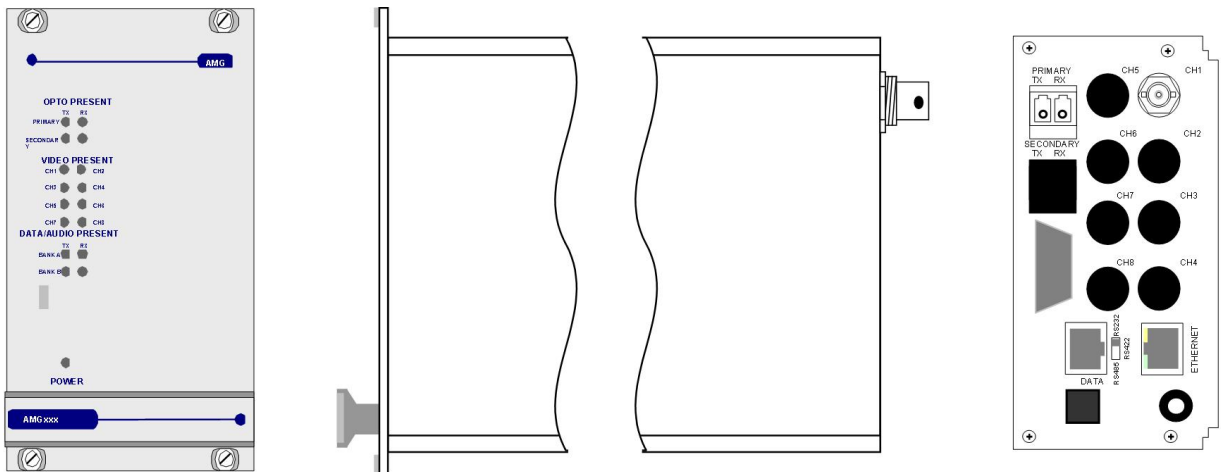## Single Channel Video Insert Unit with Bi-directional Data and Audio Channels and Ethernet for a Dual Redundant fibre ring using CWDM

The **AMG3713EBxD-DR-CWDMn/m-C** is a rackmount one channel video insert unit designed to transmit one video signal onto a single optical fibre ring with Dual Redundant operation. It also provides bi-directional data channels via a low speed data interface, plus full duplex 100BaseT Ethernet connectivity around the ring. The 'C' suffix in the AMG part number indicates internal single channel optical Couplers.

The **AMG3713EBxD-DR-CWDMn/m-C** is designed to be powered using an **AMG2003** standalone power supply.

The **AMG3713EBxD-DR-CWDMn/m-C** is designed to operate with an **AMG3784EBx-DR-CWDMn/m** or rackmount equivalent **AMG3784EBxR-DR-CWDMn/m** eight channel video, data and Ethernet receive unit. The receive unit will 'drop off' up to eight video channels which are being transmitted around the fibre ring from up to eight single channel insert units.

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Contents

Introduction

Unit Functional Schematic

The **AMG3713EBxD-DR-CWDMn/m-C** transmits and receives optical signals from both a primary and a secondary optical channel. The optical channels operate at wavelengths defined by '**n**' and '**m**' in the CWDM**n/m** part number and are transmitted on the same optical fibre in different directions.

A typical configuration is shown in the schematic where **n** = 1, **m** = 2, the primary channel operates on 1510nm and the secondary channel on 1530nm.

The **AMG3713EBxD-DR-CWDMn/m-C** receives and drops off data and Ethernet signals transmitted from an **AMG3784EBx-DR-CWDMn/m** receiver. It then inserts video, data and Ethernet signals onto the outgoing optical signal.
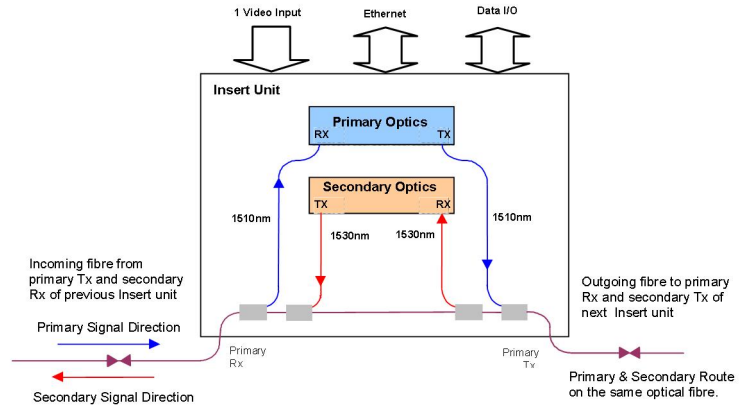
As each unit regenerates the optical signal of the same wavelength, the optical dynamic range between each optically connected node of the same wavelength is 22dB.

CWDM Operation

In a CWDM based system, each unit uses two distinct CWDM wavelengths. For example, in the case of a CWDM1/2 unit, the wavelengths used are CWDM1 (1510nm) for the primary and CWDM2 (1530nm) for the secondary and they travel on the same optical fibre in different directions. See table below for details of available CWDM wavelengths.

The **AMG3713EBxD-DR-CWDMn/m-C** is designed to be connected into a single fibre loop and contains internal optical couplers to provide a pass-through functionality between the incoming and outgoing optical fibre for signals at other wavelengths.

Standard AMG CWDM Wavelengths

CWDM Code 'n' or 'm'	Wavelength (nm)	CWDM Code 'n' or 'm'	Wavelength (nm)
1	1510	5	1470
2	1530	6	1490
3	1550	7	1590
4	1570	8	1610

Video Input Channel Configuration

At the **AMG3713EBx-DR-CWDMn/m-C** or rackmount **AMG3713EBxD-DR-CWDMn/m-C** 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.

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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.

Dual Redundant Operation

In normal operation where optical connection to both the previous unit and subsequent insert units is OK, video and data signals are transmitted on the primary output and data is received from the primary input. The secondary optical input is independent and is regenerated on the secondary output.

If the primary input signal is not present, a unit will shut down the secondary output to inform the previous unit that the signal route is not OK. The previous unit will then send out the video and data signals on its secondary output in the opposite direction. This signal will be repeated around the ring to get back to this unit on the secondary route. As the primary input is not present on this unit, the data signal will now be taken from the secondary optical input thus maintaining integrity of the data transmission.

If the secondary input signal is not present, an insert unit will assume that the route to the next unit is not OK and send out the video and data signal on the secondary optical output. This video and data will be transmitted to the next unit around the ring in the opposite direction on the secondary route.

Optical Connection

The **AMG3713EBx-DR-CWDMn/m-C** or rackmount **AMG3713EBxD-DR-CWDMn/m-C** 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.
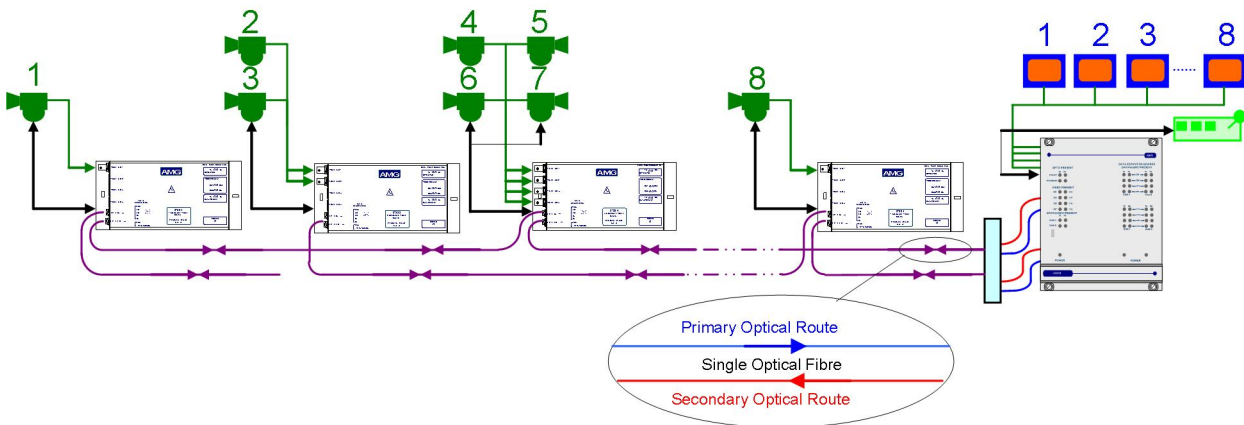
If a fibre link is broken, operation of the ring continues by making use of the secondary optical fibre route as below:

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Primary Optical Route
Single Optical Fibre
Secondary Optical Route
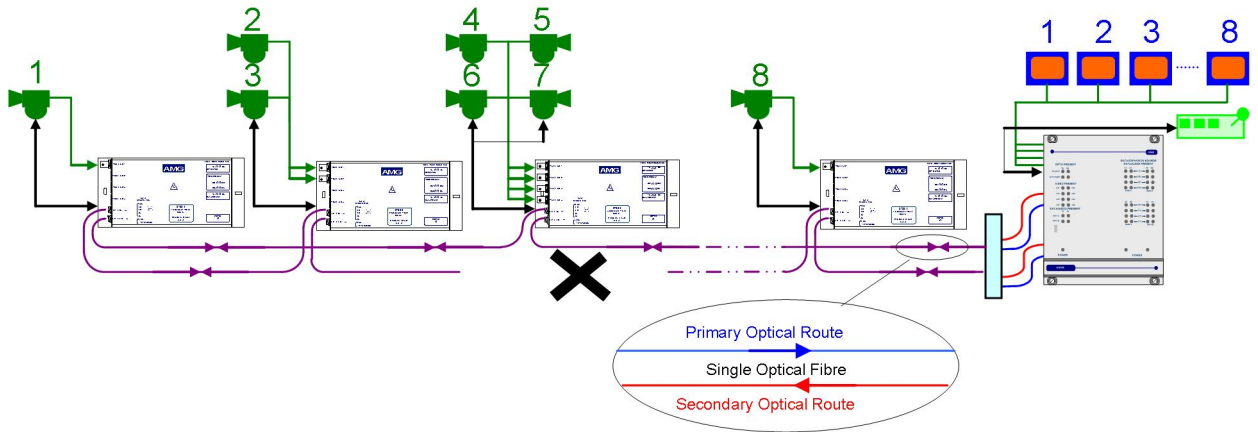
If multiple breaks occur, operation is maintained with all the units still physically connected to the receiver. For the scenario shown below camera signals and control would now be lost from cameras 1, 2 and 3 as there is now no physical connection between the transceivers and the receiver. However operation of cameras 4,5,6,7 and 8 remains fully functional.

Primary Optical Route
Single Optical Fibre
Secondary Optical Route
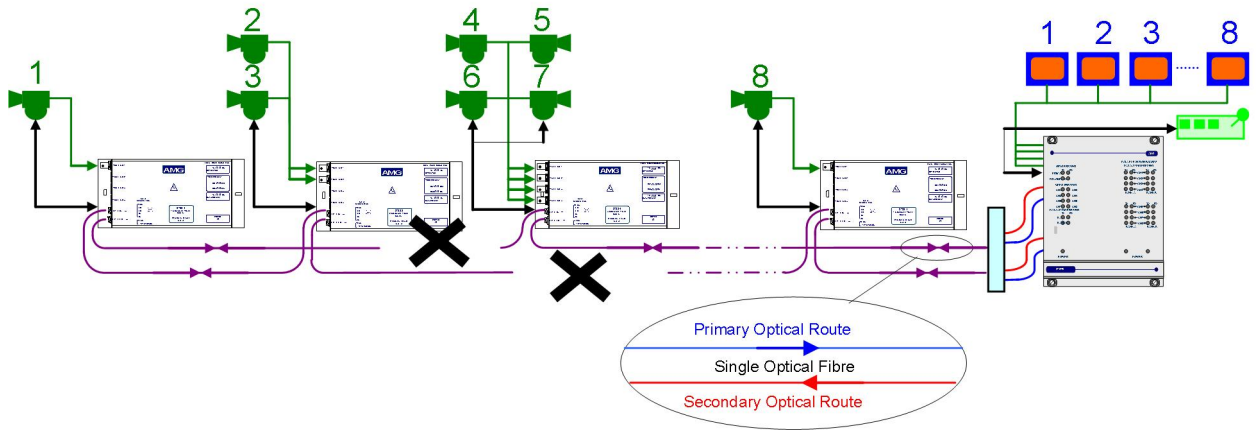
Note that where necessary repeaters can be added at nodes to increase the average distance between nodes.

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Connections

Data and Audio Channel Connections

Total No. of Data Channels ....2 channels

DATA CHANNEL A
Data Connector....................................RJ45
Channel A Interface ....On Board Data Interface – RS232, RS422 or RS485. Selected by slide switch above the RJ45 connector.

      RS232 – switch position - high (closest to BNC connections)
      RS422 – switch position – middle
      RS485 – switch position – low (furthest from BNC connections)

DATA CHANNEL B
Data Connector....................................RJ45
Channel B Interface ....Defined by data/audio interface daughter board fitted into Slot 1 on main board and indicated by the 'x' in the AMG partno.

Video Input Connections

No. of channels...................................1
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
Primary Optical Launch Power ....-1dBm
Wavelength..Defined by '**n**' in the AMG Partno.

Secondary Optical Sensitivity ....-23dBm
Wavelength..Defined by '**m**' in the AMG Partno.

PRIMARY OPTO IN
Connector ....LC/PC
Primary Optical Sensitivity ....-23dBm
Wavelength..Defined by '**n**' in the AMG Partno.

Secondary Optical Launch Power ....-1dBm
Wavelength..Defined by '**n**' in the AMG Partno.

Through Loss ....2dB (for channels not of '**n**' or '**m**' wavelengths)

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 ....10 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

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.

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Data and Audio Channel Configuration

Data and Audio Channel Configuration

The **AMG3713EBx-DR-CWDMn/m-C** and rackmount equivalent **AMG3713EBxD-DR-CWDMn/m-C** sends and receives data to/from Channel A and Channel B. Channel A is a single data interface selectable by the user with the slide switch on the rear panel. Channel B carries a second channel of data / audio, the function and physical interface being determined by the type of daughter board fitted to the B Channel data slot.

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.

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) 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.

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Data / Audio Channel B Configuration

Data Channel B is operational when fitted with the appropriate daughter board.

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

Audio / Data Interface Connections RJ45 - Channel B

RJ45 Channel B low speed data/audio interface connections:

RJ45 Pin No.	Channel B Data / Audio Daughter Board	Cat 5/6 Cable Colour Code T568B
1		White/orange
2		Orange
3	OUT + (A)	White/green
4	IN - (B)	Blue
5	IN + (A)	White/blue
6	OUT - (B)	Green
7		White/brown
8		Brown

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

Front Panel Indicators

Power LED

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

Video Input LED's

Video Present CH1 ....Green	-	video signal present on input BNC
Org	-	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 receiving

Secondary Opto Sync TX ....Green	-	optical channel transmitting
Off	-	optical channel not transmitting

Secondary Opto Sync RX....................Green	-	optical channel receiving
Org	-	optical channel receiving but not sync.
Off	-	optical channel not receiving

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

Channel B (When RS232 data daughter board fitted)

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

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This represents the data signals being transmitted on the optical fibre

Data Present 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

Channel B (When RS485 / RS422 data daughter board fitted)
Data Present 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 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

Channel B (When audio daughter board fitted)
Audio Present 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 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.

Physical Information

Dimensions

Height...3U Plug-in
Width..14HP
Depth ....170mm excluding connectors
Weight...1000grams

Mounting Details

The unit is designed to be mounted within an AMG2009 or AMG2015 Subrack on standard card guides.

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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