



Cisco 6015 Hardware Installation Guide

Corporate Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100



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Preface xvii

- Audience **xvii**
- Purpose **xvii**
- Organization **xvii**
- Conventions **xviii**
- Related Documentation **xix**
- Obtaining Documentation **xix**
 - World Wide Web **xx**
 - Documentation CD-ROM **xx**
 - Ordering Documentation **xx**
 - Documentation Feedback **xx**
- Obtaining Technical Assistance **xxi**
 - Cisco.com **xxi**
 - Technical Assistance Center **xxi**
 - Contacting TAC by Using the Cisco TAC Website **xxi**
 - Contacting TAC by Telephone **xxii**

CHAPTER 1

Product Overview 1-1

- 1.1 Introduction to the Cisco 6015 System **1-1**
 - 1.1.1 Features **1-3**
 - 1.1.2 Configurations **1-4**
 - 1.1.2.1 Cisco 6015 with a POTS Splitter Configuration **1-5**
 - 1.1.2.2 Cisco 6015 Without a POTS Splitter Configuration **1-6**
 - 1.1.2.3 Subtended Network Configuration **1-6**
- 1.2 Cisco 6015 Chassis Overview **1-10**
 - 1.2.1 Cisco 6015 Cards and Modules **1-11**
 - 1.2.1.1 4xflexi Overview **1-12**
 - 1.2.1.2 8xDMT Overview **1-14**
 - 1.2.1.3 8xDMT Over ISDN Overview **1-17**
 - 1.2.1.4 8xG.SHDSL Overview **1-19**
 - 1.2.1.5 DS3+T1/E1 IMA NI-2 Card Overview **1-21**
 - 1.2.1.6 OC-3c/OC-3c NI-2 Card Overview **1-25**
 - 1.2.1.7 I/O Module Overview **1-29**
 - 1.2.1.8 DSL Interface Module Overview **1-31**

- 1.2.1.9 DC PEM Overview **1-32**
- 1.2.1.10 Fan Module Overview **1-33**
- 1.2.2 Rear Interface Header **1-36**
- 1.2.3 AC/DC Converter **1-37**
- 1.3 Management Software **1-38**

CHAPTER 2

Preparing for Installation 2-1

- 2.1 Safety Requirements **2-1**
 - 2.1.1 Safety Guidelines **2-1**
 - 2.1.2 Maintaining Safety with Electricity **2-8**
 - 2.1.3 Preventing Electrostatic Discharge Damage **2-9**
 - 2.1.4 General Maintenance Guidelines **2-9**
 - 2.1.4.1 Hot Swapping Cards **2-10**
 - 2.1.4.2 Hot Swapping Modules **2-10**
 - 2.1.4.3 Installation and Replacement Suggestions **2-11**
- 2.2 Site Requirements **2-11**
 - 2.2.1 Environmental Requirements **2-11**
 - 2.2.1.1 Temperature, Altitude, and Humidity **2-12**
 - 2.2.1.2 Ventilation **2-13**
 - 2.2.1.3 Space **2-14**
 - 2.2.2 DC Power **2-16**
 - 2.2.3 AC Power **2-17**
 - 2.2.4 Cables **2-18**
 - 2.2.5 Rack-Mounting **2-18**
- 2.3 Required Tools and Equipment **2-19**
- 2.4 Unpacking the Cisco 6015 System **2-22**
- 2.5 Verifying Contents **2-23**
- 2.6 Inspecting for Damage **2-23**

CHAPTER 3

Installing a Cisco 6015 with a POTS Splitter Configuration in a Commercial Environment 3-1

- 3.1 Installation Checklist **3-1**
- 3.2 Installation Procedures **3-2**
 - 3.2.1 Measure Required Rack Space **3-3**
 - 3.2.2 Install the POTS Splitter **3-4**
 - 3.2.3 Install the AC/DC Converter and Converter Tray **3-4**
 - 3.2.4 Install the Cisco 6015 Chassis **3-5**
 - 3.2.5 Install Blank Faceplates **3-6**
 - 3.2.6 Ground the Cisco 6015 and POTS Splitter(s) **3-7**

- 3.2.7 Connect the DC PEM to the AC/DC Converter 3-9
- 3.2.8 Connect the DC PEM to the Fuse and Alarm Panel 3-10
- 3.2.9 Connect the BITS Interface 3-11
- 3.2.10 Connect the Facility Alarm Input 3-13
- 3.2.11 Connect the DSL Interface Module to the POTS Splitter(s) 3-15
- 3.2.12 Connect the POTS Splitter(s) to the MDF 3-17
- 3.2.13 Install a Subtended Network Configuration 3-17
 - 3.2.13.1 Connect the DS3+T1/E1 Subtending Network Configuration 3-17
 - 3.2.13.2 Connect the IMA Subtending Network Configuration 3-18
 - 3.2.13.3 Connect the OC-3c Subtending Network Configuration 3-19
- 3.2.14 Connect the Cisco 6015 to the Network 3-19
 - 3.2.14.1 DS3 Network Connection Installation 3-19
 - 3.2.14.2 T1 Network Connection Installation 3-20
 - 3.2.14.3 E1 Network Connection Installation 3-21
 - 3.2.14.4 IMA Network Connection Installation 3-21
 - 3.2.14.5 OC-3c Network Connection Installation 3-21
- 3.2.15 Apply Power 3-22
 - 3.2.15.1 Apply AC Power 3-22
 - 3.2.15.2 Apply DC Power 3-23
- 3.2.16 Verify Fan Module Operation 3-23
- 3.2.17 Install the POTS Cards 3-24
- 3.2.18 Connect the Ethernet to the Management Network 3-24
- 3.2.19 Connect a Console Terminal 3-25
- 3.2.20 Connect the Auxiliary Port 3-25
- 3.2.21 Complete Initial Configuration 3-26
 - 3.2.21.1 Before You Begin 3-26
 - 3.2.21.2 Using the System Configuration Dialog 3-26

CHAPTER 4**Installing a Cisco 6015 Without a POTS Splitter Configuration in a Commercial Environment 4-1**

- 4.1 Installation Checklist 4-1
- 4.2 Installation Procedures 4-2
 - 4.2.1 Measure Required Rack Space 4-3
 - 4.2.2 Install the AC/DC Converter and Converter Tray 4-4
 - 4.2.3 Install the Cisco 6015 Chassis 4-4
 - 4.2.4 Install Blank Faceplates 4-5
 - 4.2.5 Ground the Cisco 6015 4-6
 - 4.2.6 Connect the DC PEM to the AC/DC Converter 4-8
 - 4.2.7 Connect the DC PEM to the Fuse and Alarm Panel 4-9
 - 4.2.8 Connect the BITS Interface 4-10

- 4.2.9 Connect the Facility Alarm Input **4-12**
- 4.2.10 Connect the Cisco 6015 to the MDF **4-14**
- 4.2.11 Install a Subtended Network Configuration **4-15**
 - 4.2.11.1 Connect the DS3+T1/E1 Subtending Network Configuration **4-15**
 - 4.2.11.2 Connect the IMA Subtending Network Configuration **4-16**
 - 4.2.11.3 Connect the OC-3c Subtending Network Configuration **4-16**
- 4.2.12 Connect the Cisco 6015 to the Network **4-17**
 - 4.2.12.1 DS3 Network Connection Installation **4-17**
 - 4.2.12.2 T1 Network Connection Installation **4-18**
 - 4.2.12.3 E1 Network Connection Installation **4-19**
 - 4.2.12.4 IMA Network Connection Installation **4-19**
 - 4.2.12.5 OC-3c Network Connection Installation **4-19**
- 4.2.13 Apply Power **4-20**
 - 4.2.13.1 Apply AC Power **4-20**
 - 4.2.13.2 Apply DC Power **4-21**
- 4.2.14 Verify Fan Module Operation **4-21**
- 4.2.15 Connect the Ethernet to the Management Network **4-22**
- 4.2.16 Connect a Console Terminal **4-23**
- 4.2.17 Connect the Auxiliary Port **4-23**
- 4.2.18 Complete Initial Configuration **4-23**
 - 4.2.18.1 Before You Begin **4-24**
 - 4.2.18.2 Using the System Configuration Dialog **4-24**

CHAPTER 5

Installing a Cisco 6015 Configuration in an Outside-Plant Environment 5-1

- 5.1 Installation Checklist **5-1**
- 5.2 Installation Procedures **5-3**
 - 5.2.1 Verify the Remote Terminal Enclosure Compliance **5-3**
 - 5.2.2 Verify the Cooling Capacity **5-3**
 - 5.2.3 Verify and Measure Rack Space **5-3**
 - 5.2.4 Install the POTS Splitter **5-4**
 - 5.2.5 Attach the BITS Interface Wire **5-4**
 - 5.2.6 Attach the Facility Alarm Input Wire **5-6**
 - 5.2.7 Install the Cisco 6015 Chassis **5-8**
 - 5.2.8 Connect the BITS Interface and Facility Alarm Input Wires **5-9**
 - 5.2.9 Install Blank Faceplates **5-9**
 - 5.2.10 Ground the Cisco 6015, POTS Splitter(s), and Enclosure Protection Block **5-10**
 - 5.2.11 Connect the DC PEM to the Fuse Panel **5-12**
 - 5.2.12 Connect the DSL Interface Module to the POTS Splitter(s) **5-13**
 - 5.2.13 Connect the POTS Splitter(s) to the Enclosure Protection Block or SAC Box **5-15**

5.2.14	Connect the Cisco 6015 to the Enclosure Protection Block or SAC Box	5-15
5.2.15	Connect the I/O Modules for Subtending	5-16
5.2.16	Connect the I/O Module to the NIU or Enclosure Protection Block	5-17
5.2.16.1	DS3 Network Connection Installation	5-17
5.2.16.2	T1 Network Connection Installation	5-18
5.2.16.3	E1 Network Connection Installation	5-18
5.2.16.4	IMA Network Connection Installation	5-19
5.2.17	Apply Power	5-19
5.2.18	Verify Fan Module Operation	5-20
5.2.19	Install the POTS Cards	5-20
5.2.20	Connect the Ethernet to the Management Network	5-20
5.2.21	Connect a Console Terminal	5-21
5.2.22	Connect the Auxiliary Port	5-22
5.2.23	Complete Initial Configuration	5-22
5.2.23.1	Before You Begin	5-23
5.2.23.2	Using the System Configuration Dialog	5-23

CHAPTER 6**Troubleshooting 6-1**

6.1	Hot-Swappable FRUs	6-2
6.2	Basic Checks	6-3
6.3	Contacting the Cisco TAC for Help	6-3
6.4	System-Wide Problems	6-4
6.5	Cisco 6015 Component-Specific Problems	6-9
6.5.1	NI-2 Card Problems	6-9
6.5.2	Line Card Problems	6-10
6.5.3	I/O Module Problems	6-14
6.5.4	DSL Interface Module Problems	6-15
6.5.5	DC PEM Problems	6-16
6.5.6	Fan Module Problems	6-16
6.5.7	Rear Interface Header Problems	6-17
6.5.8	AC/DC Converter Problems	6-18
6.6	Alarms	6-18

CHAPTER 7**Upgrading and Maintaining the Cisco 6015 System 7-1**

7.1	Backing Up Software	7-1
7.2	Installing and Replacing Hardware	7-2
7.2.1	4xflexi Installation and Removal	7-2
7.2.1.1	Installing a 4xflexi	7-2
7.2.1.2	Removing a 4xflexi	7-4

7.2.2	8xDMT Installation and Removal	7-4
7.2.2.1	Installing an 8xDMT	7-4
7.2.2.2	Removing an 8xDMT	7-5
7.2.3	8xDMT over ISDN Installation and Removal	7-6
7.2.3.1	Installing an 8xDMT over ISDN	7-6
7.2.3.2	Removing an 8xDMT Over ISDN	7-7
7.2.4	8xG.SHDSL Installation and Removal	7-8
7.2.4.1	Installing an 8xG.SHDSL	7-8
7.2.4.2	Removing an 8xG.SHDSL	7-9
7.2.5	Blank Faceplate Installation and Removal	7-10
7.2.5.1	Installing a Blank Faceplate	7-10
7.2.5.2	Removing a Blank Faceplate	7-10
7.2.6	DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card Installation and Removal	7-10
7.2.6.1	Installing a DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card	7-11
7.2.6.2	Removing a DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card	7-13
7.2.7	OC-3c/OC-3c NI-2 Card Installation and Removal	7-14
7.2.7.1	Installing an OC-3c/OC-3c NI-2 Card	7-14
7.2.7.2	Removing an OC-3c/OC-3c NI-2 Card	7-17
7.2.8	I/O Module Installation and Removal	7-17
7.2.8.1	Installing an I/O Module	7-18
7.2.8.2	Removing an I/O Module	7-20
7.2.9	DSL Interface Module Installation and Removal	7-20
7.2.9.1	Installing a DSL Interface Module	7-21
7.2.9.2	Removing a DSL Interface Module	7-23
7.2.10	DC PEM Installation and Removal	7-24
7.2.10.1	Installing a DC PEM	7-24
7.2.10.2	Removing a DC PEM	7-26
7.2.11	Fan Module Installation and Removal	7-27
7.2.11.1	Installing the Fan Module	7-27
7.2.11.2	Removing the Fan Module	7-27
7.2.12	AC/DC Converter Installation and Removal	7-28

APPENDIX A

Technical Specifications A-1

A.1	Hardware Specifications	A-1
A.1.1	Cisco 6015 System Specifications	A-2
A.1.2	4xflexi Specifications	A-3
A.1.3	8xDMT Specifications	A-4
A.1.4	8xDMT Over ISDN Specifications	A-5
A.1.5	8xG.SHDSL Specifications	A-6
A.1.6	DS3+T1/E1 IMA and ITEMP DS3+T1/E1 IMA NI-2 Cards Specifications	A-7

A.1.7	OC-3c/OC-3c NI-2 Card Specifications	A-8
A.1.8	I/O Module Specifications	A-9
A.1.9	DSL Interface Module Specifications	A-10
A.1.10	DC PEM Specifications	A-10
A.1.11	Fan Module Specifications	A-11
A.2	Software Specifications	A-11

APPENDIX B**Cable and Port Mapping Specifications B-1**

B.1	Cabling Guidelines	B-1
B.2	Cabling Configuration Diagrams	B-2
B.3	Port Mapping Tables	B-3
B.4	Standard Telco Color Chart	B-5

APPENDIX C**Connector and Pinout Specifications C-1**

C.1	xDSL Connectors	C-1
C.2	T1/E1 Connectors	C-1
C.3	Rear Interface Header	C-2
C.4	Console and Auxiliary Ports	C-3
C.5	Ethernet Port	C-4

GLOSSARY

INDEX



<i>Figure 1-1</i>	Network Architecture for a Cisco 6015 in an Outside-Plant Environment	1-2
<i>Figure 1-2</i>	Cisco 6015 with a POTS Splitter Configuration in North America	1-5
<i>Figure 1-3</i>	Cisco 6015 Without a POTS Splitter Configuration	1-6
<i>Figure 1-4</i>	Star Topology for Cisco 6015 Subtended Network	1-8
<i>Figure 1-5</i>	Inverse Multiplexing and Recombining of ATM Cells Through IMA Groups	1-9
<i>Figure 1-6</i>	Daisy Chain Topology for OC-3c Interfaces	1-10
<i>Figure 1-7</i>	Cisco 6015 Card and Module Slots	1-11
<i>Figure 1-8</i>	4xflexi Faceplate	1-13
<i>Figure 1-9</i>	Commercial Environment 8xDMT Faceplate	1-15
<i>Figure 1-10</i>	Outside-Plant Environment 8xDMT Faceplate	1-16
<i>Figure 1-11</i>	8xDMT Over ISDN Faceplate	1-18
<i>Figure 1-12</i>	8xG.SHDSL Faceplate	1-20
<i>Figure 1-13</i>	DS3+T1/E1 IMA NI-2 Card Faceplate	1-23
<i>Figure 1-14</i>	OC-3c/OC-3c NI-2 Card Faceplate	1-27
<i>Figure 1-15</i>	I/O Module Location in the Cisco 6015 Chassis	1-29
<i>Figure 1-16</i>	DS3+T1 I/O module Faceplate	1-30
<i>Figure 1-17</i>	E1 I/O module Faceplate	1-31
<i>Figure 1-18</i>	DSL Interface Module Faceplate	1-32
<i>Figure 1-19</i>	DC PEM Faceplate	1-33
<i>Figure 1-20</i>	Fan Module for the Cisco 6015	1-34
<i>Figure 1-21</i>	Fan Module Faceplate	1-35
<i>Figure 1-22</i>	Air Flow Through Intake and Exhaust Vents on the Chassis	1-36
<i>Figure 1-23</i>	Cisco 6015 5-Pin Header	1-36
<i>Figure 1-24</i>	AC/DC Converter Faceplate	1-37
<i>Figure 2-1</i>	Air Flow Through Intake and Exhaust Vents on the Chassis	2-13
<i>Figure 3-1</i>	Screw Locations for the AC/DC Converter Tray	3-5
<i>Figure 3-2</i>	Extender Installation on the Cisco 6015	3-6
<i>Figure 3-3</i>	Strip and Square Off Ground Wire	3-7
<i>Figure 3-4</i>	Grounding Lug Closed and Open Positions	3-8
<i>Figure 3-5</i>	Attaching the Grounding Wire to the Cisco 6015	3-8
<i>Figure 3-6</i>	Attaching the Grounding Wire to the Rack	3-9

<i>Figure 3-7</i>	Connecting the DC PEM to the AC/DC Converter	3-10
<i>Figure 3-8</i>	Connecting the DC PEM to the Fuse and Alarm Panel	3-11
<i>Figure 3-9</i>	Plate Removal over BITS Interface Pinouts	3-12
<i>Figure 3-10</i>	BITS Interface Pinouts	3-12
<i>Figure 3-11</i>	Wire Alignment Under the Plate	3-13
<i>Figure 3-12</i>	Plate Removal Over Facility Alarm Input Pinouts	3-14
<i>Figure 3-13</i>	Wire Alignment Under the Plate	3-15
<i>Figure 3-14</i>	Connecting the DSL Interface Module to the POTS Splitter	3-15
<i>Figure 3-15</i>	Connecting the DSL Interface Module to Two POTS Splitters	3-16
<i>Figure 3-16</i>	Attaching a Champ Connector to the Chassis	3-16
<i>Figure 3-17</i>	DS3+T1 Subtended Network Configuration	3-18
<i>Figure 3-18</i>	Daisy Chain Topology for OC-3c/STM-1 Interfaces	3-19
<i>Figure 3-19</i>	ENET, CNSL, and AUX RJ-45 Receptacles on the DS3+T1/E1 IMA NI-2 Card	3-24
<i>Figure 4-1</i>	Screw Locations for the AC/DC Converter Tray	4-4
<i>Figure 4-2</i>	Extender Installation on the Cisco 6015	4-5
<i>Figure 4-3</i>	Strip and Square Off Ground Wire	4-6
<i>Figure 4-4</i>	Grounding Lug Closed and Open Positions	4-7
<i>Figure 4-5</i>	Attaching the Grounding Wire to the Cisco 6015	4-7
<i>Figure 4-6</i>	Attaching the Grounding Wire to the Rack	4-8
<i>Figure 4-7</i>	Connecting the DC PEM to the AC/DC Converter	4-9
<i>Figure 4-8</i>	Connecting the DC PEM to the Fuse and Alarm Panel	4-10
<i>Figure 4-9</i>	Plate Removal over BITS Interface Pinouts	4-11
<i>Figure 4-10</i>	BITS Interface Pinouts	4-11
<i>Figure 4-11</i>	Wire Alignment Under the Plate	4-12
<i>Figure 4-12</i>	Plate Removal Over Facility Alarm Input Pinouts	4-13
<i>Figure 4-13</i>	Wire Alignment Under the Plate	4-14
<i>Figure 4-14</i>	Attaching a Champ Connector to the Chassis	4-14
<i>Figure 4-15</i>	DS3+T1 Subtended Network Configuration	4-16
<i>Figure 4-16</i>	Daisy Chain Topology for OC-3c/STM-1 Interfaces	4-17
<i>Figure 4-17</i>	ENET, CNSL, and AUX RJ-45 Receptacles on the DS3+T1/E1 IMA NI-2 Card	4-22
<i>Figure 5-1</i>	Plate Removal over BITS Interface Pinouts	5-5
<i>Figure 5-2</i>	BITS Interface Pinouts	5-5
<i>Figure 5-3</i>	Wire Alignment Under the Plate	5-6
<i>Figure 5-4</i>	Plate Removal Over Facility Alarm Input Pinouts	5-7
<i>Figure 5-5</i>	Wire Alignment Under the Plate	5-8

<i>Figure 5-6</i>	Extender Installation on the Cisco 6015	5-9
<i>Figure 5-7</i>	Strip and Square Off Ground Wire	5-10
<i>Figure 5-8</i>	Grounding Lug Closed and Open Positions	5-11
<i>Figure 5-9</i>	Attaching the Grounding Wire to the Cisco 6015	5-11
<i>Figure 5-10</i>	Connecting the DC PEM to the Fuse and Alarm Panel	5-13
<i>Figure 5-11</i>	Connecting the DSL Interface Module to the Corning Cable Systems POTS Splitter	5-14
<i>Figure 5-12</i>	Connecting the DSL Interface Module to Two POTS Splitters	5-14
<i>Figure 5-13</i>	Attaching a Champ Connector to the Chassis	5-15
<i>Figure 5-14</i>	Subtended Network Configuration	5-16
<i>Figure 5-15</i>	ENET, CNSL, and AUX RJ-45 Receptacles on the ITEMP DS3+T1/E1 IMA NI-2 Card	5-21
<i>Figure 7-1</i>	4xflexi Installation in the Cisco 6015	7-3
<i>Figure 7-2</i>	Positioning the Locking Tab on the 4xflexi	7-3
<i>Figure 7-3</i>	8xDMT Installation in the Cisco 6015	7-5
<i>Figure 7-4</i>	Positioning the Locking Tab on the 8xDMT	7-5
<i>Figure 7-5</i>	8xDMT Over ISDN Installation in the Cisco 6015	7-7
<i>Figure 7-6</i>	Positioning the Locking Tab on the 8xDMT Over ISDN	7-7
<i>Figure 7-7</i>	8xG.SHDSL Installation in the Cisco 6015	7-8
<i>Figure 7-8</i>	Positioning the Locking Tab on the 8xG.SHDSL	7-9
<i>Figure 7-9</i>	NI-2 Card Installation in the Cisco 6015	7-11
<i>Figure 7-10</i>	Positioning the Locking Tab on the NI-2 Card	7-12
<i>Figure 7-11</i>	ENET, CNSL, and AUX RJ-45 Receptacles on the DS3+T1/E1 IMA NI-2 Card	7-12
<i>Figure 7-12</i>	NI-2 Card Installation in the Cisco 6015	7-15
<i>Figure 7-13</i>	UPositioning the Locking Tab on the NI-2 Card	7-15
<i>Figure 7-14</i>	CNSL, AUX, and ENET RJ-45 Receptacles on the OC-3c/OC-3c NI-2 Card	7-16
<i>Figure 7-15</i>	I/O Module Installation	7-18
<i>Figure 7-16</i>	DSL Interface Module Installation	7-21
<i>Figure 7-17</i>	Connecting the DSL Interface Module to the POTS Splitter	7-22
<i>Figure 7-18</i>	Connecting the DSL Interface Module to Two POTS Splitters	7-22
<i>Figure 7-19</i>	Attaching the Champ Connector to the Chassis	7-23
<i>Figure 7-20</i>	DC PEM Installation	7-24
<i>Figure 7-21</i>	Connecting the DC PEM to the AC/DC Converter	7-25
<i>Figure 7-22</i>	Connecting the DC PEM to the Fuse and Alarm Panel	7-25
<i>Figure 7-23</i>	Fan Module Installation in the Cisco 6015	7-27
<i>Figure B-1</i>	Attaching the Champ Connector to the Chassis	B-1
<i>Figure B-2</i>	Connecting the DSL Interface Module to the POTS Splitter	B-2

<i>Figure B-3</i>	Connecting the DSL Interface Module to Two POTS Splitters	B-2
<i>Figure C-1</i>	xDSL Connector Pin Locations	C-1
<i>Figure C-2</i>	Cisco 6015 5-Pin Header	C-2
<i>Figure C-3</i>	NI-2 Card Console and Auxiliary Receptacles	C-3
<i>Figure C-4</i>	NI-2 Card Management Ethernet Receptacle	C-4



<i>Table 1</i>	Font Conventions	xviii
<i>Table 2</i>	Command Syntax Conventions	xviii
<i>Table 1-1</i>	Interface Naming Conventions	1-9
<i>Table 1-2</i>	4xflexi LED Functions	1-13
<i>Table 1-3</i>	8xDMT LED Functions	1-16
<i>Table 1-4</i>	8xDMT Over ISDN LED Functions	1-18
<i>Table 1-5</i>	8xG.SHDSL LED Functions	1-20
<i>Table 1-6</i>	DS3+T1/E1 IMA NI-2 Card LED Group Indicators	1-24
<i>Table 1-7</i>	OC-3c/OC-3c NI-2 Card LED Group Indicators	1-28
<i>Table 1-8</i>	Cisco 6015 5-Pin Header Contact Pinouts	1-37
<i>Table 2-1</i>	Commercial Operating Environment Requirements	2-12
<i>Table 2-2</i>	Outside-Plant Operating Environment Requirements	2-12
<i>Table 2-3</i>	Rack Space Requirements	2-14
<i>Table 2-4</i>	Rack Space Calculation for the Cisco 6015 System Configurations	2-15
<i>Table 2-5</i>	Power Consumption Calculation for Cisco 6015 System Components	2-17
<i>Table 2-6</i>	Tool and Equipment Requirements Checklist	2-19
<i>Table 3-1</i>	Installation Checklist—Cisco 6015 with a POTS Splitter Configuration in a Commercial Environment	3-2
<i>Table 3-2</i>	Terminal Settings	3-25
<i>Table 4-1</i>	Installation Checklist—Cisco 6015 Without a POTS Splitter Configuration in a Commercial Environment	4-2
<i>Table 4-2</i>	Terminal Settings	4-23
<i>Table 5-1</i>	Installation Checklist—Cisco 6015 Configuration in an Outside-Plant Environment	5-2
<i>Table 5-2</i>	Terminal Settings	5-21
<i>Table 6-1</i>	Service Interruptions Caused by Replacing FRUs	6-2
<i>Table 6-2</i>	Chassis Alarms	6-18
<i>Table 6-3</i>	Line Card Slot Alarms	6-18
<i>Table 6-4</i>	Cisco IOS Controller Alarms	6-19
<i>Table 6-5</i>	DS3 Network Interface Alarms	6-19
<i>Table 6-6</i>	OC-3c/Synchronous Transfer Mode (STM-1) Network Interface Alarms	6-20
<i>Table 6-7</i>	T1/E1 Network Interface Alarms	6-20
<i>Table 6-8</i>	IMA Link Network Interface Alarms	6-20
<i>Table 6-9</i>	IMA Group Alarms	6-21

<i>Table 6-10</i>	Fan Module Alarms	6-22
<i>Table 6-11</i>	Power Supply Alarms	6-22
<i>Table 7-1</i>	Terminal Settings	7-13
<i>Table A-1</i>	Hardware Specifications	A-2
<i>Table A-2</i>	4xflexi Specifications	A-3
<i>Table A-3</i>	8xDMT Specifications	A-4
<i>Table A-4</i>	8xDMT Over ISDN Specifications	A-5
<i>Table A-5</i>	8xG.SHDSL Line Card Specifications	A-6
<i>Table A-6</i>	DS3+T1/E1 IMA and ITEMP DS3+T1/E1 IMA NI-2 Card Specifications	A-7
<i>Table A-7</i>	OC-3c/OC-3c NI-2 Card Specifications	A-8
<i>Table A-8</i>	I/O Module Specifications	A-9
<i>Table A-9</i>	DSL Interface Module Specifications	A-10
<i>Table A-10</i>	DC PEM Specifications	A-10
<i>Table A-11</i>	Fan Module Specifications	A-11
<i>Table A-12</i>	Software Specifications	A-11
<i>Table B-1</i>	Port Mapping for a Cisco 6015 to Two POTS Splitters	B-3
<i>Table B-2</i>	Port Mapping for a Cisco 6015 to One POTS Splitter	B-4
<i>Table B-3</i>	Standard Telco Color Chart	B-5
<i>Table C-1</i>	T1/E1 Connector Pinouts	C-2
<i>Table C-2</i>	Cisco 6015 5-Pin Header Contact Pinouts	C-2
<i>Table C-3</i>	Pin Assignments for the NI-2 Card Console and Auxiliary Receptacles	C-3
<i>Table C-4</i>	Pin Assignments for the NI-2 Card Management Ethernet Receptacle	C-4



Preface

This preface explains the audience, purpose, and organization of the *Cisco 6015 Hardware Installation Guide*. It also defines the conventions that are used to present instructions and information.

Audience

The *Cisco 6015 Hardware Installation Guide* is intended for use by central office (CO) technicians and maintenance personnel who are responsible for installing, configuring, and maintaining the Cisco 6015 system. A familiarity with telco products and networking systems is recommended.

Purpose

The *Cisco 6015 Hardware Installation Guide* describes how to set up, install, and troubleshoot the Cisco 6015 system. After completing the installation procedures that are covered in this guide, refer to the appropriate related documents to provision your Cisco 6015 system. For additional information on related documentation, see the “Related Documentation” section on page xix.

Organization

The *Cisco 6015 Hardware Installation Guide* is organized as follows:

- Chapter 1, “Product Overview,” provides an overview of the Cisco 6015 system.
- Chapter 2, “Preparing for Installation,” provides the requirements that are necessary to prepare for the installation of the Cisco 6015 system.
- Chapter 3, “Installing a Cisco 6015 with a POTS Splitter Configuration in a Commercial Environment,” provides installation procedures for a Cisco 6015 with a POTS splitter configuration in a commercial environment.
- Chapter 4, “Installing a Cisco 6015 Without a POTS Splitter Configuration in a Commercial Environment,” provides installation procedures for a Cisco 6015 without a POTS splitter configuration in a commercial environment.
- Chapter 5, “Installing a Cisco 6015 Configuration in an Outside-Plant Environment,” provides installation procedures for a Cisco 6015 configuration in an outside-plant environment, using a Cisco 6015 with a POTS splitter configuration or a Cisco 6015 without a POTS splitter configuration.

- Chapter 6, “Troubleshooting,” provides information about isolating faults in the Cisco 6015 system.
- Chapter 7, “Upgrading and Maintaining the Cisco 6015 System,” describes upgrade and maintenance procedures for the Cisco 6015 system.
- Appendix A, “Technical Specifications,” provides the technical specifications for the Cisco 6015 system.
- Appendix B, “Cable and Port Mapping Specifications,” provides cabling guidelines, cabling configuration diagrams, and port mapping tables.
- Appendix C, “Connector and Pinout Specifications,” provides information about connectors and pinouts for the Cisco 6015 system.
- Glossary.
- Index.

Conventions

This publication uses the document conventions listed in this section.

Table 1 *Font Conventions*

Convention	Definition	Sample
Times bold	Text body font used for any argument, command, keyword, or punctuation that is part of a command that the user enters in text and command environments. Also used for names of some GUI elements.	This is similar to the UNIX route command.
<i>Times italic</i>	Text body font used for publication names and for emphasis.	See the <i>Cisco 6100 Series User Guide</i> for further details.
<code>Courier</code>	Font used for screen displays, prompts, and scripts.	Are you ready to continue? [Y]
Courier bold	Font used to indicate what the user enters in examples of command environments.	Login: root Password: <password>

Table 2 *Command Syntax Conventions*

Convention	Definition	Sample
Vertical bar ()	Separates alternative, mutually exclusive elements.	offset-list {in out} offset
Square brackets ([])	Indicate optional elements.	[no] offset-list {in out} offset
Braces ({ })	Indicate a required choice.	offset-list {in out} offset
Braces within square brackets ([{ }])	Indicate a required choice within an optional element.	[{letter}number] Enter

Table 2 *Command Syntax Conventions (continued)*

Convention	Definition	Sample
Boldface	Indicates commands and keywords that are entered literally as shown	[no] offset-list {in out} offset
<i>Italics</i>	Indicate arguments for which you supply values. Note In contexts that do not allow italics, arguments are enclosed in angle brackets (< >).	offset-list {in out} offset

**Note**

Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the manual.

**Tip**

Means *the following information will help you solve a problem*. The tips information might not be troubleshooting or even an action, but could be useful information or information that might save time.

**Caution**

Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

**Warning**

Means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translated versions of the warning, refer to the *Regulatory Compliance and Safety* document that accompanied the device.

Related Documentation

A complete list of all DSL product related documentation is available on the World Wide Web at http://www.cisco.com/univercd/cc/td/doc/product/dsl_prod/index.htm.

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

You can access the most current Cisco documentation on the World Wide Web at the following sites:

- <http://www.cisco.com>
- <http://www-china.cisco.com>
- <http://www-europe.cisco.com>

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or as an annual subscription.

Ordering Documentation

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- Registered Cisco Direct Customers can order Cisco Product documentation from the Networking Products MarketPlace:
http://www.cisco.com/cgi-bin/order/order_root.pl
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- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco corporate headquarters (California, USA) at 408 526-7208 or, in North America, by calling 800 553-NETS(6387).

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San Jose, CA 95134-9883

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Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

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Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information and resources at anytime, from anywhere in the world. This highly integrated Internet application is a powerful, easy-to-use tool for doing business with Cisco.

Cisco.com provides a broad range of features and services to help customers and partners streamline business processes and improve productivity. Through Cisco.com, you can find information about Cisco and our networking solutions, services, and programs. In addition, you can resolve technical issues with online technical support, download and test software packages, and order Cisco learning materials and merchandise. Valuable online skill assessment, training, and certification programs are also available.

Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

<http://www.cisco.com>

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

<http://www.cisco.com/tac>

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

<http://www.cisco.com/register/>

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

<http://www.cisco.com/tac/caseopen>

Contacting TAC by Telephone

If you have a priority level 1 (P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.



Product Overview

This chapter provides an overview of the Cisco 6015 system. This chapter contains the following sections:

- Introduction to the Cisco 6015 System, page 1-1
- Cisco 6015 Chassis Overview, page 1-10
- Management Software, page 1-38

1.1 Introduction to the Cisco 6015 System

The Cisco 6015 system is part of the Cisco digital subscriber line (DSL) product family that provides end-to-end service by carrying data between a subscriber's home or office and a network, which can be managed by one of the following:

- Competitive local exchange carrier (CLEC)
- Incumbent local exchange carrier (ILEC)
- International post, telephone, and telegraph (PTT)

The Cisco 6015 system is also designed for use in multitenant/multiple dwelling units (MTU/MDUs) and can be deployed in either a commercial or an outside-plant environment, such as at a digital loop carrier (DLC) remote site.

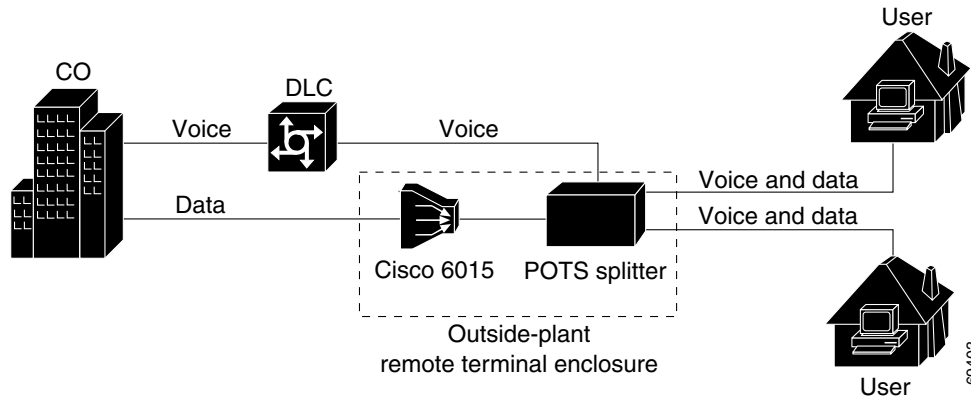


Note

Before you install a Cisco 6015 system in an outside-plant environment, verify that the remote terminal enclosure meets the following compliance requirements: GR-487, UL 50 Type 4X, EN60529 IP 55, and NEMA 4X.

Figure 1-1 details a high-level network architecture diagram of a Cisco 6015 installed in an outside-plant environment.

Figure 1-1 Network Architecture for a Cisco 6015 in an Outside-Plant Environment



The Cisco 6015 system sends and receives subscriber data (often Internet service) over existing copper telephone lines and concentrates all traffic onto a single high-speed trunk for transport to the Internet or a corporate intranet. Asymmetric digital subscriber line (ADSL) or single-pair high-speed digital subscriber line, also known as symmetric high bit rate digital subscriber loop (SHDSL), customer premises equipment (CPE) devices, which are connected to PCs or routers at the subscriber site, modulate data so that it can travel over telephone lines to the Cisco 6015 system.



Note

For detailed information on the various components in the Cisco DSL product family (including central office [CO] and CPE devices), see the “Related Documentation” section on page xix.

The Cisco 6015 system includes the following hardware and software components:

- Cisco 6015 chassis—Deployed with a standard network interface-version 2 (NI-2). The following components will be installed in the chassis:
 - Quad-port flexi ATU-C line cards (4xflexis), octal-port DMT ATU-C line cards (8xDMTs—both commercial and outside-plant versions), octal-port DMT ATU-C over ISDN line cards (8xDMT over ISDN), octal-port single-pair high-speed digital subscriber line, also known as symmetric high bit rate digital subscriber loop (G.SHDSL) line cards (8xG.SHDSLs)



Note

The 4xflexi, 8xG.SHDSL, commercial environment 8xDMT, and the 8xDMT over ISDN can be used only in a commercial environment. They cannot be used in an outside-plant environment. For line card intermixing information, see the “Cisco 6015 Cards and Modules” section on page 1-11.

- DS3+T1/E1 inverse multiplexing over ATM (IMA) NI-2 card, the industrial temperature (ITEMP) DS3+T1/E1 IMA NI-2 card, or the OC-3c/OC-3c NI-2 card



Note

The OC-3c/OC-3c NI-2 card can only be used in a commercial environment. The ITEMP DS3+T1/E1 IMA NI-2 card is the only NI-2 card designed for use in an outside-plant environment.

- Fan module
- DS3+T1 Input/Output (I/O) module or E1 I/O module
- DSL interface module
- DC power entry module (PEM)
- AC/DC converter (optional if you need to convert AC power to usable DC power)



Note The AC/DC converter can be used only in a commercial environment. It cannot be used in an outside-plant environment.

- Plain old telephone service (POTS) splitter (optional). The POTS splitter is a passive device that supports simultaneous voice (basic telephone service) and data services and is available from Cisco Ecosystem partners



Note Third-party POTS splitters can be installed in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility with your Cisco representative.

For POTS splitter information, refer to the vendor documentation.

A system configuration using 8xDMTs or 8xDMT over ISDNs requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

- Management software—Provisions and manages the Cisco 6015 system.
 - Cisco IOS—A command-line interface (CLI) that is available for network element provisioning.
 - Cisco DSL Manager (CDM)—A graphical user interface (GUI) designed to configure and manage the 6xxx series of Cisco IOS software-based DSL access multiplexers (DSLAMs). CDM provides the following areas of network management—fault, configuration, performance, and security. CDM runs with the Cisco Element Manager Framework (EMF); both are installed on Sun workstations.

Cisco EMF is based on an object model in which network elements or modules represent the managed entity. Each object is defined by a class and specific attributes. An object can represent a network element or a more abstract entity such as a link relationship, a network, or a container such as a site, shelf, or region.



Note See the “Hardware Specifications” section on page A-1 for minimum software and network management release requirements per Cisco 6015 chassis component.

1.1.1 Features

The Cisco 6015 system includes the following features:

- Small footprint that terminates up to 48 subscribers per chassis
- Front-access, six-slot multiport line-card architecture
- North American and world-wide safety and compliance

- Network Equipment Building System (NEBS)
- American National Standards Institute (ANSI)
- European Telecommunication Standards Institute (ETSI)
- ATM carrier-class network element standards
- Supports up to 24 ADSL ports with 4xflexis
- Supports up to 48 ADSL ports with 8xDMTs or 8xDMT over ISDNs, or up to 48 SHDSL ports with 8xG.SHDSLs
- Carrierless amplitude and phase modulation (CAP) rate-adaptive DSL (RADSL), ANSI T1.413 Discrete Multitone (DMT), trellis coded pulse amplitude modulation (TC-PAM), and G.lite modem support
- Network transmission connections
 - DS3
 - T1/E1 IMA
 - OC-3c
- Manageable through IOS or CDM
- Subtending—Up to 13 Cisco 6015 chassis can be linked together (subtended) so that they are served by a single network trunk port, which supports up to 624 subscribers (using octal-port xTU-C line cards)



Note The Cisco 6015 can also serve as the subtending host chassis to, or a subtended node chassis from, the Cisco 6100, Cisco 6130, Cisco 6160, and Cisco 6260.

- Supports the entire range of virtual channel identifier (VCI)/virtual path identifier (VPI) connections, and none of the connections are limited by memory.
- Building integrated timing supply (BITS) clock input
- Facility alarm input
- Nonblocking ATM switching architecture
- Up to three ATM classes of service simultaneously per queue
- Commercial or outside plant deployment
- Optional AC power supply, for use only in a commercial environment

1.1.2 Configurations

This guide details the installation steps for the following configurations:

- Cisco 6015 with a POTS Splitter Configuration
- Cisco 6015 Without a POTS Splitter Configuration
- Subtended Network Configuration
- IMA Configuration

1.1.2.1 Cisco 6015 with a POTS Splitter Configuration

The Cisco 6015 with a POTS splitter configuration supports up to 48 subscribers through directly connected modems using ADSL technology. To increase subscribership, you can add additional chassis to your system.

This configuration includes the following hardware components:

- Cisco 6015 chassis
 - 4xflexis (configure as CAP, DMT, or G.lite)—Use only in a commercial environment
 - 8xDMTs—Two versions: one for a commercial environment and one for an outside-plant environment
 - 8xDMT over ISDNs—Use only in a commercial environment
- AC/DC converter—Optional if you use AC power; use only in a commercial environment
- Third-party vendor POTS splitter
 - POTS cards

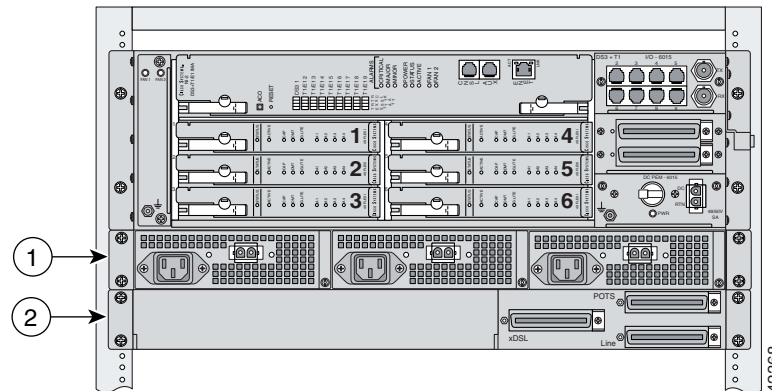


Note A system configuration using 8xDMTs or 8xDMT over ISDNs requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

The 8xDMT over ISDN is designed for use in a configuration with a POTS splitter only.

Figure 1-2 shows the components that can be used in a Cisco 6015 with a POTS splitter configuration.

Figure 1-2 Cisco 6015 with a POTS Splitter Configuration in North America



1	AC/DC Converter	2	Third-party POTS splitter
----------	-----------------	----------	---------------------------



Note

In North America, the DS3+T1 I/O module will be installed in the chassis. In world-wide environments, the E1 I/O module will be installed in the chassis.

1.1.2.2 Cisco 6015 Without a POTS Splitter Configuration

The Cisco 6015 without a POTS splitter configuration supports up to 48 subscribers through directly connected modems using ADSL or SHDSL technology. To increase subscribership, you can add additional chassis to your system.

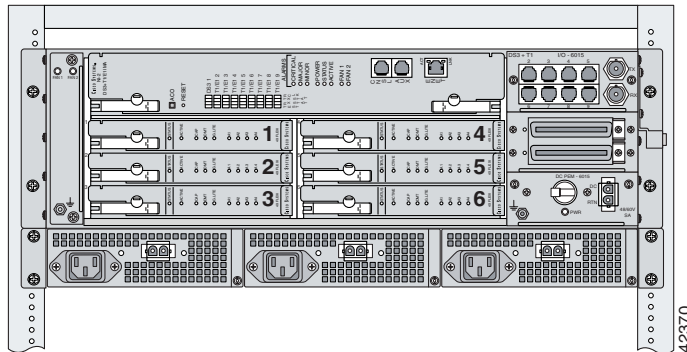
This configuration includes the following hardware components:

- Cisco 6015 chassis
 - 4xflexis (configure as CAP, DMT, or G.lite)—Use only in a commercial environment
 - 8xDMTs—Two versions: one for a commercial environment and one for an outside-plant environment
 - 8xG.SHDSLs—Use only in a commercial environment
- AC/DC converter—Optional if you use AC power; use only in a commercial environment

In this configuration, the Cisco 6015 connects directly to the main distribution frame (MDF) in a commercial environment or the enclosure protection block in an outside-plant environment.

Figure 1-3 shows the components that can be used in a Cisco 6015 without a POTS splitter configuration.

Figure 1-3 Cisco 6015 Without a POTS Splitter Configuration



Note

In North America, the DS3+T1 I/O module will be installed in the chassis. In world-wide environments, the E1 I/O module will be installed in the chassis.

1.1.2.3 Subtended Network Configuration

A subtended network configuration

- Services and aggregates the data from one or more Cisco 6015 chassis into a subtending host chassis to take advantage of the data network interface on the subtending host chassis.



Note

The Cisco 6015 can also serve as the subtending host chassis to, or a subtended node chassis from, the Cisco 6100, Cisco 6130, Cisco 6160, and Cisco 6260.

- Provides additional benefits by reducing the number of ATM edge-switch ports that are required to terminate the chassis.
- Supports both a Cisco 6015 with a POTS splitter and a Cisco 6015 without a POTS splitter configuration.

The term *subtending* refers to the host chassis, and *subtended* refers to the downstream chassis in a subtended network.

The following subtended network configurations are supported:

- DS3 trunk with up to eight individual T1/E1 subtended interfaces or up to four IMA groups, or a combination of the two
- Daisy chain configuration for OC-3c subtended Cisco 6015 chassis.
- Eight T1 IMA trunked and subtended interfaces
 - T1 IMA group or T1 User-Network Interface (UNI) as the trunk
 - Up to seven individual T1 interfaces or up to four IMA groups, or a combination of the two

**Note**

The use of a T1 or IMA group trunk disables the DS3 interface.

- Eight E1 IMA trunked and subtended interfaces
 - E1 IMA group or E1 UNI as the trunk
 - Up to seven individual E1 interfaces or up to four IMA groups, or a combination of the two

The following sections detail the different types of subtending network connections.

1.1.2.3.1 Subtended Network Configuration with the DS3+T1/E1 IMA NI-2 Card and the ITEMP DS3+T1/E1 IMA NI-2 Card

In a subtended network configuration using a DS3+T1/E1 IMA NI-2 card or an ITEMP DS3+T1/E1 IMA NI-2 card, you can subtend up to 12 Cisco 6015 chassis through a daisy-chain configuration of IMA links, or a star configuration of IMA links. The subtending chassis connect through one subtending host chassis with a DS3 connection to the ATM backbone.

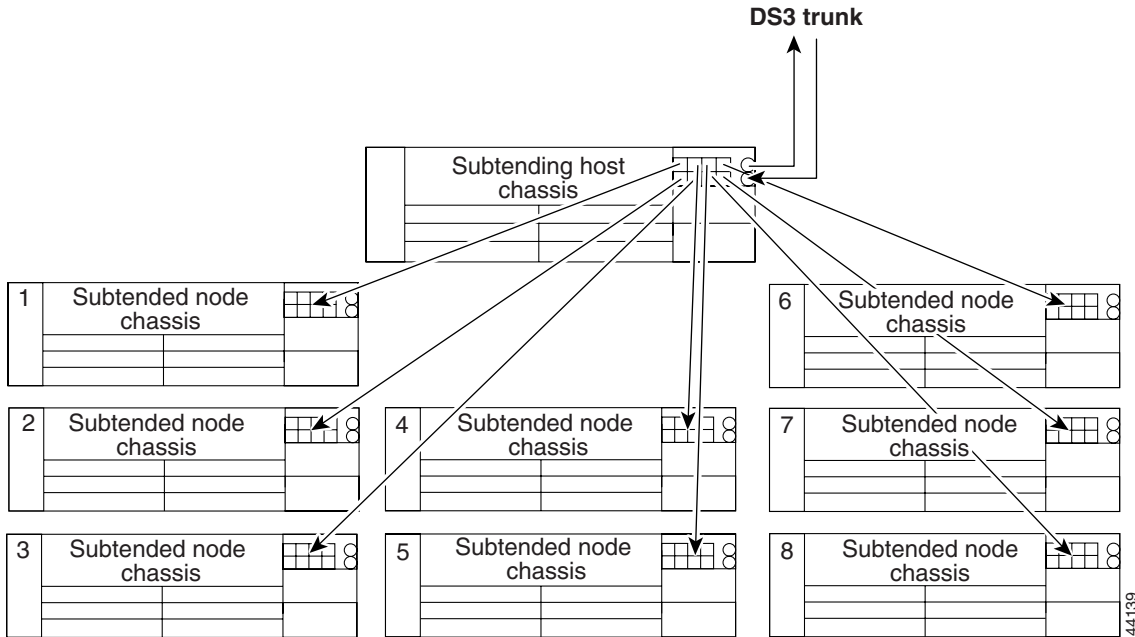
You can also make the host chassis ATM trunk connection through a T1 or IMA group, but that disables the DS3 interface. See the “IMA Configuration” section on page 1-8 for more information on using IMA group or individual links.

**Note**

The Cisco 6015 can also serve as the subtending host chassis to, or as a subtended node chassis from, the Cisco 6100, Cisco 6130, Cisco 6160, or Cisco 6260.

Figure 1-4 shows an example of a subtended network with a star topology. Subtended Network—Star Topology. The subtending host chassis in the middle of the star topology connects directly to the ATM switch. With a DS3 trunk, you can have up to eight subtended node chassis connected to the subtending host chassis.

Figure 1-4 Star Topology for Cisco 6015 Subtended Network

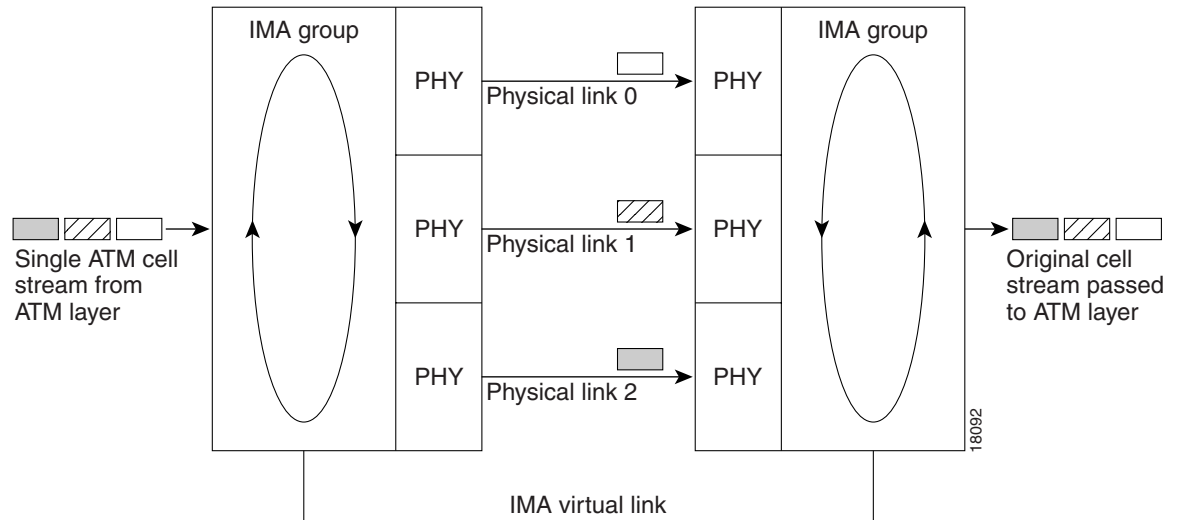
**Note**

Consult with your network architect or Cisco customer service representative for examples of other subtending topology configurations using the DS3+T1/E1 IMA NI-2 card and the ITEMP DS3+T1/E1 IMA NI-2 card.

1.1.2.3.2 IMA Configuration

The DS3+T1/E1 IMA NI-2 card uses IMA technology to aggregate multiple low-speed links into one larger virtual trunk or IMA group. An inverse multiplexer appears to your ATM switch router as one logical pipe. IMA provides you with modular bandwidth to access the ATM network between T1 or E1 and DS3 or E3 rates. The Cisco 6015 allows you to combine up to a maximum of eight T1 or E1 lines to form an IMA group.

IMA breaks up the ATM cell stream, distributes the cells over the multiple physical links of an IMA group, then recombines the cells into a single stream at the other end of the connection. The ATM cells are distributed in a round-robin fashion over the physical links of the IMA group, recombined at the receiving IMA group, and passed in their original form to the ATM layer (see Figure 1-5). Using the multiple links of an IMA group increases the logical link bandwidth to approximately the sum of the individual link rates. The physical links should be nominally the same length to avoid excessive intra-group delay. Cisco recommends that all of the links in an IMA group be bundled together between the source and the destination.

Figure 1-5 Inverse Multiplexing and Recombining of ATM Cells Through IMA Groups

The T1 and E1 IMA I/O modules have eight ports. You can use the eight ports on the T1 and E1 IMA I/O modules as independent ATM links or in the IMA mode. The following bullets are examples of possible IMA groups, independent ATM links, and mixed modes. Examples of IMA groups assume two links per group.

- Four IMA groups with any combination of eight links
- Three IMA groups and up to two independent ATM links
- Two IMA groups and up to four independent ATM links
- One IMA group and up to six independent ATM links
- No IMA group and up to eight independent ATM links

The T1 (1.544 Mbps) and E1 (2.048 Mbps) IMA port adapters provide trunk or subtrunk connectivity and are used for intercampus or wide-area links. The T1 and E1 IMA port adapters support unshielded twisted-pair (UTP) connectors. The order of assignment of links to an IMA group is not restricted.

The IMA group interfaces use a modified naming convention from the other interfaces in the system. These interfaces are named with the convention `atm<slot>/ima<group>`, where `<slot>` is the slot number for the DS3+T1/E1 IMA NI-2 card and `<group>` is the IMA group number from 0 to 3. Table 1-1 lists the interface naming conventions.

Table 1-1 Interface Naming Conventions

Interface	Name
DS3 link	atm0/1
T1/E1 link 0	atm0/2
T1/E1 link 1	atm0/3
T1/E1 link 2	atm0/4
T1/E1 link 3	atm0/5
T1/E1 link 4	atm0/6
T1/E1 link 5	atm0/7
T1/E1 link 6	atm0/8

Table 1-1 Interface Naming Conventions (continued)

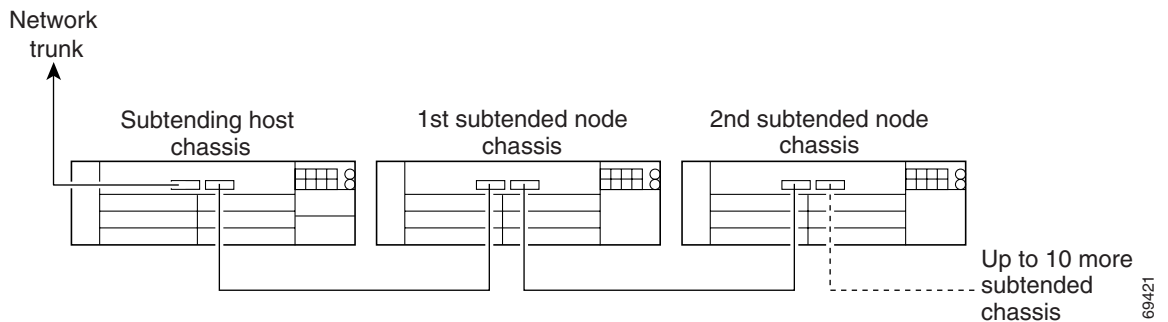
Interface	Name
T1/E1 link 7	atm0/9
IMA group 0	atm0/ima0
IMA group 1	atm0/ima1
IMA group 2	atm0/ima2
IMA group 3	atm0/ima3

1.1.2.3.3 Subtended Network Configuration with OC-3c/OC-3c NI-2 Cards

In a subtended network configuration using OC-3c/OC-3c NI-2 cards (SMF or MMF), you can subtend up to 12 OC-3c configured chassis in a daisy chain, all connecting through one subtending host chassis to the ATM backbone (see Figure 1-6).


Note

The Cisco 6015 can also serve as the subtending host chassis to, or as a subtended node chassis from, the Cisco 6100, Cisco 6130, Cisco 6160, or Cisco 6260.

Figure 1-6 Daisy Chain Topology for OC-3c Interfaces

69421

1.2 Cisco 6015 Chassis Overview

The Cisco 6015 chassis uses a front-access, six-slot multiport line-card architecture capable of supporting up to 48 xDSL ports that are connected either directly or through a POTS splitter.


Note

For hardware specifications for the Cisco 6015, see the “Cisco 6015 System Specifications” section on page A-2.

The chassis supports the following hardware components:

- Up to six 4xflexi, 8xDMT, 8xG.SHDSL, or 8xDMT over ISDNs
- DS3+T1/E1 IMA NI-2 card, ITEMP DS3+T1/E1 IMA NI-2 card, or OC-3c/OC-3c NI-2 card
- DS3+T1 or E1 I/O module
- DSL interface module

- DC PEM
- Fan module

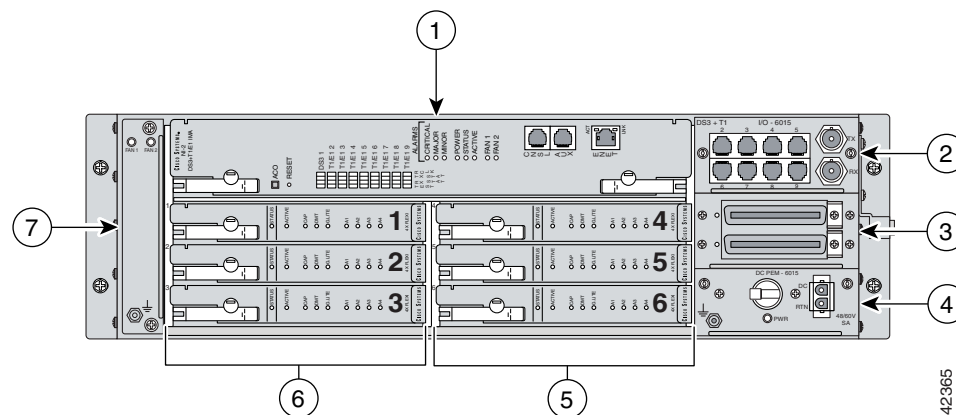
**Note**

You can purchase blank faceplates for empty Cisco 6015 module slots.

The 8xDMT over ISDN can be used only in a Cisco 6015 system with a POTS splitter configuration.

Figure 1-7 identifies the Cisco 6015 card and module slots. Each line card slot on a chassis is numbered along the left edge of the card slot (slots 1 through 6). In the guide illustrations, the slot numbers are shown on the cards for easy reference and readability. These slots are referred to in subsequent sections of this chapter and elsewhere in this guide.

Figure 1-7 Cisco 6015 Card and Module Slots



1	NI-2 card	5	Line card slots 4 to 6
2	I/O module	6	Line card slots 1 to 3
3	DSL interface module	7	Fan module
4	DC PEM		

The following sections detail these Cisco 6015 hardware components:

- Cisco 6015 Cards and Modules, page 1-11
- Rear Interface Header, page 1-36
- AC/DC Converter, page 1-37

1.2.1 Cisco 6015 Cards and Modules

This section contains the following information about Cisco 6015 cards and modules:

- 4xflexi Overview, page 1-12
- 8xDMT Overview, page 1-14
- 8xDMT Over ISDN Overview, page 1-17

- 8xG.SHDSL Overview, page 1-19
- DS3+T1/E1 IMA NI-2 Card Overview, page 1-21
- OC-3c/OC-3c NI-2 Card Overview, page 1-25
- I/O Module Overview, page 1-29
- DSL Interface Module Overview, page 1-31
- DC PEM Overview, page 1-32
- Fan Module Overview, page 1-33

The Cisco 6015 chassis supports line card intermixing. However, mixing cards with different types of encoding (ADSL or SHDSL) on the same side of the chassis could result in decreased performance of the loop due to overlapping frequency spectrums. To minimize potential performance degradation in the binder, install ADSL and SHDSL line cards in separate halves of the chassis. For example, if you install 4xflexis on the left side of the chassis (slots 1 to 3), install 8xSHDSLs on the right side of the chassis (slots 4 to 6).

1.2.1.1 4xflexi Overview

The 4xflexi

- Supports CAP, DMT, or G.lite line encoding.
- Supports four ADSL modem connections.
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card.
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance.



Note

The 4xflexi cannot be used in an outside-plant environment.

For line card intermixing information, see the “Cisco 6015 Cards and Modules” section on page 1-11.

If provisioned, the 4xflexi rate adapts to the maximum bit rate negotiable on the line. The maximum bit rate settings are provisioned in the management software.



Note

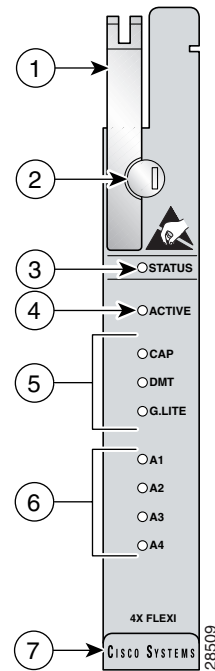
For hardware specifications for the 4xflexi, see the “4xflexi Specifications” section on page A-3.

The Cisco 6015 chassis can include up to six 4xflexis for a total of 24 ADSL modem connections.

The edge connector key, located on the rear of the 4xflexi, connects the 4xflexi to the backplane of the chassis. You can install only the edge connector key with seven notches in the Cisco 6015.

Figure 1-8 shows a close-up of the 4xflexi faceplate.

Figure 1-8 4xflexi Faceplate



1	Ejector lever	5	Line card mode LED
2	Locking tab	6	Modem port status LEDs
3	STATUS LED	7	Extraction tab
4	ACTIVE LED		

Table 1-2 describes the 4xflexi LED indicator functions.

Table 1-2 4xflexi LED Functions

LED	State	Function
STATUS	Green slow blinking	The self-test is in progress.
	Green fast blinking	The image download is in progress.
	Green solid	The status is OK.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.
CAP	Green solid	The line card is in CAP mode.
	Off	The line card is not in CAP mode.

Table 1-2 4xflexi LED Functions (continued)

LED	State	Function
DMT	Green solid	The line card is in DMT mode.
	Off	The line card is not in DMT mode.
G.LITE	Green solid	The line card is in G.lite mode.
	Off	The line card is not in G.lite mode.
A1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.
A2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
A3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
A4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.

1.2.1.2 8xDMT Overview

The 8xDMT can be installed in the following environments:

- Commercial—Use 8xDMT product number ATUC-8-DMT-1
- Outside plant—Use 8xDMT product number ATUC-8-DMT-1-H

The 8xDMT

- Supports eight ADSL modem connections.
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card.
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance.

If provisioned, the 8xDMT rate adapts to the maximum bit rate negotiable on the line. The maximum bit rate settings are provisioned in the management software.



Note

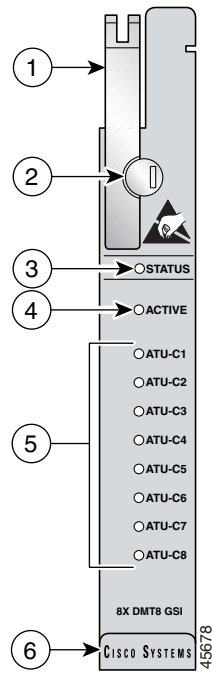
For hardware specifications for the 8xDMT, see the “8xDMT Specifications” section on page A-4.

For line card intermixing information, see the “Cisco 6015 Cards and Modules” section on page 1-11.

The Cisco 6015 chassis can include up to six 8xDMTs for a total of 48 ADSL modem connections.

Figure 1-9 shows a close-up of the 8xDMT commercial environment faceplate.

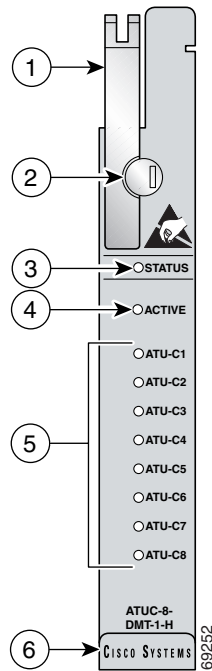
Figure 1-9 Commercial Environment 8xDMT Faceplate



1	Ejector lever	4	ACTIVE LED
2	Locking tab	5	Modem port status LEDs
3	STATUS LED	6	Extraction tab

Figure 1-10 shows a close-up of the 8xDMT outside-plant environment faceplate.

Figure 1-10 Outside-Plant Environment 8xDMT Faceplate



1	Ejector lever	4	ACTIVE LED
2	Locking tab	5	Modem port status LEDs
3	STATUS LED	6	Extraction tab

Table 1-3 describes LED functions on both the commercial and the outside-plant versions of the 8xDMT.

Table 1-3 8xDMT LED Functions

LED	State	Function
STATUS	Green slow blinking	No errors, but no connection established.
	Green fast blinking	The image download is in progress.
	Green solid	NI-2 communication established.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has had a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.
ATU-C 1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 1 is idle.

Table 1-3 8xDMT LED Functions (continued)

LED	State	Function
ATU-C 2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
ATU-C 3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
ATU-C 4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.
ATU-C 5	Green solid	Modem 5 is trained.
	Green blinking	Training is in progress for modem 5.
	Off	Modem 5 is idle.
ATU-C 6	Green solid	Modem 6 is trained.
	Green blinking	Training is in progress for modem 6.
	Off	Modem 6 is idle.
ATU-C 7	Green solid	Modem 7 is trained.
	Green blinking	Training is in progress for modem 7.
	Off	Modem 7 is idle.
ATU-C 8	Green solid	Modem 8 is trained.
	Green blinking	Training is in progress for modem 8.
	Off	Modem 8 is idle.

1.2.1.3 8xDMT Over ISDN Overview

The 8xDMT over ISDN

- Supports eight ADSL modem connections.
- Converts ADSL modulation from the line into digital data streams to and from the NI-2 card.
- Negotiates the line rate with the CPE when it trains and bases the rate on line quality and distance.
- The 8xDMT over ISDN can be used only in a Cisco 6015 system with a POTS splitter configuration.



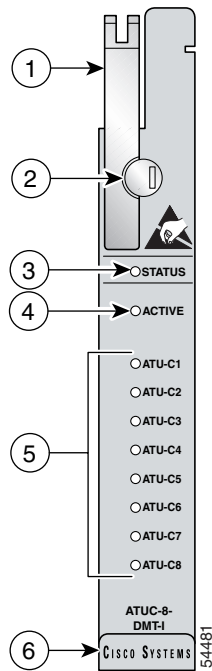
Note

The 8xDMT over ISDN cannot be used in an outside plant environment.

For hardware specifications for the 8xDMT over ISDN, see the “8xDMT Over ISDN Specifications” section on page A-5.

Figure 1-11 shows a close-up of the 8xDMT over faceplate.

Figure 1-11 8xDMT Over ISDN Faceplate



1	Ejector lever	4	ACTIVE LED
2	Locking tab	5	Modem port status LEDs
3	STATUS LED	6	Extraction tab

Table 1-4 describes the 8xDMT over ISDN LED indicator functions.

Table 1-4 8xDMT Over ISDN LED Functions

LED	State	Function
STATUS	Green slow blinking	No errors, but no connection established.
	Green fast blinking	The image download is in progress.
	Green solid	NI-2 communication established.
	Red	The self-test or line card has failed.
	Off	The ATU-C line card has had a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.
ATU-C 1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.

Table 1-4 8xDMT Over ISDN LED Functions (continued)

LED	State	Function
ATU-C 2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
ATU-C 3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
ATU-C 4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.
ATU-C 5	Green solid	Modem 5 is trained.
	Green blinking	Training is in progress for modem 5.
	Off	Modem 5 is idle.
ATU-C 6	Green solid	Modem 6 is trained.
	Green blinking	Training is in progress for modem 6.
	Off	Modem 6 is idle.
ATU-C 7	Green solid	Modem 7 is trained.
	Green blinking	Training is in progress for modem 7.
	Off	Modem 7 is idle.
ATU-C 8	Green solid	Modem 8 is trained.
	Green blinking	Training is in progress for modem 8.
	Off	Modem 8 is idle.

1.2.1.4 8xG.SHDSL Overview

The 8xG.SHDSL

- Is designed for use in a Cisco 6015 without a POTS splitter configuration.
- Supports eight G.SHDSL modem connections.
- Supports trellis coded pulse amplitude modulation (TC-PAM) line encoding.
- Converts G.SHDSL modulation from the line into digital data streams to and from the NI-2 card.
- Supports fixed and adaptive rate modes.



Note

The 8xG.SHDSL cannot be used in an outside-plant environment.

For line card intermixing information, see the “Cisco 6015 Cards and Modules” section on page 1-11. For hardware specifications for the 8xG.SHDSL, see the “8xG.SHDSL Specifications” section on page A-6.

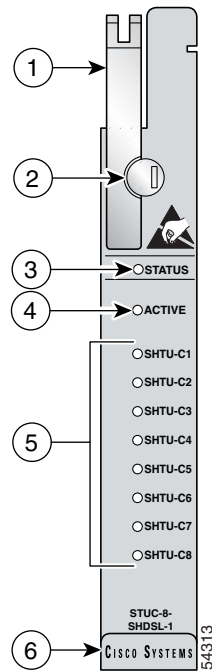
The Cisco 6015 chassis can include up to six 8xG.SHDSLs for a total of 48 SHDSL modem connections.

**Note**

The 8xG.SHDSL line card supports multiple line rates ranging from 72 kbps to 2312 kbps in fixed mode. In rate adaptive mode, the 8xG.SHDSL line card supports rates ranging from 2312 kbps to 200 kbps in 64 kbps decrements. In rate adaptive mode, line rate is negotiated and then locked when the line trains.

Figure 1-12 shows a close-up of the 8xG.SHDSL faceplate.

Figure 1-12 8xG.SHDSL Faceplate



1	Ejector lever	4	ACTIVE LED
2	Locking tab	5	Modem port status LEDs
3	STATUS LED	6	Extraction tab

Table 1-5 describes the 8xG.SHDSL LED indicator functions.

Table 1-5 8xG.SHDSL LED Functions

LED	State	Function
STATUS	Green slow blinking	No errors, but no connection established.
	Green fast blinking	The image download is in progress.
	Green solid	NI-2 communication established.
	Red	The self-test or line card has failed.
	Off	The line card has had a power failure.
ACTIVE	Green solid	The line card is activated.
	Off	The line card is not in service.

Table 1-5 8xG.SHDSL LED Functions (continued)

LED	State	Function
SHTU-C1	Green solid	Modem 1 is trained.
	Green blinking	Training is in progress for modem 1.
	Off	Modem 1 is idle.
SHTU-C2	Green solid	Modem 2 is trained.
	Green blinking	Training is in progress for modem 2.
	Off	Modem 2 is idle.
SHTU-C3	Green solid	Modem 3 is trained.
	Green blinking	Training is in progress for modem 3.
	Off	Modem 3 is idle.
SHTU-C4	Green solid	Modem 4 is trained.
	Green blinking	Training is in progress for modem 4.
	Off	Modem 4 is idle.
SHTU-C5	Green solid	Modem 5 is trained.
	Green blinking	Training is in progress for modem 5.
	Off	Modem 5 is idle.
SHTU-C6	Green solid	Modem 6 is trained.
	Green blinking	Training is in progress for modem 6.
	Off	Modem 6 is idle.
SHTU-C7	Green solid	Modem 7 is trained.
	Green blinking	Training is in progress for modem 7.
	Off	Modem 7 is idle.
SHTU-C8	Green solid	Modem 8 is trained.
	Green blinking	Training is in progress for modem 8.
	Off	Modem 8 is idle.

1.2.1.5 DS3+T1/E1 IMA NI-2 Card Overview

The DS3+T1/E1 IMA NI-2 card can be installed in the following environments:

- Commercial—Use the DS3+T1/E1 IMA NI-2 card (part number NI-2-DS3-T1E1)
- Outside plant—Use the ITEMP DS3+T1/E1 IMA NI-2 card (part number NI-2-DS3-T1E1-H)

The DS3+T1/E1 IMA NI-2 card provides a high-speed connection for aggregated data traffic from the xTU-C line cards. The NI-2 card performs central processor, host, and system controller functions. The NI-2 card runs and is controlled by Cisco IOS software.

The DS3+T1/E1 IMA NI-2 card performs the following system tasks:

- Contains the ATM switch fabric
- Controls timing through an internal clock or BITS interface, or from an ATM interface (DS3, T1, or E1)



Note The BITS interface is connected through a header that is located on the back of the chassis.

- Provides CO facility alarm input
- Provides operating status visual indications
- Performs subtending and other control functions

The ITEMP DS3+T1/E1 IMA NI-2 card motherboard and IOS daughter card are populated with industrial temperature components so that the NI-2 card can operate in an outside-plant environment.

The NI-2 card operation mode (DS3/T1 or E1) is determined by the type of I/O module, DS3+T1 or E1, installed in the Cisco 6015 chassis. For more information on the I/O modules, see the “I/O Module Overview” section on page 1-29.



Note

For hardware specifications for the DS3+T1/E1 IMA NI-2 card, see the “DS3+T1/E1 IMA and ITEMP DS3+T1/E1 IMA NI-2 Cards Specifications” section on page A-7.

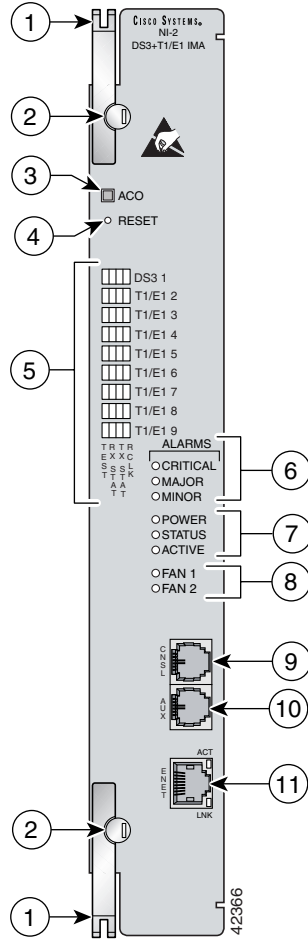
Figure 1-13 shows a close-up of the DS3+T1/E1 IMA NI-2 card faceplate.



Note

The only cosmetic difference between the DS3+T1/E1 IMA NI-2 card and the ITEMP DS3+T1/E1 IMA NI-2 card is the word “ITEMP” silkscreened on the card faceplate.

Figure 1-13 DS3+T1/E1 IMA NI-2 Card Faceplate



1	Ejector lever	7	Card status LED group
2	Locking tab	8	Fan alarm LED group
3	ACO ¹ button	9	CNSL—An RJ-45 receptacle that provides a serial connection to a system console.

4	Maintenance RESET port	10	AUX—An RJ-45 receptacle that provides connection to an auxiliary device (such as a modem) used to remotely configure the system.
5	Interface status LED groups: DS3 1, T1/E1 2, T1/E1 3, T1/E1 4, T1/E1 5, T1/E1 6, T1/E1 7, T1/E1 8, and T1/E1 9. These groups show the status of the trunk and subtend connections on the I/O module or I/O card	11	ENET—An RJ-45 10BaseT receptacle that complies with Ethernet standards and that provides connection to a system Ethernet.
6	System alarm LED group		

1. ACO = alarm cutoff

Table 1-6 describes the LED group indicators and their functions.

Table 1-6 DS3+T1/E1 IMA NI-2 Card LED Group Indicators

LED Group	LED	State	Function
Interface status LED (5 in Figure 1-13)	TEST	Amber solid	Cisco IOS detects that an obtrusive test (loopback) is active on this interface.
		Off	Cisco IOS does not detect obtrusive test activity.
	RX ¹ STAT	Amber solid	The receiver detects a physical layer problem.
		Off	The receiver does not detect a physical layer problem.
	TX ² STAT	Amber solid	The transmitter detects a physical layer problem.
		Off	The transmitter does not detect a physical layer problem.
RCLK ³	Green solid	Hardware detects an incoming clock signal.	
	Off	Hardware does not detect an incoming clock signal.	
System alarm (6 in Figure 1-13)	CRITICAL	Red	A critical alarm is active.
	MAJOR	Red	A major alarm is active.
	MINOR	Amber	A minor alarm is active.
Card status (7 in Figure 1-13)	POWER	Green	The NI-2 card has power.
	STATUS	Green	The operational status of the NI-2 card. <ul style="list-style-type: none"> On—There are no internal faults or problems. Off—The NI-2 card has not booted properly, or a problem is preventing normal operation.
	ACTIVE	Green	When lit, this LED indicates that the NI-2 card is operating as the active network interface in the chassis.

Table 1-6 DS3+T1/E1 IMA NI-2 Card LED Group Indicators (continued)

LED Group	LED	State	Function
Fan alarm (8 in Figure 1-13)	FAN 1	Red	The fan module or fan tray is not operational and is in alarm mode.
	FAN 2	Red	The fan module or fan tray is not operational and is in alarm mode. Note Because there is only one fan module in the Cisco 6015, this LED is not operational.
ENET interface LED (11 in Figure 1-13)	ACT	Green solid or blinking	The Ethernet interface is active.
		Off	The Ethernet interface is inactive.
	LNK	Green solid	The Ethernet link is connected and enabled.

1. RX = receive
2. TX = transmit
3. RCLK = receive clock

1.2.1.6 OC-3c/OC-3c NI-2 Card Overview

The OC-3c/OC-3c NI-2 card

- Connects to the xTU-C line cards through point-to-point serial data buses on the backplane
- Performs central processor, host, and system controller functions
- Contains the ATM switch fabric
- Supports the aggregation of up to 12 subtended node chassis configured for OC-3c operation in a daisy chain configuration.
- Provides an OC-3c subtend interface through optical connectors located on the NI-2 card faceplate.
- Controls timing and redundancy



Note

The BITS interface is connected through a header located on the back of the Cisco 6015 chassis.

The OC-3c/OC-3c NI-2 card can only be used in a commercial environment.

- Provides CO facility alarm relay contact interfaces and an ACO button
- Provides operating status visual and audible indications
- Performs subtending and other control functions
- Provides the network OC-3c WAN trunk interface through connectors located on the NI-2 card faceplate. The following two versions of the OC-3c/OC-3c NI-2 card are available to support the WAN trunk interface:
 - SMF intermediate range.
 - MMF short range.

**Note**

The OC-3c/OC-3c NI-2 card cannot be used in an outside-plant environment.

Use of the OC-3c/OC-3c NI-2 card in the Cisco 6015 disables whichever I/O module is installed in the chassis. Therefore, neither I/O module will affect the OC-3c/OC-3c NI-2 card operation in the Cisco 6015.

For hardware specifications for the OC-3c/OC-3c NI-2 card, see the “OC-3c/OC-3c NI-2 Card Specifications” section on page A-8.

The OC-3c/OC-3c NI-2 card functions are managed by Cisco IOS software. The IOS software operates and integrates controller, network trunk, and subtending functionality from this single NI-2 card.

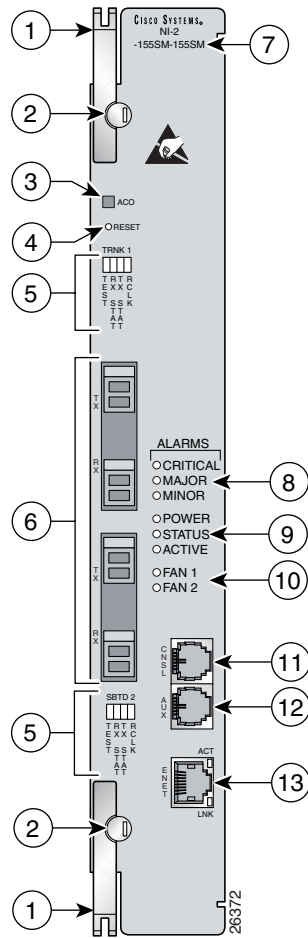
The SMF and MMF OC-3c/OC-3c NI-2 cards operate in conjunction with network interfaces that are supplied by optical interface connectors on the OC-3c/OC-3c NI-2 card faceplate. The OC-3c/OC-3c NI-2 card faceplates have two optical connector pairs:

- The top optical connector pair receives OC-3c ATM network transmit and receive trunk optical cables or OC-3c transmit and receive optical cables from the NI-2 card of a subtending host chassis.
- The bottom optical connector pair accommodates receive and transmit optical cables from the NI-2 card of a subtended node chassis that is configured for operation in an OC-3c network.

Both the SMF and MMF OC-3c/OC-3c NI-2 cards support the aggregation of up to 12 additional subtended Cisco 6015 chassis in a daisy chain configuration.

Figure 1-14 shows a close-up of the OC-3c/OC-3c NI-2 card faceplate.

Figure 1-14 OC-3c/OC-3c NI-2 Card Faceplate



1	Ejector lever	8	System alarm LED group
2	Locking tab	9	Card status LED group
3	ACO button	10	Fan alarm LED group
4	Maintenance RESET port	11	CNSL—An RJ-45 receptacle that provides a serial connection to a system console.

5	Interface status LED groups: TRNK 1 and SBTD 2, which show the status of the network trunk and subtend connections.	12	AUX—An RJ-45 receptacle that provides connection to an auxiliary device (such as a modem) used to remotely configure the system.
6	Two optical interface connector pairs: TRNK 1 and SBTD 2 <ul style="list-style-type: none"> • TRNK 1—for network trunk interface TX and RX data optical cables. On a subtended node chassis, these TX and RX cables connect to SBTD 2 on the subtending host chassis. • SBTD 2—for subtended node chassis TX and RX data optical cables. 	13	ENET—An RJ-45 10BaseT receptacle that complies with Ethernet standards and that provides connection to a system Ethernet.
7	Model number		

Table 1-7 describes the LED group indicators and their functions.

Table 1-7 OC-3c/OC-3c NI-2 Card LED Group Indicators

LED Group	LED	State	Function
Interface status LED (5 in Figure 1-14)	TEST	Amber solid	Cisco IOS detects that an obtrusive test (loopback) is active on this interface.
		Off	Cisco IOS does not detect obtrusive test activity.
	RX STAT	Amber solid	The receiver detects a physical layer problem.
		Off	The receiver does not detect a physical layer problem.
	TX STAT	Amber solid	The transmitter detects a physical layer problem.
		Off	The transmitter does not detect a physical layer problem.
RCLK	Green solid	Hardware detects an incoming clock signal.	
	Off	Hardware does not detect an incoming clock signal.	
System alarm (7 in Figure 1-14)	CRITICAL	Red	A critical alarm is active.
	MAJOR	Red	A major alarm is active.
	MINOR	Amber	A minor alarm is active.
Card status (8 in Figure 1-14)	POWER	Green	The NI-2 card has power.
	STATUS	Green	The operational status of the NI-2 card. <ul style="list-style-type: none"> • On—There are no internal faults or problems. • Off—The NI-2 card has not booted properly, or a problem is preventing normal operation.
	ACTIVE	Green	When lit, this LED indicates that the NI-2 card is operating as the active network interface in the chassis.

Table 1-7 OC-3c/OC-3c NI-2 Card LED Group Indicators (continued)

LED Group	LED	State	Function
Fan alarm (9 in Figure 1-14)	FAN 1	Red	The fan module or fan tray is not operational and is in alarm mode.
	FAN 2	Red	The fan module or fan tray is not operational and is in alarm mode. Note Because there is only one fan module in the Cisco 6015, this LED is not operational.
ENET interface LED (12 in Figure 1-14)	ACT	Green solid or blinking	The Ethernet interface is active.
		Off	The Ethernet interface is inactive.
	LNK	Green solid	The Ethernet link is connected and enabled.

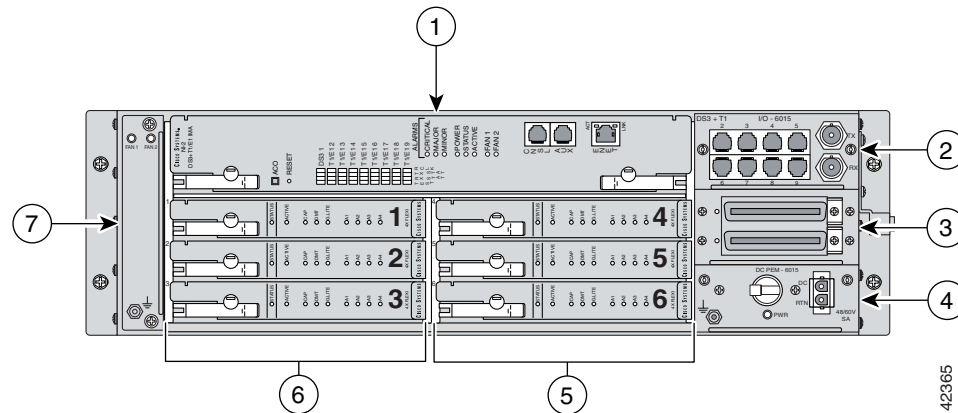
1.2.1.7 I/O Module Overview

The I/O module performs the following system tasks:

- Provides the network WAN trunk physical interface
- Provides the subtending physical interfaces to subtended node chassis

Figure 1-15 shows the location of the I/O module in the Cisco 6015 chassis.

Figure 1-15 I/O Module Location in the Cisco 6015 Chassis



1	NI-2 card	5	xDSL line cards (slots 4 to 6)
2	I/O ¹ module	6	xDSL line cards (slots 1 to 3)
3	DSL ² interface module	7	Fan module
4	DC PEM ³		

1. I/O = input/output
2. DSL = digital subscriber line
3. PEM = power entry module

Currently, there are two versions of the I/O module:

- DS3+T1
- E1



Note

Use of the OC-3c/OC-3c NI-2 card in the Cisco 6015 disables whichever I/O module is installed in the chassis. However, an I/O module must be installed in the chassis for the system to operate correctly. The OC-3c/OC-3c NI-2 card does not support the DS3, E1, or T1 interfaces found on the front of the I/O modules. Therefore, the trunk and subtending interfaces are provided on the front of the OC-3c/OC-3c NI-2 card.

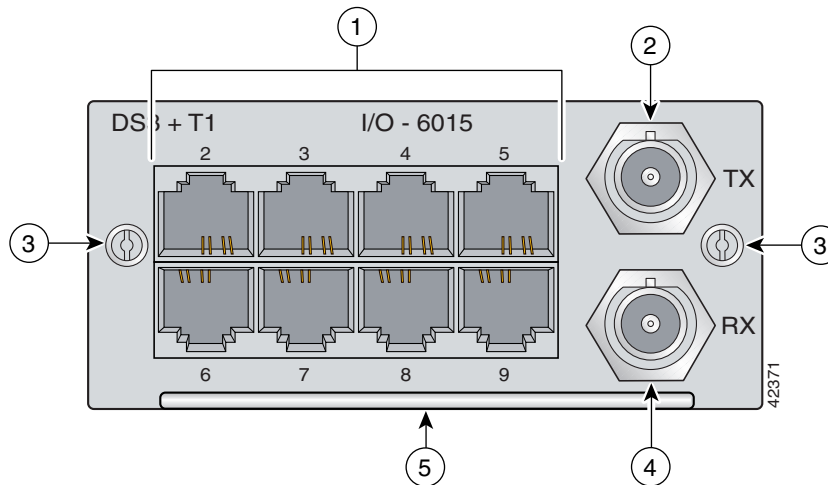
For hardware specifications for the I/O module, see the “I/O Module Specifications” section on page A-9.

The two versions of the I/O module are detailed in the following sections.

1.2.1.7.1 DS3+T1 I/O module

The DS3+T1 I/O module is used in North America. Figure 1-16 shows a close-up of the DS3+T1 I/O module faceplate.

Figure 1-16 DS3+T1 I/O module Faceplate



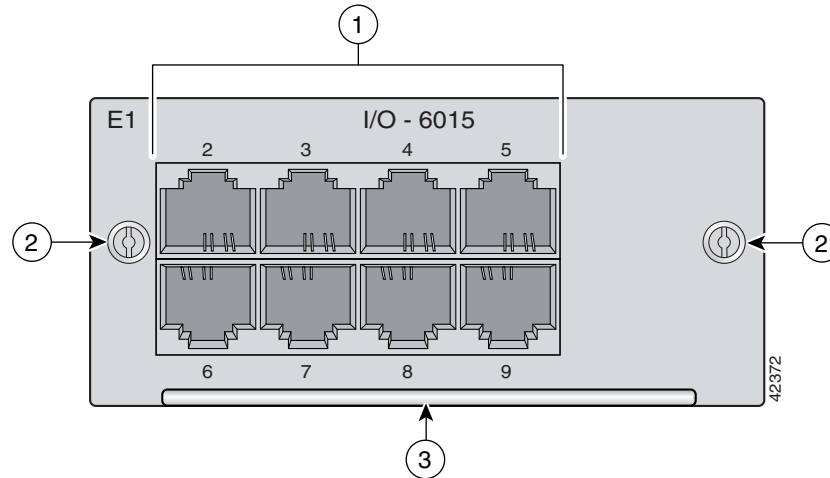
1	Eight RJ-48 ¹ receptacle connectors for eight T1 trunk or subtending interfaces	4	RX ² BNC connector for the DS3 trunk interface
2	TX ³ BNC connector for the DS3 trunk interface	5	Extraction handle
3	Screws to secure the I/O module in the chassis		

1. An RJ-48 is a receptacle for an RJ-45 connection.
2. RX = receive.
3. TX = transmit.

1.2.1.7.2 E1 I/O module

The E1 I/O module is used world wide, except for North America. Figure 1-17 shows a close-up of the E1 I/O module faceplate.

Figure 1-17 E1 I/O module Faceplate



1	Eight RJ-48 ¹ receptacle connectors for eight E1 trunk or subtending interfaces	3	Extraction handle
2	Screws to secure the I/O module in the chassis		

1. An RJ-48 is a receptacle for an RJ-45 connection.

1.2.1.8 DSL Interface Module Overview

The DSL interface module enables you to

- Connect the Cisco 6015 to a POTS splitter in a Cisco 6015 with a POTS splitter configuration.
- Connect the Cisco 6015 to the MDF or enclosure protection block in a Cisco 6015 without a POTS splitter configuration.

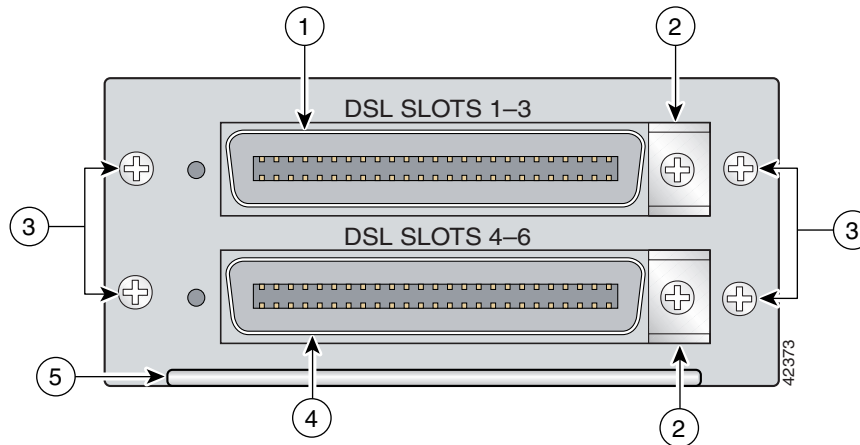


Note

For hardware specifications for the DSL interface module, see the “DSL Interface Module Specifications” section on page A-10.

Figure 1-18 shows a close-up of the DSL interface module faceplate.

Figure 1-18 DSL Interface Module Faceplate



1	50-pin Champ connector for DSL slots 1 through 3	4	50-pin Champ connector for DSL slots 4 through 6
2	Cable tie-downs	5	Extraction handle
3	Screws to secure the DSL interface module to the chassis		

The Cisco 6015 chassis follows the FCC part 68 industry standard convention for Tip and Ring connections on the twisted pairs of the 50-pin Champ connector. The Champ connectors are pinned out to accommodate quad-port or octal-port xTU-C line cards. If you are not currently using octal-port xTU-C line cards but plan to in the future, Cisco recommends that you use Champ cables that can accommodate higher density line cards.



Note

See Table 2-6, “Tool and Equipment Requirements Checklist” for information on the types of cables needed.

See Appendix B, “Cable and Port Mapping Specifications” for port mapping tables.

1.2.1.9 DC PEM Overview

Each Cisco 6015 is equipped with a $-48/-60V$ DC PEM, which distributes DC power within the chassis. Each DC PEM can be connected in one of the following ways:

- To the fuse and alarm panel for DC power.
- To the AC/DC converter, which is mounted below the Cisco 6015 chassis. The AC/DC converter converts AC power to usable DC power for the Cisco 6015.



Note

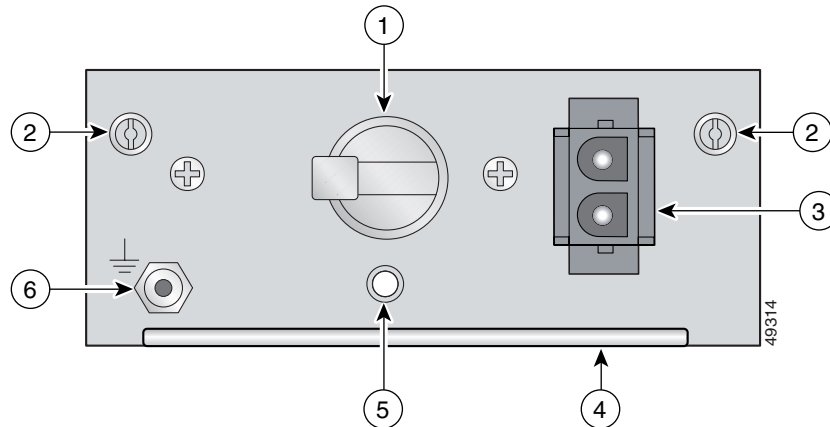
The AC/DC converter can be used only in a commercial environment. It cannot be used in an outside-plant environment.

**Note**

For hardware specifications for the DC PEM, see the “DC PEM Specifications” section on page A-10.

Figure 1-19 shows a close-up of the DC PEM faceplate.

Figure 1-19 DC PEM Faceplate

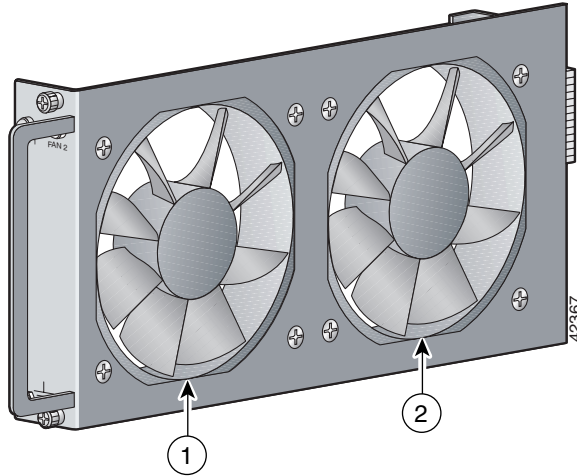


1	Two-position circuit breaker. The positions are Off (0) and On (1).	4	Extraction handle.
2	Screws to secure the DC PEM to the chassis.	5	LED showing the status of the DC PEM. <ul style="list-style-type: none"> • Green—Output is correct. • Off—DC PEM is not operational or input is not correct.
3	Two-pin connector to cable to the facility DC power or the AC/DC converter.	6	ESD grounding jack.

1.2.1.10 Fan Module Overview

The fan module houses two fans that provide system cooling. The Cisco 6015 requires that a fan module be installed when the system is in operation. Figure 1-20 shows the fan module.

Figure 1-20 Fan Module for the Cisco 6015



1	Fan 2	2	Fan 1
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**Note**

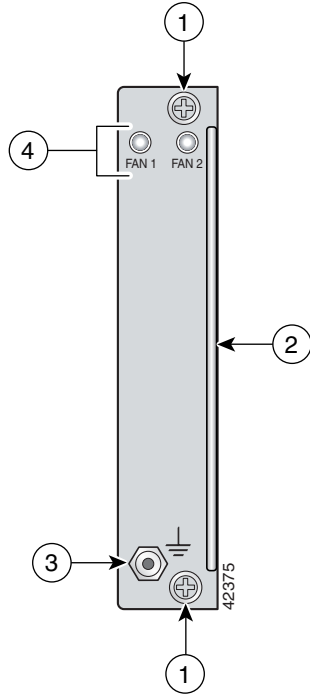
The fan module is installed in the chassis when it is shipped. If the fan module fails, replace it immediately.

**Note**

For hardware specifications for the fan module, see the “Fan Module Specifications” section on page A-11.

Figure 1-21 shows a close-up of the fan module faceplate.

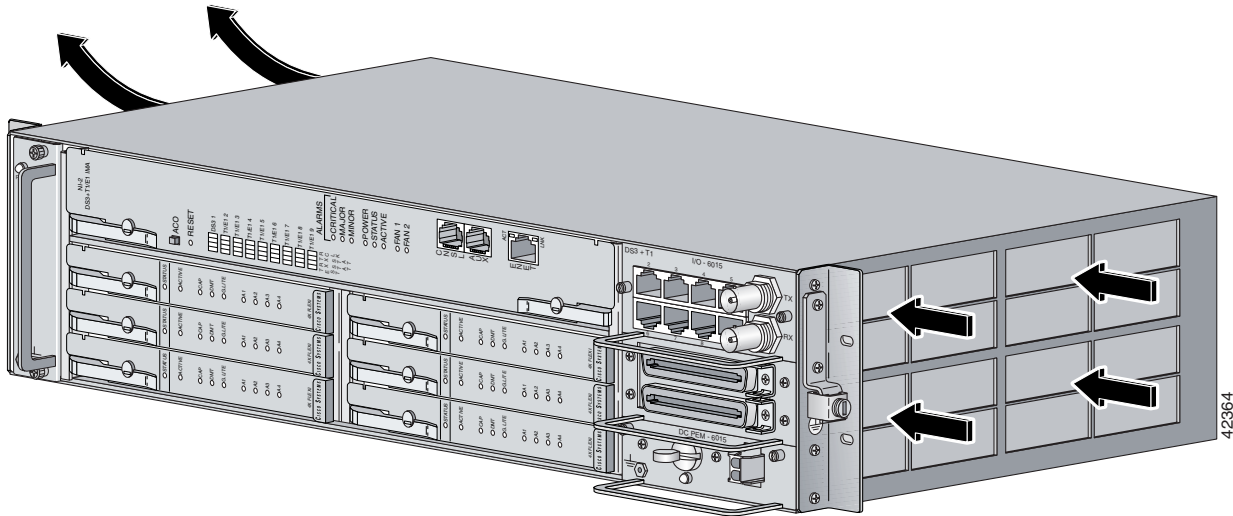
Figure 1-21 Fan Module Faceplate



1	Screws to secure the fan module to the chassis.	3	ESD grounding jack.
2	Extraction handle.	4	Fan LEDs. The LED on the left is for the fan that is located closest to the back of the chassis (Fan 1). The LED on the right is for the fan that is located closest to the front of the chassis (Fan 2).

The fan module pulls air from the right of the chassis, through the modules, and out the left of the chassis, as shown in Figure 1-22.

Figure 1-22 Air Flow Through Intake and Exhaust Vents on the Chassis



1.2.2 Rear Interface Header

The only rear-accessible chassis component is the 5-pin header that connects the BITS interface (network clocking) and the facility alarm input.

See Figure 1-23 for a close view of the pinouts that are located on the back of the Cisco 6015 chassis.

Figure 1-23 Cisco 6015 5-Pin Header

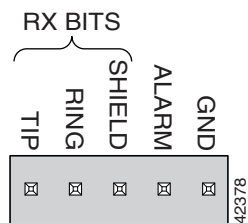


Table 1-8 lists the pinout descriptions for the header contacts.

Table 1-8 Cisco 6015 5-Pin Header Contact Pinouts

Function	Connector	Pin
BITS Interface	Tip	1
	Ring	2
	Shield	3
Facility Alarm Input	Alarm	4
	Ground	5

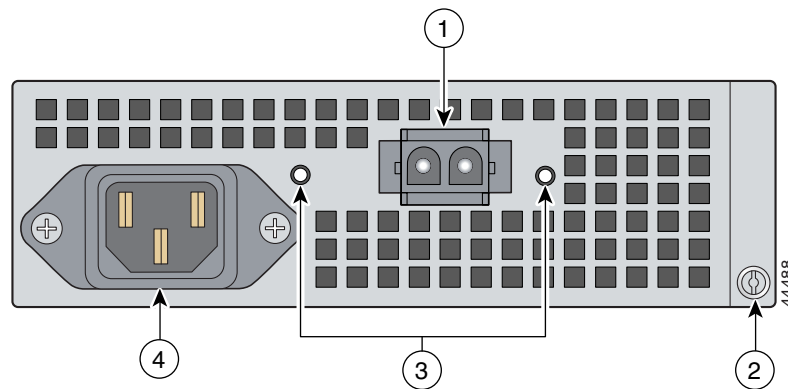
1.2.3 AC/DC Converter

An optional AC/DC converter must be installed and connected to the DC PEM if the system is powered by AC power. The AC/DC converter converts 120/240V AC power to -48V DC power for the Cisco 6015 system. The AC/DC converter is orderable through Cisco.


Note

The AC/DC converter can be used only in a commercial environment. It cannot be used in an outside-plant environment.

Figure 1-24 shows a close-up of the AC/DC converter faceplate.

Figure 1-24 AC/DC Converter Faceplate

	2-pin connector	LEDs. When green, the left LED indicates that there is good AC input. When the right LED is green, it indicates that there is good DC output between the AC/DC converter and the DC PEM. If either LED is off, troubleshoot the AC/DC converter or the AC input.
1		3
2	Screw	4 AC power receptacle

**Note**

An AC power cord applicable to your country's electrical specifications will accompany the AC/DC converter.

An AC/DC converter tray is available to house up to three AC/DC converters. The AC/DC converter tray is installed directly below the Cisco 6015 chassis. Extenders are available for the tray if you are installing the system in a 23-inch rack.

**Note**

For hardware specifications for the AC/DC converter, see the “Cisco 6015 System Specifications” section on page A-2.

1.3 Management Software

You can provision and manage the Cisco 6015 system through the following management software:

- Cisco IOS—A CLI that is available for network element provisioning.
- CDM—A GUI designed to configure and manage the 6xxx series of Cisco IOS software-based DSLAMs. CDM provides the following areas of network management—fault, configuration, performance, and security. CDM runs with the Cisco EMF; both are installed on Sun workstations.

Cisco EMF is based on an object model in which network elements or modules represent the managed entity. Each object is defined by a class and specific attributes. An object can represent a network element or a more abstract entity such as a link relationship, a network, or a container such as a site, shelf, or region.

**Note**

If your network contains multiple Sun workstations, you must dedicate one workstation as the server and all additional workstations as clients. The server should be the repository and distributor of database information from which the clients request information. The client workstations allow multiple users to monitor the managed network.

**Note**

See the “Hardware Specifications” section on page A-1 for minimum software and network management release requirements per Cisco 6015 chassis component.

The supported alarms that are generated by the management software are

- Critical visual—A critical visual alarm condition is indicated when the CRITICAL LED in the NI-2 card faceplate system alarm group lights. Whenever a critical alarm occurs
 - The critical visual alarm relay is activated.
 - Many or all subscribers that are connected to the node are affected (for example, failure of the network timing clock [NTC] or the trunk can cause a critical alarm).

Critical alarm indications are cleared when the alarm condition is resolved.

- Major visual—A major visual alarm condition is indicated when the MAJOR LED in the NI-2 card faceplate system alarm group lights. Whenever a major alarm occurs
 - The major visual alarm relay is activated.
 - Several subscribers that are connected to the node are affected.

Major alarm indications are cleared when the alarm condition is resolved.

- Minor visual—A minor visual alarm condition is indicated when the MINOR LED in the NI-2 card faceplate system alarm group lights. Whenever a minor alarm occurs
 - The minor visual alarm relay is activated.
 - A small number of subscribers that are connected to the node are affected.

Minor alarm indications are cleared when the alarm condition is resolved.

The facility alarm input, which is located on the rear of the chassis, allows an external event to trigger an alarm on the NI-2 card. (See the “Rear Interface Header” section on page 1-36 for more information.)

Audible alarms can be turned off by pressing the ACO button.

For more information on alarms that are generated in the management software, see Chapter 6, “Troubleshooting”.



Preparing for Installation

This chapter provides the requirements that are necessary to prepare for the installation of the Cisco 6015 system.

This chapter includes the following sections:

- Safety Requirements, page 2-1
- Site Requirements, page 2-11
- Required Tools and Equipment, page 2-19
- Unpacking the Cisco 6015 System, page 2-22
- Verifying Contents, page 2-23
- Inspecting for Damage, page 2-23



Caution

Before you start the installation procedures, read the entire chapter for important information and safety warnings.

2.1 Safety Requirements

This section describes safety requirements for the Cisco 6015 system. Before you install the Cisco 6015 system, ensure that all of the criteria in this section are met. The section describes the following safety requirements:

- Safety Guidelines, page 2-1
- Maintaining Safety with Electricity, page 2-8
- Preventing Electrostatic Discharge Damage, page 2-9
- General Maintenance Guidelines, page 2-9

2.1.1 Safety Guidelines

Before working on the equipment, be aware of standard safety guidelines and the hazards involved in working with electrical circuitry to prevent accidents. Adhere to the following guidelines, cautions, and warnings and those throughout the guide for safe and hazard-free installation.

Follow these guidelines to ensure general safety:

- Keep the equipment area clear and dust-free during and after installation.
- Keep tools away from walk areas where you and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis. Fasten ties or scarves and roll up shirt sleeves.
- Wear safety glasses if you are working under conditions that might be hazardous to your eyes.
- Do not perform any action that makes the equipment unsafe or creates a potential hazard to yourself or others.

**Caution**

Before you start the installation procedures, read the entire chapter for important information and safety warnings.

**Caution**

Proper ESD protection is required whenever you handle Cisco equipment. Installation and maintenance personnel should be properly grounded using ground straps to eliminate the risk of ESD damage to the equipment. Modules are subject to ESD damage whenever they are removed from the chassis.

**Caution**

Installing the cards in the chassis with the power leads reversed can damage the modules.

**Caution**

If fuses are already installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed. Do not power up the system while you install and connect the system.

**Caution**

If the power connections are improperly connected and power is applied while the cards are installed, the cards and chassis could be damaged.

**Caution**

It is important that the chassis cooling fans run continuously while the system is powered.

**Caution**

Any card that is only partially connected to the backplane can disrupt system operation.

**Warning**

This warning symbol means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information* document that accompanied this device.

Waarschuwing

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen. Voor vertalingen van de waarschuwingen die in deze publicatie verschijnen, kunt u het document *Regulatory Compliance and Safety Information* (Informatie over naleving van veiligheids- en andere voorschriften) raadplegen dat bij dit toestel is ingesloten.

Varoitus

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä julkaisussa esiintyvien varoitusten käännökset löydät laitteen mukana olevasta *Regulatory Compliance and Safety Information* -kirjastesta (määräysten noudattaminen ja tietoa turvallisuudesta).

Attention

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez le document *Regulatory Compliance and Safety Information* (Conformité aux règlements et consignes de sécurité) qui accompagne cet appareil.

Warnung

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise finden Sie im Dokument *Regulatory Compliance and Safety Information* (Informationen zu behördlichen Vorschriften und Sicherheit), das zusammen mit diesem Gerät geliefert wurde.

Avvertenza

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti. La traduzione delle avvertenze riportate in questa pubblicazione si trova nel documento *Regulatory Compliance and Safety Information* (Conformità alle norme e informazioni sulla sicurezza) che accompagna questo dispositivo.

Advarsel

Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker. Hvis du vil se oversettelser av de advarslene som finnes i denne publikasjonen, kan du se i dokumentet *Regulatory Compliance and Safety Information* (Overholdelse av forskrifter og sikkerhetsinformasjon) som ble levert med denne enheten.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes. Para ver as traduções dos avisos que constam desta publicação, consulte o documento *Regulatory Compliance and Safety Information* (Informação de Segurança e Disposições Reguladoras) que acompanha este dispositivo.

¡Advertencia! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes. Para ver una traducción de las advertencias que aparecen en esta publicación, consultar el documento titulado *Regulatory Compliance and Safety Information* (Información sobre seguridad y conformidad con las disposiciones reglamentarias) que se acompaña con este dispositivo.

Varning! Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador. Se förklaringar av de varningar som förekommer i denna publikation i dokumentet *Regulatory Compliance and Safety Information* (Efterrättelse av föreskrifter och säkerhetsinformation), vilket medföljer denna anordning.



Warning

Two people are required to lift the chassis. Grasp the chassis underneath the lower edge and lift with both hands. To prevent injury, keep your back straight and lift with your legs, not your back. To prevent damage to the chassis and components, never attempt to lift the chassis with the handles on the power supplies or on the interface modules. These handles were not designed to support the weight of the chassis.



Warning

Before opening the chassis, disconnect the telephone-network cables to avoid contact with telephone-network voltages



Warning

Do not work on the system or connect or disconnect cables during periods of lightning activity.



Warning

Read the installation instructions before you connect the system to its power source.



Warning

To prevent the switch from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104°F (40°C). To prevent airflow restriction, allow at least 3 inches (7.6 cm) of clearance around the ventilation openings.



Warning

To prevent the outside-plant environment DSLAM from overheating, do not operate it in an area that exceeds the maximum ambient temperature of 149°F (65°C). Verify that the remote terminal enclosure provides adequate cooling through the use of an appropriately sized heat exchanger or air conditioner.

**Warning**

The power supply circuitry for the equipment can constitute an energy hazard. Before you install or replace the equipment, remove all jewelry (including rings, necklaces, and watches). Metal objects can come into contact with exposed power supply wiring or circuitry inside the DSLAM equipment. This could cause the metal objects to heat up and cause serious burns or weld the metal object to the equipment.

**Warning**

Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units.

**Warning**

To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

—This unit should be mounted at the bottom of the rack if it is the only unit in the rack.

—When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.

—If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.

**Warning**

The ports labeled “Ethernet,” “10BaseT,” “Token Ring,” “Console,” and “AUX” are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

**Warning**

Class 1 laser product.

**Warning**

Do not stare into the beam or view it directly with optical instruments.

**Warning**

This unit is intended for installation in restricted access areas. A restricted access area is where access can only be gained by service personnel through the use of a special tool, lock and key, or other means of security, and is controlled by the authority responsible for the location.

**Warning**

When installing the unit, always make the ground connection first and disconnect it last.

**Warning**

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

**Warning**

This equipment is to be installed and maintained by service personnel only as defined by AS/NZS 3260 Clause 1.2.14.3 Service Personnel.

**Warning**

A readily accessible two-poled disconnect device must be incorporated in the fixed wiring.

**Warning**

To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

**Warning**

Never defeat the ground conductor or operate the equipment in the absence of a suitably installed ground conductor. Contact the appropriate electrical inspection authority or an electrician if you are uncertain that suitable grounding is available.

**Warning**

During this procedure, wear grounding wrist straps to avoid ESD damage to the card. Do not directly touch the backplane with your hand or any metal tool, or you could shock yourself.

**Warning**

Use copper conductors only.

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.

**Warning**

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

**Warning**













VCCI Compliance for Class B Equipment (Japan).

This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

警告

VCCI準拠クラスB機器（日本）

この機器は、Information Technology EquipmentのVoluntary Control Council for Interference (VCCI)の規格に準拠したクラスB製品です。この機器をラジオやテレビ受信機の近くで使用した場合、混信を発生する恐れがあります。本機器の設置および使用に際しては、取扱説明書に従ってください。

-  **Warning** Connect the unit only to DC power source that complies with the Safety Extra-Low Voltage (SELV) requirements in IEC 60950 based safety standards.
-  **Warning** Do not use this product near water; for example, near a bathtub, washbowl, kitchen sink or laundry tub, in a wet basement, or near a swimming pool.
-  **Warning** Never install telephone wiring during an electrical storm.
-  **Warning** Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
-  **Warning** Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
-  **Warning** Use caution when installing or modifying telephone lines.
-  **Warning** Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
-  **Warning** Do not use a telephone to report a gas leak in the vicinity of the leak.
-  **Warning** Ultimate disposal of this product should be handled according to all national laws and regulations.
-  **Warning** Only trained and qualified personnel should be allowed to install, replace, or service this equipment. This equipment contains an energy hazard. Disconnect the system before servicing.
-  **Warning** To prevent personal injury or damage to the chassis, never attempt to lift or tilt the chassis using the handles on the port adapters; these types of handles are not designed to support the weight of the unit. Lift the unit only by grasping the chassis underneath its lower edge.
-  **Warning** This equipment needs to be grounded. Use a green and yellow 14 AWG ground wire to connect the host to earth ground during normal use.

**Warning**

The DS3 ports are not intended to be connected to cables that run outside the building where it is installed. For any connections outside the building, the DS3 ports must be connected to a network termination unit (NTU). NTU devices should comply with appropriate national safety standards such as UL 1950, CSA 950, EN 60950, IEC 950, and AS 3260.

**Warning**

This product requires short-circuit (overcurrent) protection, to be provided as part of the building installation. Install only in accordance with national and local wiring regulations.

**Warning**

High-performance devices on this card can get hot during operation. To remove the card, hold it by the faceplate and bottom edge. Allow the card to cool before touching any other part of it or before placing it in an antistatic bag.

**Warning**

Do not reach into a vacant slot or chassis while you install or remove a module or a fan. Exposed circuitry could constitute an energy hazard.

2.1.2 Maintaining Safety with Electricity

Follow these guidelines when working on equipment that is powered by electricity:

- Locate the emergency power-off switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to turn off the power.
- Disconnect all power by removing the fuses from the fuse and alarm panel before:
 - Installing or removing a chassis
 - Working near power supplies
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit; always check the circuit.
- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, frayed power cords, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
 - Use caution; do not become a victim yourself.
 - Turn off power to the system.
 - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
 - Determine if the person needs rescue breathing or external cardiac compressions; then, take appropriate action.

2.1.3 Preventing Electrostatic Discharge Damage

Proper ESD protection is required whenever you handle Cisco equipment. ESD damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Use an antistatic strap during handling.



Use the ESD grounding jack on the fan module for all maintenance except when you are removing the fan module. Use the ESD grounding jack on the DC power entry module (PEM) when you are removing the fan module.

Follow these guidelines to prevent ESD damage:

- Always use an ESD ankle or wrist strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to the ESD grounding jack. There are two ESD grounding jacks that are located on the following Cisco 6015 chassis modules:
 - Fan module
 - DC PEM
- When you install a component, use available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help ensure that bus connectors are properly seated.
- When you remove a component, use available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Avoid touching the printed circuit boards or connectors on the NI-2 cards or line cards.
- Handle the modules by the extraction handles only; avoid touching the printed circuit boards or connectors.
- Place a removed component board-side-up on an antistatic surface or in a static-shielding container. If you plan to return the component to the factory, immediately place it in a static-shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap protects components from ESD voltages on the body only; ESD voltages on clothing can still cause damage.

**Caution**

Periodically check the resistance value of the antistatic strap. Ensure that the measurement is between 1 and 10 megohms.

2.1.4 General Maintenance Guidelines

This section covers the following topics:

- Hot Swapping Cards, page 2-10
- Hot Swapping Modules, page 2-10
- Installation and Replacement Suggestions, page 2-11

2.1.4.1 Hot Swapping Cards

Hot swapping allows you to remove and replace cards without disconnecting the system power. The Cisco 6015 chassis supports hot swapping for the following cards:

- The following line cards can be hot swapped: quad-port flexi ATU-C line card (4xflexi), octal-port discrete multitone (DMT) ATU-C line card (8xDMT), octal-port DMT ATU-C over ISDN line card (8xDMT over ISDN); octal-port single-pair high-speed digital subscriber line, also known as symmetric high bit-rate digital subscriber loop (G.SHDSL) line card (8xG.SHDSL). When the system detects that you have added or removed a line card, it automatically runs diagnostic and discovery routines and acknowledges the presence or absence of the line card. Hot swapping a line card will interrupt service for the subscribers assigned to that particular line card until the card is replaced.

If you remove a line card and replace it with the same type of line card, the newly installed line card receives the same provisioning as the original line card. The system resumes operation without any operator intervention.

If an unprovisioned line card is installed for the first time, the system identifies it as present but unprovisioned. Instructions for provisioning the line card are found in the appropriate software guide for your chassis.



Note

Reseating the 8xDMT over ISDN during simultaneous DSL and ISDN traffic operation results in the ISDN signal being temporarily interrupted.

To reseat the 8xDMT over ISDN in the chassis, shut down all the subscriber ports on the line card, wait one minute, and then replace the line card.

- DS3+T1/E1 inverse multiplexing over ATM (IMA), industrial temperature (ITEMP) DS3+T1/E1 IMA NI-2 card, or the OC-3/OC-3c NI-2 card—Hot swapping the NI-2 card will interrupt service for the entire system until the NI-2 card is replaced.

2.1.4.2 Hot Swapping Modules

Hot swapping allows you to remove and replace a module without disconnecting the system power. The Cisco 6015 chassis supports hot swapping for the fan module. Hot swapping the fan module will not interrupt the service for any subscribers.



Caution

The input/output (I/O) module, DSL interface module, and DC PEM are field replaceable units (FRUs); however, they are not hot swappable. The system must be powered down when these modules are replaced. These modules must be installed and removed by a trained technician only.

2.1.4.3 Installation and Replacement Suggestions

The following bullets list examples of recommended installation and replacement practices for the Cisco 6015 system cards and modules.

**Caution**

Any card or module that is only partially connected to the backplane can disrupt system operation.

- Do not force the card or module into its slot. This action can damage the pins on the backplane if they are not aligned properly with the card or module.
- Ensure that the card or module is straight and not at an angle when you install it in the slot. Installing the card or module at an angle can damage it. Use the guide rails to install the card or module correctly.
- Fully depress the ejector tabs to ensure that the card connector mates with the backplane correctly. Firmly seat the card in the slot by locking the card.

2.2 Site Requirements

This section describes requirements for the site where the Cisco 6015 system will be installed. Before you install the Cisco 6015 system, ensure that all the criteria in this section are met. The section describes the following:

- Environmental Requirements, page 2-11
- DC Power, page 2-16
- Cables, page 2-18
- Rack-Mounting, page 2-18

2.2.1 Environmental Requirements

Proper operation of the Cisco 6015 system depends on a proper environment. This section describes environmental requirements for the site where you will install the Cisco 6015 system. The section describes the following requirements:

- Temperature, Altitude, and Humidity, page 2-12
- Ventilation, page 2-13
- Space, page 2-14

2.2.1.1 Temperature, Altitude, and Humidity

The system can tolerate a wide range of temperatures. Table 2-1 provides the Cisco recommendations for temperature, altitude, and humidity conditions in a commercial environment.

Table 2-1 Commercial Operating Environment Requirements

Environmental Specifications	Description
Temperature	41 to 104°F (5 to 40°C)—Operating 23 to 131°F (–5 to 55°C)—Short-term operating
Altitude	–197 to 13,123 feet (–60 to 4000 meters)
Humidity	5 to 90% (noncondensing)



Warning

To prevent the switch from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104°F (40°C). To prevent airflow restriction, allow at least 3 inches (7.6 cm) of clearance around the ventilation openings.

Table 2-2 provides the Cisco recommendations for temperature, altitude, and humidity conditions in an outside-plant environment.

Table 2-2 Outside-Plant Operating Environment Requirements

Environmental Specifications	Description
Temperature	–40 to 149°F (–40 to 65°C)—Operating
Altitude	–197 to 13,123 feet (–60 to 4000 meters)
Humidity	5 to 95% (noncondensing)



Note

Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate your system has adequate air circulation. The Cisco 6015 system can be used in any environment that meets Network Equipment Building Systems (NEBS) requirements.

Enclosed racks must have adequate ventilation. Ensure that the rack is not overly congested, since each unit generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air.

Before you install a Cisco 6015 system in an outside-plant environment, verify that the remote terminal enclosure meets the following compliance requirements: GR-487, UL 50, Type 4X, EN60529 IP 55, and NEMA 4X.

The enclosure must also provide adequate cooling through the use of an appropriately sized heat exchanger or air conditioner, which dissipates the heat generated by existing remote terminal system components and by the installed Cisco 6015 chassis.

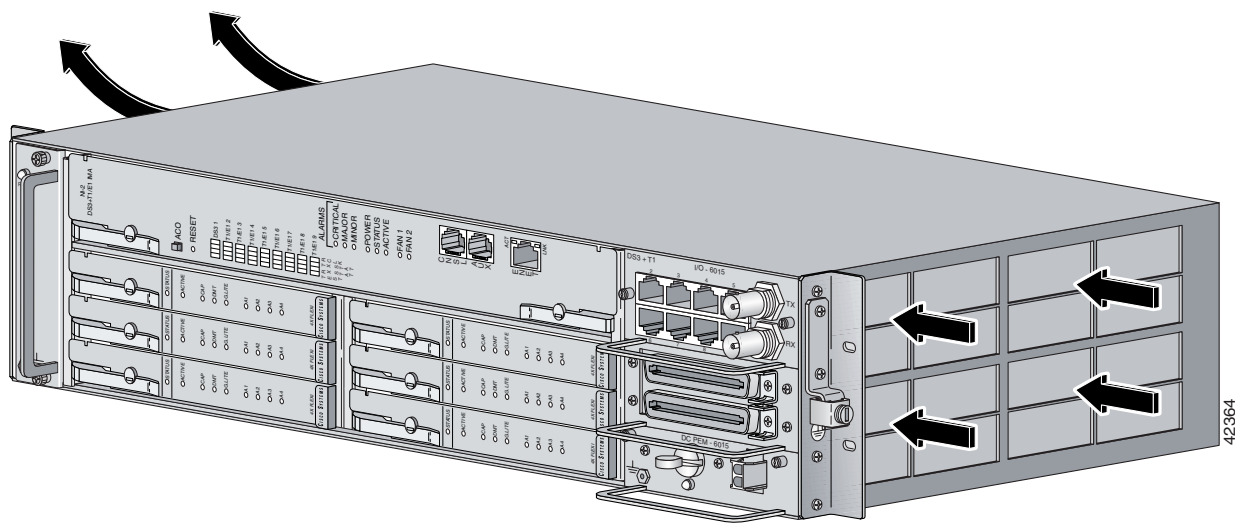
2.2.1.2 Ventilation

The following practices ensure proper ventilation for the Cisco 6015 system:

- Fan module installation—A fan module must be installed in the Cisco 6015 chassis.
- POTS splitter location—The POTS splitters do not dissipate heat and should be positioned at the bottom of the rack.

The Cisco 6015 fans maintain a suitable operating temperature for the internal circuitry. Ensure that the air intake vent at the right of the chassis and the air exhaust vent at the left side of the chassis (viewed from the front) are not obstructed in any way. Figure 2-1 shows the air flow through the Cisco 6015 chassis.

Figure 2-1 Air Flow Through Intake and Exhaust Vents on the Chassis

**Note**

Enclosed racks must have adequate ventilation. Ensure that the rack is not overly congested, because each unit generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air.

Before you install a Cisco 6015 system in an outside-plant environment, verify that the remote terminal enclosure meets the following compliance requirements: GR-487, UL 50, Type 4X, EN60529 IP 55, and NEMA 4X.

The enclosure must also provide adequate cooling through the use of an appropriately sized heat exchanger or air conditioner, which dissipates the heat generated by existing remote terminal system components and by the installed Cisco 6015 chassis.

2.2.1.3 Space

You can install a combination of the following Cisco 6015 system components in a rack:

- Cisco 6015 chassis
- AC/DC converter and converter tray—Optional and used only in a commercial environment
- POTS splitter (third-party POTS splitter)—Required only in a Cisco 6015 with a POTS splitter configuration

The Cisco 6015 system fits in either a 19-inch wide rack or a 23-inch wide rack (with extenders installed). See Table 2-3 for individual rack space requirements.

Table 2-3 Rack Space Requirements

Component	Rack Space	Height	Depth
Cisco 6015 chassis	3 RUs ¹	5.25 in. (13.34 cm)	11.02 in. (27.99 cm)
AC/DC converter tray, optional	1 RU	1.75 in. (4.45 cm)	13 in. (33.02 cm)
POTS splitter, optional ²	1 RU	1.75 in. (4.45 cm)	12 in. (30.48 cm)

1. An RU is equal to 1.75 inches (4.45 cm).

2. Third-party POTS splitters can be used. Please verify compatibility with your Cisco representative.



Note

In a Cisco 6015 with a POTS splitter configuration using 4xflexis, install only one POTS splitter.

In a Cisco 6015 with a POTS splitter configuration using 8xDMTs and 8xDMT over ISDNs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

The 8xDMT over ISDN is designed for use in a configuration with a POTS splitter only.

Depending on your configuration type, plan accordingly so that the rack accommodates your needs. Use Table 2-4 to calculate the rack space necessary for your Cisco 6015 system configuration.



Note

In a commercial (central office [CO]) environment, the total amount of rack space should not exceed 42 RUs. If your total configuration exceeds 42 RUs, either replan your configuration or use more than one rack to house the Cisco 6015 system components.

In an outside-plant environment, the total amount of rack space should not exceed the available space inside the equipment bay of your remote terminal enclosure (typically 26 RUs). If your total configuration exceeds the available space, either replan your configuration or use more than one equipment bay (or a larger capacity cabinet) to house the Cisco 6015 system components.

Table 2-4 Rack Space Calculation for the Cisco 6015 System Configurations

Line	Instructions	Calculation
Cisco 6015 with a POTS Splitter Configuration		
1	<p>Total number of Cisco 6015 chassis in the rack</p> <ul style="list-style-type: none"> If you are installing 4xflexis in a commercial environment, the maximum is nine chassis per rack (include subtending host and subtended node chassis) for a seven-foot. rack. If you are installing 8xDMTs or 8xDMT over ISDNs in a commercial environment, the maximum is six chassis per rack (include subtending host and subtended node chassis) for a seven-foot. rack. <p>Note In an outside-plant environment, Cisco recommends installing no more than three Cisco 6015 chassis in a four-foot (1.22 meters) remote terminal enclosure.</p>	
2	<p>Total number of AC/DC converter trays in the rack.</p> <p>Note The AC/DC converter can be used only in a commercial environment. It cannot be used in an outside-plant environment.</p>	
3	<p>Total number of POTS splitters¹ in the rack.</p> <p>Note In a system configuration using 4xflexis, install only one POTS splitter.</p> <p>In a system configuration using 8xDMTs or 8xDMT over ISDNs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.</p>	
4	Multiply 3 RUs by the total number of chassis on line 1.	
5	Multiply 1 RU by the total number of AC/DC converter trays on line 2.	
6	<p>If you are installing 4xflexis, add 1 RU of space between each group of two Cisco 6015 chassis.</p> <p>If you are installing 8xDMTs or 8xDMT over ISDNs, add 1 RU of space between each chassis.</p>	
7	If you are installing a third-party vendor POTS splitter, multiply the total RUs for the POTS splitter by the total number of POTS splitters on line 3.	
8	<p>Add lines 4 through 7 for the total number of RUs that are needed for your Cisco 6015 with a POTS splitter configuration.</p> <p>Note In an outside-plant environment, the number of RUs calculated is the additional rack space required in a remote terminal enclosure to install the configured Cisco 6015 system.</p>	
Cisco 6015 Without a POTS Splitter Configuration		
9	<p>Total number of Cisco 6015 chassis in the rack</p> <ul style="list-style-type: none"> If you are installing 4xflexis in a commercial environment, the maximum is nine chassis per rack (include subtending host and subtended node chassis) for a 7-ft. rack. If you are installing 8xDMTs or 8xG.SHDSLs in a commercial environment, the maximum is six chassis per rack (include subtending host and subtended node chassis) for a seven-foot. rack. <p>Note In an outside-plant environment, Cisco recommends installing no more than three Cisco 6015 chassis in a four-foot (1.22 meters) remote terminal enclosure.</p>	

Table 2-4 Rack Space Calculation for the Cisco 6015 System Configurations (continued)

Line	Instructions	Calculation
10	Total number of AC/DC converter trays in the rack. Note The AC/DC converter can be used only in a commercial environment. It cannot be used in an outside-plant environment.	
11	Multiply 3 RUs by the total number of chassis on line 9.	
12	Multiply 1 RU by the total number of AC/DC converter trays on line 10.	
13	If you are installing 4xflexis, add 2 RUs of space between each group of three Cisco 6015 chassis. If you are installing 8xDMTs or 8xG.SHDSLs, add 2 RUs of space between each chassis.	
14	Add lines 11 through 13 for the total number of RUs that are needed for your Cisco 6015 without a POTS splitter configuration. Note In an outside-plant environment, the number of RUs calculated is the additional rack space required in a remote terminal enclosure to install the configured Cisco 6015 system.	

1. Third-party POTS splitters can be used in a Cisco 6015 with a POTS splitter configuration.

The location of the Cisco 6015 system and the layout of your rack or wiring room are extremely important for proper system operation. Equipment that is placed too close together, inadequate ventilation, and inaccessible panels can cause system malfunctions and shutdowns, which can make maintenance difficult.

When planning your site layout and equipment locations, keep in mind the precautions that are described in the “Safety Requirements” section on page 2-1 and the “Site Requirements” section on page 2-11 to help avoid equipment failures and reduce the possibility of environmentally-caused shutdowns. If you are currently experiencing shutdowns or unusually high errors with your existing equipment, these precautions might help you isolate the cause of failures and prevent future problems.

2.2.2 DC Power

The CO power source or rectifier supplies external power to the system as $-48/-60V$ DC from the fuse and alarm panel. Power connections from the fuse and alarm panel are wired to the DC PEM in the Cisco 6015 chassis. The nominal voltage is $-48V$ DC; the minimum operating value is $-40V$ DC; and the maximum operating value is $-72V$ DC.

Before you connect the system to a power source, verify that the power source is properly grounded and falls within the internal power supply rating.

Calculate the typical power requirement for each Cisco 6015 component in your configuration type. Use Table 2-5 to calculate the typical power requirement that is necessary to operate your Cisco 6015 system.

Table 2-5 Power Consumption Calculation for Cisco 6015 System Components

Line	Instructions	Calculation
Cisco 6015 Chassis¹		
1a	If you are using 4xflexis (CAP mode), multiply 13.5W by the total number of 4xflexis (CAP mode) in the Cisco 6015.	
1b	If you are using 4xflexis (DMT mode), multiply 17.5W by the total number of 4xflexis (DMT mode) in the Cisco 6015.	
1c	If you are using 4xflexis (G.lite mode), multiply 13W by the total number of 4xflexis (G.lite mode) in the Cisco 6015.	
1d	If you are using 8xDMTs, multiply 24W by the total number of 8xDMTs in the Cisco 6015.	
1e	If you are using 8xDMT over ISDNs, multiply 24W by the total number of 8xDMT over ISDNs in the Cisco 6015.	
1f	If you are using 8xG.SHDSLs at 136 kbps, multiply 11.3W by the total number of 8xG.SHDSLs in the Cisco 6015.	
1g	If you are using 8xG.SHDSLs at 1.554 Mbps, multiply 15W by the total number of 8xG.SHDSLs in the Cisco 6015.	
1h	If you are using 8xG.SHDSLs at 2.312 Mbps, multiply 16.5W by the total number of 8xG.SHDSLs in the Cisco 6015.	
2	Add the amounts for lines 1a through 1g.	
3	Enter 33.5W for each NI-2 card.	
4	Enter 9W for the fan module.	
5	Enter 20W for the DC PEM.	
6	Add lines 2 through 5. This is the typical power required for the Cisco 6015.	
7	Divide line 6 by 48. This is the nominal current for the Cisco 6015.	

1. Complete this table for each Cisco 6015 system.

2.2.3 AC Power

An optional AC/DC converter must be installed and connected to the DC PEM if the system is powered by AC power. The AC/DC converter converts 120/240V AC power to –48V DC power for the Cisco 6015 system.



Note

The AC/DC converter can be used only in a commercial environment.

An AC/DC converter tray is available to house up to three AC/DC converters. The AC/DC converter tray is installed directly below the Cisco 6015 chassis.

**Note**

For more information about the AC/DC converter, see the “AC/DC Converter” section on page 1-37.

**Tip**

Check the power at your site to ensure that you are receiving “clean” power (free of spikes and noise). Install a power conditioner if necessary.

2.2.4 Cables

For detailed information about required cables, refer to Appendix B, “Cable and Port Mapping Specifications.”

2.2.5 Rack-Mounting

**Warning**

To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

—**This unit should be mounted at the bottom of the rack if it is the only unit in the rack.**

—**When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.**

—**If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.**

Cisco recommends that you mount the Cisco 6015 system in a rack. Ensure that the vertical hole spacing on the rack rails meets standard EIA-310-C requirements—1 inch (2.54 cm) spacing. All portions of the rack are equal to or less than the NEBS maximum allowances of 12 inches (30.48 cm).

When you install the Cisco 6015 system in a rack, allow enough room to access the backplane of the unit for wiring purposes. The building integrated timing supply (BITS) clock input and the facility alarm input headers are located on the backplane.

2.3 Required Tools and Equipment

Table 2-6 lists the tools and equipment that are required to install and remove the Cisco 6015 system components.

Table 2-6 Tool and Equipment Requirements Checklist

Check	Tools and Equipment
	Hardware Components and Cables
	<p>Cisco 6015 chassis, which will have the following components already installed:</p> <ul style="list-style-type: none"> • Line cards (one or more types) <ul style="list-style-type: none"> – 4xflexis—Commercial environment only. – 8xDMTs—Commercial environment or outside-plant environment. – 8xDMT over ISDNs—Commercial environment only. – 8xG.SHDSLs—Commercial environment only. • One of the following NI-2 cards: <ul style="list-style-type: none"> – DS3+T1/E1 IMA NI-2 card—Commercial environment. – ITEMP DS3+T1/E1 IMA NI-2 card—Outside-plant environment. – OC-3c/OC-3c SMF¹ NI-2 card—Commercial environment. – OC-3c/OC-3c MMF² NI-2 card—Commercial environment. • Fan module. • One of the following I/O modules: <ul style="list-style-type: none"> – DS3+T1. – E1. • DSL interface module. • DC PEM.
	<p>Third-party POTS splitters can be installed in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility with your Cisco representative.</p> <p>In a system configuration using 4xflexis, install only one POTS splitter.</p> <p>In a system configuration using 8xDMTs or 8xDMT over ISDNs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.</p>
	AC/DC converter, optional for AC power and available for use only in a commercial environment.

Table 2-6 Tool and Equipment Requirements Checklist (continued)

Check	Tools and Equipment
	<p>AC power cord for AC/DC converter, optional for AC power and available for use only in a commercial environment</p> <ul style="list-style-type: none"> • Argentina: CAB-ACR, part number 37-0095-01. • Australia: CAB-ACA, part number 72-0746-01. • Europe: CAB-ACE, part number 72-0460-01. • Italy: CAB-ACI, part number 72-0556-01. • South Africa: CAB-ACSA, part number 72-1694-01. • Switzerland: CAB-ACS, part number 72-1483-01. • UK: CAB-ACU, part number 72-0557-01. • USA: CAB-AC, part number 72-0259-01.
	<p>DC PEM Power cable</p> <ul style="list-style-type: none"> • DC power cable to connect to the AC/DC converter—Supplied by Ascom, part number 72-2178-01. • DC power cable to connect to the fuse and alarm panel—Supplied by Cisco, part number 72-2223-01.
	<p>Before you install a Cisco 6015 system in an outside-plant environment, verify that the remote terminal enclosure meets the following compliance requirements:</p> <ul style="list-style-type: none"> • GR-487 • UL 50, Type 4X • EN60529 IP 55 • NEMA 4X
	<p>One of the following cables for POTS splitter connections</p> <ul style="list-style-type: none"> • Y-cable for DSL interface module to third-party POTS splitter connection (part number 72-1973-01) or equivalent. • 24 AWG, 25-twisted pair, solid core shielded telco cable with shielded RJ21X (Champs) connector³. <p>Note See Appendix B, “Cable and Port Mapping Specifications” for cable information. The Y-cable is used when only one POTS splitter is installed.</p> <p>Unshielded cable cannot be used in an FCC/CISPR Class B compliance environment.</p>
	<p>24 AWG, 25-twisted pair, solid core shielded telco cable with shielded RJ21X (Champs) connector² for MDF⁴ (commercial environment) or enclosure protection block (outside-plant environment) connections.</p>

Table 2-6 Tool and Equipment Requirements Checklist (continued)

Check	Tools and Equipment
	<p>Wire for the following connections:</p> <ul style="list-style-type: none"> • T1 trunk—Industry standard T1 twisted-pair wire (use two-pair stock only). • T1 subtend—RJ-48 to RJ-48 industry standard T1 twisted-pair wire (use two-pair stock only). • E1 trunk—Industry standard E1 twisted-pair wire (use two-pair stock only). • E1 subtend—RJ-48 to RJ-48 industry standard E1 twisted-pair wire (use two-pair stock only). • BITS interface—12 AWG twisted-pair black and red copper solid or stranded wire. • Facility alarm input—26 AWG UTP⁵. • Ground the Cisco 6015 chassis—12 AWG or thicker green or green with yellow stripes stranded copper wire. • Ground the POTS splitter and remote terminal enclosure, as necessary—Refer to the vendor documentation.
	Coaxial cable for a DS3 connection—Type 734A or equivalent (75 ohm double shielded, minimum coverage 80% braid and 100% foil). Use AIM Electronics BNC Coaxial Type 3 Piece Connector (part number 27-9023) or equivalent only.
	Fiber cable—Used to connect the OC-3c/OC-3c NI-2 card
	Console and auxiliary cables—Unshielded RJ-45 serial cable that complies with the EIA/TIA-232 standard and provides connection to a system console.
	Ethernet connection ⁶ —Cat 5 UTP or Cat 5 STP ⁷ cable with an RJ-45 connector that complies with Ethernet standards.
	Necessary equipment for ESD protection—Required whenever you handle Cisco equipment, which includes the chassis and modules.
	Mounting screws—To mount the Cisco 6015, optional AC/DC converter tray, and POTS splitter to the rack.
	Extenders for the Cisco 6015 and AC/DC converter tray (when using a 23-inch wide rack).
	<p>Ferrites that yield an impedance of 53 ohms at 25 MHz and 177 ohms at 100 MHz are to be used under the following conditions:</p> <ul style="list-style-type: none"> • Cisco 6015 to POTS splitter connection—If unshielded cable is used for FCC Class A or EN55022 Class A compliance, ferrites are needed. • Cisco 6015 to MDF (commercial environment) or enclosure protection block (outside-plant environment)—If unshielded cable is used for FCC Class A or EN55022 Class A compliance, ferrites are needed. • T1/E1 trunk or subtended—If unshielded cable is used for FCC Class B or EN55022 Class B compliance, ferrites are needed. • Ethernet cable.
	Ring lug for the grounding wire.
	Note The hole in the ring lug should be large enough for the screw to pass through.
	Tie wraps.
	Tools

Table 2-6 Tool and Equipment Requirements Checklist (continued)

Check	Tools and Equipment
	No. 1 flat-head screwdriver.
	A Phillips-head screwdriver.
	Wire stripper.
	Wire-wrapping tool, optional.
	Software Components
	Cisco IOS or CDM ⁸ .
	Note See Appendix A, “Technical Specifications,” for minimum software and network management release requirements per Cisco 6015 chassis component.

1. SMF = single-mode fiber.
2. MMF = multimode fiber.
3. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, ferrites are needed.
4. MDF = main distribution frame.
5. UTP = unshielded twisted pair.
6. Ferrites are required for the Ethernet connection.
7. STP = shielded twisted pair.
8. CDM = Cisco DSL Manager.

**Warning**

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

2.4 Unpacking the Cisco 6015 System

Each Cisco 6015 system chassis is securely packaged in a shipping box. The Cisco 6015 chassis ships with the modules installed and any additional modules packaged separately.

**Caution**

Proper ESD protection is required whenever you handle Cisco equipment. Installation and maintenance personnel should be properly grounded using ground straps to eliminate the risk of ESD damage to the equipment. Modules are subject to ESD damage whenever they are removed from the chassis.

To unpack the Cisco 6015 system, complete the following steps:

-
- Step 1** Inspect the packing containers. If any damage or other signs of mishandling are evident, inform both the local freight carrier and Cisco before unpacking. Your freight carrier can provide you with the procedures necessary to file a claim for damages.
 - Step 2** Carefully open the box.
 - Step 3** Remove all packing material.
 - Step 4** Remove the chassis from the box.
 - Step 5** Open the accessory kits and boxes that contain the cables, ferrites, documentation, management software, and any additional modules. Do not use a knife to open these boxes.
-

2.5 Verifying Contents

To verify that all equipment, cables, documentation, and so forth are received, compare the packing list to your shipment and to your order. If any items are missing or if you need additional information, contact the Cisco Technical Assistance Center (TAC) at one of the following:

- 800 553-2447
- 408 526-7209
- tac@cisco.com

2.6 Inspecting for Damage

After you verify that all of the equipment is included, carefully examine the assemblies, modules, and cables for any damage resulting from shipping. If you suspect any damage from shipping, contact your local freight carrier for procedures on damage claims.

If you observe any physical defects in the items you ordered, obtain standard warranty service by delivering the defective part, accompanied by a copy of the dated proof-of-purchase, to the Cisco Systems Corporate Service Center or an authorized Cisco Systems service center during the applicable warranty period. Contact the Cisco TAC for the location of your nearest service center.

See the back of the title page for the Cisco Systems warranty information for hardware and software products.



Installing a Cisco 6015 with a POTS Splitter Configuration in a Commercial Environment

This chapter provides installation procedures for a Cisco 6015 with a POTS splitter configuration in a commercial environment.


Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.


Caution

Before you start the installation procedures, read the entire chapter for important information and safety warnings.


Note

Before installing and cabling the equipment, be aware of standard safety practices and the hazards involved in working with electrical circuitry to prevent accidents. See the “Safety Requirements” section on page 2-1 for all cautions and warnings that are necessary to ensure a safe and hazard-free installation.

To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information for the Cisco 6015 System*.


Tip

See the “Cisco 6015 with a POTS Splitter Configuration” section on page 1-5 for more information about Cisco 6015 with a POTS splitter configuration components.

3.1 Installation Checklist

When you install a Cisco 6015 with a POTS splitter configuration in a commercial environment, be sure that you follow the installation procedures in the proper sequence. Table 3-1 is a checklist of the installation steps in the order in which they should occur. Detailed installation instructions are discussed in the sections following Table 3-1.

Table 3-1 *Installation Checklist—Cisco 6015 with a POTS Splitter Configuration in a Commercial Environment*

Check	Installation Procedure
	1. Measure the required rack space.
	2. Install the POTS splitter(s) in the rack.
	3. Install the AC/DC converter and converter tray in the rack, if applicable.
	4. Install the Cisco 6015 chassis in the rack.
	5. Install the blank faceplates in the open slots.
	6. Ground the Cisco 6015 chassis and POTS splitter(s).
	7. Connect the DC PEM ¹ to the AC/DC converter, if you are using AC power.
	8. Connect the DC PEM to the fuse and alarm panel, if you are using DC power.
	9. Connect the BITS ² interface, if applicable.
	10. Connect the facility alarm input, if applicable.
	11. Connect the DSL interface module to the POTS splitter(s).
	12. Connect the POTS splitter(s) to the MDF ³ .
	13. Connect the I/O ⁴ module on the subtending host chassis to the I/O module on the subtended node chassis (optional). Note This step is necessary only when installing a subtended network configuration. For an OC-3c/OC-3c NI-2 card subtended network configuration, the network connections are made through the faceplates of the OC-3c/OC-3c NI-2 cards, not the I/O modules.
	14. Connect the I/O module to the network. Note If you have an OC-3c/OC-3c NI-2 card installed in your system, the network connection is made through the NI-2 card faceplate, not the I/O module.
	15. Apply power to the system.
	16. Verify that the fan modules are operational.
	17. Install the POTS cards.
	18. Connect the Ethernet to the management network.
	19. Connect a console terminal.
	20. Connect the auxiliary port (optional).
	21. Complete initial configuration.

1. PEM = power entry module
2. BITS = building integrated timing supply
3. MDF = main distribution frame
4. I/O = Input/Output

3.2 Installation Procedures

The following sections detail the installation procedures for a Cisco 6015 with a POTS splitter configuration in a commercial environment.

**Caution**

Proper ESD protection is required whenever you handle Cisco equipment. Installation and maintenance personnel should be properly grounded using ground straps to eliminate the risk of ESD damage to the equipment. Cards are subject to ESD damage whenever they are removed from the chassis.

See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.

3.2.1 Measure Required Rack Space

For the rack to remain stable, you must install your Cisco 6015 system from the bottom to the top of the rack. Before you install any of the chassis, determine the total rack space that is required to install your system. The required rack space depends on the type of line cards installed and the number of Cisco 6015 chassis, AC/DC converters, and POTS splitters that you plan to use. The number of components will increase if you plan to install a subtended network.

You can install a combination of the following Cisco 6015 components in a 7-foot rack:

- Cisco 6015 chassis.
 - If you are installing quad-port flexi ATU-C line cards (4xflexis), the maximum is nine chassis per rack (include subtending host and subtended node chassis).
 - If you are installing octal-port discrete multitone (DMT) ATU-C line cards (8xDMTs) or octal-port DMT ATU-C over ISDN line cards (8xDMT over ISDNs), the maximum is six chassis per rack (include subtending host and subtended node chassis).
- AC/DC converter and converter tray—Optional.
- Third-party POTS splitter.

**Note**

Third-party POTS splitters can be installed in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility of your third-party POTS splitter with your Cisco representative.

In a system configuration using 4xflexis, install only one POTS splitter.

In a system configuration using 8xDMTs or 8xDMT over ISDNs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

**Tip**

See Chapter 2, “Preparing for Installation,” for the calculation tables that are necessary to plan the total rack space for your Cisco 6015 system configuration.

The Cisco 6015 system fits in either a 19-inch or a 23-inch wide rack. See Table 2-3 for individual rack space requirements.

**Warning**

To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

—This unit should be mounted at the bottom of the rack if it is the only unit in the rack.

—When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.

—If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.

If you plan to expand your system to include more chassis in the future, allow space in the rack for additions during the initial installation, keeping in mind the weight distribution and stability of the rack.

3.2.2 Install the POTS Splitter

You can use third-party POTS splitters in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility of your third-party POTS splitter with your Cisco representative.



Note In a system configuration using 4xflexis, install only one POTS splitter.

In a system configuration using 8xDMTs or 8xDMT over ISDNs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

For installation procedures for each POTS splitter, refer to the vendor documentation.

See Figure 1-2 for the correct placement of the POTS splitters.

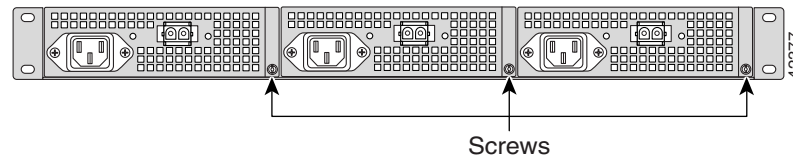
3.2.3 Install the AC/DC Converter and Converter Tray

If you are using AC power, complete the following steps to install the AC/DC converter. If you are not using AC power, proceed to the “Install the Cisco 6015 Chassis” section on page 3-5.

- Step 1** Use four mounting screws and a Phillips-head screwdriver to attach the extenders to the sides of the tray if you are installing the system in a 23-inch rack.
- Step 2** Position an AC/DC converter tray, which occupies 1 RU of space, above the POTS splitter.
The bottom of the tray should be flush with the top of the POTS splitter.
- Step 3** Use four mounting screws and a Phillips-head screwdriver to bolt the tray in the rack.
- Step 4** Slide an AC/DC converter into one of the three open slots.
- Step 5** Use a Phillips-head or flat-head screwdriver to attach the screw that secures the AC/DC converter in the tray.

Figure 3-1 shows the screw locations on the tray.

Figure 3-1 Screw Locations for the AC/DC Converter Tray



3.2.4 Install the Cisco 6015 Chassis

Complete the following steps to install the Cisco 6015 chassis.



Warning

Two people are required to lift the chassis. Grasp the chassis underneath the lower edge and lift with both hands. To prevent injury, keep your back straight and lift with your legs, not your back. To prevent damage to the chassis and components, never attempt to lift the chassis with the handles on the power supplies or on the interface modules. These handles were not designed to support the weight of the chassis.

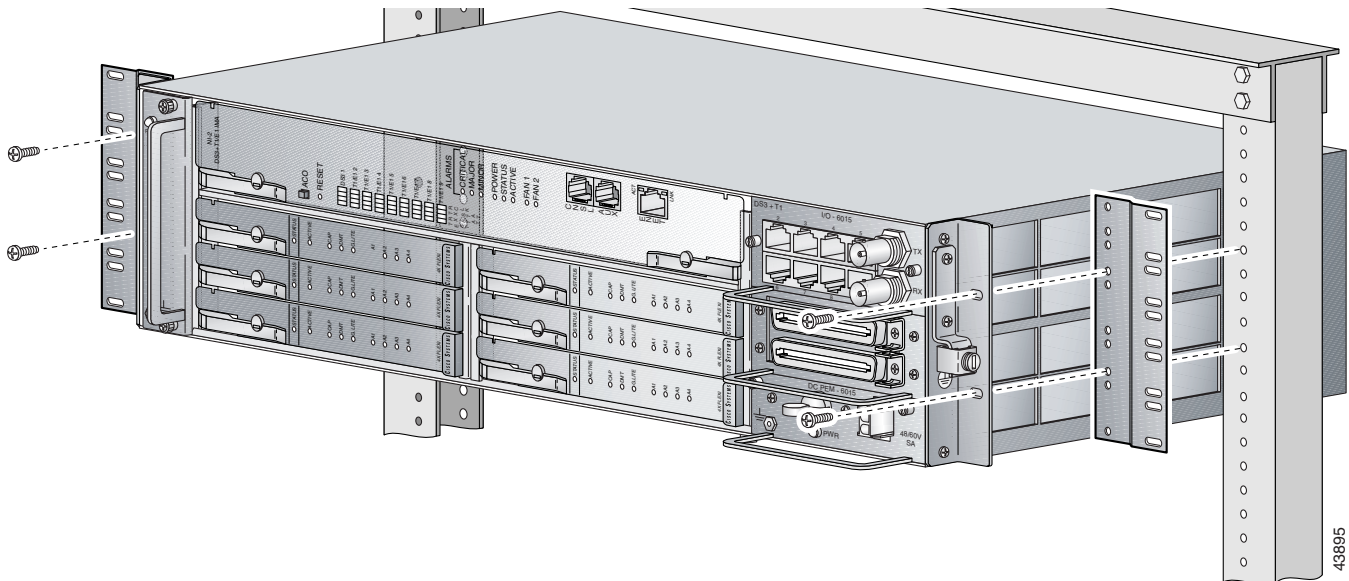


Note

The Cisco 6015 chassis ships with the cards and modules installed. To prevent damage, ensure that the screws on each card and module are tightened so that the cards do not fall out of the chassis during installation.

- Step 1** Position one Cisco 6015, which occupies 3 RUs of space, above the AC/DC converter or the POTS splitter. The bottom of the Cisco 6015 chassis should be flush with the top of the AC/DC converter or POTS splitter.
- Step 2** Use four mounting screws and a Phillips-head screwdriver to attach the extenders to the sides of the chassis if you are installing the system in a 23-inch rack, as shown in Figure 3-2.

Figure 3-2 Extender Installation on the Cisco 6015



Step 3 Use four mounting screws and a Phillips-head screwdriver to attach the Cisco 6015 to the rack.

Step 4 Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.

See Figure 1-2 for the correct placement of the Cisco 6015.

3.2.5 Install Blank Faceplates

Blank faceplates should occupy any empty line card slots in the Cisco 6015 chassis. Blank faceplate installation is similar to line card installation.



Warning

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.

Complete the following steps to install blank faceplates in any empty line card slots in the Cisco 6015:

Step 1 Connect a grounding strap to an ESD grounding jack on the Cisco 6015. See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.

Step 2 Horizontally align the blank faceplate edge with the guides at the left and right of the slot.

Step 3 Lift out on the ejector tab and gently apply pressure to the faceplate while pushing the blank faceplate into the slot.

- Step 4** Push on the faceplate to fully seat the blank faceplate.
- Step 5** Press down on the ejector tab to secure the faceplate.

3.2.6 Ground the Cisco 6015 and POTS Splitter(s)

Complete the following steps to connect the grounding lug on the Cisco 6015 and POTS splitter(s) directly to the rack:



Warning

When installing the unit, always make the ground connection first and disconnect it last.

- Step 1** Remove all paint or oxidation from the rack at the point of the grounding connection.
- Step 2** Measure enough wire to connect the Cisco 6015 to the rack. See Table 2-6 on page 2-19 for wire requirements.

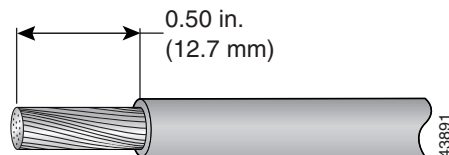


Tip

Make sure that your wire is only as long as is needed to make the connection.

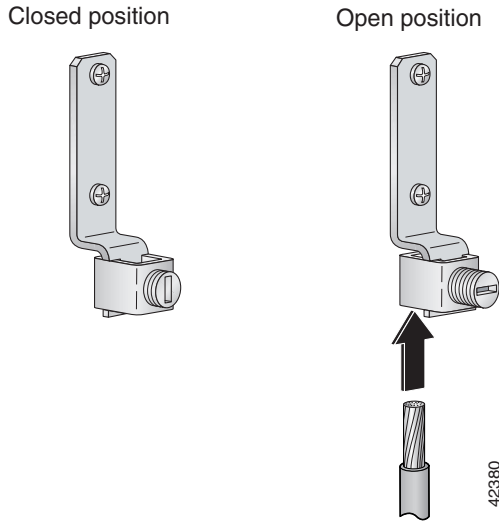
- Step 3** Cut the ends of the ground wire so that the ends are straight, not slanted.
- Step 4** Measure 1/2 inch (12.7 mm) up from the end of the ground wire and place a mark at that point. This is the wire end that will be connected to the Cisco 6015.
- Step 5** Use a wire stripper to remove 1/2 inch (12.7 mm) of the covering from the end of the wire. Trim the end of the covering so that it is straight, not slanted, as shown in Figure 3-3.

Figure 3-3 Strip and Square Off Ground Wire



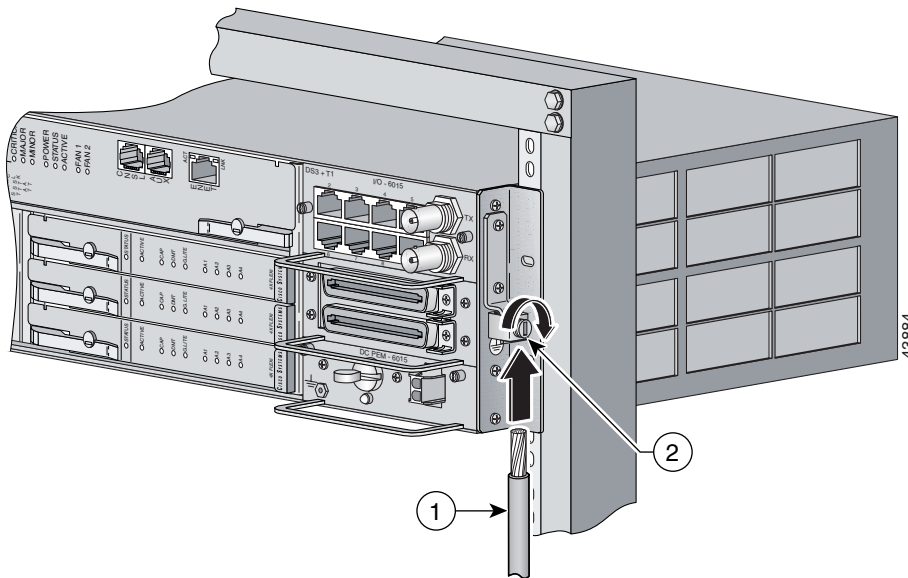
- Step 6** Use a flat-head screwdriver to loosen the compression screw (open position) that is provided on the grounding lug of the Cisco 6015, as shown in Figure 3-4.

Figure 3-4 Grounding Lug Closed and Open Positions



The Cisco 6015 grounding lug is located on the right side of the chassis (if viewed from the front), as shown in Figure 3-5.

Figure 3-5 Attaching the Grounding Wire to the Cisco 6015



1	Grounding wire	2	Grounding lug
----------	----------------	----------	---------------

Step 7 Insert the end of the copper wire that you prepared in Step 5 under the compression plate on the grounding lug, as shown in Figure 3-4.

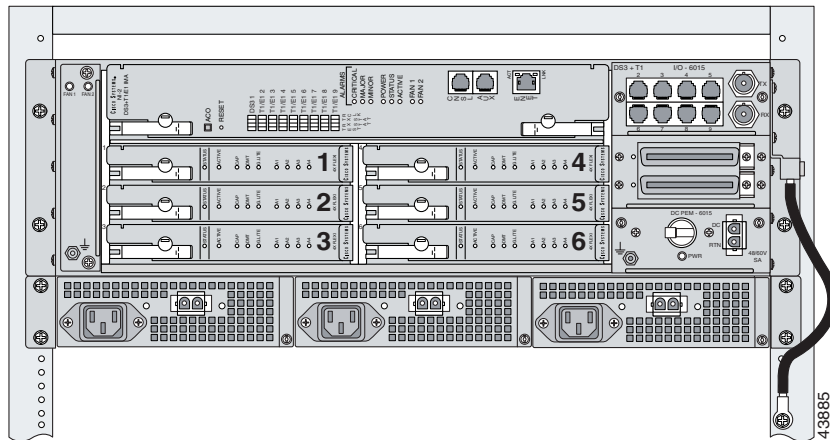


Caution

Do not place the copper wire between the compression screw and the compression plate.

- Step 8** Use a flat-head screwdriver to tighten the compression screw against the compression plate, as shown in Figure 3-4.
- Step 9** Prepare the other end of the wire to be connected to the rack, according to the requirements of your site.
- Step 10** Use a flat-head screwdriver to loosen the screw on the rack.
- Step 11** Connect the copper wire to a ring lug (large enough for the rack screw to fit through).
- Step 12** Use a flat-head screwdriver and the screw that you loosened in Step 10 to attach the ring lug to the rack, as shown in Figure 3-6.

Figure 3-6 Attaching the Grounding Wire to the Rack



- Step 13** Use a flat-head screwdriver to tighten the rack screw over the copper wire.
- Step 14** Repeat Step 1 through Step 13 for each Cisco 6015, as necessary.
- Step 15** Ground each POTS splitter.

For wire specifications and procedures for grounding each POTS splitter, refer to the vendor documentation.



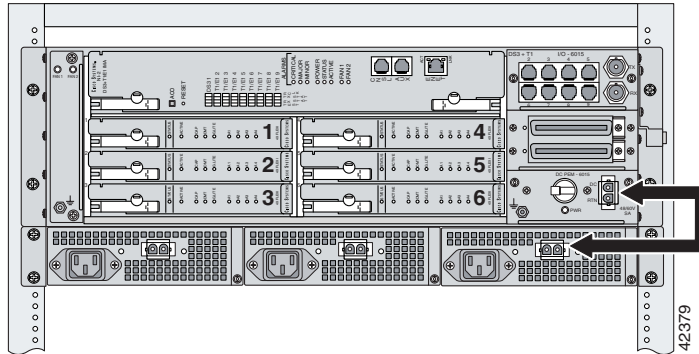
Note Do not ground the components in a rack by chaining them together.

3.2.7 Connect the DC PEM to the AC/DC Converter

If you are using AC power, complete the following steps to connect the DC PEM to the AC/DC converter. If you are using DC power, proceed to the “Connect the DC PEM to the Fuse and Alarm Panel” section on page 3-10.

- Step 1** Attach one end of the DC power cable (part number 72-2178-01) to the 2-pin connector located on the faceplate of the DC PEM, as shown in Figure 3-7.

Figure 3-7 Connecting the DC PEM to the AC/DC Converter



Step 2 Attach the other end of the cable to the 2-pin connector located on the faceplate of the AC/DC converter, as shown in Figure 3-7.

Step 3 Repeat Step 1 and Step 2 for each Cisco 6015, as necessary.



Caution Do not plug in the AC power cord at this time.

3.2.8 Connect the DC PEM to the Fuse and Alarm Panel

If you are using DC power, complete the following steps to connect the DC PEM to the fuse and alarm panel. If you are using AC power, proceed to the “Connect the BITS Interface” section on page 3-11.



Caution To prevent the system from powering up, do not install the fuses at this time. If the fuses are already installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed and connected.



Note The fuse and alarm panel is not provided by Cisco.

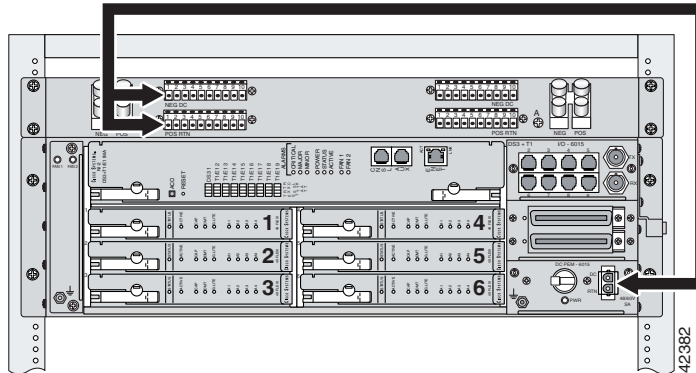


Note Connect each Cisco 6015 system component to a separate fuse. Do not power the components in the rack by chaining them together.

See Chapter 2, “Preparing for Installation,” for the calculation tables that are necessary to determine the typical power requirement for each component that is wired to the fuse and alarm panel.

- Step 1** Attach one end of the DC power cable (part number 72-2223-01) to the 2-pin connector located on the faceplate of the DC PEM, as shown in Figure 3-8.

Figure 3-8 Connecting the DC PEM to the Fuse and Alarm Panel



- Step 2** Attach the red wire coming from the DC PEM to a fuse and alarm panel POS (positive) DC connector, as shown in Figure 3-8.
- Step 3** Attach the black wire coming from the DC PEM to a fuse and alarm panel NEG (negative) DC connector, as shown in Figure 3-8.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.



Caution

Do not set the circuit breaker on the DC PEM to the ON (1) position at this time.

3.2.9 Connect the BITS Interface

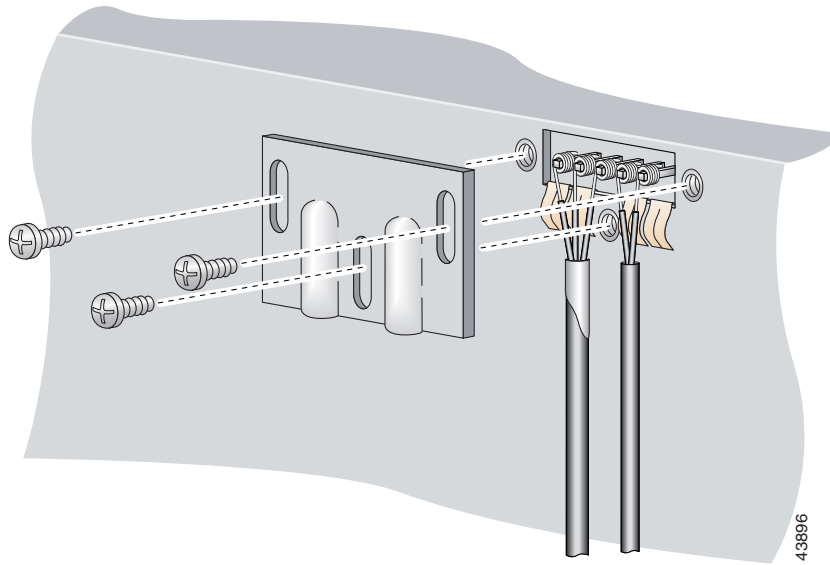
The BITS interface provides the network clocking. Complete the following steps to connect the BITS interface to the BITS clock source:



Note

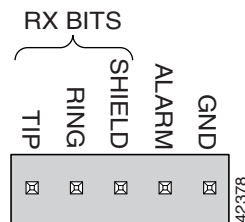
For more information on the BITS interface, see the “Rear Interface Header” section on page 1-36.

- Step 1** Use a Phillips-head screwdriver to remove the three screws that hold the plate over the BITS interface pins, as shown in Figure 3-9. Remove the plate, and set the screws and the plate aside.

Figure 3-9 Plate Removal over BITS Interface Pinouts

- Step 2** Measure one strand of wire long enough to connect the first three BITS interface pins to the BITS clock source. See Table 2-6 on page 2-19 for wire requirements.

See Figure 3-10 for a close view of the pinouts that are located on the back of the Cisco 6015 chassis. For pinout descriptions, see Table 1-8 on page 1-37.

Figure 3-10 BITS Interface Pinouts

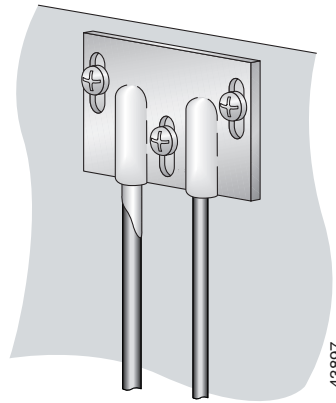
- Step 3** Use a wire stripper to remove the casing from both ends of the wire.
- Step 4** Pull the foil shield back over the wire casing and separate the three exposed wires, as shown in Figure 3-9.
- Step 5** Use a wire-wrapping tool to attach the drain wire in the twisted-pair to pin 3 (Shield), as shown in Figure 3-9.
- Step 6** Use a wire-wrapping tool to attach one of the two remaining wires in the twisted-pair to pin 2 (Ring), as shown in Figure 3-9.
- Step 7** Use a wire-wrapping tool to attach the remaining wire in the twisted-pair to pin 1 (Tip), as shown in Figure 3-9.
- Step 8** Use a Phillips-head screwdriver and three screws to reattach the plate that covers the BITS interface pins. Align the wires with the recessed channels on the plate so that the wires are not pinched when the plate is attached to the chassis, as shown in Figure 3-11.

**Note**

When the plate is reattached to the chassis, the bottom of the plate should reside in the middle of the foil shield, as shown in Figure 3-11.

If you are going to connect the facility alarm input, do not reattach the plate at this time.

Figure 3-11 Wire Alignment Under the Plate



Step 9 Connect the other end of the wires from Step 5 through Step 7 to the BITS clock source.

Step 10 Repeat Step 1 through Step 9 for each Cisco 6015, as necessary.

3.2.10 Connect the Facility Alarm Input

Complete the following steps to connect the facility alarm input to the alarm relay contact:

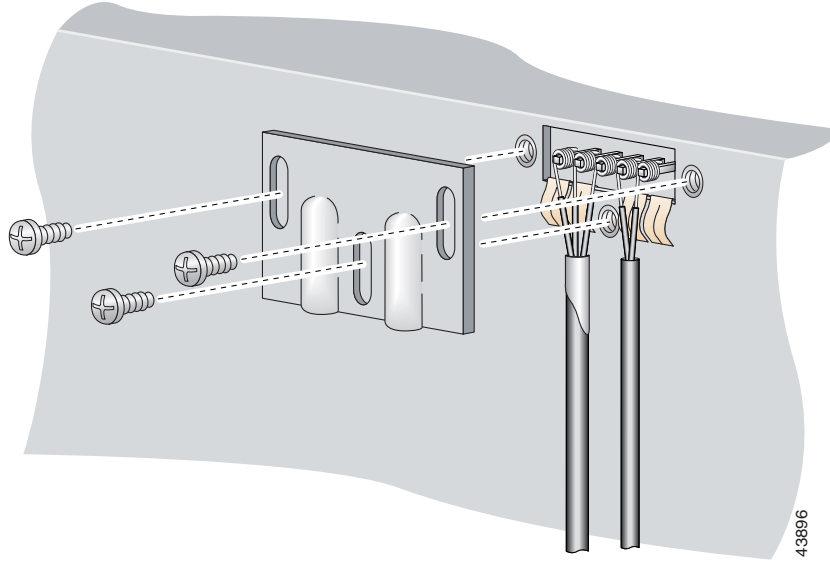
**Note**

For more information on the facility alarm input, see the “Rear Interface Header” section on page 1-36.

Step 1 Use a Phillips-head screwdriver to remove the three screws that hold the plate over the BITS interface pins, as shown in Figure 3-12. Remove the plate, and set the screws and the plate aside.

**Note**

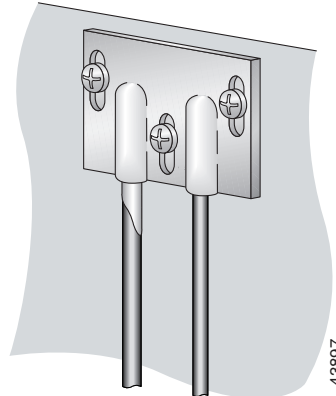
If you connected the BITS interface pins, skip this step and proceed to Step 2.

Figure 3-12 Plate Removal Over Facility Alarm Input Pinouts

- Step 2** Measure wire long enough to connect both pins 4 and 5 to the alarm relay contact. See Table 2-6 on page 2-19 for wire requirements.
- See Figure 3-10 for a close-up of the pinouts that are located on the back of the Cisco 6015 chassis. For pinout descriptions, see Table 1-8 on page 1-37.
- Step 3** Use a wire stripper to remove the casing from both ends of the wire.
- Step 4** Use a wire-wrapping tool to attach one of the wires to pin 4 (Alarm), as shown in Figure 3-12.
- Step 5** Use a wire-wrapping tool to attach the remaining wire to pin 5 (Ground), as shown in Figure 3-12.
- Step 6** Connect the relay activator to the alarm event trigger.
- Step 7** Use a Phillips-head screwdriver and three screws to reattach the plate that covers the BITS and alarm interface pins. Align the wires with the recessed channels on the plate so that the wires are not pinched when the plate is attached to the chassis, as shown in Figure 3-13.



Note When the plate is reattached to the chassis, the bottom of the plate should reside in the middle of the foil shield for the BITS interface. The casing for the facility alarm input wire should be captured under the plate. (See Figure 3-13.)

Figure 3-13 Wire Alignment Under the Plate

Step 8 Repeat Step 1 through Step 7 for each Cisco 6015, as necessary.

3.2.11 Connect the DSL Interface Module to the POTS Splitter(s)

You can use third-party POTS splitters in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility of your third-party POTS splitter with your Cisco representative.

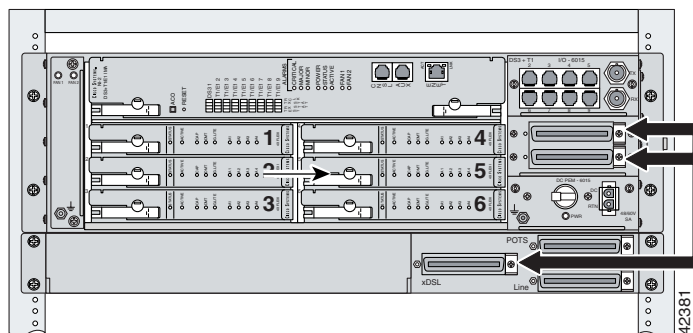


Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

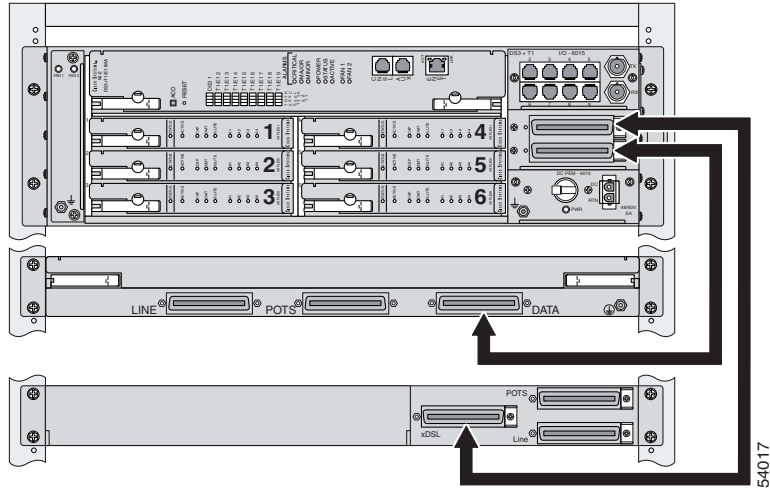
For cabling procedures for each POTS splitter, refer to the vendor documentation.

Figure 3-14 and Figure 3-15 show examples of cabling between the DSL interface module and a third-party POTS splitter. These connections are for xDSL data flow between the Cisco 6015 and the third-party POTS splitter.

Figure 3-14 Connecting the DSL Interface Module to the POTS Splitter

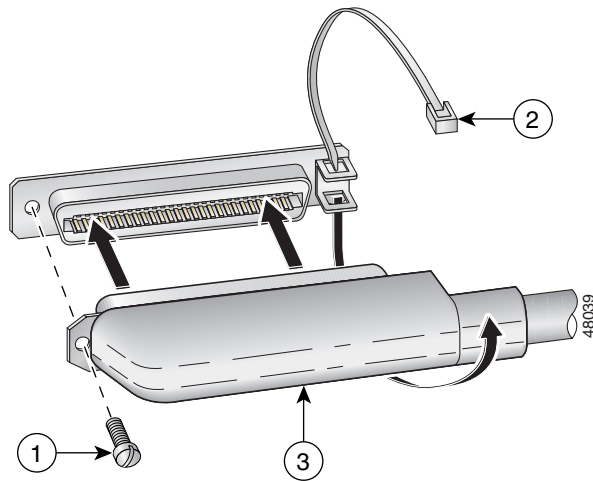
A system configuration using 8xDMTs and 8xDMT over ISDNs requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary. Figure 3-15 shows the cabling between the DSL interface module and two third-party POTS splitters. These connections are for xDSL data flow between the Cisco 6015 and the POTS splitters.

Figure 3-15 Connecting the DSL Interface Module to Two POTS Splitters



Ensure that all cables are screwed in and that the Champ connectors are tie wrapped. (See Figure 3-16.)

Figure 3-16 Attaching a Champ Connector to the Chassis



1	Champ connector screw	3	Champ connector
2	Tie wrap		

3.2.12 Connect the POTS Splitter(s) to the MDF

You can use different third-party POTS splitters in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility of your third-party POTS splitter with your Cisco representative.

For cabling procedures for each POTS splitter, refer to the appropriate vendor documentation.

**Note**

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

3.2.13 Install a Subtended Network Configuration

If you are installing a subtended network, complete the following steps. If you are not installing a subtended network, proceed to the “Connect the Cisco 6015 to the Network” section on page 3-19.

The following sections provide installation procedures for subtended network configurations using the DS3+T1/E1 IMA NI-2 card and the OC-3c/OC-3c NI-2 card.

**Tip**

The term *subtending* refers to the host chassis, and *subtended* refers to the downstream chassis in a subtended network.

Cisco recommends that you label each data cable at both ends to identify its destination.

**Note**

For more information on a subtended network configuration, see the “Subtended Network Configuration” section on page 1-6.

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

3.2.13.1 Connect the DS3+T1/E1 Subtending Network Configuration

Connections for T1 cabling are located on the DS3+T1 I/O module. The DS3+T1 I/O module is used in North America. Connections for E1 cabling are located on the E1 I/O module. The E1 I/O module is used world-wide, except in North America.

The TX and RX RJ-48 T1/E1 connectors on the subtending host chassis I/O module are connected to the TX and RX RJ-48 T1/E1 connectors on the subtended node chassis I/O module.

**Note**

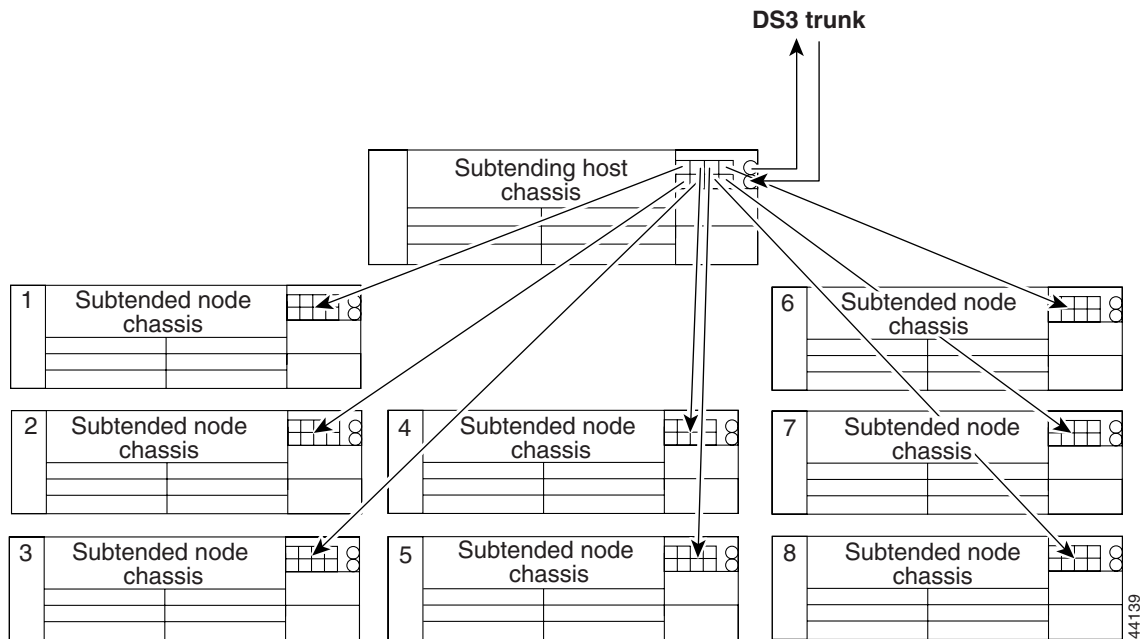
The E1 I/O module is used in world-wide environments, except in North America. The E1 I/O module has eight RJ-48 receptacles for eight E1 trunk or subtending interfaces.

Complete the following steps to cable the I/O module for T1/E1 subtending:

- Step 1** Verify that you have either DS3+T1 I/O modules or E1 I/O modules installed on your subtending host and node chassis.
- Step 2** Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module in the subtending host chassis.
- Step 3** Connect the other end of the RJ-48 cable to one of the RJ-48 receptacles on the I/O module in a subtended node chassis.

Figure 3-17 shows an example of a subtended network configuration.

Figure 3-17 DS3+T1 Subtended Network Configuration



- Step 4** Repeat Step 2 through Step 3 to connect the subtending host chassis to each subtended node chassis.



Note If you are using a T1 or E1 trunk to the network, the trunk connection will originate at one of the RJ-48 receptacles on the DS3+T1 I/O module or the E1 I/O module on the host chassis. Therefore, only seven RJ-48 receptacles will be available for subtending connections.

3.2.13.2 Connect the IMA Subtending Network Configuration

See the “IMA Configuration” section on page 1-8 for more information on how to configure an IMA subtending network configuration.

3.2.13.3 Connect the OC-3c Subtending Network Configuration

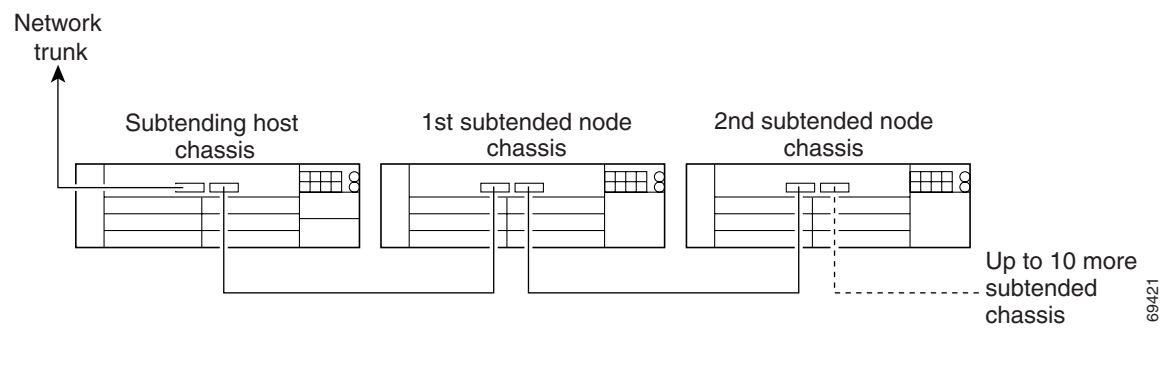
For OC-3c subtending, the connections are made from the OC-3c/OC-3c NI-2 cards in the subtending host chassis and the subtended node chassis. Connect one subtended Cisco 6015 to the subtending interfaces on the NI-2 (OC-3c interfaces).

To cable the Cisco 6015 system for OC-3c subtending, complete the following steps:

-
- Step 1** Verify that you have OC-3c/OC-3c NI-2 cards installed in the subtending host and node chassis.
 - Step 2** Locate the trunk 1 interface connectors (TX and RX) and the subtend 2 interface connectors (TX and RX) on the front of each OC-3c/OC-3c NI-2 card.
 - Step 3** Attach an OC-3c fiber-optic cable to the TX subtend 2 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the subtending host chassis.
 - Step 4** Attach the other end of the cable that you used in Step 2 to the RX trunk 1 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the subtended node chassis.
 - Step 5** Attach an OC-3c fiber-optic cable to the RX subtend 2 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the subtending host chassis.
 - Step 6** Attach the other end of the cable that you used in Step 4 to the TX trunk 1 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the second subtended node chassis.

Figure 3-18 shows the OC-3c subtending connections between three Cisco 6015 system chassis.

Figure 3-18 Daisy Chain Topology for OC-3c/STM-1 Interfaces



3.2.14 Connect the Cisco 6015 to the Network

The following sections detail the connection procedures for a DS3, T1, E1, IMA group, or OC-3c network connection.

3.2.14.1 DS3 Network Connection Installation

Complete the following steps to connect the I/O module to the network using a DS3 connection. If you are using a T1 connection, proceed to the “T1 Network Connection Installation” section on page 3-20. If you are using an E1 connection, proceed to the “E1 Network Connection Installation” section on

page 3-21. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 3-21. If you are using an OC-3c connection, proceed to the “OC-3c Network Connection Installation” section on page 3-21.

**Tip**

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.

The I/O module DS3 connections attach to the ATM switch. Two 75-ohm DS3 Bayonet-Neill-Concelman (BNC) connectors are provided for DS3 TX and RX. Attach one end of a coaxial cable (type 734A or equivalent) to the TX DS3 BNC connector on the I/O module.

**Note**

See Table 2-6 on page 2-19 for cable requirements.

Step 2 Attach the other end of the cable that originates at the TX DS3 BNC connector to the RX DS3 BNC connector on the ATM switch.

Step 3 Attach one end of a coaxial cable (type 734A or equivalent) to the RX DS3 BNC connector on the I/O module.

Step 4 Attach the other end of the cable that originates at the RX DS3 BNC connector to the TX DS3 BNC connector on the ATM switch.

Step 5 Repeat Step 1 through Step 4 for each Cisco 6015, as necessary.

3.2.14.2 T1 Network Connection Installation

Complete the following steps to connect the I/O module to the network using a T1 connection. If you are using an E1 connection, proceed to the “E1 Network Connection Installation” section on page 3-21. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 3-21. If you are using an OC-3c connection, proceed to the “OC-3c Network Connection Installation” section on page 3-21.

**Tip**

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.

Step 2 Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.

**Note**

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

Step 3 Connect the other end of the cable used in Step 2 to the ATM switch.

Step 4 Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.



Note Verify that the RJ-48 cable pinouts connect TX to RX and RX to TX.

3.2.14.3 E1 Network Connection Installation

Complete the following steps to connect the I/O module to the network using an E1 connection. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 3-21. If you are using an OC-3c connection, proceed to the “OC-3c Network Connection Installation” section on page 3-21.



Tip Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have an E1 I/O module installed in the Cisco 6015 chassis.

Step 2 Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.



Note See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

Step 3 Connect the other end of the cable used in Step 2 to the ATM switch.

Step 4 Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.



Note Verify that the RJ-48 cable pinouts connect TX to RX and RX to TX.

3.2.14.4 IMA Network Connection Installation

See the “IMA Configuration” section on page 1-8 for more information on how to configure an IMA network connection.

3.2.14.5 OC-3c Network Connection Installation

Complete the following steps to connect the OC-3c/OC-3c NI-2 card to the network.



Warning Do not stare into the beam or view it directly with optical instruments.

Step 1 Verify that you have an OC-3c/OC-3c NI-2 card installed in your Cisco 6015 chassis.

- Step 2** Attach the RX cable from the ATM switch to the TX connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card.
- The TX connector is the one closest to the top of the faceplate. The RX connector is closest to the bottom of the faceplate. The connector IDs are silkscreened inside the inset.
- Step 3** Attach the TX cable from the ATM switch to the RX connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card (trunk 1 interface connector RX). See Figure 1-14 on page 1-27 for the OC-3c network interface connection location.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015 chassis, as necessary.
-

3.2.15 Apply Power

The following sections detail the procedures to apply either AC or DC power.




Warning

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.


3.2.15.1 Apply AC Power

Complete the following steps to apply AC power to the Cisco 6015 system:

- Step 1** Attach the AC power cord to the AC/DC converter.
- Step 2** Plug the other end of the power cord into the wall outlet.
- 
- Caution** If the power connections are improperly made and power is applied while the cards are installed, the cards and chassis could be damaged.
-
- Step 3** Verify that the DC PEM is properly connected to the AC/DC converter, as described in the “Connect the DC PEM to the AC/DC Converter” section on page 3-9.
- Step 4** Set the circuit breaker on the DC PEM to the ON (1) position.
- Step 5** Verify that the DC PEM is operational by locating the LEDs on the front of the DC PEM. If the LED is
- Green—Output is correct.
 - Off—DC PEM is not operational. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Step 6** Verify that the AC/DC converter is operational by locating the LEDs on the front of the AC/DC converter.
- If the left LED is green, this indicates that there is good AC input.
 - If the right LED is green, this indicates that there is good DC output from the DC PEM to the AC/DC converter.
 - If either LED is off, troubleshoot the AC/DC converter or the AC input.
-

3.2.15.2 Apply DC Power

Complete the following steps to apply DC power to the Cisco 6015 system:

-
- Step 1** Apply power to the system with one of the following methods:
- Install the fuses in the fuse and alarm panel.
 - Reinsert the fuses in the fuse and alarm panel if you removed them in the “Connect the DC PEM to the Fuse and Alarm Panel” section on page 3-10.
 - Turn on the breakers in the fuse and alarm panel.
-
-  **Caution** If the power connections are improperly made and power is applied while the cards are installed, the cards and chassis could be damaged.
-
- Step 2** Verify that the DC PEM is properly connected to the fuse and alarm panel as described in the “Connect the DC PEM to the Fuse and Alarm Panel” section on page 3-10.
- Step 3** Set the circuit breaker on the DC PEM to the ON (1) position.
- Step 4** Verify that the DC PEM is operational by locating the LEDs on the front of the DC PEM. If the LED is
- Green—Output is correct.
 - Off—DC PEM is not operational. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Step 5** Check the polarity of the –48V DC connections to each chassis by attaching a voltmeter with the minus lead on the red wire and the plus lead on the black wire, at the fuse and alarm panel. Ensure that the meter reads between –40V DC and –68V DC. If your voltmeter shows a positive voltage, the power inputs might be reversed. If the voltmeter shows a negative voltage that is out of the –40V DC to –68V DC range, check the power supply for failure or check for a blown fuse in the fuse and alarm panel.
-

3.2.16 Verify Fan Module Operation

Verify that the fan module is operational by locating the LEDs on the front of the fan module. If the LEDs are

- Green—The fan module is operational.
- Red—The fan module is not operational and the fan module is in alarm mode. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Off—The fan is not operational due to a power problem or the LED is defective. See Chapter 6, “Troubleshooting” for troubleshooting procedures.

The fans should be operational before you complete the installation procedures.



It is important that the Cisco 6015 cooling fans run continuously.

3.2.17 Install the POTS Cards

For POTS card installation procedures for each POTS splitter, refer to the appropriate vendor documentation.

3.2.18 Connect the Ethernet to the Management Network

Complete the following steps to connect the Ethernet to the management network.



Warning

The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1

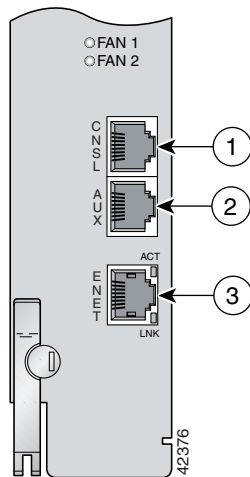
Connect the 10BaseT RJ-45 connector to the NI-2 card ENET receptacle. Figure 3-19 shows where to connect the Ethernet cable.



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements.

Figure 3-19 ENET, CNSL, and AUX RJ-45 Receptacles on the DS3+T1/E1 IMA NI-2 Card



1	Console port	3	Ethernet port
2	Auxiliary port		

- Step 2** Run the cable through the ferrite one time, loop the cable back through the ferrite, and clamp the ferrite shut.
- Step 3** Connect the other end of the cable to the management network (for example, a LAN).

3.2.19 Connect a Console Terminal

Connect a VT100-compatible terminal to the system console port on the NI-2 card (CNSL). Connect the terminal to a power source and set it up using the values shown in Table 3-2. Figure 3-19 shows where to connect the console cable. See Table 2-6 on page 2-19 for cable requirements.



Warning

The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

Table 3-2 Terminal Settings

Baud rate	9600 (transmit and receive)
Character size	8 bits
Parity	None
Stop bits	1
Flow control	None

3.2.20 Connect the Auxiliary Port

Connect a terminal, a modem, or another serial device to the auxiliary port on the NI-2 card (AUX). Figure 3-19 shows where to connect the auxiliary cable. See Table 2-6 on page 2-19 for cable requirements.



Warning

The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.



Note

This step is optional.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

3.2.21 Complete Initial Configuration

When you turn on the Cisco 6015 for the first time, an interactive dialog called the System Configuration Dialog appears on the console screen. The System Configuration Dialog guides you through the initial configuration process. (You can run the dialog at any time by entering the **setup** command in privileged EXEC mode.)

When you complete the dialog, the system displays the configuration command script that you have created. It then offers you three options:

[0] Go to the IOS command prompt without saving this config.

[1] Return back to the setup without saving this config.

[2] Save this configuration to nvram and exit.

If you enter **2**, the configuration is saved and used. If you answer **0** or **1**, the configuration you created is not saved. Enter **1** if you wish to discard the configuration and restart the System Configuration Dialog.



Note

Use the **show facility-alarm status** command to display any current alarms on the system.

The following is sample output of the **show facility-alarm status** command for the Cisco 6015:

```
System Totals Critical: 1 Major: 0 Minor: 0
Source: ATM0/1 Severity: CRITICAL Description: 0 Loss of Signal
```

3.2.21.1 Before You Begin

Complete these steps before you run the System Configuration Dialog:

-
- Step 1** Determine the IP address for the Ethernet interface.
 - Step 2** If you plan to configure in-band management, also determine the IP address for the ATM interface that will be used for in-band management (ATM0/0).
 - Step 3** Find out what the password strategy is for your environment. The System Configuration Dialog prompts you for three passwords, plus an SNMP community string. The three required password types are enable secret, enable, and virtual terminal.
 - Step 4** Choose a name for the Cisco 6015. (This step is optional.)
-

3.2.21.2 Using the System Configuration Dialog

When you power up a Cisco 6015 for the first time, you are offered the option of running the System Configuration Dialog. The System Configuration Dialog offers two configuration options: basic management setup and extended setup.

- Choose basic management setup if you want to use the System Configuration Dialog to configure the passwords and the Ethernet interface only, and then use the management station or the command line interface to configure the remaining Cisco 6015 interfaces.

- Choose extended setup if you want to use the System Configuration Dialog to configure all of the Cisco 6015 interfaces.

An example of the use of each option follows the “Interface Numbering” section.

3.2.21.2.1 Interface Numbering

The System Configuration Dialog and the command line interface use the following interface numbering scheme:

- Interfaces whose names begin with “ATM0” (ATM0/1, ATM0/2, and so forth) are NI-2 card WAN interfaces. ATM0/0 is the ATM switch interface with the processor (sometimes referred to as the ASP interface, for ATM switch/processor). There is no need to configure ATM0/0 unless you plan to use in-band management. For DS3+T1, ATM0/1 is the default trunk port. ATM0/2 and through ATM0/9 can be used as trunk or subtending interfaces. For E1, ATM0/2 is the default trunk port. For IMA group interfaces using the DS3+T1/E1 IMA NI-2 card, one port from ATM0/ima0 through ATM0/ima3 can be the trunk port, with the other three being possible subtending interfaces.
- Interfaces whose names begin with “ATM1” through “ATM6” are line card interfaces.
- Ethernet0/0 is the interface for the LAN that connects the Cisco 6015 to its management system.

For dsl line card interfaces, the number before the slash indicates the slot number. The number after the slash indicates the interface or port number. For example, ATM6/4 is slot 6, port 4.

3.2.21.2.2 Basic Management Setup Example

This is the basic management setup example:

```

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: y

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: y
Configuring global parameters:

Enter host name [DSLAM]: 6015_basic

The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.
Enter enable secret: cisco

The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.
Enter enable password: lab

The virtual terminal password is used to protect
access to the router over a network interface.
Enter virtual terminal password: lab
Configure SNMP Network Management? [yes]: y
Community string [public]:

```

Current interface summary

Any interface listed with OK? value "NO" does not have a valid configuration

Interface	IP-Address	OK?	Method	Status	Protocol
ATM0/0	unassigned	NO	unset	up	up
Ethernet0/0	unassigned	NO	unset	up	up
ATM0/1	unassigned	NO	unset	up	down
ATM0/2	unassigned	NO	unset	down	down
ATM0/3	unassigned	NO	unset	down	down
ATM0/4	unassigned	NO	unset	down	down
ATM0/5	unassigned	NO	unset	down	down
ATM0/6	unassigned	NO	unset	down	down
ATM0/7	unassigned	NO	unset	down	down
ATM0/8	unassigned	NO	unset	down	down
ATM0/9	unassigned	NO	unset	down	down
ATM0/IMA0	unassigned	NO	unset	up	up
ATM0/IMA1	unassigned	NO	unset	up	up
ATM0/IMA2	unassigned	NO	unset	up	up
ATM0/IMA3	unassigned	NO	unset	up	up

Enter interface name used to connect to the management network from the above interface summary: **ethernet0/0**

Configuring interface Ethernet0/0:

Configure IP on this interface? [yes]:

IP address for this interface: **192.168.1.1**

Subnet mask for this interface [255.255.255.0] : **255.255.255.0**

Class C network is 192.168.1.0, 24 subnet bits; mask is /24

The following configuration command script was created:

```
hostname 6015_basic
enable secret 5 $1$f1TA$jw/Rpe/EBj.fDQ3HYCjVw/
enable password lab
line vty 0 4
password lab
snmp-server community public
!
no ip routing

!
interface ATM0/0
shutdown
no ip address
!
interface Ethernet0/0
no shutdown
ip address 192.168.1.1 255.255.255.0
!
interface ATM0/1
shutdown
no ip address
!
interface ATM0/2
shutdown
no ip address
!
interface ATM0/3
shutdown
no ip address
!
interface ATM0/4
```

```
shutdown
no ip address
!
interface ATM0/5
shutdown
no ip address
!
interface ATM0/6
shutdown
no ip address
!
interface ATM0/7
shutdown
no ip address
!
interface ATM0/8
shutdown
no ip address
!
interface ATM0/9
shutdown
no ip address
!
interface ATM0/IMA0
shutdown
no ip address
!
interface ATM0/IMA1
shutdown
no ip address
!
interface ATM0/IMA2
shutdown
no ip address
!
interface ATM0/IMA3
shutdown
no ip address
!
end
```

```
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.
```

```
Enter your selection [2]: 2
% Shutdown not allowed for ATM0/0.
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.
```

Press RETURN to get started!

3.2.21.2.3 Extended Setup Example

This is the extended setup example:

```
--- System Configuration Dialog ---
```

```
Would you like to enter the initial configuration dialog? [yes/no]: y
```

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].

Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: **n**

First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid configuration

Interface	IP-Address	OK?	Method	Status	Protocol
ATM0/0	unassigned	NO	unset	up	up
Ethernet0/0	unassigned	NO	unset	up	up
ATM0/1	unassigned	NO	unset	up	down
ATM0/2	unassigned	NO	unset	down	down
ATM0/3	unassigned	NO	unset	down	down
ATM0/4	unassigned	NO	unset	down	down
ATM0/5	unassigned	NO	unset	down	down
ATM0/6	unassigned	NO	unset	down	down
ATM0/7	unassigned	NO	unset	down	down
ATM0/8	unassigned	NO	unset	down	down
ATM0/9	unassigned	NO	unset	down	down
ATM0/IMA0	unassigned	NO	unset	up	up
ATM0/IMA1	unassigned	NO	unset	up	up
ATM0/IMA2	unassigned	NO	unset	up	up
ATM0/IMA3	unassigned	NO	unset	up	up

Configuring global parameters:

Enter host name [DSLAM]: **6015**

The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.

Enter enable secret: **cisco**

The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.

Enter enable password: **test**

The virtual terminal password is used to protect
access to the router over a network interface.

Enter virtual terminal password: **test**

Configure SNMP Network Management? [yes]:

Community string [public]:

Configure IP? [yes]:

Configure IGRP routing? [yes]: **n**

Configure RIP routing? [no]:

Configure CLNS? [no]:

Configure bridging? [no]:

Configuring interface parameters:

Do you want to configure ATM0/0 interface? [yes]: **n**

Do you want to configure Ethernet0/0 interface? [yes]:

Configure IP on this interface? [yes]:

IP address for this interface: **192.168.1.1**

```
Subnet mask for this interface [255.255.255.0] :
Class C network is 192.168.1.0, 24 subnet bits; mask is /24
```

```
Do you want to configure ATM0/1 interface? [yes]:
Configure IP on this interface? [yes]: n
```

```
Do you want to configure ATM0/2 interface? [yes]:
Configure IP on this interface? [yes]: n
```

```
Do you want to configure ATM0/3 interface? [yes]: n
```

```
Do you want to configure ATM0/4 interface? [yes]: n
```

```
Do you want to configure ATM0/5 interface? [yes]: n
```

```
Do you want to configure ATM0/6 interface? [yes]: n
```

```
Do you want to configure ATM0/7 interface? [yes]: n
```

```
Do you want to configure ATM0/8 interface? [yes]: n
```

```
Do you want to configure ATM0/9 interface? [yes]: n
```

```
Do you want to configure ATM0/IMA0 interface? [yes]: n
```

```
Do you want to configure ATM0/IMA1 interface? [yes]: n
```

```
Do you want to configure ATM0/IMA2 interface? [yes]: n
```

```
Do you want to configure ATM0/IMA3 interface? [yes]: y
```

```
Configure IP on this interface? [yes]:
```

```
IP address for this interface: 192.168.2.1
```

```
Subnet mask for this interface [255.255.255.0] :
```

```
Class C network is 192.168.2.0, 24 subnet bits; mask is /24
```

The following configuration command script was created:

```
hostname 6015
enable secret 5 $1$T768$ufai0PuEf1cGFcG0VtmUV1
enable password test
line vty 0 4
password test
snmp-server community public
!
ip routing
no clns routing
no bridge 1
!
interface ATM0/0
shutdown
no ip address
!
interface Ethernet0/0
ip address 192.168.1.1 255.255.255.0
!
interface ATM0/1
no ip address
!
interface ATM0/2
no ip address
!
interface ATM0/3
shutdown
no ip address
```

```

!
interface ATM0/4
shutdown
no ip address
!
interface ATM0/5
shutdown
no ip address
!
interface ATM0/6
shutdown
no ip address
!
interface ATM0/7
shutdown
no ip address
!
interface ATM0/8
shutdown
no ip address
!
interface ATM0/9
shutdown
no ip address
!
interface ATM0/IMA0
shutdown
no ip address
!
interface ATM0/IMA1
shutdown
no ip address
!
interface ATM0/IMA2
shutdown
no ip address
!
interface ATM0/IMA3
ip address 192.168.2.1 255.255.255.0
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
end

```

[0] Go to the IOS command prompt without saving this config.

[1] Return back to the setup without saving this config.

[2] Save this configuration to nvram and exit.

Enter your selection [2]: 2

% Shutdown not allowed for ATM0/0.

Building configuration...

Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!



Note

To configure your system, refer to the appropriate software or network management configuration guides.



Installing a Cisco 6015 Without a POTS Splitter Configuration in a Commercial Environment

This chapter provides installation procedures for a Cisco 6015 without a POTS splitter configuration in a commercial environment.


Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.


Caution

Before you start the installation procedures, read the entire chapter for important information and safety warnings.


Note

Before installing and cabling the equipment, be aware of standard safety practices and the hazards involved in working with electrical circuitry to prevent accidents. See the “Safety Requirements” section on page 2-1 for all cautions and warnings that are necessary to ensure a safe and hazard-free installation.

To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information for the Cisco 6015 System*.


Tip

See the “Cisco 6015 Without a POTS Splitter Configuration” section on page 1-6 for more information about Cisco 6015 without a POTS splitter configuration components.

4.1 Installation Checklist

When you install a Cisco 6015 without a POTS splitter configuration in a commercial environment, be sure that you follow the installation procedures in the proper sequence. Table 4-1 is a checklist of the installation steps in the order in which they should occur. Detailed installation instructions are discussed in the sections following Table 4-1.

Table 4-1 *Installation Checklist—Cisco 6015 Without a POTS Splitter Configuration in a Commercial Environment*

Check	Installation Procedure
	1. Measure the required rack space.
	2. Install the AC/DC converter and converter tray in the rack, if applicable.
	3. Install the Cisco 6015 chassis in the rack.
	4. Install the blank faceplates in the open slots.
	5. Ground the Cisco 6015 chassis.
	6. Connect the DC PEM ¹ to the AC/DC converter if you are using AC power.
	7. Connect the DC PEM to the fuse and alarm panel if you are using DC power.
	8. Connect the BITS ² interface, if applicable.
	9. Connect the facility alarm input, if applicable.
	10. Connect the Cisco 6015 chassis to the MDF ³ .
	11. Connect the network I/O ⁴ module on the subtending host chassis to the I/O module on the subtended node chassis (optional). Note This step is necessary only when installing a subtended network configuration. For an OC-3c/OC-3c NI-2 card subtended network configuration, the network connections are made through the faceplates of the OC-3c/OC-3c NI-2 cards, not the I/O modules.
	12. Connect the I/O module to the network. Note If you have an OC-3c/OC-3c NI-2 card installed in your system, the network connection is made through the NI-2 card faceplate, not the I/O module.
	13. Apply power to the system.
	14. Verify that the fan modules are operational.
	15. Connect the Ethernet to the management network.
	16. Connect a console terminal.
	17. Connect the auxiliary port (optional).
	18. Complete initial configuration.

1. PEM = power entry module
2. BITS = building integrated timing supply
3. MDF = main distribution frame
4. I/O = Input/Output

4.2 Installation Procedures

The following sections detail the installation procedures for a Cisco 6015 without a POTS splitter configuration in a commercial environment.

**Caution**

Proper ESD protection is required whenever you handle Cisco equipment. Installation and maintenance personnel should be properly grounded using ground straps to eliminate the risk of ESD damage to the equipment. Cards are subject to ESD damage whenever they are removed from the chassis.

See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.

4.2.1 Measure Required Rack Space

For the rack to remain stable, you must install your Cisco 6015 system from the bottom to the top of the rack. Before you install any of the chassis, determine the total rack space that is required to install your system. The required rack space depends on the type of line cards installed and the number of Cisco 6015 chassis and AC/DC converters that you plan to use. The number of components will increase if you plan to install a subtended network.

You can install a combination of these Cisco 6015 components in a 7-foot rack:

- Cisco 6015 chassis.
 - If you are installing quad-port flexi ATU-C line cards (4xflexis), the maximum is nine chassis per rack (include subtending host and subtended node chassis).
 - If you are installing octal-port Discrete Multitone (DMT) ATU-C line cards (8xDMTs) or octal-port single-pair high-speed digital subscriber line, also known as symmetric high bit-rate digital subscriber loop (G.SHDSL) line cards (8xG.SHDSLs), the maximum is six chassis per rack (include subtending host and subtended node chassis).
- AC/DC converter and converter tray—Optional.

**Tip**

See Chapter 2, “Preparing for Installation,” for the calculation tables that are necessary to plan the total rack space for your Cisco 6015 system configuration.

The Cisco 6015 system fits in either a 19-inch or a 23-inch wide rack. See Table 2-3 for individual rack space requirements.

**Warning**

To prevent bodily injury when mounting or servicing this unit in a rack, you must take special precautions to ensure that the system remains stable. The following guidelines are provided to ensure your safety:

—This unit should be mounted at the bottom of the rack if it is the only unit in the rack.

—When mounting this unit in a partially filled rack, load the rack from the bottom to the top with the heaviest component at the bottom of the rack.

—If the rack is provided with stabilizing devices, install the stabilizers before mounting or servicing the unit in the rack.

If you plan to expand your system to include more chassis in the future, allow space in the rack for additions during the initial installation, keeping in mind the weight distribution and stability of the rack.

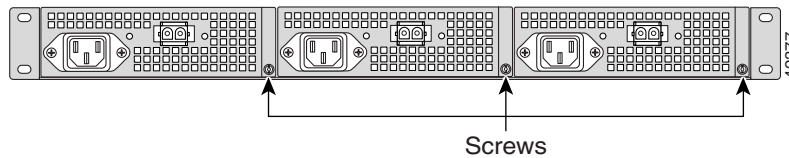
4.2.2 Install the AC/DC Converter and Converter Tray

If you are using AC power, complete the following steps to install the AC/DC converter. If you are not using AC power, proceed to the “Install the Cisco 6015 Chassis” section on page 4-4.

-
- Step 1** Use four mounting screws and a Phillips-head screwdriver to attach the extenders to the sides of the tray if you are installing the system in a 23-inch rack.
 - Step 2** Position an AC/DC converter tray, which occupies 1 RU of space, at the bottom of the rack.
 - Step 3** Use four mounting screws and a Phillips-head screwdriver to bolt the tray in the rack.
 - Step 4** Slide an AC/DC converter into one of the three open slots.
 - Step 5** Use a Phillips-head or flat-head screwdriver to attach the screw that secures the AC/DC converter in the tray.

Figure 4-1 shows the screw locations on the tray.

Figure 4-1 Screw Locations for the AC/DC Converter Tray



4.2.3 Install the Cisco 6015 Chassis

Complete the following steps to install the Cisco 6015 chassis:



Warning

Two people are required to lift the chassis. Grasp the chassis underneath the lower edge and lift with both hands. To prevent injury, keep your back straight and lift with your legs, not your back. To prevent damage to the chassis and components, never attempt to lift the chassis with the handles on the power supplies or on the interface modules. These handles were not designed to support the weight of the chassis.

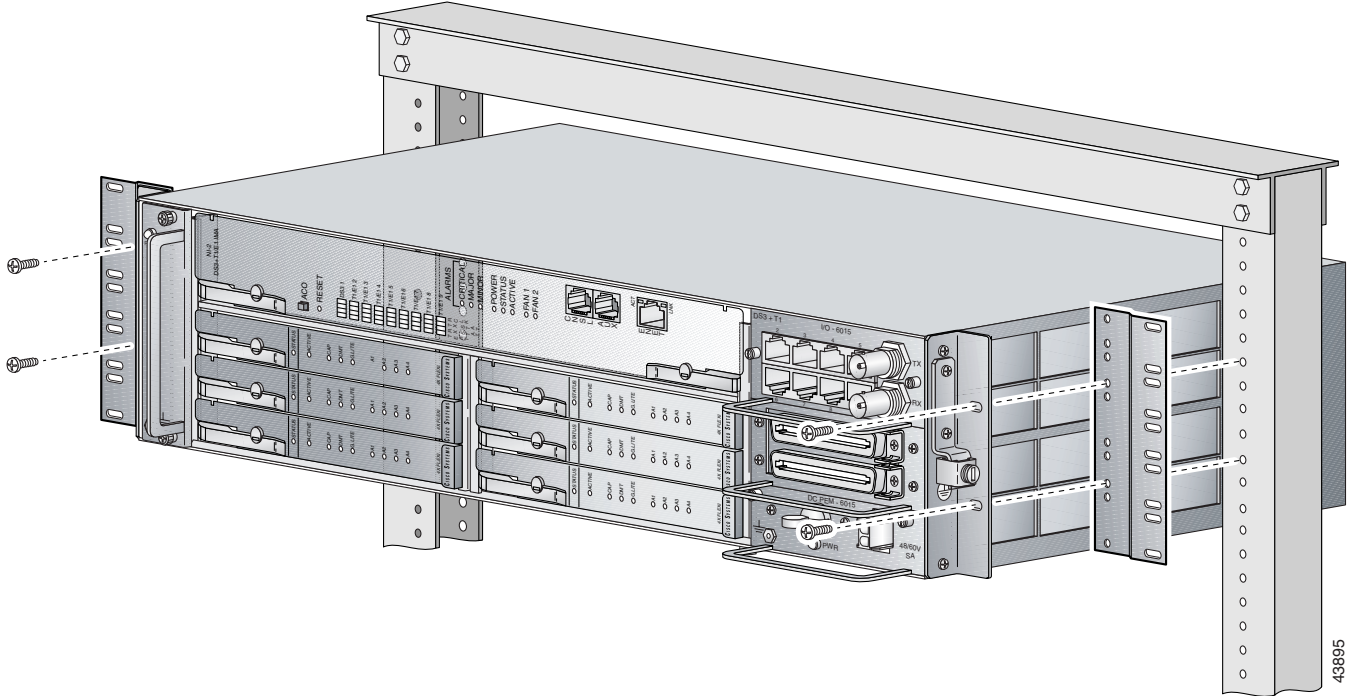


Note

The Cisco 6015 chassis ships with the cards and modules installed. To prevent damage, ensure that the screws on each card and module are tightened so that the cards do not fall out of the chassis during installation.

-
- Step 1** Position one Cisco 6015, which occupies 3 RUs of space, above the AC/DC converter. If you have an AC/DC converter installed, the bottom of the Cisco 6015 chassis should be flush with the top of the AC/DC converter.
 - Step 2** Use four mounting screws and a Phillips-head screwdriver to attach the extenders to the sides of the chassis if you are installing the system in a 23-inch rack, as shown in Figure 4-2.

Figure 4-2 Extender Installation on the Cisco 6015



- Step 3** Use four mounting screws and a Phillips-head screwdriver to bolt the Cisco 6015 in the rack.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.
See Figure 1-2 for the correct placement of the Cisco 6015.

4.2.4 Install Blank Faceplates

Blank faceplates should occupy any empty line card slots in the Cisco 6015 chassis. Blank faceplate installation is similar to line card installation.



Warning

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.

Complete the following steps to install blank faceplates in any empty line card slots in the Cisco 6015:

- Step 1** Connect a grounding strap to an ESD grounding jack on the Cisco 6015. See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.
- Step 2** Horizontally align the blank faceplate edge with the guides at the left and right of the slot.
- Step 3** Lift out on the ejector tab and gently apply pressure to the faceplate while pushing the blank faceplate into the slot.

- Step 4** Push on the faceplate to fully seat the blank faceplate.
- Step 5** Press down on the ejector tab to secure the faceplate.

4.2.5 Ground the Cisco 6015

During the system installation, complete the following steps to connect the grounding lug on the Cisco 6015 directly to the rack:



Warning

When you are installing or replacing the unit, the ground connection must always be made first and disconnected last.

- Step 1** Remove all paint or oxidation from the rack at the point of the grounding connection.
- Step 2** Measure enough wire to connect the Cisco 6015 to the rack. See Table 2-6 on page 2-19 for wire requirements.

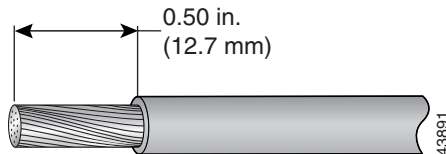


Tip

Make sure that your wire is only as long as is needed to make the connection.

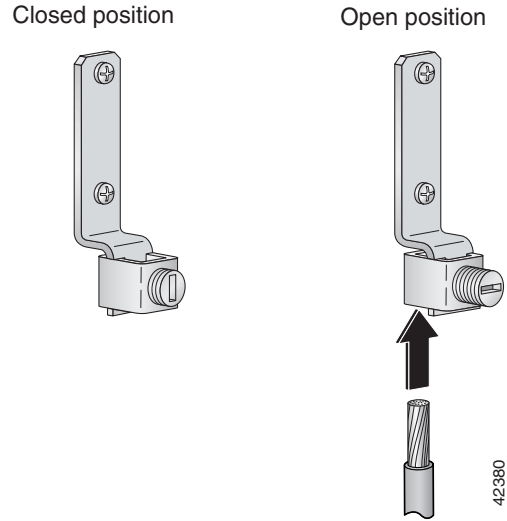
- Step 3** Cut the ends of the ground wire so that the ends are straight, not slanted.
- Step 4** Measure 1/2 inch (12.7 mm) up from the end of the ground wire and place a mark at that point. This is the wire end that will be connected to the Cisco 6015.
- Step 5** Use a wire stripper to remove 1/2 inch (12.7 mm) of the covering from the end of the wire. Trim the end of the covering so that it is straight, not slanted, as shown in Figure 4-3.

Figure 4-3 Strip and Square Off Ground Wire



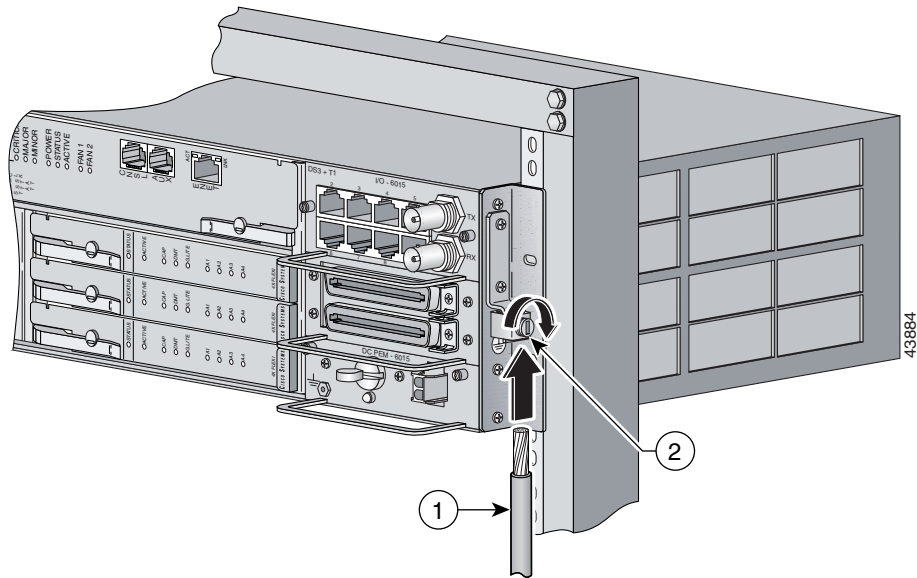
Step 6 Use a flat-head screwdriver to loosen the compression screw (open position) that is provided on the grounding lug of the Cisco 6015, as shown in Figure 4-4.

Figure 4-4 Grounding Lug Closed and Open Positions



The Cisco 6015 grounding lug is located on the right side of the chassis (viewed from the front), as shown in Figure 4-5.

Figure 4-5 Attaching the Grounding Wire to the Cisco 6015



1	Grounding wire	2	Grounding lug
----------	----------------	----------	---------------

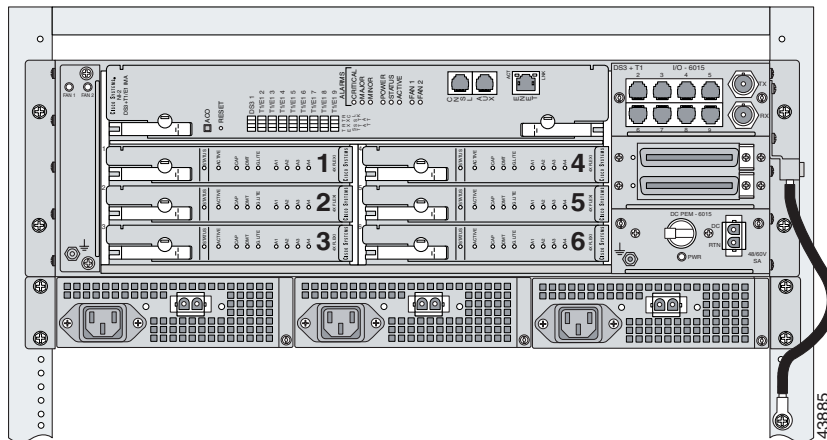
- Step 7** Insert the end of the copper wire that you prepared in Step 5 under the compression plate on the grounding lug, as shown in Figure 4-4.

**Caution**

Do not place the copper wire between the compression screw and the compression plate.

- Step 8** Use a flat-head screwdriver to tighten the compression screw against the compression plate, as shown in Figure 4-4.
- Step 9** Prepare the other end of the wire to be connected to the rack, according to the requirements of your site.
- Step 10** Use a flat-head screwdriver to loosen the screw on the rack.
- Step 11** Connect the copper wire to a ring lug (large enough for the rack screw to fit through).
- Step 12** Use the flat-head screwdriver and the screw that you loosened in Step 10 to attach the ring lug to the rack, as shown in Figure 4-6.

Figure 4-6 Attaching the Grounding Wire to the Rack



- Step 13** Use a flat-head screwdriver to tighten the rack screw over the copper wire.
- Step 14** Repeat Step 1 through Step 13 for each Cisco 6015, as necessary.

**Note**

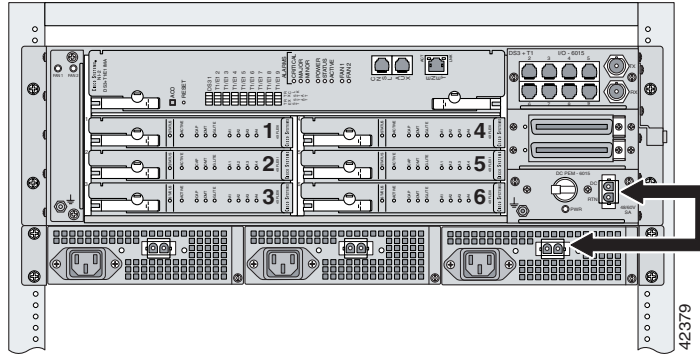
Do not ground the components in a rack by chaining them together.

4.2.6 Connect the DC PEM to the AC/DC Converter

If you are using AC power, complete the following steps to connect the DC PEM to the AC/DC converter. If you are using DC power, proceed to the “Connect the DC PEM to the Fuse and Alarm Panel” section on page 4-9.

- Step 1** Attach one end of the DC power cable (part number 72-2178-01) to the 2-pin connector located on the faceplate of the DC PEM, as shown in Figure 4-7.

Figure 4-7 Connecting the DC PEM to the AC/DC Converter



- Step 2** Attach the other end of the cable to the 2-pin connector located on the faceplate of the AC/DC converter, as shown in Figure 4-7.
- Step 3** Repeat Step 1 and Step 2 for each Cisco 6015, as necessary.



Caution

Do not plug in the AC power cord at this time.

4.2.7 Connect the DC PEM to the Fuse and Alarm Panel



Caution

To prevent the system from powering up, do not install the fuses at this time. If the fuses are already installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed and connected.



Note

The fuse and alarm panel is not provided by Cisco.

If you are using DC power, complete the following steps to connect the DC PEM to the fuse and alarm panel. If you are using AC power, proceed to the “Connect the BITS Interface” section on page 4-10.



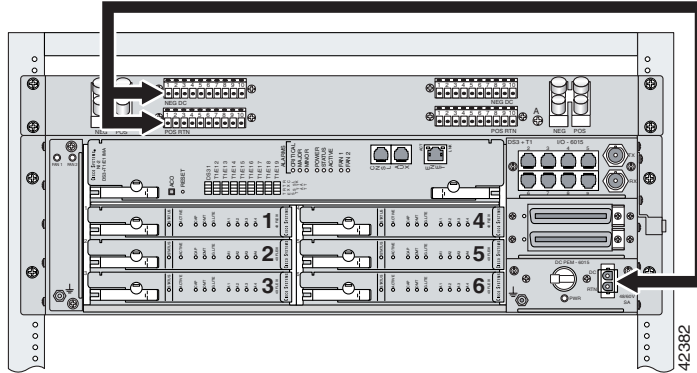
Note

Connect each Cisco 6015 system component to a separate fuse. Do not power the components in the rack by chaining them together.

See Chapter 2, “Preparing for Installation,” for the calculation tables that are necessary to determine the typical power requirement for each component that is wired to the fuse and alarm panel.

- Step 1** Attach one end of the DC power cable (part number 72-2223-01) to the 2-pin connector located on the faceplate of the DC PEM, as shown in Figure 4-8.

Figure 4-8 Connecting the DC PEM to the Fuse and Alarm Panel



- Step 2** Attach the red wire coming from the DC PEM to a fuse and alarm panel POS (positive) DC connector, as shown in Figure 4-8.
- Step 3** Attach the black wire coming from the DC PEM to a fuse and alarm panel NEG (negative) DC connector, as shown in Figure 4-8.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.



Caution

Do not set the circuit breaker on the DC PEM to the ON (1) position at this time.

4.2.8 Connect the BITS Interface

The BITS interface provides the network clocking. Complete the following steps to connect the BITS interface to the BITS clock source:

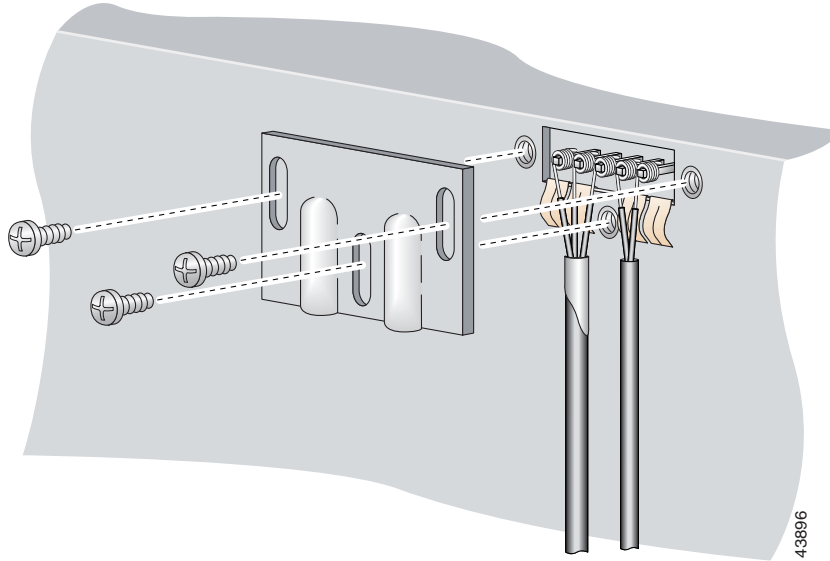


Note

For more information on the BITS interface, see the “Rear Interface Header” section on page 1-36.

- Step 1** Use a Phillips-head screwdriver to remove the three screws that hold the plate over the BITS interface pins, as shown in Figure 4-9. Remove the plate, and set the screws and the plate aside.

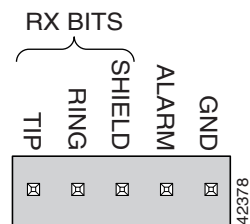
Figure 4-9 Plate Removal over BITS Interface Pinouts



- Step 2** Measure one strand of wire long enough to connect the first three BITS interface pins to the BITS clock source. See Table 2-6 on page 2-19 for wire requirements.

See Figure 4-10 for a close view of the pinouts that are located on the back of the Cisco 6015 chassis. For pinout descriptions, see Table 1-8 on page 1-37.

Figure 4-10 BITS Interface Pinouts



- Step 3** Use a wire stripper to remove the casing from both ends of the wire.
- Step 4** Pull the foil shield back over the wire casing and separate the three exposed wires, as shown in Figure 4-9.
- Step 5** Use a wire-wrapping tool to attach the drain wire in the twisted-pair to pin 3 (Shield), as shown in Figure 4-9.
- Step 6** Use a wire-wrapping tool to attach one of the two remaining wires in the twisted-pair to pin 2 (Ring), as shown in Figure 4-9.
- Step 7** Use a wire-wrapping tool to attach the remaining wire in the twisted-pair to pin 1 (Tip), as shown in Figure 4-9.

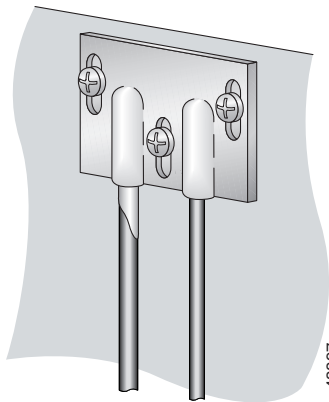
- Step 8** Use a Phillips-head screwdriver and three screws to reattach the plate that covers the BITS interface pins. Align the wires with the recessed channels on the plate so that the wires are not pinched when the plate is attached to the chassis, as shown in Figure 4-11.



Note When the plate is reattached to the chassis, the bottom of the plate should reside in the middle of the foil shield, as shown in Figure 4-11.

If you are going to connect the facility alarm input, do not reattach the plate at this time.

Figure 4-11 Wire Alignment Under the Plate



- Step 9** Connect the other end of the wires from Step 5 through Step 7 to the BITS clock source.
- Step 10** Repeat Step 1 through Step 9 for each Cisco 6015, as necessary.

4.2.9 Connect the Facility Alarm Input

Complete the following steps to connect the facility alarm input to the alarm relay contact:

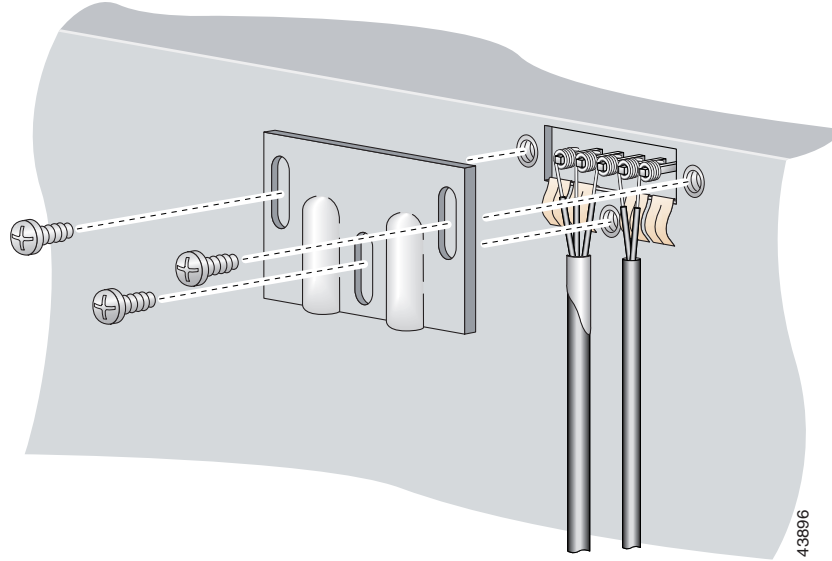


Note For more information on the facility alarm input, see the “Rear Interface Header” section on page 1-36.

- Step 1** Use a Phillips-head screwdriver to remove the three screws that hold the plate over the BITS interface pins, as shown in Figure 4-12. Remove the plate, and set the screws and the plate aside.



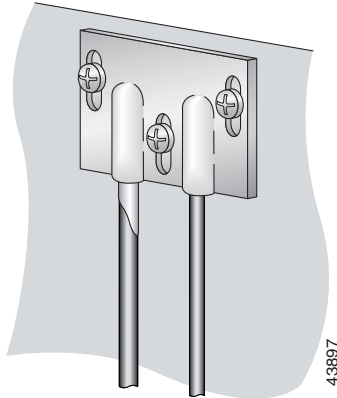
Note If you connected the BITS interface pins, skip this step and proceed to Step 2.

Figure 4-12 Plate Removal Over Facility Alarm Input Pinouts

- Step 2** Measure wire long enough to connect both pins 4 and 5 to the alarm relay contact. See Table 2-6 on page 2-19 for wire requirements.
- See Figure 4-10 for a close-up of the pinouts that are located on the back of the Cisco 6015 chassis. For pinout descriptions, see Table 1-8 on page 1-37.
- Step 3** Use a wire stripper to remove the casing from both ends of the wire.
- Step 4** Use a wire-wrapping tool to attach one of the wires to pin 4 (Alarm), as shown in Figure 4-12.
- Step 5** Use a wire-wrapping tool to attach the remaining wire to pin 5 (Ground), as shown in Figure 4-12.
- Step 6** Connect the relay activator to the alarm event trigger.
- Step 7** Use a Phillips-head screwdriver and three screws to reattach the plate that covers the BITS and alarm interface pins. Align the wires with the recessed channels on the plate so that the wires are not pinched when the plate is attached to the chassis, as shown in Figure 4-13.



Note When the plate is reattached to the chassis, the bottom of the plate should reside in the middle of the foil shield for the BITS interface. The casing for the facility alarm input wire should be captured under the plate. (See Figure 4-13.)

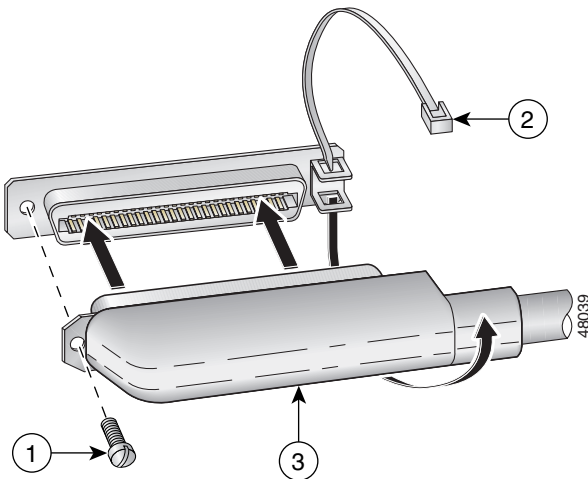
Figure 4-13 Wire Alignment Under the Plate

Step 8 Repeat Step 1 through Step 7 for each Cisco 6015, as necessary.

4.2.10 Connect the Cisco 6015 to the MDF

Connect the two Champ cables from the DSL interface module (DSL Slots 1 through 3 and DSL Slots 4 through 6) to the MDF.

Ensure that all cables are screwed in to the DSL interface module and that the Champ connectors are tie wrapped. (See Figure 4-14.)

Figure 4-14 Attaching a Champ Connector to the Chassis

1	Champ connector screw	3	Champ connector
2	Tie wrap		

**Note**

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

4.2.11 Install a Subtended Network Configuration

If you are installing a subtended network, complete the following steps. If you are not installing a subtended network, proceed to the “Connect the Cisco 6015 to the Network” section on page 4-17.

The following sections provide installation procedures for subtended network configurations using the DS3+T1/E1 IMA NI-2 card and the OC-3c/OC-3c NI-2 card.

**Tip**

The term *subtending* refers to the host chassis, and *subtended* refers to the downstream chassis in a subtended network.

Cisco recommends that you label each data cable at both ends to identify its destination.

**Note**

For more information on a subtended network configuration, see the “Subtended Network Configuration” section on page 1-6.

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

4.2.11.1 Connect the DS3+T1/E1 Subtending Network Configuration

Connections for T1 cabling are located on the DS3+T1 I/O module. The DS3+T1 I/O module is used in North America. Connections for E1 cabling are located on the E1 I/O module.

The TX and RX RJ-48 T1/E1 connectors on the subtending host chassis I/O module are connected to the TX and RX RJ-48 T1/E1 connectors on the subtended node chassis I/O module.

**Note**

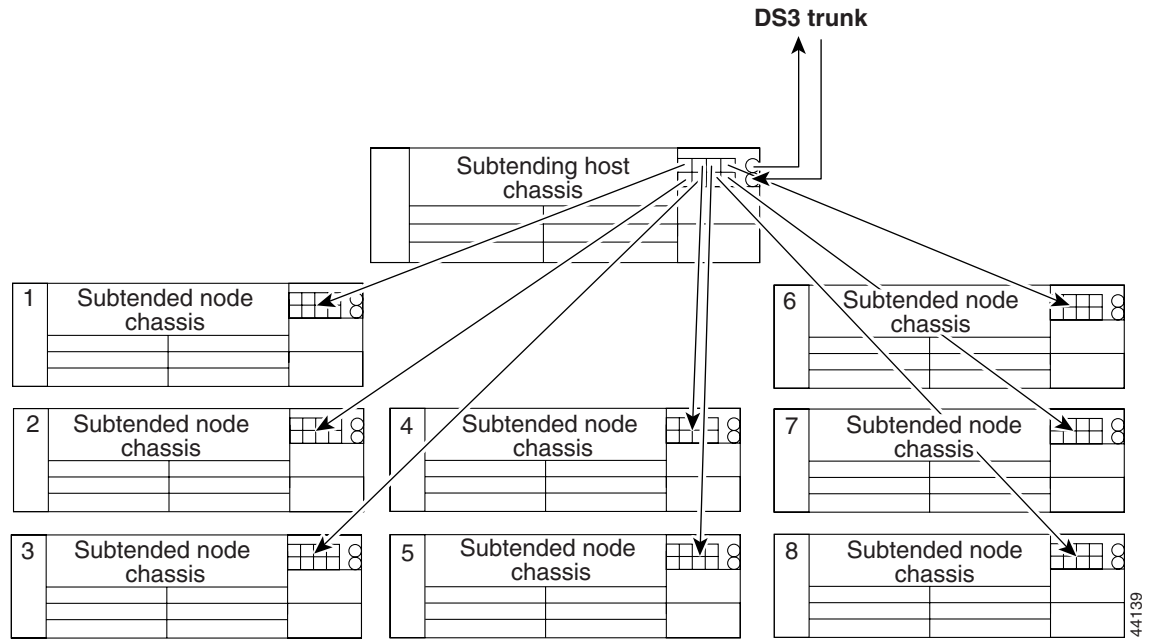
The E1 I/O module is used in world-wide environments, except in North America. The E1 I/O module has eight RJ-48 receptacles for eight E1 trunk or subtending interfaces.

Complete the following steps to cable the I/O module for T1/E1 subtending:

- Step 1** Verify that you have either DS3+T1 I/O modules or E1 I/O modules installed on your subtending host and node chassis.
- Step 2** Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module in the subtending host chassis.
- Step 3** Connect the other end of the RJ-48 cable to one of the RJ-48 receptacles on the I/O module in a subtended node chassis.

Figure 4-15 shows an example of a subtended network configuration.

Figure 4-15 DS3+T1 Subtended Network Configuration



Step 4 Repeat Step 2 through Step 3 to connect the subtending host chassis to each subtended node chassis.



Note

If you are using a T1 or E1 trunk to the network, the trunk connection will originate at one of the RJ-48 receptacles on the DS3+T1 I/O module or the E1 I/O module on the host chassis. Therefore, only seven RJ-48 receptacles will be available for subtending connections.

4.2.11.2 Connect the IMA Subtending Network Configuration

See the “IMA Configuration” section on page 1-8 for more information on how to configure an IMA subtending network configuration.

4.2.11.3 Connect the OC-3c Subtending Network Configuration

For OC-3c subtending, the connections are made from the OC-3c/OC-3c NI-2 cards in the subtending host chassis and the subtended node chassis. Connect one subtended Cisco 6015 to the subtending interfaces on the NI-2 (OC-3c interfaces).

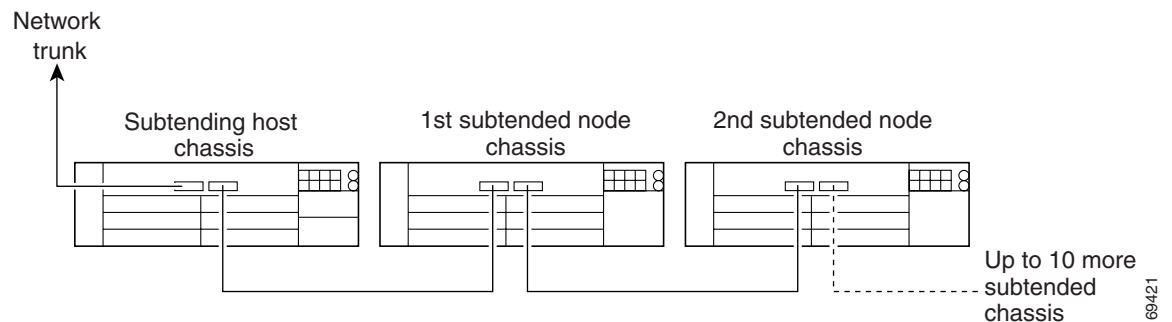
To cable the Cisco 6015 system for OC-3c subtending, complete the following steps:

- Step 1** Verify that you have OC-3c/OC-3c NI-2 cards installed in the subtending host and node chassis.
- Step 2** Locate the trunk 1 interface connectors (TX and RX) and the subtend 2 interface connectors (TX and RX) on the front of each OC-3c/OC-3c NI-2 card.

- Step 3** Attach an OC-3c fiber-optic cable to the TX subtend 2 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the subtending host chassis.
- Step 4** Attach the other end of the cable that you used in Step 2 to the RX trunk 1 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the subtended node chassis.
- Step 5** Attach an OC-3c fiber-optic cable to the RX subtend 2 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the subtending host chassis.
- Step 6** Attach the other end of the cable that you used in Step 4 to the TX trunk 1 interface connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card in the second subtended node chassis.

Figure 4-16 shows the OC-3c subtending connections between three Cisco 6015 system chassis.

Figure 4-16 Daisy Chain Topology for OC-3c/STM-1 Interfaces



68421

4.2.12 Connect the Cisco 6015 to the Network

The following sections detail the connection procedures for a DS3, T1, E1, IMA group, or OC-3c network connection.

4.2.12.1 DS3 Network Connection Installation

Complete the following steps to connect the I/O module to the network using a DS3 connection. If you are using a T1 connection, proceed to the “T1 Network Connection Installation” section on page 4-18. If you are using an E1 connection, proceed to the “E1 Network Connection Installation” section on page 4-19. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 4-19. If you are using an OC-3c connection, proceed to the “OC-3c Network Connection Installation” section on page 4-19.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

-
- Step 1** Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.
The I/O module DS3 connections attach to the ATM switch. Two 75-ohm DS3 Bayonet-Neill-Concelman (BNC) connectors are provided for DS3 TX and RX. Attach one end of a coaxial cable (type 734A or equivalent) to the TX DS3 BNC connector on the I/O module.



Note See Table 2-6 on page 2-19 for cable requirements.

- Step 2** Attach the other end of the cable that originates at the TX DS3 BNC connector to the RX DS3 BNC connector ATM switch.
- Step 3** Attach one end of a coaxial cable (type 734A or equivalent) to the RX DS3 BNC connector on the I/O module.
- Step 4** Attach the other end of the cable that originates at the RX DS3 BNC connector to the TX DS3 BNC connector ATM switch.
- Step 5** Repeat Step 1 through Step 4 for each Cisco 6015, as necessary.
-

4.2.12.2 T1 Network Connection Installation

Complete the following steps to connect the I/O module to the network using a T1 connection. If you are using an E1 connection, proceed to the “E1 Network Connection Installation” section on page 4-19. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 4-19. If you are using an OC-3c connection, proceed to the “OC-3c Network Connection Installation” section on page 4-19.



Tip Cisco recommends that you label each data cable at both ends to identify its destination.

- Step 1** Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.
- Step 2** Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.



Note See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

- Step 3** Connect the other end of the cable used in Step 2 to the ATM switch.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.



Note Verify that the RJ-48 cable pinouts connect TX to RX and RX to TX.

4.2.12.3 E1 Network Connection Installation

Complete the following steps to connect the I/O module to the network using an E1 connection. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 4-19. If you are using an OC-3c connection, proceed to the “OC-3c Network Connection Installation” section on page 4-19.

**Tip**

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have an E1 I/O module installed in the Cisco 6015 chassis.

Step 2 Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.

**Note**

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

Step 3 Connect the other end of the cable used in Step 2 to the ATM switch.

Step 4 Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.

**Note**

Verify that the RJ-48 cable pinouts connect TX to RX and RX to TX.

4.2.12.4 IMA Network Connection Installation

See the “IMA Configuration” section on page 1-8 for more information on how to configure an IMA network connection.

4.2.12.5 OC-3c Network Connection Installation

Complete the following steps to connect the OC-3c/OC-3c NI-2 card to the network.

**Warning**

Do not stare into the beam or view it directly with optical instruments.

Step 1 Verify that you have an OC-3c/OC-3c NI-2 card installed in your Cisco 6015 chassis.

Step 2 Attach the RX cable from the ATM switch to the TX connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card.

The TX connector is the one closest to the top of the faceplate. The RX connector is closest to the bottom of the faceplate. The connector IDs are silkscreened inside the inset.

- Step 3** Attach the TX cable from the ATM switch to the RX connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card (trunk 1 interface connector RX). See Figure 1-14 on page 1-27 for the OC-3c network interface connection location.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015 chassis, as necessary.
-

4.2.13 Apply Power

The following sections detail the procedures to apply the power for either AC or DC power.



Warning

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

4.2.13.1 Apply AC Power

Complete the following steps to apply AC power to the Cisco 6015 system:

- Step 1** Attach the AC power cord to the AC/DC converter.
- Step 2** Plug the other end of the power cord into the wall outlet.




Caution

If the power connections are improperly made and power is applied while the cards are installed, the cards and chassis could be damaged.

- Step 3** Verify that the DC PEM is properly connected to the AC/DC converter, as described in the “Connect the DC PEM to the AC/DC Converter” section on page 4-8.
- Step 4** Set the circuit breaker on the DC PEM to the ON (1) position.
- Step 5** Verify that the DC PEM is operational by locating the LEDs on the front of the DC PEM. If the LED is
- Green—Output is correct.
 - Off—DC PEM is not operational. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Step 6** Verify that the AC/DC converter is operational by locating the LEDs on the front of the AC/DC converter.
- If the left LED is green, this indicates that there is good AC input.
 - If the right LED is green, this indicates that there is good DC output from the DC PEM to the AC/DC converter.
 - If either LED is off, troubleshoot the AC/DC converter or the AC input.
-

4.2.13.2 Apply DC Power

Complete the following steps to apply DC power to the Cisco 6015 system:

-
- Step 1** Apply power to the system with one of the following methods:
- Install the fuses in the fuse and alarm panel.
 - Reinsert the fuses in the fuse and alarm panel if you removed them in the “Connect the DC PEM to the Fuse and Alarm Panel” section on page 4-9.
 - Turn on the breakers in the fuse and alarm panel.
-
-  **Caution** If the power connections are improperly made and power is applied while the cards are installed, the cards and chassis could be damaged.
-
- Step 2** Verify that the DC PEM is properly connected to the fuse and alarm panel as described in the “Connect the DC PEM to the Fuse and Alarm Panel” section on page 4-9.
- Step 3** Set the circuit breaker on the DC PEM to the ON (1) position.
- Step 4** Verify that the DC PEM is operational by locating the LEDs on the front of the DC PEM. If the LED is
- Green—Output is correct.
 - Off—DC PEM is not operational. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Step 5** Check the polarity of the –48V DC connections to each chassis by attaching a voltmeter with the minus lead on the red wire and the plus lead on the black wire, at the fuse and alarm panel. Ensure that the meter reads between –40V DC and –68V DC. If your voltmeter shows a positive voltage, the power inputs might be reversed. If the voltmeter shows a negative voltage that is out of the –40V DC to –68V DC range, check the power supply for failure or check for a blown fuse in the fuse and alarm panel.
-

4.2.14 Verify Fan Module Operation

Verify that the fan module is operational by locating the LEDs on the front of the fan module. If the LEDs are

- Green—The fan module is operational.
- Red—The fan module is not operational and the fan module is in alarm mode. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Off—The fan is not operational due to a power problem or the LED is defective. See Chapter 6, “Troubleshooting” for troubleshooting procedures.

The fans should be operational before you complete the installation procedures.

 **Caution**

It is important that the Cisco 6015 cooling fans run continuously.

4.2.15 Connect the Ethernet to the Management Network

Complete the following steps to connect the Ethernet to the management network.



Warning

The ports labeled "ENET," "CNLSL," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should be connected only to other SELV circuits. Because the DSL circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1

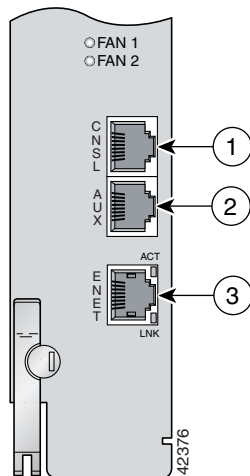
Connect the 10BaseT RJ-45 connector to the NI-2 card ENET receptacle. Figure 4-17 shows where to connect the Ethernet cable.



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements.

Figure 4-17 ENET, CNLSL, and AUX RJ-45 Receptacles on the DS3+T1/E1 IMA NI-2 Card



1	Console port	3	Ethernet port
2	Auxiliary port		

Step 2

Run the cable through the ferrite one time, loop the cable back through the ferrite, and clamp the ferrite shut.

Step 3

Connect the other end of the cable to the management network (for example, a LAN).

4.2.16 Connect a Console Terminal

Connect a VT100-compatible terminal to the system console port on the NI-2 card (CNSL). Connect the terminal to a power source and set it up using the values that are shown in Table 4-2. Figure 4-17 shows where to connect the console cable. See Table 2-6 on page 2-19 for cable requirements.



Warning

The ports labeled "ENET," "CNSL," and "AUX" are SELV circuits. SELV circuits should be connected only to other SELV circuits. Because the DSL circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the TNV circuits.

Table 4-2 Terminal Settings

Baud rate	9600 (transmit and receive)
Character size	8 bits
Parity	None
Stop bits	1
Flow control	None

4.2.17 Connect the Auxiliary Port

Connect a terminal, a modem, or another serial device to the auxiliary port on the NI-2 card (AUX). Figure 4-17 shows where to connect the auxiliary cable. See Table 2-6 on page 2-19 for cable requirements.



Warning

The ports labeled "ENET," "CNSL," and "AUX" are SELV circuits. SELV circuits should be connected only to other SELV circuits. Because the DSL circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the TNV circuits.



Note

This step is optional.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

4.2.18 Complete Initial Configuration

When you turn on the Cisco 6015 for the first time, an interactive dialog called the System Configuration Dialog appears on the console screen. The System Configuration Dialog guides you through the initial configuration process. (You can run the dialog at any time by entering the **setup** command in privileged EXEC mode.)

When you complete the dialog, the system displays the configuration command script that you have created. It then offers you three options:

```
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.
```

If you enter **2**, the configuration is saved and used. If you answer **0** or **1**, the configuration you created is not saved. Enter **1** if you wish to discard the configuration and restart the System Configuration Dialog.

**Note**

Use the **show facility-alarm status** command to display any current alarms on the system.

The following is sample output of the **show facility-alarm status** command for the Cisco 6015:

```
System Totals Critical: 1 Major: 0 Minor: 0
Source: ATM0/1 Severity: CRITICAL Description: 0 Loss of Signal
```

4.2.18.1 Before You Begin

Complete these steps before you run the System Configuration Dialog:

-
- Step 1** Determine the IP address for the Ethernet interface.
 - Step 2** If you plan to configure in-band management, also determine the IP address for the ATM interface that will be used for in-band management (ATM0/0).
 - Step 3** Find out what the password strategy is for your environment. The System Configuration Dialog prompts you for three passwords, plus an SNMP community string. The three required password types are enable secret, enable, and virtual terminal.
 - Step 4** Choose a name for the Cisco 6015. (This step is optional.)
-

4.2.18.2 Using the System Configuration Dialog

When you power up a Cisco 6015 for the first time, you are offered the option of running the System Configuration Dialog. The System Configuration Dialog offers two configuration options: basic management setup and extended setup.

- Choose basic management setup if you want to use the System Configuration Dialog to configure the passwords and the Ethernet interface only, and then use the management station or the command line interface to configure the remaining Cisco 6015 interfaces.
- Choose extended setup if you want to use the System Configuration Dialog to configure all of the Cisco 6015 interfaces.

An example of the use of each option follows the “Interface Numbering” section.

4.2.18.2.1 Interface Numbering

The System Configuration Dialog and the command line interface use the following interface numbering scheme:

- Interfaces whose names begin with “ATM0” (ATM0/1, ATM0/2, and so forth) are NI-2 card WAN interfaces. ATM0/0 is the ATM switch interface with the processor (sometimes referred to as the ASP interface, for ATM switch/processor). There is no need to configure ATM0/0 unless you plan

to use in-band management. For DS3+T1, ATM0/1 is the default trunk port. ATM0/2 and through ATM0/9 can be used as trunk or subtending interfaces. For E1, ATM0/2 is the default trunk port. For IMA group interfaces using the DS3+T1/E1 IMA NI-2 card, one port from ATM0/ima0 through ATM0/ima3 can be the trunk port, with the other three being possible subtending interfaces.

- Interfaces whose names begin with “ATM1” through “ATM6” are line card interfaces.
- Ethernet0/0 is the interface for the LAN that connects the Cisco 6015 to its management system.

For dsl line card interfaces, the number before the slash indicates the slot number. The number after the slash indicates the interface or port number. For example, ATM6/4 is slot 6, port 4.

4.2.18.2.2 Basic Management Setup Example

This is the basic management setup example:

```

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: y

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: y
Configuring global parameters:

Enter host name [DSLAM]: 6015_basic

The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.
Enter enable secret: cisco

The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.
Enter enable password: lab

The virtual terminal password is used to protect
access to the router over a network interface.
Enter virtual terminal password: lab
Configure SNMP Network Management? [yes]: y
Community string [public]:

Current interface summary

Any interface listed with OK? value "NO" does not have a valid configuration

Interface          IP-Address      OK? Method Status      Protocol
ATM0/0             unassigned     NO  unset  up          up
Ethernet0/0       unassigned     NO  unset  up          up
ATM0/1             unassigned     NO  unset  up          down
ATM0/2             unassigned     NO  unset  down       down
ATM0/3             unassigned     NO  unset  down       down
ATM0/4             unassigned     NO  unset  down       down
ATM0/5             unassigned     NO  unset  down       down
ATM0/6             unassigned     NO  unset  down       down
ATM0/7             unassigned     NO  unset  down       down

```

ATM0/8	unassigned	NO	unset	down	down
ATM0/9	unassigned	NO	unset	down	down
ATM0/IMA0	unassigned	NO	unset	up	up
ATM0/IMA1	unassigned	NO	unset	up	up
ATM0/IMA2	unassigned	NO	unset	up	up
ATM0/IMA3	unassigned	NO	unset	up	up

Enter interface name used to connect to the management network from the above interface summary: **ethernet0/0**

Configuring interface Ethernet0/0:

Configure IP on this interface? [yes]:

IP address for this interface: **192.168.1.1**

Subnet mask for this interface [255.255.255.0] : **255.255.255.0**

Class C network is 192.168.1.0, 24 subnet bits; mask is /24

The following configuration command script was created:

```
hostname 6015_basic
enable secret 5 $1$f1TA$jw/Rpe/EBj.fDQ3HYCjVw/
enable password lab
line vty 0 4
password lab
snmp-server community public
!
no ip routing

!
interface ATM0/0
shutdown
no ip address
!
interface Ethernet0/0
no shutdown
ip address 192.168.1.1 255.255.255.0
!
interface ATM0/1
shutdown
no ip address
!
interface ATM0/2
shutdown
no ip address
!
interface ATM0/3
shutdown
no ip address
!
interface ATM0/4
shutdown
no ip address
!
interface ATM0/5
shutdown
no ip address
!
interface ATM0/6
shutdown
no ip address
!
interface ATM0/7
shutdown
no ip address
```



```

!
interface ATM0/8
shutdown
no ip address
!
interface ATM0/9
shutdown
no ip address
!
interface ATM0/IMA0
shutdown
no ip address
!
interface ATM0/IMA1
shutdown
no ip address
!
interface ATM0/IMA2
shutdown
no ip address
!
interface ATM0/IMA3
shutdown
no ip address
!
end

```

```

[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.

```

```

Enter your selection [2]: 2
% Shutdown not allowed for ATM0/0.
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

```

Press RETURN to get started!

4.2.18.2.3 Extended Setup Example

This is the extended setup example:

```

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: y

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: n

First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid configuration

```

Interface	IP-Address	OK?	Method	Status	Protocol
ATM0/0	unassigned	NO	unset	up	up
Ethernet0/0	unassigned	NO	unset	up	up
ATM0/1	unassigned	NO	unset	up	down
ATM0/2	unassigned	NO	unset	down	down
ATM0/3	unassigned	NO	unset	down	down
ATM0/4	unassigned	NO	unset	down	down
ATM0/5	unassigned	NO	unset	down	down
ATM0/6	unassigned	NO	unset	down	down
ATM0/7	unassigned	NO	unset	down	down
ATM0/8	unassigned	NO	unset	down	down
ATM0/9	unassigned	NO	unset	down	down
ATM0/IMA0	unassigned	NO	unset	up	up
ATM0/IMA1	unassigned	NO	unset	up	up
ATM0/IMA2	unassigned	NO	unset	up	up
ATM0/IMA3	unassigned	NO	unset	up	up

Configuring global parameters:

Enter host name [DSLAM]: **6015**

The enable secret is a password used to protect access to privileged EXEC and configuration modes. This password, after entered, becomes encrypted in the configuration.

Enter enable secret: **cisco**

The enable password is used when you do not specify an enable secret password, with some older software versions, and some boot images.

Enter enable password: **test**

The virtual terminal password is used to protect access to the router over a network interface.

Enter virtual terminal password: **test**

Configure SNMP Network Management? [yes]:

Community string [public]:

Configure IP? [yes]:

Configure IGRP routing? [yes]: **n**

Configure RIP routing? [no]:

Configure CLNS? [no]:

Configure bridging? [no]:

Configuring interface parameters:

Do you want to configure ATM0/0 interface? [yes]: **n**

Do you want to configure Ethernet0/0 interface? [yes]:

Configure IP on this interface? [yes]:

IP address for this interface: **192.168.1.1**

Subnet mask for this interface [255.255.255.0] :

Class C network is 192.168.1.0, 24 subnet bits; mask is /24

Do you want to configure ATM0/1 interface? [yes]:

Configure IP on this interface? [yes]: **n**

Do you want to configure ATM0/2 interface? [yes]:

Configure IP on this interface? [yes]: **n**

Do you want to configure ATM0/3 interface? [yes]: **n**

Do you want to configure ATM0/4 interface? [yes]: **n**

Do you want to configure ATM0/5 interface? [yes]: **n**

```
Do you want to configure ATM0/6 interface? [yes]: n
Do you want to configure ATM0/7 interface? [yes]: n
Do you want to configure ATM0/8 interface? [yes]: n
Do you want to configure ATM0/9 interface? [yes]: n
Do you want to configure ATM0/IMA0 interface? [yes]: n
Do you want to configure ATM0/IMA1 interface? [yes]: n
Do you want to configure ATM0/IMA2 interface? [yes]: n
Do you want to configure ATM0/IMA3 interface? [yes]: y
Configure IP on this interface? [yes]:
  IP address for this interface: 192.168.2.1
  Subnet mask for this interface [255.255.255.0] :
  Class C network is 192.168.2.0, 24 subnet bits; mask is /24
```

The following configuration command script was created:

```
hostname 6015
enable secret 5 $1$T768$ufai0PuEflcGFCG0VtmUV1
enable password test
line vty 0 4
password test
snmp-server community public
!
ip routing
no clns routing
no bridge 1
!
interface ATM0/0
shutdown
no ip address
!
interface Ethernet0/0
ip address 192.168.1.1 255.255.255.0
!
interface ATM0/1
no ip address
!
interface ATM0/2
no ip address
!
interface ATM0/3
shutdown
no ip address
!
interface ATM0/4
shutdown
no ip address
!
interface ATM0/5
shutdown
no ip address
!
interface ATM0/6
shutdown
no ip address
!
interface ATM0/7
```

```

shutdown
no ip address
!
interface ATM0/8
shutdown
no ip address
!
interface ATM0/9
shutdown
no ip address
!
interface ATM0/IMA0
shutdown
no ip address
!
interface ATM0/IMA1
shutdown
no ip address
!
interface ATM0/IMA2
shutdown
no ip address
!
interface ATM0/IMA3
ip address 192.168.2.1 255.255.255.0
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
end

```

[0] Go to the IOS command prompt without saving this config.

[1] Return back to the setup without saving this config.

[2] Save this configuration to nvram and exit.

Enter your selection [2]: **2**

% Shutdown not allowed for ATM0/0.

Building configuration...

Use the enabled mode 'configure' command to modify this configuration.

Press RETURN to get started!



Note

To configure your system, refer to the appropriate software or network management configuration guides.



Installing a Cisco 6015 Configuration in an Outside-Plant Environment

This chapter provides installation procedures for a Cisco 6015 configuration in an outside-plant environment, using a Cisco 6015 with a POTS splitter configuration or a Cisco 6015 without a POTS splitter configuration.


Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.


Caution

Before you start the installation procedures, read the entire chapter for important information and safety warnings.


Note

Before installing and cabling the equipment, be aware of standard safety practices and the hazards involved in working with electrical circuitry to prevent accidents. See the “Safety Requirements” section on page 2-1 for all cautions and warnings that are necessary to ensure a safe and hazard-free installation.

To see translations of the warnings that appear in this publication, refer to the *Regulatory Compliance and Safety Information for the Cisco 6015 System*.


Tip

See the “Cisco 6015 with a POTS Splitter Configuration” section on page 1-5 or the “Cisco 6015 Without a POTS Splitter Configuration” section on page 1-6 for more information about Cisco 6015 configuration components in an outside-plant environment.

5.1 Installation Checklist

When you install a Cisco 6015 configuration (with or without a POTS splitter) in an outside-plant environment, be sure that you follow the installation procedures in the proper sequence. Table 5-1 is a checklist of the installation steps in the order in which they should occur. Detailed installation instructions are discussed in the sections following Table 5-1.

Table 5-1 Installation Checklist—Cisco 6015 Configuration in an Outside-Plant Environment

Check	Installation Procedure
	1. Verify the remote terminal enclosure compliance.
	2. Verify the cooling capacity of the heat exchanger or air conditioner that is installed in the enclosure.
	3. Verify and measure the rack space for the Cisco 6015 chassis and POTS splitter(s) (if applicable).
	4. Install the POTS splitter(s) in the rack (applicable in a Cisco 6015 with a POTS splitter configuration).
	5. Attach the BITS ¹ interface wire, if applicable.
	6. Attach the facility alarm input wire, if applicable.
	7. Install the Cisco 6015 chassis in the rack.
	8. Connect the BITS interface and facility alarm input wires, if applicable.
	9. Install the blank faceplates in the open slots.
	10. Ground the Cisco 6015 chassis, POTS splitter(s) (if applicable), and enclosure protection block.
	11. Connect the DC PEM to the fuse panel.
	12. Connect the DSL interface module to the POTS splitter(s) (applicable in a Cisco 6015 with a POTS splitter configuration).
	13. Connect the POTS splitter(s) to the enclosure protection block for the distribution frame or SAC box connections (applicable in a Cisco 6015 with a POTS splitter configuration).
	14. Connect the Cisco 6015 chassis to the enclosure protection block for the distribution frame or SAC box connections (applicable in a Cisco 6015 without a POTS splitter configuration).
	15. Connect the I/O ² module on the subtending host chassis to the I/O module on the subtended node chassis (optional). Note This step is necessary only when installing a subtended network configuration. For an OC-3c/OC-3c NI-2 card subtended network configuration, the network connections are made through the faceplates of the OC-3c/OC-3c NI-2 cards, not the I/O modules.
	16. Connect the I/O module to the NIU ³ or to the enclosure protection block, as necessary. Note If you have an OC-3c/OC-3c NI-2 card installed in your system, the network connection is made through the NI-2 card faceplate, not the I/O module.
	17. Apply power to the system.
	18. Verify that the fan modules are operational.
	19. Install the POTS cards (applicable in a Cisco 6015 with a POTS splitter configuration).
	20. Connect the Ethernet to the management network.
	21. Connect a console terminal.
	22. Connect the auxiliary port (optional).
	23. Complete initial configuration.

1. BITS = building integrated timing supply
2. I/O = Input/Output
3. NIU = network interface unit

5.2 Installation Procedures

The following sections detail the installation procedures for a Cisco 6015 configuration (with or without a POTS splitter) in an outside-plant environment.



Proper ESD protection is required whenever you handle Cisco equipment. Installation and maintenance personnel should be properly grounded using ground straps to eliminate the risk of ESD damage to the equipment. Modules and cards are subject to ESD damage whenever they are removed from the chassis.

See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.

5.2.1 Verify the Remote Terminal Enclosure Compliance

Verify with your third-party vendor that the remote terminal enclosure meets the following compliance requirements: GR-487, UL 50, Type 4X, EN60529 IP 55, and NEMA 4X.

5.2.2 Verify the Cooling Capacity

Verify the cooling capacity of the heat exchanger or air conditioner that is installed in the enclosure. The remote terminal enclosure must provide adequate cooling by using an appropriately sized heat exchanger or air conditioner to dissipate heat generated by the installed Cisco 6015 chassis and other remote terminal system components.

See Table 2-5 to determine the power dissipation for each component that is wired to the fuse panel. Once you have determined the power dissipation required for all of the components that will be installed in the remote terminal enclosure, verify that the capacity of the heat exchanger or air conditioner is greater than this value to ensure proper equipment operation.

Ensure that your cabinet has proper airflow. For information on ventilation, heat dissipation, and cooling, see the “Ventilation” section on page 2-13.



For information on the Cisco 6015, see the “Outside-Plant Operating Environment Requirements” section on page 2-12. For Cisco 6015 chassis measurements, see Table 2-3.

5.2.3 Verify and Measure Rack Space

Before you install any of the chassis, determine the total rack space that is required for the installation of your system. The required rack space depends on the type of line card installed and the number of Cisco 6015 chassis, POTS splitters, and additional outside-plant equipment that you plan to use. The number of components will increase if you plan to install a subtended network.

You can install a combination of the following Cisco 6015 components in a rack:

- Cisco 6015 chassis —In an outside-plant environment, Cisco recommends installing no more than three Cisco 6015 chassis in a four foot (1.22 meters) remote terminal enclosure.
- Third-party POTS splitter, applicable in a Cisco 6015 with a POTS splitter configuration.



Note A system configuration using 8xDMTs requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

The 8xDMT over ISDN is designed for use in a commercial environment only.



Tip

See the “Space” section on page 2-14 for the calculation table necessary to plan the total rack space for your Cisco 6015 system configuration. For Cisco 6015 chassis measurements, see Table 2-3.

5.2.4 Install the POTS Splitter

If you are installing a Cisco 6015 with a POTS splitter configuration, you can use third-party POTS splitters in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility with your Cisco representative. If you are installing a Cisco 6015 without a POTS splitter configuration, proceed to the “Install the Cisco 6015 Chassis” section on page 5-8.



Note In a system configuration using 8xDMTs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary.

For installation procedures for each POTS splitter, refer to the vendor documentation.

See Figure 1-2 for the correct placement of the POTS splitters.

5.2.5 Attach the BITS Interface Wire

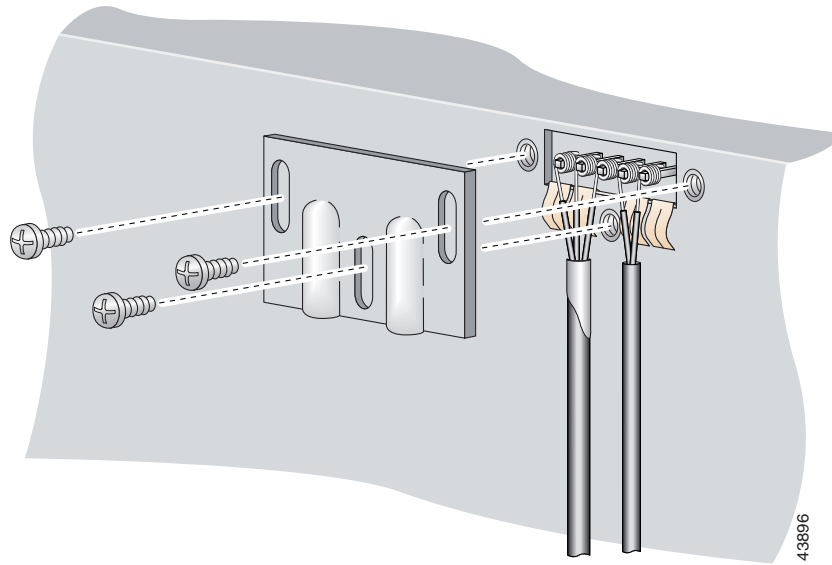
The BITS interface provides the network clocking. Complete the following steps to attach the BITS interface wire to the Cisco 6015 chassis:



Note

For more information on the BITS interface, see the “Rear Interface Header” section on page 1-36.

- Step 1** Place the Cisco 6015 chassis on a flat and stable surface (for example, a table top).
- Step 2** Use a Phillips-head screwdriver to remove the three screws that hold the plate over the BITS interface pins, as shown in Figure 5-1. Remove the plate, and set the screws and the plate aside.

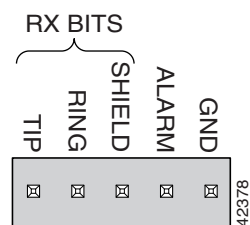
Figure 5-1 Plate Removal over BITS Interface Pinouts

- Step 3** Measure one strand of wire long enough to connect the first three BITS interface pins to the BITS clock source. See Table 2-6 on page 2-19 for wire requirements.



Note Remember that it is important that the wires and cables do not block ventilation within the remote terminal enclosure. Verify that the wires and cables follow alongside the rack bars within the enclosure.

See Figure 5-2 for a close view of the pinouts that are located on the back of the Cisco 6015 chassis. For pinout descriptions, see Table 1-8 on page 1-37.

Figure 5-2 BITS Interface Pinouts

- Step 4** Use a wire stripper to remove the casing from both ends of the wire.
- Step 5** Pull the foil shield back over the wire casing and separate the three exposed wires, as shown in Figure 5-1.
- Step 6** Use a wire-wrapping tool to attach the drain wire in the twisted-pair to pin 3 (Shield), as shown in Figure 5-1.
- Step 7** Use a wire-wrapping tool to attach one of the two remaining wires in the twisted-pair to pin 2 (Ring), as shown in Figure 5-1.
- Step 8** Use a wire-wrapping tool to attach the remaining wire in the twisted-pair to pin 1 (Tip), as shown in Figure 5-1.

- Step 9** Use a Phillips-head screwdriver and three screws to reattach the plate that covers the BITS interface pins. Align the wires with the recessed channels on the plate so that the wires are not pinched when the plate is attached to the chassis, as shown in Figure 5-3.

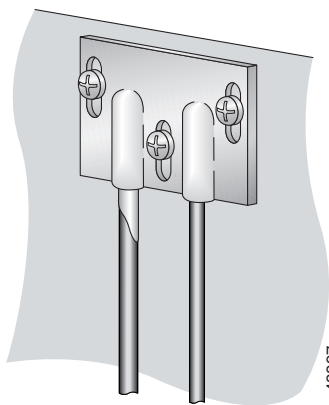


Note When the plate is reattached to the chassis, the bottom of the plate should reside in the middle of the foil shield, as shown in Figure 5-3.

If you are going to connect the facility alarm input, do not reattach the plate at this time.

Do not connect the BITS interface wires to the BITS clock source at this time.

Figure 5-3 Wire Alignment Under the Plate



- Step 10** Repeat Step 2 through Step 9 for each Cisco 6015, as necessary.

5.2.6 Attach the Facility Alarm Input Wire

Complete the following steps to attach the facility alarm input wire to the Cisco 6015 chassis.

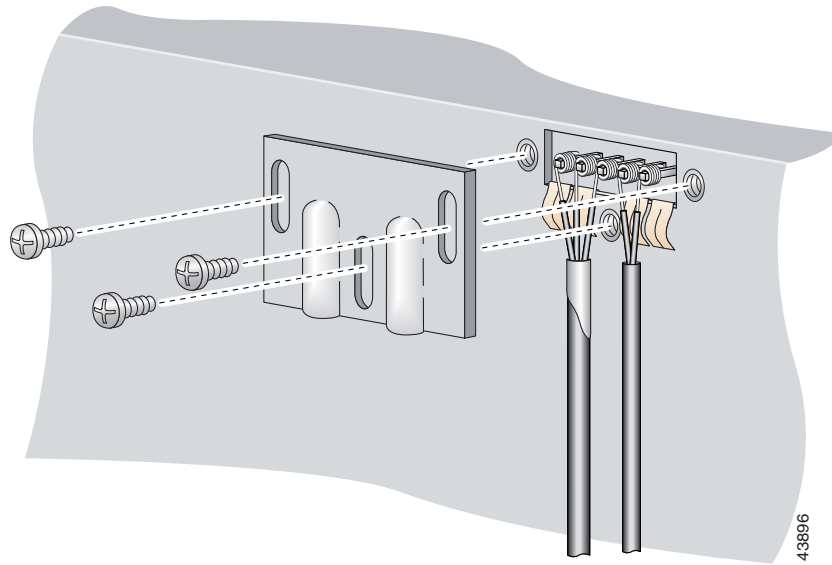


Note For more information on the facility alarm input, see the “Rear Interface Header” section on page 1-36.

- Step 1** Place the Cisco 6015 chassis on a flat and stable surface (for example, a table top).
- Step 2** Use a Phillips-head screwdriver to remove the three screws that hold the plate over the BITS interface pins, as shown in Figure 5-4. Remove the plate, and set the screws and the plate aside.



Note If you connected the BITS interface pins, skip this step and proceed to Step 3.

Figure 5-4 Plate Removal Over Facility Alarm Input Pinouts

- Step 3** Measure wire long enough to connect both pins 4 and 5 to the alarm relay contact. See Table 2-6 on page 2-19 for wire requirements.



Note It is important that the wires and cables do not block ventilation within the remote terminal enclosure. Verify that the wires and cables follow alongside the rack bars within the enclosure.

See Figure 5-2 for a close-up of the pinouts that are located on the back of the Cisco 6015 chassis. For pinout descriptions, see Table 1-8 on page 1-37.

- Step 4** Use a wire stripper to remove the casing from both ends of the wire.
- Step 5** Use a wire-wrapping tool to attach one of the wires to pin 4 (Alarm), as shown in Figure 5-4.
- Step 6** Use a wire-wrapping tool to attach the remaining wire to pin 5 (Ground), as shown in Figure 5-4.
- Step 7** Use a Phillips-head screwdriver and three screws to reattach the plate that covers the BITS and alarm interface pins. Align the wires with the recessed channels on the plate so that the wires are not pinched when the plate is attached to the chassis, as shown in Figure 5-5.

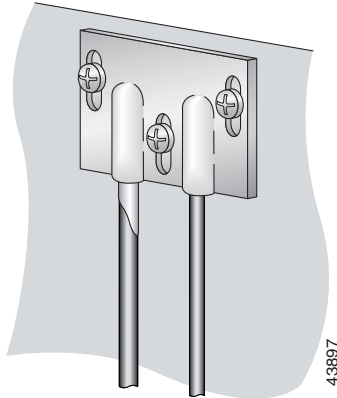


Note When the plate is reattached to the chassis, the bottom of the plate should reside in the middle of the foil shield for the BITS interface. The casing for the facility alarm input wire should be captured under the plate. (See Figure 5-5.)

Do not connect the facility alarm input wires to the alarm event trigger at this time.

- Step 8** Repeat Step 2 through Step 7 for each Cisco 6015, as necessary.

Figure 5-5 Wire Alignment Under the Plate



5.2.7 Install the Cisco 6015 Chassis

Complete the following steps to install the Cisco 6015 chassis.



Warning

Two people are required to lift the chassis. Grasp the chassis underneath the lower edge and lift with both hands. To prevent injury, keep your back straight and lift with your legs, not your back. To prevent damage to the chassis and components, never attempt to lift the chassis with the handles on the power supplies or on the interface modules. These handles were not designed to support the weight of the chassis.



Note

The Cisco 6015 chassis ships with the cards and modules installed. To prevent damage, ensure that the screws on each card and module are tightened so that the cards do not fall out of the chassis during installation.

Step 1

Connect a grounding strap to an ESD grounding jack on the Cisco 6015. See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.

Step 2

Position one Cisco 6015 above the POTS splitter (if applicable). The bottom of the Cisco 6015 chassis should be flush with the top of the POTS splitter.



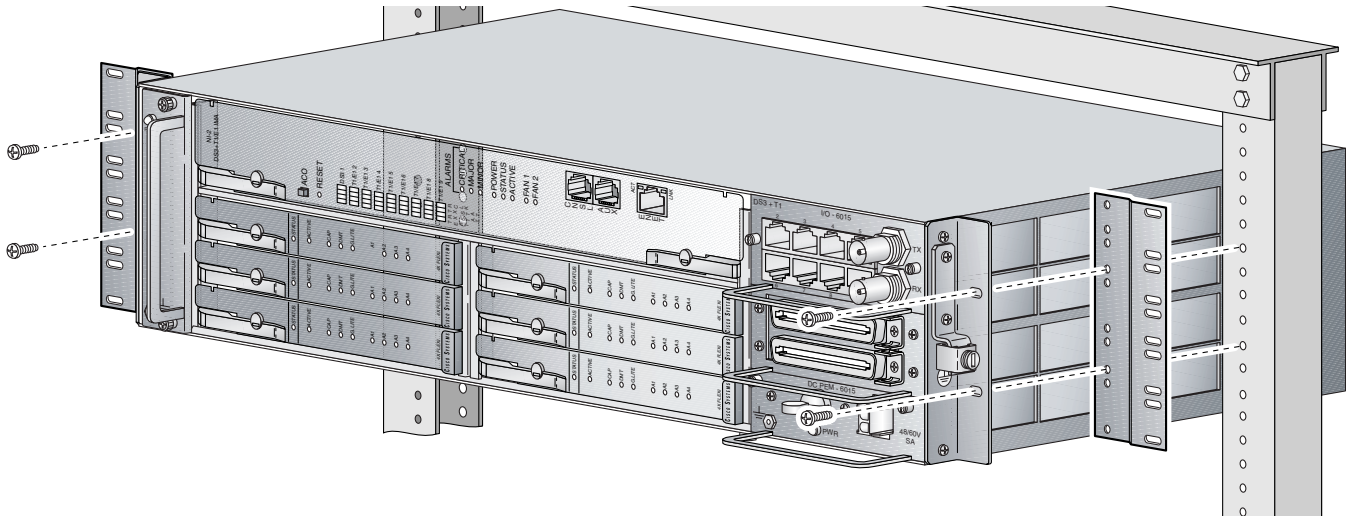
Caution

Be careful not to disconnect the wires coming from the back of the Cisco 6015 chassis for the BITS clock source and the alarm relay contact connections.

Step 3

Use four mounting screws and a Phillips-head screwdriver to attach the extenders to the sides of the chassis if you are installing the system in a 23-inch rack, as shown in Figure 5-6.


Figure 5-6 Extender Installation on the Cisco 6015



- Step 4** Use four mounting screws and a Phillips-head screwdriver to bolt the Cisco 6015 in the rack.
- Step 5** Repeat Step 1 through Step 4 for each Cisco 6015, as necessary.
See Figure 1-2 for the correct placement of the Cisco 6015.

5.2.8 Connect the BITS Interface and Facility Alarm Input Wires

Complete the following steps to connect the BITS interface to the BITS clock source and the facility alarm input to the alarm relay contact:

- Step 1** Connect the other end of the wires from the “Attach the BITS Interface Wire” section on page 5-4 to the BITS clock source.
-  **Note** It is important that the wires and cables do not block ventilation within the remote terminal enclosure. Verify that the wires and cables follow alongside the rack bars within the enclosure.
- Step 2** Repeat Step 1 for each Cisco 6015, as necessary.
- Step 3** Connect the relay activator to the alarm event trigger using the wires connected to the Cisco 6015 chassis in the “Attach the Facility Alarm Input Wire” section on page 5-6.
- Step 4** Repeat Step 3 for each Cisco 6015, as necessary.

5.2.9 Install Blank Faceplates

Blank faceplates should occupy any empty line card slots in the Cisco 6015 chassis. Blank faceplate installation is similar to line card installation.

**Warning**

Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.

Complete the following steps to install blank faceplates in any empty line card slots in the Cisco 6015:

-
- Step 1** Horizontally align the blank faceplate edge with the guides at the left and right of the slot.
- Step 2** Lift out on the ejector tab and gently apply pressure to the faceplate while pushing the blank faceplate into the slot.
- Step 3** Push on the faceplate to fully seat the blank faceplate.
- Step 4** Press down on the ejector tab to secure the faceplate.
-

5.2.10 Ground the Cisco 6015, POTS Splitter(s), and Enclosure Protection Block

During the system installation, complete the following steps to connect the grounding lug on the Cisco 6015, POTS splitter(s) (if applicable), and the enclosure protection block directly to the grounding bar in the enclosure.

**Warning**

When installing the unit, always make the ground connection first and disconnect it last.

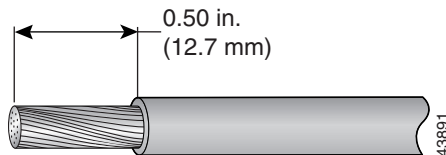
-
- Step 1** Measure enough wire to connect the Cisco 6015 to the enclosure grounding bar. See Table 2-6 on page 2-19 for wire requirements.

**Tip**

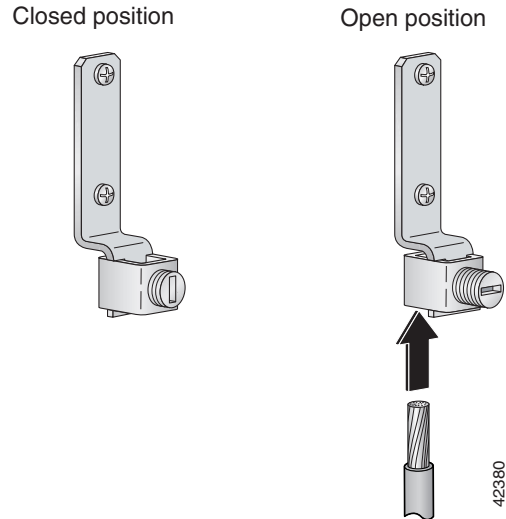
Make sure that your wire is only as long as is needed to make the connection.

-
- Step 2** Cut the ends of the ground wire so that the ends are straight, not slanted.
- Step 3** Measure 1/2 inch (12.7 mm) up from the end of the ground wire and place a mark at that point. This is the wire end that will be connected to the Cisco 6015.
- Step 4** Use a wire stripper to remove 1/2 inch (12.7 mm) of the covering from the end of the wire. Trim the end of the covering so that it is straight, not slanted, as shown in Figure 5-7.

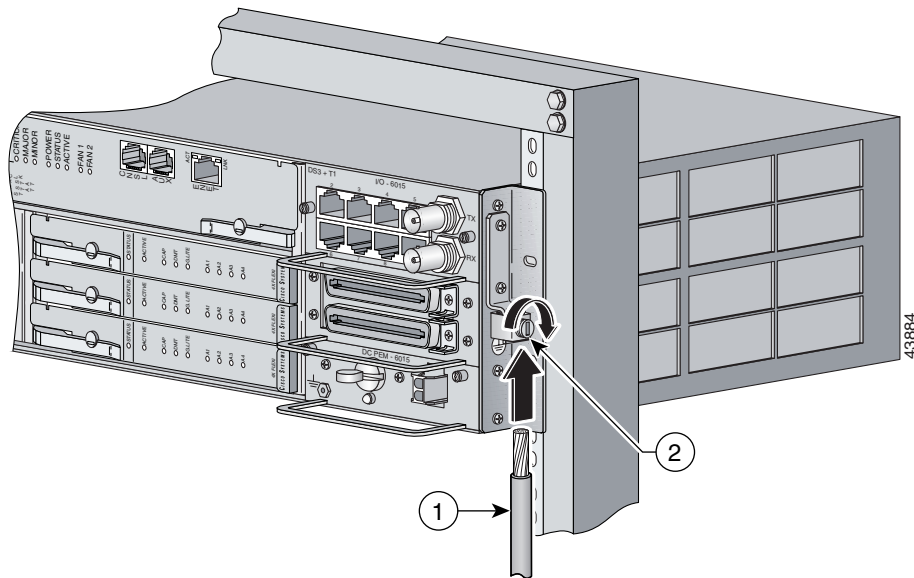
Figure 5-7 Strip and Square Off Ground Wire



- Step 5** Use a flat-head screwdriver to loosen the compression screw (open position) that is provided on the grounding lug of the Cisco 6015, as shown in Figure 5-8.

Figure 5-8 Grounding Lug Closed and Open Positions

The Cisco 6015 grounding lug is located on the right side of the chassis (viewed from the front), as shown in Figure 5-9.

Figure 5-9 Attaching the Grounding Wire to the Cisco 6015

1	Grounding wire	2	Grounding lug
----------	----------------	----------	---------------

Step 6 Insert the end of the copper wire that you prepared in Step 4 under the compression plate on the grounding lug, as shown in Figure 5-8.



Caution Do not place the copper wire between the compression screw and the compression plate.

- Step 7** Use a flat-head screwdriver to tighten the compression screw against the compression plate, as shown in Figure 5-8.
- Step 8** Prepare the other end of the wire to be connected to the enclosure grounding bar, according to the requirements of your site.
- Step 9** Use a flat-head screwdriver to loosen the screw on the enclosure grounding bar.
- Step 10** Connect the copper wire to a ring lug (large enough for the screw to fit through).
- Step 11** Use a flat-head screwdriver and the screw that you loosened in Step 9 to attach the ring lug to the enclosure grounding bar.
- Step 12** Use a flat-head screwdriver to tighten the screw over the copper wire.
- Step 13** Repeat Step 1 through Step 12 for each Cisco 6015, as necessary.
- Step 14** Ground each POTS splitter to the enclosure grounding bar.



Note For wire specifications and procedures for grounding each POTS splitter, refer to the vendor documentation.

- Step 15** Ground the enclosure protection block to the enclosure grounding bar.



Note For wire specifications and procedures for grounding the enclosure protection block, refer to the vendor documentation.

Do not ground the components in a rack by chaining them together.

5.2.11 Connect the DC PEM to the Fuse Panel



Caution

To prevent the system from powering up, do not install the fuses at this time. If the fuses are already installed in the fuse panel, remove them. You can replace the fuses after the system is installed and connected.



Note

The fuse panel is not provided by Cisco.

Complete the following steps to connect the DC PEM to the fuse panel:



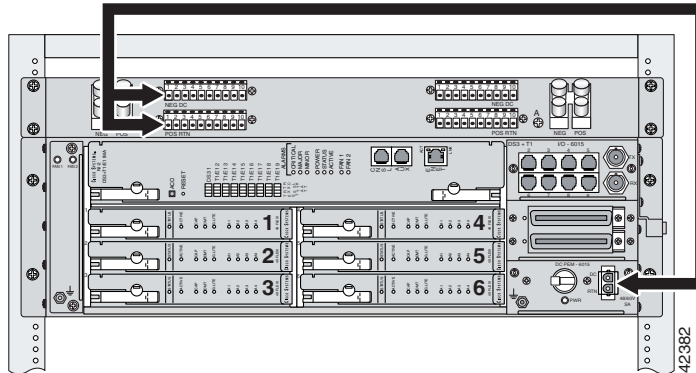
Note

Connect each Cisco 6015 system component to a separate fuse. Do not power the components in the rack by chaining them together.

See Chapter 2, “Preparing for Installation,” for the calculation tables that are necessary to determine the typical power requirement for each component that is wired to the fuse and alarm panel.

- Step 1** Attach one end of the DC power cable (part number 72-2223-01) to the 2-pin connector located on the faceplate of the DC PEM, as shown in Figure 5-10.

Figure 5-10 Connecting the DC PEM to the Fuse and Alarm Panel



- Step 2** Attach the red wire coming from the DC PEM to a fuse and alarm panel POS (positive) DC connector, as shown in Figure 5-10.
- Step 3** Attach the black wire coming from the DC PEM to a fuse and alarm panel NEG (negative) DC connector, as shown in Figure 5-10.
- Step 4** Repeat Step 1 through Step 3 for each Cisco 6015, as necessary.



Caution

Do not set the circuit breaker on the DC PEM to the ON (1) position at this time.

5.2.12 Connect the DSL Interface Module to the POTS Splitter(s)

If you are installing a Cisco 6015 with a POTS splitter configuration, please verify the POTS splitter compatibility with your Cisco representative. If you are installing a Cisco 6015 without a POTS splitter configuration, proceed to the “Connect the Cisco 6015 to the Enclosure Protection Block or SAC Box” section on page 5-15.



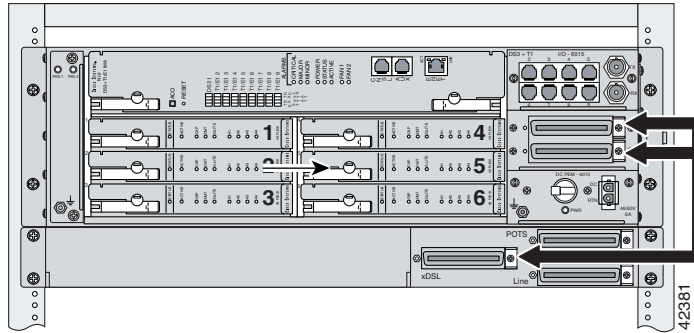
Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

For cabling procedures for each POTS splitter, refer to the vendor documentation.

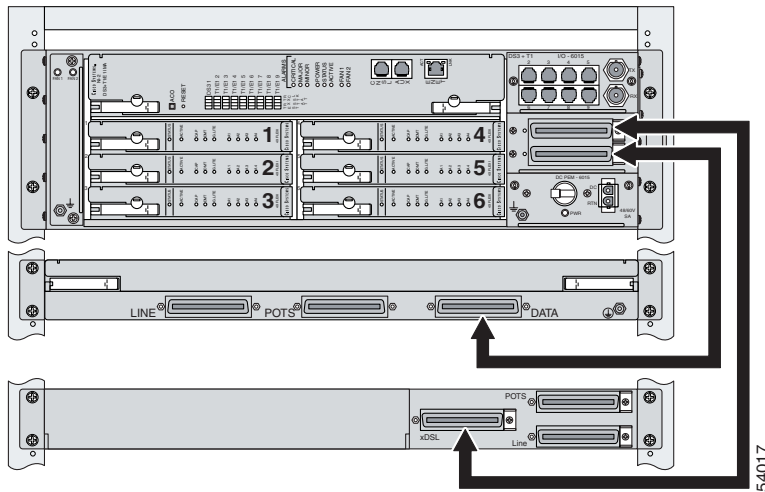
Figure 5-11 and Figure 5-12 show examples of cabling between the DSL interface module and third-party POTS splitters. These connections are for xDSL data flow between the Cisco 6015 and the third-party POTS splitters.

Figure 5-11 Connecting the DSL Interface Module to the Corning Cable Systems POTS Splitter



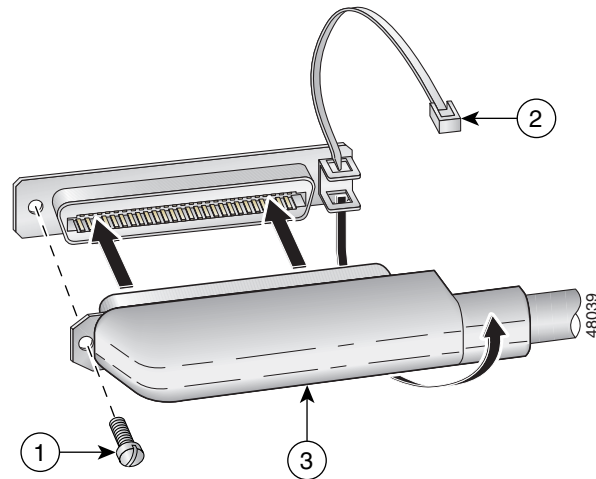
In a system configuration using 8xDMTs, the system requires a POTS splitter that expands the system capacity to 48 subscriber ports. Depending on the POTS splitter selected for your configuration, the installation of an additional POTS splitter may be necessary. Figure 5-12 shows the cabling between the DSL interface module and two third-party POTS splitters. These connections are for xDSL data flow between the Cisco 6015 and the POTS splitters.

Figure 5-12 Connecting the DSL Interface Module to Two POTS Splitters



Ensure that all cables are screwed in and that the Champ connectors are tie wrapped. (See Figure 5-13.)

Figure 5-13 Attaching a Champ Connector to the Chassis



1	Champ connector screw	3	Champ connector
2	Tie wrap		

5.2.13 Connect the POTS Splitter(s) to the Enclosure Protection Block or SAC Box

You can use different third-party POTS splitters in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility of your third-party POTS splitter with your Cisco representative.

For cabling procedures for each POTS splitter, refer to the appropriate vendor documentation.



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

5.2.14 Connect the Cisco 6015 to the Enclosure Protection Block or SAC Box

If you are installing a Cisco 6015 without a POTS splitter configuration, connect the two Champ cables from the DSL interface module (DSL Slots 1 through 3 and DSL Slots 4 through 6) to the enclosure protection block or SAC box connections. If you are installing a Cisco 6015 with a POTS splitter configuration, proceed to the “Connect the I/O Modules for Subtending” section on page 5-16.

Ensure that all cables are screwed in to the backplane and that the Champ connectors are tie wrapped. (See Figure 5-13.)



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

5.2.15 Connect the I/O Modules for Subtending

If you are installing a subtended network, complete the following steps. If you are not installing a subtended network, proceed to the “Connect the I/O Module to the NIU or Enclosure Protection Block” section on page 5-17.


Tip

The term *subtending* refers to the host chassis, and *subtended* refers to the downstream chassis in a subtended network.

Cisco recommends that you label each data cable at both ends to identify its destination.


Note

For more information on a subtended network configuration, see the “Subtended Network Configuration” section on page 1-6.

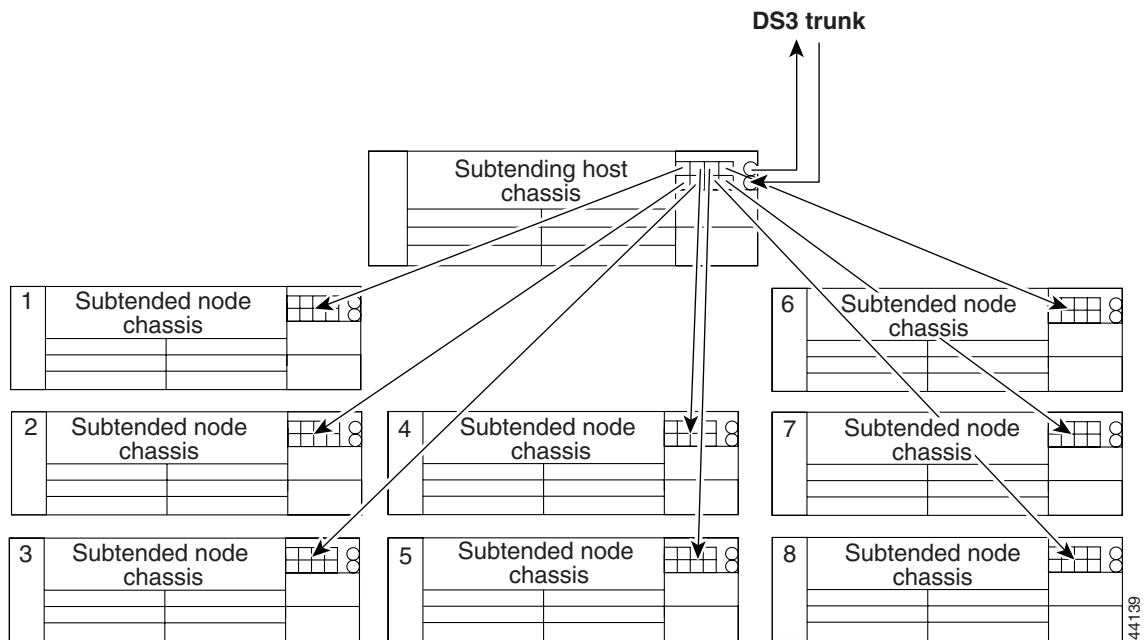
See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

Step 1 Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module in the subtending host chassis.

Step 2 Connect the other end of the RJ-48 cable to one of the RJ-48 receptacles on the I/O module in a subtended node chassis.

Figure 5-14 shows an example of a subtended network configuration.

Figure 5-14 Subtended Network Configuration



Step 3 Repeat Step 1 through Step 2 to connect the subtending host chassis to each subtended node chassis.

**Note**

If you are using a T1 or E1 trunk to the network, the trunk connection will originate at one of the RJ-48 receptacles on the I/O module. Therefore, you can subtend only seven chassis from the I/O module.

5.2.16 Connect the I/O Module to the NIU or Enclosure Protection Block

The following sections detail the I/O module connection procedures for a DS3, T1, E1, or IMA group connection.

5.2.16.1 DS3 Network Connection Installation

Complete the following steps to connect the I/O module to the network using a DS3 connection. If you are using a T1 connection, proceed to the “T1 Network Connection Installation” section on page 5-18. If you are using an E1 connection, proceed to the “E1 Network Connection Installation” section on page 5-18. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 5-19.

**Tip**

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.

Step 2 The I/O module DS3 connections attach to the ATM switch, through the NIU. Two 75-ohm DS3 Bayonet-Neill-Concelman (BNC) connectors are provided for DS3 TX and RX. Attach one end of a coaxial cable (type 734A or equivalent) to the TX DS3 BNC connector on the I/O module.



Note See Table 2-6 on page 2-19 for cable requirements.

Step 3 Attach the other end of the cable that originates at the TX DS3 BNC connector to the RX DS3 BNC connector on the NIU.

Step 4 Attach one end of a coaxial cable (type 734A or equivalent) to the RX DS3 BNC connector on the I/O module.

Step 5 Attach the other end of the cable that originates at the RX DS3 BNC connector to the TX DS3 BNC connector on the NIU.

Step 6 Connect the NIU to the ATM network according to the NIU manufacturer specifications.

Step 7 Repeat Step 1 through Step 6 for each Cisco 6015, as necessary.

5.2.16.2 T1 Network Connection Installation

Complete the following steps to connect the I/O module to the network using a T1 connection. If you are using an E1 connection, proceed to the “E1 Network Connection Installation” section on page 5-18. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 5-19.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.

Step 2 Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

Step 3 Connect the other end of the cable used in Step 2 to the NIU or enclosure protection block.

Step 4 Connect the NIU or enclosure protection block to the ATM network according to the NIU or remote terminal enclosure manufacturer specifications.

Step 5 Repeat Step 1 through Step 4 for each Cisco 6015, as necessary.



Note

Verify that the RJ-48 cable pinouts connect TX to RX and RX to TX.

5.2.16.3 E1 Network Connection Installation

Complete the following steps to connect the I/O module to the network using an E1 connection. If you are using an IMA connection, proceed to the “IMA Network Connection Installation” section on page 5-19.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1 Verify that you have an E1 I/O module installed in the Cisco 6015 chassis.

Step 2 Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

Step 3 Connect the other end of the cable used in Step 2 to the NIU or enclosure protection block.

- Step 4** Connect the NIU or enclosure protection block to the ATM network according to the NIU or remote terminal enclosure manufacturer specifications.
- Step 5** Repeat Step 1 through Step 4 for each Cisco 6015, as necessary.



Note Verify that the RJ-48 cable pinouts connect TX to RX and RX to TX.

5.2.16.4 IMA Network Connection Installation

See the “IMA Configuration” section on page 1-8 for more information on how to configure an IMA network connection.

5.2.17 Apply Power

Complete the following steps to apply DC power to the Cisco 6015 system.



Warning

Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

- Step 1** Apply power to the system with one of the following methods:
- Install the fuses in the fuse panel.
 - Reinsert the fuses in the fuse panel if you removed them in the “Connect the DC PEM to the Fuse Panel” section on page 5-12.
 - Turn on the breakers in the fuse panel.



Caution

If the power connections are improperly connected and power is applied while the cards are installed, the cards and chassis could be damaged.

- Step 2** Verify that the DC PEM is properly connected to the fuse panel as described in the “Connect the DC PEM to the Fuse Panel” section on page 5-12.
- Step 3** Set the circuit breaker on the DC PEM to the ON (1) position.
- Step 4** Verify that the DC PEM is operational by locating the LEDs on the front of the DC PEM. If the LED is
- Green—Output is correct.
 - Off—DC PEM is not operational. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Step 5** Check the polarity of the –48V DC connections to each chassis by attaching a voltmeter with the minus lead on the red wire and the plus lead on the black wire, at the fuse panel. Ensure that the meter reads between –40V DC and –68V DC. If your voltmeter shows a positive voltage, the power inputs might be reversed. If the voltmeter shows a negative voltage that is out of the –40V DC to –68V DC range, check the power supply for failure or check for a blown fuse in the fuse panel.
-

5.2.18 Verify Fan Module Operation

Verify that the fan module is operational by locating the LEDs on the front of the fan module. If the LEDs are

- Green—The fan module is operational.
- Red—The fan module is not operational and the fan module is in alarm mode. See Chapter 6, “Troubleshooting” for troubleshooting procedures.
- Off—The fan is not operational due to a power problem or the LED is defective. See Chapter 6, “Troubleshooting” for troubleshooting procedures.

The fans should be operational before you complete the installation procedures.



Caution

It is important that the Cisco 6015 cooling fans run continuously.

5.2.19 Install the POTS Cards

If you are installing a Cisco 6015 with a POTS splitter configuration, install the POTS cards. For POTS card installation procedures for each third-party POTS splitter, refer to the vendor documentation.

If you are installing a Cisco 6015 without a POTS splitter configuration, proceed to the “Connect the Ethernet to the Management Network” section on page 5-20.

5.2.20 Connect the Ethernet to the Management Network

Complete the following steps to connect the Ethernet to the management network.



Warning

The ports labeled “Ethernet,” “10BaseT,” “Token Ring,” “Console,” and “AUX” are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

Step 1

Verify that you have an ITEMP DS3+T1/E1 IMA NI-2 card installed in the Cisco 6015 chassis.

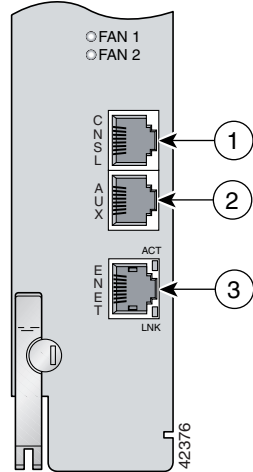
Step 2

Connect the 10BaseT RJ-45 connector to the ITEMP DS3+T1/E1 IMA NI-2 card (ENET). Figure 5-15 shows where to connect the Ethernet cable.



Note

See Table 2-6 on page 2-19 for cable and ferrite requirements.

Figure 5-15 ENET, CNSL, and AUX RJ-45 Receptacles on the ITEMP DS3+T1/E1 IMA NI-2 Card

1	Console port	3	Ethernet port
2	Auxiliary port		

- Step 3** Run the cable through the ferrite one time, loop the cable back through the ferrite, and clamp the ferrite shut.
- Step 4** Connect the other end of the cable to the management network (for example, a LAN).

5.2.21 Connect a Console Terminal

Connect a VT100-compatible terminal to the system console port on the ITEMP DS3+T1/E1 IMA NI-2 card (CNSL) for field service. Connect the terminal to a power source and set it up using the values that are shown in Table 5-2. Figure 5-15 shows where to connect the console cable. See Table 2-6 on page 2-19 for cable requirements.



Warning

The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

Table 5-2 Terminal Settings

Baud rate	9600 (transmit and receive)
Character size	8 bits
Parity	None
Stop bits	1
Flow control	None

5.2.22 Connect the Auxiliary Port

Connect a terminal, a modem, or another serial device to the auxiliary port on the ITEMP DS3+T1/E1 IMA NI-2 card (AUX). Figure 5-15 shows where to connect the auxiliary cable. See Table 2-6 on page 2-19 for cable requirements.



Warning

The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.



Note

This step is optional.



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

5.2.23 Complete Initial Configuration

When you turn on the Cisco 6015 for the first time, an interactive dialog called the System Configuration Dialog appears on the console screen. The System Configuration Dialog guides you through the initial configuration process. (You can run the dialog at any time by entering the **setup** command in privileged EXEC mode.)

When you complete the dialog, the system displays the configuration command script that you have created. It then offers you three options:

```
[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.
```

If you enter **2**, the configuration is saved and used. If you answer **0** or **1**, the configuration you created is not saved. Enter **1** if you wish to discard the configuration and restart the System Configuration Dialog.

After you have saved the initial configuration, you must set the temperature rating for your system using the **set temp** command.

To set the system temperature rating to **osp** (outside-plant environment):

```
DSLAM> set temperature-rating osp
```

To set the system temperature rating to **commercial**:

```
DSLAM# set temperature-rating commercial
```

A **temperature rating mismatch** alarm is triggered when a commercial or outside-plant environment line card or network interface card is installed in a system that has been configured with a different temperature rating. Therefore, if a system is configured for an outside-plant environment, and a commercial line card or network interface card is installed in the system, the **temperature rating mismatch** alarm will be triggered. Similarly, if a system is configured for a commercial environment, and an outside-plant environment line card or network interface card is installed in the system, the **temperature rating mismatch** alarm will be triggered.

**Note**

Use the **show facility-alarm status** command to display any current alarms on the system.

The following is sample output of the **show facility-alarm status** command for the Cisco 6015:

```
System Totals Critical: 1 Major: 0 Minor: 0
Source: ATM0/1 Severity: CRITICAL Description: 0 Loss of Signal
```

5.2.23.1 Before You Begin

Complete these steps before you run the System Configuration Dialog:

-
- Step 1** Determine the IP address for the Ethernet interface.
 - Step 2** If you plan to configure in-band management, also determine the IP address for the ATM interface that will be used for in-band management (ATM0/0).
 - Step 3** Find out what the password strategy is for your environment. The System Configuration Dialog prompts you for three passwords, plus an SNMP community string. The three required password types are enable secret, enable, and virtual terminal.
 - Step 4** Choose a name for the Cisco 6015. (This step is optional.)
-

5.2.23.2 Using the System Configuration Dialog

When you power up a Cisco 6015 for the first time, you are offered the option of running the System Configuration Dialog. The System Configuration Dialog offers two configuration options: basic management setup and extended setup.

- Choose basic management setup if you want to use the System Configuration Dialog to configure the passwords and the Ethernet interface only, and then use the management station or the command line interface to configure the remaining Cisco 6015 interfaces.
- Choose extended setup if you want to use the System Configuration Dialog to configure all of the Cisco 6015 interfaces.

An example of the use of each option follows the “Interface Numbering” section.

5.2.23.2.1 Interface Numbering

The System Configuration Dialog and the command line interface use the following interface numbering scheme:

- Interfaces whose names begin with “ATM0” (ATM0/0, ATM0/1, and so forth) are NI-2 card WAN interfaces. ATM0/0 is the ATM switch interface with the processor (sometimes referred to as the ASP interface, for ATM switch/processor). There is no need to configure ATM0/0 unless you plan to use in-band management. For DS3+T1, ATM0/1 is the default trunk port. ATM0/2 and through ATM0/9 are subtending interfaces. For E1, ATM0/2 is the default trunk port. For IMA group interfaces using the ITEMP DS3+T1/E1 IMA NI-2 card, one port from ATM0/ima0 through ATM0/ima3 can be the trunk port, with the other three being possible subtending interfaces.

- Interfaces whose names begin with “ATM1” through “ATM6” are line card interfaces.
- Ethernet0/0 is the interface for the LAN that connects the Cisco 6015 to its management system.

For line card interfaces, the number before the slash indicates the slot number. The number after the slash indicates the interface or port number. For example, ATM6/4 is slot 6, port 4.

5.2.23.2.2 Basic Management Setup Example

This is the basic management setup example:

```

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]: y

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

Would you like to enter basic management setup? [yes/no]: y
Configuring global parameters:

Enter host name [DSLAM]: 6015_basic

The enable secret is a password used to protect access to
privileged EXEC and configuration modes. This password, after
entered, becomes encrypted in the configuration.
Enter enable secret: cisco

The enable password is used when you do not specify an
enable secret password, with some older software versions, and
some boot images.
Enter enable password: lab

The virtual terminal password is used to protect
access to the router over a network interface.
Enter virtual terminal password: lab
Configure SNMP Network Management? [yes]: y
Community string [public]:

Current interface summary

Any interface listed with OK? value "NO" does not have a valid configuration

Interface          IP-Address      OK? Method Status      Protocol
ATM0/0              unassigned     NO  unset  up          up
Ethernet0/0        unassigned     NO  unset  up          up
ATM0/1              unassigned     NO  unset  up          down
ATM0/2              unassigned     NO  unset  down       down
ATM0/3              unassigned     NO  unset  down       down
ATM0/4              unassigned     NO  unset  down       down
ATM0/5              unassigned     NO  unset  down       down
ATM0/6              unassigned     NO  unset  down       down
ATM0/7              unassigned     NO  unset  down       down
ATM0/8              unassigned     NO  unset  down       down
ATM0/9              unassigned     NO  unset  down       down
ATM0/IMA0           unassigned     NO  unset  up          up
ATM0/IMA1           unassigned     NO  unset  up          up
ATM0/IMA2           unassigned     NO  unset  up          up
ATM0/IMA3           unassigned     NO  unset  up          up

```

Enter interface name used to connect to the management network from the above interface summary: **ethernet0/0**

Configuring interface Ethernet0/0:

Configure IP on this interface? [yes]:

IP address for this interface: **192.168.1.1**

Subnet mask for this interface [255.255.255.0] : **255.255.255.0**

Class C network is 192.168.1.0, 24 subnet bits; mask is /24

The following configuration command script was created:

```
hostname 6015_basic
enable secret 5 $1$f1TA$jw/Rpe/EBj.fDQ3HYCjVw/
enable password lab
line vty 0 4
password lab
snmp-server community public
!
no ip routing

!
interface ATM0/0
shutdown
no ip address
!
interface Ethernet0/0
no shutdown
ip address 192.168.1.1 255.255.255.0
!
interface ATM0/1
shutdown
no ip address
!
interface ATM0/2
shutdown
no ip address
!
interface ATM0/3
shutdown
no ip address
!
interface ATM0/4
shutdown
no ip address
!
interface ATM0/5
shutdown
no ip address
!
interface ATM0/6
shutdown
no ip address
!
interface ATM0/7
shutdown
no ip address
!
interface ATM0/8
shutdown
no ip address
!
interface ATM0/9
```

```

shutdown
no ip address
!
interface ATM0/IMA0
shutdown
no ip address
!
interface ATM0/IMA1
shutdown
no ip address
!
interface ATM0/IMA2
shutdown
no ip address
!
interface ATM0/IMA3
shutdown
no ip address
!
end

```

- [0] Go to the IOS command prompt without saving this config.
- [1] Return back to the setup without saving this config.
- [2] Save this configuration to nvram and exit.

```

Enter your selection [2]: 2
% Shutdown not allowed for ATM0/0.
Building configuration...
Use the enabled mode 'configure' command to modify this configuration.

```

Press RETURN to get started!

5.2.23.3 Extended Setup Example

This is the extended setup example:

```
--- System Configuration Dialog ---
```

```
Would you like to enter the initial configuration dialog? [yes/no]: y
```

At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '['].

Basic management setup configures only enough connectivity
for management of the system, extended setup will ask you
to configure each interface on the system

```
Would you like to enter basic management setup? [yes/no]: n
```

```
First, would you like to see the current interface summary? [yes]:
```

```
Any interface listed with OK? value "NO" does not have a valid configuration
```

Interface	IP-Address	OK?	Method	Status	Protocol
ATM0/0	unassigned	NO	unset	up	up
Ethernet0/0	unassigned	NO	unset	up	up
ATM0/1	unassigned	NO	unset	up	down
ATM0/2	unassigned	NO	unset	down	down
ATM0/3	unassigned	NO	unset	down	down

ATM0/4	unassigned	NO	unset	down	down
ATM0/5	unassigned	NO	unset	down	down
ATM0/6	unassigned	NO	unset	down	down
ATM0/7	unassigned	NO	unset	down	down
ATM0/8	unassigned	NO	unset	down	down
ATM0/9	unassigned	NO	unset	down	down
ATM0/IMA0	unassigned	NO	unset	up	up
ATM0/IMA1	unassigned	NO	unset	up	up
ATM0/IMA2	unassigned	NO	unset	up	up
ATM0/IMA3	unassigned	NO	unset	up	up

Configuring global parameters:

Enter host name [DSLAM]: **6015**

The enable secret is a password used to protect access to privileged EXEC and configuration modes. This password, after entered, becomes encrypted in the configuration.

Enter enable secret: **cisco**

The enable password is used when you do not specify an enable secret password, with some older software versions, and some boot images.

Enter enable password: **test**

The virtual terminal password is used to protect access to the router over a network interface.

Enter virtual terminal password: **test**

Configure SNMP Network Management? [yes]:

Community string [public]:

Configure IP? [yes]:

Configure IGRP routing? [yes]: **n**

Configure RIP routing? [no]:

Configure CLNS? [no]:

Configure bridging? [no]:

Configuring interface parameters:

Do you want to configure ATM0/0 interface? [yes]: **n**

Do you want to configure Ethernet0/0 interface? [yes]:

Configure IP on this interface? [yes]:

IP address for this interface: **192.168.1.1**

Subnet mask for this interface [255.255.255.0] :

Class C network is 192.168.1.0, 24 subnet bits; mask is /24

Do you want to configure ATM0/1 interface? [yes]:

Configure IP on this interface? [yes]: **n**

Do you want to configure ATM0/2 interface? [yes]:

Configure IP on this interface? [yes]: **n**

Do you want to configure ATM0/3 interface? [yes]: **n**

Do you want to configure ATM0/4 interface? [yes]: **n**

Do you want to configure ATM0/5 interface? [yes]: **n**

Do you want to configure ATM0/6 interface? [yes]: **n**

Do you want to configure ATM0/7 interface? [yes]: **n**

Do you want to configure ATM0/8 interface? [yes]: **n**

```

Do you want to configure ATM0/9 interface? [yes]: n
Do you want to configure ATM0/IMA0 interface? [yes]: n
Do you want to configure ATM0/IMA1 interface? [yes]: n
Do you want to configure ATM0/IMA2 interface? [yes]: n
Do you want to configure ATM0/IMA3 interface? [yes]: y
Configure IP on this interface? [yes]:
  IP address for this interface: 192.168.2.1
  Subnet mask for this interface [255.255.255.0] :
  Class C network is 192.168.2.0, 24 subnet bits; mask is /24

```

The following configuration command script was created:

```

hostname 6015
enable secret 5 $1$T768$ufaiPuEf1cGFCG0VtmUV1
enable password test
line vty 0 4
password test
snmp-server community public
!
ip routing
no clns routing
no bridge 1
!
interface ATM0/0
shutdown
no ip address
!
interface Ethernet0/0
ip address 192.168.1.1 255.255.255.0
!
interface ATM0/1
no ip address
!
interface ATM0/2
no ip address
!
interface ATM0/3
shutdown
no ip address
!
interface ATM0/4
shutdown
no ip address
!
interface ATM0/5
shutdown
no ip address
!
interface ATM0/6
shutdown
no ip address
!
interface ATM0/7
shutdown
no ip address
!
interface ATM0/8
shutdown
no ip address

```



```
!  
interface ATM0/9  
shutdown  
no ip address  
!  
interface ATM0/IMA0  
shutdown  
no ip address  
!  
interface ATM0/IMA1  
shutdown  
no ip address  
!  
interface ATM0/IMA2  
shutdown  
no ip address  
!  
interface ATM0/IMA3  
ip address 192.168.2.1 255.255.255.0  
dialer-list 1 protocol ip permit  
dialer-list 1 protocol ipx permit  
!  
end
```

[0] Go to the IOS command prompt without saving this config.
[1] Return back to the setup without saving this config.
[2] Save this configuration to nvram and exit.

```
Enter your selection [2]: 2  
% Shutdown not allowed for ATM0/0.  
Building configuration...  
Use the enabled mode 'configure' command to modify this configuration.
```

Press RETURN to get started!

**Note**

To configure your system, refer to the appropriate software or network management configuration guides.



Troubleshooting

This chapter provides information about isolating faults in the Cisco 6015 system. Most problems in a Cisco 6015 system can be traced to one of the following hardware components:

- NI-2 card
 - DS3+T1/E1 inverse multiplexing over ATM (IMA) NI-2 card
 - Industrial temperature (ITEMP) DS3+T1/E1 IMA NI-2 card
 - OC-3c/OC-3c NI-2 card
- Line cards
 - Quad-port flexi ATU-C line card (4xflexi)
 - Octal-port Discrete Multitone (DMT) ATU-C line card (8xDMT)
 - Octal-port DMT ATU-C over ISDN line card (8xDMT over ISDN)
 - Octal-port single-pair high-speed digital subscriber line, also known as symmetric high bit-rate digital subscriber loop (G.SHDSL) line card (8xG.SHDSL)
- Input/Output (I/O) module
- DSL interface module
- DC power entry module (PEM)
- Fan module
- AC/DC converter



Warning

Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

This chapter consists of three major sections:

- System-Wide Problems, page 6-4: Troubleshooting faults that affect the entire system
- Cisco 6015 Component-Specific Problems, page 6-9: Troubleshooting faults that affect subsystems
- Alarms, page 6-18: Descriptions of alarms that can signal problems or help with troubleshooting

6.1 Hot-Swappable FRUs

The following are the only components in the Cisco 6015 that are both hot-swappable and field-replaceable units (FRUs):

- DS3+T1/E1 IMA NI-2 card
- ITEMP DS3+T1/E1 IMA NI-2 card
- OC-3c/OC-3c NI-2 card
- 4xflexi
- 8xDMT
- 8xDMT over ISDN
- 8xG.SHDSL
- Fan module

However, hot swapping some FRUs causes an interruption in service. See Table 6-1 for information on service interruptions caused by replacing FRUs.


Note

The I/O module, DSL interface module, and DC PEM are FRUs; however, they are not hot swappable. The system must be powered down before these modules are replaced. These modules must be installed and removed by a trained technician only.

Table 6-1 Service Interruptions Caused by Replacing FRUs

FRU	Does Hot Swapping Interrupt Service?	Notes
DS3+T1/E1 IMA, ITEMP DS3+T1/E1 IMA, or OC-3c/OC-3c NI-2 card	Yes	Service is interrupted for the entire system until the NI-2 card is replaced.
4xflexi, 8xDMT, 8xDMT over ISDN, or 8xG.SHDSL	Yes	Service is interrupted only for the subscribers assigned to that particular line card.
I/O module	—	The module is not hot swappable. The system must be powered down before this module is replaced.
DSL interface module	—	The module is not hot swappable. The system must be powered down before this module is replaced.
DC PEM	—	The module is not hot swappable. The system must be powered down before this module is replaced.
Fan module	No	—

**Note**

Reseating the 8xDMT over ISDN during simultaneous DSL and ISDN traffic operation results in the ISDN signal being temporarily interrupted.

To reseat the 8xDMT over ISDN in the chassis, shut down all the subscriber ports on the line card, wait one minute, and then replace the line card.

6.2 Basic Checks

Before using the troubleshooting tables in this chapter, make the following basic checks:

- Are the ports properly configured? Refer to these sources for configuration instructions:
 - *Configuration Guide for Cisco DSLAMs with NI-2*
 - *Command Reference for Cisco DSLAMs with NI-2*
 - Cisco IOS Release 12.2 information on the World Wide Web—
http://www.cisco.com/univercd/cc/td/doc/product/dsl_prod/ios_dsl/rel122/index.htm
 - *ATM Switch Router Software Configuration Guide*
 - *ATM Switch Router Command Reference Guide*
- Are power leads and data cables firmly connected at both ends?
- Are all cards firmly seated and securely locked in the chassis?
- Is the fan module properly installed and secured to the chassis?
- Are the I/O module, DSL interface module, and DC PEM properly secured to the chassis?

6.3 Contacting the Cisco TAC for Help

In certain situations, the troubleshooting tables in this chapter direct you to contact the Cisco Technical Assistance Center (TAC) for help. If you have a maintenance contract or if your hardware is under warranty, call the TAC at 1 800 553 2447 (North America only), 1 408 526 7209, or visit this URL for a worldwide list of TAC regional telephone numbers:

<http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml>

6.4 System-Wide Problems

This section offers suggestions for problems that affect the entire Cisco 6015 system.

Symptoms	Steps to Take
System fails to come up.	<ol style="list-style-type: none"> 1. Check the POWER LED on the NI-2 card and the STATUS LEDs on the line cards. If all LEDs are off, troubleshoot the DC PEM. See the “DC PEM Problems” section on page 6-16. 2. If any green LEDs are on, the system has power. Check the STATUS LED on the NI-2 card. If the STATUS LED is off, refer to the “NI-2 Card Problems” section on page 6-9. 3. If the Cisco 6015 is set to boot from a remote device over the network, make sure the remote device is up, that its network connection is solid, and that it contains the boot file. (The Cisco 6015 tries to boot over the network for a configured period, usually 5 to 15 minutes. If it is unable to boot over the network, it will eventually boot from bootflash.) 4. Try to establish a console connection to the Cisco 6015. If you cannot connect, see the steps for the symptom “You cannot establish a console or Telnet connection to the system.” 5. If you achieve a console connection: <ul style="list-style-type: none"> – Examine the command prompt. If the prompt says <code>rommon 1></code>, the problem could be in flash memory, in bootflash, in an incorrectly set boot configuration register, or in an incorrect file name in a boot system command in the startup-config file. Refer to the <i>Configuration Guide for Cisco DSLAMs with NI-2</i> for information on setting and interpreting configuration registers, configuring flash memory, and editing the startup-config file. To select an image to boot the system from flash, enter dir flash:. In the resulting display, find the name of the software image. Then enter boot flash:imagename, replacing <i>imagenam</i>e with the name of the software image. The system boots from flash. – If you see a normal Cisco IOS prompt, which usually contains the name of the system (default is <code>DSLAM></code>), enter show oir status. If the results indicate that the line card is loading software, wait a few minutes for the port to come back up.

Symptoms	Steps to Take
You cannot establish a console or Telnet connection to the system.	<ol style="list-style-type: none"> 1. For a console problem, check the terminal settings against the list of settings in the “Connect a Console Terminal” section on page 3-25 (for a Cisco 6015 with a POTS splitter configuration) or the “Connect a Console Terminal” section on page 4-23 (for a Cisco 6015 without a POTS splitter configuration). 2. For a Telnet problem: <ul style="list-style-type: none"> – Telnet will not connect if the NI-2 card is not booted completely. – If you are connecting to the Cisco 6015 through the Ethernet interface, check the configuration of your LAN for both the Cisco 6015 and the Telnet source. – If you are connecting to the Cisco 6015 through an ATM interface, make sure that PVCs are set up between the two devices and that the map list is correctly configured. Enter the command show running-config to display this information. – If the Telnet source and the Cisco 6015 are on different networks, make sure that static routes are configured at both ends so that the two devices can communicate. To check, use the ping command to ping each device from the other (that is, ping the Cisco 6015 from the Telnet source, and ping the Telnet source from the Cisco 6015). Alternatively, ping your default gateways from each end of the connection. 3. For both console and Telnet problems: <ul style="list-style-type: none"> – Check the cabling and connectors between the terminal or Telnet source and the Cisco 6015. Refer to Appendix C, “Connector and Pinout Specifications,” to check pinouts. – Press the Reset button on the NI-2 card faceplate to reset the card. – If the problem persists, replace the NI-2 card.
System experiences a critical, major, or minor alarm.	<ol style="list-style-type: none"> 1. Enter the command show facility-alarm status. Note the affected slot and port, if any, and the description of the problem. 2. If no slot number is indicated, enter show environment all and examine the results for an indication of which FRU is at fault. Refer to the “Cisco 6015 Component-Specific Problems” section on page 6-9 for instructions on troubleshooting that FRU. 3. If atm0/0, atm0/1, atm0/2, atm0/3, atm0/4, atm0/5, atm0/6, atm0/7, atm0/8, atm0/9, atm0/ima0, atm0/ima1, atm0/ima2, or atm0/ima3 is indicated: <ul style="list-style-type: none"> – Enter a show int command for the interface (for example, show int atm0/1). Results may indicate a physical layer problem (Loss of Signal, for example). Refer to the “NI-2 Card Problems” section on page 6-9 for instructions on troubleshooting the NI-2 card. – Enter show controllers commands for all trunk and subtending ports. (The ports are atm0/1, atm0/2, atm0/3, atm0/4, atm0/5, atm0/6, atm0/7, atm0/8, atm0/9, atm0/ima0, atm0/ima1, atm0/ima2, or atm0/ima3.) For example, enter show controllers atm0/1. In the resulting display, check that the framing mode is set to the same value on this interface as at the other end of the connection. Also check that cell payload scrambling is on (on DS3 interfaces only). 4. If a line card slot is indicated, consult the “Line Card Problems” section on page 6-10.

Symptoms	Steps to Take
A trunk port fails to come up (DS3 or OC-3c). Or an OC-3c subtending port fails to come up.	<ol style="list-style-type: none"> 1. Verify that the trunk port selection is correct. 2. Check the cable connections at both ends. Refer to Appendix C, “Connector and Pinout Specifications,” to check pinouts. 3. To check the interface status and configuration, enter show interface atm slot#/port#. Check the following information in the resulting display: <ul style="list-style-type: none"> – If the port Admin Status is down, enter the commands below to correct the problem, replacing slot/port ID atm 0/1 with your slot/port ID: <pre> DSLAM> configure terminal Enter configuration commands, one per line. End with CNTL/Z. DSLAM(config-if)# int atm 0/1 DSLAM(config-if)# no shutdown DSLAM(config-if)# </pre> – If the port IF Status is down, check for disconnected or faulty cables. (Optical cables connect to the NI-2 card; DS3 coaxial cables connect to the I/O module.) – If the Line Protocol is down, the line protocol software processes might have determined that the line is unusable; try swapping the cable. Another possibility is that clocking might be misconfigured, or the clocking source might have failed. – Check the CRC field. The presence of many CRC errors but not many collisions is an indication of excessive noise. If the number is too high (greater than 0.5 to 2 percent of total traffic on the interface), check the cables to determine if any are damaged. <p>If you need more information on interface configuration, refer to the <i>Configuration Guide for Cisco DSLAMs with NI-2</i> and the <i>ATM Switch Router Software Configuration Guide</i>.</p> 4. Enter show controllers atm slot#/port#. Check the following information in the resulting display: <ul style="list-style-type: none"> – Framing mode must be the same at both ends of the connection. – Cell payload scrambling must be on at both ends of the connection. 5. Check the status and configuration of the interface at the far end. 6. If you need to run a loopback test, do the following: <ul style="list-style-type: none"> – In interface configuration mode, enter loopback diagnostic (or loopback line). – Set the external test equipment to loop data through the Cisco 6015 port. – Obtain loopback results from your external test equipment. – Enter no loopback diagnostic (or no loopback line) to take the port out of loopback mode. 7. In interface configuration mode, reset the trunk port by executing the shutdown command followed by the no shutdown command. 8. Replace the NI-2 card. 9. If the problem with a DS3 interface persists, troubleshoot the I/O module. See the “I/O Module Problems” section on page 6-14.

Symptoms	Steps to Take
A trunk or subtending port fails to come up (T1/E1).	<ol style="list-style-type: none"> 1. Verify that the trunk port selection is correct. 2. Check the cable connections at both ends. Refer to Appendix C, “Connector and Pinout Specifications,” to check pinouts. 3. To check the interface status and configuration, enter show interface atm slot#/port#. Check the following information in the resulting display: <ul style="list-style-type: none"> – If the port Admin Status is down, enter the commands below to correct the problem, replacing slot/port ID atm 0/2 with your slot/port ID (atm 0/2 through atm 0/9): <pre> DSLAM> configure terminal Enter configuration commands, one per line. End with CNTL/Z. DSLAM(config-if)# int atm 0/2 DSLAM(config-if)# no shutdown DSLAM(config-if)# </pre> – If the port IF Status is down, check for disconnected or faulty wire. T1/E1 twisted pair wire connects to the I/O module. – If the Line Protocol is down, the line protocol software processes might have determined that the line is unusable; try swapping the cable. Another possibility is that clocking might be misconfigured, or the clocking source might have failed. – Check the CRC field. The presence of many CRC errors but not many collisions is an indication of excessive noise. If the number is too high (greater than 0.5 to 2 percent of total traffic on the interface), check the cables to determine if any are damaged. <p>If you need more information on interface configuration, refer to the <i>Configuration Guide for Cisco DSLAMs with NI-2</i> and the <i>ATM Switch Router Software Configuration Guide</i>.</p> 4. Enter show controllers atm slot#/port#. Check the following information in the resulting display: <ul style="list-style-type: none"> – Framing mode must be the same at both ends of the connection. – Line coding must be the same at both ends of the connection (T1/E1). – Cell payload scrambling must be on at both ends of the connection. 5. Check the status and configuration of the interface at the far end. 6. If you need to run a loopback test to troubleshoot the T1/E1 links, do the following: <ul style="list-style-type: none"> – In interface configuration mode, enter loopback diagnostic (or loopback line). – Set the external test equipment to loop data through the Cisco 6015 port. – Obtain loopback results from your external test equipment. – Enter no loopback diagnostic (or no loopback line) to take the port out of loopback mode. 7. In interface configuration mode, reset the trunk port by executing the shutdown command followed by the no shutdown command. 8. Replace the NI-2 card. 9. If the problem with a T1/E1 interface persists, troubleshoot the I/O module. See the “I/O Module Problems” section on page 6-14.

Symptoms	Steps to Take
A trunk or subtending port fails to come up (T1/E1 IMA).	<ol style="list-style-type: none"> 1. Before checking IMA interface problems, troubleshoot the T1/E1 links that are configured in the IMA group, as described in the previous section. Verify that the links are up. 2. Check an IMA interface status with show ima interface atm0/imaX command, where <i>X</i> is the IMA interface ID (0 through 3). Look at the following items in the resulting display: <ul style="list-style-type: none"> – MinNumLinks (minimum number of links) should be equal to or below the number of links you have configured in your IMA group. You can change the minimum number of links parameter from 1 to 8 in the IMA group. – NeTxClkMode (near end transmit clock mode) should match the FeTxClkMode (far end transmit clock mode), which will be either ctc or itc. Both sides of the IMA link must use the same IMA clock mode. – DiffDelayMaxObs (maximum observed differential delay) should be less than DiffDelayMax (maximum differential delay configured for the group). If the differential delay observed is more than the maximum allowed, one or more links will not be allowed in the IMA group. Configure more allowable differential delay (up to 69 ms in T1, 55 ms in E1) using T1/E1 lines with less differential delay, or reconfigure similarly-delayed lines into IMA groups if possible. – The IMA Link Information table shows the interfaces configured in your IMA group, the near end and far end receive state, and any IMA alarms received at the near end. The NeRxState and FeRxState must both be active for each line to be active in the IMA group. The whole IMA group will be up when the number of active links on both sides are equal to or greater than the minimum number of configured links (MinNumLinks) for that IMA group. 3. It can take several seconds for an IMA group to synchronize between two IMA systems. Wait several minutes after configuring or reconfiguring a group to allow the synchronization to occur. 4. If synchronization does not occur in any one link or in the group after several minutes, or links cannot be successfully added to an active group, and the above IMA parameters have been checked and are found to be correct, clear the interface with a clear interface atm0/imaX command. This will reset the IMA group and start the IMA synchronization process again with all links in the group. 5. To check the interface status and configuration, enter show interface atm slot#/imagroup#. Check the following information in the resulting display: <ul style="list-style-type: none"> – If the port Admin Status is down, enter the commands below to correct the problem, replacing slot/port ID atm0/ima2 with your slot/port ID: <pre> DSLAM> configure terminal Enter configuration commands, one per line. End with CNTL/Z. DSLAM(config-if)# int atm0/ima2 DSLAM(config-if)# no shutdown DSLAM(config-if)# </pre> <p>If you need more information on interface configuration, refer to the <i>Configuration Guide for Cisco DSLAMs with NI-2</i> and the <i>ATM Switch Router Software Configuration Guide</i>.</p>

Symptoms	Steps to Take
	<ol style="list-style-type: none"> 6. In interface configuration mode, reset the port by executing the shutdown command followed by the no shutdown command. 7. Replace the NI-2 card. 8. If the problem with a T1/E1 interface persists, troubleshoot the I/O module. See the “I/O Module Problems” section on page 6-14.
System overheats.	Troubleshoot the fan module. See the “Fan Module Problems” section on page 6-16.
System experiences a clocking problem.	Troubleshoot the NI-2 card. See the “NI-2 Card Problems” section on page 6-9.
System experiences a power problem.	Troubleshoot the DC PEM. See the “DC PEM Problems” section on page 6-16.

6.5 Cisco 6015 Component-Specific Problems

The following sections describe symptoms that might occur and the steps that you need to take if you experience problems with any of the following Cisco 6015 components:

- NI-2 Card Problems, page 6-9
- Line Card Problems, page 6-10
- I/O Module Problems, page 6-14
- DSL Interface Module Problems, page 6-15
- DC PEM Problems, page 6-16
- Fan Module Problems, page 6-16
- Rear Interface Header Problems, page 6-17
- AC/DC Converter Problems, page 6-18

6.5.1 NI-2 Card Problems

Use the following table to diagnose and troubleshoot any problems with the DS3+T1/E1 IMA NI-2 card, the ITEMP DS3+T1/E1 IMA NI-2 card, or the OC-3c/OC-3c NI-2 card.



Note

If you need to remove or replace a DS3+T1/E1 IMA NI-2 card, complete the steps in the “DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card Installation and Removal” section on page 7-10.

If you need to remove or replace an OC-3c/OC-3c NI-2 card, complete the steps in the “OC-3c/OC-3c NI-2 Card Installation and Removal” section on page 7-14.

Symptom	Steps to Take
POWER LED is off.	<ol style="list-style-type: none"> 1. Check the STATUS LEDs on the line cards. If all LEDs are off, troubleshoot the DC PEM—see the “DC PEM Problems” section on page 6-16. 2. If the line card STATUS LEDs are lit, remove the NI-2 card from its slot and check for bent or broken pins on both the card and the backplane. If you find damaged pins on the card, replace it. If you find damaged pins on the backplane, contact the Cisco TAC.
STATUS LED is off, indicating that the NI-2 card failed to boot or failed its power-on self test.	Press the Reset button on the NI-2 card. If the problem persists, replace the card.
CRITICAL LED, MAJOR LED, or MINOR LED is on.	See the “System-Wide Problems” section on page 6-4.
A trunk or subtending port fails to come up.	See the “System-Wide Problems” section on page 6-4.
NI-2 card cannot be fully inserted into its slot.	Inspect connectors on both the card and the backplane, looking for obstructions, bent pins, or other damage. If you find damage to an NI-2 card connector, replace the card. If you find damage to a backplane connector, contact the Cisco TAC.

6.5.2 Line Card Problems

Use the following table to diagnose and troubleshoot any problems with the line cards (4xflexi, 8xDMT, 8xDMT over ISDN, or 8xG.SHDSL).



Note

If you need to remove or replace a 4xflexi, complete the steps in the “4xflexi Installation and Removal” section on page 7-2.

If you need to remove or replace an 8xDMT, complete the steps in the “8xDMT Installation and Removal” section on page 7-4.

If you need to remove or replace an 8xDMT over ISDN, complete the steps in the “8xDMT over ISDN Installation and Removal” section on page 7-6.

If you need to remove or replace an 8xG.SHDSL, complete the steps in the “8xG.SHDSL Installation and Removal” section on page 7-8.

Symptom	Steps to Take
All LEDs are off.	<ol style="list-style-type: none"> 1. Check the POWER LED on the NI-2 card. If it is not lit, troubleshoot the DC PEM—See the “DC PEM Problems” section on page 6-16. 2. If the NI-2 card POWER LED is lit, remove the line card from its slot and check for bent or broken pins on both the line card and the backplane. If you find damaged pins on the line card, replace it. If you find damaged pins on the backplane, contact the Cisco TAC.
All ports on a line card fail to come up (modems do not train). STATUS LED might be red, indicating that the line card failed to boot or failed its power-on self test.	<ol style="list-style-type: none"> 1. Enter the show ipc nodes command to find out if there is a communication problem between the line card and the NI-2 card. There should be an entry in the resulting display for each line card (“SMB IP Slot <i>n</i>”) and for the NI-2 card (“IPC Master”). If there is an entry for each card, go to step 4. 2. If one or more line cards are not listed, enter show oir status. If the resulting display indicates that the line card in question is loading new code, wait a few minutes and reenter the command. (Usually, 2 to 3 minutes is long enough to wait.) The line card status should change to <code>running</code>. 3. Enter the command show dsl int atm slot#/port#. If the status says <code>Microcode downloading</code>, wait 10 minutes. When the download is complete, the line card will reboot and come up normally. 4. Check the ALARM LEDs on the NI-2 card or enter show facility-alarm status to determine the alarm status of the system. If any alarms are indicated, see the “System-Wide Problems” section on page 6-4 for instructions on how to troubleshoot alarms. 5. Enter the command show dsl status and examine the results to ensure that the line card is configured to be in its current slot. (In the Names column, the slot number appears as part of the port ID. For example, in ATM19/2, the slot number is 19. Nothing is displayed for slots that are not configured.) If necessary, use the slot command to update the configuration, or move the line card to the correct slot. <p>Note The 4xflexi will not function unless you use the slot command to configure either CAP, DMT, or G.lite operation.</p> <ol style="list-style-type: none"> 6. Reset the line card by disconnecting it from the backplane and reseating it in its slot. 7. Install the line card in another slot. 8. If the problem persists, replace the line card.

Symptom	Steps to Take
Port fails to come up (modems do not train), or port LED flashes continuously.	<ol style="list-style-type: none"> 1. Enter the command show dsl int atm slot#/port# to display the port's configuration. Check the display to ensure that the port is properly provisioned. Make sure the port is configured to be running ("no shutdown" or IOS admin state = up). Also check the line status; if this reads "No CPE detected," troubleshoot the CPE device and the loop as described below under the symptom "You suspect a problem with the CPE or the subscriber loop." 2. In interface configuration mode, reset the port by executing the shutdown command followed by the no shutdown command. 3. Connect the subscriber to another port on the Cisco 6015. If the modems do not train, troubleshoot the CPE device and the loop as described below under the symptom "You suspect a problem with the CPE or the subscriber loop." If the modems train, go to the next step to troubleshoot the port that failed. 4. To test the modem on the line card, enter dsl test atm slot#/port# self. Results are displayed automatically after a few seconds. If the modem fails the test, replace the line card.
You suspect a problem with the CPE or the subscriber loop.	<ol style="list-style-type: none"> 1. Disconnect the local loop and replace it with a test setup that consists of a modem or CPE that is known to work and a few thousand feet of wire. If the modems train over the shorter distance, the problem lies in the local loop or in the CPE—see the steps that follow. If the modems do not train, the port is probably at fault. Replace the line card. 2. Make sure that the CPE at the subscriber site is powered up. 3. Make sure that the CPE is compatible with the Cisco 6015, and that the software version that is running on the CPE is compatible with the software version that is running on the Cisco 6015. 4. Turn off the CPE and then turn it back on. When you turn the power on, the WAN Link LED on the CPE should blink. If the LED does not blink, check the CPE's configuration—if the interface is shut down, bring it up. 5. Perform a continuity check to find out if the cabling to the CPE is connected and intact. For example, if there is a phone on the line, check for a dial tone. 6. If there is no POTS, check DC resistance by shorting tip and ring at the remote end. 7. Make sure there are no load coils on the local loop. 8. Determine if the local loop is too long. The maximum length range is 15,000 to 25,000 feet (4572 to 7620 meters). Within that range, wire gauge, cross talk, and multiple bridge taps reduce the distance over which the modems can train. 9. Determine if the local loop is too short. DMT modems train best over loops of several thousand feet. In a test situation with a loop just a few feet in length, the modems may fail to train. Add wire to the loop. 10. Replace the CPE.

Symptom	Steps to Take
<p>Modems train at a low bit rate, or modems retrain continuously, or the line experiences too many errors.</p> <p>Note These steps apply to line cards in DMT mode.</p>	<ol style="list-style-type: none"> 1. Enter the command show dsl int atm slot#/port# to display the port's configuration. Check the display to ensure that the port is properly provisioned. Look in particular for these statistics: <ul style="list-style-type: none"> – Attenuation: typically this is 20 to 50 dB. If the attenuation value is higher than 50 dB, it might be depressing the bit rate. Repair or replace the cables and connectors in the loop. – SNR margin: 3 to 6 dB is optimum. Use the dmt margin command to adjust SNR margin. – Correction ratio: under DSL Statistics, look at the Received Superframes and Corrected Superframes values. A ratio of more than 1 corrected superframe for every 10 superframes received is too high. One or more of these adjustments might correct the problem: increase the SNR margin using the dmt margin command; increase error correction using the dmt check-bytes command; or increase interleaving using the dmt interleaving-delay command. – Errored seconds: a rate of 10 to 20 errored seconds per minute or more is likely to cause retraining. (1 or 2 errored seconds every 15 minutes is a good rate.) See the steps that follow on cross talk and impulse noise for suggestions on how to compensate. – CRC errors: normal rates vary system by system. If the CRC error rate is higher than usual, it might cause excessive retraining. See the steps that follow on cross talk and impulse noise for suggestions on how to compensate. 2. Cross talk is caused by interference between services in adjacent cables. It affects random bits rather than chunks of data; upstream and downstream traffic can be affected differently. If cross talk is increasing the bit error rate (BER), you can compensate in several ways: <ul style="list-style-type: none"> – Reduce the bit rate using the dmt bitrate command. (See the <i>Command Reference for Cisco DSLAMs with NI-2</i> for information on the dmt bitrate command.) – Increase the SNR margin using the dmt margin command. (See the <i>Command Reference for Cisco DSLAMs with NI-2</i> for information on the dmt margin command.) – Turn on or increase error correction. Use the dmt check-bytes command. If the code word size is not set to auto, you might need to use the dmt codeword-size command to adjust the code word setting. (See the <i>Command Reference for Cisco DSLAMs with NI-2</i> for information on these commands.) 3. If you experience impulse noise or clipping, both of which affect chunks of data rather than random bits, you can compensate by turning on or increasing interleaving and error correction. (However, note that this approach adds delay.) Use the dmt interleaving-delay command for interleaving. Use the dmt encoding-trellis command or the dmt check-bytes command for error correction. If you use dmt check-bytes and if the code word size is not set to auto, you might need to use the dmt codeword-size command to adjust the code word setting. 4. If errors or retraining occur while the line is ringing, use the dmt interleaving-delay command to turn on interleaving. 5. In interface configuration mode, reset the port by executing the shutdown command followed by the no shutdown command.

Symptom	Steps to Take
	<ol style="list-style-type: none"> 6. Connect the customer to a different port on the Cisco 6015. If the modems train, replace the line card with the faulty port. 7. Troubleshoot the CPE device and the loop as described previously under the symptom “You suspect a problem with the CPE or the subscriber loop.” 8. Replace the line card.
Line card cannot be fully inserted into its slot.	<ol style="list-style-type: none"> 1. Remove the line card and reinsert it, pushing firmly on both the top and the bottom of the faceplate. (The line card might jam in the slot if you apply pressure to the top only.) If the chassis is full, you might need to push sideways to insert the line card. 2. Inspect connectors on both the line card and the backplane, looking for obstructions, bent pins, or other damage. If you find damage to a line card connector, replace the line card. If you find damage to a backplane connector, contact the Cisco TAC.
Line card experiences problems in one slot but operates normally in another.	There may be a fault in your backplane. Contact the Cisco TAC.

6.5.3 I/O Module Problems

Use the following table to diagnose and troubleshoot any problems with the I/O module.



Note

If you need to remove or replace a I/O module, complete the steps in the “OC-3c/OC-3c NI-2 Card Installation and Removal” section on page 7-14.

The I/O module is a FRU; however, it is not hot swappable. The system must be powered down before this module is replaced.

Symptom	Steps to Take
A trunk port fails to come up.	See the “System-Wide Problems” section on page 6-4.
A subtending port fails to come up.	See the “System-Wide Problems” section on page 6-4.
<p>This message appears on the console or in the system log file:</p> <pre>00:00:28:%C6100-4-COOKIE: Corrupt or missing MAC address cookie using random base 007e.eb7d.e700</pre>	<ol style="list-style-type: none"> 1. Make sure the software release that is running on your system is compatible with the hardware. Currently, the Cisco 6015 requires Cisco IOS Release 12.1(4)DA or greater. <p>Note See the “Hardware Specifications” section on page A-1 for minimum software and network management release requirements per Cisco 6015 chassis component.</p> <ol style="list-style-type: none"> 2. Enter the command show hardware. In the resulting display, look for data from the I/O module EEPROM. If the system can read the contents of the EEPROM, the I/O module is likely to be functional. 3. Disconnect the cables and use an external loopback. If the diagnostic loopback works and the external loopback does not work, the problem may be on the I/O module and it may need to be replaced. 4. If the I/O module is present, reseal it. First, turn off system power. Use a screwdriver to unfasten the screws that secure the I/O module cover, and pull the card off the connectors. Push it firmly back into place and tighten the screws. 5. If the problem persists, replace the I/O module.

6.5.4 DSL Interface Module Problems

Use the following table to diagnose and troubleshoot any problems with the DSL interface module.



Note

If you need to remove or replace a DSL interface module, complete the steps in the “DSL Interface Module Installation and Removal” section on page 7-20.

The DSL interface module is a FRU; however, it is not hot swappable. The system must be powered down before this module is replaced.

Symptom	Steps to Take
Modems do not train	<ol style="list-style-type: none"> 1. Make sure the DSL interface module is properly seated in the chassis and screwed in place. 2. Verify that the cables are connected to the Champ connectors. 3. If the problem persists, replace the I/O module.

6.5.5 DC PEM Problems

Use the following table to diagnose and troubleshoot any problems with the DC PEM.


Note

If you need to remove or replace a DC PEM, complete the steps in the “DC PEM Installation and Removal” section on page 7-24.

The DC PEM is a FRU; however, it is not hot swappable. The system must be powered down before this module is replaced. Removing this module will interrupt the service for the entire system until it is replaced.

Symptom	Steps to Take
Input LED on DC PEM is off.	<ol style="list-style-type: none"> 1. Make sure the circuit breaker on the DC PEM is turned to ON (1). 2. Make sure the DC PEM is properly seated in the chassis and screwed in place. 3. Make sure the cable from the fuse and alarm panel or the AC/DC converter is properly connected to the DC PEM. If connections are loose or their polarity is reversed, the chassis does not receive power. 4. Check the power cable for breaks, cracked insulation, loose lugs, and signs of wear. Replace the power cable if it is not in good condition. 5. Check the power source. 6. If the problem persists, replace the DC PEM. <p>Note Only trained technicians can replace a DC PEM.</p>
Circuit breaker on DC PEM trips.	A tripped circuit breaker indicates a serious overcurrent situation. The probable cause is a faulty backplane, a faulty power connector on the backplane, or a faulty DC PEM. Contact the Cisco TAC for assistance.

6.5.6 Fan Module Problems

Use the following table to diagnose and troubleshoot any problems with the fan module.


Note

If you need to remove or replace a fan module, complete the steps in the “Fan Module Installation and Removal” section on page 7-27.

Symptom	Steps to Take
Fans do not run.	<ol style="list-style-type: none"> 1. Make sure that the fan module is fully inserted into the chassis and screwed in place. 2. Replace the fan module.
Fan module runs but the system overheats.	<ol style="list-style-type: none"> 1. Make sure that the air intake vent at the right of the chassis and the exhaust vent at the left of the chassis are free of blockages. (See the “Ventilation” section on page 2-13.) 2. Make sure that the ambient temperature and other environmental factors that are affecting the system are within the ranges specified in the “Environmental Requirements” section on page 2-11. 3. Make sure that all line cards and blank faceplates are in place. The cooling system cannot operate effectively unless the chassis is fully enclosed. 4. Check the LEDs on the fan module. If an LED is red, one of the fans has failed. Replace the fan module. 5. Reduce the ambient temperature.
Fan module LED is red.	One or more fans have failed. Replace the fan module.
Fan module LED is off.	<p>The fan module has failed or is not receiving power. If other components in the system are receiving power (look for green LEDs), check the DC PEM LED. If the DC PEM LED is off, replace the DC PEM. If the DC PEM LED is green, replace the fan module.</p> <p>Note Only trained technicians can replace a DC PEM.</p>

6.5.7 Rear Interface Header Problems

Use the following table to diagnose and troubleshoot any problems with the rear interface header.

Symptom	Steps to Take
An alarm relay or BITS circuit fails.	<ol style="list-style-type: none"> 1. Check the connection at the wire-wrap connector on the back of the Cisco 6015 chassis. See the “Rear Interface Header” section on page 1-36 for the pin assignments of the wire-wrap connector. 2. Check the connection at the other end of the circuit. 3. For a BITS problem, troubleshoot the T1/E1 line at the other end of the circuit.

6.5.8 AC/DC Converter Problems

Use the following table to diagnose and troubleshoot any problems with the AC/DC converter.

Symptom	Steps to Take
Either LED is off.	<ol style="list-style-type: none"> 1. Troubleshoot the AC/DC converter. 2. Troubleshoot the AC input. 3. If the problem persists, replace the power cable. 4. If the problem persists, replace the AC/DC converter. 5. If the problem persists, replace the DC PEM.

6.6 Alarms

Tables 6-2 through 6-11 describe alarms for the Cisco 6015. In each table, the text in the Alarm column is the text that appears in the description field of the alarm message. Alarm messages appear on the console screen as the alarms occur; to see a list of current alarms, enter **show facility-alarm status**.

See the problem tables in this chapter for more detailed troubleshooting instructions.

Table 6-2 Chassis Alarms

Alarm	Severity	Description
Chassis temperature too high	Major	An overtemperature condition has been detected. (Temperature is measured on the NI-2 card.)
Chassis temperature too low	Major	An undertemperature condition has been detected. (Temperature is measured on the NI-2 card.)
Temperature Rating Mismatch	Major	A commercial or outside-plant environment line card or network interface card is installed in a system that has been configured with a different temperature rating. It is also possible that the chassis is incorrectly provisioned for its current environment (commercial or outside-plant). Verify the chassis rating in your management software.

Table 6-3 Line Card Slot Alarms

Alarm	Severity	Description
Provisioned slot is empty	Major	This slot is configured for a line card, but no line card is present.
Line card not equal to provisioning	Minor	The line card in this slot does not match the type that is configured for this slot.
Invalid line card for this slot	Minor	The line card detected in this slot cannot operate in this slot or is incompatible with the system configuration.

Table 6-3 Line Card Slot Alarms (continued)

Alarm	Severity	Description
Module not equal to provisioning	Minor	A 4xflexi line card has been detected in an outside-plant environment. The 4xflexi line cards can be installed only in commercial environments.
Flexi ATU-C line card not provisioned	Info	You must use the slot command to configure a 4xflexi as either CAP or DMT.

Table 6-4 Cisco IOS Controller Alarms

Alarm	Severity	Description
Loss of active clock sync	Major	Loss of timing reference. The configured clock source is not available, so the system is using its internal clock.
BITS clock failure	Major	BITS clock failure (LOS or AIS). The configured clock source is not available, so the system is using its internal clock.

**Note**

The alarms form a hierarchy in the system where a higher priority alarm takes precedence over any lower priority alarms. The alarms listed in Table 6-5 through Table 6-9 are in descending order of priority, the highest to lowest. These conditions are viewable through the **show facility-alarm status** command.

The source of the DS3 alarms in Table 6-5 is the ATM0/1 (the trunk).

Table 6-5 DS3 Network Interface Alarms

Alarm	Severity	Description
Non-Trunk	Critical	The DS3 line is not selected as the system trunk.
LOS ¹ Detected	Critical	The DS3 line has detected Loss of Signal at the framer.
AIS ² Received	Critical	The DS3 line is receiving an Alarm Indication Signal.
OOF ³ Received	Critical	The DS3 line has detected an Out of Frame condition.
Yellow Alarm Received	Critical	The DS3 line is receiving a yellow alarm, indicating that another device has detected a possible failure in this device.
RAI ⁴ Received	Critical	The DS3 line is receiving a remote alarm indication.
PLCP ⁵ LOF ⁶ Detected (red alarm)	Critical	The DS3 line has detected a Physical Layer Convergence Procedure Loss of Frame error.
LCD ⁷	Critical	The DS3 line is experiencing a loss of cell delineation.

1. LOS = loss of signal
2. AIS = alarm indication signal
3. OOF = out of frame
4. RAI = remote alarm indication
5. PLCP = physical layer convergence procedure
6. LOF = loss of frame
7. LCD = loss of cell delineation

The source of the OC-3c alarms in Table 6-6 is one of the following interfaces: ATM0/1 (the trunk) or ATM0/2 (the subterminating interface).

Table 6-6 OC-3c/Synchronous Transfer Mode (STM-1) Network Interface Alarms

Alarm	Severity	Description
Loss of Cell Delineation	Critical	Loss of cell delineation on a SONET line.
Path RDI Received	Critical	Path Remote Defect Indication was received on a SONET line. This is equivalent to Path Far End Receive Failure (FERF).
Path AIS Received	Critical	Path Alarm Indication Signal was received on a SONET line.
Loss of Pointer	Critical	Loss of pointer condition on a SONET line.
Line RDI	Critical	Line Remote Defect Indication received on a SONET line. This is equivalent to line Far End Receive Failure (FERF).
Line AIS Received	Critical	Line Alarm Indication Signal received on a SONET line.
Loss of Frame	Critical	LOF condition on a SONET line.
Loss of Signal	Critical	LOS detected on the SONET line.
Signal Label Mismatch	Minor	Incorrect payload type signal label mismatch on a SONET line.

The source of the T1/E1 alarms in Table 6-7 is the ATM0/2 through ATM0/9 (the trunk).

Table 6-7 T1/E1 Network Interface Alarms

Alarm	Severity	Description
LOS Detected	Critical	The T1/E1 line has detected Loss of Signal at the framer.
AIS Received	Critical	The T1/E1 line is receiving an Alarm Indication Signal.
RAI Received	Critical	The T1/E1 line is receiving a remote alarm indication.
LOF Detected (red alarm)	Critical	The T1/E1 line has detected a Loss of Frame error.
LCD	Critical	The T1/E1 line is experiencing a loss of cell delineation.

The source of the IMA link alarms in Table 6-8 is the ATM0/2 through ATM0/9.

Table 6-8 IMA Link Network Interface Alarms

Alarm	Severity	Description
LOS Detected	Critical	The IMA link has detected Loss of Signal at the framer.
LOF Detected	Critical	The IMA link has detected a Physical Layer Convergence Procedure Loss of Frame error.

Table 6-8 IMA Link Network Interface Alarms (continued)

Alarm	Severity	Description
AIS Received	Critical	The IMA link is receiving an Alarm Indication Signal.
RAI Received	Critical	The IMA link is receiving a remote alarm indication.
LCD	Critical	The IMA link is experiencing a loss of cell delineation.
LIF ¹	Critical	The IMA link is experiencing an LIF defect at the near end.
LODS ²	Critical	The link differential delay between the link and the other links in the group is over the tolerable link differential delay.
Rx Failed	Critical	A persistent detection of a defect at the receiver. The criteria for entering the condition are implementation specific.
Tx Link Misconnected	Critical	The Tx link is not connected to the same far end IMA unit as the other Tx links in the group. The detection is implementation specific.
Rx Link Misconnected	Critical	The Rx link is not connected to the same far end IMA unit as the other Rx links in the group. The detection is implementation specific.
Persistent NE ³ RDI-IMA	Critical	One of the available remote defect indicators (including IMA link specific defect) is in the link-related “Link Information” field.
Rx Fault	Critical	Implementation specific Rx fault declared at the near end.
Tx Fault	Critical	Implementation specific Tx fault declared at the near end.
Tx Link Unusable—FE ⁴	Critical	The far end is reporting that Tx is unusable.
Rx Link Unusable—FE	Critical	The far end is reporting that Rx is unusable.

1. LIF = loss of IMA frame
2. LODS = link out of delay sync
3. NE = near end
4. FE = far end

The source of the IMA group alarms in Table 6-9 is the ATM0/IMA0 through ATM0/IMA3.

Table 6-9 IMA Group Alarms

Alarm	Severity	Description
Start-up—FE	Critical	The far end is starting up—The declaration of this failure alarm may be delayed to ensure that the far end remains in start-up.
Configuration Abort	Critical	The far end is trying to use unacceptable configuration parameters.

Table 6-9 IMA Group Alarms (continued)

Alarm	Severity	Description
Configuration Abort—FE	Critical	The far end is reporting unacceptable configuration parameters.
Insufficient Links	Critical	Fewer than P _{Tx} transmit or P _{Rx} receive links are active.
Insufficient Links—FE	Critical	The far end is reporting that fewer than P _{Tx} transmit or P _{Rx} receive links are active.
Blocked—FE	Critical	The far end is reporting that it is blocked.
Timing Mismatch	Critical	The far end transmit clock mode is different than the near end transmit clock mode.

Table 6-10 Fan Module Alarms

Alarm	Severity	Description
Not detected or missing	Major	The fan module has been removed from the chassis or is missing.
Multiple fan failures	Major	Both fans in the fan module have failed.
Single fan failure	Minor	A single fan (one of two) in the fan module has failed.

Table 6-11 Power Supply Alarms

Alarm	Severity	Description
Voltage alarm	Major	The input voltage is out of range.
Current alarm	Major	An overcurrent condition has been detected.



Upgrading and Maintaining the Cisco 6015 System

This chapter describes upgrade and maintenance procedures for the Cisco 6015 system.

7.1 Backing Up Software

Cisco recommends that you maintain, on a TFTP server, current copies of three files for each Cisco 6015 system:

- The Cisco IOS software image
- The configuration file (running-config)
- The bootflash file

If you keep copies of these files on a TFTP server, you can easily recover from a fault in an NI-2 card. You can simply replace the NI-2 card and download the software image and configuration file from the TFTP server. Remember to update your backup files whenever you change your configuration or upgrade your Cisco IOS software.

Complete the following steps to copy the Cisco IOS software image and configuration file to a TFTP server:

-
- Step 1** Log into the Cisco 6015 node whose software you wish to back up.
- Step 2** Enter the **dir** command to display the names of the files:
- ```
6015# dir
```
- Step 3** Enter a copy command to copy the IOS software file to the node's TFTP server:
- ```
6015# copy flash:<image-name> tftp
```
- Step 4** Enter a second copy command to copy the configuration file to the node's TFTP server:
- ```
6015# copy running-config tftp
```
-

## 7.2 Installing and Replacing Hardware

This section details the installation and removal procedures for the following field replaceable unit (FRU) hardware components:

- Quad-port flexi ATU-C line card (4xflexi)
- Octal-port Discrete Multitone (DMT) ATU-C line card (8xDMT)
- Octal-port DMT ATU-C over ISDN line card (8xDMT over ISDN)
- Octal-port single-pair high-speed digital subscriber line, also known as symmetric high bit-rate digital subscriber loop (G.SHDSL) line card (8xG.SHDSL)
- Blank faceplate
- DS3+T1/E1 inverse multiplexing over ATM (IMA) and industrial temperature (ITEMP) DS3+T1/E1 IMA NI-2 card
- OC-3c/OC-3c NI-2 card
- Network Input/Output (I/O) module
- DSL interface module
- DC power entry module (PEM)
- Fan module
- AC/DC converter



**Tip**

See the “General Maintenance Guidelines” section on page 2-9 for installation and replacement practices for the Cisco 6015 system cards and modules.



**Caution**

Proper ESD protection is required whenever you handle Cisco equipment. Installation and maintenance personnel should be properly grounded using ground straps to eliminate the risk of ESD damage to the equipment. Cards are subject to ESD damage whenever they are removed from the chassis.

See the “Preventing Electrostatic Discharge Damage” section on page 2-9 for ESD grounding jack locations on the Cisco 6015 system.

### 7.2.1 4xflexi Installation and Removal

The following sections detail the installation and removal procedures for the 4xflexi.

#### 7.2.1.1 Installing a 4xflexi

Complete these steps to install the 4xflexi in the Cisco 6015 chassis.



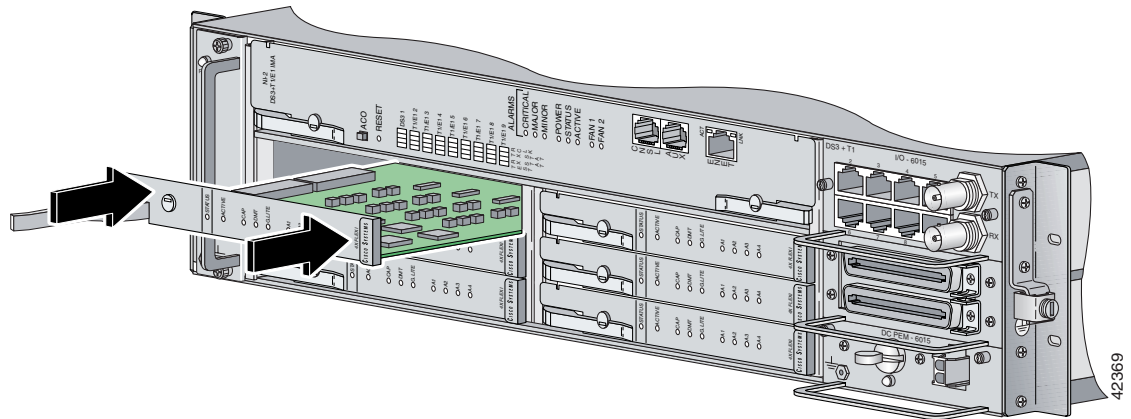
**Note**

The 4xflexi can be used only in a commercial environment. It cannot be used in an outside-plant environment.

- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
- Step 2** Hold the 4xflexi horizontally, with the line card faceplate toward you and the connectors facing the chassis slot.
- Step 3** Horizontally align the line card edge with the guides at the right and left of the slot in the Cisco 6015.
- Step 4** Lift up on the ejector tab and gently apply pressure to the faceplate while pushing the line card into the slot.

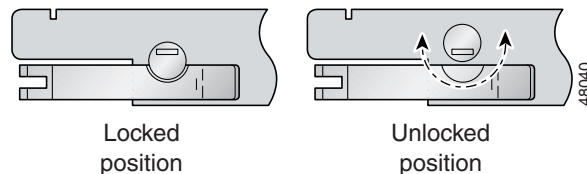
Figure 7-1 shows the 4xflexi installation for a Cisco 6015 chassis.

**Figure 7-1 4xflexi Installation in the Cisco 6015**



- Step 5** Push on the faceplate of the line card to fully seat the line card.
- Step 6** Press down on the ejector tab to secure the line card and connect it to the backplane.
- Step 7** Use a flat-head screwdriver to turn the locking tab so that it overlaps the line card ejector tab to prevent inadvertent dislodging. Figure 7-2 shows how to position the locking tab.

**Figure 7-2 Positioning the Locking Tab on the 4xflexi**



- Step 8** Verify that the STATUS LED is solid green after the brief self-test. If the STATUS LED is not green after the self-test, see Chapter 6, “Troubleshooting,” for troubleshooting procedures.



**Note**

If you are installing the line card for the first time, refer to the provisioning procedures in the *Configuration Guide for Cisco DSLAMs with NI-2*.

## 7.2.1.2 Removing a 4xflexi

Complete the following steps to remove a 4xflexi from the Cisco 6015 chassis:

- 
- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
  - Step 2** Use a flat-head screwdriver to move the locking tab from the locked to the unlocked position. Be sure to turn the locking tab so that it does not overlap the line card ejector tab, as shown in Figure 7-2.
  - Step 3** Lift up on the ejector tab. This action disconnects the line card from the backplane.
  - Step 4** Carefully slide the line card out of the slot.

Either replace the 4xflexi that you remove, or insert a blank faceplate in the empty slot. See the “Installing a 4xflexi” section on page 7-2 for 4xflexi installation procedures. See the “Installing a Blank Faceplate” section on page 7-10 for blank faceplate installation procedures.




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**Note** Blank faceplates should occupy any empty slots in the chassis.

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## 7.2.2 8xDMT Installation and Removal

The following sections detail the installation and removal procedures for the 8xDMT.

### 7.2.2.1 Installing an 8xDMT

Complete these steps to install the 8xDMT in the Cisco 6015 chassis.




---

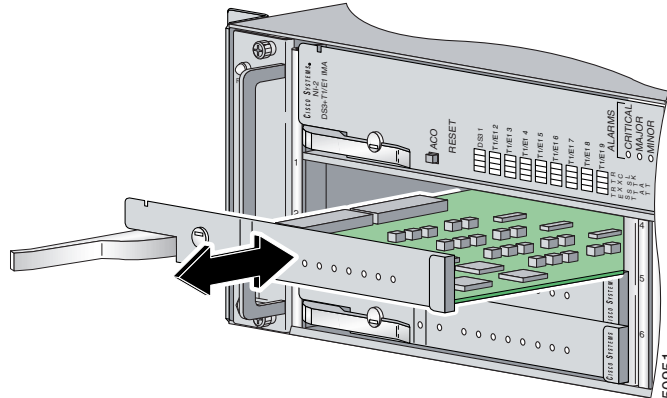
**Note** Install the 8xDMT with part number ATUC-8-DMT-1 only in a commercial environment. Install the 8xDMT with part number ATUC-8-DMT-1-H only in an outside-plant environment.

---

- 
- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
  - Step 2** Hold the 8xDMT horizontally, with the line card faceplate toward you and the connectors facing the chassis slot.
  - Step 3** Align the line card edge with the guides at the right and left of the slot in the Cisco 6015.
  - Step 4** Lift up on the ejector tab and gently apply pressure to the faceplate while pushing the line card into the slot.

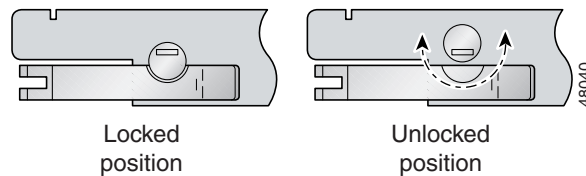
Figure 7-3 shows the 8xDMT installation in a Cisco 6015 chassis.

Figure 7-3 8xDMT Installation in the Cisco 6015



- Step 5** Push on the faceplate of the line card to fully seat the card.
- Step 6** Press down on the ejector tab to secure the line card and connect it to the backplane.
- Step 7** Use a flat-head screwdriver to turn the locking tab so that it overlaps the line card ejector tab to prevent inadvertent dislodging. Figure 7-4 shows how to position the locking tab.

Figure 7-4 Positioning the Locking Tab on the 8xDMT



- Step 8** Verify that the STATUS LED is solid green after the brief self-test. If the STATUS LED is not green after the self-test, see Chapter 6, “Troubleshooting,” for troubleshooting procedures.

**Note**

If you are installing the line card for the first time, refer to the provisioning procedures in the *Configuration Guide for Cisco DSLAMs with NI-2*.

## 7.2.2.2 Removing an 8xDMT

Complete the following steps to remove an 8xDMT from the Cisco 6015 chassis:

- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
- Step 2** Use a flat-head screwdriver to move the locking tab from the locked to the unlocked position. Be sure to turn the locking tab so that it does not overlap the line card ejector tab, as shown in Figure 7-4.
- Step 3** Lift up on the ejector tab. This action disconnects the line card from the backplane.
- Step 4** Carefully slide the line card out of the slot.

Either replace the 8xDMT that you remove, or insert a blank faceplate in the empty slot. See the “Installing an 8xDMT” section on page 7-4 for 8xDMT installation procedures. See the “Installing a Blank Faceplate” section on page 7-10 for blank faceplate installation procedures.



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**Note** Blank faceplates should occupy any empty slots in the chassis.

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## 7.2.3 8xDMT over ISDN Installation and Removal

The following sections detail the installation and removal procedures for the 8xDMT over ISDN.

### 7.2.3.1 Installing an 8xDMT over ISDN

Complete these steps to install the 8xDMT over ISDN in the Cisco 6015 chassis.



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**Note** The 8xDMT over ISDN is designed for use in a commercial environment only.

---

The 8xDMT over ISDN is designed for use in a Cisco 6015 with a POTS splitter configuration only.

Reseating the 8xDMT over ISDN during simultaneous DSL and ISDN traffic operation results in the ISDN signal being temporarily interrupted.

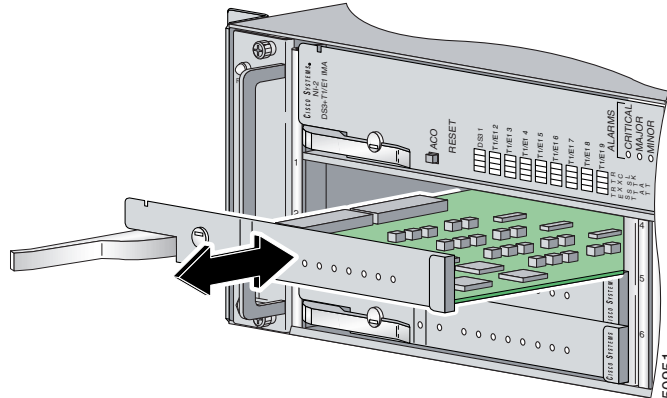
To reseat the 8xDMT over ISDN in the chassis, shut down all the subscriber ports on the line card, wait one minute, and then replace the line card.

---

- 
- Step 1** Connect a grounding strap to the ESD grounding jack on the chassis.
  - Step 2** Hold the line card horizontally, with the module faceplate toward you and the connectors facing the chassis slot
  - Step 3** Align the line card edge with the guides at the left and right of the slot in the chassis.
  - Step 4** Lift up on the ejector tab and gently apply pressure to the faceplate while pushing the line card into the slot.

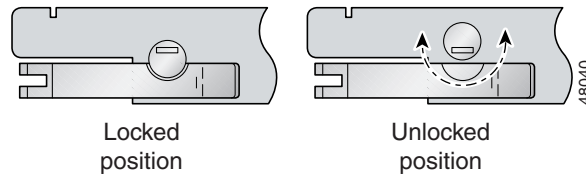
Figure 7-5 shows the 8xDMT over ISDN installation in a Cisco 6015 chassis.

Figure 7-5 8xDMT Over ISDN Installation in the Cisco 6015



- Step 5** Push on the faceplate of the line card until it stops to fully seat the card.
- Step 6** Press down on the ejector tab to secure the line card.
- Step 7** Use a flat-head screwdriver to turn the locking tab so that it overlaps the line card ejector tab to prevent inadvertent dislodging. Figure 7-6 shows how to position the locking tabs.

Figure 7-6 Positioning the Locking Tab on the 8xDMT Over ISDN



- Step 8** Verify that the STATUS LED is solid green after the brief self-test. If the STATUS LED is not green after the self-test, see the appropriate hardware guide for your chassis for troubleshooting procedures.

**Note**

If you are installing the line card for the first time, refer to the provisioning procedures in the *Configuration Guide for Cisco DSLAMs with NI-2*.

### 7.2.3.2 Removing an 8xDMT Over ISDN

Complete the following steps to remove an 8xDMT over ISDN from the Cisco 6015 chassis:

- Step 1** Connect a grounding strap to the ESD grounding jack on the chassis.
- Step 2** Use a flat-head screwdriver to move the locking tab from the locked to the unlocked position. Be sure to turn the locking tab so that it does not overlap the line card ejector tab as shown in Figure 7-6.
- Step 3** Lift up on the ejector tab. This action disconnects the line card from the backplane.
- Step 4** Carefully slide the line card out of the slot.

Either replace the line card that you remove, or insert a blank faceplate in the empty slot. See the “Installing an 8xDMT over ISDN” section on page 7-6 for 8xDMT over ISDN installation instructions. See the “Installing a Blank Faceplate” section on page 7-10 for blank faceplate installation instructions.



**Note** Blank faceplates should occupy any empty slots in the chassis.

## 7.2.4 8xG.SHDSL Installation and Removal

The following sections detail the installation and removal procedures for the 8xG.SHDSL.



**Note**

The 8xG.SHDSL can be used only in a commercial environment. It cannot be used in an outside-plant environment.

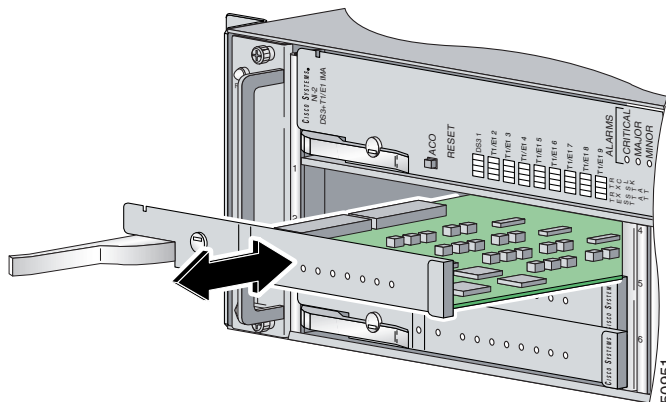
### 7.2.4.1 Installing an 8xG.SHDSL

Complete the following steps to install the 8xG.SHDSL in the Cisco 6015 chassis:

- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
- Step 2** Hold the 8xG.SHDSL horizontally, with the line card faceplate toward you and the connectors facing the chassis slot.
- Step 3** Align the line card edge with the guides at the right and left of the slot in the Cisco 6015.
- Step 4** Lift up on the ejector tab and gently apply pressure to the faceplate while pushing the line card into the slot.

Figure 7-7 shows the 8xG.SHDSL installation in a Cisco 6015 chassis.

**Figure 7-7 8xG.SHDSL Installation in the Cisco 6015**





**Step 5** Push on the faceplate of the line card to fully seat the line card.

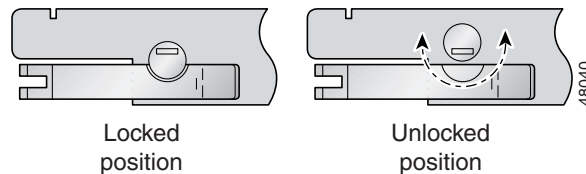


**Note** The card must be properly seated in its slot to maintain the EMI emissions containment. Apply gentle pressure if needed to ensure that the board is properly seated.

**Step 6** Press down on the ejector tab to secure the line card and connect it to the backplane.

**Step 7** Use a flat-head screwdriver to turn the locking tab so that it overlaps the line card ejector tab to prevent inadvertent dislodging. Figure 7-4 shows how to position the locking tab.

**Figure 7-8 Positioning the Locking Tab on the 8xG.SHDSL**



**Step 8** Verify that the STATUS LED is solid green after the brief self-test. If the STATUS LED is not green after the self-test, see Chapter 6, “Troubleshooting,” for troubleshooting procedures.



**Note** If you are installing the line card for the first time, refer to the provisioning procedures in the *Configuration Guide for Cisco DSLAMs with NI-2*.

## 7.2.4.2 Removing an 8xG.SHDSL

Complete the following steps to remove an 8xG.SHDSL from the Cisco 6015 chassis:

**Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.

**Step 2** Use a flat-head screwdriver to move the locking tab from the locked to the unlocked position. Be sure to turn the locking tab so that it does not overlap the line card ejector tab, as shown in Figure 7-4.

**Step 3** Lift up on the ejector tab. This action disconnects the line card from the backplane.

**Step 4** Carefully slide the line card out of the slot.

Either replace the 8xG.SHDSL that you remove, or insert a blank faceplate in the empty slot. See the “Installing an 8xG.SHDSL” section on page 7-8 for 8xG.SHDSL installation procedures. See the “Installing a Blank Faceplate” section on page 7-10 for blank faceplate installation procedures.



**Note** Blank faceplates should occupy any empty slots in the chassis.

## 7.2.5 Blank Faceplate Installation and Removal

Blank faceplates should occupy any empty line card slots in the Cisco 6015 chassis. Blank faceplate installation is similar to line card installation.

The following sections detail the installation and removal procedures for a blank faceplate.

### 7.2.5.1 Installing a Blank Faceplate

Complete the following steps to install a blank faceplate in the Cisco 6015 chassis:

- 
- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
  - Step 2** Horizontally align the blank faceplate edge with the guides at the left and right of the slot.
  - Step 3** Lift up on the ejector tab and gently apply pressure to the faceplate while pushing the blank faceplate into the slot.
  - Step 4** Push on the faceplate to fully seat the blank faceplate.
  - Step 5** Press down on the ejector tab to secure the faceplate.
- 

### 7.2.5.2 Removing a Blank Faceplate

Complete the following steps to remove a blank faceplate from the Cisco 6015 chassis:

- 
- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
  - Step 2** Lift up on the ejector tab. This action disconnects the line card from the backplane.
  - Step 3** Carefully slide the line card out of the slot.

Either replace the blank faceplate that you remove, or insert a line card in the empty slot. See the “Installing a Blank Faceplate” section on page 7-10 for blank faceplate installation procedures. For line card installation procedures, see either the “Installing a 4xflexi” section on page 7-2 or the “Installing an 8xDMT” section on page 7-4.

---

## 7.2.6 DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card Installation and Removal

The following sections detail the installation and removal procedures for the NI-2 card.



### Warning

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**The ports labeled "ENET," "CNSL," and "AUX" are SELV circuits. SELV circuits should be connected only to other SELV circuits. Because the DSL circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the TNV circuits.**

---

**Tip**

Cisco recommends that you label each data cable at both ends to identify its destination.

**Caution**

Service is interrupted for the entire system when the NI-2 card is removed.

### 7.2.6.1 Installing a DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card

Complete these steps to install the NI-2 card in the Cisco 6015 chassis.

**Note**

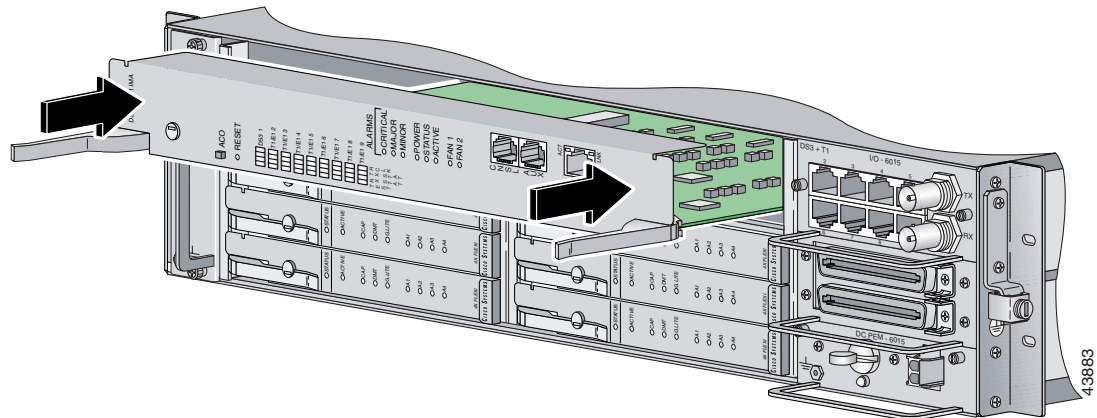
The DS3+T1/E1 IMA NI-2 card is used in a commercial environment. The ITEMP DS3+T1/E1 IMA NI-2 card is used in an outside-plant environment.

**Tip**

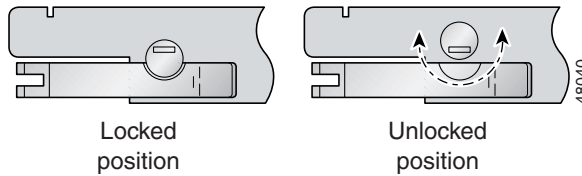
Cisco recommends that you label each data cable at both ends to identify its destination.

- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
- Step 2** Hold the NI-2 card horizontally, with the faceplate toward you and the connectors facing the chassis slot.
- Step 3** Horizontally align the card edge with the guides at the right and left of the slot in the Cisco 6015.
- Step 4** Lift up on the ejector tabs and gently apply pressure to the faceplate while pushing the card into the slot. Figure 7-9 shows the module installation in a Cisco 6015 chassis.

**Figure 7-9 NI-2 Card Installation in the Cisco 6015**



- Step 5** Push on the faceplate of the card to fully seat the card.
- Step 6** Press down on the ejector tabs to secure the card and connect it to the backplane.
- Step 7** Use a flat-head screwdriver to turn the locking tabs so that they overlap the NI-2 card ejector tabs to prevent inadvertent dislodging. Figure 7-10 shows how to position the locking tabs.

**Figure 7-10 Positioning the Locking Tab on the NI-2 Card**

- Step 8** Verify that the STATUS LED is solid green after the brief self-test. If the STATUS LED is not green after the self-test, see Chapter 6, “Troubleshooting,” for troubleshooting procedures.

**Note**

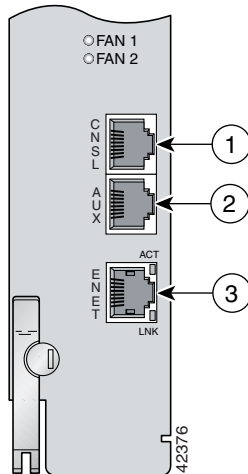
If you are installing the line card for the first time, refer to the provisioning procedures in the *Configuration Guide for Cisco DSLAMs with NI-2*.

- Step 9** Connect the Ethernet cable to the management network.

- a. Connect the 10BaseT RJ-45 connector to the NI-2 card (ENET). Figure 7-11 shows where to connect the Ethernet cable.

**Note**

See Table 2-6 on page 2-19 for cable and ferrite requirements.

**Figure 7-11 ENET, CNSL, and AUX RJ-45 Receptacles on the DS3+T1/E1 IMA NI-2 Card**

|          |                |          |               |
|----------|----------------|----------|---------------|
| <b>1</b> | Console port   | <b>3</b> | Ethernet port |
| <b>2</b> | Auxiliary port |          |               |

- b. Run the cable through the ferrite one time, loop the cable back through the ferrite, and clamp the ferrite shut.
- c. Connect the other end of the cable to the management network (for example, a LAN).

- Step 10** Connect a VT100-compatible terminal to the system console port on the NI-2 card (CNSL). Connect the terminal to a power source and set it up using the values that are shown in Table 7-1. Figure 7-11 shows where to connect the console cable.

**Table 7-1 Terminal Settings**

|                |                             |
|----------------|-----------------------------|
| Baud rate      | 9600 (transmit and receive) |
| Character size | 8 bits                      |
| Parity         | None                        |
| Stop bits      | 1                           |
| Flow control   | None                        |

- Step 11** Connect a terminal, a modem, or another serial device to the auxiliary port on the NI-2 card (AUX). Figure 7-11 shows where to connect the auxiliary cable.



**Note** This step is optional.

### 7.2.6.2 Removing a DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card

Complete these steps to remove an NI-2 card from the Cisco 6015 chassis.



**Note** The DS3+T1/E1 IMA NI-2 card is used in a commercial environment. The ITEMP DS3+T1/E1 IMA NI-2 card is used in an outside-plant environment.

- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
- Step 2** Disconnect the RJ-45 connector from the auxiliary port on the NI-2 card (AUX).
- Step 3** Disconnect the VT100-compatible terminal connector from the system console port on the NI-2 card (CNSL).
- Step 4** Disconnect the 10BaseT RJ-45 connector from the ethernet port on the NI-2 card (ENET).
- Step 5** Use a flat-head screwdriver to move the locking tabs from the locked to the unlocked position. Be sure to turn the locking tabs so that they do not overlap the NI-2 ejector tabs, as shown in Figure 7-10.
- Step 6** Lift up on the ejector tabs. This action disconnects the card from the backplane.
- Step 7** Carefully slide the card out of the slot.
- See the “Installing a DS3+T1/E1 IMA or ITEMP DS3+T1/E1 IMA NI-2 Card” section on page 7-11 for NI-2 card installation procedures.

## 7.2.7 OC-3c/OC-3c NI-2 Card Installation and Removal

Complete these steps to install the NI-2 card in the Cisco 6015 chassis.



### Warning

The ports labeled "ENET," "CNLSL," and "AUX" are SELV circuits. SELV circuits should be connected only to other SELV circuits. Because the DSL circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the TNV circuits.



### Tip

Cisco recommends that you label each data cable at both ends to identify its destination.



### Caution

Service is interrupted for the entire system when the NI-2 card is removed.



### Caution

Installing the cards in the chassis with the power leads reversed can damage the cards.



### Warning

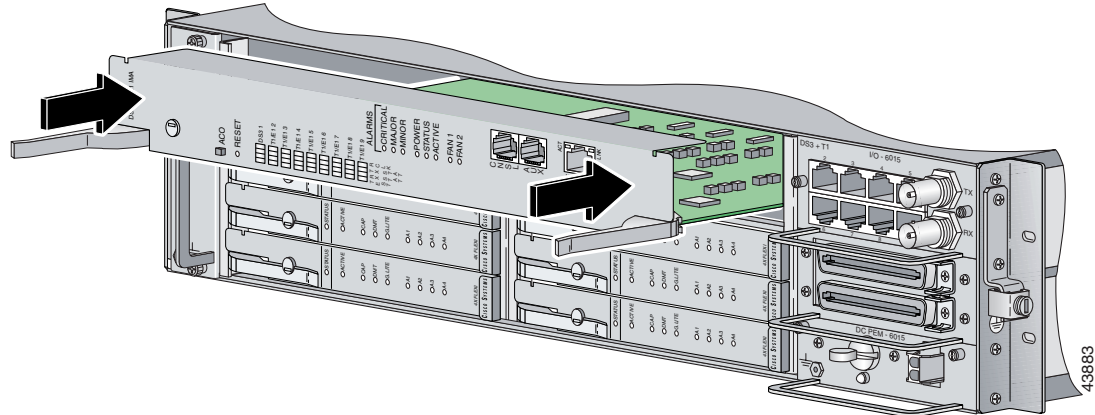
Do not stare into the beam or view it directly with optical instruments.

### 7.2.7.1 Installing an OC-3c/OC-3c NI-2 Card

Complete the following steps to install an OC-3c/OC-3c NI-2 card in the chassis. It is important that you complete each step before moving on to the next step.

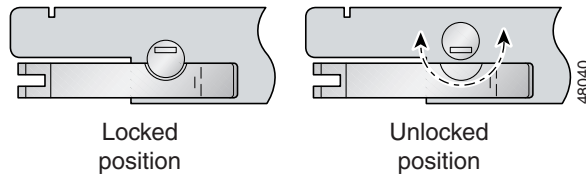
- 
- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.
  - Step 2** Hold the NI-2 card horizontally, with the faceplate toward you and the connectors facing the chassis slot.
  - Step 3** Horizontally align the card edge with the guides at the right and left of the slot in the Cisco 6015.
  - Step 4** Lift up on the ejector tabs and gently apply pressure to the faceplate while pushing the card into the slot. Figure 7-12 shows the module installation in a Cisco 6015 chassis.

Figure 7-12 NI-2 Card Installation in the Cisco 6015



- Step 5** Push on the faceplate of the card to fully seat the card.
- Step 6** Press down on the ejector lever to secure the card and connect it to the backplane.
- Step 7** Use a flat-head screwdriver to turn the locking tabs so that they overlap the NI-2 card ejector levers to prevent inadvertent dislodging. Use a flat-head screwdriver to turn the locking tab so that it overlaps the NI-2 card to prevent inadvertent dislodging, as shown in Figure 7-13.

Figure 7-13 Positioning the Locking Tab on the NI-2 Card



- Step 8** Verify that the STATUS LED is solid green after the brief self-test. If the STATUS LED is not green after the self-test, see Chapter 6, “Troubleshooting,” for troubleshooting procedures.



**Note** If you are installing the NI-2 card for the first time, refer to the provisioning procedures in the *Configuration Guide for Cisco DSLAMs with NI-2*.

- Step 9** Attach the RX cable from the ATM switch to the TX connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card (trunk 1 interface connector TX).

The TX connector is the one closer to the top of the faceplate. The RX connector is closer to the bottom of the faceplate. The connector IDs are silkscreened inside the inset.

- Step 10** Attach the TX cable from the ATM switch to the RX connector in the inset on the faceplate of the OC-3c/OC-3c NI-2 card (trunk 1 interface connector RX).



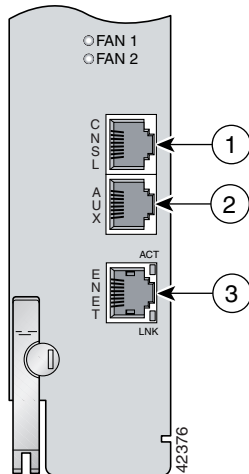
**Note** To cable the chassis for OC-3c subtending, see the appropriate installation chapter for your system.

- Step 11** Connect the Ethernet to the management network.
- Connect an Ethernet cable to the 10BaseT RJ-45 port (ENET) on the OC-3c/OC-3c NI-2 card faceplate. Figure 7-14 shows where to connect the Ethernet cable.



**Note** See the Table 2-6 on page 2-19 for cable and ferrite requirements.

**Figure 7-14 CNSL, AUX, and ENET RJ-45 Receptacles on the OC-3c/OC-3c NI-2 Card**



|          |                |          |               |
|----------|----------------|----------|---------------|
| <b>1</b> | Console port   | <b>3</b> | Ethernet port |
| <b>2</b> | Auxiliary port |          |               |

- Run the Ethernet cable through the ferrite one time, loop the cable back through the ferrite, and clamp the ferrite shut.

- Step 12** Connect the other end of the cable to the management network (for example, a LAN).
- Step 13** Connect a VT100-compatible terminal to the system console port on the NI-2 card (CNSL). Connect the terminal to a power source and set it up using the values that are shown in Table 7-1. Figure 7-14 shows where to connect the console cable.



**Note** This step is optional.

- Step 14** Connect a terminal, a modem, or another serial device to the RJ-45 auxiliary port on the NI-2 card (AUX). Figure 7-14 shows where to connect the auxiliary cable.



## 7.2.7.2 Removing an OC-3c/OC-3c NI-2 Card

Complete the following steps to remove an OC-3c/OC-3c NI-2 card from the chassis. It is important that you complete each step before moving on to the next step.

- 
- Step 1** Connect a grounding strap to the ESD grounding jack on the fan module.
  - Step 2** Disconnect the cable connected to the RJ-45 auxiliary port (AUX) on the NI-2 card, as necessary.
  - Step 3** Disconnect the cable connected to the VT100-compatible terminal from the system console port (CNSL) on the NI-2 card, as necessary.
  - Step 4** Disconnect the cable connected to the 10BaseT RJ-45 port (ENET) on the NI-2 card, as necessary.
  - Step 5** Disconnect the RX cable from the TX connector in the inset on the faceplate of the NI-2 card (trunk 1 interface connector TX).
  - Step 6** Disconnect the TX cable from the RX connector in the inset on the faceplate of the NI-2 card (trunk 1 interface connector RX).
  - Step 7** Disconnect the RX subtend 2 interface connector in the inset on the faceplate of the NI-2 card, if necessary.
  - Step 8** Disconnect the TX subtend 2 interface connector in the inset on the faceplate of the NI-2 card, if necessary.
  - Step 9** Use a flat-head screwdriver to move the locking tabs on the faceplate from the locked to the unlocked position. Be sure to turn the locking tabs so that they do not overlap the NI-2 card locking levers, as shown in Figure 7-10.
  - Step 10** Lift up on the locking levers. This action disconnects the card from the backplane.
  - Step 11** Carefully slide the card out of the slot.

See the “Installing an OC-3c/OC-3c NI-2 Card” section on page 7-14 for NI-2 card installation procedures.

---

## 7.2.8 I/O Module Installation and Removal

The following sections detail the installation and removal procedures for the I/O module.



**Tip**

Cisco recommends that you label each data cable at both ends to identify its destination.

---



**Tip**

The term *subtending* refers to the host chassis, and *subtended* refers to the downstream chassis in a subtended network.

---

## 7.2.8.1 Installing an I/O Module

Complete the following steps to install the I/O module in the Cisco 6015 chassis:

- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.
- Step 2** Power off the Cisco 6015.
- If you are using AC power and the power cord is plugged into the wall outlet, unplug it.
  - If you are using DC power and the fuses are installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed and connected.

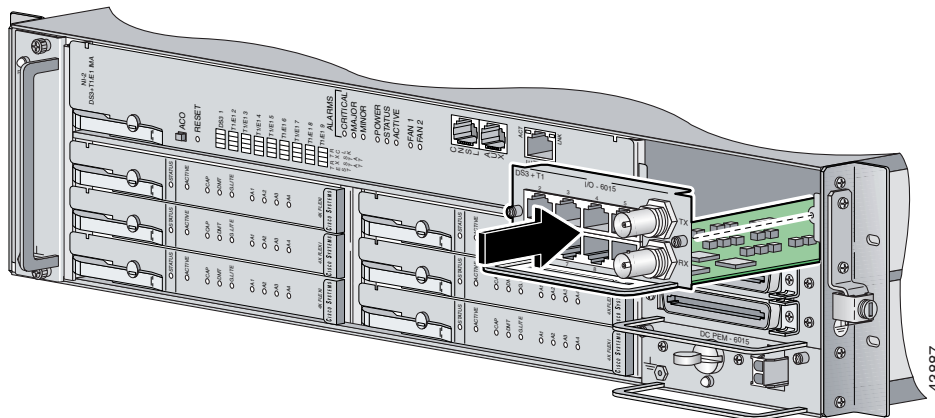


**Note** The fuse and alarm panel is not provided by Cisco.

- Set the circuit breaker on the DC PEM to the OFF (0) position.
- Step 3** Horizontally align the module edge with the module guides at the right and left of the slot in the Cisco 6015.

Figure 7-15 shows the I/O module installation.

**Figure 7-15 I/O Module Installation**



- Step 4** Hold the handle on the front of the module and gently apply pressure while pushing the module into the slot.
- Step 5** Push on the faceplate of the module to fully seat the module.
- Step 6** Use a flat-head or Phillips-head screwdriver to attach the two I/O module screws to the Cisco 6015 chassis.
- Step 7** If you are installing a subtended network, complete the following steps. If you are not installing a subtended network, proceed to Step 8.



**Note** For more information on a subtended network configuration, see the “Subtended Network Configuration” section on page 1-6.

If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

- a. Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module in the subtending host chassis.
- b. Connect the other end of the cable to one of the RJ-48 receptacles on the I/O module in a subtended node chassis.
- c. Repeat Step 7a and Step 7b to connect the subtending host chassis to each subtended node chassis.



**Note** If you are using a T1 or E1 trunk to the network, the trunk connection will originate at one of the eight RJ-48 receptacles on the I/O module. Therefore, you can subtend only seven node chassis.

**Step 8** Complete the following steps to connect the DS3+T1 I/O module to the network using a DS3 connection. If you are using a T1 connection, proceed to Step 9; if you are using an E1 connection, proceed to Step 10.

- a. Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis. The I/O module DS3 connections attach to the ATM switch. Two 75-ohm DS3 Bayonet-Neill-Concelman (BNC) connectors are provided for DS3 TX and RX. Attach one end of a coaxial cable (type 734A or equivalent) to the TX DS3 BNC connector on the I/O module.
- b. Attach the other end of the cable that originates at the TX DS3 BNC connector to the RX DS3 BNC connector on the ATM switch.
- c. Attach one end of a coaxial cable (type 734A or equivalent) to the RX DS3 BNC connector on the I/O module.
- d. Attach the other end of the cable that originates at the RX DS3 BNC connector to the TX DS3 BNC connector on the ATM switch.

**Step 9** Complete the following steps to connect the DS3+T1 I/O module to the network using a T1 connection. If you are using an E1 connection, proceed to Step 10.

- a. Verify that you have a DS3+T1 I/O module installed in the Cisco 6015 chassis.
- b. Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.



**Note** If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

- c. Connect the other end of the cable to the ATM switch.

**Step 10** Complete the following steps to connect the E1 I/O module to the network using an E1 connection:

- a. Verify that you have an E1 I/O module installed in the Cisco 6015 chassis.
- b. Connect one end of an RJ-48 cable to one of the RJ-48 receptacles on the I/O module. If you have a subtended network configuration installed, this connection must be made from the I/O module in the subtending host chassis.

**Note**


---

If unshielded cable is used for FCC Class B or EN55022 Class B compliance, the cables will need to be looped through ferrites.

---

- c. Connect the other end of the cable to the ATM switch.

**Step 11** Plug the AC power cord into the wall outlet or reinsert the fuses in the fuse and alarm panel.

**Step 12** Set the circuit breaker on the DC PEM to the ON (1) position.

---

## 7.2.8.2 Removing an I/O Module

Complete the following steps to remove an I/O module from the Cisco 6015 chassis:

**Note**


---

If you are using AC power and the power cord is plugged into the wall outlet, unplug it.

If you are using DC power and the fuses are installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed and connected.

The fuse and alarm panel is not provided by Cisco.

---

**Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.

**Step 2** Set the circuit breaker on the DC PEM to the OFF (0) position.

**Step 3** Disconnect the two DS3 BNC connections from the front of the I/O module, as necessary.

**Step 4** Disconnect the T1 or E1 RJ-48 cables from the RJ-48 receptacles on the front of the I/O module, as necessary.

**Step 5** Use a flat-head or Phillips-head screwdriver to unscrew the two screws that hold the I/O module to the Cisco 6015 chassis.

**Step 6** Hold the extraction handle on the front of the module and carefully slide the module out of the slot. See the “Installing an I/O Module” section on page 7-18 for I/O module installation procedures.

---

## 7.2.9 DSL Interface Module Installation and Removal

The following sections detail the installation and removal procedures for the DSL interface module.

**Note**


---

If you are using AC power and the power cord is plugged into the wall outlet, unplug it.

If you are using DC power and the fuses are installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed and connected.

The fuse and alarm panel is not provided by Cisco.

---



Tip

Cisco recommends that you label each data cable at both ends to identify its destination.

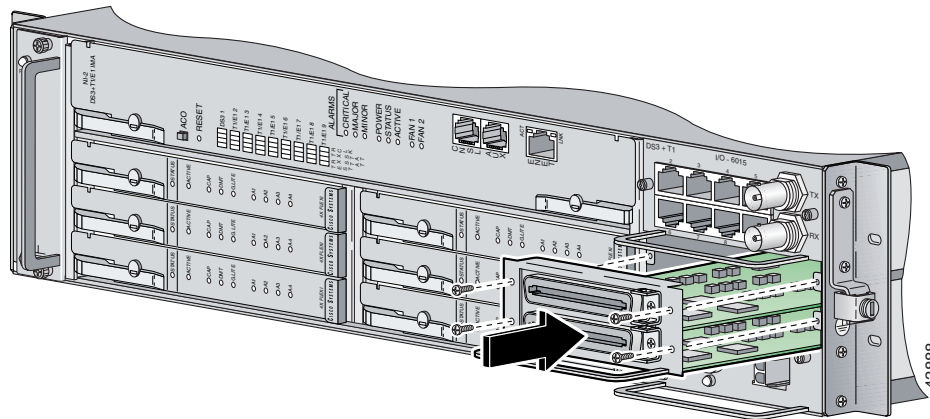
## 7.2.9.1 Installing a DSL Interface Module

Complete the following steps to install the DSL interface module in the Cisco 6015 chassis:

- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.
- Step 2** Set the circuit breaker on the DC PEM to the OFF (0) position.
- Step 3** Horizontally align the module edge with the module guides at the right and left of the slot in the Cisco 6015.

Figure 7-16 shows the DSL interface module installation.

**Figure 7-16 DSL Interface Module Installation**



- Step 4** Hold the extraction handle on the front of the module and gently apply pressure while carefully pushing the module into the slot.
- Step 5** Push on the faceplate of the module to fully seat the module.
- Step 6** Use a flat-head or Phillips-head screwdriver and four screws to attach the DSL interface module to the Cisco 6015 chassis.
- Step 7** Connect the DSL interface module to the POTS splitter (Cisco 6015 with a POTS splitter configuration) or MDF (Cisco 6015 without a POTS splitter configuration).

Use the cables that are described in the “Required Tools and Equipment” section on page 2-19 to connect the DSL interface module to the POTS splitter or MDF. For cabling procedures for each POTS splitter, refer to the appropriate vendor documentation.

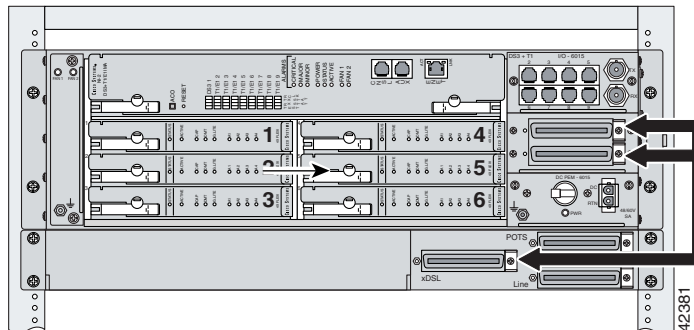


Note

If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

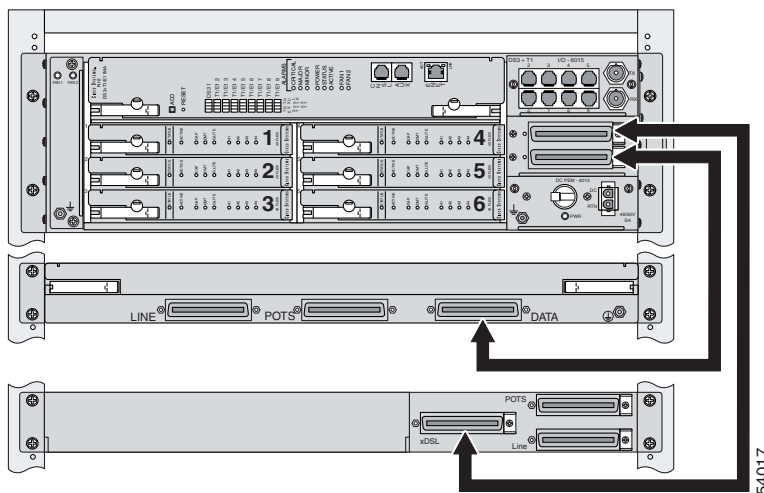
Figure 7-17 shows the cabling between the DSL interface module and a third-party POTS splitter. These connections are for xDSL data flow between the Cisco 6015 and the POTS splitter.

**Figure 7-17 Connecting the DSL Interface Module to the POTS Splitter**

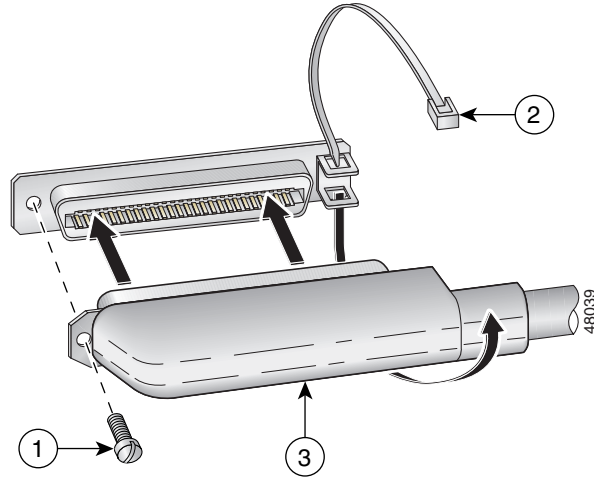


A system configuration using 8xDMT or 8xDMT over ISDNs requires the installation of an additional POTS splitter. The additional POTS splitter expands the system capacity to 48 subscriber ports. Figure 7-18 shows the cabling between the DSL interface module and two third-party POTS splitters. These connections are for xDSL data flow between the Cisco 6015 and the POTS splitters.

**Figure 7-18 Connecting the DSL Interface Module to Two POTS Splitters**



- Step 8** Use a flat-head screwdriver to screw in the Champ connectors, and tie wrap the connector to the chassis, as shown in Figure 7-19.

**Figure 7-19 Attaching the Champ Connector to the Chassis**

|          |                       |          |                 |
|----------|-----------------------|----------|-----------------|
| <b>1</b> | Champ connector screw | <b>3</b> | Champ connector |
| <b>2</b> | Tie wrap              |          |                 |

- Step 9** Plug the AC power cord into the wall outlet or reinsert the fuses in the fuse and alarm panel.
- Step 10** Set the circuit breaker on the DC PEM to the ON (1) position.

### 7.2.9.2 Removing a DSL Interface Module

Complete the following steps to remove a DSL interface module from the Cisco 6015 chassis:

- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.
- Step 2** Set the circuit breaker on the DC PEM to the OFF (0) position.
- Step 3** Disconnect the two Champ connector cables from the front of the DSL interface module.
- Step 4** Use a flat-head or Phillips-head screwdriver to unscrew the four screws that hold the DSL interface module to the Cisco 6015 chassis.
- Step 5** Hold the extraction handle on the front of the module and firmly pull the module out of the slot.
- See the “Installing a DSL Interface Module” section on page 7-21 for DSL interface module installation procedures.

## 7.2.10 DC PEM Installation and Removal

The following sections detail the installation and removal procedures for the DC PEM.

### 7.2.10.1 Installing a DC PEM

Complete the following steps to install the DC PEM in the Cisco 6015 chassis:



**Note**

If you are using AC power and the power cord is plugged into the wall outlet, unplug it.

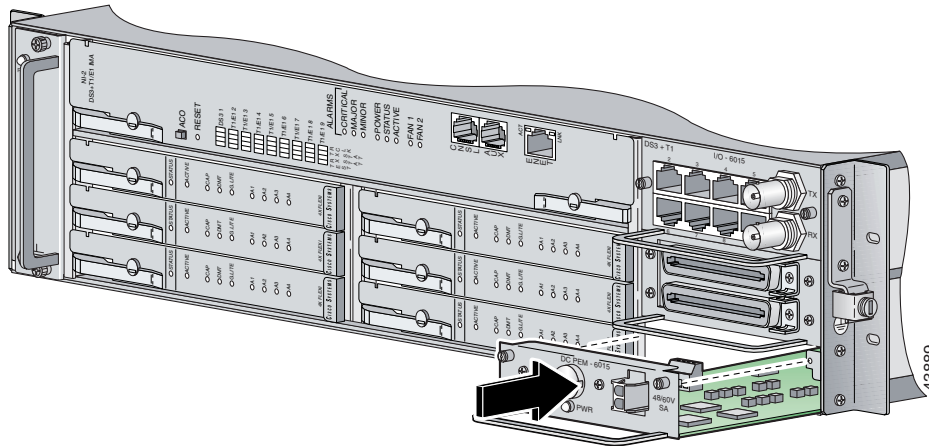
If you are using DC power and the fuses are installed in the fuse and alarm panel, remove them. You can replace the fuses after the system is installed and connected.

The fuse and alarm panel is not provided by Cisco.

- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.
- Step 2** Set the circuit breaker on the DC PEM to the OFF (0) position.
- Step 3** Horizontally align the module edge with the module guides at the right and left of the slot in the Cisco 6015.

Figure 7-20 shows the DC PEM installation.

**Figure 7-20 DC PEM Installation**



- Step 4** Hold the extraction handle on the front of the module and gently apply pressure while carefully pushing the module into the slot.



**Note**

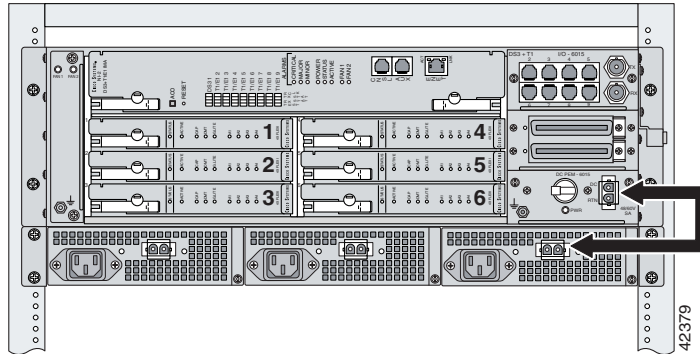
Forcefully inserting the DC PEM in the slot could cause damage to the EMI gasketing located on the top of the faceplate.

- Step 5** Push on the faceplate of the module to fully seat the module.
- Step 6** Use a flat-head or Phillips-head screwdriver and two screws to attach the DC PEM to the Cisco 6015 chassis.



- Step 7** If you are using AC power, connect the DC PEM to the AC/DC converter.
- Attach one end of the DC power cable (part number 72-2178-01) to the DC PEM, as shown in Figure 7-21.

**Figure 7-21 Connecting the DC PEM to the AC/DC Converter**



- Attach the other end of the cable to the AC/DC converter, as shown in Figure 7-21.
- Attach the AC power cord to the AC/DC converter.

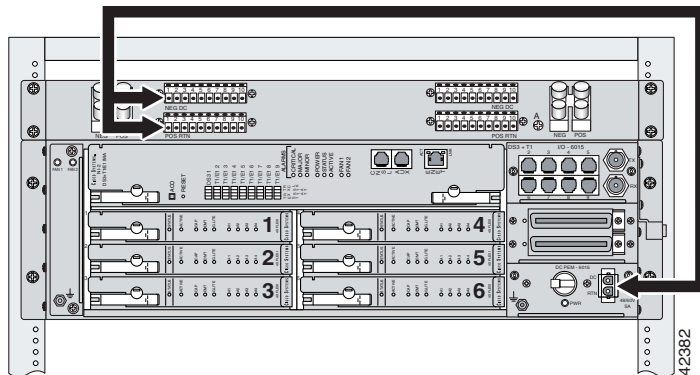


**Caution**

If the power connections are improperly connected and power is applied while the cards are installed, the cards and chassis could be damaged.

- Step 8** If you are using DC power, connect the DC PEM to the fuse and alarm panel.
- Attach one end of the DC power cable (part number 72-2223-01) to the DC PEM, as shown in Figure 7-22.

**Figure 7-22 Connecting the DC PEM to the Fuse and Alarm Panel**



- Attach the red wire coming from the DC PEM to a fuse and alarm panel POS (positive) DC connector, as shown in Figure 7-22.
- Attach the black wire coming from the DC PEM to a fuse and alarm panel NEG (negative) DC connector, as shown in Figure 7-22.

**Note**


---

Connect each Cisco 6015 system component to a separate fuse. Do not power the components in the rack by chaining them together.

See the “DC Power” section on page 2-16 for the calculation tables that are necessary to determine the minimum power requirement for each component that is wired to the fuse and alarm panel.

---

- Step 9** Plug the AC power cord into the wall outlet or reinsert the fuses in the fuse and alarm panel.
- Step 10** Set the circuit breaker on the DC PEM to the ON (1) position.
- Step 11** Verify that the DC PEM is operational by locating the LEDs on the front of the DC PEM. If the LED is
- Green—Output is correct.
  - Off—DC PEM is not operational. See the “DC PEM Problems” section on page 6-16 for troubleshooting procedures.
- Step 12** Verify that the AC/DC converter is operational by locating the LEDs on the front of the AC/DC converter.
- If the left LED is green, this indicates that there is good AC input.
  - If the right LED is green, this indicates that there is good DC output between the AC/DC converter and the DC PEM.
  - If either LED is off, troubleshoot the AC/DC converter or the AC input.
- 

## 7.2.10.2 Removing a DC PEM

Complete the following steps to remove a DC PEM from the Cisco 6015 chassis:

- 
- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the fan module.
- Step 2** Set the circuit breaker on the DC PEM to the OFF (0) position.
- Step 3** Unplug the power cord from the wall outlet, if you are using AC power.
- Step 4** Remove the fuses from the fuse and alarm panel, if you are using DC power.
- Step 5** Disconnect the cable that runs from either the fuse and alarm panel or the AC/DC converter to the DC PEM.
- Step 6** Use a flat-head or Phillips-head screwdriver to unscrew the two screws that hold the DC PEM to the Cisco 6015 chassis
- Step 7** Hold the extraction handle on the front of the module and carefully slide the module out of the slot.
- See the “Installing a DC PEM” section on page 7-24 for DC PEM installation procedures.
-

## 7.2.11 Fan Module Installation and Removal

The following sections detail the installation and removal procedures for the fan module.

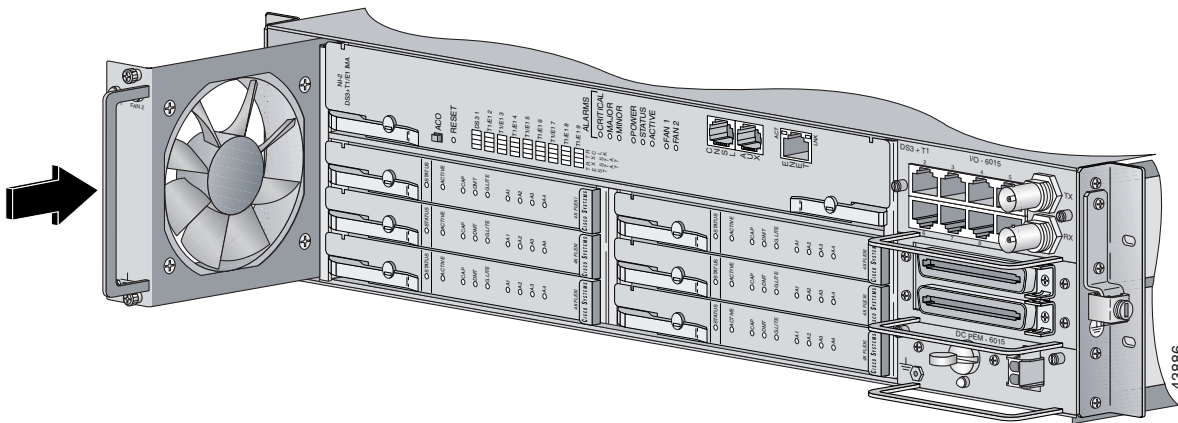
### 7.2.11.1 Installing the Fan Module

Complete the following steps to install the fan module in the Cisco 6015 chassis:

- 
- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the DC PEM.
  - Step 2** Vertically align the module edge with the module guides at the top and bottom of the slot in the Cisco 6015.

Figure 7-23 shows the fan module installation.

**Figure 7-23 Fan Module Installation in the Cisco 6015**



- Step 3** Hold the extraction handle on the right side of the module and gently apply pressure while pushing the module into the slot.
  - Step 4** Push on the faceplate of the module to fully seat the module.
  - Step 5** Align the two screws that are located at the top and bottom of the module with the screw holes in the Cisco 6015 chassis.
  - Step 6** Use a flat-head or Phillips-head screwdriver to tighten the screws to secure the fan module.
  - Step 7** Verify that the LEDs on the fan module are solid green once the module is installed and secured. If the LEDs are not green, see Chapter 6, “Troubleshooting,” for troubleshooting procedures.
- 

### 7.2.11.2 Removing the Fan Module

Complete the following steps to remove the fan module from the Cisco 6015 chassis:

- 
- Step 1** Connect a grounding strap to the ESD grounding jack that is located on the DC PEM.
  - Step 2** Use a flat-head or Phillips-head screwdriver to unscrew the two screws that hold the fan module to the Cisco 6015 chassis.

**Step 3** Hold the extraction handle on the right side of the module and carefully slide the module out of the slot.

**Caution**

---

The Cisco 6015 requires that a fan module be installed when the system is in operation. See the “Installing the Fan Module” section on page 7-27 for fan module installation procedures.

---

## 7.2.12 AC/DC Converter Installation and Removal

For installation and removal procedures for the AC/DC converter, refer to the AC/DC converter documentation.



## Technical Specifications

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This appendix provides the technical specifications for the Cisco 6015 system. The appendix contains the following sections:

- Hardware Specifications, page A-1
- Software Specifications, page A-11



**Note**

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For information on site and safety requirements, see Chapter 2, “Preparing for Installation.”

---

### A.1 Hardware Specifications

This section details the specifications for the following hardware components:

- Cisco 6015 chassis
- Quad-port flexi ATU-C line card (4xflexi)
- Octal-port Discrete Multitone (DMT) ATU-C line card (8xDMT)
- Octal-port DMT ATU-C over ISDN line card (8xDMT over ISDN)
- Octal-port single-pair high-speed digital subscriber line, also known as symmetric high bit-rate digital subscriber loop (G.SHDSL) line card (8xG.SHDSL)
- DS3+T1/E1 inverse multiplexing over ATM (IMA) NI-2 card and industrial temperature (ITEMP) DS3+T1/E1 IMA NI-2 card
- OC-3c/OC-3c NI-2 card
- Input/Output (I/O) module
- DSL interface module
- DC power entry module (PEM)
- Fan module

## A.1.1 Cisco 6015 System Specifications

Table A-1 lists the hardware specifications of the Cisco 6015 system.

**Table A-1 Hardware Specifications**

| Specification                     |                                   | Description                                                                                                                                                                                                                                                  |
|-----------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimensions                        | Cisco 6015                        | 3 RUs <sup>2</sup> —5.25 in. x 17.48 in. x 11.02 in. (13.34 cm x 44.40 cm x 27.99 cm)                                                                                                                                                                        |
|                                   | AC/DC converter tray <sup>1</sup> | 1 RU—1.75 in. x 19 in. x 13 in. (4.45 cm x 48.26 cm x 33.02cm)                                                                                                                                                                                               |
|                                   | AC/DC converter                   | 1 RU—1.75 in. x 5.75 in. x 13 in. (4.45 cm x 14.61 cm x 33.02 cm)                                                                                                                                                                                            |
| Weight                            | Cisco 6015                        | Empty—Approximately 14.5 lb (6.59 kg)                                                                                                                                                                                                                        |
|                                   | AC/DC converter                   | Loaded—Approximately 26.04 lb (11.84 kg)<br>6 lb (2.73 kg)                                                                                                                                                                                                   |
| Network interface                 |                                   | DS3+T1/E1IMA <ul style="list-style-type: none"> <li>• DS3 WAN uplink</li> <li>• T1/E1 interface configured as either WAN or subtend</li> <li>• T1/E1 interfaces can be configured in up to four IMA groups</li> </ul> ATM OC-3c (single- or multimode fiber) |
| ADSL interface                    |                                   | CAP—Up to 7.168 Mbps downstream/1.088 Mbps upstream per port<br>DMT—Up to 8.032 Mbps downstream/1024 kbps upstream per port<br>G.lite—Up to 1.536 Mbps downstream/512 kbps upstream per port                                                                 |
| SHDSL interface                   |                                   | TC-PAM <sup>3</sup> —Up to 2.312 Mbps downstream/upstream                                                                                                                                                                                                    |
| Craft interface                   |                                   | Console terminal connection on the NI-2 card                                                                                                                                                                                                                 |
| Management access                 |                                   | <ul style="list-style-type: none"> <li>• RJ-45 interface for craft alarm discovery</li> <li>• RJ-45 Ethernet</li> <li>• ATM in-band management</li> </ul>                                                                                                    |
| External alarm contacts           |                                   | Single dry contact alarm input, Normally Open (NO)                                                                                                                                                                                                           |
| Power requirements                |                                   | <ul style="list-style-type: none"> <li>• -48/-60V DC</li> <li>• 120/240 AC, with optional AC/DC converter</li> </ul> <b>Note</b> See Chapter 2, “Preparing for Installation,” for detailed power requirements.                                               |
| Commercial operating requirements | Temperature                       | 41 to 104°F (5 to 40°C)—Operating<br>23 to 131°F (-5 to 55°C)—Short-term operating                                                                                                                                                                           |
|                                   | Altitude                          | -197 to 13,123 feet (-60 to 4000 meters)                                                                                                                                                                                                                     |
|                                   | Humidity                          | 5 to 90% (noncondensing)                                                                                                                                                                                                                                     |

**Table A-1 Hardware Specifications (continued)**

| Specification                        |             | Description                                                                                                             |
|--------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------------|
| Outside Plant operating requirements | Temperature | –40 to 149°F (–40 to 65°C)—Operating                                                                                    |
|                                      | Altitude    | –197 to 13,123 feet (–60 to 4000 meters)                                                                                |
|                                      | Humidity    | 5 to 95% (noncondensing)                                                                                                |
| Subtending                           |             | <ul style="list-style-type: none"> <li>I/O module</li> <li>One OC-3c connection on the OC-3c/OC-3c NI-2 card</li> </ul> |

- For additional hardware specifications for the AC/DC converter or converter tray, refer to the AC/DC converter documentation.
- RU = rack unit. An RU is equal to 1.75 inches (4.45 cm).
- TC-PAM = trellis coded pulse amplitude modulation.

## A.1.2 4xflexi Specifications

Table A-2 lists the specifications for the 4xflexi.

**Table A-2 4xflexi Specifications**

| Specification                                       | DMT Mode                                                                               | CAP Mode           | G.lite Mode          |
|-----------------------------------------------------|----------------------------------------------------------------------------------------|--------------------|----------------------|
| Standards supported                                 | ITU G.dmt (G.992.1)<br>ANSI T1.413                                                     | RADSL <sup>1</sup> | ITU G.lite (G.992.2) |
| Power consumption                                   | 17.5W                                                                                  | 13.5W              | 13W                  |
| Maximum data rates (per port)                       |                                                                                        |                    |                      |
| Downstream                                          | 8.032 Mbps                                                                             | 7.168 Mbps         | 1.536 Mbps           |
| Upstream                                            | 864 kbps                                                                               | 1.088 Mbps         | 512 kbps             |
| External interfaces                                 | 4 (no connectors on card)                                                              |                    |                      |
| Internal hardware                                   | AMD 186-based 3.3V 18-MHz CPU<br>128-KB SRAM<br>512K flash                             |                    |                      |
| Dimensions                                          | Height: 6.07 in. (15.42 cm)<br>Depth: 8.50 in. (21.59 cm)<br>Width: 0.88 in. (2.24 cm) |                    |                      |
| Weight                                              | 0.875 lb (0.4 kg)                                                                      |                    |                      |
| Minimum software and network management requirement | Cisco IOS—Release 12.1(4)DA<br>CDM <sup>2</sup> —Release 3.2 (optional)                |                    |                      |

- RADSL = rate-adaptive digital subscriber line.
- CDM = Cisco DSL Manager

## A.1.3 8xDMT Specifications

Table A-3 lists the specifications for the 8xDMT.

**Table A-3 8xDMT Specifications**

| Specification                                       | Description                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standards supported                                 | <ul style="list-style-type: none"> <li>ANSI T1.413-Issue 2, Category 1 only</li> <li>ANSI T1.413-Issue 2, Annex F (Reduced NEXT)\</li> <li>Universal Test &amp; Operations PHY for ATM, Level 2; A standard for transport of ATM cells over a 16-bit parallel data bus. Refer to the ATM Forum document af-phy-0039.000.</li> <li>ITU G.992.1, Annex A (G.dmt)</li> <li>ITU G.992.2. (G.lite)</li> <li>ITU G.994.1. (G.hs)</li> </ul> |
| External interfaces                                 | 8 (no connectors on card)                                                                                                                                                                                                                                                                                                                                                                                                             |
| Data rates (per port)                               | Upstream: Up to 1024 kbps<br>Downstream: Up to 8.064 Mbps                                                                                                                                                                                                                                                                                                                                                                             |
| Internal hardware                                   | <ul style="list-style-type: none"> <li>40 MHz Motorola MPC850 microprocessor</li> <li>8MB SDRAM</li> <li>1 Mb boot flash</li> <li>1 kb serial EEPROM</li> </ul>                                                                                                                                                                                                                                                                       |
| Dimensions                                          | Height: 6.07 in. (15.42 cm)<br>Depth: 8.50 in. (21.59 cm)<br>Width: 0.88 in. (2.24 cm)                                                                                                                                                                                                                                                                                                                                                |
| Weight                                              | 0.875 lb (0.4 kg)                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Power consumption                                   | 24W                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Minimum software and network management requirement | Commercial version: <ul style="list-style-type: none"> <li>Cisco IOS—Release 12.1(6)DA</li> <li>CDM<sup>1</sup>—Release 3.3(2) (optional)</li> </ul> Outside-plant version: <ul style="list-style-type: none"> <li>Cisco IOS—Release 12.2(5)DA</li> <li>CDM—Release 3.4 (optional)</li> </ul>                                                                                                                                         |

1. CDM = Cisco DSL Manager



## A.1.4 8xDMT Over ISDN Specifications

Table A-4 lists the specifications for the 8xDMT over ISDN.

**Table A-4 8xDMT Over ISDN Specifications**

| Specification                                       | Description                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standards supported                                 | <ul style="list-style-type: none"> <li>• Universal Test &amp; Operations PHY for ATM, Level 2; standard for transport of ATM cells over a 16-bit parallel data bus. Refer to ATM Forum document af-phy-0039.000.</li> <li>• ITU G.992.1 (G.dmt), Annex B/ETSI</li> <li>• ITU G.994.1 (G.hs)</li> <li>• ETSI TS 101 388 V.1.1.1/(draft) TM6(98)12</li> <li>• TS102 080 v1.3.2 -Support for 2B1Q and 4B3T ISDN</li> </ul> |
| External interfaces                                 | 8 (no connectors on card)                                                                                                                                                                                                                                                                                                                                                                                               |
| Data rates (per port)                               | Upstream: Up to 1024 kbps<br>Downstream: Up to 7.616 Mbps                                                                                                                                                                                                                                                                                                                                                               |
| Framing mode                                        | Overhead Framing Mode 3 supported                                                                                                                                                                                                                                                                                                                                                                                       |
| Internal hardware                                   | <ul style="list-style-type: none"> <li>• 40 MHz Motorola MPC850 microprocessor</li> <li>• 64 MB SDRAM</li> <li>• 16 Mb boot Flash</li> <li>• 1 KB serial EEPROM</li> </ul>                                                                                                                                                                                                                                              |
| Dimensions                                          | Height: 6.07 in. (15.42 cm)<br>Depth: 8.62 in. (21.89 cm)<br>Width: 0.88 in. (2.24 cm)                                                                                                                                                                                                                                                                                                                                  |
| Weight                                              | 0.875 lb (0.4 kg)                                                                                                                                                                                                                                                                                                                                                                                                       |
| Power consumption                                   | 24 W                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Minimum software and network management requirement | Cisco IOS—Release 12.2(5) DA<br>CDM—Release 3.3(3-2) (optional)                                                                                                                                                                                                                                                                                                                                                         |

## A.1.5 8xG.SHDSL Specifications

Table A-5 lists the specifications for the 8xG.SHDSL.

**Table A-5 8xG.SHDSL Line Card Specifications**

| Specification                                                            | Description                                                                                                |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Standards supported                                                      | TC-PAM without OPTIS<br>ITU G.991.2<br>ITU G.994.1<br>ETSI SDSL, TM6(00)10<br>ETSI SDSL DRAFT (TS 101 524) |
| Power consumption                                                        | 11.3W at 136 kbps<br>15.0W at 1.554 Mbps<br>16.5W at 2.312 Mbps                                            |
| Maximum data rates (per port)                                            | 2.312 Mbps                                                                                                 |
| Maximum data rate (per card)<br>Minimum software<br>Cisco IOS 12.1(7)DA2 | 18.5 Mbps downstream<br>5.0 Mbps for odd ports upstream<br>5.0 Mbps for even ports upstream                |
| Maximum data rate (per card)<br>Minimum software<br>Cisco IOS 12.2(7)    | 18.5 Mbps downstream<br>18.5 Mbps upstream                                                                 |
| External interfaces                                                      | 8 (no connectors on card)                                                                                  |
| Internal hardware                                                        | MPC850 3.3V power 40-Mhz CPU                                                                               |
| Dimensions                                                               | Height: 6.07 in. (15.42 cm)<br>Depth: 8.50 in. (21.59 cm)<br>Width: 0.88 in. (2.24 cm)                     |
| Weight                                                                   | 0.70 lb (0.32 kg)                                                                                          |
| Minimum software and network management requirement                      | Cisco IOS 12.1(7)DA2<br>CDM 3.3.3 (optional)                                                               |
| Minimum requirements for rate adaptive DSL.                              | Cisco IOS 12.2(7)<br>CDM 3.4 (optional)                                                                    |

## A.1.6 DS3+T1/E1 IMA and ITEMP DS3+T1/E1 IMA NI-2 Cards Specifications

Table A-6 lists the specifications for the DS3+T1/E1 IMA and the ITEMP DS3+T1/E1 IMA NI-2 cards.

**Table A-6 DS3+T1/E1 IMA and ITEMP DS3+T1/E1 IMA NI-2 Card Specifications**

| Specification         | Description                                                                                                                                                                                               |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal hardware     | 150 MHz RC64475 CPU<br>Galileo GT64120 system controller<br>1M x 32 bootflash<br>4M x 32 Flash<br>512 KB boot EPROM                                                                                       |
| Dimensions            | Height: 12.38 in. (31.45 cm)<br>Depth: 8.50 in. (21.59 cm)<br>Width: 1.80 in. (4.57 cm)                                                                                                                   |
| Weight                | 3.0 lb (1.36 kg)                                                                                                                                                                                          |
| External interfaces   | One DS3 (44.736 Mbps) coaxial port<br>Eight T1(1.544 Mbps)/E1 (2.048 Mbps) RJ-48 ports                                                                                                                    |
| Connector type        | DS3—BNC <sup>1</sup><br>E1/T1—RJ-48 <sup>2</sup>                                                                                                                                                          |
| Impedance             | DS3—75 ohms (nominal)<br>T1—100 ohms (nominal)<br>E1—120 ohms (nominal)                                                                                                                                   |
| Line encoding         | DS3—B3ZS<br>T1—AMI or B8ZS<br>E1—AMI or HDB3                                                                                                                                                              |
| Framing               | DS3—C-bit parity, optionally PLCP with M23, otherwise ADM <sup>3</sup><br>T1—SF or ESF<br>E1—PCM30 or CRC4                                                                                                |
| Transmission distance | DS3—Short haul: <225 feet (68.58 meters), long haul: 225 to 450 feet (68.58 to 137.16 meters)<br>T1/E1—Short haul: 0 to 655 feet (0 to 199.64 meters), long haul: >655 feet (199.64 meters) no span power |

**Table A-6 DS3+T1/E1 IMA and ITEMP DS3+T1/E1 IMA NI-2 Card Specifications (continued)**

|                                                     |                                                                                                                                                                                                                                                                                                |
|-----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power consumption                                   | 32.5W                                                                                                                                                                                                                                                                                          |
| Minimum software and network management requirement | Commercial environment: <ul style="list-style-type: none"> <li>• Cisco IOS—Release 12.1(4)DA</li> <li>• CDM—Release 3.2 (optional)</li> </ul> Outside-plant environment: <ul style="list-style-type: none"> <li>• Cisco IOS—Release 12.2(5)DA</li> <li>• CDM—Release 3.4 (optional)</li> </ul> |

1. The BNC connectors are located on the I/O module.
2. The E1 and T1 connectors are located on the I/O module.
3. ADM = add drop multiplexor

## A.1.7 OC-3c/OC-3c NI-2 Card Specifications

Table A-7 lists the specifications of the single-mode and multimode versions of the OC-3c/OC-3c NI-2 card.

**Table A-7 OC-3c/OC-3c NI-2 Card Specifications**

| Specification                                       | Description                                                                                                                                       |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Internal hardware                                   | 150 MHz RC64475 CPU<br>Galileo GT64120 system controller<br>1 M x 32 bootflash <sup>1</sup> (4 MB)<br>4 M x 32 Flash (16 MB)<br>512 KB boot EPROM |
| Dimensions                                          | Height: 12.38 in. (31.45 cm)<br>Depth: 8.50 in. (21.59 cm)<br>Width: 1.80 in. (4.57 cm)                                                           |
| Weight                                              | 3.0 lb (1.36 kg)                                                                                                                                  |
| Layer 2 protocol                                    | ATM                                                                                                                                               |
| Power consumption                                   | 33.5W                                                                                                                                             |
| Minimum software and network management requirement | Cisco IOS—Release 12.2(5)DA<br>CDM—Release 3.2 (optional)                                                                                         |

**Table A-7 OC-3c/OC-3c NI-2 Card Specifications (continued)**

|                           | Single Mode Card                             | Multimode Card                             |
|---------------------------|----------------------------------------------|--------------------------------------------|
| External interfaces       | Two OC-3c/STM-1 (155 Mbps) single-mode ports | Two OC-3c/STM-1 (155 Mbps) multimode ports |
| Connector type            | SC-PC                                        | SC-PC                                      |
| Fiber type                | Intermediate reach single mode               | Multimode                                  |
| Average transmitted power | -15 to -8 dBm                                | -20 to -14 dBm                             |
| Average received power    | -8 dBm                                       | -11 dBm                                    |
| Transmission distance     | Up to 20 km (12 miles)                       | Up to 2 km (1.2 miles)                     |
| Wavelength                | 1310 nm                                      | 1300 nm                                    |

1. The version of the OC-3c/OC-3c NI-2 card with enhanced upstream bandwidth features (NI2-155SM-155SM2 and NI2-155MM-155MM2) has a 2M x 32 bootflash (8 MB).

## A.1.8 I/O Module Specifications

Table A-8 lists the specifications for the I/O module.

**Table A-8 I/O Module Specifications**

| Specification                                       | Description                                                                                |                                                              |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| Dimensions                                          | Height: 1.688 in. (4.29 cm)<br>Depth: 9.375 in. (23.813 cm)<br>Width: 3.375 in. (8.573 cm) |                                                              |
| Weight                                              | 0.64 lb (0.29 kg)                                                                          |                                                              |
| External interfaces                                 | One DS3 (44.736 Mbps) coaxial port<br>Eight T1 (1.544 Mbps)/E1 (2.048 Mbps) RJ-48 ports    |                                                              |
| Connector type                                      | DS3—BNC <sup>1</sup><br>E1/T1—RJ-48                                                        |                                                              |
| Power consumption                                   | 3W                                                                                         |                                                              |
| Minimum software and network management requirement | Use with a DS3+T1/E1 IMA NI-2 card in a commercial environment                             | Cisco IOS—Release 12.1(4)DA<br>CDM <sup>2</sup> —Release 3.2 |
|                                                     | Use with an ITEMP DS3+T1/E1 IMA NI-2 card in an outside-plant environment                  | Cisco IOS—Release 12.1(6)DA<br>CDM—Release 3.4               |
|                                                     | Use with an OC-3c/OC-3c NI-2 card in a commercial environment                              | Cisco IOS—Release 12.2(5)DA<br>CDM—Release 3.2               |

1. BNC = Bayonet-Neill Concelman.
2. CDM = Cisco DSL Manager

## A.1.9 DSL Interface Module Specifications

Table A-9 lists the specifications for the DSL interface module.

**Table A-9 DSL Interface Module Specifications**

| Specification                                       | Description                                                                                 |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------|
| Dimensions                                          | Height: 1.375 in. (3.493 cm)<br>Depth: 9.375 in. (23.813 cm)<br>Width: 3.375 in. (8.573 cm) |
| Weight                                              | 0.71 lb (0.32 kg)                                                                           |
| Data connectors                                     | Two 50-pin Champ connectors                                                                 |
| Power consumption                                   | Not applicable.                                                                             |
| Minimum software and network management requirement | Cisco IOS—Release 12.1(4)DA<br>CDM—Release 3.2 (optional)                                   |

## A.1.10 DC PEM Specifications

Table A-10 lists the specifications for the DC PEM.

**Table A-10 DC PEM Specifications**

| Specification                                       | Description                                                                              |
|-----------------------------------------------------|------------------------------------------------------------------------------------------|
| Dimensions                                          | Height: 1.56 in. (3.96 cm)<br>Depth: 9.875 in. (25.08 cm)<br>Width: 3.375 in. (8.573 cm) |
| Weight                                              | 1.08 lb (0.49 kg)                                                                        |
| Power consumption                                   | 20W                                                                                      |
| Minimum software and network management requirement | Cisco IOS—Release 12.1(4)DA<br>CDM—Release 3.2 (optional)                                |

## A.1.11 Fan Module Specifications

Table A-11 lists the specifications for the fan module.

**Table A-11 Fan Module Specifications**

| Specification                                       | Description                                                                             |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------|
| Dimensions                                          | Height: 5.0 in. (12.7 cm)<br>Depth: 9.375 in. (23.813 cm)<br>Width: 1.125 in. (2.86 cm) |
| Weight                                              | 0.87 lb (0.40 kg)                                                                       |
| Power consumption                                   | 9W                                                                                      |
| Minimum software and network management requirement | Cisco IOS—Release 12.1(4)DA<br>CDM—Release 3.2 (optional)                               |

## A.2 Software Specifications

Table A-12 lists Cisco 6015 system software specifications.

**Table A-12 Software Specifications**

| Specification           | Description                                                                  |
|-------------------------|------------------------------------------------------------------------------|
| Management protocols    | IOS software support for SNMP to Cisco EMF <sup>1</sup>                      |
| Management applications | <ul style="list-style-type: none"> <li>• Cisco IOS</li> <li>• CDM</li> </ul> |
| Management interfaces   | In band—ATM VC<br>Out of band—10BaseT Ethernet, console, auxiliary           |

1. EMF = Element Management Framework







# Cable and Port Mapping Specifications

This appendix provides cabling guidelines, cabling configuration diagrams, and port mapping tables.

  
**Warning**

**Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**

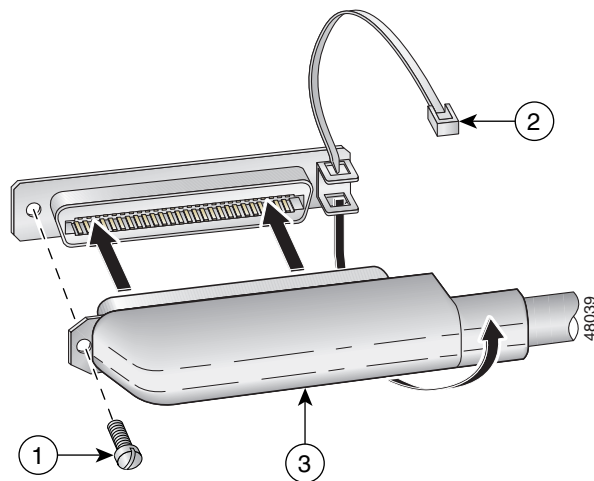
Cisco used a standard telco color chart when designing the cables for the Cisco 6015 connections. This appendix includes a standard telco color chart.

See Table 2-6 on page 2-19 for cable part numbers and specifications.

## B.1 Cabling Guidelines

You need to ensure that all Champ connectors are securely fastened (screwed in) and tie wrapped to the connector bracket, as shown in Figure B-1.

**Figure B-1 Attaching the Champ Connector to the Chassis**



|   |                       |   |                 |
|---|-----------------------|---|-----------------|
| 1 | Champ connector screw | 3 | Champ connector |
| 2 | Tie wrap              |   |                 |

## B.2 Cabling Configuration Diagrams

You can use third-party POTS splitters in a Cisco 6015 with a POTS splitter configuration. Please verify the compatibility with your Cisco representative.

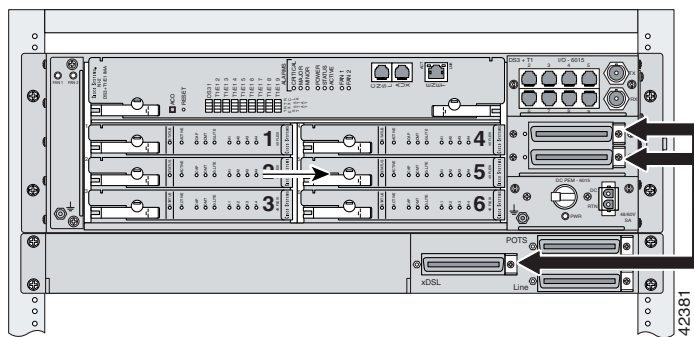


### Note

See Table 2-6 on page 2-19 for cable and ferrite requirements. If unshielded cable is used for FCC Class A or EN55022 Class A compliance, the cables will need to be looped through ferrites.

Figure B-2 shows the cabling between the DSL interface module and a third-party POTS splitter. These connections are for xDSL data flow between the Cisco 6015 and the third-party POTS splitter.

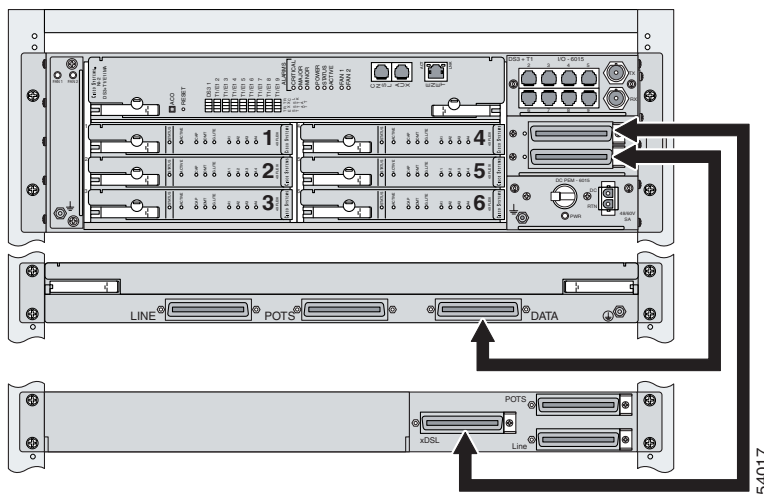
**Figure B-2** Connecting the DSL Interface Module to the POTS Splitter



A system configuration using 8xDMTs or 8xDMT over ISDNs requires a POTS splitter that expands the system capacity to 48 subscriber ports.

Figure B-3 shows the cabling between the DSL interface module and two third-party POTS splitters. These connections are for xDSL data flow between the Cisco 6015 and the POTS splitters.

**Figure B-3** Connecting the DSL Interface Module to Two POTS Splitters



## B.3 Port Mapping Tables

Table B-1 maps the Cisco 6015 ports, the POTS splitter ports, and the wire pairs when connecting a Cisco 6015 to two POTS splitters.



**Note** In a system configuration using quad-port flexi ATU-C line cards (4xflexis), install only one POTS splitter.

In a system configuration using 8xDMTs or 8xDMT over ISDNs, install an additional POTS splitter. The additional POTS splitter expands the system capacity to 48 subscriber ports.

**Table B-1 Port Mapping for a Cisco 6015 to Two POTS Splitters**

| Cisco 6015 DSL Connector         | Slot/Line | Tip/Ring | Cisco 6015 DSL Connector         | Slot/Line | Tip/Ring |
|----------------------------------|-----------|----------|----------------------------------|-----------|----------|
| Connector 1<br>Slots 1 through 3 | 1/1       | 26/1     | Connector 2<br>Slots 4 through 6 | 4/1       | 26/1     |
|                                  | 1/2       | 27/2     |                                  | 4/2       | 27/2     |
|                                  | 1/3       | 28/3     |                                  | 4/3       | 28/3     |
|                                  | 1/4       | 29/4     |                                  | 4/4       | 29/4     |
|                                  | 1/5       | 30/5     |                                  | 4/5       | 30/5     |
|                                  | 1/6       | 31/6     |                                  | 4/6       | 31/6     |
|                                  | 1/7       | 32/7     |                                  | 4/7       | 32/7     |
|                                  | 1/8       | 33/8     |                                  | 4/8       | 33/8     |
|                                  | 2/1       | 34/9     |                                  | 5/1       | 34/9     |
|                                  | 2/2       | 35/10    |                                  | 5/2       | 35/10    |
|                                  | 2/3       | 36/11    |                                  | 5/3       | 36/11    |
|                                  | 2/4       | 37/12    |                                  | 5/4       | 37/12    |
|                                  | 2/5       | 38/13    |                                  | 5/5       | 38/13    |
|                                  | 2/6       | 39/14    |                                  | 5/6       | 39/14    |
|                                  | 2/7       | 40/15    |                                  | 5/7       | 40/15    |
|                                  | 2/8       | 41/16    |                                  | 5/8       | 41/16    |
|                                  | 3/1       | 42/17    |                                  | 6/1       | 42/17    |
|                                  | 3/2       | 43/18    |                                  | 6/2       | 43/18    |
|                                  | 3/3       | 44/19    |                                  | 6/3       | 44/19    |
|                                  | 3/4       | 45/20    |                                  | 6/4       | 45/20    |
|                                  | 3/5       | 46/21    |                                  | 6/5       | 46/21    |
|                                  | 3/6       | 47/22    |                                  | 6/6       | 47/22    |
|                                  | 3/7       | 48/23    |                                  | 6/7       | 48/23    |
|                                  | 3/8       | 49/24    |                                  | 6/8       | 49/24    |
| Not used                         | 50/25     | Not used | 50/25                            |           |          |

Table B-2 maps the Cisco 6015 ports, the POTS splitter ports, and the wire pairs when using the Y-cables to connect one POTS splitter.

**Table B-2 Port Mapping for a Cisco 6015 to One POTS Splitter**

| DSL Port/Slot | POTS Champ<br>Tip/Ring | Cisco 6015                           |                                      |
|---------------|------------------------|--------------------------------------|--------------------------------------|
|               |                        | DSL Champ<br>Connector 1<br>Tip/Ring | DSL Champ<br>Connector 2<br>Tip/Ring |
| Port 1/1      | 26/1                   | 26/1                                 | N/C                                  |
| Port 1/2      | 27/2                   | 27/2                                 | N/C                                  |
| Port 1/3      | 28/3                   | 28/3                                 | N/C                                  |
| Port 1/4      | 29/4                   | 29/4                                 | N/C                                  |
| Port 2/1      | 30/5                   | 34/9                                 | N/C                                  |
| Port 2/2      | 31/6                   | 35/10                                | N/C                                  |
| Port 2/3      | 32/7                   | 36/11                                | N/C                                  |
| Port 2/4      | 33/8                   | 37/12                                | N/C                                  |
| Port 3/1      | 34/9                   | 42/17                                | N/C                                  |
| Port 3/2      | 35/10                  | 43/18                                | N/C                                  |
| Port 3/3      | 36/11                  | 44/19                                | N/C                                  |
| Port 3/4      | 37/12                  | 45/20                                | N/C                                  |
| Port 4/1      | 38/13                  | N/C                                  | 26/1                                 |
| Port 4/2      | 39/14                  | N/C                                  | 27/2                                 |
| Port 4/3      | 40/15                  | N/C                                  | 28/3                                 |
| Port 4/4      | 41/16                  | N/C                                  | 29/4                                 |
| Port 5/1      | 42/17                  | N/C                                  | 34/9                                 |
| Port 5/2      | 43/18                  | N/C                                  | 35/10                                |
| Port 5/3      | 44/19                  | N/C                                  | 36/11                                |
| Port 5/4      | 45/20                  | N/C                                  | 37/12                                |
| Port 6/1      | 46/21                  | N/C                                  | 42/17                                |
| Port 6/2      | 47/22                  | N/C                                  | 43/18                                |
| Port 6/3      | 48/23                  | N/C                                  | 44/19                                |
| Port 6/4      | 49/24                  | N/C                                  | 45/20                                |
| N/C           | 50/25                  | N/C                                  | N/C                                  |

## B.4 Standard Telco Color Chart

In designing the cables for the Cisco 6015 connections, Cisco used a standard telco color chart. Table B-3 lists the colors that are used for the Cisco 6015 cables.

**Table B-3 Standard Telco Color Chart**

| Wire Color | P1 | Wire Color | P2 | Wire Color | P1 | Wire Color | P2 |
|------------|----|------------|----|------------|----|------------|----|
| Wht/blu    | 1  | Wht/blu    | 1  | Grn/blk    | 38 | Grn/blk    | 38 |
| Blu/wht    | 26 | Blu/wht    | 26 | Blk/brn    | 14 | Blk/brn    | 14 |
| Wht/org    | 2  | Wht/org    | 2  | Brn/blk    | 39 | Brn/blk    | 39 |
| Org/wht    | 27 | Org/wht    | 27 | Blk/gry    | 15 | Blk/gry    | 15 |
| Wht/grn    | 3  | Wht/grn    | 3  | Gry/blk    | 40 | Gry/blk    | 40 |
| Grn/wht    | 28 | Grn/wht    | 28 | Yel/blu    | 16 | Yel/blu    | 16 |
| Wht/brn    | 4  | Wht/brn    | 4  | Blu/yel    | 41 | Blu/yel    | 41 |
| Brn/wht    | 29 | Brn/wht    | 29 | Yel/org    | 17 | Yel/org    | 17 |
| Wht/gry    | 5  | Wht/gry    | 5  | Org/yel    | 42 | Org/yel    | 42 |
| Gry/wht    | 30 | Gry/wht    | 30 | Yel/grn    | 18 | Yel/grn    | 18 |
| Red/blu    | 6  | Red/blu    | 6  | Grn/yel    | 43 | Grn/yel    | 43 |
| Blu/red    | 31 | Blu/red    | 31 | Yel/brn    | 19 | Yel/brn    | 19 |
| Red/org    | 7  | Red/org    | 7  | Brn/yel    | 44 | Brn/yel    | 44 |
| Org/red    | 32 | Org/red    | 32 | Yel/gry    | 20 | Yel/gry    | 20 |
| Red/grn    | 8  | Red/grn    | 8  | Gry/yel    | 45 | Gry/yel    | 45 |
| Grn/red    | 33 | Grn/red    | 33 | Vio/blu    | 21 | Vio/blu    | 21 |
| Red/brn    | 9  | Red/brn    | 9  | Blu/vio    | 46 | Blu/vio    | 46 |
| Brn/red    | 34 | Brn/red    | 34 | Vio/org    | 22 | Vio/org    | 22 |
| Red/gry    | 10 | Red/gry    | 10 | Org/vio    | 47 | Org/vio    | 47 |
| Gry/red    | 35 | Gry/red    | 35 | Vio/grn    | 23 | Vio/grn    | 23 |
| Blk/blu    | 11 | Blk/blu    | 11 | Grn/vio    | 48 | Grn/vio    | 48 |
| Blu/blk    | 36 | Blu/blk    | 36 | Vio/brn    | 24 | Vio/brn    | 24 |
| Blk/org    | 12 | Blk/org    | 12 | Brn/vio    | 49 | Brn/vio    | 49 |
| Org/blk    | 37 | Org/blk    | 37 | Vio/gry    | 25 | Vio/gry    | 25 |
| Blk/grn    | 13 | Blk/grn    | 13 | Gry/vio    | 50 | Gry/vio    | 50 |





## Connector and Pinout Specifications

This appendix provides information about connectors, receptacles, and pinouts for a Cisco 6015 system.

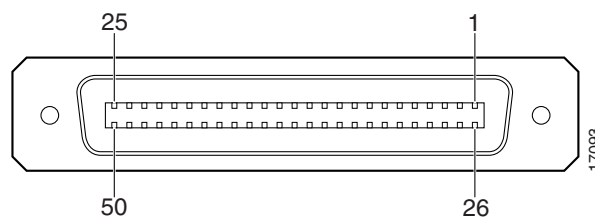
### C.1 xDSL Connectors

The DSL interface module of the Cisco 6015 chassis contains two Champ connector receptacles that connect to the ATU-C twisted-pair subscriber data interface. This connection can be made by either of the following methods:

- Through a POTS splitter for voice and data applications (Cisco 6015 with a POTS splitter configuration)
- Directly for data only applications (Cisco 6015 without a POTS splitter configuration)

Figure C-1 shows connector pin locations for the xDSL Champ connectors. Pin locations are the same for all Champ connectors.

**Figure C-1** xDSL Connector Pin Locations



**Note**

You must screw all cables into the backplane and tie wrap the Champ connectors (see “Cabling Guidelines” section on page B-1).

### C.2 T1/E1 Connectors

The RJ-48 receptacles on the network Input/Output (I/O) module are pinned out at customer premises equipment rather than central office equipment. Connecting from one T1/E1 connector to another T1/E1 connector requires a crossover cable.

Table C-1 lists the pinout descriptions for the T1/E1 connectors.

**Table C-1 T1/E1 Connector Pinouts**

| Pin Number | Signal Name |
|------------|-------------|
| 1          | RX ring     |
| 2          | RX tip      |
| 3          | Not used    |
| 4          | TX ring     |
| 5          | TX tip      |
| 6          | Not used    |
| 7          | Not used    |
| 8          | Not used    |

## C.3 Rear Interface Header

The only rear-accessible chassis component is the 5-pin header that connects the BITS interface (network clocking) and the facility alarm input.

Figure C-2 shows a close view of the pinouts that are located on the back of the Cisco 6015 chassis.

**Figure C-2 Cisco 6015 5-Pin Header**

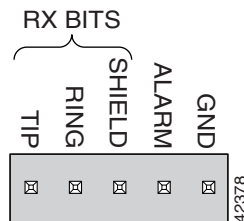


Table C-2 lists the pinout descriptions for the header contacts.

**Table C-2 Cisco 6015 5-Pin Header Contact Pinouts**

| Function             | Connector | Pin |
|----------------------|-----------|-----|
| BITS Interface       | Tip       | 1   |
|                      | Ring      | 2   |
|                      | Shield    | 3   |
| Facility Alarm Input | Alarm     | 4   |
|                      | Ground    | 5   |



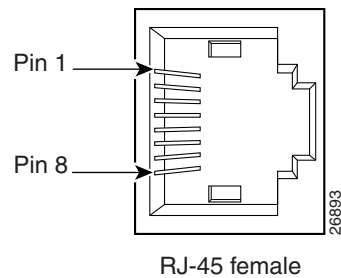
## C.4 Console and Auxiliary Ports

The console and auxiliary ports, which are two identical serial EIA/TIA-232 ports, use RJ-45 receptacles on the NI-2 card faceplate. Table C-3 shows the console and auxiliary pin assignments, and Figure C-3 shows an RJ-45 receptacle.

**Table C-3** Pin Assignments for the NI-2 Card Console and Auxiliary Receptacles

| Pin Number | Signal |
|------------|--------|
| 1          | RTS    |
| 2          | DTR    |
| 3          | TXD    |
| 4          | GND    |
| 5          | GND    |
| 6          | RXD    |
| 7          | DSR    |
| 8          | CTS    |

**Figure C-3** NI-2 Card Console and Auxiliary Receptacles



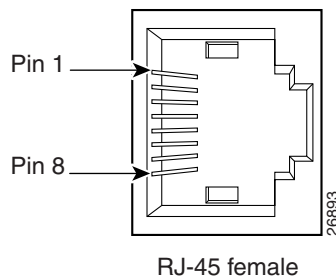
## C.5 Ethernet Port

The Ethernet port, a 10BaseT interface with an RJ-45 receptacle, is located on the NI-2 card faceplate. The Ethernet port is used to connect the Cisco 6015 to the management station, which is a Sun SPARCstation running Cisco DSL Manager (CDM) software. Table C-4 shows the Ethernet port pin assignments, and Figure C-4 shows an NI-2 card Ethernet receptacle.

**Table C-4 Pin Assignments for the NI-2 Card Management Ethernet Receptacle**

| Pin Number | Signal |
|------------|--------|
| 1          | TX+    |
| 2          | TX-    |
| 3          | RX+    |
| 4          | Unused |
| 5          | Unused |
| 6          | RX-    |
| 7          | Unused |
| 8          | Unused |

**Figure C-4 NI-2 Card Management Ethernet Receptacle**





## GLOSSARY

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### A

- AAL5** ATM adaptation layer 5. This layer maps higher layer user data into ATM cells, making the data suitable for transport through the ATM network.
- access identifier** See *AID*.
- address mask** A bit mask used to select bits from an Internet address for subnet addressing. The mask is 32 bits long and selects the network portion of the Internet address and one or more bits of the local portion. Sometimes called subnet mask.
- ADSL** asymmetric digital subscriber line. A digital subscriber line (DSL) technology in which the transmission of data from server to client is much faster than the transmission from the client to the server.
- ADSL Transmission Unit—central office** See *ATU-C*.
- ADSL Transmission Unit—remote** See *ATU-R*.
- AID** access identifier.
- AIS** alarm indication signal.
- American National Standards Institute** See *ANSI*.
- American Wire Gauge** See *AWG*.
- ANSI** American National Standards Institute. An organization that develops standards for many things, only some having to do with computers. ANSI is a member of the International Standards Organization (ISO). See *ISO*.
- asymmetric digital subscriber line** See *ADSL*.
- asynchronous communications** A method of transmitting data in which each transmitted character is sent separately. The character has integral start and stop bits so that the character can be sent at an arbitrary time, and separate from any other character.
- Asynchronous Transfer Mode** See *ATM*.

|                               |                                                                                                                                                                                                                                   |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ATM</b>                    | Asynchronous Transfer Mode. A cell-based data transfer technique in which channel demand determines packet allocation. ATM offers fast packet technology, real time, demand led switching for efficient use of network resources. |
| <b>ATM adaptation layer 5</b> | See <i>AAL5</i> .                                                                                                                                                                                                                 |
| <b>ATU-C</b>                  | ADSL Transmission Unit—central office.                                                                                                                                                                                            |
| <b>ATU-R</b>                  | ADSL Transmission Unit—remote.                                                                                                                                                                                                    |
| <b>authentication</b>         | A security feature that allows access to information to be granted on an individual basis.                                                                                                                                        |
| <b>autonegotiation</b>        | Procedure for adjusting line speeds and other communication parameters automatically between two computers during data transfer.                                                                                                  |
| <b>AWG</b>                    | American Wire Gauge. The measurement of thickness of a wire.                                                                                                                                                                      |

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**B**

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>bandwidth</b>                      | The range of frequencies a transmission line or channel can carry: the greater the bandwidth, the greater the information-carrying capacity of a channel. For a digital channel this is defined in bits. For an analog channel, it is dependent on the type and method of modulation used to encode the data.                                                                                                                           |
| <b>bandwidth on demand</b>            | The ability of a user to dynamically set upstream and downstream line speeds to a particular rate of speed.                                                                                                                                                                                                                                                                                                                             |
| <b>BOOTP</b>                          | A TCP/IP network protocol that lets network nodes request configuration information from a BOOTP “server” node.                                                                                                                                                                                                                                                                                                                         |
| <b>bps</b>                            | bits per second. A standard measurement of digital transmission speeds.                                                                                                                                                                                                                                                                                                                                                                 |
| <b>bits per second</b>                | See <i>bps</i> .                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>bridge</b>                         | A device that connects two or more physical networks and forwards packets between them. Bridges can usually be made to filter packets, that is, to forward only certain traffic. Related devices are: repeaters which simply forward electrical signals from one cable to the other, and full-fledged routers which make routing decisions based on several criteria. See repeater and router.                                          |
| <b>broadband</b>                      | Characteristic of any network that multiplexes independent network carriers onto a single cable. This is usually done using frequency division multiplexing (FDM). Broadband technology allows several networks to coexist on one single cable; traffic from one network does not interfere with traffic from another since the “conversations” happen on different frequencies in the “ether” rather like the commercial radio system. |
| <b>broadband remote access server</b> | Device that terminates remote users at the corporate network or Internet users at the ISP network that provides firewall, authentication, and routing services for remote users.                                                                                                                                                                                                                                                        |
| <b>broadcast</b>                      | A packet delivery system where a copy of a given packet is given to all hosts attached to the network. Example: Ethernet.                                                                                                                                                                                                                                                                                                               |

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**C**

|                                                         |                                                                                                                                                                                                                                            |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CAP</b>                                              | Carrierless Amplitude and Phase Modulation. A modulation technology for ADSL.                                                                                                                                                              |
| <b>Carrierless Amplitude and Phase Modulation</b>       | See <i>CAP</i> .                                                                                                                                                                                                                           |
| <b>CBOS</b>                                             | Cisco Broadband Operating System. Operating System that users access to configure and operate the Cisco products.                                                                                                                          |
| <b>CCO</b>                                              | Cisco Connection Online.                                                                                                                                                                                                                   |
| <b>cell relay</b>                                       | Generic term for a protocol based on small fixed packet sizes capable of supporting voice, video, and data at very high speeds.                                                                                                            |
| <b>central office</b>                                   | See <i>CO</i> .                                                                                                                                                                                                                            |
| <b>Channel Service Unit/Data Service Unit (CSU/DSU)</b> | A digital interface unit that connects end user equipment to the local digital telephone loop.                                                                                                                                             |
| <b>chassis</b>                                          | The card cage (housing) where modules are placed.                                                                                                                                                                                          |
| <b>Cisco Broadband Operating System</b>                 | See <i>CBOS</i> .                                                                                                                                                                                                                          |
| <b>Cisco Connection Online</b>                          | See <i>CCO</i> .                                                                                                                                                                                                                           |
| <b>CLEI</b>                                             | Common Language Equipment Identifier.                                                                                                                                                                                                      |
| <b>client-server model</b>                              | A common way to describe network services and the user processes (programs) of those services. Examples include the name-server/name-resolver paradigm of the DNS and file-serve/file-client relationships such as NFS and diskless hosts. |
| <b>CLI</b>                                              | command line interface.                                                                                                                                                                                                                    |
| <b>CLLI</b>                                             | Common Language Location Identifier.                                                                                                                                                                                                       |
| <b>CO</b>                                               | central office. Local telephone office through which all local loops in a given area connect and switch subscriber lines.                                                                                                                  |
| <b>Common Language Equipment Identifier</b>             | See <i>CLEI</i> .                                                                                                                                                                                                                          |
| <b>Common Language Location Identifier</b>              | See <i>CLLI</i> .                                                                                                                                                                                                                          |
| <b>connectionless network</b>                           | The transport of a single datagram or packet of information from one network node to a destination node or multiple nodes without establishing a network connection.                                                                       |
| <b>connection-oriented network</b>                      | The transport of packets of information from one network node to a destination node following an established network connection.                                                                                                           |

|                                    |                                                                                                                                                                                                                                |
|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CPE</b>                         | customer premises equipment. Terminating equipment, such as terminals, telephones, and modems, supplied by the telephone company. The equipment is installed at customer sites and connected to the telephone company network. |
| <b>CTC</b>                         | common transmit clock.                                                                                                                                                                                                         |
| <b>customer premises equipment</b> | See <i>CPE</i> .                                                                                                                                                                                                               |

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**D**

|                                           |                                                                                                                                                                                                                                                                |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>daemon</b>                             | A program that is not invoked explicitly but lies dormant waiting for some condition(s) to occur.                                                                                                                                                              |
| <b>DDTS</b>                               | Cisco Distributed Defect Tracking System.                                                                                                                                                                                                                      |
| <b>dial-up network</b>                    | Enables computer users to dial up a service provider's computer using a modem.                                                                                                                                                                                 |
| <b>digital signal level 3</b>             | See <i>DS3</i> .                                                                                                                                                                                                                                               |
| <b>Discrete Multitone</b>                 | See <i>DMT</i> .                                                                                                                                                                                                                                               |
| <b>Distributed Defect Tracking System</b> | See <i>DDTS</i> .                                                                                                                                                                                                                                              |
| <b>distributed processing</b>             | An approach that allows one application program to execute on multiple computers linked together by a network. The networked computers share the work between them.                                                                                            |
| <b>DMT</b>                                | Discrete Multitone.                                                                                                                                                                                                                                            |
| <b>dotted decimal notation</b>            | The syntactic representation for a 32-bit integer that consists of four 8-bit numbers written in base 10 with periods (dots) separating them. Used to represent IP addresses in the Internet as in: 221.34.64.32.                                              |
| <b>downstream rate</b>                    | The line rate for return messages or data transfers from the network machine to the user's CPE.                                                                                                                                                                |
| <b>DRAM</b>                               | dynamic random-access memory. A type of semiconductor memory in which the information is stored in capacitors on a metal oxide semiconductor integrated circuit.                                                                                               |
| <b>DS1</b>                                | digital signal level 1. A 1.544 Mbps digital signal that is carried on a T1 line.                                                                                                                                                                              |
| <b>DS3</b>                                | digital signal level 3. Framing specification used for transmitting digital signals at 44.736 Mbps on a T3 facility.                                                                                                                                           |
| <b>DSLAM</b>                              | digital subscriber line access multiplexer. Concentrates and multiplexes digital subscriber line signals at the telephone service provider location to the broadband wide area network. Replaces ADSLAM.                                                       |
| <b>DSL Forum</b>                          | An organization of competing companies that sponsors an Internet Web site ( <a href="http://www.adsl.com">http://www.adsl.com</a> ) containing information about the applications, technology, systems, market, trials, and tariffs related to DSL technology. |
| <b>dynamic random-access memory</b>       | See <i>DRAM</i> .                                                                                                                                                                                                                                              |

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**E**

- E1** A digital carrier that is used to transmit a formatted signal at 2.048 Mbps.
- EIA** Electronic Industries Association. A standards organization made up of electronics industry organizations. EIA is responsible for The RS-232C and RS-422 standards.
- Electronic Industries Association** See *EIA*.
- encapsulation** The technique used by layered protocols in which a layer adds header information to the protocol data unit (PDU) from the layer above. As an example, in Internet terminology, a packet would contain a header from the physical layer, followed by a header from the network layer (IP), followed by a header from the transport layer (TCP), followed by the application protocol data.
- entity** A physical or logical system component which is represented in the 6100 SNMP Agent.
- EPROM** Erasable programmable read-only memory.
- erasable programmable read-only memory** See *EPROM*.
- error detection** A process used during file transfer to discover discrepancies between transmitted and received data. Some file transfer programs only detect errors; others detect errors and attempt to fix them (called error correction).
- ESF** Extended Superframe. A framing type that is used on T1 circuits that consists of 24 frames of 192 bits each, with the 193rd bit providing timing and other functions.
- Ethernet** One of the most common local area network (LAN) wiring schemes, Ethernet has a transmission rate of 10 Mbps; a newer standard called Fast Ethernet carries 100 Mbps.
- ETSI** A European standards body established in 1988 by a decision of the European Conference of Postal and Telecommunications Administrations (CEPT). It has taken over the work of the CEPT the area of developing the *Net-Normes Europeene de Telecommunication*, Net standards.

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**F**

- FCC** Federal Communications Commission. A U.S. government agency that regulates interstate and foreign communications. The FCC sets rates for communication services, determines standards for equipment, and controls broadcast licensing.
- Federal Communications Commission** See *FCC*.
- File Transfer Protocol** See *FTP*.
- finger daemon** A software tool that allows a client to query a server for information on users.

|                 |                                                                                                                                                                                                     |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>firewall</b> | A method for protecting Internet-connected enterprise networks from break-ins by unauthorized persons outside the network.                                                                          |
| <b>frame</b>    | A packet as it is transmitted over a serial line. The term derives from character oriented protocols where special start-of-frame and end-of-frame characters were added when transmitting packets. |
| <b>FTP</b>      | File Transfer Protocol. The Internet protocol (and program) used to transfer files between hosts.                                                                                                   |

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**G**

|                |                                                                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>G.804</b>   | ITU-T framing standard that defines the mapping of ATM cells into the physical medium.                                                           |
| <b>gateway</b> | A system which does translation from some native format to another. Examples include X.400 to/from RFC 822 electronic mail gateways. See router. |

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**H**

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>handshake</b>                    | Part of the procedure to set up a data communications link. The handshake can be part of the protocol itself or an introductory process. The computers wishing to talk to each other set out the conditions they can operate under. Sometimes, the handshake is just a warning that a communication is imminent.                                                                                                                                                  |
| <b>HDLC</b>                         | High-Level Data Link Control. A bit-oriented, synchronous, link layer, data-framing, flow control, and error detection and correction protocol. Available subsets include: 802.2 (logical link control for FDDI, Token Ring, and some Ethernet LANs), LAP (link access procedure balanced for X.25), LAPD (link access procedure for the ISDN D channel and frame relay), and LAPM (link access procedure for error-correcting modems specified as part of V.42). |
| <b>High-Level Data Link Control</b> | See <i>HDLC</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>hop count</b>                    | A measure of distance between two points on the Internet. It is equivalent to the number of gateways that separate the source and destination.                                                                                                                                                                                                                                                                                                                    |
| <b>HTML</b>                         | Hypertext Markup Language. The page-coding language for the World Wide Web.                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>HTML browser</b>                 | A browser used to traverse the Internet, such as Netscape or Microsoft Internet Explorer.                                                                                                                                                                                                                                                                                                                                                                         |
| <b>HTTP</b>                         | Hypertext Transfer Protocol. The protocol used to carry world wide web (WWW) traffic between a WWW browser computer and the WWW server being accessed.                                                                                                                                                                                                                                                                                                            |
| <b>Hypertext Markup Language</b>    | See <i>HTML</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Hypertext Transfer Protocol</b>  | See <i>HTTP</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                 |



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|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ICMP</b>                                                                           | Internet Control Message Protocol. The protocol used to handle errors and control messages at the IP layer.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>ICP</b>                                                                            | IMA control protocol.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>IDCR</b>                                                                           | IMA data cell rate.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>IEEE</b>                                                                           | Institute of Electrical and Electronics Engineers. A U.S. publishing and standards organization responsible for many LAN standards.                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>IMA</b>                                                                            | inverse multiplexing over ATM. Standard protocol defined by the ATM Forum in 1997.                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Industry-Standard Architecture</b>                                                 | See <i>ISA</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Institute of Electrical and Electronics Engineers</b>                              | See <i>IEEE</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>International Organization for Standardization</b>                                 | See <i>ISO</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>International Telecommunication Union Telecommunication Standardization Sector</b> | See <i>ITU-T</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Internet</b>                                                                       | A collection of networks interconnected by a set of routers, which allows them to function as a single, large virtual network. When written in upper case, Internet refers specifically to the DARPA (Defense Advanced Research Projects Agency) Internet and the TCP/IP protocols it uses.                                                                                                                                                                                                                                                                   |
| <b>Internet address</b>                                                               | An IP address assigned in blocks of numbers to user organizations accessing the Internet. The United States Department of Defense's Network Information Center establishes these addresses. Duplicate addresses can cause major problems on the network, but the NIC trusts organizations to use individual addresses responsibly. Each address is a 32-bit address in the form of x.x.x.x where <i>x</i> is an eight-bit number from 0 to 255. There are three classes: A, B, and C, depending on how many computers on the site are likely to be connected. |
| <b>Internet Control Message Protocol</b>                                              | See <i>ICMP</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Internet Protocol</b>                                                              | See <i>IP</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Internet service provider</b>                                                      | See <i>ISP</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Internetwork Packet Exchange</b>                                                   | See <i>IPX</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

**Internetwork Packet Exchange Control Protocol** See *IPXCP*.

**inverse multiplexing** Allows individually dialed channels across the network to be combined into a single, higher-speed data streams. Using this service, a user can dial multiple calls and combine them together into a single high-speed data stream.

**IP** Internet Protocol. The network layer protocol for the Internet Protocol suite.

**IP address** The 32-bit address assigned to hosts that want to participate in a TCP/IP Internet.

**IP datagram** The fundamental unit of information passed across the Internet. It contains source and destination addresses along with data and a number of fields that define such things as the length of the datagram, the header checksum, and flags to say whether the datagram can be or has been fragmented.

**IPX** Internetwork Packet Exchange. The network layer (OSI Layer 3) datagram-based protocol usually used by Novell's NetWare network operating system. Supports any window size and packet sizes up to 64 KB.

**IPXCP** Internetwork Packet Exchange Control Protocol. A protocol defined in RFC 1552.

**ISA** Industry-Standard Architecture. The bus used in standard IBM-compatible PCs to provide power to add-in boards and to the motherboard (into which the boards plug). Typical maximum transfer speed of 1 to 2.5 Mbps (variables include other devices, memory, and buffering) but designed for up to 16 Mbps.

**ISO** International Organization for Standardization. A voluntary, nontreaty organization founded in 1946, responsible for creating international standards in many areas, including computers and communications.

**ISP** Internet service provider. A company that allows home and corporate users to connect to the Internet.

**ITC** independent transmit clock.

**ITU-T** International Telecommunication Union Telecommunication Standardization Sector. ITU-T is the telecommunication standardization sector of ITU and is responsible for making technical recommendations about telephone and data (including fax) communications systems for service providers and suppliers.

---

## L

**LAN** local-area network. A limited distance (typically under a few kilometers or a couple of miles) high-speed network (typically 4 to 100 Mbps) that supports many computers (typically two to thousands).

**LCD** loss of cell delineation.

**LCP** link control protocol.

**LED** light emitting diode. The lights indicating status or activity on electronic equipment.

**LIF** loss of IMA frame.

|                                    |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>light emitting diode</b>        | See <i>LED</i> .                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>line concentration</b>          | Functionality performed by a type of multiplexer that combines multiple channels onto a single transmission medium in such a way that all the individual channels can be simultaneously active. For example, ISPs use concentrators to combine their dial-up modem connections onto faster T1 lines that connect to the Internet.                                                                                            |
| <b>line rate</b>                   | The speed by which data is transferred over a particular line type, express in bits per second (bps).                                                                                                                                                                                                                                                                                                                        |
| <b>local-area network</b>          | See <i>LAN</i> .                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>LODS</b>                        | loss of delay synchronization.                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>LOF</b>                         | loss of frame.                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>logical pool</b>                | A logical grouping of ATU-C ports and LIM ports that comprise a particular DOH oversubscription ratio.                                                                                                                                                                                                                                                                                                                       |
| <b>logical port</b>                | A logical entry to a server machine. These ports are mostly invisible to the user, though you may occasionally see a URL with a port number included in it. These ports do not refer to physical locations; they are set up by server administrators for network trafficking.                                                                                                                                                |
| <b>loopback</b>                    | A diagnostic test that returns the transmitted signal back to the sending device after it has passed through a network or across a particular link. The returned signal can then be compared to the transmitted one. The discrepancies between the two help to trace the fault. When trying to locate a faulty piece of equipment, loopbacks will be repeated, eliminating satisfactory machines until the problem is found. |
| <b>LOS</b>                         | loss of signal.                                                                                                                                                                                                                                                                                                                                                                                                              |
| <hr/>                              |                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>M</b>                           |                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>MAC</b>                         | Media Access Control. A sublayer of the Data Link Layer (Level Two) of the ISO OSI Model responsible for media control.                                                                                                                                                                                                                                                                                                      |
| <b>Management Information Base</b> | See <i>MIB</i> .                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>MD5 protocol</b>                | Authentication and encryption protocol.                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>MDI</b>                         | Multidocument Interface.                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Media Access Control</b>        | See <i>MAC</i> .                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>MIB</b>                         | Management Information Base. A collection of objects that can be accessed via a network management protocol, such as SNMP and CMIP (Common Management Information Protocol).                                                                                                                                                                                                                                                 |
| <b>MMF</b>                         | multimode fiber.                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>modem redundancy</b>            | When backup modems are immediately available should a modem facilitating communication fail.                                                                                                                                                                                                                                                                                                                                 |
| <b>module</b>                      | A printed circuit board that occupies a slot in a chassis.                                                                                                                                                                                                                                                                                                                                                                   |

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Multidocument Interface</b> | See <i>MDI</i> .                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>multimode fiber</b>         | See <i>MMF</i> .                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>multicast</b>               | A special form of broadcast where copies of the packet are delivered to only a subset of all possible destinations. See also <i>broadcast</i> .                                                                                                                                                                                                                                                                              |
| <b>multiplexer</b>             | A device that can send several signals over a single line. They are then separated by a similar device at the other end of the link. This can be done in a variety of ways: time division multiplexing, frequency division multiplexing, and statistical multiplexing. Multiplexers are also becoming increasingly efficient in terms of data compression, error correction, transmission speed, and multidrop capabilities. |

---

## N

|                                    |                                                                                                                                                            |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NAT</b>                         | Network Address Translation.                                                                                                                               |
| <b>Network Address Translation</b> | See <i>NAT</i> .                                                                                                                                           |
| <b>network interface</b>           | Boundary between a carrier network and a privately-owned installation.                                                                                     |
| <b>network layer</b>               | The OSI layer that is responsible for routing, switching, and subnetwork access across the entire OSI environment.                                         |
| <b>Network Virtual Terminal</b>    | See <i>NVT</i> .                                                                                                                                           |
| <b>NI-2</b>                        | A second generation network interface card.                                                                                                                |
| <b>node</b>                        | A general term used to refer to a computer or related device; often used to refer to a networked computer or device.                                       |
| <b>Node System Save file</b>       | See <i>NSS</i> .                                                                                                                                           |
| <b>noise margin</b>                | The amount of noise tolerated by the ATU-C and ATU-R while training.                                                                                       |
| <b>NSS</b>                         | Node System Save file. The file that is saved during a Save Configuration or during a Software download. This file is required for Restore Configurations. |
| <b>NVT</b>                         | Network Virtual Terminal.                                                                                                                                  |

---

## O

|              |                                                                                                                                                       |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OC-3</b>  | optical carrier level 3. Physical protocol, defined for SONET optical signal transmissions.                                                           |
| <b>octet</b> | A networking term that identifies eight bits. In TCP/IP, it is used instead of <i>byte</i> , because some systems have bytes that are not eight bits. |

|                                    |                                                                                                                                                           |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>OOF</b>                         | out of frame.                                                                                                                                             |
| <b>Open System Interconnection</b> | See <i>OSI</i> .                                                                                                                                          |
| <b>Optical Carrier Level 3</b>     | See <i>OC-3</i> .                                                                                                                                         |
| <b>OSI</b>                         | Open System Interconnection. An international standardization program to facilitate communications among computers from different manufacturers. See ISO. |
| <b>OSR</b>                         | oversubscription ratio. The number of LIM ports divided by the number of ATU-C ports within a given logical pool.                                         |
| <b>oversubscription ratio</b>      | See <i>OSR</i> .                                                                                                                                          |

---

**P**

|                                          |                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>packet</b>                            | The unit of data sent across a packet switching network.                                                                                                                                                                                                                                                                          |
| <b>PAP</b>                               | Password Authentication Protocol.                                                                                                                                                                                                                                                                                                 |
| <b>Password Authentication Protocol</b>  | See <i>PAP</i> .                                                                                                                                                                                                                                                                                                                  |
| <b>PCI</b>                               | Peripheral Component Interconnect. An industry local bus standard. Supports up to 16 physical slots but is electrically limited to typically three or four plug-in PCI cards in a PC. Has a typical sustained burst transfer rate of 80 Mb—enough to handle 24-bit color at 30 frames per second (full-color, full-motion video). |
| <b>PEM</b>                               | power entry module.                                                                                                                                                                                                                                                                                                               |
| <b>Peripheral Component Interconnect</b> | See <i>PCI</i> .                                                                                                                                                                                                                                                                                                                  |
| <b>permanent virtual circuit</b>         | See <i>PVC</i> .                                                                                                                                                                                                                                                                                                                  |
| <b>physical layer</b>                    | Handles transmission of raw bits over a communication channel. The physical layer deals with mechanical, electrical, and procedural interfaces.                                                                                                                                                                                   |
| <b>physical pool</b>                     | A physical grouping of chassis slots within the Cisco 6100/6130 or Cisco 6110.                                                                                                                                                                                                                                                    |
| <b>physical port</b>                     | A physical connection to a computer through which data flows. An “Ethernet port,” for example, is where Ethernet network cabling plugs into a computer.                                                                                                                                                                           |
| <b>plain old telephone service</b>       | See <i>POTS</i> .                                                                                                                                                                                                                                                                                                                 |
| <b>Point-to-Point Protocol</b>           | See <i>PPP</i> .                                                                                                                                                                                                                                                                                                                  |
| <b>port</b>                              | The abstraction used by Internet transport protocols to distinguish among multiple simultaneous connections to a single destination host. A single termination point on one of the multiport modules (POTS, LIM, or ATU-C).                                                                                                       |
| <b>POTS</b>                              | plain old telephone service.                                                                                                                                                                                                                                                                                                      |
| <b>PPP</b>                               | Point-to-Point Protocol. The successor to SLIP, PPP provides router-to-router and host-to-network connections over both synchronous and asynchronous circuits. See SLIP.                                                                                                                                                          |
| <b>protocol</b>                          | A formal description of messages to be exchanged and rules to be followed for two or more systems to exchange information.                                                                                                                                                                                                        |
| <b>PVC</b>                               | permanent virtual circuit. A fixed virtual circuit between two users: the public data network equivalent of a leased line. No call setup or clearing procedures are needed.                                                                                                                                                       |

---

**Q**

- QoS** quality of service. A characteristic of data transmission that measures how accurately and how quickly a message or data is transferred from a source computer to a destination computer over a network.
- quality of service** See *QoS*.

---

**R**

- RADIUS** Remote Authentication Dial-In User Service. A client/server security protocol created by Livingston Enterprises. Security information is stored in a central location, known as the RADIUS server.
- RADIUS Accounting Client** Permits system administrators to track dial-in use.
- RADIUS Security Client** Controls access to specific services on the network.
- RADSL** rate adaptive digital subscriber line. A technique for keeping the quality of transmissions within specified parameters.
- Rate Adaptive Digital Subscriber Line** See *RADSL*.
- remote address** The IP address of a remote server.
- Remote Authentication Dial-In User Service** See *RADIUS*.
- remote server** A network computer that allows a user to log onto the network from a distant location.
- Request for Comments** See *RFC*.
- RFC** Request for Comments. The document series, begun in 1969, which describes the Internet suite of protocols and related experiments. Not all RFCs describe Internet standards, but all Internet standards are written up as RFCs.
- route** The path that network traffic takes from its source to its destination. The route a datagram may follow can include many gateways and many physical networks. In the Internet, each datagram is routed separately.
- router** A system responsible for making decisions about which of several paths network (or Internet) traffic will follow. To do this, it uses a routing protocol to gain information about the network and algorithms to choose the best route based on several criteria known as “routing metrics.” See also *bridge*.
- routing table** Information stored within a router that contains network path and status information. It is used to select the most appropriate route to forward information along.
- RS-232** An EIA standard that is the most common way of linking data devices together.

---

**S**

|                                           |                                                                                                                                                                                                                                                                            |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>SAP</b>                                | Service Advertisement Protocol.                                                                                                                                                                                                                                            |
| <b>SDSL</b>                               | symmetrical digital subscriber line.                                                                                                                                                                                                                                       |
| <b>secret</b>                             | It is the encryption key used by RADIUS to send authentication information over a network.                                                                                                                                                                                 |
| <b>serial line</b>                        | A serial line is used to refer to data transmission over a telephone line via a modem or when data goes from a computer to a printer or other device.                                                                                                                      |
| <b>Service Advertisement Protocol</b>     | See <i>SAP</i> .                                                                                                                                                                                                                                                           |
| <b>shared secret</b>                      | RADIUS uses the shared secret to encrypt the passwords in the authentication packets, so outside parties do not have access to the passwords on your network.                                                                                                              |
| <b>signal-to-noise ratio</b>              | See <i>SNR</i> .                                                                                                                                                                                                                                                           |
| <b>SIMM</b>                               | Single In-line Memory Module. A small circuit board or substrate, typically about 10cm x 2cm, with RAM integrated circuits or die on one or both sides and a single row of pins along one long edge.                                                                       |
| <b>Simple Network Management Protocol</b> | See <i>SNMP</i> .                                                                                                                                                                                                                                                          |
| <b>Single In-line Memory Module</b>       | See <i>SIMM</i> .                                                                                                                                                                                                                                                          |
| <b>single-mode fiber</b>                  | See <i>SMF</i> .                                                                                                                                                                                                                                                           |
| <b>slot</b>                               | A numbered location within a chassis capable of housing a module.                                                                                                                                                                                                          |
| <b>SMF</b>                                | single-mode fiber.                                                                                                                                                                                                                                                         |
| <b>SNMP</b>                               | Simple Network Management Protocol. The network management protocol of choice for TCP/IP-based internets.                                                                                                                                                                  |
| <b>SNR</b>                                | signal-to-noise ratio. Usable signal being transmitted divided by the noise or undesired signal.                                                                                                                                                                           |
| <b>socket</b>                             | (1) The Berkeley Unix mechanism for creating a virtual connection between processes. (2) IBM term for software interfaces that allow two Unix application programs to talk via TCP/IP protocols.                                                                           |
| <b>Spanning-Tree Protocol</b>             | See <i>STP</i> .                                                                                                                                                                                                                                                           |
| <b>spoofing</b>                           | A method of fooling network end stations into believing that keep-alive signals have come from and return to the host. Polls are received and returned locally at either end of the network and are transmitted only over the open network if there is a condition change. |



|                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>STP</b>                                 | Spanning-Tree Protocol. Part of an IEEE standard. A bridge protocol for detecting and preventing loops from occurring in a multibridged environment. When bridges connect three or more LAN segments, a loop can occur. Because a bridge forwards all packets which are not recognized as being local, some packets can circulate for long periods of time, eventually degrading system performance. This algorithm ensures only one path connects any pair of stations, selecting one bridge as the 'root' bridge, with the highest priority one as identifier, from which all paths should radiate. |
| <b>STU-C</b>                               | SDSL Transmission Unit—central office.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>subnet</b>                              | For routing purposes, IP networks can be divided into logical sub nets by using a subnet mask. Values below those of the mask are valid addresses on the subnet.                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>subnet mask</b>                         | See <i>address mask</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>subordinate entity</b>                  | An entity which has a superior entity.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>subscriber</b>                          | A logical entity with attributes identifying the customer that is receiving service on a particular LIM port.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>superior entity</b>                     | An entity which has subordinate entities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>SVC</b>                                 | switched virtual circuit. A temporary virtual circuit between two users.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>switch</b>                              | Equipment used to connect and distribute communications between a trunk line or backbone and individual nodes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>switched virtual circuit</b>            | See <i>SVC</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>symmetrical digital subscriber line</b> | See <i>SDSL</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>synchronous connection</b>              | During synchronous communications, data is not sent in individual bytes, but as frames of large data blocks.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>SYSLOG</b>                              | SYSLOG allows you to log significant system information to a remote server.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

---

**T**

|               |                                                                                                                                                                                                                                                      |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>T1</b>     | A digital carrier that is used to transmit a DS1 formatted digital signal at 1.544 Mbps.                                                                                                                                                             |
| <b>T3</b>     | A digital carrier that is used to transmit a DS3 formatted digital signal at 45 Mbps.                                                                                                                                                                |
| <b>TCP</b>    | Transmission Control Protocol. The major transport protocol in the Internet suite of protocols providing reliable, connection-oriented full-duplex streams.                                                                                          |
| <b>Telnet</b> | The virtual terminal protocol in the Internet suite of protocols. Allows users of one host to log into a remote host and act as normal terminal users of that host.                                                                                  |
| <b>TFTP</b>   | Trivial File Transfer Protocol. A simple file transfer protocol (a simplified version of FTP) that is often used to boot diskless workstations and other network devices such as routers over a network (typically a LAN). Has no password security. |

|                                       |                                                                                                                                                                                                                                                                                                                    |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>training</b>                       | The procedure used by the ATU-C and ATU-R to establish an end-to-end ADSL connection.                                                                                                                                                                                                                              |
| <b>training mode</b>                  | Characteristic of a router that allows it to use RADSL technology to adjust its line speed according to noise conditions on the transmission line.                                                                                                                                                                 |
| <b>Transmission Control Protocol</b>  | See <i>TCP</i> .                                                                                                                                                                                                                                                                                                   |
| <b>transparent bridging</b>           | So named because the intelligence necessary to make relaying decisions exists in the bridge itself and is thus transparent to the communicating workstations. It involves frame forwarding, learning workstation addresses and ensuring no topology loops exist (in conjunction with the Spanning-Tree algorithm). |
| <b>Trivial File Transfer Protocol</b> | See <i>TFTP</i> .                                                                                                                                                                                                                                                                                                  |
| <b>twisted pair</b>                   | Two insulated copper wires twisted together with the twists or lays varied in length to reduce potential signal interference between the pairs.                                                                                                                                                                    |

---

## U

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>UDP</b>                       | User Datagram Protocol. A connectionless transport protocol that runs on top of the TCP/IP IP. UDP, like TCP, uses IP for delivery; however, unlike TCP, UDP provides for exchange of datagrams without acknowledgments or guaranteed delivery. Best suited for small, independent requests, such as requesting a MIB value from an SNMP agent, in which first setting up a connection would take more time than sending the data. |
| <b>UL</b>                        | Underwriters Laboratories. A private organization that tests and certifies electrical components and devices against rigorous safety standards. A UL Listing Mark on a product means that representative samples of the product have been tested and evaluated to nationally recognized safety standards with regard to fire, electric shock, and other related safety hazards.                                                    |
| <b>Underwriters Laboratories</b> | See <i>UL</i> .                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>UNI</b>                       | User-Network Interface.                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>UNI signaling</b>             | User-Network Interface signaling for ATM communications.                                                                                                                                                                                                                                                                                                                                                                           |
| <b>upstream rate</b>             | The line rate for message or data transfer from the source machine to a destination machine on the network. Also see downstream rate.                                                                                                                                                                                                                                                                                              |
| <b>User Datagram Protocol</b>    | See <i>UDP</i> .                                                                                                                                                                                                                                                                                                                                                                                                                   |

---

**V**

- VC** virtual circuit. A logical circuit created to ensure reliable communication between two network devices. A virtual circuit is defined by a VPI/VCI pair, and can be either permanent (PVC) or switched (SVC). In ATM, a virtual circuit is called a virtual channel. Sometimes abbreviated VC. See also *PVC*, *SVC*, *VCI*, and *VPI*.
- VCC** virtual channel connection. Logical circuit, made up of links, that carries data between two end points in an ATM network. Sometimes called a virtual channel connection. See also *VCI* and *VPI*.
- VCI** virtual channel identifier. 16-bit field in the header of an ATM cell. The VCI, together with the VPI, is used to identify the next destination of a cell as it passes through to the ATM switch. Sometimes called virtual channel connection. See also *VPI*.
- virtual channel** See *VC*.
- virtual circuit** See *VC*.
- virtual channel connection** See *VCC*.
- virtual channel identifier** See *VCI*.
- virtual connection** In ATM, a connection between end users that has a defined route and endpoints. See also *PVC* and *SVC*.
- virtual path** A logical grouping of virtual circuits that connect two sites. See also *virtual circuit*.
- virtual path identifier** See *VPI*.
- virtual path identifier/virtual circuit identifier** See *VPI* and *VCI*.
- VP** virtual path. One of two types of ATM circuits identified by a VPI. A virtual path is a bundle of virtual circuits, all of which are switched across a network based on a common VPI. See also *VPI*.
- VPI** virtual path identifier. An 8-bit field in the header of an ATM cell. The VPI, together with the VCI, is used to identify the next destination of a cell as it passes through the network. See also *VCI*.

---

**W**

- WAN** wide-area network. A data communications network that spans any distance and is usually provided by a public carrier (such as a telephone company or service provider).
- wide-area network** See *WAN*.





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## Numerics

### 4xflexi

alarms **6-18**

#### Cisco 6015

configuration **1-2**

location **1-11**

edge connector key **1-12**

faceplate **1-13**

hardware specifications **A-3**

hot swapping **2-10**

illustration **1-13**

installation **7-2**

intermixing **1-12**

LED indicators **1-13**

line encoding **1-12**

maximum bit rate **1-12**

modem support **1-12**

overview **1-12**

removal **7-4**

troubleshooting **6-11 to 6-14**

### 8xDMT

#### Cisco 6015

configuration **1-2**

commercial environment **1-14**

faceplate **1-15**

hardware specifications **A-4**

hot swapping **2-10**

illustration **1-15**

installation **7-4**

intermixing **1-12**

LED indicators **1-16**

maximum bit rate **1-14**

modem support **1-14**

outside plant environment **1-14**

overview **1-14**

removal **7-5**

troubleshooting **6-11 to 6-14**

### 8xDMT over ISDN

#### Cisco 6015

configuration **1-2**

faceplate **1-18**

hardware specifications **A-5**

hot swapping **2-10**

illustration **1-18**

installation **7-6**

LEDs **1-18**

modem support **1-17**

overview **1-17**

removal **7-7**

### 8xG.SHDSL

#### Cisco 6015

configuration **1-2**

faceplate **1-20**

hardware specifications **A-6**

hot swapping **2-10**

illustration **1-20**

installation **7-8**

intermixing **1-12**

LED indicators **1-20**

LEDs **1-20**

modem support **1-19**

overview **1-19**

removal **7-9**

troubleshooting **6-11 to 6-14**

**A**

## AC/DC converter

- Cisco 6015 configuration **1-3**
- connect to DC PEM **3-9, 4-8**
- extenders **1-38**
- faceplate **1-37**
- features **1-37**
- illustration **1-37**
- installation **3-4, 4-4**
- LED
  - verification **3-22, 4-20**
- power cord **1-38**
- power requirements **2-17**
- tray
  - function **1-38, 2-17**
  - installation **3-4, 4-4**
- troubleshooting **6-18**

## ACO button

- alarms **1-39**

## AC power

- apply **3-22, 4-20**
- connect the DC PEM to AC/DC converter **3-9, 4-8**
- conversion **1-3**
- introduction **2-17**
- receptacle options **2-20**
- requirements **2-17**
- see also AC/DC converter

## ADC POTS splitter

- cabling **3-17, 5-15, 7-22, B-2**
- see also POTS splitter, ADC

ADSL, definition **1-2**

## air

- exhaust vent **2-13**
- flow, illustration **1-36, 2-13**
- intake vent **2-13**

alarm input **1-22**

## alarms

- audible **1-39**

Cisco 6015 chassis **6-18**Cisco IOS controller **6-19**critical **1-38**definition **1-38, 6-18 to 6-22**DS3 network interface **6-19**E1 network interface **6-20**E3 network interface **6-19**fan module **6-22**

## IMA

group **6-21**link network interface **6-20**line card **6-18**major **1-38**minor **1-39**OC-3c interfaces **6-20**power supply **6-22**T1 network interface **6-20**altitude **2-12**

American National Standards Institute

see ANSI

ANSI **1-4**antistatic strap, resistance value **2-9**apply power **3-22, 4-20**

asymmetric digital subscriber line

see ADSL

## auxiliary

cable **2-21**connect **3-25, 4-23, 5-22**pinouts **C-3****B**backplane access **2-18**backup software **7-1**basic checks, troubleshooting **6-3**basic management setup **3-27, 4-25, 5-24**

## BITS interface

close-up **3-12, 4-11, 5-5**connect **3-11, 4-10, 5-4, 5-9**

- connection **1-22**
- location **1-36**
- pinouts **3-12, 4-11, 5-5**
- plate reinstallation **3-12, 4-12, 5-6**
- plate removal **3-12, 4-11, 5-5**
- wire **2-21**
- wire preparation **3-12, 4-11, 5-5**

blank faceplate

- installation **3-6, 4-5, 5-9, 7-10**
- removal **7-10**

## C

### cables

- auxiliary connector **2-21**
- console connector **2-21**
- DS3 connection **2-21**
- DSL interface module
  - ADC POTS splitter **2-20**
  - Corning Cable POTS splitter **2-20**
- Ethernet connector **2-21**
- MDF connections **2-20**
- OC-3c connection **2-21**

### cabling

- DSL interface module and ADC POTS splitter **7-22, B-2**
- DSL interface module and MDF **4-14, 5-15**
- guidelines **B-1**
- MDF and ADC POTS splitter **3-17, 5-15**
- MDF and Corning Cable Systems POTS splitter **3-17, 5-15**

### calculation

- fuse **2-16**
- rack space **2-15**

### card

- hot swapping **2-10**
- installation suggestions **2-11**
- removal suggestions **2-11**
- secure in chassis **3-5, 4-4, 5-8**

### caution

definition **xix**

### CDM

- definition **1-3**
- Element Management Framework **1-3**

### Champ connector

- pin locations **C-1**
- securing **3-16, 4-14, 5-15, B-1**

### chassis support **1-4**

### Cisco 6015 chassis

- 4xflexi **1-2**
- 8xDMT **1-2, 1-4**
- 8xDMT over ISDN **1-2, 1-4**
- 8xG.SHDSL **1-2, 1-4**
- AC/DC converter **1-3**
- air flow **1-36, 2-13**
- alarms **6-18**
- components **1-2, 1-3**
- cooling **1-33**
- DC PEM **1-3**
- DS3+T1/E1 IMA NI-2 card **1-2**
- DS3+T1 network I/O module **1-3**
- DSL interface module **1-3**
- E1 network I/O module **1-3**
- extender, installation **3-5, 4-4, 5-8**
- fan module **1-3**
- grounding procedures **3-7, 4-6, 5-10**
- hardware components **1-2, 1-3, 1-4, 1-10**
- installation **3-5, 4-4, 5-8**
- intermixing line cards **1-12**
- OC-3c/OC-3c NI-2 card **1-2**
- overview **1-10**
- port subscription **1-4**
- slots **1-11**
- subscribers **1-3**

### Cisco 6015 system

- altitude **2-12**
- basic management setup **3-27, 4-25, 5-24**
- cabling **2-18**
- CDM **1-3**

- Cisco IOS 1-3
- compliance 1-3
- configurations
  - Cisco 6015 without POTS splitter, definition 1-6
  - Cisco 6015 with POTS splitter, definition 1-5
  - IMA configuration, definition 1-8
  - options 1-4
  - subtended network, definition 1-6
- configuring 3-32, 4-30, 5-29
- extended setup 3-29, 4-27, 5-26
- features 1-3
- hardware
  - components 1-2
  - specifications A-2
- humidity 2-12
- IMA, definition 1-8
- initial configuration 3-26, 4-23, 5-22
- network management 1-1
- outside plant enclosure requirements 1-1, 2-12, 2-13, 2-20
- POTS splitters 1-3
- racks 2-14
- rack space requirements 2-14
- safety 1-3
- shipment damage 2-23
- software
  - components 1-3
  - specifications A-11
- subscriber data 1-2
- subtending limitations 1-4
- temperature 2-12
- unpacking 2-22
- ventilation 2-13
- verification 2-23
- Cisco 6015 without POTS splitter
  - definition 1-6
  - hardware components 1-6
  - illustration 1-6
  - installation
    - checklist 4-1
    - procedures 4-2 to 4-30
    - rack space calculation 2-15
- Cisco 6015 with POTS splitter
  - components 3-3, 4-3, 5-4
  - definition 1-5
  - hardware components 1-5
  - illustration 1-5
  - installation
    - checklist 3-1, 5-1
    - procedures 3-2 to 3-32, 5-3 to 5-29
  - POTS splitter, options 1-5
  - rack space calculation 2-15
- Cisco DSL Manager
  - see CDM
- Cisco IOS
  - controller, alarms 6-19
  - definition 1-3
- CLEC, definition 1-1
- competitive local exchange carrier
  - see CLEC
- compliance 1-3
- configuration, initial 3-26, 4-23, 5-22
- connector
  - auxiliary
    - cable 2-21
- Champ
  - securing 3-16, 4-14, 5-15
- console
  - cable 2-21
- Ethernet
  - cable 2-21
- console
  - cable 2-21
  - connect 3-25, 4-23, 5-21
  - pinouts C-3
- Corning Cable System POTS splitter
  - cabling 3-17, 5-15
- CPE
  - ADSL 1-2



definition **1-2**  
 SHDSLcustomer premises equipment  
 see CPE

## D

damage from shipping **2-23**

### DC PEM

Cisco 6015

configuration **1-3**

location **1-11**

connections **1-32**

connect to AC/DC converter **3-9, 4-8**

connect to fuse and alarm panel **3-10, 4-9, 5-12**

ESD grounding jack **2-9**

faceplate **1-33**

features **1-32**

hardware specifications **A-10**

illustration **1-33**

installation **7-24**

LED

verification **3-22, 3-23, 4-20, 4-21, 5-19**

removal **7-26**

troubleshooting **6-16**

### DC power

apply **3-23, 4-21, 5-19**

cable options **2-20**

Cisco 6015 system **1-32**

connect the DC PEM to fuse and alarm panel **3-10, 4-9, 5-12**

external power **2-16**

introduction **2-16**

### DC power entry module

see DC PEM

### digital subscriber line

see DSL

### documentation

related **xix**

### DS3

connection, cable **2-21**

disable interface **1-7**

network connection procedures **3-19, 4-17, 5-17**

network interface

alarms **6-19**

### DS3+T1/E1 I/O module

connecting the DS3+T1/E1 subtending network  
 configuration **3-17, 4-15**

### DS3+T1/E1 IMA NI-2 card

alarm input **1-22**

Cisco 6015 configuration **1-2**

Cisco 6015 location **1-11**

connect

auxiliary **3-25, 4-23, 5-22**

console **3-25, 4-23, 5-21**

Ethernet **3-24, 4-22, 5-20**

faceplate **1-23**

features **1-21**

functions **1-21**

hardware specifications **A-7**

hot swapping **2-10**

illustration **1-23**

installation **7-11**

operation mode **1-22**

removal **7-13**

subtending **1-7**

tasks **1-21**

troubleshooting **6-10**

### DS3+T1 network I/O module

Cisco 6015 configuration **1-3**

Cisco 6015 location **1-11**

faceplate **1-30**

faceplate features **1-30**

illustration **1-30**

IMA links **1-9**

IMA modes **1-9**

installation environment **1-5, 1-6**

DSL, definition **1-1**

DSL interface module

cables **2-20**  
 cabling **4-14, 5-15, 7-22, B-2**  
 Cisco 6015  
   configuration **1-3**  
   location **1-11**  
 connect to POTS splitter **3-15, 5-13**  
 faceplate **1-32**  
 features **1-31**  
 hardware specifications **1-31, A-10**  
 illustration **1-32**  
 installation **7-21**  
 pin locations **C-1**  
 removal **7-23**  
 troubleshooting **6-15**

---

## E

E1  
 connector pinouts **C-1**  
 IMA group **1-8**  
 network connection procedures **3-21, 4-19, 5-18**  
 network I/O module  
   Cisco 6015 configuration **1-3**  
   Cisco 6015 location **1-11**  
   faceplate **1-31**  
   faceplate features **1-31**  
   illustration **1-31**  
   IMA links **1-9**  
   IMA modes **1-9**  
   installation environment **1-5, 1-6**  
 network interface alarms **6-20**  
 subtend wire **2-21**  
 trunk  
   subtending connection **3-18, 4-16, 5-17**  
   wire **2-21**  
 E3 network interface alarms **6-19**  
 Element Management Framework  
   definition **1-3**  
 environmental requirements **2-11**

equipment requirements **2-19**

### ESD

  grounding jack **2-9**  
   guidelines **2-9**  
   prevention **2-9**  
   requirements **2-2**

### Ethernet

  cable **2-21**  
   connect **3-24, 4-22, 5-20**  
   pinouts **C-4**

### ETSI 1-4

European Telecommunication Standards Institute  
 see ETSI

### example

  basic management setup **3-27, 4-25, 5-24**  
   extended setup **3-29, 4-27, 5-26**

exhaust vents **1-36**

extended setup **3-29, 4-27, 5-26**

### extenders

  AC/DC converter **1-38**  
   installation **3-5, 4-4, 5-8**

external power requirements **2-16**

---

## F

### faceplate

  4xflexi **1-13**  
   8xDMT **1-15**  
   8xDMT over ISDN **1-18**  
   8xG.SHDSL **1-20**  
   AC/DC converter **1-37**  
   blank, installation **3-6, 4-5, 5-9, 7-10**  
   DC PEM **1-33**  
   DS3+T1/E1 IMA NI-2 card **1-23**  
   DS3+T1 network I/O module **1-30**  
   DSL interface module **1-32**  
   E1 network I/O module **1-31**  
   fan module **1-35**

facility alarm input

- connect 3-13, 4-12, 5-6
- interface close-up 3-12, 4-11, 5-5
- location 1-36
- pinouts 3-12, 4-11, 5-5
- plate reinstallation 3-14, 4-13, 5-7
- plate removal 3-14, 4-13, 5-7
- wire 2-21
- wire preparation 3-14, 4-13, 5-7

fan module

- air flow 1-36
- alarms 6-22
- Cisco 6015
  - configuration 1-3
  - location 1-11
- ESD grounding jack 2-9
- faceplate 1-35
- hardware specifications 1-34, A-11
- hot swapping 2-10
- illustration 1-33, 1-35
- installation 7-27
- LED
  - verification 3-23, 4-21, 5-20
- removal 7-27
- requirements 1-33
- troubleshooting 6-17
- ventilation 2-13

ferrite requirements 2-21

fuse and alarm panel

- connect to DC PEM 3-10, 4-9, 5-12

fuse calculation 2-16

---

## G

- general maintenance guidelines 2-9
- grounding
  - Cisco 6015 3-7, 4-6, 5-10
  - lug
    - Cisco 6015 4-7
    - closed position 3-7, 4-7, 5-10

- location 3-8, 4-7, 5-11
- open position 3-7, 4-7, 5-10
- POTS splitter 3-7, 5-10
- power source 2-16
- wire 2-21
  - connecting to grounding lug 3-8, 4-8, 5-11
  - connecting to rack 3-9, 4-8, 5-12
- guide contents, description xvii
- guidelines
  - cabling B-1
  - ESD 2-9
  - general maintenance 2-9
  - safety 2-1

---

## H

- hardware specifications
  - see specifications, hardware
- hot swapping
  - 4xflexi 2-10
  - 8xDMT 2-10
  - 8xDMT over ISDN 2-10
  - 8xG.SHDSL 2-10
  - cards 2-10
  - DS3+T1/E1 IMA NI-2 card 2-10
  - fan module 2-10
  - modules 2-10
  - service interruption 6-2
- humidity 2-12

---

## I

- I/O module
  - connecting for subtending 4-15
  - connecting to network 3-19, 4-17
  - hardware specifications A-9
  - troubleshooting 6-15
- ILEC, definition 1-1

## IMA

- cell distribution **1-8**
- definition **1-8**
- group
  - alarms **6-21**
  - bundling **1-8**
  - naming convention **1-9**
- groups **1-8**
- illustration **1-9**
- line maximum **1-8**
- link
  - examples **1-9**
  - length limitations **1-8**
  - naming convention **1-9**
  - network interface alarms **6-20**
- modes **1-9**
- incumbent local exchange carrier
  - see ILEC
- initial configuration **3-26, 4-23, 5-22**
- inspecting for damage **2-23**
- installation
  - 4xflexi **7-2**
  - 8xDMT **7-4**
  - 8xDMT over ISDN **7-6**
  - 8xG.SHDSL **7-8**
  - blank faceplate **7-10**
  - checklist
    - Cisco 6015 without POTS splitter configuration **4-1**
    - Cisco 6015 with POTS splitter configuration **3-1, 5-1**
  - DC PEM **7-24**
  - DS3+T1/E1 IMA NI-2 card **7-11**
  - DSL interface module **7-21**
  - fan module **7-27**
  - network I/O module **7-18**
  - OC-3c/OC-3c NI-2 card **7-14**
  - procedures
    - Cisco 6015 without POTS splitter configuration **4-2 to 4-30**

- Cisco 6015 with POTS splitter
  - configuration **3-2 to 3-32, 5-3 to 5-29**
- suggestions
  - card **2-11**
  - module **2-11**
- installation with a POTS splitter
  - connecting the DS3+T1/E1 subtending network configuration **3-17**
  - connecting the OC-3c subtending network configuration **3-19**
  - OC-3c network connection installation **3-21**
- installation without a POTS splitter
  - connecting the DS3+T1/E1 subtending network configuration **4-15**
  - connecting the OC-3c subtending network configuration **4-16**
  - OC-3c network connection installation **4-19**
- intake vents **1-36**
- interfaces, naming convention **1-9**
- intra-group-delay **1-8**
- IOS
  - see Cisco IOS

---

**L**

## LED

- 4xflexi **1-13**
  - 8xDMT **1-16**
  - 8xG.SHDSL **1-20**
- LEDs
- 8xDMT over ISDN **1-18**
  - 8xG.SHDSL **1-20**
- line card alarms **6-18**
- line encoding support **1-12**

---

**M**

- main distribution frame
  - see MDF
- management network, connect **3-24, 4-22, 5-20**

management software, alarms **1-38**

## MDF

cables **2-20**

cabling **3-17, 4-14, 5-15**

connection **1-6**

MDU, definition **1-1**

modem support **1-4, 1-12, 1-14, 1-19**

## module

hot swapping **2-10**

installation suggestions **2-11**

removal suggestions **2-11**

secure in chassis **3-5, 4-4, 5-8**

MTU, definition **1-1**

multiple dwelling unit

see MDU

multitenant unit

see MTU

---

## N

NEBS **1-4**

network clocking

connect **3-11, 4-10, 5-4, 5-9**

overview **1-36**

network connections **1-4**

Network Equipment Building System

see NEBS

network I/O module

connecting for subtending **3-18, 5-16**

connecting to network **5-17**

features **1-29**

hardware specifications **1-30**

installation **7-18**

removal **7-20**

versions **1-30**

network I/O module, DS3

see DS3+T1 network I/O module

network I/O module, E1

see E1, network I/O module

network I/O module, T1

see DS3+T1 network I/O module

NI-2 card

see DS3+T1/E1 IMA NI-2 card

see OC-3c/OC-3c NI-2 card

NI-2 cards

OC-3c/OC-3c NI-2 card **1-25**

North American

compliance **1-3**

safety **1-3**

note, definition **xix**

---

## O

OC-3c

connection, cable **2-21**

network connection procedures **3-21, 4-19**

OC-3c/OC-3c NI-2 card

Cisco 6015 configuration **1-2**

faceplate **1-27**

features **1-25**

functions **1-25**

hardware specifications **A-8**

installation **7-14**

overview **1-25**

removal **7-17**

specifications **A-8**

troubleshooting **6-10**

OC-3c/OC-3c NI-2 card, subtending **1-10**

OC-3c/OC-3c NI-2 cards, subtending **1-10**

OC-3c I/O module

network connection installation **3-21, 4-19**

octal-port DMT ATU-C line card

see 8xDMT

octal-port DMT ATU-C over ISDN line card

see 8xDMT over ISDN

octal-port G.SHDSL SHTU-C line card

see 8xG.SHDSL

octal-port single-pair high-speed digital subscriber line line card  
 see 8xG.SHDSL

octal-port symmetric high bit rate digital subscriber loop line card  
 see 8xG.SHDSL

odule **1-3**

outside plant enclosure requirements **1-1, 2-12, 2-13, 2-20**

---

**P**

polarity, check **3-23, 4-21, 5-19**

port mapping table  
 Cisco 6015 to one **B-3**  
 Y-cable **B-4**

post, telephone, and telegraph  
 see PTT

POTS splitter  
 ADC **1-3**  
 card installation **3-24, 5-20**  
 connect to DSL interface module **3-15, 5-13**  
 Corning Cable Systems **1-3**  
 grounding procedures **3-7, 5-10**  
 installation **3-4, 5-4**  
 options **1-3, 2-19**  
 ventilation **2-13**

power  
 AC **2-17**  
 apply **3-22, 4-20**  
 cord **1-38**  
 DC **2-16**  
 source, grounding **2-16**  
 supply alarms **6-22**

power entry module  
 see DC PEM

PTT, definition **1-1**

---

**Q**

quad-port flexi ATU-C line card  
 see 4xflexi

---

**R**

rack  
 requirements **2-18**  
 stabilize **3-3, 4-3, 5-3**

rack space  
 calculation **2-14**  
 Cisco 6015 without POTS splitter **2-15**  
 Cisco 6015 with POTS splitter **2-15**  
 measure **3-3, 4-3, 5-3**  
 requirements **2-14**

rear interface header  
 illustration **1-36**  
 location **1-36**  
 pinouts **1-36, C-2**  
 troubleshooting **6-17**

removal  
 4xflexi **7-4**  
 8xDMT **7-5**  
 8xDMT over ISDN **7-7**  
 8xG.SHDSL **7-9**  
 blank faceplate **7-10**  
 DC PEM **7-26**  
 DS3+T1/E1 IMA NI-2 card **7-13**  
 DSL interface module **7-23**  
 fan module **7-27**  
 network I/O module **7-20**  
 OC-3c/OC-3c NI-2 card **7-17**

replacement suggestions  
 card **2-11**  
 module **2-11**

requirements  
 AC power **2-17**  
 environmental **2-11**

equipment **2-19**  
 external power **2-16**  
 ferrite **2-21**  
 outside plant enclosure **1-1, 2-12, 2-13, 2-20**  
 rack **2-18**  
 rack space **2-14**  
 safety **2-1, 2-11**  
 tool **2-19**  
 resistance value, antistatic strap **2-9**

---

## S

safety  
   guidelines **2-1**  
   requirements **2-1, 2-11**  
 SHDSL, definition **1-2**  
 shipment  
   damage **2-23**  
   unpacking **2-22**  
   verification **2-23**  
 single-pair high-speed digital subscriber line  
   see SHDSL  
 slot numbering **1-11**  
 software, backup **7-1**  
 software specifications  
   see specifications, software  
 specifications  
   hardware  
     4xflexi **A-3**  
     8xDMT **A-4**  
     8xDMT over ISDN **A-5**  
     8xG.SHDSL **A-6**  
     Cisco 6015 system **A-2**  
     DC PEM **A-10**  
     DS3+T1/E1 IMA NI-2 card **A-7**  
     DSL interface module **A-10**  
     fan module **A-11**  
     I/O module **A-9**  
     OC-3c/OC-3c NI-2 card **A-8**  
     OC-3c/OC-3c NI-2 card **A-8**  
     software, Cisco 6015 system **A-11**  
 standard telco color chart **B-5**  
 star topology **1-7**  
 stripping wire  
   BITS interface **3-12, 4-11, 5-5**  
   facility alarm input **3-14, 4-13, 5-7**  
   grounding **3-7, 4-6, 5-10**  
 subscribers **1-3**  
 subtended network configuration  
   connecting  
     Cisco 6015 without POTS splitter **4-15**  
     Cisco 6015 with POTS splitter **3-17, 5-16**  
   definition **1-6**  
   DS3+T1/E1 IMA NI-2 card **1-7**  
   example **1-7**  
   feature **1-4**  
   features **1-6**  
   illustration **1-7**  
   OC-3c/OC-3c NI-2 card **1-10**  
   OC-3c/OC-3c NI-2 cards **1-10**  
   subtended interfaces **1-7**  
   support **1-7**  
   topologies **1-8**  
   trunk **1-7**  
 subtending  
   OC-3c subtending configuration  
     illustration **3-19, 4-17**  
 SUN workstations, CDM **1-3**  
 symmetric high bit rate digital subscriber loop  
   see SHDSL  
 system-wide problems, troubleshooting **6-4 to 6-9**

---

## T

T1  
   connector pinouts **C-1**  
   IMA group **1-8**  
   network connection procedures **3-20, 4-18, 5-18**

network interface alarms **6-20**  
 subtend wire **2-21**  
 trunk  
     subtending connection **3-18, 4-16, 5-17**  
     wire **2-21**  
 TC-PAM **1-4**  
 technical assistance  
     center **6-3**  
 temperature  
     operating **2-12**  
     short-term operating **2-12**  
 terminal settings **3-25, 4-23, 5-21**  
 timing control **1-21**  
 tip, definition **xix**  
 tip and ring connections **1-32**  
 tool requirements **2-19**  
 tray, AC/DC converter **1-38**  
 trellis coded pulse amplitude modulation  
     see TC-PAM  
 troubleshooting  
     4xflexi **6-11 to 6-14**  
     8xDMT **6-11 to 6-14**  
     8xG.SHDSL **6-11 to 6-14**  
     AC/DC converter **6-18**  
     basic checks **6-3**  
     cannot establish console connection **6-5**  
     cannot establish Telnet connection **6-5**  
     clocking problem **6-9**  
     DC PEM **6-16**  
     DS3+T1/E1 IMA NI-2 card **6-10**  
     DS3 trunk port fails to come up **6-6**  
     DSL interface module **6-15**  
     E1 IMA subtending port fails to come up **6-8**  
     E1 IMA trunk port fails to come up **6-8**  
     E1 subtending port fails to come up **6-7**  
     E1 trunk port fails to come up **6-7**  
     fan module **6-17**  
     I/O module **6-15**  
     OC-3c/OC-3c NI-2 card **6-10**

    rear interface header **6-17**  
     system experiencing critical alarm **6-5**  
     system experiencing major alarm **6-5**  
     system experiencing minor alarm **6-5**  
     system fails to come up **6-4**  
     system overheats **6-9**  
     system power problem **6-9**  
     system-wide problems **6-4 to 6-9**  
 T1 IMA subtending port fails to come up **6-8**  
 T1 IMA trunk port fails to come up **6-8**  
 T1 subtending port fails to come up **6-7**  
 T1 trunk port fails to come up **6-7**

---

## U

unpacking **2-22**

---

## V

ventilation **2-13**  
 vents  
     exhaust **1-36**  
     intake **1-36**  
 verify  
     AC/DC converter LEDs **3-22, 4-20**  
     DC PEM LEDs **3-22, 3-23, 4-20, 4-21, 5-19**  
     fan module LEDs **3-23, 4-21, 5-20**  
     shipment **2-23**  
 virtual trunk **1-8**  
 voltmeter, check polarity **3-23, 4-21, 5-19**

---

## W

warning  
     definition **xix**  
 warranty information **2-23**  
 wire  
     alignment



- BITS interface 3-13, 4-12, 5-6
  - facility alarm input 3-15, 4-14, 5-8
- BITS interface 2-21
- E1 subtend 2-21
- E1 trunk 2-21
- facility alarm input 2-21
- grounding 2-21
- T1 subtend 2-21
- T1 trunk 2-21
- world-wide
  - compliance 1-3
  - safety 1-3

