



PRODUCT DOCUMENTATION

BTI 7000 Series Optical Amplifier and DCM Solutions Guide

Part Number: BT7A73AA
Document Version: 01
Published: March 2017
Type: STANDARD

product release 13.5

Contents

Preface	vi
1.0 Optical Amplifier and Dispersion Compensation portfolios	1-1
1.1 Optical Amplifier modules	1-2
1.2 Dispersion Compensation modules	1-3
2.0 Optical Amplifier and Dispersion Compensation features	2-1
2.1 Optical Amplifier features	2-2
2.1.1 Optical Amplifier comparison	2-4
2.2 Dispersion Compensation module features	2-6
2.2.1 Dispersion Compensation module comparison	2-7
2.2.2 40-channel DWDM wavelength plan	2-10
3.0 Optical Amplifier and Dispersion Compensation applications	3-1
3.1 DWDM amplification	3-2
3.2 Single-channel and sub-band amplification	3-3
3.3 Dispersion management	3-4
4.0 Installing Optical Amplifiers and Dispersion Compensation modules	4-1
4.1 Installing Optical Amplifier modules	4-2
4.2 Installing DCF-Type Dispersion Compensation modules	4-7
4.3 Installing Expandable Dispersion Compensation Modules	4-10
5.0 Connecting fibers between modules	5-1
5.1 Connecting fibers between an amplifier with mid-stage access and a DCM	5-2

6.0 Management interfaces	6-1
6.1 proNX 900 Node Controller, CLI, TL1, SNMP, and proNX Service Manager	6-2
7.0 Provisioning Optical Amplifiers and Dispersion Compensation modules	7-1
7.1 Provisioning Optical Amplifier modules	7-2
7.1.1 Provision an Optical Amplifier module	7-3
7.1.2 Display Optical Amplifier module information	7-4
7.1.3 Remove an Optical Amplifier module from service	7-5
7.1.4 Restore an Optical Amplifier module to service	7-5
7.1.5 Restart an Optical Amplifier module	7-6
7.1.6 Delete an Optical Amplifier module	7-6
7.2 Provisioning amplifier settings	7-8
7.2.1 Provision amplifier settings	7-9
7.2.1.1 Amplifier settings, timers, and state management parameters	7-9
7.2.1.2 Amplifier alarm thresholds	7-12
7.2.2 Modify amplifier settings	7-15
7.2.3 Display amplifier information	7-15
7.2.4 Remove an amplifier from service	7-16
7.2.5 Restore an amplifier to service	7-16
7.2.6 Delete an amplifier	7-17
7.3 Provisioning Dispersion Compensation modules	7-18
7.3.1 Provision a Dispersion Compensation module	7-18
7.3.2 Display Dispersion Compensation module information	7-19
7.3.3 Remove a Dispersion Compensation module from service	7-20
7.3.4 Restore a Dispersion Compensation module to service	7-21
7.3.5 Delete a Dispersion Compensation module	7-21
7.4 Editing Dispersion Compensation module ports	7-22
7.4.1 Edit Dispersion Compensation module port settings	7-22
7.4.2 Display Dispersion Compensation module port information	7-23
8.0 Performance monitoring	8-1
8.1 Retrieve and export active PMs for amplifiers	8-2
8.2 Retrieve and export historical PMs for amplifiers	8-3
8.3 Amplifier PMs	8-4
9.0 Troubleshooting Optical Amplifier modules	9-1
9.1 Alarms and events on Optical Amplifier modules	9-2
9.2 View alarms or events for an Optical Amplifier module	9-3
9.3 Optical Amplifier module alarms	9-4
9.4 Module temperature monitoring	9-5
9.5 Module voltage and fuse monitoring	9-7
10.0 Replacing Optical Amplifiers and Dispersion Compensation modules	10-1
10.1 Replace Optical Amplifier modules	10-2

10.2 Replace Dispersion Compensation modules	10-7
--	------

Appendix A: Optical Backreflection Safety feature	A-1
--	------------

Appendix B: Universal connectors	B-1
---	------------

Preface

This preface explains who should read this guide, related documentation, and documentation conventions.

Audience

This guide is primarily intended for technicians and network operation center (NOC) staff.

Features of the BTI 7000 Series

For detailed information about this release, see the *BTI 7000 Series Release Notes* for this release.

BTI 7000 Series common equipment

The following table lists the shelves and other common equipment introduced as part of the BTI 7000 Series. For detailed information, see the *BTI 7000 Series Product Guide* and the *BTI 7000 Series Common Equipment Installation Guide*.

BTI 7000 Series common equipment

Equipment	PEC
BTI 7060	BT7A50AA
BTI 7060 with rear access -48V	BT7A50AR
BTI 7060 Cooling Unit (CU)	BT7A52DA, BT7A52EA
BTI 7060 Main Shelf Interface (MSI)	BT7A53BA, BT7A53BB
BTI 7060 Expansion Shelf Interface (ESI)	BT7A54BA
BTI 7060/BTI 7200 System Control Processor (SCP)	BT7A20CA
BTI 7060 AC Power Assembly Kit	BT7A50BA
BTI 7060 AC Power Module	BT7A58AA
BTI 7060 Filler Panel Kit	BT7A55EA
2U Cover – ANSI	BT7A5070
2U Cover – ETSI	BT7A5071
BTI 7030	BT7A56AA
BTI 7030 Cooling Unit (CU)	BT7A57BA
BTI 7030 Main Shelf Interface (MSI)	BT7A53CA, BT7153CB, BT7A53BB
BTI 7030 System Control Processor (SCP)	BT7A21BA
BTI 7030 AC Power Assembly Kit	BT7A56CA
BTI 7030 AC Power Module	BT7A58BA
1U Cover – ANSI	BT7A5670
1U Cover – ETSI	BT7A5671
BTI 7020	BT7A56BA
BTI 7200	BT7A51AA

BTI 7000 Series common equipment (Continued)

Equipment	PEC
BTI 7200 with rear access -48V	BT7A51AR
BTI 7200 Cooling Unit (CU)	BT7A52EA
BTI 7200 Main Shelf Interface (MSI)	BT7A53EA
BTI 7200 Common Communication Module (CCM)	BT7A54EA
BTI 7200 ANSI shelf cover	BT7A5180
BTI 7200 ETSI shelf cover	BT7A5181
BTI 7200 Air Deflector	BT7A59EA
BTI 7200 Installation kit	BT7A5034
BTI 7200 Pack of 5 Mounting Bracket Pairs (7200)	BT7A5035
BTI 7200 Pack of 5 Center Guides	BT7A5036
Single Expansion Shelf Kit (2x 1310 SFP, 1x Dual SM Patch Cord 1.5m)	BP1A58LA-01.5
Single Expansion Shelf Kit (2x 1310 SFP, 1x Dual SM Patch Cord 2m)	BP1A58LA-02

The BTI 7000 Series shelves support a wide range of modules. For the list of modules supported, see the *BTI 7000 Series Product Guide*.

The following table lists the BTI graphical user interface management software suite. For detailed information about each application, refer to the documentation set for the application.

Management software suite

proNX Management Suite
proNX Service Manager (PSM)
proNX 900 Node Controller (proNX 900)

Equipment compliance

The following table provides agency-compliance information for BTI 7000 Series equipment.



Agency	Compliance information
FDA	This equipment is classified by the FDA under IEC 60825, parts 1 and 2, as a Class 1 laser product with a Class 1 hazard rating.
FCC	This equipment complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.
Industry Canada	This Class A digital apparatus complies with Canadian ICES-003.


Organization of the BTI 7000 Series documentation

The following guides are contained in the BTI 7000 Series documentation suite.

- *BTI 7000 Series Alarm and Troubleshooting Guide*
- *BTI 7000 Series Command Line Interface Reference Guide*
- *BTI 7000 Series Common Equipment Installation Guide*
- *BTI 7000 Series Dynamic Optical Layer Engineering Guideline*
- *BTI 7000 Series Management Communications Channel Solutions Guide*
- *BTI 7000 Series Multiplexing Solutions Guide*
- *BTI 7000 Series Muxponder Solutions Guide*
- *BTI 7000 Series Operations Solutions Guide*
- *BTI 7000 Series Optical Amplifier and DCM Solutions Guide*
- *BTI 7000 Series packetVX Solutions Guide*
- *BTI 7000 Series Product Guide*
- *BTI 7000 Series SNMP Overview Guide*
- *BTI 7000 Series Test and Turn-up Guide*
- *BTI 7000 Series TL1 Reference Guide*
- *BTI 7000 Series Transceiver InformationGuide*
- *BTI 7000 Series Transponder Solutions Guide*
- *BTI 7000 Series Upgrade Guide*
- *BTI 7000 Series Release Notes*
- BTI 7000 Series Quick Installation Notes (various)

Documentation conventions

Convention	Description
Note	Means reader take note. Notes contain helpful suggestions or background information.
 Caution	Means reader be careful. Equipment damage or loss of data can result from your actions.
 Warning	Means reader be careful. Harm to yourself or others can result from your actions.

Convention	Description
 Laser Warning	Invisible laser radiation can be emitted from the aperture ports of amplifier circuit packs when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Copyright © 2017 Juniper Networks, Inc. ALL RIGHTS RESERVED.

This product is the property of Juniper Networks, Inc. and its licensors, and is protected by copyright. Any reproduction in whole or in part is strictly prohibited. Juniper, Juniper Networks, BTI, BTI SYSTEMS, packetVX, proNX, and The Network You Need are trademarks or registered trademarks of Juniper Networks, Inc. and/or its subsidiaries in the U.S. and/or other countries.

Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

Copyright 2003-2016 BTI Systems, Inc. All rights reserved.

Copyright 1997-2001 Lumos Technologies Inc. All rights reserved.

Unpublished - All rights reserved under the copyright laws of the United States. This software is furnished under a license and use, duplication, disclosure and all other uses are restricted to the rights specified in the written license between the licensee and Lumos Technologies Inc.

Copyright 1998-2006 NuDesign Team Inc. All rights reserved. Copyright 1982-2001 QNX Software Systems Ltd. All rights reserved.

Copyright 1990-2001 Sleepycat Software. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. 3. Redistributions in any form must be accompanied by information on how to obtain complete source code for the DB software and any accompanying software that uses the DB software. The source code must either be included in the distribution or be available for no more than the cost of distribution plus a nominal fee, and must be freely redistributable under reasonable conditions. For an executable file, complete source code means the source code for all modules it contains. It does not include source code for modules or files that typically accompany the major components of the operating system on which the executable file runs. THIS SOFTWARE IS PROVIDED BY SLEEPYCAT SOFTWARE "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT, ARE DISCLAIMED. IN NO EVENT SHALL SLEEPYCAT SOFTWARE BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Copyright 1990, 1993, 1994, 1995 The Regents of the University of California. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. 3. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission. THIS SOFTWARE IS PROVIDED BY THE REGENTS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE REGENTS OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR

CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Copyright 1995, 1996 The President and Fellows of Harvard University. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. 3. Neither the name of the University nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission. THIS SOFTWARE IS PROVIDED BY HARVARD AND ITS CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL HARVARD OR ITS CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Copyright 1998 The NetBSD Foundation, Inc. All rights reserved.

This code is derived from software contributed to The NetBSD Foundation by Christos Zoulas. Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. 3. All advertising materials mentioning features or use of this software must display the following acknowledgement: This product includes software developed by the NetBSD Foundation, Inc. and its contributors. 4. Neither the name of The NetBSD Foundation nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission. THIS SOFTWARE IS PROVIDED BY THE NETBSD FOUNDATION, INC. AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE FOUNDATION OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Copyright 2003 Maxim Sobolev sobomax@FreeBSD.org. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met: 1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer. 2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution. THIS SOFTWARE IS PROVIDED BY THE AUTHOR AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT

SHALL THE AUTHOR OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Copyright 1995,1996,1997,1998 Lars Fenneberg lf@elemental.net.

Permission to use, copy, modify, and distribute this software for any purpose and without fee is hereby granted, provided that this copyright and permission notice appear on all copies and supporting documentation, the name of Lars Fenneberg not be used in advertising or publicity pertaining to distribution of the program without specific prior permission, and notice be given in supporting documentation that copying and distribution is by permission of Lars Fenneberg. Lars Fenneberg makes no representations about the suitability of this software for any purpose. It is provided "as is" without express or implied warranty.

Copyright 1992 Livingston Enterprises, Inc. Livingston Enterprises, Inc. 6920 Koll Center Parkway Pleasanton, CA 94566.

Permission to use, copy, modify, and distribute this software for any purpose and without fee is hereby granted, provided that this copyright and permission notice appear on all copies and supporting documentation, the name of Livingston Enterprises, Inc. not be used in advertising or publicity pertaining to distribution of the program without specific prior permission, and notice be given in supporting documentation that copying and distribution is by permission of Livingston Enterprises, Inc. Livingston Enterprises, Inc. makes no representations about the suitability of this software for any purpose. It is provided "as is" without express or implied warranty.

The Regents of the University of Michigan and Merit Network, Inc. 1992, 1993, 1994, 1995. All Rights Reserved.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose and without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies of the software and derivative works or modified versions thereof, and that both the copyright notice and this permission and disclaimer notice appear in supporting documentation. THIS SOFTWARE IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE REGENTS OF THE UNIVERSITY OF MICHIGAN AND MERIT NETWORK, INC. DO NOT WARRANT THAT THE FUNCTIONS CONTAINED IN THE SOFTWARE WILL MEET LICENSEE'S REQUIREMENTS OR THAT OPERATION WILL BE UNINTERRUPTED OR ERROR FREE. The Regents of the University of Michigan and Merit Network, Inc. shall not be liable for any special, indirect, incidental or consequential damages with respect to any claim by Licensee or any third party arising from use of the software.

Copyright 1991-2, RSA Data Security, Inc. Created 1991. All rights reserved.

License to copy and use this software is granted provided that it is identified as the "RSA Data Security, Inc. MD5 Message-Digest Algorithm" in all material mentioning or referencing this software or this function. License is also granted to make and use derivative works provided that such works are identified as "derived from the RSA Data Security, Inc. MD5 Message-Digest Algorithm" in all material mentioning or referencing the derived work. RSA Data Security, Inc. makes no representations concerning either the merchantability of this software or the suitability of this software for any particular purpose. It is provided "as is" without express or implied warranty of any kind. These notices must be retained in any copies of any part of this documentation and/or software.

All other product and company names are trademarks or registered trademarks of their respective companies. All of the above-referenced components are not necessarily included in all versions of the product.

1.0 Optical Amplifier and Dispersion Compensation portfolios

This section identifies the Optical Amplifier modules and Dispersion Compensation modules (DCMs) that the BTI 7000 Series supports, and provides information about software release compatibility.

- 1.1, “Optical Amplifier modules”
- 1.2, “Dispersion Compensation modules”

1.1 Optical Amplifier modules

Table 1-1 Optical Amplifiers

Module	PEC	System Software introduced
DWDM C-Band Pre-Amplifier (OPA)	BP1A01DA	7.1.0
DWDM C-Band Booster Amplifier (OBA)	BP1A02DA	7.1.0
DWDM Optical Line Amplifier (OLA)	BP1A03AA	7.1.0
DWDM Optical Line Amplifier with Mid-Stage Access (OLAM)	BP1A04BA	7.1.0
Single-Channel/Sub-Band Booster Amplifier (SBA)	BP1A05BB	7.1.0
Single-Channel/Sub-Band Pre-Amplifier (SPA)	BP1A05PB	7.1.0
DWDM C-Band Low Gain Amplifier (LGA)	BT7A02AA	12.1
DWDM C-Band Mid Gain Amplifier (MGA)	BT7A03AA	12.1
DWDM C-Band Mid Gain Amplifier with Mid-stage access (MGM)	BT7A04AA	12.1

1.2 Dispersion Compensation modules

Table 1-2 Dispersion Compensation modules

Module	PEC	System software introduced
Dispersion Compensation Modules (DCF-type)		
SMF DCM 20 KM	BP1A10CH-UC	7.1.0
SMF DCM 40 KM	BP1A10CC-SC	7.1.0
SMF DCM 60 KM	BP1A10CA-SC	7.1.0
SMF DCM 80 KM	BP1A10CB-SC	7.1.0
C-Band Dispersion Compensation Modules (FBG-type)		
SMF 100 GHz C-Band DCM 40 KM	BP1A10AA-UC	7.1.0
SMF 100 GHz C-Band DCM 60 KM	BP1A10AB-UC	7.1.0
SMF 100 GHz C-Band DCM 80 KM	BP1A10AC-UC	7.1.0
Dispersion Compensation Modules (Expandable)		
Dispersion Compensation Module - SMF 5 km	BT7A13AA	9.1
Dispersion Compensation Module - SMF 10 km	BT7A12AA	9.1
Dispersion Compensation Module - SMF 15 km	BT7A13BA	9.1
Dispersion Compensation Module - SMF 20 km	BT7A12BA	9.1
Dispersion Compensation Module - SMF 30 km	BT7A12CA	9.1
Dispersion Compensation Module - SMF 40 km	BT7A12DA	9.1
Dispersion Compensation Module - SMF 50 km	BT7A12EA	9.1
Dispersion Compensation Module - SMF 60 km	BT7A12FA	9.1
Dispersion Compensation Module - SMF 70 km	BT7A12GA	9.1
Dispersion Compensation Module - SMF 80 km	BT7A12HA	9.1
Dispersion Compensation Module - SMF 90 km	BT7A12JA	9.1
Dispersion Compensation Module - SMF 100 km	BT7A12KA	9.1

2.0 Optical Amplifier and Dispersion Compensation features

This section provides information about the features of the Optical Amplifier modules and the Dispersion Compensation modules.

- [2.1, “Optical Amplifier features”](#)
- [2.2, “Dispersion Compensation module features”](#)

2.1 Optical Amplifier features

The Optical Amplifier portfolio offers the following modules:

Table 2-1 Optical Amplifiers

Module	PEC	System Software introduced
DWDM C-Band Pre-Amplifier (OPA)	BP1A01DA	7.1.0
DWDM C-Band Booster Amplifier (OBA)	BP1A02DA	7.1.0
DWDM Optical Line Amplifier (OLA)	BP1A03AA	7.1.0
DWDM Optical Line Amplifier with Mid-Stage Access (OLAM)	BP1A04BA	7.1.0
Single-Channel/Sub-Band Booster Amplifier (SBA)	BP1A05BB	7.1.0
Single-Channel/Sub-Band Pre-Amplifier (SPA)	BP1A05PB	7.1.0
DWDM C-Band Low Gain Amplifier (LGA)	BT7A02AA	12.1
DWDM C-Band Mid Gain Amplifier (MGA)	BT7A03AA	12.1
DWDM C-Band Mid Gain Amplifier with Mid-stage access (MGM)	BT7A04AA	12.1

Note This equipment must be installed in a RESTRICTED ACCESS location only. RESTRICTED ACCESS refers to an accessible location that is normally inaccessible by the general public by means of any administrative or engineering control measure, but that is accessible to authorized personnel who may not have laser safety training.

Features

- Module size: Single slot
- Supported platforms
 - BTI 7030: OPA, OBA, OLA, OLAM, SBA, SPA
 - BTI 7060, BTI 7200: all amplifiers
- Single-channel, sub-band, and C-band (DWDM) amplification options
- Pre-, post-, or line-amplification options
- Adjustable gain and power control modes
- High performance – flat gain over a wide dynamic range
- Fully managed, with inventory and optical performance monitoring
- Integrated optical monitoring port on some modules
- Temperature and voltage/fuse monitoring (LGA, MGA, MGM only):
 - Module temperature monitoring, including automatic shutdown if critical temperature is reached

- Module voltage rail and feed fuse monitoring
- PM collection of historical module temperature levels

Figure 2-1 DWDM Optical Line Amplifier (OLA)



Figure 2-2 Optical Line Amplifier with Mid-Stage Access (OLAM)



Figure 2-3 Single-Channel/Sub-Band Amplifier (SPA)



Figure 2-4 DWDM C-Band Low Gain Amplifier (LGA)



Figure 2-5 DWDM C-Band Mid Gain Amplifier (MGA)



Figure 2-6 DWDM C-Band Mid Gain Amplifier with Mid-stage access (MGM)



2.1.1 Optical Amplifier comparison

The portfolio of Optical Amplifier modules includes single-channel amplifiers and DWDM amplifiers. For information, see [1.1, “Optical Amplifier modules”](#).

DWDM C-Band Booster Amplifier (OBA)

The DWDM C-Band Booster Amplifier (OBA) is designed to amplify the output signals at the transmit end of an optical link after the DWDM signals have been multiplexed together. The OBA is typically deployed at the output of a multiplexer at the head of an optical link, but it can be used anywhere in an optical link where the input power to the amplifier is high and the required gain is low.

Optical Line Amplifier (OLA)

The Optical Line Amplifier (OLA) is designed to increase the power level of a signal at intermediate sites along an optical link. The OLA has high gain and high output levels. Although this amplifier is intended for applications at line sites, it can be used at terminal and regen sites where high gain and high output power are required. For more information, see the *Product Guide*.

Optical Line Amplifier with Mid-Stage Access (OLAM)

The Optical Line Amplifier with Mid-Stage Access is designed to increase the power level of a signal at intermediate sites along an optical link. The OLAM also provides two connectors between the first- and second-stage amplifiers so that devices such as Dispersion Compensation modules can be inserted without increasing the span loss. For more information, see the *Product Guide*.

DWDM C-Band Pre-Amplifier (OPA)

The DWDM C-Band Pre-Amplifier (OPA) is designed to provide high gain and moderate output power for operating conditions typically found at the receiver end of an optical link. The OPA can be used anywhere along an optical link where the input and output power and the gain meet the requirements of the application under consideration.

Single Channel/Sub-Band Booster Amplifier (SBA), Single Channel/Sub-Band Pre-Amplifier (SPA), DWDM C-Band Booster Amplifier (OBA), and DWDM C-Band Pre-Amplifier (OPA)

The Single-Channel/Sub-Band Amplifiers (SBA, SPA) and DWDM C-Band amplifiers (OBA, OPA), combining both built-in power monitoring and the ability to collect PMs for power received and power transmitted, provide non-intrusive power monitoring. The power monitor allows one percent of the signal to be redirected for monitoring purposes. The power monitor ports on these amplifiers can be connected to either a power meter or an Optical Spectrum Analyzer (OSA).

Low Gain Amplifier (LGA)

The Low Gain Amplifier (LGA) is a variable gain amplifier for low gain and high output applications, and includes a monitor port for power monitoring and troubleshooting. The LGA

supports the BTI 96-channel plan, and can be used in place of the OBA and SBA amplifiers. This is the highest input power amplifier, and is suitable as a post-amp function.

Mid Gain Amplifier (MGA)

The Mid Gain Amplifier (MGA) is a variable gain amplifier for moderate to high gain and high output applications, and includes a monitor port for power monitoring and troubleshooting. The MGA supports the BTI 96-channel plan, and can be used in place of the SPA, OLA, and OPA amplifiers.

Mid Gain Amplifier with Mid-stage access (MGM)

The Mid Gain Amplifier with Mid-stage access (MGM) is a variable gain amplifier for moderate to high gain and high output applications, and includes mid-stage access for a dispersion compensation module (DCM) and a monitor port for power monitoring and troubleshooting. The MGM supports the BTI 96-channel plan, and can be used in place of the OLAM amplifier.

Amplifier feature comparison

The following table provides comparison information for each Optical Amplifier module in the portfolio.

Table 2-2 Amplifier comparison

Module	Operating Wavelength	Input levels (dBm)	Maximum output (dBm)	Gain (dB)	Power monitor
SBA	Single: 1528–1563nm DWDM: 1546.12–1559.79nm	$-15 \leq P_{in} \leq 9$	18	18	Yes
SPA	Single: 1528–1563nm DWDM: 1546.12–1559.79nm	$-35 \leq P_{in} \leq -10$	5	27	Yes
OBA	DWDM: 1528–1563nm	$-15 \leq P_{in} \leq 10$	20	10	Yes
OLA	DWDM: 1528–1563nm	$-28 \leq P_{in} \leq -5$	16	16 to 26	No
OLAM	DWDM: 1528–1563nm	$-28 \leq P_{in} \leq -5$	18	19 to 29	No
OPA	DWDM: 1528–1563nm	$-35 \leq P_{in} \leq -1$	10	27	Yes
LGA	DWDM: 1528–1567nm	$-21 \leq P_{in} \leq 10$	20	5 to 16	Yes
MGA	DWDM: 1528–1567nm	$-33 \leq P_{in} \leq 0$	16	16 to 26	Yes
MGM	DWDM: 1528–1567nm	$-36 \leq P_{in} \leq -1$	18	19 to 29	Yes

2.2 Dispersion Compensation module features

The Dispersion Compensation module (DCM) portfolio offers the following modules:

Table 2-3 Dispersion Compensation modules

Module	PEC	System software introduced
Dispersion Compensation Modules (DCF-type)		
SMF DCM 20 KM	BP1A10CH-UC	7.1.0
SMF DCM 40 KM	BP1A10CC-SC	7.1.0
SMF DCM 60 KM	BP1A10CA-SC	7.1.0
SMF DCM 80 KM	BP1A10CB-SC	7.1.0
C-Band Dispersion Compensation Modules (FBG-type)		
SMF 100 GHz C-Band DCM 40 KM	BP1A10AA-UC	7.1.0
SMF 100 GHz C-Band DCM 60 KM	BP1A10AB-UC	7.1.0
SMF 100 GHz C-Band DCM 80 KM	BP1A10AC-UC	7.1.0
Dispersion Compensation Modules (Expandable)		
Dispersion Compensation Module - SMF 5 km	BT7A13AA	9.1
Dispersion Compensation Module - SMF 10 km	BT7A12AA	9.1
Dispersion Compensation Module - SMF 15 km	BT7A13BA	9.1
Dispersion Compensation Module - SMF 20 km	BT7A12BA	9.1
Dispersion Compensation Module - SMF 30 km	BT7A12CA	9.1
Dispersion Compensation Module - SMF 40 km	BT7A12DA	9.1
Dispersion Compensation Module - SMF 50 km	BT7A12EA	9.1
Dispersion Compensation Module - SMF 60 km	BT7A12FA	9.1
Dispersion Compensation Module - SMF 70 km	BT7A12GA	9.1
Dispersion Compensation Module - SMF 80 km	BT7A12HA	9.1
Dispersion Compensation Module - SMF 90 km	BT7A12JA	9.1
Dispersion Compensation Module - SMF 100 km	BT7A12KA	9.1

Features

- Module size: Single slot
- Supported platforms: BTI 7020, BTI 7030, BTI 7060
- Dispersion-Compensating-Fiber-based (DCF) modules provide compensation to any signal in the C-Band, including broadband 1550nm signals and ITU-T wavelength on the 50GHz grid
- Fiber-Bragg-Grating-based (FBG) modules provide reduced insertion loss and lower cost when compensating ITU-T 100GHz grid wavelengths
- Full inventory visibility when installed in an active shelf

Figure 2-7 Dispersion Compensation module

2.2.1 Dispersion Compensation module comparison

The following table provides comparison information for each Dispersion Compensation module (DCM) in the portfolio. For a listing of the modules in the portfolio, see [1.2, “Dispersion Compensation modules”](#).

Table 2-4 SMF Dispersion Compensation module BP1A10CH/CC/CA/CB specifications

Parameter	20 km	40 km	60 km	80 km	Units
Dispersion	-340 $\pm 2\%$	-680 $\pm 2\%$	-1020 $\pm 2\%$	-1345 $\pm 2\%$	ps/nm
Relative Dispersion Slope	0.0035 $\pm 20\%$	0.0035 $\pm 20\%$	0.0035 $\pm 20\%$	0.0035 $\pm 20\%$	nm ⁻¹
Insertion Loss (IL)	1.5<IL< 2.7	2.8<IL< 4.0	4.2<IL<6.3	5.5<IL<8.0	dB
Note Insertion Loss is specified at room temperature. An additional 0.5 dB must be added to account for worst case loss variation due to temperature over the entire operational range.					
Polarization Mode Dispersion	<0.44	<0.55	<0.58	<0.67	ps
Polarization Dependent Loss	<0.1	<0.1	<0.1	<0.1	dB

Table 2-5 DCM module specifications (BT7A13AA/13BA, BT7A12AA to BT7A12KA)

Distance	Dispersion ps/nm	Relative Dispersion Slope nm ⁻¹	Insertion Loss (IL) dB	Polarization Mode Dispersion ps	Polarization Dependent Loss dB	Loopback loss dB	Expansion connection loss dB
5 km	-85 ±2%	0.0035 ±20%	0.5<IL< 1.4	0.2	0.1	0.2<IL<1.0	0<IL<0.6
10 km	-170 ±2%	0.0035 ±20%	0.8<IL< 1.8	0.2	0.1	0.2<IL<1.0	0<IL<0.6
15 km	-255 ±2%	0.0035 ±20%	1.0<IL< 2.1	0.3	0.1	0.2<IL<1.0	0<IL<0.6
20 km	-340 ±2%	0.0035 ±20%	1.2<IL< 2.5	0.3	0.1	0.2<IL<1.0	0<IL<0.6
30 km	-510 ±2%	0.0035 ±20%	1.7<IL< 3.2	0.4	0.1	0.2<IL<1.0	0<IL<0.6
40 km	-680 ±2%	0.0035 ±20%	2.3<IL< 4.0	0.4	0.1	0.2<IL<1.0	0<IL<0.6
50 km	-850 ±2%	0.0035 ±20%	3.0<IL< 4.8	0.5	0.1	0.2<IL<1.0	0<IL<0.6
60 km	-1020 ±2%	0.0035 ±20%	3.7<IL<5.4	0.5	0.1	0.2<IL<1.0	0<IL<0.6
70 km	-1190 ±2%	0.0035 ±20%	4.4<IL< 6.1	0.6	0.1	0.2<IL<1.0	0<IL<0.6
80 km	-1345 ±2%	0.0035 ±20%	5.0<IL< 6.7	0.6	0.1	0.2<IL<1.0	0<IL<0.6
90 km	-1530 ±2%	0.0035 ±20%	4.3<IL< 7.1	0.6	0.1	0.2<IL<1.0	0<IL<0.6
100 km	-1700 ±2%	0.0035 ±20%	4.8<IL< 7.5	0.7	0.1	0.2<IL<1.0	0<IL<0.6

Table 2-6 SMF 100 GHz C-Band Dispersion Compensation module BP1A10AA/AB/AC specifications

Parameter	40 km	60 km	80 km	Units
Wavelength Range	See 2.2.2 , “40-channel DWDM wavelength plan”			
Channel Bandwidth	30			GHz
Peak to Peak Group Delay Ripple (averaged)	≤11	≤12	≤13	ps/nm
Dispersion				
1530.33 nm	-635 ±5%	-950 ±5%	-1270 ±5%	ps/nm
1559.79 nm	-700 ±5%	-1050 ±5%	-1400 ±5%	ps/nm
Insertion Loss (IL)	≤5.5			dB
Insertion Loss Ripple	≤1.0			dB
Polarization Mode Dispersion	<0.7	<1.0	<1.5	ps
Polarization Dependent Loss	<0.3			dB

2.2.2 40-channel DWDM wavelength plan

The following is the DWDM wavelength plan for SMF 100 GHz C-Band DCMs.

Table 2-7 DWDM Wavelength Plan

Wavelength (nm)	BTI Channel Numbers	Wavelength (nm)	BTI Channel Numbers
1529.55	E8	1545.32	E4
1530.33	32	1546.12	16
1531.12	31	1546.92	15
1531.90	30	1547.72	14
1532.68	29	1548.51	13
1533.47	28	1549.32	12
1534.25	27	1550.12	11
1535.04	26	1550.92	10
1535.82	25	1551.72	9
1536.61	E7	1552.52	E3
1537.40	E6	1553.33	E2
1538.19	24	1554.13	8
1538.98	23	1554.94	7
1539.77	22	1555.75	6
1540.56	21	1556.55	5
1541.35	20	1557.36	4
1542.14	19	1558.17	3
1542.94	18	1558.98	2
1543.73	17	1559.79	1
1544.53	E5	1560.61	E1

3.0 Optical Amplifier and Dispersion Compensation applications

This section provides information about the applications that Optical Amplifier modules and Dispersion Compensation modules (DCM) support.

- [3.1, “DWDM amplification”](#)
- [3.2, “Single-channel and sub-band amplification”](#)
- [3.3, “Dispersion management”](#)

3.1 DWDM amplification

The DWDM C-Band Optical Booster Amplifier (OBA), DWDM Optical Line Amplifier (OLA), and DWDM C-Band Optical Pre-Amplifier (OPA) can be used to extend the length of DWDM links of up to 80 channels in the wavelength band. The Optical Line Amplifier with Mid-Stage Access (OLAM) allows passive devices, such as Dispersion Compensation modules, to be inserted between the first-and second-stage amplifiers without increasing span loss.

For signals of up to 10 Gbps and typical fiber and dispersion characteristics, the combination of OBA, OLAM, and OPA modules boosts power levels to extend reach up to 350km for a 40-wavelength channel count when combined with Dispersion Compensation modules and Forward Error Correction.

The DWDM C-Band Low Gain Amplifier (LGA) and the DWDM C-Band Mid Gain Amplifier (MGA) support a wide range of line, pre- and post-amp applications, with a gain range extending from a low of 5 dB on the LGA to a high of 29 dB on the MGA, and an input power range from -36 dBm on the MGA to 10 dBm on the LGA. The DWDM C-Band Mid Gain Amplifier with Mid-stage access (MGM) allows passive devices, such as Dispersion Compensation modules, to be inserted between the first-and second-stage amplifiers without increasing span loss. The LGA, MGA, and MGM all operate on the full BTI 96-channel wavelength plan.

3.2 Single-channel and sub-band amplification

The Single-Channel/Sub-Band Booster Amplifier (SBA) and Single-Channel/Sub-Band Pre-Amplifier (SPA) modules provide an affordable alternative to the full C-Band amplifiers for single-channel amplification or low-to-moderate count systems.

SBA and SPA modules are cost optimized for use in single-channel optical links in the wavelength region from 1528nm to 1563nm.

SBAs and SPAs can also be used to extend the length of single 1550nm-channel or DWDM signals from one to 16 wavelengths within the ITU-T C-band between the wavelengths 1546.12nm and 1559.79nm. This corresponds to Band 1 (1554.13nm – 1559.79nm) and Band 2 (1546.12nm – 1551.72nm).

For signals of up to 10 Gbps and typical fiber and dispersion characteristics, the SBA and SPA boost power levels to extend reach up to 160km point-to-point when combined with Dispersion Compensation modules.

3.3 Dispersion management

The Dispersion Compensation module (DCM) portfolio provides different compensation levels to correct for the amount of chromatic dispersion in a specific fiber span (or link) and slope matched to the fiber type.

DWDM Channelized DCMs use Fiber Bragg Grating (FBG) technology to provide reduced insertion loss for specific wavelength configurations. Greater reach and lower cost is achieved than with standard Dispersion Compensating Fiber modules. Modules can be selected to compensate for 40, 60, or 80km of dispersion. ITU-T DWDM wavelengths to be compensated must be in the 100 GHz grid for these modules to work.

Dispersion Compensating Fiber modules support any wideband signal at any wavelength inside the C-band independently of the ITU-T grid used. A wide range of compensating distances is available to adjust the dispersion compensation cost to the specific link requirements.

4.0 Installing Optical Amplifiers and Dispersion Compensation modules

This section provides instructions for installing Optical Amplifier modules and Dispersion Compensation modules in supported shelves.

- [4.1, “Installing Optical Amplifier modules”](#)
- [4.2, “Installing DCF-Type Dispersion Compensation modules”](#)
- [4.3, “Installing Expandable Dispersion Compensation Modules”](#)

4.1 Installing Optical Amplifier modules

Use this procedure to install Amplifier modules.

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Optical Amplifier module
- Isopropyl alcohol and lint-free pads
- Fiber scope to verify that the fiber ends are clean

Prerequisites

- None



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).



Laser

Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Key installation features

The following figures show typical amplifiers and indicate the key features for installation.

Figure 4-1 Single-Channel /Sub-Band Amplifiers (SBA/SPA) and DWDM C-Band Amplifiers (OBA/OPA)

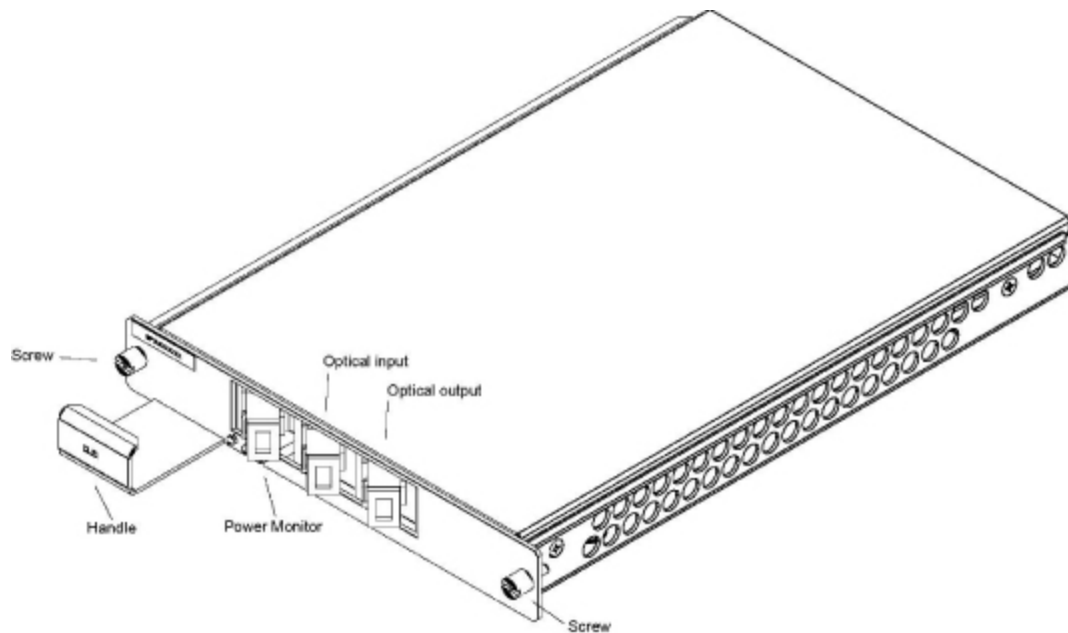


Figure 4-2 DWDM Optical Line Amplifier (OLA)

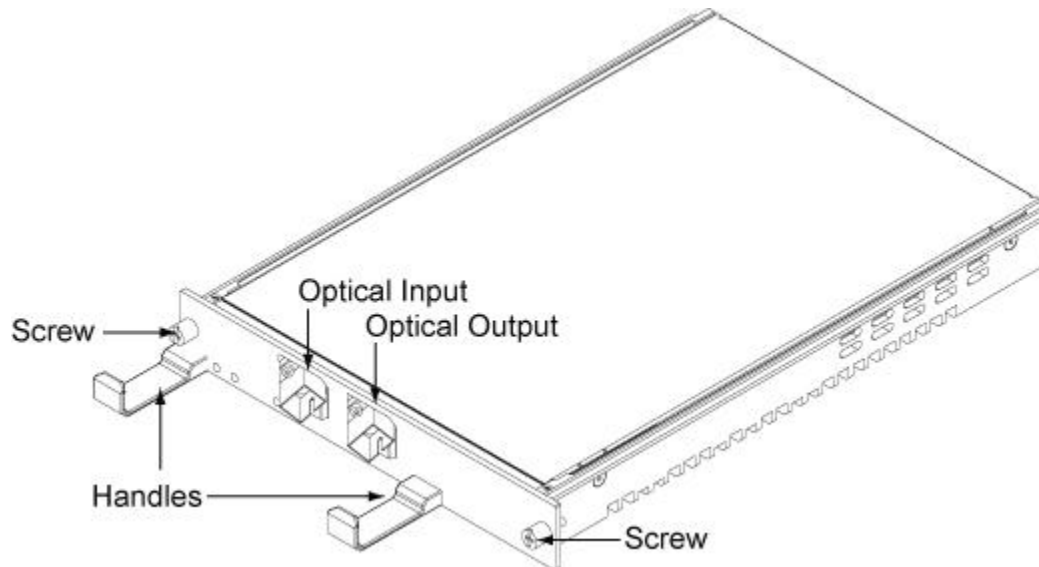


Figure 4-3 Optical Line Amplifier with Mid-Stage Access (OLAM)

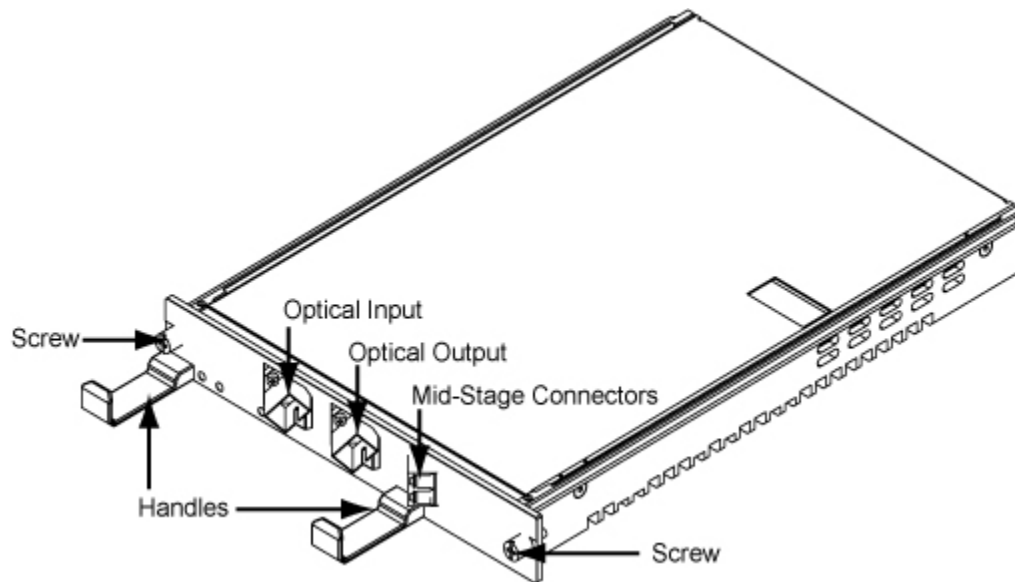


Figure 4-4 DWDM C-Band Low and Mid Gain Amplifiers (LGA/MGA)

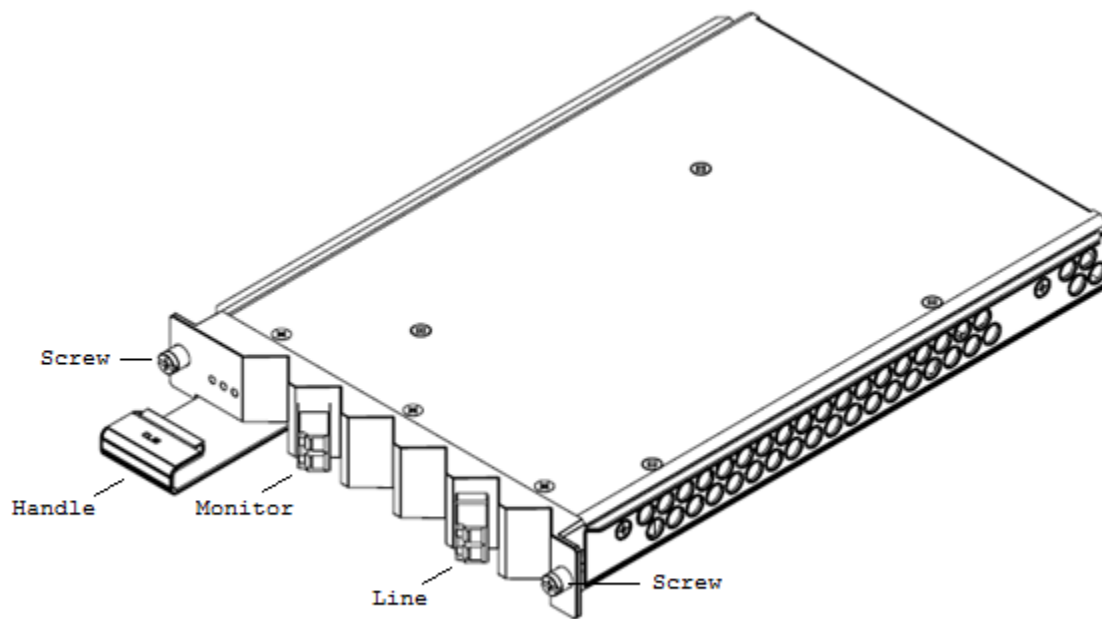
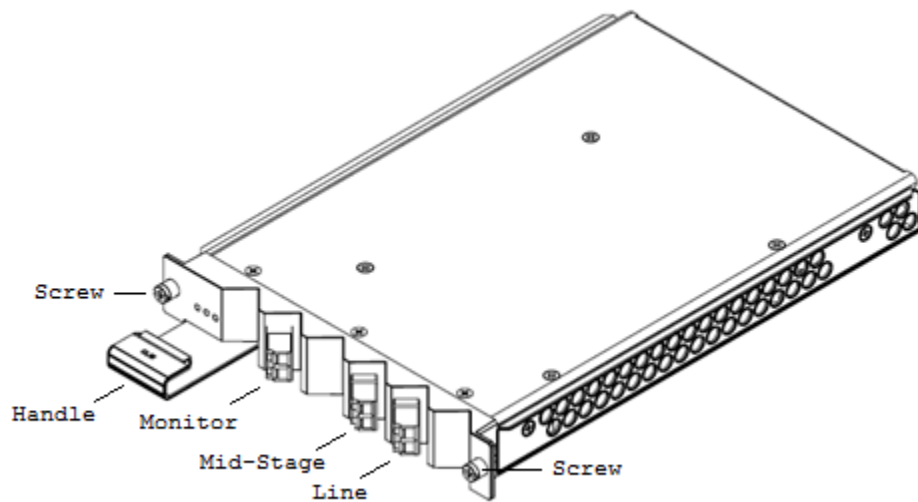


Figure 4-5 DWDM C-Band Mid Gain Amplifier with Mid-Stage Access (MGM)**Installation procedure**

Follow these steps to install an Optical Amplifier module:

Step 1 Insert the Amplifier Module

- a) Align the module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.
- c) Push with sufficient pressure until the LEDs come on and the faceplate of the module matches the position of the adjacent module.

Step 2 Attach the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the two faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 3 Inspect and clean the Ends of the Fiber Optic Cables

Use lint-free pads with isopropyl alcohol to clean the ends of the fiber optic cables if required.

Step 4 Connect the Optical Cables

Connect the input and output cables to the faceplate of the module.

Step 5 Replace Cables

If any cables were moved to access the slot, replace the cables to their original locations.

You have successfully completed this procedure.

Note A replacement kit of five sets of UC (FC, SC, and ST) removable connector caps is orderable as item BP1A5035.

4.2 Installing DCF-Type Dispersion Compensation modules

Use this procedure to install any DCF-Type Dispersion Compensation module (DCM).

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Dispersion Compensation module
- Isopropyl alcohol and lint-free pads
- 1.25mm and 2.5mm HUXcleaners (recommended)

Prerequisites

- None



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).



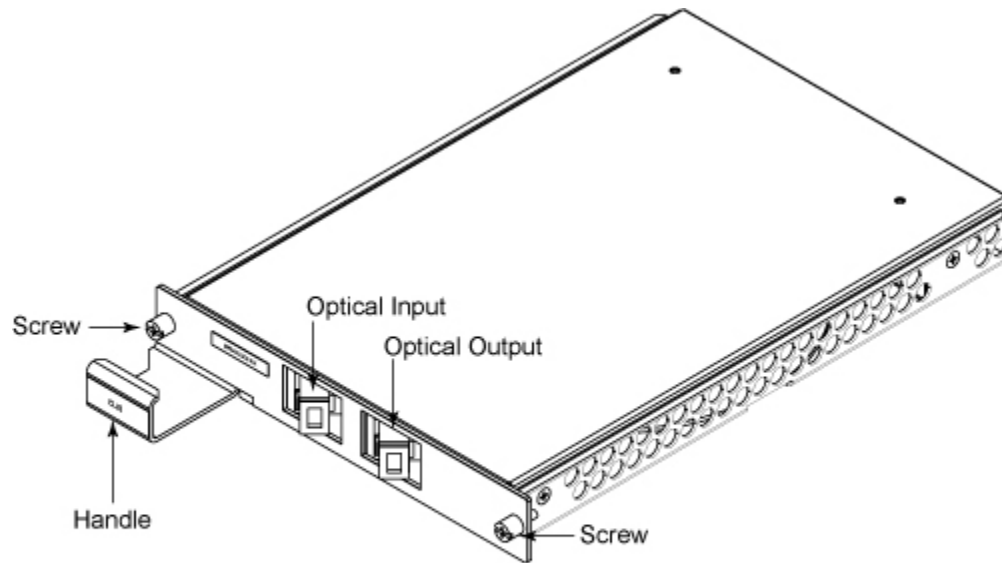
Laser

Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Key installation features

The following figure shows a DCM and indicates the key features for installation.

Figure 4-6 DCF-Type Dispersion Compensation module



Installation procedure

Follow these steps to install a DCF-Type Dispersion Compensation module:

Step 1 Insert the Module

- a) Align the module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.
- c) Push with sufficient pressure until the LEDs come on and the faceplate of the module matches the position of the adjacent module.

Step 2 Attach the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the two faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 3 Clean the Ends of the Optical Cables

Use lint-free pads with isopropyl alcohol to clean the ends of the fiber optic cables.

Step 4 Connect the Optical Cables

According to the deployment configuration, connect the input and output optical cables to the faceplate of the module.

Step 5 Replace the Cables

If any cables were moved to access the slot, replace the cables to their original locations.

You have successfully completed this procedure.

4.3 Installing Expandable Dispersion Compensation Modules

Use this procedure to install any Expandable Dispersion Compensation Module (DCM).

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Dispersion Compensation module
- Isopropyl alcohol and lint-free pads
- 1.25mm and 2.5mm HUXcleaners (recommended)

Prerequisites

- None



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

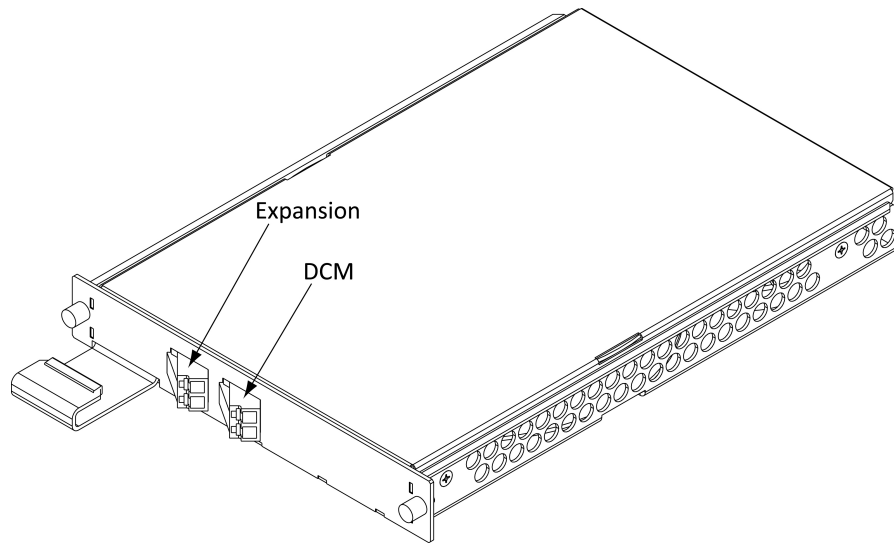


Laser

Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Key installation features

The following figure shows a DCM and indicates the key features for installation.

Figure 4-7 Expandable Dispersion Compensation Module**Installation procedure**

Follow these steps to install an Expandable Dispersion Compensation Module:

Step 1 Insert the Module

- a) Align the module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.
- c) Push with sufficient pressure until the LEDs come on and the faceplate of the module matches the position of the adjacent module.

Step 2 Attach the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the two faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 3 Clean the Ends of the Optical Cables

Use lint-free pads with isopropyl alcohol to clean the ends of the fiber optic cables.

Step 4 Connect the Optical Cables

According to the deployment configuration, connect the input and output optical cables to the faceplate of the module.

Step 5 Replace the Cables

If any cables were moved to access the slot, replace the cables to their original locations.

You have successfully completed this procedure.

5.0 Connecting fibers between modules

This section provides information about connecting an amplifier with mid-stage access (e.g. OLAM, MGM) to a Dispersion Compensation module.

- [5.1, “Connecting fibers between an amplifier with mid-stage access and a DCM ”](#)

5.1 Connecting fibers between an amplifier with mid-stage access and a DCM

Use the following procedure to connect the fiber patch cables between an amplifier with mid-stage access (e.g. OLAM, MGM) and a Dispersion Compensation module (DCM).

Note For on-shelf optical connections and intrashelf connections, BTI recommends using short 0.5 m fiber patch cords.

- Step 1** For convenience, provision the amplifier and DCM modules adjacent to each other.
- Step 2** Using a fiber patch cable with LC connectors on both ends, connect the fibers to the appropriate input and output LC connectors on the DCM.
- Step 3** Carefully wrap the fiber patch cable around the fiber management spool to take up slack in the fibers.
- Step 4** Connect the other ends of the fiber patch cables to the appropriate second-stage input and first-stage output connectors on the amplifier.
- Step 5** Connect the first-stage input and second-stage output connectors on the amplifier to their respective output and input fibers on the DCM.

Note Do not wrap the main input and output fibers around the fiber management spool. Use an appropriate fiber slack management system inside the rack or cabinet to manage the main input and output optical fibers.

6.0 Management interfaces

This section provides a brief overview about each management interface you can use to provision, monitor, and administer Optical Amplifiers and Dispersion Compensation modules.

- 6.1, “proNX 900 Node Controller, CLI, TL1, SNMP, and proNX Service Manager”

6.1 proNX 900 Node Controller, CLI, TL1, SNMP, and proNX Service Manager

proNX 900 Node Controller

proNX 900 Node Controller (proNX 900) provides a graphical user interface you can use to provision, operate, monitor, and troubleshoot all BTI 7000 Series modules. This interface provides a representational view of the physical configuration of each shelf in the network, and the modules in each shelf. For information about using the proNX 900 Node Controller, see the *proNX 900 Node Controller Online Help*.

CLI

The CLI is used to configure, monitor, and maintain packetVX and other modules. The CLI does not support all BTI 7000 Series modules. For information about using CLI commands, see the *CLI Reference Guide*.

TL1

The BTI 7000 Series supports a comprehensive and interactive Transaction Language One (TL1) interface, based on Telcordia standards, including GR-831, GR-199-CORE, and GR-833-Core. For information about using TL1 commands to provision, monitor, and administer BTI 7000 Series modules, see the *TL1 Reference Guide*.

SNMP

The BTI SNMP implementation supports SNMP Version 1 (SNMPv1) as defined in RFCs 1155, 1157, 1212, 1213, and 1215. The SNMP implementation also supports SNMPv2c as defined in RFCs 1901 through 1907. For information about the BTI SNMP implementation, see the *SNMP Overview Guide*.

proNX Service Manager

The proNX Service Manager provides proactive, service-centric management of network resources using tools closely aligned with service providers' own business processes. It is designed to simplify network operations from visualization and activation of services to troubleshooting and supporting end customers. For more information, see the *proNX Service Manager User Guide*.

7.0 Provisioning Optical Amplifiers and Dispersion Compensation modules

This section provides information about provisioning Optical Amplifier modules and Dispersion Compensation modules.

- [7.1, “Provisioning Optical Amplifier modules”](#)
- [7.2, “Provisioning amplifier settings”](#)
- [7.3, “Provisioning Dispersion Compensation modules”](#)
- [7.4, “Editing Dispersion Compensation module ports”](#)

7.1 Provisioning Optical Amplifier modules

Optical Amplifier modules may be provisioned before they are physically present in the shelf.

Autoprovisioning support on Optical Amplifier modules

Optical amplifier modules support autoprovisioning. For detailed information about autoprovisioning, see the *Operations Guide*.

When an Optical Amplifier module is inserted into an unprovisioned slot in a shelf, the module is autoprovisioned with its primary state set to the same value as the AUTOP parameter. The supported amplifier is autoprovisioned with its primary state set to the same value as the module, and all provisionable parameters are set to default values.

Provisioning settings and custom settings

When you provision an Optical Amplifier module, you specify settings such as its name and its Product Equipment Code, and provide brief ID information about the module. You can also provision custom information to record information specific to your environment. For example, you may want to record information about equipment usage, upgrades, and maintenance.

An Optical Amplifier module must be provisioned before the amplifier supported on the module can be provisioned. For information, see [7.2, “Provisioning amplifier settings”](#).

When a module is physically present in the shelf, the system checks to see if the module type matches the provisioned Optical Amplifier module type. If the inserted module type does not match the provisioned module type, an equipment mismatch alarm is raised. The alarm clears when the proper module type is inserted or when the provisioning data is updated to resolve the mismatch.

Displaying module information

Once an Optical Amplifier module is provisioned, you can view the settings specified when the module was provisioned, as well as inventory information, such as the module's hardware release number and date of manufacture.

Removing and restoring service

An Optical Amplifier module should be removed from service before it is deleted, so that alarms are not raised. A module that has been removed from service can be restored to service.

Restarting a module

Optical Amplifier modules support both cold and warm restarts. A warm restart lets you restart the software on the module. Although a warm restart is not service affecting, you cannot make configuration changes to the module while the warm restart is in process. A cold restart recycles the power on the module and is service affecting.

Deleting a module

If you want to change the type of Optical Amplifier module that is either preprovisioned or physically present in a shelf, you must first delete it.

This section covers the following topics:

- [7.1.1, “Provision an Optical Amplifier module”](#)
- [7.1.2, “Display Optical Amplifier module information”](#)
- [7.1.3, “Remove an Optical Amplifier module from service”](#)
- [7.1.4, “Restore an Optical Amplifier module to service”](#)
- [7.1.5, “Restart an Optical Amplifier module”](#)
- [7.1.6, “Delete an Optical Amplifier module”](#)

7.1.1 Provision an Optical Amplifier module

Use this procedure to provision an Optical Amplifier module.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Shelf must be provisioned.
- Based on the calculations and choices made during the design of the optical link, the following criteria must be known:
 - type of amplifier to be provisioned
 - physical slot in the shelf that the amplifier is to be inserted

Provisioning module settings

Follow these steps to provision an Optical Amplifier module:

- Step 1** In the Navigation pane, right-click a slot, and then click **Provision Module**.
- Step 2** On the **Settings** tab of the **Provision Module** dialog, select an amplifier module in the **Name** list.
- The first available product equipment code (PEC) and, if available, the Common Language Equipment Identification (CLEI) code for the selected module type automatically appear in the **PEC/CLEI** list.
- Step 3** Select the PEC for the module type from the **PEC/CLEI** list.
- Step 4** Optionally, enter information (up to 20 alphanumeric characters) about the module in the **ID** field.
- Step 5** Choose one of the following from the **Initial State** list:

- **IS** — to set the state of the module to In Service
- **OOS** — to set the state of the module to Out of Service

Step 6 Click **Apply**.

Step 7 Optionally, click the **Custom Settings** tab, and then enter information in any of the **Custom** fields.

Step 8 Click **Apply**.

Step 9 Optionally, click **Provision Amplifier** to provision settings for the supported amplifier. For detailed information, see [7.2.1, “Provision amplifier settings”](#).

You have successfully completed this procedure.

7.1.2 Display Optical Amplifier module information

Use this procedure to view inventory information for an Optical Amplifier module.



Prerequisites

- Optical Amplifier module must be provisioned.

Displaying module information

Follow these steps to view inventory information for an Optical Amplifier module:

Step 1 In the toolbar, click the System Configuration icon. The System Configuration view displays.

Step 2 In the Navigation pane, right-click a module, and then click **Display Module Inventory**. The **Display Inventory Information** dialog displays **General**, **Hardware**, **Manufacturing**, and **Testing** parameters for the Optical Amplifier module. See [Table 7-1](#).

Step 3 Click **Close**.

You have successfully completed this procedure.

Table 7-1 Module inventory information

Type	Parameter	Description
General	Full Name	Official name of the module
	Name	Short name of the module
	Shelf Number	The shelf in which the module is installed

Table 7-1 Module inventory information (Continued)

Type	Parameter	Description
Hardware	Slot Number	The slot in which the module is installed
	PEC Code	The product equipment code assigned by the manufacturer
	CLEI Code	The Common Language Equipment Identifier number assigned by Telcordia. The CLEI identifies the physical hardware.
	Release Number	The hardware release number
	Serial Number	The serial number of the module
Manufacturing	Manufacturing Date	The date that the module was manufactured
	Manufacturing Location	The location where the module was manufactured
Testing	Testing Date	The date that the manufacturer tested the module
	Testing Location	The location where the manufacturer tested the module

7.1.3 Remove an Optical Amplifier module from service

Use this procedure to remove an Optical Amplifier module from service.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Optical Amplifier module must be provisioned.

Removing a module from service

Follow these steps to remove an Optical Amplifier module from service:

- Step 1** In the Navigation pane, right-click a module, and then click **Provision Module**.
- Step 2** On the **Settings** tab of the **Provision Module** dialog, click the **Remove** button beside the **State** field.
- Step 3** Click **Yes** in the confirmation dialog.

You have successfully completed this procedure.

7.1.4 Restore an Optical Amplifier module to service

Use this procedure to restore an Optical Amplifier module to service.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Optical Amplifier module must be removed from service.

Restore a module to service

Follow these steps to restore an Optical Amplifier module to service:

- Step 1** In the Navigation pane, right-click a module, and then click **Provision Module**.
- Step 2** On the **Settings** tab of the **Provision Module** dialog, click the **Restore** button beside the **State** field.
- Step 3** Click **Apply**.

You have successfully completed this procedure.

7.1.5 Restart an Optical Amplifier module

Use this procedure to restart an Optical Amplifier module.



Prerequisites

- Optical Amplifier module must be provisioned.

Restarting a module

Follow these steps to perform a cold or warm restart on an Optical Amplifier module:

- Step 1** In the Navigation pane, right-click a module, select **Restart Module**, and then click one of the following:
- **Warm Restart** — to restart the software on the module
 - **Cold Restart** — to cycle the power on the module

- Step 2** In the **Restart** confirmation dialog, click **Yes**.

You have successfully completed this procedure.

Note A CONTCOM (Control Communications Failure with Circuit Pack) alarm is raised during a cold or warm restart of an Optical Amplifier module. For information about this alarm, see the *Alarm and Troubleshooting Guide*.

7.1.6 Delete an Optical Amplifier module

Use this procedure to delete an Optical Amplifier module.



Prerequisites

- The Optical Amplifier module must be removed from service.

Deleting a module

Follow these steps to delete an Optical Amplifier module:

Step 1 In the Navigation pane, right-click a module, and then click **Delete Module**.

Step 2 In the **Delete Module** confirmation dialog, click **Yes**.

You have successfully completed this procedure.

7.2 Provisioning amplifier settings

Amplifier settings for an Optical Amplifier module may be provisioned before the module is physically present in the shelf; however, the Optical Amplifier module must be provisioned. For information, see [7.1, “Provisioning Optical Amplifier modules”](#).

Provisioning settings and custom settings

When you provision amplifier settings, you specify whether the amplifier will operate in Constant Gain or Constant Power mode, and then specify related settings such as Target Signal Gain or Target Output Power, and Tilt Compensation. You can also provision custom information to record information specific to your environment. For example, you may want to record the type of fiber connected to the amplifier and the ITU-T grid number.

Alarm threshold settings

Amplifiers are preconfigured with default minimum and maximum threshold values for system-level alarms (for example, Optical Power Received, Optical Power Transmitted, and Laser Temperature). You can provision threshold settings for any system-level alarm to a value within the default range.

Displaying amplifier information

Once amplifier settings are provisioned, you can view the settings specified when the amplifier was provisioned, as well as non-provisionable parameters, such as the amplifier's operational status and the laser status.

Removing and restoring service

An amplifier should be removed from service before it is deleted or its settings changed. An amplifier that has been removed from service can be restored to service.

Deleting an amplifier

When you no longer need an amplifier, you can delete it.

This section covers the following topics:

- [7.2.1, “Provision amplifier settings”](#)
- [7.2.2, “Modify amplifier settings”](#)
- [7.2.3, “Display amplifier information”](#)
- [7.2.4, “Remove an amplifier from service”](#)
- [7.2.5, “Restore an amplifier to service”](#)
- [7.2.6, “Delete an amplifier”](#)

7.2.1 Provision amplifier settings

Use this procedure to provision settings for an amplifier supported on an Optical Amplifier module.



Prerequisites

- Optical Amplifier module must be provisioned.

Provisioning amplifier settings

Follow these steps to provision settings for an amplifier:

- Step 1** In the Navigation pane, right-click an amplifier on an Optical Amplifier module, and then click **Provision Amplifier**.
- Step 2** On the **Amplifier** tab of the **Provision Amplifier** dialog, specify values for the amplifier parameters. For information, see [7.2.1.1, “Amplifier settings, timers, and state management parameters”](#).
- Step 3** Click **Apply**.
- Step 4** Optionally, click the **Alarm Thresholds** tab, and specify values for any alarm threshold. For information, see [7.2.1.2, “Amplifier alarm thresholds”](#).
- Step 5** Click **Apply**.

You have successfully completed this procedure.

7.2.1.1 Amplifier settings, timers, and state management parameters

The following table provides information about provisionable and non-provisionable parameters for Optical Amplifier modules.

Table 7-2 Amplifier provisionable parameters

Parameter	Range	Description
Provisioned Mode	Constant Gain	The output power varies directly with the input power, providing a constant amount of gain. This is the default mode and the recommended setting.
	Constant Power	The output power is fixed (i.e., user specified) regardless of the level of input power. This setting should be used for single channel applications only.
Target Signal Gain	OBA: 10.0 dB	Note This parameter is used when Provisioned Mode = Constant Gain.
	OLA: 16.0 to 26.0 dB	
	OLAM: 19.0 to 29.0 dB	
	OPA: 24.0 dB	

Table 7-2 Amplifier provisionable parameters

Parameter	Range	Description
	SPA: 27.0 dB	
	SBA: 18.0 dB	
	LGA: 5.0 to 16.0 dB (default 5.0)	
	MGA: 16.0 to 26.0 dB (default 16.0)	
	MGM: 19.0 to 29.0 dB (default 19.0)	

Table 7-2 Amplifier provisionable parameters (Continued)

Parameter	Range	Description
Target Output Power	OBA: -5 to 18 dBm	The power of the transmitted signal Note This parameter is used when Provisioned Mode = Constant Power.
	OLA: -7 to 16 dBm	
	OLAM: -5 to 18 dBm	
	OPA: -8 to 8 dBm	
	SPA: -8 to 5 dBm	
	SBA: 3 to 19 dBm	
	LGA: -5 to 20 dBm (default -5)	
	MGA: -7 to 16 dBm (default -7)	
	MGM: -7 to 18 dBm (default -7)	
Channel	SPA, SPB: 1530.33nm to 1561.42nm (40 channels ITU Grid)	The wavelength to be amplified by the SPA or SBA
Tilt Compensation	OLAM: -3.0 to 3.0 dB	The value by which to compensate for the tilt introduced by the external device or fiber in the output power profile. The default setting is 0 dB.
	LGA: -3.0 to 3.0 dB	
	MGA: -3.0 to 3.0 dB	
	MGM: -3.0 to 3.0 dB	
Auto-In Service Timer	00-00 to 96-00	The automatic in-service timer for the amplifier in the format HH-MM. The default is 08-00.
Initial State	IS	The initial state of the amplifier. Note The amplifier defaults to the initial state of the module.
	OOS	
	AINS	
ID 1, ID 2	Up to 32 alphanumeric characters per field	Identifier information about the amplifier
Fiber Type	DSF	The fiber type that connects to the amplifier
	NDSF	
	NZDSF	
Custom 1, Custom 2, Custom 3	Up to 255 alphanumeric characters per field	Custom fields for operating company information.
Remote ID	Up to 255 alphanumeric characters per field	Identifier of the remote device connected to the local port. See the <i>proNX Service Manager User Guide</i> for more details.
Grid	LGA, MGA, MGM, OBA, OPA:	ITU-T wavelength grid number
	20nm	
	50GHz	
	100GHz	
	200GHz	
Number of channels	OBA, OPA: 0 to 40	The number of DWDM channels carried by the amplifier.
	LGA, MGA, MGM: 0 to 96	

Table 7-3 Amplifier read-only parameters

Parameter	Range	Description
Gain Room ¹ (refresh)	Not applicable	<p>The supported gain range. Depending on the input power level, this may be different from the stated gain range for this amplifier.</p> <p>Note Applies to LGA, MGA, MGM only.</p>
Tilt Compensation Room ² (calculate/refresh)	Not applicable	<p>The usable range for tilt compensation is dependent on the VOA setting of the amplifier. The VOA cannot fall below 0. The calculator takes into account the VOA setting to quickly show the usable range for the amplifier. This range may be different from the stated tilt compensation range for this amplifier.</p>
Monitor Port Loss	Not applicable	<p>The loss through the monitor port. This tap loss can be used to calibrate external instruments connected to the monitor port.</p> <p>Note Applies to LGA, MGA, MGM only.</p>
Active Auto-In Service Timer	Hours-Minutes	The time left on the AINS timer in the format HH-MM.
State	IS OOS	The operational state of the amplifier.
Amplifier Mode	Constant Output Constant Gain Eye Safe Shutdown None	<p>Indicates the operational status of the amplifier.</p> <p>Note When the amplifier is removed from service, the laser turns off automatically.</p>
Laser Status	On Off	Indicates whether the laser is on or off

¹This is the range from the Gain Margin Minimum (gainmarmin) value to the Gain Margin Maximum (gainmarmax) value as seen from the CLI (TL1).

²This is the range from the Tilt Margin Minimum (tiltmarmin) value to the Tilt Margin Maximum (tiltmarmax) value as seen from the CLI (TL1).

Important For information about Eye Safe mode, see [Appendix A, “Optical Backreflection Safety feature”](#).

7.2.1.2 Amplifier alarm thresholds

The following table provides information about amplifier alarm thresholds.

Table 7-4 Amplifier alarm thresholds

Alarm	Description	Range	Default
Case Temperature High Alarm Threshold (CTEMP-HT)	OBA, OPA, OLA, OLAM, SBA, SPA:	45°C to 75°C	60°C

Table 7-4 Amplifier alarm thresholds (Continued)

Alarm	Description	Range	Default
	Raised when the temperature of the optical amplifier module exceeds the alarm threshold		
Case Temperature High Shutdown Threshold (CTEMP-HTS)	OBA, OPA, OLA, OLAM, SBA, SPA: Raised when the high temperature shutdown threshold for the optical amplifier module has been crossed	75°C	75°C
Optical Power Received Low Threshold (OPR-LT)	Raised when the input signal to the optical amplifier crosses below the lower threshold	OPA: -38 to -10 dBm OBA: -18 to 10 dBm OLA: -31 to -5 dBm OLAM: -31 to -5 dBm SBA: -18 to 9 dBm SPA: -38 to -10 dBm LGA: -26 to 7 dBm MGA: -38 to -3 dBm MGM: -42 to -4 dBm	-36 -16 -29 -29 -16 -36 -21 -33 -36
Optical Power Received High Threshold (OPR-HT)	Raised when the input signal to the optical amplifier crosses above the upper threshold	OPA: -35 to 0 dBm OBA: -15 to 11 dBm OLA: -28 to 1 dBm OLAM: -28 to -4 dBm SBA: -15 to 10 dBm SPA: -35 to -9 dBm LGA: -18 to 10 dBm MGA: -30 to 0 dBm MGM: -33 to -1 dBm	0 11 -4 -4 10 -9 10 0 -1
Optical Power Transmitted Low Threshold (OPT-LT)	Raised when the output signal from the optical amplifier crosses below the lower threshold	OPA: -11 to 10 dBm OBA: -8 to 20 dBm OLA: -10 to 16 dBm OLAM: -8 to 18 dBm SBA: 0 to 18 dBm SPA: -11 to 7 dBm LGA: -5 to 17 dBm MGA: -7 to 13 dBm MGM: -7 to 15 dBm	-9 -6 -8 -6 2 -9 -5 -7 -7
Optical Power Transmitted High Threshold (OPT-HT)	Raised when the output signal from the optical amplifier crosses above the higher threshold	OPA: 8 to 11 dBm OBA: -5 to 21 dBm OLA: -7 to 17 dBm OLAM: -5 to 19 dBm SBA: 3 to 19 dBm	11 21 17 19 19

Table 7-4 Amplifier alarm thresholds (Continued)

Alarm	Description	Range	Default
		SPA: -8 to 8 dBm	8
		LGA: -2 to 20 dBm	20
		MGA: -4 to 16 dBm	16
		MGM: -4 to 18 dBm	18
Optical Back Reflection High Shutdown Threshold	Raised when the optical power reflected back along the fiber from one or more reflective events exceeds the alarm threshold	OBA, OPA, OLA, OLAM, SBA, SPA: -4 dBm	-4 dBm
		LGA, MGA, MGM: -18 dBm	-18 dBm
Laser Temperature Low Shutdown Threshold	OBA, OPA, OLA, OLAM, SBA, SPA: Raised when the temperature of the pump laser is below the alarm threshold	16°C	16°C
Laser Temperature High Shutdown Threshold	OBA, OPA, OLA, OLAM, SBA, SPA: Raised when the temperature of the pump laser is above the alarm threshold	34°C	34°C
Mid-Stage Loss High Threshold (MSLOSS-HT)	OLAM, MGM: Raised when a mid-stage insertion loss high threshold is exceeded in a mid-stage amplifier	OLAM: 5 to 15	15
		MGM: 5 to 18	16
Second-Stage Input Optical Power Received High Threshold (SSIOPR-HT)	OLAM, MGM: Raised when a second stage input optical power received (OPR) high threshold has been crossed	OLAM: -16 to 7	5.5
		MGM: -27 to 20	20
Second-Stage Input Optical Power Received Low Threshold (SSIOPR-LT)	MGM: Raised when a second stage input optical power received (OPR) low threshold has been crossed	-30 to 17	-30
First-Stage Output Optical Power Transmitted High Threshold (FSOOPT-HT)	MGM: Raised when a first stage output optical power transmitted (OPT) high threshold has been crossed	-7 to 20	20
First-Stage Output Optical Power Transmitted Low Threshold (FSOOPT-LT)	MGM: Raised when a first stage output optical power transmitted (OPT) low threshold has been crossed	-25 to 15	-23
High Temperature Alarm Threshold (TEMPHT)	LGA, MGA, MGM: Raised when the temperature of the module is above the alarm threshold.	70°C	70°C
High Temperature Shutdown Threshold (TEMPHTS)	LGA, MGA, MGM: Raised when the temperature of the module is above the shutdown threshold.	80°C	80°C

7.2.2 Modify amplifier settings

Use this procedure to modify provisioned settings for an amplifier.



Prerequisites

- Amplifier must be removed from service.

Modifying amplifier settings

Follow these steps to modify provisioned settings for an amplifier:

- Step 1** In the Navigation pane, right-click an amplifier on an Optical Amplifier module, and then click **Provision Amplifier**.
- Step 2** On the **Amplifier** tab of the **Provision Amplifier** dialog, modify values for the parameters. For information, see [7.2.1.1, “Amplifier settings, timers, and state management parameters”](#).
- Step 3** Click **Apply**.
- Step 4** Optionally, click the **Alarm Thresholds** tab, and then modify the value for any alarm threshold. For information, see [7.2.1.2, “Amplifier alarm thresholds”](#).
- Step 5** Click **Apply**.

You have successfully completed this procedure.

7.2.3 Display amplifier information

Use this procedure to display information for an amplifier on an Optical Amplifier module.



Prerequisites

- Amplifier settings must be provisioned.

Displaying amplifier information

Follow these steps to display information for an amplifier:

- Step 1** In the Navigation pane, right-click an amplifier on an Optical Amplifier module, and then click **Provision Amplifier**.
- Step 2** In the **Provision Amplifier** dialog, click the **Amplifier**, **Custom Info**, or **Alarm Thresholds** tab to view amplifier information. For more information, see the following:
- [7.2.1.1, “Amplifier settings, timers, and state management parameters”](#)

- [7.2.1.2, “ Amplifier alarm thresholds”](#)

Step 3 Click **Close**.

You have successfully completed this procedure.

7.2.4 Remove an amplifier from service

Use this procedure to remove an amplifier from service on an Optical Amplifier module.



Prerequisites

- Amplifier settings must be provisioned.

Removing an amplifier from service

Follow these steps to remove an amplifier from service:

Step 1 In the Navigation pane, right-click an amplifier on an Optical Amplifier module, and then click **Provision Amplifier**.

Step 2 On the **Amplifier** tab of the **Provision Amplifier** dialog, click the **Remove** button beside the **State** field.

Step 3 Click **Yes** in the confirmation dialog.

You have successfully completed this procedure.

7.2.5 Restore an amplifier to service

Use this procedure to restore an amplifier to service on an Optical Amplifier module..



Prerequisites

- Amplifier must be out of service.

Restore an amplifier to service

Follow these steps to restore an amplifier to service:

Step 1 In the Navigation pane, right-click an amplifier on an Optical Amplifier module, and then click **Provision Amplifier**.

Step 2 On the **Amplifier** tab of the **Provision Amplifier** dialog, click the **Restore** button beside the **State** field.

Step 3 Click **Close**.

You have successfully completed this procedure.

7.2.6 Delete an amplifier

Use this procedure to delete an amplifier on a Optical Amplifier module.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Amplifier must be removed from service.

Deleting an amplifier

Follow these steps to delete an amplifier:

Step 1 In the Navigation pane, right-click an amplifier on an Optical Amplifier module, and then click **Delete Amplifier**.

Step 2 In the **Delete Amplifier** confirmation dialog, click **Yes**.

You have successfully completed this procedure.

7.3 Provisioning Dispersion Compensation modules

Dispersion Compensation modules may be provisioned before they are physically present in the shelf.

Provisioning settings and custom settings

When you provision a Dispersion Compensation module, you specify settings such as its name and its Product Equipment Code, and provide brief ID information about the module. You can also provision custom information to record information specific to your environment. For example, you may want to record information about equipment usage, upgrades, and maintenance.

A Dispersion Compensation module must be provisioned before the port settings on the module can be edited. For information, see [7.4.1, “Edit Dispersion Compensation module port settings”](#).

When a module is physically present in the shelf, the system checks to see if the module type matches the provisioned Dispersion Compensation module type. If the inserted module type does not match the provisioned module type, an equipment mismatch alarm is raised. The alarm clears when the proper module type is inserted or when the provisioning data is updated to resolve the mismatch.

Displaying module information

Once a Dispersion Compensation module is provisioned, you can view the settings specified when the module was provisioned, as well as inventory information, such as the module's hardware release number and date of manufacture.

Removing and restoring service

A Dispersion Compensation module should be removed from service before it is deleted. A module that has been removed from service can be restored to service.

Deleting a module


If you want to change the type of Dispersion Compensation module that is either preprovisioned or physically present in a shelf, you must first delete it.

This section covers the following topics:

- [7.3.1, “Provision a Dispersion Compensation module”](#)
- [7.3.2, “Display Dispersion Compensation module information”](#)
- [7.3.3, “Remove a Dispersion Compensation module from service”](#)
- [7.3.4, “Restore a Dispersion Compensation module to service”](#)
- [7.3.5, “Delete a Dispersion Compensation module”](#)

7.3.1 Provision a Dispersion Compensation module

Use this procedure to provision settings for a Dispersion Compensation module.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Shelf must be provisioned.

Provisioning module settings

Follow these steps to provision settings on a Dispersion Compensation module:

- Step 1** In the Navigation pane, right-click a slot, and then click **Provision Module**.
- Step 2** On the **Settings** tab of the **Provision Module** dialog, choose a module in the **Name** list.
The first available product equipment code (PEC) and, if available, the Common Language Equipment Identification (CLEI) code for the selected module type automatically appear in the **PEC/CLEI** list.
- Step 3** Select the PEC for the module type from the **PEC/CLEI** list.
- Step 4** Optionally, enter information (up to 20 alphanumeric characters) about the module in the **ID** field.
- Step 5** Choose one of the following from the **Initial State** list:
- **IS** — to set the state of the module to In Service
 - **OOS** — to set the state of the module to Out of Service
- Step 6** Click **Apply**.
- Step 7** Optionally, click the **Custom Settings** tab, and then enter information in any of the **Custom** fields.
- Step 8** Click **Close**.

You have successfully completed this procedure.

7.3.2 Display Dispersion Compensation module information

Use this procedure to display inventory information for a Dispersion Compensation module.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Dispersion Compensation module must be provisioned.

Displaying module information

Follow these steps to display inventory information for a Dispersion Compensation module:

Step 1 In the Navigation pane, right-click a module, and then click **Display Module Inventory**.

The **Display Inventory Information** dialog displays **General**, **Hardware**, **Manufacturing**, and **Testing** parameters for the Dispersion Compensation module. See [Table 7-5](#).

Step 2 Click **Close**.

You have successfully completed this procedure.

Table 7-5 Module inventory information

Type	Parameter	Description
General	Full Name	Official name of the module
	Name	Short name of the module
	Shelf Number	The shelf in which the module is installed
	Slot Number	The slot in which the module is installed
Hardware	PEC Code	The product equipment code assigned by the manufacturer
	CLEI Code	The Common Language Equipment Identifier number assigned by Telcordia. The CLEI identifies the physical hardware.
	Release Number	The hardware release number
	Serial Number	The serial number of the module
Manufacturing	Manufacturing Date	The date that the module was manufactured
	Manufacturing Location	The location where the module was manufactured
Testing	Testing Date	The date that the manufacturer tested the module
	Testing Location	The location where the manufacturer tested the module

7.3.3 Remove a Dispersion Compensation module from service

Use this procedure to remove a Dispersion Compensation module from service.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- Dispersion Compensation module must be in service.

Removing a module from service

Follow these steps to remove a Dispersion Compensation module from service:

Step 1 In the Navigation pane, right-click a module, and then click **Provision Module**.

Step 2 On the **Settings** tab of the **Provision Module** dialog, click the Remove button beside the **State** field.

Step 3 Click **Close**.

You have successfully completed this procedure.

7.3.4 Restore a Dispersion Compensation module to service

Use this procedure to restore a Dispersion Compensation module to service.



Prerequisites

- Dispersion Compensation module must be removed from service.

Restore a module to service

Follow these steps to restore a Dispersion Compensation module to service:

Step 1 In the Navigation pane, right-click a module, and then click **Provision Module**.

Step 2 On the **Settings** tab of the **Provision Module** dialog, click the **Restore** button beside the **State** field.

Step 3 Click **Close**.

You have successfully completed this procedure.

7.3.5 Delete a Dispersion Compensation module

Use this procedure to delete a Dispersion Compensation module.



Prerequisites

- Dispersion Compensation module must be removed from service.

Deleting a module

Follow these steps to delete a Dispersion Compensation module:

Step 1 In the Navigation pane, right-click a module, and then click **Delete Module**.

Step 2 In the **Delete Module** confirmation dialog, click **Yes**.

You have successfully completed this procedure.

7.4 Editing Dispersion Compensation module ports

The port on a Dispersion Compensation module may be provisioned before the module is physically present in the shelf; however, the Dispersion Compensation module must be provisioned. For information, see [7.3, “Provisioning Dispersion Compensation modules”](#).

Editing port settings

When you provision the port on a Dispersion Compensation module, you can provide brief ID information about the port, as well as the type of fiber connected to it. You can also provision custom information to record information specific to your environment.

Displaying and modifying DCM module port information

Once a port on a Dispersion Compensation module is provisioned, you can view the settings specified when the port was provisioned, and you can modify any of this information.

This section covers the following topics:

- [7.4.1, “Edit Dispersion Compensation module port settings”](#)
- [7.4.2, “Display Dispersion Compensation module port information”](#)

7.4.1 Edit Dispersion Compensation module port settings

Use this procedure to edit port settings for a Dispersion Compensation module (DCM).

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- DCM must be provisioned.

Editing port settings

Follow these steps to edit port settings for a Dispersion Compensation module:

Step 1 In the Navigation pane, right-click a port on a DCM, and then click **Edit Port**.

Step 2 In the **Edit DCM Port** dialog, enter values for the following port parameters:

- **ID 1, ID 2** — up to 32 alphanumeric characters per field to identify the DCM port

Note The information you enter in the **ID 1** field appears at the port in the Navigation pane.

- **Fiber Type** — the type of fiber that connects to the port. Select one of the following from the list:
 - **DSF**
 - **NDSF**

- **NZDSF**
- **Grid** — the ITU-T grid number (C-Band DCMs only)
- **Custom 1, Custom 2, Custom 3** — up to 255 alphanumeric characters per field for information specific to the operating environment

Step 3 Click **Apply**.

You have successfully completed this procedure.

7.4.2 Display Dispersion Compensation module port information

Use this procedure to display information for a port on a Dispersion Compensation module (DCM).



Prerequisites

- DCM port must be provisioned.

Displaying module information

Follow these steps to display information for a DCM port:

Step 1 In the Navigation pane, right-click a port on a DCM module, and then click **Edit Port**.

The **Edit DCM Port** dialog displays the following information for the port.

- **ID 1, ID 2** — information identifying the DCM port
- **Fiber Type** — the type of fiber that connects to the port
- **Grid** — the ITU-T grid number (C-Band DCMs only)
- **Custom 1, Custom 2, Custom 3** — information specific to the operating environment

Step 2 Optionally, modify any of the parameter values, and then click **Apply**,

Step 3 Click **Close**.

You have successfully completed this procedure.

8.0 Performance monitoring

This section provides information about monitoring performance metrics for amplifiers. For more information about performance metrics, see the *Operations Solution Guide*.

- 8.1, “Retrieve and export active PMs for amplifiers”
- 8.2, “Retrieve and export historical PMs for amplifiers”
- 8.3, “ Amplifier PMs”

8.1 Retrieve and export active PMs for amplifiers

Use this procedure to retrieve and, if required, export active performance metrics (PMs) for an amplifier.



Prerequisites

- The Optical Amplifier must be present in the shelf and the amplifier settings must be provisioned.

Step 1 In the Navigation pane, right-click the Optical Amplifier module and select **View Amplifier PM...**

Step 2 The Performance tab of the Provision Amplifier window appears.

Step 3 Specify the **Refresh** setting.

This is the frequency that you want the data to be updated (from 5 to 3600 seconds).

Step 4 Specify the **Bin Type**.

Step 5 Optionally, click **Clear Counter** to clear a specific counter. This command can be performed at any time.

Step 6 Click **Start**.

The PM measurements are run and the values captured.

Step 7 Click **Stop** to stop PM collection.

Step 8 Optionally, click **Export** to save the data retrieved to CSV (.csv) or text (.txt) format.

You have successfully completed this procedure.

8.2 Retrieve and export historical PMs for amplifiers

Use this procedure to view historical performance metrics (PMs) for an amplifier.

Authorization Required

Superuser

Provisioning

Maintenance

Surveillance

Prerequisites

- The Optical Amplifier module must be present in the shelf, and the amplifier settings must be provisioned.

Retrieving and exporting historical PMs

Follow these steps to retrieve and, if required, export historical PMs for an amplifier:

Step 1 In the Navigation pane, click an Optical Amplifier module.

Step 2 On the **View** menu, choose **Performance Monitoring**.

Step 3 Click the **Historical PM** tab in the **Performance Monitoring** window.

Step 4 Click one of the following option buttons:

- **15 Min Bins** — to retrieve PMs for the 15-minute period you set using the **From** and **To** lists
- **1 Day Bin** — to retrieve PMs for the most recent 24-hour period

Step 5 Select a PM parameter from the **Parameters** list, and then click **Apply**.

The PM data for the parameter appears as a chart report on the **Chart** tab if you specified a 15-minute bin, and as a table report on the **Table** tab if you specified a 1-day bin.

Note The chart report provides the actual values and indicates the high and low thresholds for the parameter. Hover text at each collection point on the chart indicates the time and value of the PM. The table report provides the present value for each parameter.

Step 6 Optionally, click **Export** to save the data retrieved to CSV (.csv) or text (.txt) format.

Step 7 Repeat steps 4 to 6 for each parameter whose data you want to retrieve and, if required, export.

You have successfully completed this procedure.

8.3 Amplifier PMs

Table 8-1 Optical Amplifier PMs (gauges)

PM (montype)	Supported modules
CTEMP Case Temperature measures the amplifier's case temperature in degrees Celsius	OBA OPA OLA OLAM SBA SPA
EFFGAIN Effective Gain measures the amplifier's effective gain level in dB	All
Note The EFFGAIN is compensated for amplified spontaneous emissions (ASE).	
L1CUR Laser One Current measures the amplifier's laser number one current in milliamperes	OLA OLAM
L1PWR Laser One Power measures the amplifier's laser one's power in milliwatts	OLA OLAM
L1TEMP Laser One Temperature measures the amplifier's laser one's temperature in degrees Celsius	OLA OLAM
L2CUR Laser Two Current measures the amplifier's laser two's current in milliamperes	OBA OPA OLA OLAM SBA SPA
L2PWR Laser Two Power measures the amplifier's laser two's power in milliwatts	OBA OPA OLA OLAM SBA SPA
L2TEMP Laser Two Temperature measures the amplifier's laser two's temperature in degrees Celsius	OBA OPA OLA OLAM SBA SPA
OBR	All

Table 8-1 Optical Amplifier PMs (gauges) (Continued)

PM (montype)	Supported modules
Optical Backreflection measures the amplifier's optical backreflection level in dB	
OPR	All
Optical Power Received measures the amplifier's optical power received level in dBm	
OPR-MIN	LGA
Optical Power Received Minimum measures the amplifier's minimum optical power received level in dBm	MGA
	MGM
OPR-MAX	LGA
Optical Power Received Maximum measures the amplifier's maximum optical power received level in dBm	MGA
	MGM
OPR-AVG	LGA
Optical Power Received Average measures the amplifier's average optical power received level in dBm	MGA
	MGM
OPT	All
Optical Power Transmitted measures the amplifier's optical power transmitted level in dBm	
OPT-MIN	LGA
Optical Power Transmitted Minimum measures the amplifier's minimum optical power transmitted level in dBm	MGA
	MGM
OPT-MAX	LGA
Optical Power Transmitted Maximum measures the amplifier's maximum optical power transmitted level in dBm	MGA
	MGM
OPT-AVG	LGA
Optical Power Transmitted Average measures the amplifier's average optical power transmitted level in dBm	MGA
	MGM
FSOOPT	OLAM
First-stage output optical power transmitted measures the amplifier's first-stage output optical power transmitted level in dBm	MGM
SSIOPR	OLAM
Second-Stage Input Optical Power Received measures the amplifier's second-stage input optical power received level in dBm	MGM
MSLOSS	OLAM
Mid-stage insertion loss measures the amplifier's mid-stage insertion loss in dB	MGM
VOAATN	OLA
Variable Optical Attenuator Attenuation measures the amplifier's variable optical attenuator's attenuation level in dB	OLAM
TILT-ACH	LGA
Tilt Achieved measures the amount of tilt that has been achieved	MGA
	MGM

Note All composite power measurements reported by optical amplifiers are accurate to ± 0.2 dB. As a result, gain or loss measurements may vary by ± 0.4 dB.

9.0 Troubleshooting Optical Amplifier modules

This section provides information for troubleshooting issues on Optical Amplifier modules.

- [9.1, “Alarms and events on Optical Amplifier modules”](#)
- [9.2, “View alarms or events for an Optical Amplifier module”](#)
- [9.3, “ Optical Amplifier module alarms”](#)
- [9.4, “Module temperature monitoring ”](#)
- [9.5, “Module voltage and fuse monitoring ”](#)

9.1 Alarms and events on Optical Amplifier modules

proNX 900 Node Controller allows you to view alarms and events reported on an Optical Amplifier module at any time.

If an Optical Amplifier module is in the In-Service state or Out-of-Service state, any fault condition pertaining to the module is reported as an autonomous alarm. For information about clearing alarms pertaining to Optical Amplifier modules, see the *Alarm and Troubleshooting Guide*.

An event reported on an Optical Amplifier module can indicate the module's status, a periodic report of information, or asynchronous command completion information.

For a description of the information provided by proNX 900 Node Controller about an alarm or event, see the *proNX 900 Node Controller Online Help*.

9.2 View alarms or events for an Optical Amplifier module

Use this procedure to view alarms or events reported on an Optical Amplifier module.



Prerequisites

- Optical Amplifier module must be provisioned and physically present in the shelf.

Viewing alarms and events

Follow these steps to view alarms and events on an Optical Amplifier module:

Step 1 Click one of the following tabs in the **Alarm** pane:

- **Alarms** — to view the list of alarms
- **Events** — to view the list of events

Step 2 Double-click an alarm or event to view detailed information about it.

You have successfully completed this procedure.

9.3 Optical Amplifier module alarms

For a list of alarms supported on Optical Amplifier modules, see the *BTI 7000 Series Alarm and Troubleshooting Guide*.

9.4 Module temperature monitoring

This section describes module-specific temperature monitoring.

Module temperature monitoring is supported on the following Amplifier modules:

- DWDM C-Band Low Gain Amplifier (LGA) (BT7A02AA)
- DWDM C-Band Mid Gain Amplifier (MGA) (BT7A03AA)
- DWDM C-Band Mid Gain Amplifier with Mid Stage Access (MGM) BT7A04AA)

Note	Temperature monitoring for modules is not the same as monitoring the temperature of individual pluggable SFPs and XFPs. Temperature monitoring for SFPs and XFPs is part of a port's physical performance metrics (PM).
-------------	---

Temperature thresholds

Temperature monitoring threshold crossing alarms have two levels. The first, high threshold, alerts you to rising temperatures so that you may take action to prevent traffic interruption. The second, shutdown threshold, indicates that module damage may occur. The shutdown temperature is likely to be reached only in case of total cooling unit failure.

The threshold values can be viewed in the module inventory. They cannot be changed.

Automatic shutdown

If automatic shutdown is enabled (through the use of the system setting HTAS), then if the shutdown threshold is exceeded, the module is shut down to avoid damage.

The HTAS setting is off by default.

When a module has been shut down due to temperature, the REPLUNITHATS alarm is raised.

Temperature is not monitored while a module is shut down. You can start up a module that has been shut down due to temperature by using the `TL1 INIT-SYS` command with the phase 2 power-on option. Alternatively, the module can be re-seated.

Temperature PMs

The module temperature can be viewed under equipment PMs (`rtrv-pm-eqpt`).

Temperature PMs provide the current and historical temperature readings.

To view PMs, the module must be provisioned.

High temperature automatic shutdown unsupported (HTASUNS) alarm

The high temperature automatic shutdown (HTAS) feature is not supported by all versions of the MSI. In the case of an incompatible MSI, the HTASUNS alarm is raised. To clear the alarm, you can either disable the HTAS feature, or you can replace the MSI with a compatible version. To obtain a compatible MSI, contact your BTI representative.

Temperature monitoring alarms

The following table lists the alarms associated with monitoring the module temperature. For more information about these alarms and alarm clearing procedures, refer to the *BTI 7000 Series Alarm and Troubleshooting Guide*:

Alarm Code	Alarm Name	Problem Description
HTASUNS	High Temperature Automatic Shutdown Unsupported	The HTAS option has been enabled, but the system is not able to support the feature.
REPLUNITHTAS	Circuit Pack High Temperature Automatic Shutdown	The module has exceeded the shutdown temperature threshold and has been shut down because the HTAS feature is enabled.
T-REPLUNIT-HT	Circuit pack exceeded the high temperature threshold.	The module has exceeded the high temperature threshold.
T-REPLUNIT-HTS	Circuit pack exceeded the shutdown temperature threshold.	The module has exceeded the shutdown temperature threshold.

Commands used for module temperature monitoring

This section lists the TL1 commands used for monitoring module temperature. For more information about these commands, refer to the *BTI 7000 Series TL1 Reference Guide*.

Command type	Command	Description
TL1	ED-SYS:BTI7000:: [CTAG]:HTAS=[ON OFF]	Turns the HTAS feature on or off. The default is OFF.
TL1	RTRV-INV: [TID]:[<aid>]:[CTAG]::;	Displays the module high temperature threshold (TEMPHT) and the module high shutdown temperature threshold (TEMPHTS) in degrees Celcius.
TL1	INIT-SYS: [TID]:[<aid>]:[CTAG]::[<2>]:	Restarts the module following a temperature shutdown. The value of the phase parameter is 2.
TL1	RTRV-ALM-ALL: [TID]:[<aid>]:[CTAG]:: [<ntfcncde>], [<condtype>], [<srveff>], [<locn>], [<dirn>], [<tmper>];	Displays all alarms, including the module temperature alarms and severity for the specified condition type (HTASUNS, REPLUNITHTAS, T-REPLUNIT-HT, T-REPLUNIT-HTS).

9.5 Module voltage and fuse monitoring

This section describes module-specific voltage and fuse monitoring.

Module voltage and fuse monitoring is supported on the following Amplifier modules:

- DWDM C-Band Low Gain Amplifier (LGA) (BT7A02AA)
- DWDM C-Band Mid Gain Amplifier (MGA) (BT7A03AA)
- DWDM C-Band Mid Gain Amplifier with Mid Stage Access (MGM) BT7A04AA)

Voltage monitoring

All supply voltage rails on the module are monitored. If any rail falls below nominal voltage by a preset amount, the module is shut down.

When the module is shut down due to a voltage rail failure, the REPLUNITPWR alarm is raised.

Fuse monitoring

The two 48V feed fuses on the module are monitored. If either of the fuses fails, a feed fuse alarm is raised.

Module operation is not affected if only one fuse fails, unless the system feed for the other side also fails.

A feed fuse alarm indicates that the module should be replaced as soon as possible.

Voltage and fuse monitoring alarms

The following table lists the alarms associated with monitoring the module voltage and fuses. For more information about these alarms and alarm clearing procedures, refer to the *BTI 7000 Series Alarm and Troubleshooting Guide*:

Alarm Code	Alarm Name	Problem Description
FEEDAFUSEFAIL	Circuit pack feed A fuse failure.	The module's fuse for the 48V feed A has failed.
FEEDBFUSEFAIL	Circuit pack feed B fuse failure.	The module's fuse for the 48V feed B has failed.
REPLUNITPWR	Circuit pack power failure.	A voltage rail failure was detected on the module.

Commands used for module voltage monitoring

This section lists the TL1 commands used for monitoring module voltage and fuses. For more information about these commands, refer to the *BTI 7000 Series TL1 Reference Guide*.

Command type	Command	Description
TL1	RTRV-ALM-EQPT :[TID]:[<aid>]:[CTAG]: [FEEDAFUSEFAIL FEEDBFUSEFAIL REPLUNITPWR]	Displays the module voltage alarms and severity for the specified condition type.

10.0 Replacing Optical Amplifiers and Dispersion Compensation modules

This section provides instructions for replacing Optical Amplifier modules and Dispersion Compensation modules in supported shelves.

- [10.1, “Replace Optical Amplifier modules”](#)
- [10.2, “Replace Dispersion Compensation modules”](#)

10.1 Replace Optical Amplifier modules

Use this procedure to replace any Optical Amplifier module.

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Optical Amplifier module

Prerequisites

- None



Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

Key module replacement features

The following figures show typical amplifiers and indicate the key features for replacing them.

Figure 10-1 Single Channel /Sub-Band Amplifiers (SBA) and DWDM C-Band Amplifiers (OBA/OPA)

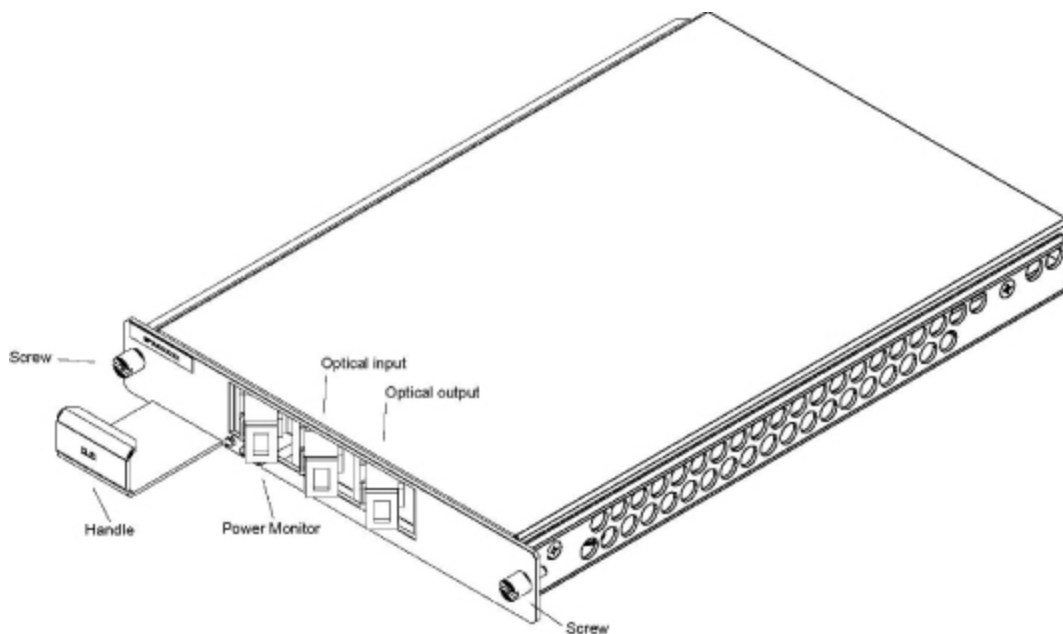


Figure 10-2 DWDM Optical Line Amplifier (OLA)

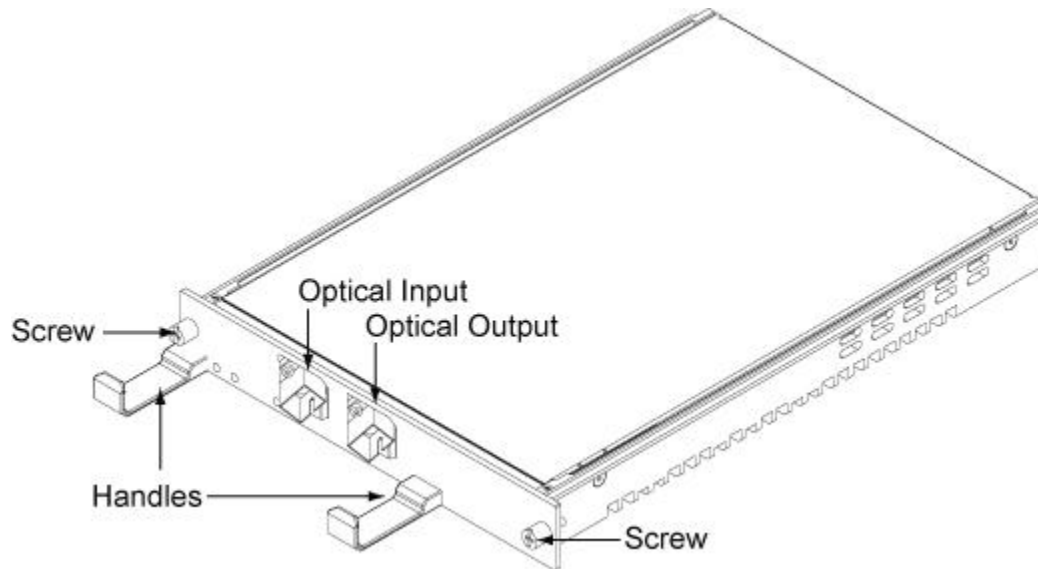


Figure 10-3 Optical Line Amplifier with Mid-Stage Access (OLAM)

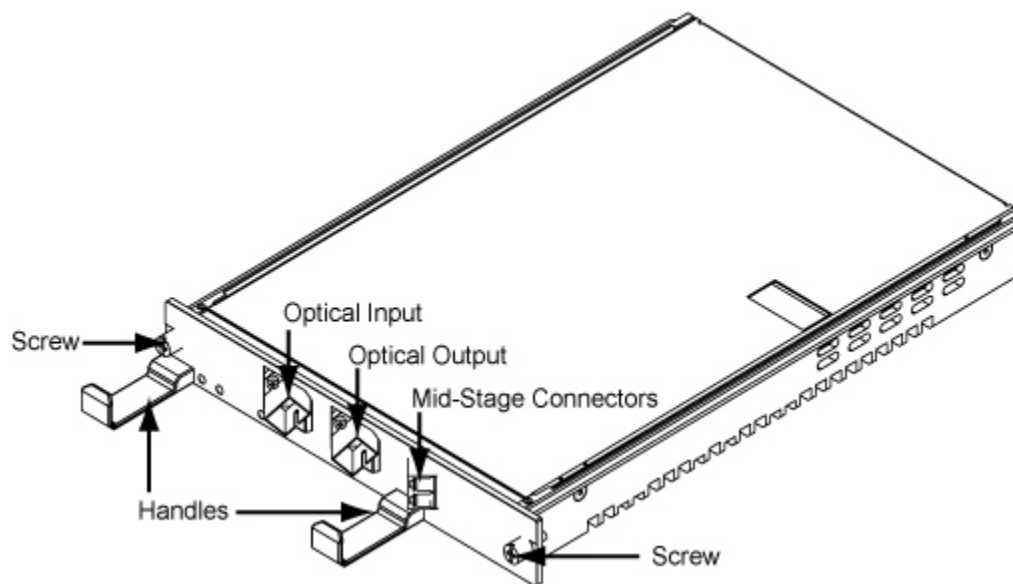


Figure 10-4 DWDM C-Band Low and Mid Gain Amplifiers (LGA/MGA)

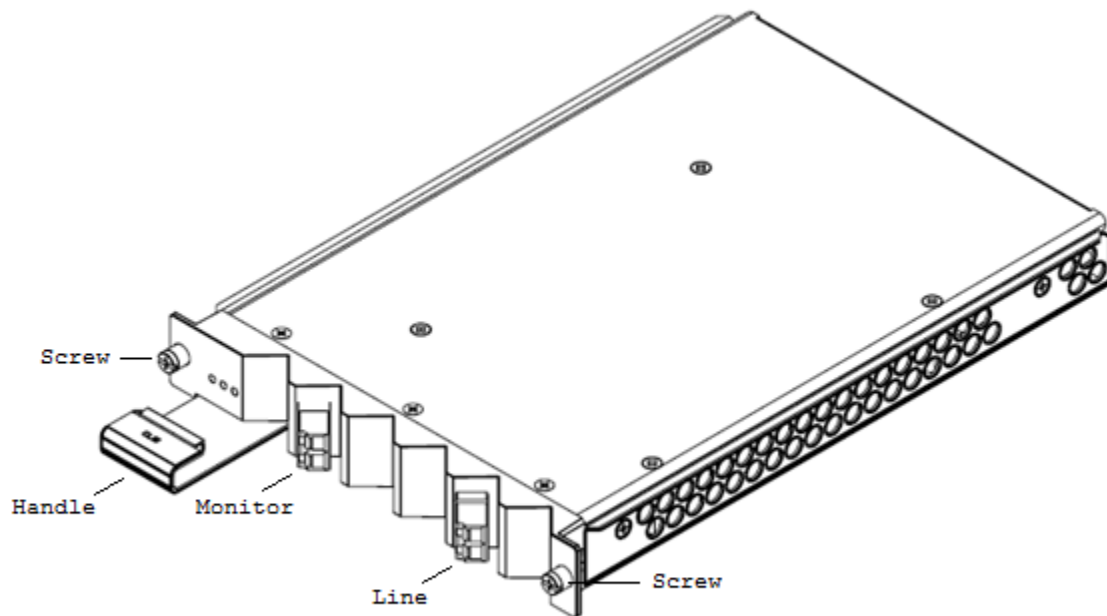
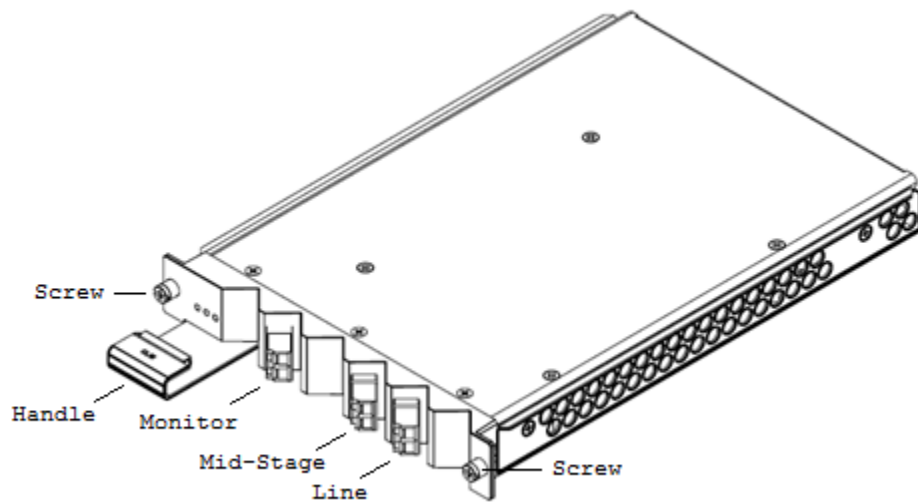


Figure 10-5 DWDM C-Band Mid Gain Amplifier with Mid-Stage Access (MGM)



Replacement procedure

Follow these steps to replace an Optical Amplifier module:

Step 1 Reroute Traffic

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.

Step 2 Remove the Optical Amplifier from Service

The Optical Amplifier must be removed from service.

Step 3 Move the Cables

Optical cables may need to be moved aside to get clear access to the module. The cables rest on the handles that are at the front of the module.

Step 4 Disconnect the Cables

Disconnect the optical cables from the ports on the faceplate of the module.

Note Ensure that the optical ports on the module and the optical cables are protected with protective caps while disconnected.

Step 5 Loosen the Faceplate Screws

- a) Facing the front of the shelf, locate the faceplate screws.
- b) Using a slot-head or Phillips screwdriver, loosen the screws.

Step 6 Remove the Module

- a) Grasp the handles on the front of the module and firmly pull the module straight out.

Note A REPLUNITMISS alarm appears once you remove the module.

- b) Place the module on a flat work surface.

Step 7 Replace the Module

- a) Align the replacement module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot until the module LEDs turn on. The LEDs remain on for 5 to 10 seconds and then turn off. The REPLUNITMISS should clear after a few seconds.

Step 8 Replace the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.

- Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 9 Reconnect Optical Cables

Clean the optical cables and then reconnect them to their original positions.

Note If you loop excess fiber around the fiber management spool, allow sufficient slack for the fiber management spool to move freely.

Step 10 Replace Cables

If any cables were moved to access the module, replace the cables to their original locations.

Step 11 Restore the Module to Service

The module can now be restored to service.

You have successfully completed this procedure.

10.2 Replace Dispersion Compensation modules

Use this procedure to replace any Dispersion Compensation module (DCM).

What you need

- Slot-head or Phillips screwdriver
- Electrostatic discharge (ESD) wrist strap
- Dispersion Compensation module
- Isopropyl alcohol and lint-free pads

Prerequisites

- None



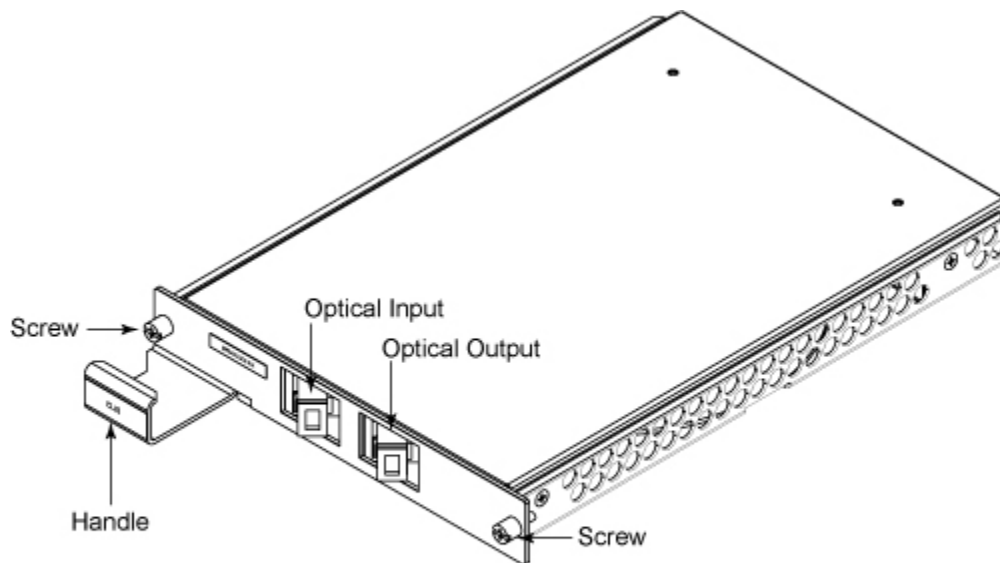
Caution

Use an ESD wrist strap whenever you open the equipment, particularly when you are handling modules as well as SFP and XFP transceivers. To work properly, the wrist strap must make good contact at both ends (that is, with your skin at one end and with the chassis at the other).

Key module replacement features

The following figure shows a DCM and indicates the key features for replacing it.

Figure 10-6 Dispersion Compensation module



Replacement procedure

Follow these steps to replace a Dispersion Compensation module:

Step 1 Reroute Traffic

Caution Failure to reroute traffic can result in lost data. Select an alternate route for the traffic that passes through the optical amplifier, transceiver, or mux/demux. Transfer traffic to this alternate route before proceeding with this procedure.

Step 2 Move the Cables

Shelf cables may need to be moved aside to get clear access to the module. The cables rest on the handles that are at the front of the module.

Step 3 Disconnect the Cables

Disconnect the optical cables from the ports on the faceplate of the module.

Note Ensure that the optical ports on the module and the optical cables are protected with protective caps while disconnected.

Step 4 Loosen the Faceplate Screws

- a) Facing the front of the shelf, locate the faceplate screws.
- b) Using a slot-head or Phillips screwdriver, loosen the screws.

Step 5 Remove the Module

- a) Grasp the handles on the front of the module and firmly pull the module straight out.

Note An equipment missing alarm appears once you remove the module.

- b) Place the module on a flat work surface.

Step 6 Replace the Module

- a) Align the replacement module to the slot in which it is being inserted.
- b) Carefully push the module straight into the slot.

Step 7 Replace the Faceplate Screws

- a) Facing the front of the shelf, align the module with its mounting holes.
- b) Using a slot-head or Phillips screwdriver, carefully tighten the faceplate screws:
 - Partially tighten the center support screw.
 - Partially tighten the other screw.
 - Fully tighten the center support screw.
 - Fully tighten the other screw.

Caution Tighten to a torque that is no more than 4.7 in-lbs.

Step 8 Reconnect Optical Cables

Clean the optical cables and then reconnect them to their original positions.

Note If you loop excess fiber around the fiber management spool, allow sufficient slack for the fiber management spool to move freely.

Step 9 Replace Cables

If any cables were moved to access the module, replace the cables to their original locations.

You have successfully completed this procedure.

Appendix A: Optical Backreflection Safety feature

This section explains the Optical Backreflection Safety feature, which is a laser eye-safety mechanism designed to detect that the output port of an Optical Amplifier has been disconnected.

- [A.1, “Optical Backreflection Safety: principle of operation”](#)
- [A.2, “Querying the backreflection photo-detector”](#)

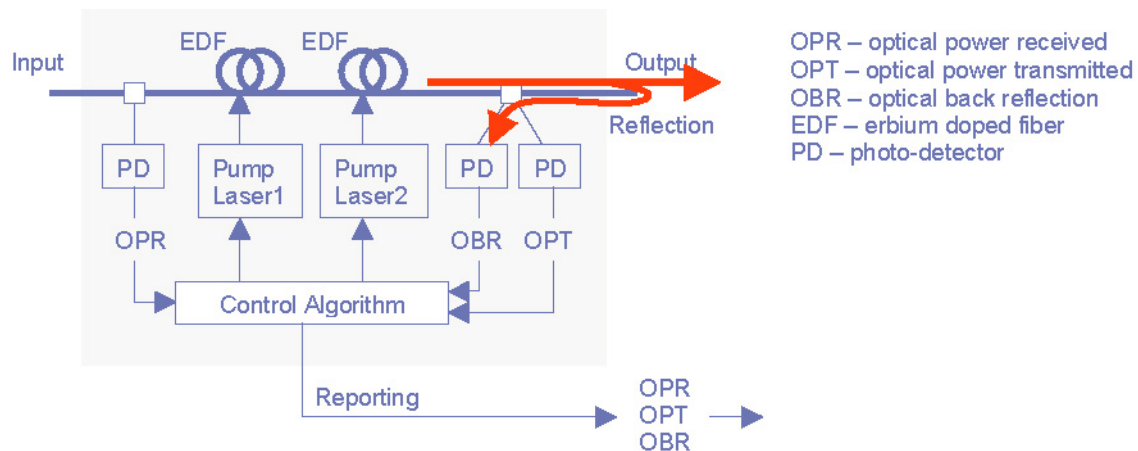
A.1 Optical Backreflection Safety: principle of operation

The Optical Backreflection Safety feature is a laser eye-safety mechanism designed to detect that the output port of an optical amplifier has been disconnected. This feature is supported on the following optical amplifier modules:

- DWDM C-Band Booster Amplifier (OBA) . See A.1.1, “About Optical Backreflection on the OBA and SBA” for more information.
- DWDM Optical Line Amplifier (OLA)
- Optical Line Amplifier with 0–15 dB Mid-Stage Access (OLAM)
- Single-Channel/Sub-Band Booster Amplifier (SBA) See A.1.1, “About Optical Backreflection on the OBA and SBA” for more information.
- DWDM C-Band Low Gain Amplifier (LGA)
- DWDM C-Band Mid Gain Amplifier (MGA)
- DWDM C-Band Mid Gain Amplifier with Mid-stage access (MGM)

The backreflection photo-detector on the output port of the optical amplifier measures the reflected optical power (see the following figure). When the reflected optical power exceeds -4 dBm, the amplifier switches to EYESAFE mode. In this mode, the first pump laser is turned off and the second pump laser runs in constant power mode with an output of 0 dBm. The amplifier provides little or no signal amplification in this mode.

Figure A-1 Optical Amplifier block diagram



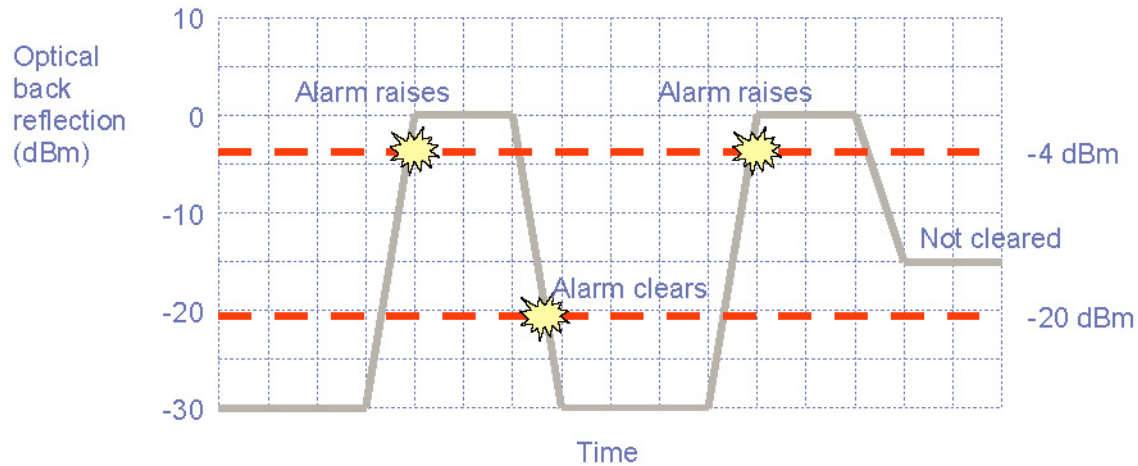
The threshold to transition to EYESAFE mode ($\text{OBR-HTS} = -4 \text{ dBm}$) cannot be changed. The rationale for this value is as follows:

- 4% of the transmitted light is reflected from surface of a disconnected output connector.
- Safety is a concern when output power is 10 dBm or greater.
- The threshold equals 4% of 10 dBm, or the threshold of -4 dBm is 4% of 10 dBm.

The amplifier reverts to COGAIN/COPWR mode when backreflection is less than or equal to -20 dBm. The design includes hysteresis (-4 dBm to raise and -20 dBm to clear) so that the amplifier does not toggle between COGAIN/COPWR and EYESAFE modes.

To ensure optical performance, we recommend that backreflection is -23dBm.

Figure A-2 Optical backreflection safety raising and clearing



A.1.1 About Optical Backreflection on the OBA and SBA

For the following optical amplifiers, the backreflection behavior is slightly modified.

- DWDM C-Band Booster Amplifier (OBA)
- Single-Channel and Sub-Band Booster Amplifier (SBA).

Instead of fixed values for the raising and clearing of the optical backreflection alarm, the thresholds are relative to the current output power of the amplifier. A disconnected fiber has a back reflection of approximately 4% (14 to 17 dB).

Raising the alarm

To raise the alarm, the back reflection reading must be greater than the transmitted output power of the amplifier minus 14 to 17 dB (that is, with a transmitted output power of +12 dBm, the reflection must be greater than -2 to -5 dBm).

Clearing the alarm

To clear the alarm, the following factors must occur:

- 1 The backreflection alarm must be currently raised, and
- 2 The backreflection reading must be less than the transmitted output power of the amplifier minus 20 dB. (that is, with a transmitted output power of 0 dBm, the reflection must be less than -20 dBm).

A.2 Querying the backreflection photo-detector

The power measured by the backreflection photo-detector can be queried. The system reports the optical back reflected power (OBR) as a percentage of output power (OPT), that is, in dB, and not as an absolute value. The absolute value can be calculated by adding OPT and OBR. For example, if OPT is 11 dBm and OBR is -31 dB, the absolute power is -20 dBm.

proNX 900 Node Controller plots OBR (in dB) as a function of time. Although the graph returned shows the OBR-HTS threshold, the threshold should be disregarded as it is reported in dBm.

Appendix B: Universal connectors

This appendix explains what universal connectors are and how to clean them.

- [B.1, “About universal connectors”](#)
- [B.2, “Cleaning universal connectors”](#)

B.1 About universal connectors

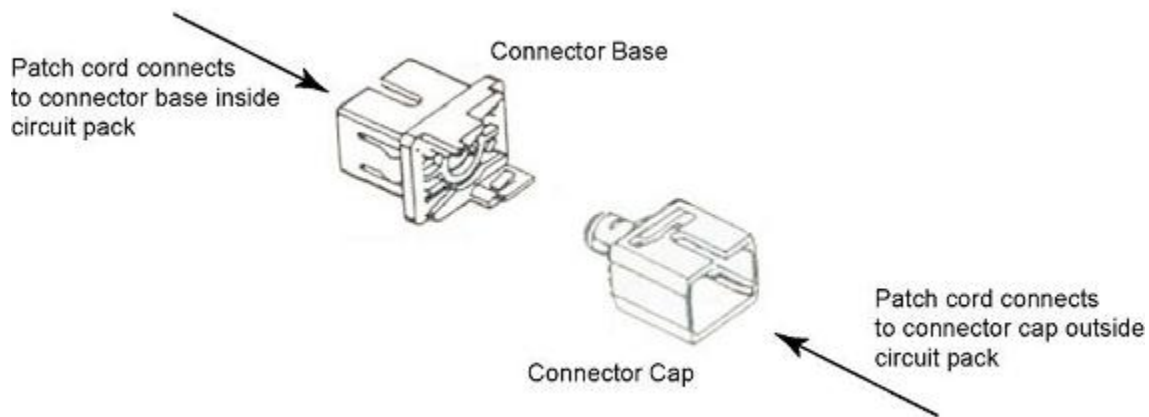
A universal connector consists of two distinct parts: a “connector base” that is permanently mounted into the faceplate of a module, and a “connector cap” that serves as the external connector port.

The principal advantage is that the universal connector parts can be easily accessed for cleaning of the optical elements.

In addition, a variety of connector caps are available, which permits the use of FC, SC and ST patch-cord connectors. All connector caps can be removed and replaced without special tools.

The following figure shows the various parts of a universal connector.

Figure B-1 Parts of a universal connector



B.2 Cleaning universal connectors

Each universal connector assembly is inspected for debris before it is packaged. During use, the assembly can become contaminated with debris from multiple connections or environmental contaminants. This debris is best observed using a 200x scope with backlighting from any safe white light source. If debris is found on the connector optical surfaces, use the following procedure to safely clean it.



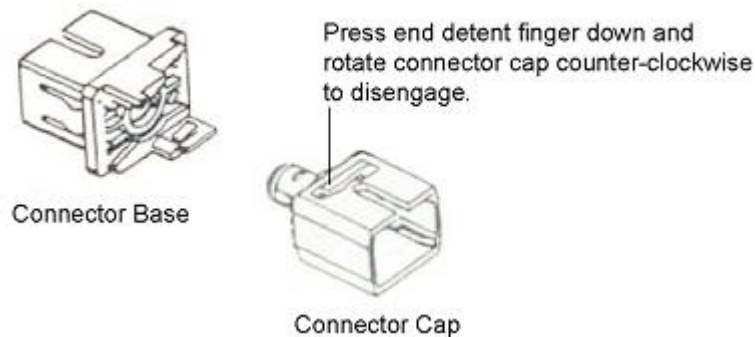
Invisible laser radiation can be emitted from the aperture ports of various modules when no fiber cable is connected. Avoid exposure and do not stare into open apertures to avoid permanent eye damage.

Use the following procedure to clean universal connectors:

Step 1 Disengage the Universal Connector

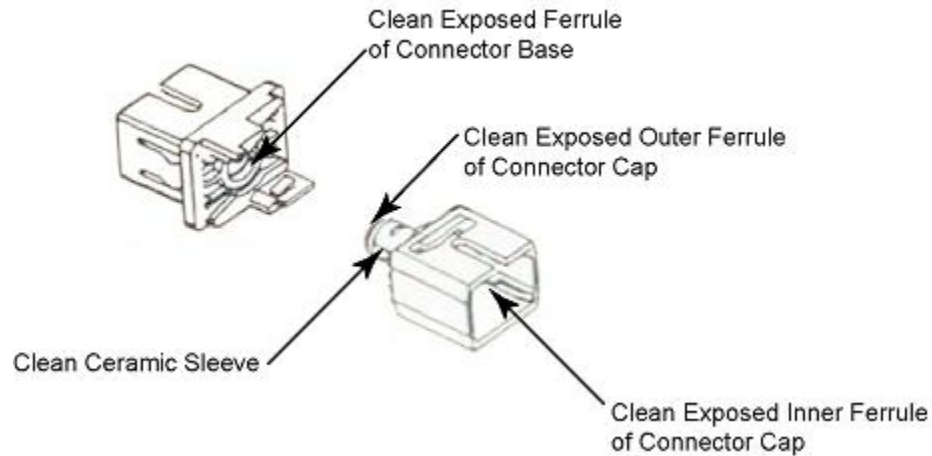
To separate the connector cap from the connector base, do the following:

- a) With a patch cord inserted into the connector cap, gently grasp the patch cord sleeve and press the detent finger end of the connector cap.
- b) Still holding the detent finger down, rotate the connector cap counter-clockwise to disengage, and then the pull connector cap straight out.



Step 2 Clean the optical surfaces

Using clean, dry compressed air or gas, hold the optical surfaces approximately one inch from the end of the nozzle and blow onto the optical surfaces. One inch is a safe distance to prevent damage.



Step 3 Check for debris

Caution Never insert a cleaning stick of any kind into the connector.

Look into the connector housing with a 200x scope. If debris is still present, repeat steps 1 through 3 until the element is clean, then proceed to the next step.

Note If the connector base or connector cap is damaged, cleaning will not improve the performance.

Step 4 Reconnect the Universal Connector

After cleaning, ensure that there is no patch cord attached to the connector cap, and then do the following:

- Align the connector cap to the connector base with the connector cap turned slightly counter-clockwise to the connector base
- Carefully insert the ceramic sleeve of the connector cap into the connector base and then turn the connector cap clockwise until you hear an audible click as the connector cap latches to the connector base.
- Confirm that the connector cap has locked onto the connector base by gently pulling the connector cap straight out. The connector cap should hold firmly to the connector base.

You have successfully completed this procedure.



Part Number:
Document Version:
Published:
Type:

BT7A73AA
01
March 2017
STANDARD

product release 13.5