions present on OUT+
	Off	-	logic one (-V) present on OUT+

This represents the data signals being received on the optical fibre

BANK B (When RS485 / RS422 data daughter board fitted)
Data Present CH1-8 TX ....Green   -   logic zero (+V, -V) present on IN+, IN-
                                              Red   -   logic transitions present on IN+, IN-
                                              Off   -   logic one (-V, +V) present on IN+, IN-

This represents the data signals being transmitted on the optical fibre

Data Present CH1-8 RX ....Green   -   logic zero (+V, -V) present on OUT+, OUT-
                                                Red   -   logic transitions present on OUT+, OUT-
                                              Off   -   logic one (-V , +V) present on OUT+, OUT-

This represents the data signals being received on the optical fibre

BANK B (When audio daughter board fitted)
Audio Present CH1-8 TX.....................Green   -   audio present > -40dBm
                                                Red   -   audio present > 0dBm (overload at +6dBm)
                                              Off   -   audio not present or < -40dBm

This represents the audio signals being transmitted on the optical fibre

Audio Present CH1-8 RX ....Green   -   audio present > -40dBm
                                                Red   -   audio present > 0dBm (overload at +6dBm)
                                              Off   -   audio not present or < -40dBm

This represents the audio signals being received from the optical fibre.

Ethernet Operation

In order for the AMG system to transmit Ethernet signals, an onboard RJ45 Ethernet interface or X16003 Ethernet interface adaptor should be fitted to all units in the ring.

The Ethernet interface can operate at either 10Mbits/s half duplex, or 100Mbit/s full duplex. When all the Ethernet interfaces around the ring are operating at 100Mbit/s full duplex the system behaves as a multi-port repeater. Data transmitted on any one port is transmitted out on all other ports with the minimum of delay or buffering. The nominal bandwidth available for Ethernet transmission within the ring is 100Mbit/s when Ethernet only, or 50MBit/s when the low speed data option is also used. If one node is transmitting, the entire bandwidth is available for this traffic. If multiple nodes transmit simultaneously on the ring, then the bandwidth is shared between each node as required. With similar traffic at each node the sharing would be nominally equal.

Although the limit for the number of video channels which can be transmitted around the ring is eight, up to 64 nodes can be attached for distributing Ethernet signals with the bandwidth sharing implemented. The units use Flow Control (Pause Frames) to limit the access to the ring to share the bandwidth and to ensure that no data is lost. When an Ethernet port is operating at 10Mbits/s half duplex, this port will now only receive data from a receive unit rather than all ports as when operating at 100Mbits/s full duplex.

The 100BaseT port does not implement MDI/MDIX; it should be connected with a straight though cable to an external switch port and with a cross over cable when connected directly to a PC or DTE.

Physical Information

Dimensions

Height...112mm
Width..170mm (excluding connectors)
Depth 105mm
Weight...1200grams

Mounting Details

The AMG unit is supplied with a clip-on mounting bracket which should be attached to a panel or wall using 2 off 4.0mm screws, see diagram on page 1 for dimensions. The unit is clipped into the mounting bracket, and is then held firmly in position.

Removal / replacement from / to the Case

Note: - The AMG unit PCB's are static sensitive. Handle with proper care and use normal electrostatic discharge (ESD) procedures. Use properly grounded protection (for example, wrist straps) when handling the PCB.

To remove units from the case to access the data expansion boards and the daughter boards, remove the 2 or 4 fixing screws on the rear panel and slide the PCB's out of the case.
Ensure that the fibres do not snag or get trapped.

To replace the PCB's into the case, slide the PCB's gently into the case aligning the boards with the appropriate slots. Ensure that the fibre do not snag or get trapped.

Safety

AMG Optical Fibre Products use Class 1 laser systems in accordance with EN 60825-2:2000.

It is always advisable to follow good practice when working with optical fibre systems. This includes:

- Do not stare with unprotected eyes or with any unapproved collimating device at fibre ends or connector faces, or point them at other people.

- Use only approved filtered or attenuating viewing aids

For other safety issues and advice on good practice associated with optical fibre systems, please see EN 60825-2:2000 or your local safety officer.

Maintenance and Repair

There are no user serviceable parts within AMG products. See unit data sheet for full specification.

In case of problem or failure, please call your local support centre or contact: **AMG Systems Ltd.** at 3 The Omega Centre, Stratton Business Park, Biggleswade, Beds., SG18 8QB, UK.

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