

MGM Multiwavelength Gain Module EDFA Configuration Manual



Contents

List of Figures	2
List of Tables.....	2
Introduction.....	3
Optical Safety.....	3
Description	3
Electrical Connections	3
Power Requirements	3
Digital Input Signals	3
Digital Output Signals	3
Serial Communications Port	3
Port Configuration	3
MGM EDFA User Commands	3
Command Structure.....	3
Command Set	3
Establishing Communications.....	3
Addressing Multiple EDFA's.....	3
Address & Password Commands.....	3
Alarm Commands	3
Amplifier Commands.....	3
Pump Commands	3
Using the EVMGM Interface Board	3
Mechanical	3

List of Figures

Figure 1 - Suggest RS232 interface circuit.....	3
Figure 2: Device Dimensions.....	3

List of Tables

Table 1: Electrical Pin Connections.....	3
Table 2: Electrical Power Requirements	3
Table 3: Digital inputs	3
Table 4: Alarm Outputs.....	3
Table 5: PC serial port configuration	3
Table 6: Command set summary	3
Table 7: Mechanical Dimensions	3

Introduction

This document provides the user with information relating to the use of the Bookham Multi-Wavelength Gain EDFA Module (MGM series). Details on how to configure the unit via the serial port, electrical connections, digital control lines and power requirements are included. For detailed optical and electrical characteristics, please refer to the appropriate data sheet or product specification.

Optical Safety

The MGM amplifier is rated according to the following classification:

Class 3b laser product in accordance with IEC825-1:1993

Class IIIb laser product in accordance with 21CFR 1040.10

Care must be taken to avoid exposure.

Description

MGM amplifier modules may be specified for use in 1530-1563nm (C-Band) and 1570- 1603 nm (L-Band) WDM optical transmission systems. The module is designed for integration with a control system, which will include appropriate power supplies, serial communications, alarm monitoring and thermal control. The module's integral control system monitors input and/or output optical power of the module and the status of the components within the optical amplifier module. This information is used to adjust the control parameters to maintain the required amplifier performance. Analogue and digital electrical connections enable external control of the module, continuous monitoring of its performance, and provide TTL logic levels associated with specified faults for system performance alarms.

Electrical Connections

All electrical connectivity is achieved through the 25 way D-type plug connector. Power supply requirement is a single 5 V supply to 6 pins as defined in Table 1.

Table 1: Electrical Pin Connections

Pin Number	Description
1, 2, 3, 4, 12, 24	+5.0V
13, 14, 15, 16, 17, 25	GND
5	Output Power Monitor
6	Input Power Monitor
7	EDFA Temperature Alarm
8	Loss of Output Power Alarm
9	Pumps Bias Alarm
10	Pumps Temperature Alarm
11, 23	N/C
18	RS-232 OUT (TTL Levels)
19	Loss of Input Power Alarm
20	Output Power Mute Input
21	Amplifier Disable Input
22	RS-232 IN (TTL Levels)

Power Requirements

Table 2: Electrical Power Requirements

Parameter	Minimum	Typical	Maximum
Positive Supply Voltage	+4.75V	+5.0V	+5.25V
Power Dissipation (Start of Life)			
Preamp		2.5W	-
Dual Pump Boost / Line		5W	-
Triple Pump Boost / Line		7W	-
Power Dissipation (End of Life)			
Preamp	-	-	12.5W
Dual Pump Boost / Line	-	-	23.5W
Triple Pump Boost / Line	-	-	35W
Ripple Noise	-	-	2%PP
Transient Pulse	+4.6V for 75ms.	-	+6.0V for 75ms.
Radiated Emissions	EN5022 class B		
Conducted Emissions	EN5022 class B		
Radiation Immunity	IEC801-3		
ESD	8kV to EN61000-4-2		

Digital Input Signals

Table 3: Digital inputs

Input	Description	Pin	Logic State	Action
ADI	Amplifier disable:- drive current to the pump lasers switched off.	21	TTL LOW	Normal operation
			TTL HIGH	Pump laser(s) disabled
OPMI	Output power mute – output power set to a nominal 5mW	20	TTL LOW	Normal operation
			TTL HIGH	Output set to 5mW

NOTE: THAT UNDER HIGH INPUT POWER CONDITIONS, CONSIDERABLE OUTPUT POWER MAY EXIST EVEN WHEN THE AMPLIFIER IS DISABLED OR MUTED. USE OF THESE INPUTS DOES NOT CONSTITUTE AN INTERLOCK AND THE AMPLIFIER MUST STILL BE CONSIDERED AS CLASS IIIb (3b).

Digital Output Signals

These signals are used as alarms for various system faults. Table 7 summarises the functions. These TTL compatible alarm outputs are all active high logic, i.e. TTL LOW = normal operation, TTL HIGH = alarm. Hysteresis is included on all alarms to prevent oscillation

Table 4: Alarm Outputs

ALARM	Pin	Condition	Hysteresis
EDFA Temperature	7	This alarm is activated if the case temperature is $>60^{\circ}\text{C}$ or $<-5^{\circ}\text{C}$	3°C
Loss of Output Power	8	This alarm is derived from an optical tap and PIN diode, and is activated if the output power falls below a user-specified value. The factory default value is set at 2dB from output power set point	0.5dB
Pump Bias	9	Set if any of the pumps are driven at greater than 95% of their end of life value.	5mA
Pump Temperature	10	This alarm is activated if any of the pumps' submount temperatures are higher or lower than the set temperature by greater than 5°C .	2°C
Loss of Input Power	19	This alarm is derived from an optical tap and PIN diode, and is activated if the input power falls below a user specified value. The factory default value is set at 6dB below the minimum operating point.	0.3dB

Serial Communications Port

Management/status reporting is available through the serial port (TTL levels). If connecting to an RS232 interface, an interface converter (Eg Maxim RS232ACPE) should be used (see Figure 1).

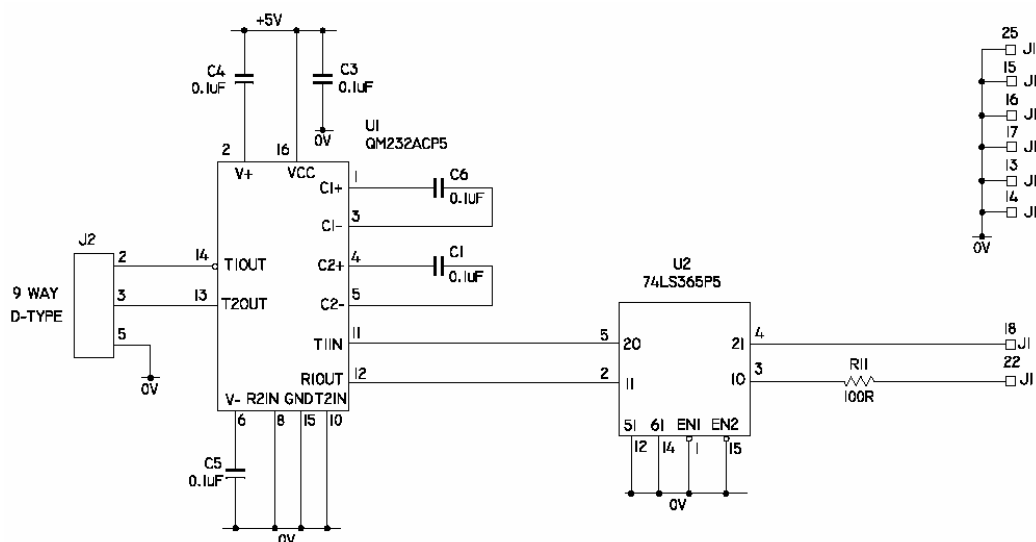


Figure 1 - Suggest RS232 interface circuit

Alternatively, the Nortel MGM EDFA interface board may be used (Part Number: EVMGM). The interface board provides logic level conversion between the MGM EDFA serial data input/output pins (TTL Levels) and a PC serial port (RS-232 Levels). Any terminal emulator program may be used, although best results are usually obtained with Windows Terminal.

Port Configuration

The PC serial port settings should be configured as shown in Table 5.

Table 5: PC serial port configuration

Bits/second	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

MGM EDFA User Commands

Command Structure

The command list shows the commands which are sent to the EDFA and the replies which would be received. All commands must be terminated by CR, LF. A prompt of the address of the unit is shown when a particular EDFA is ready to receive a command, e.g. **0001>**. A syntax error in command entry will cause a reply of **???**

Note that when an EDFA is powered up it will be inactive (i.e. it will not respond to any commands received), until it receives its own address command. At this time it will then become active and reply to all subsequent commands. When a different address command is used to communicate with another unit the first EDFA will become inactive. Note that the terms active and inactive refer only to the communications operation and does not affect the unit's function as an optical amplifier.

In the following command listing, the characters shown inside pointed brackets <> are mandatory. Where characters are shown in square brackets [] following a command, then this signifies that a choice of the listed options may be included.

Command Set

Password protected comments are identified by a (P) in the command title, and by a 'X' in the 'pass' column in Table 6: Command set summary. Password protected commands are those which affect the operation of the amplifier, e.g. to change the gain, laser drive.

The password is factory set to '1234' (it can be altered using the 'CP' command).

Establishing Communications

The following dialogue assumes communications is not yet established and that there is only one EDFA connected to the PC serial port. CR, LF follows each line – this should be set in the terminal properties menu.

AD FFFF 1234 - Address any connected unit, password (optional) (FFFF is the universal address to which any connected EDFA will respond.)

The EDFA should respond with:-

XXXX>

Where XXXX is the hexadecimal EDFA address. Any of the commands shown in Table 6 may now be issued. If the correct password is not sent, password protected commands will not be recognised and the EDFA will respond with: -

**????
XXXX>**

Addressing Multiple EDFA's

When 2 or more EDFA's are connected via a single serial port, each EDFA will need to be given a different address, by means of the Change address (see CA in Address & Password Commands).

Address & Password Commands

The following list of commands and syntax examples assumes unit address is 0001 and password is 1234.

AD <Unit Add.> [Password] Address Unit

AD 1 [1234] Instructs unit with address 1 to become active and respond to protected commands.
All modules are set to address 1 as the default. 1234 is the default password and allows use of commands which alter the EDFA operating mode.

AD FFFF Instructs any connected unit to respond. This command may be used if the address of a particular EDFA is unknown
Reply is
0001>

ADQ <Unit Add.> [Password] Address Unit Quietly

ADQ 1 [1234] Same as the AD command, but unit does not echo characters.
Reply is
0001>

CA <Serial No.> <Add.> Change Address

CA 12345678 0005 Change address of unit with serial number 12345678 to 0005.
Reply is
OK
0005>

CP [Old] [New] [New] Change Password (P)

CP 1234 ABCD ABCD Change the unit password from 1234 to ABCD.
Password is a Hex value from 0001 to FFFE.
Reply is:
O.K.
0001>

Alarm Commands

AO

Alarm Operation (P)

AO

Report status of alarm operation.

Alarms on modules containing 2 amplifiers may either be combined or separate. In combined mode, an alarm on one of the amplifiers which causes that amplifier to be shut down will also cause the second amplifier to be shut down. If the alarms are separate, then an alarm shutting down one amplifier will not affect the second amplifier.

Reply is:

C

0001>

or

S

0001>

AO [C,S]

Alarm Operation

AO C

Set alarms to combined mode.

Reply is:

OK

0001>

Amplifier Commands

AP

Amplifier Power

Reports input and output power levels. Reply is in the form:-

I/P:-31.2 dBm O/P:10 dBm

0001>

AS

Amplifier Status Request

Reports any problems with either of the amplifiers:

- DISABLED** - amplifier's output power is disabled.
- sw** - disable CMOS input is active.
- PWR** - amplifier cannot achieve its set output condition.
- MUTE** - MUTE CMOS input is active.
- LOS** - input power alarm is active.
- TINT** - unit's internal temperature is out of limits.
- OK** - means that there are no alarms.

Reply is:

STATUS: DISABLED, sw, PWR, MUTE, LOS, TINT, OK

0001>

AS [1,2]

Amplifier Status Request

Same as the AS command, but applies to amplifier 1 or 2 individually.

IT

Internal temperature

Reports the internal temperature of the unit.

Reply is:

Tint : 30.6 C

0001>

LA

Link Amplifier

Reports whether amplifiers are operated in linked mode. (See below).

Reply is:

Not linked

0001>

or

Linked

0001>

LA [Y,N]

Link Amplifier (P)

For modules containing a preamp/booster pair. Amplifier input and output powers may be reported either individually (amplifiers not linked) or if linked, the input power reported will be the preamp input and the output power will be the booster output

LA Y	Set amplifiers to operate in linked mode Reply is: OK 0001>
LO [1,2] [D,<value>]	Sets or disables LOS for each stage (P) Reply is: OK 0001>
LO [1,2]	Reports LOS value for stage Reply is: Disabled 0001> or in the form:- -20 dBm 0001>
SA [1,2] [O,G] [<Value>]	Set Amplifier (P) Sets the operating condition for each amplifier O defines output power control. Value field is power in dBm. G defines gain control. Value field is gain in dB.
SA 1 G 23	Sets stage 1 amplifier to constant gain of 23 dB.
SA 1 O 14	Sets stage 1 amplifier to constant output power of +14 dBm Reply is: O.K. 0001>
SA [1,2]	Set Amplifier Reports the operating condition for each amplifier Reply is: Stage 1: Mode[O,G][D] Req: 20.0 [dBm, dB] 0001> The O or G indicate constant output power or gain mode. If the letter 'D' is present at least one of the lasers assigned to the stage is in constant drive current mode.
V	Version Inquiry Asks for the version identification of the firmware currently loaded into program EEPROM and the version of the downloader software in EPROM. Reply is: Downloader V1.00 Micro V1.00 DSP V1.00 Serial No : AM12345.6 Gain Block No : AB45678.9

Pump Commands

FL [1,2,3]

Fit Laser

Replies 1, 2 or N depending on which stage it is fitted to or whether it is absent

Reply is:

[1,2,N]

0001>

LP [1,2,3]

Laser Power

LP 1

Reports laser drive current and output power for laser 1.

Reply is:

P1 123.4 mA, 78.9 mW

0001>

Signifying the drive current for laser 1 is 123.4mA, and the output power is 78.9mW.

LS [1,2,3]

Laser Status

LS 1

Reports status of laser 1:

Reply is:

S1: DISABLED TLAS IDR V NOT FITTED DRV OK

0001>

DISABLED - laser is disabled.

TLAS - laser's cooler temperature is out of limits.

IDRV - laser drive current is above its end of life value.

NOT FITTED - specified laser is not fitted.

DRV - laser is in constant forward current mode.

OK - no alarms.

LT [1,2,3]

Laser Temperature

LT 1

Requests temperature of laser 1

Reply is:

T1: 20.5, 700mA

0001>

Signifying that the laser 1's submount temperature is 20.5°C and the thermoelectric cooler drive current is 700mA.

MD [1,2,3] <N,<value>>	Mode Drive (P) Set drive current for each laser, or specify that the laser drive current requirement is defined by the 'Set Amplifier' (SA) command with set laser drive currents according to the required gain or output power. The 'mode drive' command will override the laser current values defined by the SA command.
MD 1 80	Set laser 1 to 80 mA forward current.
MD 1 N	Set laser 1 control according to 'set Amplifier' (SA) requirement. Reply is: O.K. 0001>
MD [1,2,3]	Mode Drive Reports set drive current for laser, or whether drive current under SA control. Reply is one of the following three forms: NOT FITTED – Laser not present in amp 123.4 mA – Constant drive mode, set to 123.4 mA LASER 1: STAGE 1 – Not in constant drive mode, operating as part of stage 1, under SA control.
ST [1,2,3] [min] [set] [max]	Set Temperature (P) Sets the thermal conditions for each laser.
ST 1 20 25 30	Sets the minimum submount temperature to 20 °C, operating point to 25 °C and the maximum temperature to 30 °C. The minimum and maximum values define the limits for temperature alarms. Reply is: OK 0001>
ST [1,2,3]	Set Temperature Reports the temperature settings for each laser.
ST 1	Reports settings for laser 1. Reply is: L1 20:25:30 0001> This signifies that for laser 1 the minimum temperature is 20°C, the set point is 25°C and the maximum temperature is 30°C. Note that on power-up, the lasers will not be supplied drive current until their submount temperatures are within the limits.

Table 6: Command set summary

	Arg1	Arg2	Arg3	Arg4	Pass Write Read	
AD	[<Unit address>]	<Password>			X	Address unit, optional password
ADQ	[<Unit address>]	<Password>			X	Quietly address unit
CA	[<Serial No>]	[<Address>]			X	Change unit address
AO					X	Reads status of whether alarms are combined or not (Alarm operation)
AO	[C,S]				X X	Alarms combined or separate, will disable amplifiers independently or not.
AP					X	Displays amplifier powers
AS	[1,2]				X	Displays status of amplifier 1 or 2
CP	[Old Password]	[New Password]	[New Password]		X	Change password (Hex value 0001 to FFFE)
FG	[Y,N]				X X	Turn dither on or off for all lasers
FL	[1,2,3]				X	Replies 1,2 or N depending on which stage it is fitted to or whether it is absent
IT					X	Reads internal temperature of unit
LA	[Y,N]				X X	Amplifier works in linked mode or not (One stage using ADCs 1 and 4)
LA					X	Reports whether amplifier is linked
LO	[1,2]	[D,<value>]			X X	Sets or disables LOS for each stage
LO	[1,2]				X	Reports LOS value for stage
LP	[1,2,3]				X	Reads the power being driven by each laser
LS	[1,2,3]				X	Reports the status for each laser
LT	[1,2,3]				X	Reports the temperature for each laser
MD	[1,2,3]	<N,<value>>			X X	Set drive current for each laser, or whether the follows the stage (n)
MD	[1,2,3]				X	Reads set drive current for laser, or reports whether it operates with the stage
R	[<Address>]				X	Read HC12 memory address
SA	[1,2]	[O,G]	[<Value>]		X X	Sets the operating condition for each amplifier
SA	[1,2]				X	Reports the operating condition for each amplifier
ST	[1,2,3]	[min]	[set]	[max]	X X	Sets the set temperature for each laser
ST	[1,2,3]				X	Reports the set temperature for each laser
V					X	Reports the version information

Using the EVMGM Interface Board

There is a Technical Note available detailing the MGM interface board.

Mechanical

Figure 1 shows a schematic drawing of the complete module. The outer dimensions are shown in mm.

