Industrial Fiber Optic Components, Cabling and Accessories

Selection Guide

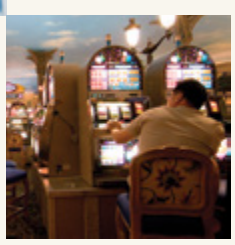
Your Imagination, Our Innovation

Sense • Illuminate • Connect

Fiber Optic Components for Industrial, Automation, Power Generation/ Distribution, Transportation, Gaming and Medical Applications

Avago Technologies is the world's leading provider of fiber optic transmitters, receivers, and transceivers. Avago offers unmatched quality with high-volume, cost-effective manufacturing techniques. Industry leaders and small firms alike turn to Avago for their fiber optic needs.

The SFH-series (Connectorless) has 650nm fiber-optic components with the capability to work with unconnectorized POF (plastic optical fiber) for ease of installation. The Versatile Link Package contains 650nm discrete components that feature snap-in connector parts. The SMA/ST Package is an extremely robust industrial-grade family with SMA or ST ports suitable for use in Fieldbus applications. The Miniature Link family which provides greater link-lengths, is available with 820nm and 1300nm technology. These are discrete components that can use SMA, ST, SC, or FC connectors.

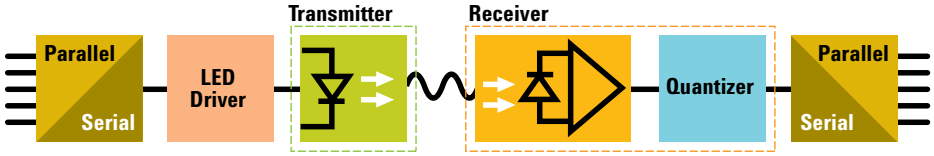


Fundamentals of Digital Fiber Optic Links

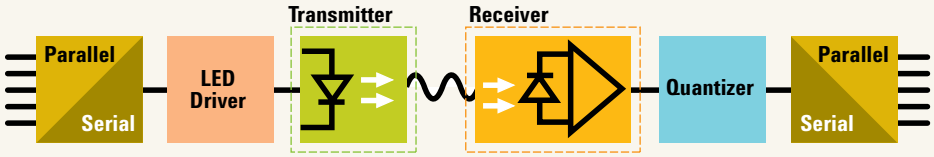
All the optical transmitters from these families include an LED without driver circuitry. Cost effective driver ICs are available from many suppliers, and we offer application notes that will demonstrate easy integration of these ICs into a transmitter circuit.

The optical receivers from DC up to 50 MBd include a photodiode, preamp, and quantizer circuit (shown in the block diagram below). These receivers have TTL outputs (dc coupled) and can be used with arbitrary timing (no duty factor restriction). Typical applications are RS232, RS485, SERCOS, INTERBUS-S and PROFIBUS protocols.

Typical link block diagram from DC to 50 MBd.



Typical link block diagram from 1 MBd to 160 MBd.



The receivers for data rates from 1 MBd to 160 MBd include a photodiode, pre-amp and analog outputs. They have to be ac coupled to a comparator or quantizer circuitry to provide digital logic levels (i.e. ECL, TTL). The ac coupling requires encoding of the serial data (i.e. Manchester, 4B/5B, scrambled coding), but provide better sensitivity than DC coupled receivers.

Plastic Optical Fiber (POF) Components

Avago Technologies is committed to the advancement of fiber optics technologies and recognizes the importance of optical data transmission for today's growing data networking needs. Plastic Optic Fiber (POF) enables low-cost applications with the advantages of optical data transmission; suitable for automotive, industrial and consumer markets.

Industrial Fiber Optic Transceiver

Providing a comprehensive line of high-performance fiber optic transceivers, Avago's products reliably support a wide range of industrial data networking standards and speeds.

Applications

- Factory automation at Fast Ethernet speeds
- Fast Ethernet networking
- IPTV connection high-speed gateway to set-top box
- Home networking
- Industrial applications

Industrial Fiber Optic Transceiver

Connector Configuration		Data Rate	Reach	Fiber	Supply Voltage	Part Numbers	DMI	Evaluation Board
	SFF/LC	Fast Ethernet (10/100 Mbps)	2000m	Multi-mode	3.3V	HFBR-5963LZ AFBR-59E4APZ	No	
	SFF/MT-RJ	Fast Ethernet (10/100 Mbps)	2000m	Multi-mode	3.3V	AFBR-5903AZ	No	
	SFP/LC	Fast Ethernet (10/100 Mbps)	2000m	Multi-mode	3.3V	HFBR-57E0APZ HFBR-57E5APZ	No Yes	
	1x9/SC	Fast Ethernet (10/100 Mbps)	2000m	Multi-mode	3.3V/5V	AFBR-5803ATQZ	No	
	1x9/ST	Fast Ethernet (10/100 Mbps)	2000m	Multi-mode	3.3V/5V	AFBR-5803ATQZ	No	
	Versatile Link	Fast Ethernet (10/100 Mbps)	50m	POF	3.3V	AFBR-5972Z	No	AFBR-0544Z
	SC-RJ Profinet®	Fast Ethernet (10/100 Mbps)	50/100m	POF/HCS®	3.3V	AFBR-5978Z	Yes	AFBR-0978Z

650nm Industrial Fiber Optic Components

Components listed here are compatible with both plastic (1 mm core diameter) and HCS® (hard clad silica) optical fibers. Plastic fiber (1mm core diameter), often specified in cost-effective solutions will see implementations in frequency conversion, power electronics control and industrial fieldbuses. HCS is typically used for higher data rates and link length. Connectorization schemes include Connectorless, ST, SMA and Versatile Link.

Applications

- Factory automation
- Industrial networking and fieldbuses
- Audio visual links and datalinks, up to 160 Mbd
- High-voltage conversion
- IGBT, GTO, IGCT power electronics
- High-voltage isolation
- Gaming
- Human machine interfaces

Fieldbus (SMA/ST Connectors)

Connector Configuration		Data Rate	Reach		Supply Voltage	Part Numbers		Application Notes	Evaluation Board
			POF	HCS®		Transmitter	Receiver		
	SMA	DC-2MBd	50m	400m	5V	HFBR-1505CZ	HFBR-2505CZ		HFBR-0538Z
			50m	300m	5V	HFBR-1505CFZ	HFBR-2505CFZ		
			20m		5V	HFBR-1602Z	HFBR-2602Z		
			20m		5V	HFBR-1604Z	HFBR-2602Z		
		DC-10MBd	40m	200m	5V	HFBR-1505AZ	HFBR-2505AZ	AN1080	HFBR-0540Z
			40m	100m	5V	HFBR-1505AFZ	HFBR-2505AFZ		
		DC-16MBd	45m	200m	5V	HFBR-1506AMZ	HFBR-2506AMZ	AN5006	HFBR-0541Z
			45m	100m	5V	HFBR-1506AFZ	HFBR-2506AFZ		
		2MBd - 16MBd	45m		3.3V/5V	HFBR-1506AFZ	HFBR-2555AFZ		
	ST	DC-10MBd	40m	200m	5V	HFBR-1515BZ	HFBR-2515BZ	AN1080	HFBR-0539Z
			40m	100m	5V	HFBR-1515BFZ	HFBR-2515BFZ		

Versatile Link Package/Connector

Connector Configuration		Data Rate	Reach		Supply Voltage	Part Number		Application Notes	Evaluation Board
			POF	HCS®		Transmitter	Receiver		
	Horizontal	DC-40kBd	110m		5V	HFBR-1523Z	HFBR-2523Z	AN1035	HFBR-0503Z
		DC-1MBd	10m		5V	HFBR-1524Z	HFBR-2524Z	AN5374	
			45m		5V	HFBR-1522Z	HFBR-2522Z	AN1035	HFBR-0502Z
			45m		5V	HFBR-1522ETZ	HFBR-2522ETZ		
		DC-5MBd	20m		5V	HFBR-1521Z	HFBR-2521Z	AN1035	HFBR-0501Z
			20m		5V		HFBR-2521ETZ		
		DC-10MBd	40m	200m	3.3V/5V	AFBR-1529Z	AFBR-2529Z		
		DC-50MBd	50m		3.3V/5V	AFBR-1624Z	AFBR-2624Z		AFBR-0546Z AFBR-0548Z
			50m		3.3V/5V	AFBR-1629Z	AFBR-2529Z		AFBR-0547Z
		125MBd	30m	100m	5V	HFBR-1527Z	HFBR-2526Z	AN1121 AN1123 AN1066	HFBR-0527xZ
			30m	100m	5V	HFBR-1527ETZ	HFBR-2526ETZ		
		160MBd	50m	50m	5V	HFBR-1527Z	HFBR-2526Z		
			50m	50m	5V	HFBR-1527ETZ	HFBR-2526ETZ		
	Vertical	DC-40kBd	110m		5V	HFBR-1533Z	HFBR-2533Z	AN1035	HFBR-0503Z
		DC-1MBd	10m		5V	HFBR-1534Z	HFBR-2534Z	AN5374	
			45m		5V	HFBR-1532Z	HFBR-2532Z	AN1035	HFBR-0502Z
		DC-5MBd	20m		5V	HFBR-1531Z	HFBR-2531Z	AN1035	HFBR-0501Z
			20m		5V	HFBR-1531ETZ	HFBR-2531ETZ	AN1035	
		125MBd	30m	100m	5V	HFBR-1537Z	HFBR-2536Z	AN1066	HFBR-0527xZ
		160MBd	50m	50m	5V			AN1123	
	Tilted	DC-1MBd	45m		5V	HFBR-1542ETZ	HFBR-2542ETZ	AN1035	HFBR-0502Z
		DC-5MBd	20m		5V	HFBR-1541ETZ	HFBR-2541ETZ	AN1035	HFBR-0501Z
		DC-50MBd	50m		3.3V/5V	AFBR-1644Z	AFBR-2644Z		AFBR-0546Z AFBR-0548Z
	FO Short Link	DC-10MBd	24.96mm Creepage & Clearance		5V	HFBR-3810Z & HFBR-3810MSZ			HFBR-0543Z

Connectorless

Connector Configuration		Data Rate	Reach		Supply Voltage	Part Numbers		Application Notes	Evaluation Board
			POF	HCS®		Transmitter	Receiver		
	V-Housing	DC-5MBd	20m		5V	SP000063858 (SFH757V)	SP000063855 (SFH551/1-1V)	AN5341 AN5342	
		100MBd	20m		5V	SP000063858 (SFH757V)	SP000063852 (SFH250V)		
	LL-Housing	DC-5MBd	20m		5V	SP000063871 (SFH757)	SP000063860 (SFH551/1-1)	AN5341 AN5342	
		100MBd	20m		5V	SP000063871 (SFH757)	SP000063866 (SFH250)		

Miniature Link 820nm/850nm/1300nm Industrial Fiber Optic Components

These cost-effective components with long link-length capabilities can be used to build high-performance ethernet transceivers. Typical applications include FDDI, Token Ring, FOIRL, 10Base-FL and 100Base-SX. Glass fiber specified in this selection guide are multimode fiber both 62.5/125 µm and 50/125 µm multi-mode glass fiber can be used.

Applications

- LAN applications, such as 10Base-FL
- FDDI, Token Ring, 100base-SX
- Audio video links and industrial datalinks
- Wind turbine control system and farm networking
- Hydro and solar power generation plants
- Media and fiber converters
- Railway control systems
- Locomotive in-car and car-to-car communications
- Motorway infrastructures

Miniature Link 820nm/850nm/1300nm Industrial Fiber Optic Components

Connector Configuration	Data Reach	Reach	Voltage	Standard RoHS Part Number		Evaluation Board
				Transmitter	Receiver	
ST, SMA, FC	DC-5 MBd	1500m	5V	HFBR-14X2Z	HFBR-24X2Z	HFBR-0410Z
ST, SC, SMA	20 MBd	2700m	5V	HFBR-14X4Z	HFBR-24X6Z	HFBR-0416Z
	32 MBd	2200m				
	55 MBd	1400m				
	125 MBd	700m				
	155 MBd	600m				
	160 MBd	500m				
ST, SC, SMA	20 MBd	3000m	3.3V/5V	HFBR-14X4Z HFBR-1712TZ	AFBR-24X9XZ	
	32 MBd	2200m				
	40 MBd	1500m				
	50 MBd	1000m				
ST	20 MBd	5000m	5V	HFBR-1312TZ	HFBR-2316TZ	HFBR-0310Z
	32 MBd	3200m				
	55 MBd	3200m				
	125 MBd	2800m				
	155 MBd	2700m				
	160 MBd	2000m				
ST	DC-5 MBd	4000m	5V	HFBR-1712TZ	HFBR-24XXZ	HFBR-0542Z
	20 MBd	2700m				
	32 MBd	2200m				
	55 MBd	1400m				
	125 MBd	700m				
	155 MBd	600m				
	160 MBd	500m				

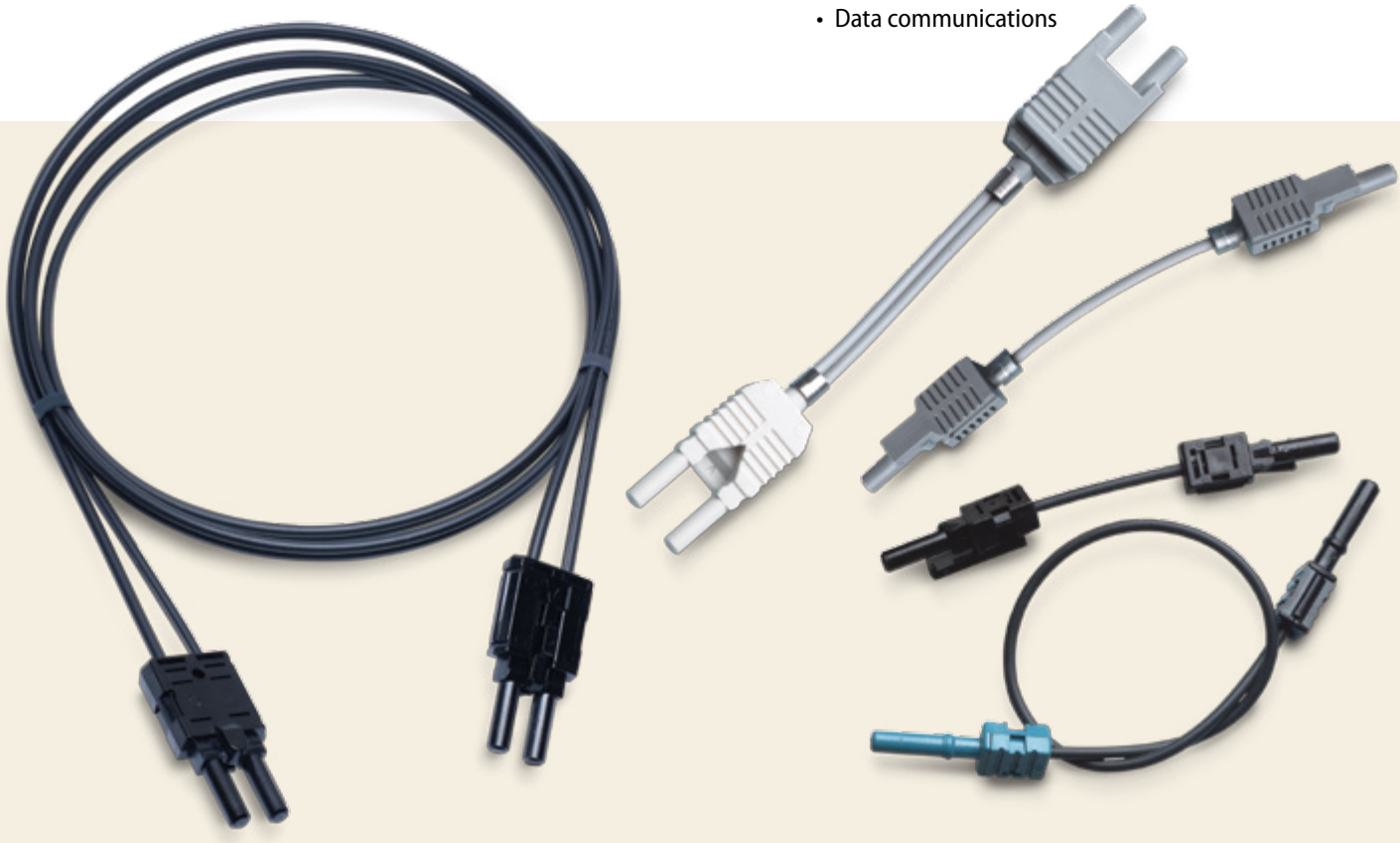
Plastic Optical Fiber Cables

The HFBR-C/E/RXXYYZ series of plastic fiber optic cables are constructed of a single step index fiber, sheathed in a black polyethylene jacket. The duplex fiber consists of two simplex fibers joined with a zipcord web. Standard attenuation and extra low loss POF cables are identical except for attenuation specifications. Polyethylene jackets on all plastic fiber cables comply with ULVW-1 flame retardant specification (UL file #E89328). Cables are available in unconnectorized or connectorized options.

Compatible with our Versatile Link family of connectors and fiber optic components, we offer 1mm diameter (outer diameter 2.2 mm) POF in two grades: Standard POF with 0.22 dB/m typical attenuation or High Performance Extra Low Loss POF with 0.19 dB/m typical attenuation.

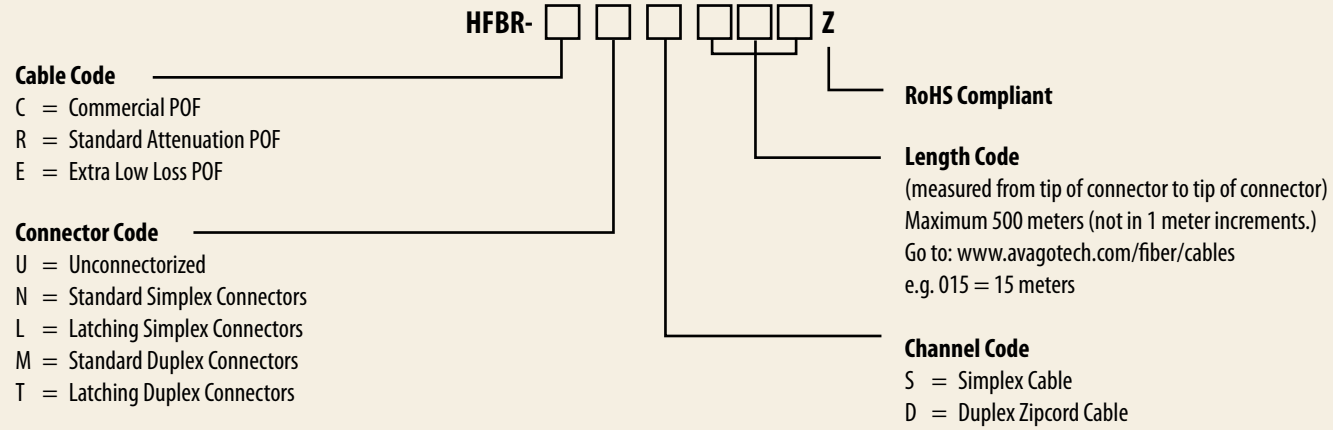
Applications

- Industrial data links for factory automation and plant control
- Intra-system links: board-to-board or rack-to-rack
- Telecommunications switching systems
- Computer-to-peripheral data links, PC bus extension
- Proprietary LANs
- Digitized video
- Medical instruments
- Reduction of lightning and voltage transient susceptibility
- High-voltage isolation
- Power electronics
- Gaming equipment
- Data communications



Plastic Optical Fiber Specifications: HFBR-C/E/RXXYYZ

Parameter		Symbol	Min.	Typ.	Max	Unit	Condition
Cable Attenuation Source: 660nm LED, 0.5 NA (HFBR-15xxZ) Length: 50m	Commercial Grade cable, type "C"	α_0	0.15	0.22	0.27	dB/m	T_A=0°C to +70°C
	Standard cable type "R"		0.15	0.22	0.27		T_A=-40°C to +85°C
	Extra low loss type "E"		0.15	0.19	0.23		T_A=-40°C to +85°C
Reference Attenuation Source: 650nm, 0.5 NA (monochrometer) Length: 50m	Commercial Grade cable, type "C"	α_R	0.12	0.19	0.24	dB/m	T_A=0°C to +70°C
	Standard cable type "R"		0.12	0.19	0.24		T_A=-40°C to +85°C
	Extra low loss type "E"		0.12	0.16	0.19		T_A=-40°C to +85°C
Numerical Aperture		NA	0.46	0.47	0.50		>2meters
Diameter, Core and Cladding	DC	0.94	1.00	1.06	mm		



POF and HCS Connectors and Accessories

Crimp Style

The HFBR-4501Z, HFBR-4503Z and HFBR-4506Z connector styles are available for termination of plastic optical fiber: simplex, simplex latching, duplex and duplex latching. All connectors provide a snap-in action when mated to Versatile Link components. Simplex connectors are color coded to facilitate identification of transmitter and receiver connections. Duplex connectors are keyed so that proper orientation is ensured during insertion. The connectors are made of a flame retardant VALOX UL94 V-0 material (UL file # E121562).

Crimpless Style

The HFBR-453XZ series connectors are an enhanced version of the HFBR-4501Z and HFBR-4503Z connectors for plastic optical fiber, compatible with Avago's Versatile Link series transmitters and receivers. This design uses a simple, snap-together concept, which eliminates the need for crimping. User labor and tool cost are reduced together with the yield loss due to installation error. The HFBR-453XZ series connectors are available in two-styles: latching and non-latching. For a duplex connector, two nonlatching simplex connectors can be snapped together. The connectors are made of a rugged, flame resistant plastic which is good for industrial and other harsh environments. The HFBR-453XZ series connectors are for use with plastic optical fiber only.

Plastic Optical Fiber Connectors

Part Number	Description
HFBR-4501Z/4511Z	Gray/blue simplex conector with crimp ring
HFBR-4503Z/4513Z	Gray/blue simplex latching conector with crimp ring
HFBR-4505Z/4515Z	Gray/blue mating adapter for two simplex non-latching POF connectors
HFBR-4506Z/4516Z	Parchment/gray duplex connector with crimp ring
HFBR-4531Z/4532Z	Black crimpless simplex non-latching/latching connector
HFBR-4533Z/4535Z	Blue/gray crimpless simplex non-latching connector
AFBR-4526Z	Black crimpless latching connector (mating transceiver: AFBR-5972Z)

Plastic Optical Fiber Accessories

Part Number	Description
HFBR-4522Z	500 HFBR-0500 products port plugs
HFBR-4525Z	1000 simplex crimp rings
HFBR-4526Z	500 duplex crimp rings
HFBR-4593Z	Polishing kit (one polishing tool, two pieces 600 grit abrasive paper and two pieces 3µm pink lapping film)
AFBR-4594Z	Polishing kit for AFBR-4526Z (One polishing tool, two pieces 600 grit abrasive paper, and two pieces 3um pink lapping film)
HFBR-4597Z	Crimping tool 4.5 - 5.5mm for simplex/duplex crimp rings

Your Imagination. Our Innovation

Avago Technologies is a leading designer, developer and global supplier of a broad range of analog, mixed signal and optoelectronics components and subsystems with a focus in III-V compound semiconductor design and processing. Backed by an extensive portfolio of intellectual property. Avago products serve three primary target markets: wireless communications, wired infrastructure, and industrial and other. Avago has a global employee presence and heritage of technical innovation dating back 50 years to its Hewlett-Packard roots.

Avago products serve three diverse end markets

Wireless Communications serving the smartphone/handset and Base Station infrastructure markets with leading-edge products that include:

- Power Amplifiers
- Front End Modules
- Film Bulk Acoustic Resonator (FBAR) Filters
- GPS/GLONASS LNAs
- Optical Finger Navigation
- LED Backlighting, Screen Illumination
- Ambient Light and Proximity Sensors

Wired Infrastructure for switches/routers, data centers, supercomputers and storage/servers with products that include:

- 168Gb Parallel Optic Arrays
- 28Gb SerDes ASICs in 28nm
- Storage Fibre Channel Transceivers
- QSFP+/SFP+ Ethernet Transceivers

Industrial and Other for alternative energy power generation, electronic sign and signals, automated manufacturing, automotive lighting, GPS/GLONASS navigation, motor inverter system, battery charging and management, infotainment systems and vehicle safety systems with products that include:

- Inverters
- Isolation and Digital Optocouplers
- Motion Control Optical & Magnetic Encoders
- Polymer Optical Fiber
- Indicator and Display LEDs

For product information and a complete list of distributors, please go to our web site:

www.avagotech.com
www.avagotech.com/pof
www.avagotech.com/fiber

For technical support please email a Technical Response Center in your region:

United States: support@avagotech.com

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AV00-0269EN 09/24/13

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