

Introducing the AMG 2800 Guardian System

Introduction

The AMG 2800 Guardian system is configurable multi-channel video, audio and data transmission system designed for the large CCTV surveillance systems now widely used in the transportation and security industries. Video signals, together with auxiliary data and audio signals, can be collected from single or multiple sites and can be transmitted to single or multiple sites anywhere on the Guardian network over virtually unlimited distances on single or multiple singlemode optical fibres.

The video is transmitted in real time linearly digitised full bandwidth format. It does not undergo any form of compression. As a result there is no significant latency and video quality is maintained regardless of where in the network the video is collected or dropped off.

The system is made up of a number of 19" rackmount 2U Guardian mainframes that can be connected to provide different system architectures such as ring, point-to-point, or dual homing systems.

The system can connect to virtually unlimited numbers of cameras and monitors and can carry up to 80 video channels simultaneously per single optical fibre using Coarse Wavelength Division Multiplexing (CWDM). This capacity will be able to be increased in the near future, see AMG for details. Using Dense Wavelength Division Multiplexing the camera count per fibre can be increased to 320.

Guardian Overview

Each Guardian mainframe is a 19" rackmount 2U unit. It is a modular unit consisting of a motherboard assembly with connector slots to accept the appropriate daughter boards which define the functionality of the system.

The unit has 20 video I/O slots which are configured into two banks, video bank A and video bank B. Each bank can be fitted with up to ten video input cards or up to ten video output cards. A video bank cannot contain a mix of video inputs and video outputs. Each video I/O card accepts or produces a serial data stream at a nominal rate of 140Mbits/s which contains each full bandwidth real time video signal.

Ethernet input and output cards can be used instead of video cards if a 100baseT Ethernet channel is required.

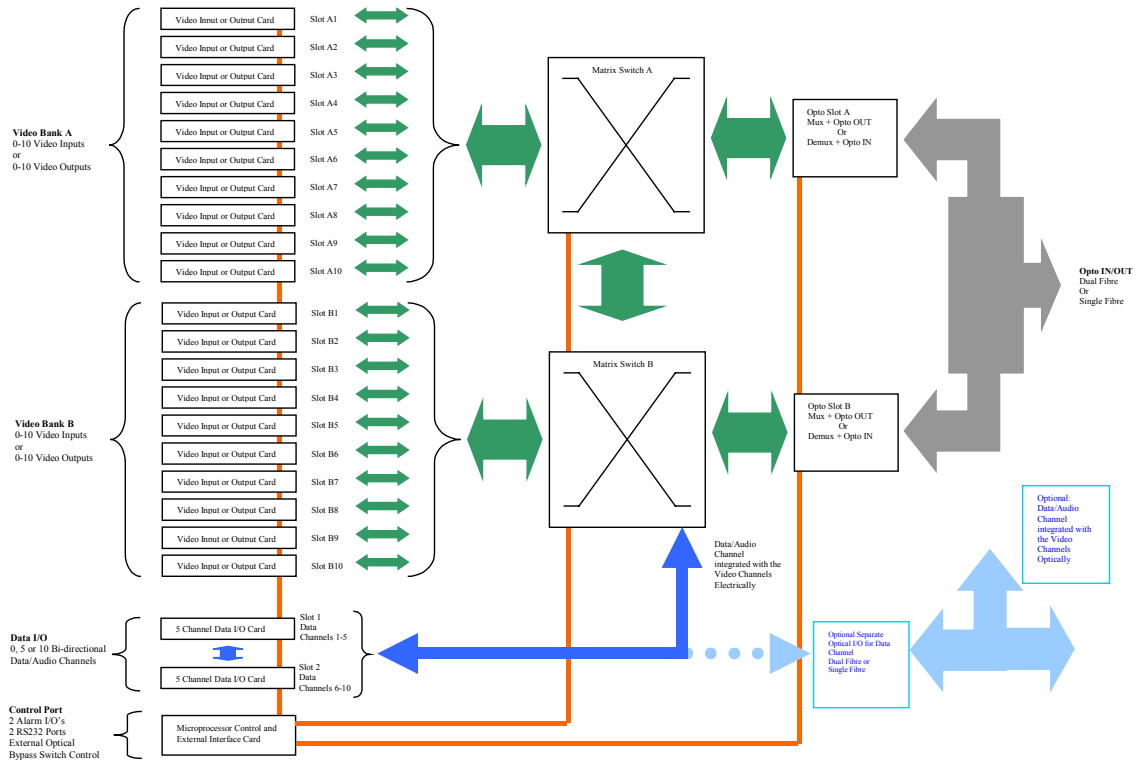
The 20 serial bit streams from the two banks are then connect to two high speed optical card slots via a full crosspoint switch. The optical card slots can accept either a high speed optical input card or a high speed optical output card. The optical output card accepts 10 serial video bit streams and time division multiplexes them onto the fibre. The optical input card does the inverse. The wavelength of the optical transmitter card can be standard 1310nm or 1550nm, or up to 8 different CWDM wavelengths in the 1550 region, (soon to include a further 4 in the 1310nm region). There is also an option to use up to 32 DWDM laser wavelengths within the 1550nm wavelength range. The different wavelengths can be combined on to a single fibre either internally or externally of the Guardian units.

The motherboard also has two data card slots, each with five bi-directional data or audio channels. The data channels can be combined with the video signals

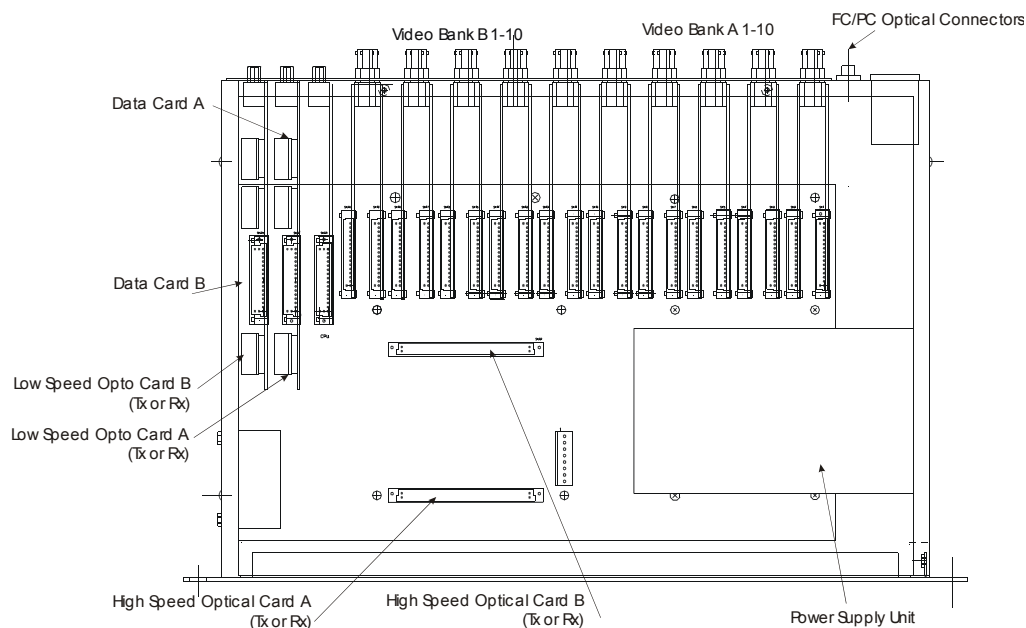
and transmitted on the high speed optical channel or can be transmitted on their own low speed optical channel via a daughter board on the data card.

A Microprocessor Card controls the configuration of the 2800 unit locally and communicates with other units in the network. It provides two RS232 ports for control and configuration of both the local Guardian and all remote Guardian units on the network

The functionality of individual Guardian units is represented below.



This is physically realised as the 2U mainframe as follows:



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Specification

Video Performance

The analogue video input is a BNC connector and with input impedance of 75 ohms unbalanced.

It will accept either PAL or NTSC signals without any adjustment.

The video input is low pass filtered to 7.5MHz.

The video input will accommodate an overload of 3dB in the video signal level (1.41V p-p)

The video input signal is linearly sampled at 16Mhz with a resolution of 8 bits. (An option of sampling 14.4Mhz with a resolution of 10 bits is available.) to produce a serial digital video stream at 128Mbits/s.

The sampling of the video stream is not asynchronous and is synchronised to the line sync pulse on the video signal. This avoids any digitisation artefacts appearing on the picture due to timing differences in a sampling point from one line and one frame to the next.

At the video output the 128Mbit/s digital video stream is converted back input an analogue video signal.

The analogue output is transmitted through a low pass filter with a bandwidth of 7.5Mhz to remove any digitisation artefacts.

The combined video input to video output combination produces a performance of less than 56dB weighted signal to noise ratio, (68dB for 10 bit operation). A differential phase and gain performance of 2° and 2% respectively.

The combined video input to video output latency, excluding the transmission latency at nominally 5us/km of fibre transmitted, is less than 2us.

Each video input card will input one video signal on to the Guardian network.

Each video output card will output one video signal from the Guardian network.

Each Guardian mainframe can will accept up to 20 video input cards, 20 video output cards or up to 10 video input cards and 10 video output cards.

Each Guardian mainframe is able to insert up to 10 video signals onto a high speed optical stream.

It is possible to insert any video channel onto any one of the 10 optical channels within the optical stream either on a permanent basis or dynamic basis as part of distributed video switching routing and transmission system.

Each video input can be disabled and not be transmitted onto an optical channel if it is not required to be transmitted onto the Guardian network.

Up to 8 optical streams from 8 Guardian units can be combined onto a single fibre using coarse wavelength division multiplexing (or up to 32 optical streams using dense wavelength division multiplexing).

If 20 input cards are fitted in any Guardian unit any 10 of the video inputs can be selected for transmission.

Ethernet Performance

The Guardian units can be used to provide Ethernet channels across the 2800 ring. This is done by plugging in an Ethernet Input card and Ethernet Output card in a unit at one location and the same at a second location. The Ethernet Input cards provides a 100BaseT RJ45 interface between the two location. These will provide a full duplex point to point transceiver functionality. If Ethernet is required between other locations on the 2800 ring this has to be done as above on a point to point basis. Therefore if Ethernet is required between 4 nodes on a 2800 ring, then three point to point links have to be set up between what would be a fourth master site. At the master site the three 100BaseT connection to the remote sites would connect directly to a multiway (>4) Ethernet switch. It is recommended that at either end of a Guardian Ethernet link an Ethernet Switch is used to ensure most efficient use of the Ethernet channel on the Guardian. The Guardian Ethernet channel is full bandwidth and will not restrict the data flow between two 100BaseT switch ports.

Auxiliary Audio/Data Channel Performance

Each 2U Guardian mainframe can transmit and receive up to 10 auxiliary data or audio channels.

The auxiliary channels are incremental to the video channel capacity.

The auxiliary channels are added by inserting up to 2 five auxiliary channel cards into the Guardian motherboard.

The physical layer interface of the auxiliary channel is configured by inserting a data daughter board into any of the 5 daughter board slots in the 2 data motherboards.

The data interfaces are RS422, RS485, RS232, Audio, TTL, 20mA current loop or a contact closure alarm interface.

Any of the 10 auxiliary channels can be configured with any of the interfaces.

The auxiliary channel connection is via a 25 D-Type male connector on the rear of each data motherboard.

Each auxiliary channel uses 5 pins on the connector, a TX pair, and RX pair and a chassis ground connection.

The combined data input to data output latency excluding the transmission latency at nominally 5us/km of fibre transmitted, is less than 10us.

The auxiliary data channels can be transmitted and received via the high speed optical channels or via low speed optical channels which can be attached to the data motherboard as required.

Audio Channels

The audio interface is a two wire 600ohm differential input and a two wire 600ohm differential output.

With a nominal input of 0dBm the audio signal to noise ratio is better than 50dB.

The frequency response is 10Hz to 15kHz.

The input overload level is +9dBm before compression of the signal.

The common mode rejection ratio of the audio channel is better than 35dB over the frequency response range.

Data Channels

The data channels will transmit asynchronous data signals ranging from DC up to a bit rate of 128kbit/s NRZ independent of format (number of data bits, stop bits, parity bits etc.) without any user adjustment.

The maximum jitter introduced into the data is 0.75us.

RS232 Data

RS232 is supported as TX and RX pairs. There is no handshaking required for transmission.

If required handshaking and clock signals (for synchronous RS232 transmission) can be transmitted using additional RS232 data channels.

RS422 / RS485

RS422 and RS485 are supported using the same data interface daughter board selected by switch settings on the data daughter board.

For RS485 two wire half duplex operation, a line bias is provided of 10kohms. This can be enhanced to 330ohms by way of switch settings on the daughter board.

The transmit dwell time, where the RS485 transmitter is held on prior to going into a tri-state condition, is 50us. Other dwell times can be achieved as required.

An optional input impedance of 120ohms can be selected by a switch setting on the data interface daughter board.

RS422 operation can be set to standard point to point operation where the output continually mimics the input by use of the daughter board switches.

Alternatively the data outputs can be set to tri-state following a data transmission in order that several data outputs can be connected in parallel as a 4 wire RS422 bus (sometimes referred to as RS485 4-wire) bus. This is set using switches on the daughter board.

TTL

TTL signals can be accommodated using a TTL data interface daughter board.

20mA Current Loop

20mA current loop signal transmission is accommodated using a 20mA data interface daughter board. The default unit provides an opto-isolated passive

input and active output. An active input and/or a passive output can be provided as a factory option.

Contact Closure

A contact closure channel can be provided by use of a contact closure data interface daughter board. The input accepts a volts free contact change over which is replicated at the output.

The contact closure output provides a relay driven contact replicating the state of any input contact.

The contact output rating is 1 amp at 24 volts dc.

High Speed Optical Performance

Two high speed optical cards can be plugged into the Guardian motherboard. These can be either receiver cards or transmitter cards. This gives the capability of 2 uni-directional high speed optical channels or 1 bi-directional high speed optical channel. The latter option is used for connecting the Guardians in a ring configuration

The standard optical interface is a FC/PC style optical connector. There are up to four optical connectors on the rear panel. One for each of the two possible high speed optical interface and one for each of the two possible low speed optical interface. See 'Low Speed Optical Performance' section for details on the low speed optical interface.

High Speed Optical Transmit Cards

Transmit card wavelengths are as follows:

Wavelength	AMG Part No.
1310nm	HSOTCA
1550nm	HSOTCB
1550nm high power	HSOTCC
1510nm CWDM1	HSOTCD1
1530nm CWDM2	HSOTCD2
1550nm CWDM3	HSOTCD3
1570nm CWDM4	HSOTCD4
1470nm CWDM5	HSOTCD5
1490nm CWDM6	HSOTCD6
1590nm CWDM7	HSOTCD7
1610nm CWDM8	HSOTCD8

1310nm (Standard) using HSOTCA, 1550nm (standard),

The launch power for all options apart from the High Power version is -3dBm. This can be increased to +2dBm using the Guardian Muxcom management software Optical Power Status menu.

The High Power transmit card (HSOTCC) transmits at +8dBm.

High Speed Optical Receive Cards

The high speed optical receive card is not wavelength specific and will receive the optical signal from any transmit card. If transmit wavelengths have been combined onto the same fibre, they need to be separated using the appropriate optical coupler prior to being received by the optical receive card.

The optical receive cards will operate with signals down to an optical power level of -20dBm for all wavelengths.

The optical receive cards will operate with optical signals up to a power level of -3dBm .

1310nm, 1550nm WDM Optical Coupler

The standard 1310nm and 1550nm (HSOTCA and HSOTCB) can be combined onto one fibre using a WDM optical coupler (AMG Pt. No. WDMOC). This will normally be mounted within the Guardian unit. The two wavelengths will need to be separated prior to connection into a high speed optical receiver, again using a WDM optical coupler.

Single Channel CWDM Optical Coupler

The CWDM1-n coupler will combine or separate off one wavelength (specified by 'n') from a fibre and transmit on all other CWDM wavelengths on the fibre.

These are normally mounted within the Guardian unit. In a ring architecture this Guardian unit will then be associated with wavelength 'n'. It will not effect video or data channels on other wavelengths on the same fibre, termed the 'through wavelengths'.

The optical loss associated with the through wavelengths following the dropping off and insertion of a single wavelength within a Guardian is 2dB. This includes the loss associated with the two CWDM1-n couplers.

A Guardian unit associated with wavelength 'n' can be inserted anywhere on an optical fibre to drop off and/or insert video, data and audio signals associated with wavelength 'n' without affecting signals on any other wavelengths.

Four Channel CWDM Optical Coupler

The four channel CWDM coupler (AMG Pt. No. CWDM4) is mounted external to the Guardian units in a 1U rack mount enclosure. It has five optical connectors, four of which combine wavelengths onto or separate wavelengths from the fifth connector. The wavelengths are as follows:

Port	Wavelength
Port 1	1510nm
Port 2	1530nm
Port 3	1550nm
Port 4	1570nm
Port 5	All wavelengths

As the couplers are bi-directional it is possible in the ring architecture to send wavelengths in either directional around an optical fibre ring to provide some system resilience to fibre breaks.

The optical loss associated with any of the wavelengths going though the coupler is 1.5dB.

Eight Channel CWDM Optical Coupler

The eight channel CWDM coupler (AMG Pt. No. CWDM8) is mounted external to the Guardian units in a 1U rack mount enclosure. It has nine optical connectors, eight of which combine wavelengths onto or separate wavelengths from the ninth connector. The wavelengths are as follows:

Port	Wavelength
Port 1	1510nm
Port 2	1530nm
Port 3	1550nm
Port 4	1570nm
Port 5	1470nm
Port 6	1490nm
Port 7	1590nm
Port 8	1610nm
Port 9	All wavelengths

As the couplers are bi-directional it is possible in the ring architecture to send wavelengths in either direction around an optical fibre ring to provide some system resilience to fibre breaks.

The optical loss associated with any of the wavelengths going through the coupler is 2.5dB. (contact AMG for low loss applications).

Guardian Control Ports

The Guardian unit has two RS232 control ports, one on a standard 9 way d-type connector, the second on the 15 way d-type connector.

These are used for monitoring or controlling a Guardian network. From any one Guardian it is possible to monitor and control other Guardians connected on the same network.

Guardian can be monitored using the AMG MUXCOM software running on a separate PC connected via the RS232 port.

The Muxcom software will display all the parameters associated with both local and remote Guardian units.

The Muxcom software can also switch any video input onto any optical channel and vice versa, any video output from any optical channel, both on the local Guardian and any remote Guardian units.

The RS232 control ports can also be used to connect to a third party CCTV control system to allow the CCTV control system to switch the video channels as required by the user.

The 15 way d-type control port also provides 2 contact closure outputs and alarm inputs which can be controlled and monitored using the muxcom software.

Power Requirements

Power is supplied to the Guardian via a standard IEC mains inlet. The mains power is switched.

The Guardian will accept 100 to 240 VAC input at 47 to 400Hz.

The power consumption of each Guardian unit is a maximum of 100 Watts.

Indicators

A power LED indicates that the unit is powered correctly.

The front panel video indicators indicate whether the video bank is configured as video inputs or video outputs. It also indicates whether a video card is fitted in each of the card slots and also whether a video signal is present.

On the rear panel, each video card has an LED indicator along side the BNC input or output which indicates whether a video signal is present on the BNC connection.

The front panel data indicators indicate whether a data card is fitted in each of the card slots and also whether a data signal is present.

Optical Sync LED's indicates whether the high speed optical channels are synchronised.

A fault LED indicates a fault condition within the Guardian unit.

Mechanical Specification

Each Guardian unit takes up 2U of rack space in a 19" rack environment.

The Guardian is 300mm deep excluding connectors. 50mm to 100mm should be allowed to accommodate connectors, depending on type.

Environmental Performance

The Guardian operates over a temperature range of -15C to +65C in conjunction with non-condensing humidity levels up to 95%.

The Guardian conforms to the EC Directive on Electromagnetic Compatibility (89/336/EEC, as amended by directive 92/31/EEC).

The equipment complies with EN55022 Class B and EN55024 under the following conditions:

IEC801-2 class 3 (EN61000-4-2)

IEC801-3 (EN61000-4-3) 80Mhz – 1GHz, 10V/m, 80% amplitude modulated.

IEC801-5 (EN61000-4-5).

The Guardian conforms to ENV50204:1995 3V/m 900MHz 200Hz pulsed.

The Guardian conforms to EN50130-4:1996.

Miscellaneous

All electrical and optical connections are on the rear of the Guardian unit.