

## Cisco DCM Series D9900 Digital Content Manager MPEG Processor

Today's digital systems demand powerful, flexible, and compact solutions that allows the service provider to support new network architectures. The Cisco® DCM Series D9900 Digital Content Manager (DCM) MPEG Processor is a compact 2RU platform capable of processing a high number of MPEG video streams. The DCM Series D9900 MPEG Processor is the next generation of intelligent headend processing equipment where the combination of compactness and flexibility leads to a cost-effective solution. Based on our experience, the DCM Series D9900 MPEG Processor brings operational and economic benefits in MPEG processing applications. The optional built-in DVB scrambler allows easy integration with several Conditional Access (CA) systems.

**Figure 1.** Cisco DCM Series D9900 MPEG Processor



### Physical Configuration

The DCM Series D9900 MPEG Processor comes in a compact 2RU chassis with hot-swappable and redundant power supplies. The unit can be configured with up to four I/O cards, with each card having a maximum of ten ASI ports or four GbE ports. The DCM Series D9900 MPEG Processor can be fitted with up to four co-processor cards or up to three transcoder cards to support advanced video processing functions. For receiving off-air ATSC terrestrial signals, the unit can be fitted with up to 3 high-density 8-VSB input cards. The DCM Series D9900 MPEG Processor conforms with the Network Equipment Building Standards (NEBS) Level 3.

The ASI cards have been designed to support full ASI rates allowing freedom in system design. All ASI ports can be individually configured as input or output and all ASI ports support MPTS and SPTS streams.

The GbE I/O cards support four GbE ports via SFP connectors, with the card having a total throughput of 2 Gbps in and 2 Gbps out. The GbE ports support MPTS and SPTS streams.

The co-processor cards' powerful MPEG content processing cores allow the DCM Series D9900 MPEG Processor to perform content recompression to lower bit rates, support open loop statistical multiplexing, digital program insertion, and scrambling. Because the cards are designed around general purpose FPGAs, the DCM Series D9900 MPEG Processor is prepared to support multiple functions in the future through simple code downloads.

Each 8-VSB input card can simultaneously receive up to 8 RF channels and can fully benefit from DCM's MPEG processing functionality.

### **Grooming and Remultiplexing**

Grooming and remultiplexing of content is only the first step of the DCM Series D9900's MPEG processing capability.

The DCM Series D9900 MPEG Processor supports advanced PSI and descriptor handling capabilities. PSI, SI and PSIP tables can be regenerated and played out, changing dynamically according to input changes and configurations. Integration with Continuum<sup>®</sup> DVP SI-Server allows customized PSI/SI situations to be addressed.

It supports extensive transport stream and program analysis, including program level bit rate measurements on both incoming and outgoing streams. This allows the operator to easily configure the content into logical outgoing program groups. Every version also includes monitoring of many TR 101 290 errors.

The high processing power of the DCM Series D9900 MPEG Processor is designed to meet evolving architectures for certain future applications.

### **Advanced Video Processing**

The DCM Series D9900 MPEG Processor has been designed to provide MPEG processing power for today's needs as well as anticipated future requirements. The DCM Series D9900 MPEG Processor supports up to 8 Gbps of input and output capability. Each of the four co-processing cores is capable of transrating, statistically multiplexing, or rate-limiting up to 350 SD streams or 85 HD streams using new IntelliRate *Plus* advanced transrating technology and algorithms. Each of the cores allow for digital program insertion (ad splicing) on SD streams as well as on HD streams. Splicing on component level allows for seamless insertion of regional content or advertisements into existing transport streams. In addition to video processing, these cores also enable the DCM Series D9900 MPEG Processor to perform DVB Simulcrypt compliant scrambling. Functionality of the co-processing cores is enabled via software licenses, allowing the operator to scale the functionality to meet their needs while at the same time reducing the capital expense necessary to meet system requirements.

### **MPEG Processing Applications**

Designed as an MPEG processing application platform, the DCM Series D9900 MPEG Processor accommodates bandwidth management of several encoder pools using IP-based closed-loop statistical multiplexing.

The DCM Series D9900 MPEG Processor can also operate as a Digital Transport Formatter (DTF) in which multiple incoming transport streams are combined into a single transport stream, making it suitable for distributing DVB-T and DVB-H signals for broadcast networks that may operate in an SFN environment.

Using an ASI SFN I/O card in the DCM Series D9900 MPEG Processor offers full SFN adapter functionality, including insertion of MIP information according to TS 101 191 in any outgoing ASI MPEG transport stream on that card.

The DCM Series D9900 MPEG Processor can also generate a so-called slate service out of a still image picture or clip that is loaded onto the device. The slate service might be used as a dummy service or as a backup program to switch to during a service loss.

### **Conditional Access**

The built-in scrambler allows easy integration with several CA systems. Integrating multiple CA systems at the same time is possible through the Simulcrypt interface. The DCM Series D9900 MPEG Processor also supports BISS-1 scrambling to secure satellite or IP transmission links. It also provides BISS-1 descrambling functionality for remote locations that need to receive BISS-1 encrypted video streams over secured primary distribution links.

### **Transcoding**

Following today's rapidly growing IPTV channel lineup requirements, the DCM Series D9900 MPEG Processor also performs high-density MPEG-2 to H.264 video transcoding, and is able to support optional audio transcoding from AC-3 and MPEG-1 Layer II to HE-AAC. It is capable of processing a high number of both SD and HD video streams, supporting 1080i and 720p formats at up to full HD resolution. It is designed to support numerous advanced features like closed caption handling, picture-in-picture (PIP), audio, and metadata pass-through. Functionality of the transcoding modules is enabled via software licenses, allowing operators to scale and grow to meet their needs.

### **Digital Overlays**

To address applications like channel branding, message crawls and emergency alerts, the DCM Series D9900 MPEG Processor allows for insertion of digital overlays such as logos. The DCM Series D9900 MPEG Processor avoids complex decoding and re-encoding by overlaying and rendering logos that remain in the MPEG domain, resulting in a reduction in cost and complexity for the operator.

### **ATSC Off-air Reception**

The state-of-the art 8-VSB input card allows 4 or 8 RF channels to be received simultaneously depending on the chosen hardware version. Each RF input is licensed and can be configured independently to provide full flexibility.

After reception, each received transport stream can use all other DCM processing functionality and allows operators to build a flexible solution.

### **Redundancy and Reliability**

The DCM Series D9900 MPEG Processor has been designed to help operators configure highly reliable networks. It supports hot-swappable and redundant power supplies and hot-swappable cooling fans. The DCM Series D9900 MPEG Processor can be configured in a hot 1:1 configuration to support maximum up-time with minimum switch-over interruption. To maximize service availability, the DCM Series D9900 MPEG Processor also offers port, transport stream, and service redundancy.

## High-Quality Video Transmission over IP Networks

As IP is becoming more and more the transport network of choice, advanced functionality is required to maximize quality of service. The DCM Series D9900 MPEG Processor's extensive set of IP over GbE features, including extensive protocol support and Forward Error Correction (Pro-MPEG COP3 release 2 / SMPTE 2022 FEC) functionality, allows for seamless integration with these IP networks.

## Security Functions

Today's IP attack profiles cover operating systems, networks, applications, and protocols. These attacks can cause hours or days of downtime, affecting availability of resources and creating serious breaches in data confidentiality and integrity. Depending on the level of the attack and the type of information compromised, the consequences vary in degree from mildly annoying to completely debilitating, and the cost of troubleshooting and recovery can become considerable. To cope with the increased complex and open nature of the IP network environment, the DCM Series D9900 MPEG Processor is designed with robust and comprehensive security features.

## User Interface and Management

The DCM Series D9900 MPEG Processor is controlled via an easy and intuitive GUI. To keep things simple, there is no software to load on the user's computer. The GUI of the DCM Series D9900 MPEG Processor is a HTML-based user interface that can be opened using Microsoft Internet Explorer 6.0 and higher or Firefox 3.0. The GUI supports simple program provisioning through drag-and-drop functionality. The interface provides detailed information to the user, showing the DCM Series D9900 MPEG Processor configuration, input and output bit rate measurements, transport stream alarms, and other information. For easy access to content details, sorting of program information can be performed on various program criteria, including input and output ports, bit rates, and program names. The general-purpose inputs on the chassis also allow for triggering of service backup or digital program insertion.

For integrated network monitoring and control, the DCM Series D9900 MPEG Processor is integrated with ROSA<sup>®</sup> Network Management and Control (NMC) system. All functionality available via the HTML interface is available with the ROSA control system.

## Features

### Interfaces

- Up to 40 ASI interfaces ports (10 ASI ports per ASI I/O card)
  - SPTS and MPTS supported
  - User-configurable as input or output on a per-port basis
  - Each ASI port supports up to 213 Mbps data rate
  - Supporting ASI input bandwidth limiting
  - Connector type: BNC
- Interface for external GPS receiver on ASI SFN I/O card (8 ASI ports per ASI SFN I/O card)
  - 1 PPS & 10 MHz inputs
  - SPTS and MPTS supported
  - User-configurable as input or output on a per-port basis
  - Each output port can be configured in normal or in SFN mode
  - Each ASI port supports up to 213 Mbps data rate
  - Supporting ASI input bandwidth limiting
  - Connector type: BNC
- Up to 16 GbE ports (4 ports per GbE I/O card)
  - SPTS and MPTS supported
  - Unicast and multicast support
  - Protocols supported: 802.3, Ethernet, VLAN, RTP, UDP, IP, ARP, ICMP, IGMPv2 / v3
  - Port configurations: 2+2 backup or 2 inputs + 2 outputs
  - Quality of Service: Diffserv/TOS 802.1p
  - Connector type: SFP interfaces
  - FEC according to Pro-MPEG COP3 release 2 (COP3R2)/SMPTE 2022
  - Low latency dejitter option
  - Connector type: SFP interfaces
- Up to 8 ATSC 8-VSB RF input ports
  - 4 and 8 RF input version available
  - Each RF input is enabled via software licensing
  - ATSC A/74 tested
  - Supports reception of MPTS and SPTS

### Remultiplexing

- PID filtering / remapping on each input
- PID tracking
- Auxiliary PID synchronization with video
- Remultiplexing of services and components
- Content routing from any input to any output port

**Monitoring**

- Error monitoring on each input
- Input and output bit rate measurements
- Graphical bit rate viewer showing transrater group bit rates

**Advanced Video Processing**

- Transrating of single SD and HD programs (recompression to lower bit rates)
  - VBR to VBR
  - VBR to CBR (clamped VBR)
  - CBR to CBR
- Open loop statistical remultiplexing of SD and HD programs
  - Group statistical multiplexing of programs and transrating to lower bit rate if required
  - Support of user-defined program prioritization
- Digital Program Insertion in both SD and HD domains
  - Ad insertion based on SCTE 35 and SCTE 30 standards
  - Program substitution based on SCTE 35 triggers or manual interaction
  - eTV (enhanced TV) support
- DVB Simulcrypt and/or BISS-1 (de)scrambling of SD and HD programs
- Advanced processing features enabled through software licenses on a per-program basis

**Transcoding**

- Up to 48 SD or 12 HD channels in 2RU
- Up to 96 stereo pairs transcoding of AC-3 or MPEG-1 Layer II to HE-AAC
- Support of audio and metadata pass-through
- Closed caption handling
- Integrated PIP support
- Transcoding features enabled through software licenses on a per-program basis

**Digital Overlays**

- Static logo insertion with logo resolution up to 320 x 180
- Up to 12 MPEG-2 HD programs in 2RU

**Extended PSI-SI Capabilities**

- Dynamic PSI/SI regeneration
- PSI/SI playout carousel
- Import of PSI/SI tables according DVB Simulcrypt
- PSI descriptor editing capabilities
- Built-in PSI/SI viewer
- Pass-through and regeneration of PSIP tables

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**Redundancy**

- 1:1 Redundant configuration supported
- 1:1 GbE port backup supported
- ASI, GbE port, and GbE port pair mirroring
- Input service and transport stream redundancy

**System**

- 10 Gbps internal processing throughput with 8 Gbps of I/O capability
- User hot-swappable power supplies and fans
- Redundant load-sharing power supplies, supports both AC and DC power supplies
- Configuration settings stored on Compact Flash card (transferable to cold standby unit)

**Management**

- SNMP traps
- ROSA management
- Easy control using web browser
- Ethernet interface for communication with management system and web browser
- IPsec
- General-purpose inputs

## Product Specifications

**Table 1.** Product Specifications

Specification	Value
<b>ASI Interface Card</b>	
Number of ports per card	10 ports, each port configurable as input or output
Connector	BNC-type
Impedance	75 $\Omega$
Interface type	Asynchronous Serial Interface (ASI) (according to EN 50083-9)
Packet format	Auto detection: 188 / 204 byte packets
Bit rate	0.1 – 213 Mbps
Syntax	SPTS or MPTS (according to ISO/IEC 13818)
<b>ASI SFN Interface Card</b>	
Number of ASI ports per card	8 ports, each port configurable as input or output
ASI port connector	BNC-type
ASI port impedance	75 $\Omega$
ASI port interface type	Asynchronous Serial Interface (ASI) (according to EN 50083-9)
ASI port packet format	Auto detection: 188 / 204 byte packets
ASI port bit rate	0.1 – 213 Mbps
ASI port syntax	SPTS or MPTS (according to ISO/IEC 13818)
GPS interfaces	1 PPS & 10 MHz reference inputs
GPS interface connector	BNC-type
GPS interface impedance	50 $\Omega$ or > 1 K $\Omega$ (selectable via GUI)
10 MHz reference input frequency	10 MHz
10 MHz reference input level	200 mVpp – 3 Vpp
10 MHz reference input coupling	AC
10 MHz reference input clock edge	Rising or falling edge (selectable via GUI)
1 PPS reference input frequency	1 PPS, phase locked to the 10 MHz reference input
1 PPS reference input range	0 V min., 5 V max.
1 PPS reference input sensitivity	200 mVpp min.
1 PPS reference input power	150 mWRMS into 50 $\Omega$ max.
1 PPS reference input coupling	DC
1 PPS reference input trigger	Rising or falling edge (selectable via GUI)
1 PPS reference input trigger level	Automatic or manual (selectable via GUI)
<b>Digital Transport Formatter (ASI Interface Card Mode)</b>	
Number of ASI input ports per card	7 ASI ports
Number of ASI output ports per card	3 ASI ports (ports are identical)
Scrambling Activation	Per combined incoming transport stream
Conditional Access	BISS Mode 1

<b>GbE Interface Card</b>	
Number of ports per card	4 GbE ports, 2+2 (for redundancy)
Connector type	Optical/electrical Small Form Factor Pluggable (SFP) (see Note 1)
Interface type	Gigabit Ethernet (GbE) according to IEEE 802.3ab (Electrical) or IEEE 802.3z (Optical) Support for IEEE 802.Q VLAN tagging
Protocols	MPEG over IP/UDP and IP/UDP/RTP
Maximum throughput	2 Gbps input and 2 Gbps output per card
Syntax	SPTS or MPTS (according to ISO/IEC 13818)
Forward Error Correction	Pro-MPEG COP3R2/SMPTE 2022
<b>IP Statmux (GbE Card Mode)</b>	
Number of supported encoders	Up to 60
Number of supported encoder pools	Up to 20 statmux pools
<b>Co-Processing Card</b>	
Video formats	MP@ML (SD) en MP@HL (HD)
Audio formats	MPEG-1 Layer II and Dolby AC-3
Transrating (MPEG 2)	Up to 420 PAL/350 NTSC SD Streams or 85 HD Streams per card
DVB Simulcrypt Scrambling	Up to 500 streams per card
Maximum throughput	2 Gbps
<b>Transcoder Card</b>	
Video input coding format	MPEG-2 MP@ML (SD) and MPEG-2 MP@HL (HD)
Video output coding format	H.264 MP@L3, H.264 HP@L3 and H.264 HP@L4
Video resolutions	SD: 525i/29.97 and 625i/50 HD: 720p/59.94, 1080i/29.97, 720p/50 and 1080i/25
Video modes	CBR and VBR
Video transcoding	Up to 16 SD streams per card or up to 4 HD streams per card
Audio input coding format	MPEG-1 Layer II and AC-3
Audio output coding format	Pass-through: MPEG-1 Layer II, AC-3 and others Transcoding: HE-AAC
Audio transcoding	Up to 32 stereo pairs per card
PIP encoding format	H.264 main profile
PIP picture size	96 x 96 or 128 x 96 or 176 x 144 or 192 x 192
Chassis Compact Flash size	16 GB required
<b>8-VSB Input Card</b>	
Number of ports per card	4 or 8 ports, each port independently configurable
Connector	F-type, female
Impedance	75 Ω
Interface type	ATSC 8-VSB according to ATSC A/53 - Part 2 (A/74 tested)
Frequency range	50 – 860 MHz
Input level range	-80 – -20 dBm
Syntax	SPTS or MPTS (according to ISO/IEC 13818)
<b>Transport Stream Processing</b>	
PID filtering / remapping capability	
Built-in PSI Viewer	
Dynamic PSI regeneration with advanced descriptor handling support	
Detailed bit rate measurement of incoming services	
Error monitoring	

Conditional Access	
Scrambling Algorithm	DVB Common Scrambling Algorithm BISS Mode 1
Level and mode of scrambling	Service/Program level scrambling support, Component level scrambling support, both MPTS and SPTS scrambling supported
Number of CA system connectors	1
Connector type	RJ-45
Interface Type	Ethernet 10/100/1000 BT
Simulcrypt	Simulcrypt version 3
Digital Overlays	
Video input coding format	MPEG-2 MP@HL (HD)
Video output coding format	MPEG-2 MP@HL (HD)
Video resolutions	HD: 720p/59.94 and 720p/50
End-to-end delay	1.4 s
Logo format	PNG
Number of logos per program	Up to 2
Maximum logo resolution	320 x 180 pixels
Total supported screen logo size	Up to 25% vertically and horizontally of screen size

Note: 1. SFP Module not included.

**Figure 2.** Cisco DCM Series D9900 MPEG Processor Rear Panel with AC and DC power supplies, 2 GbE cards, 1 ASI card and 1 ASI SFN card



<b>Management and Monitoring</b>	
Number of ports on chassis	2
Connector type	RJ-45
Interface type	10/100 & 10/100/1000 BT
Protocols	HTTP, SNMP, IIOIP
User interface	Embedded HTML user interface
General Purpose Inputs	4 (spring clamp terminal block connector)
<b>Environmental Specifications</b>	
Operating temperature	0°C – +50°C / +32°F – +122°F
Storage temperature	-40°C – +70°C / -40°F – +158°F
Humidity	5% – 95% (non condensing)
Altitude	-200 – 10000 feet (-61 – 3048 m)
<b>Power Requirements</b>	
Power consumption (fully loaded)	< 350 W
Input voltage	
AC input voltage	
Nominal	100 – 240 VAC
Normal service voltage range	90 – 254 VAC
Frequency	47 – 63 Hz
DC input voltage	
Nominal	-48 – -60 VDC
Normal service voltage range	-38 – -72 VDC
<b>Chassis Mechanical Specifications</b>	
Height	2RU 3.48 in. / 88 mm
Width	19 in. / 483 mm
Depth	21.8 in. / 554 mm
Weight (fully loaded)	28.3 lbs / 12.8 kg
Cooling	Front to back, forced air; units are stackable

**Table 2.** Ordering Information Cisco DCM Series D9900 Components

Cisco DCM Series D9900 Components	Part Number
<b>DCM Series D9900 Preconfigured Unit</b>	
DCM Series D9900 preconfigured unit (fully assembled and pre-enabled licenses)	DSxxxxxxxxxxxxxx Call for Part Number
<b>Hardware Upgrades (Boards delivered as separate kits)</b>	
DCM co-processor board	4010882
DCM ASI I/O board	4010881
DCM ASI SFN I/O board	4027574
DCM GbE board	4023050
DCM GbE I/O + FEC board kit	4022724
DCM 8-VSB input card: 4 RF inputs (Note 2)	4035123
DCM 8-VSB input card: 8 RF inputs (Note 2)	4033441
DCM FEC board	4019399
DCM Transcoder / Digital Overlay board (Note 2)	4028140
DCM blank plate for I/O slot	4008973
DCM blank plate for power supply	4010913
Dust filter	4035393
D9900 / D9901 DCM 16G Compact Flash upgrade kit V06.09.52	4031873.V06.009.52
D9900 / D9901 DCM 16G Compact Flash upgrade kit V07.00.55	4031873.V07.000.55
D9900 / D9901 DCM 16G Compact Flash upgrade kit V07.01.79	4031873.V07.001.79
<b>Power Supplies</b>	
AC power supply (AC power cord needs to be ordered separately)	4009626
DC power supply	4009627
<b>AC Power Cords</b>	
Argentina	207340
Australia	1000897
China	745415
Europe	3989835
Italy	3993130
Japan	3993133
UK	3989836
US	3989838

License Upgrades (Upgrade delivered on a CD-ROM – see Note 3)	
DCM license upgrade containing one or more of the following licenses:	
- Transrating license package (1 license needed for each SD, 4 licenses needed for each HD, co-processor board needed)	40113440xxxx (Note 4)
- Splicing license package (1 license needed for each SD, 2 licenses needed for each HD, co-processor board needed)	40113460xxxx (Note 4)
- DVB Simulcrypt / BISS Mode 1 Scrambling license package (1 license needed per service, co-processor board needed)	40113480xxxx (Note 4)
- BISS Mode 1 Descrambling license package (1 license needed per service, co-processor board needed)	40336660xxxx (Note 4)
- Digital Transport Formatter (DTF) license package (1 license needed for each ASI board)	40223400xxxx (Note 4)
- Digital Transport Formatter BISS Mode 1 (DTF-BISS) license package (1 license needed for each ASI board) (BISS license can only be used on an ASI board already having a DTF license)	40223420xxxx (Note 4)
- COP3 FEC license package (1 license needed per FEC encode/decode repair stream)	40208020xxxx (Note 4)
- PID Sync Delay license package (1 license needed per PID that needs to be synchronized to the video)	40268760xxxx (Note 4)
- MIP Insertion license package (1 license needed per MPTS that requires MIP insertion)	40281300xxxx (Note 4)
- GPI Interface license package (1 license needed per hard contact)	40290940xxxx (Note 4)
- EIT Filter license package (1 license needed per DCM)	402909000000
- EIT Advanced Filter license package (1 license needed per DCM)	402909200000
- MPEG-2 → AVC SD Transcoding license package (1 license needed for each SD service, transcoder board needed)	40302320xxxx (Note 4)
- MPEG-2 → AVC HD Transcoding license package (1 license needed for each HD service, transcoder board needed)	40302340xxxx (Note 4)
- MPEG-1 Layer II → HE-AAC Transcoding license package (1 license needed for each stereo pair, transcoder board needed)	40302360xxxx (Note 4)
- AC-3 → HE-AAC Transcoding license package (1 license needed for each stereo pair, transcoder board needed)	40302380xxxx (Note 4)
- PIP license package (1 license needed for each service, transcoder board needed)	40302400xxxx (Note 4)
- 8-VSB Reception license package (1 license needed for each RF input, 8-VSB input card needed)	40369840xxxx (Note 5)
- Digital Overlay license package (1 license needed per static logo inserted per program, transcoder board needed)	40373230xxxx (Note 4)

Note: 2. NEBS Level 3 qualification pending

Note: 3. License Upgrade CD-ROMs are delivered as one separate CD-ROM per part number.

Note: 4. 'xxxx' in the License Upgrade part numbers represent the license quantity for that specific license type.

Note: 5. 'xxxx' in the License Upgrade part numbers represent the license quantity for that specific license type. Available quantities are 0004, 0008, 0012, 0016, 0020 and 0024.

**Table 3.** Ordering Information SFP Plug-ins (see Note 6)

Cisco DCM Series D9900 Components	Part Number
<b>SFP Plug-ins – WDM types</b>	
GbE SFP module 850 nm (LC, up to 500 m)	4002019
GbE SFP module 1310 nm (LC, up to 5 km)	4002020
GbE SFP module 1310 nm (LC, up to 40 km)	4003466
<b>SFP Plug-ins – CWDM types</b>	
GbE SFP module 1470 nm (LC, up to 40 km)	4002003
GbE SFP module 1490 nm (LC, up to 40 km)	4002004
GbE SFP module 1510 nm (LC, up to 40 km)	4002005
GbE SFP module 1530 nm (LC, up to 40 km)	4002006
GbE SFP module 1550 nm (LC, up to 40 km)	4002007
GbE SFP module 1570 nm (LC, up to 40 km)	4002008
GbE SFP module 1590 nm (LC, up to 40 km)	4002009
GbE SFP module 1610 nm (LC, up to 40 km)	4002010
GbE SFP module 1470 nm (LC, up to 70 km)	4002011
GbE SFP module 1490 nm (LC, up to 70 km)	4002012
GbE SFP module 1510 nm (LC, up to 70 km)	4002013
GbE SFP module 1530 nm (LC, up to 70 km)	4002014
GbE SFP module 1550 nm (LC, up to 70 km)	4002015
GbE SFP module 1570 nm (LC, up to 70 km)	4002016
GbE SFP module 1590 nm (LC, up to 70 km)	4002017
GbE SFP module 1610 nm (LC, up to 70 km)	4002018
<b>SFP Plug-ins – 1000 BT copper</b>	
GbE SFP module 1000 BT copper	4006222

Note: 6. All Class 1 SFP plug-ins according to IEC 60825-1 (1997) Amendment 2 (2001).



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