

# Final SDN-based Media Server Prototype

## Nevion Virtuoso

### Media Virtualization Platform

**Nevion Virtuoso is a revolutionary software-defined media virtualization platform, offering wide-ranging functionality for live production, contribution and professional media transport applications.**

The Nevion Virtuoso platform is designed to meet the challenges of live IP media production and transport, where the distinction between local and wide-area media networks is blurring, and where virtualization plays an increasing role, leading to faster time-to-production and greater cost-effectiveness.

Nevion Virtuoso runs a variety of Media Functions to perform different tasks, including video and audio processing, encoding and decoding, content protection and encryption, confidence monitoring, and IP transport protection for media and data.

The virtualization of Media Functions is achieved by using flexible network-attached media server Appliances and Accelerators. Provisioning of new a Media Function is easy thanks to a software and license-based approach.

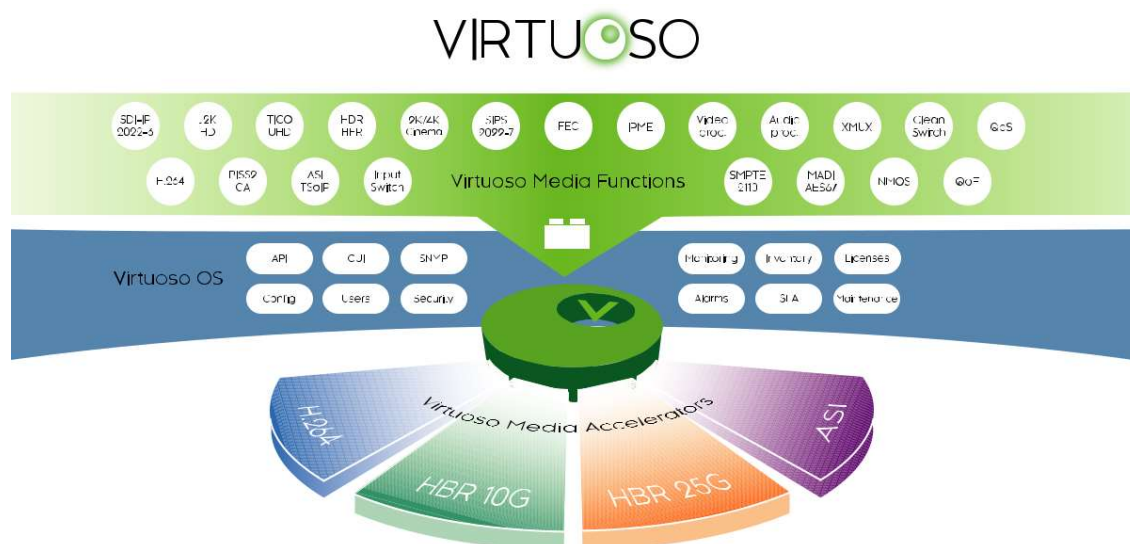
The versatile Nevion Virtuoso platform, together with Nevion's VideoPath orchestration software, are designed to enable the full potential of IP-based lean production.

#### Applications

- IP in the facilities and IP production infrastructure
- In-house/campus media networks
- Outside broadcast live sports/event contribution
- Live remote and at-home production workflows
- Regional and wide-area contribution networks
- High availability managed media services
- Programming and television distribution networks
- End-to-end service monitoring

#### Key features

- Software-defined platform for media processing
- Multi-format video and audio compression
- Adaptation of SDI, TS, audio and data signals
- Fully standards-compliant IP media transport
- Advanced audio/video processing
- Content protection and encryption
- High availability device and network redundancy
- Simple integration in any IT/IP network infrastructure
- Powerful monitoring and alarm handling
- Easy-to-use web interface for monitoring & control
- Fully integrated with Nevion's VideoPath orchestration and SDN control solution



## Media Server Appliances

The Nevion Virtuoso platform has been designed to allow for the provision of Media Servers (appliances) with different characteristics, such as size, number of Media Accelerators that can be accommodated and level of modularity, in order to suit virtually any deployment scenario.

The **Nevion Virtuoso FA** is a 1 RU flexible appliance with dual AC load-sharing power supplies. It includes a built-in 10GE uplink for MPEG-2 TS over IP adaptation, processing and monitoring, as well as element management functions. It can hold up to four Media Accelerators, and is cost-effective and suitable for fixed and mobile flight case deployments.

The **Nevion Virtuoso MI** is a 1RU modular infrastructure appliance with dual AC or DC load-sharing power supplies, supporting hot-swap and internal redundancy for element management, internal communications and network uplinks. Nevion Virtuoso MI can hold up to 8 Media Accelerators, supporting for example 1 Network Uplink and 7 Media Functions, 2 Network Uplink and 6 Media Functions, or 8 stand-alone Media Functions.

## Virtuoso OS

Nevion Virtuoso OS offer a set of sophisticated element manager functionalities including web user interfaces, APIs, alarm management, alarm and event notification and logging, authentication and security, and timing/sync distribution. The ease of use simplifies operations and allows for fast reconfiguration for occasional use applications.

## Software defined Media Functions

Nevion Virtuoso is a software defined media node, supporting a variety of Media Functions that can be deployed in a flexible manner to meet changing business requirements, thereby making it extremely versatile, cost-effective and future-proof.

## Media Accelerators

### HBR Media Accelerator

- FPGA-based accelerator for high bitrate media signal processing and networking applications.
- 10GE network with PTP, flexible media interfacing up to 12G on 4x SFP+ ports.

### HBR25 Media Accelerator

- FPGA-based accelerator for high bitrate media signal processing and networking applications.
- 25GE/10GE network with PTP on 2x SFP28, flexible media interfacing up to dual 12G on 1 x SFP+ port.

### H.264/AVC Accelerator

- H.264/AVC encoder or decoder (10-bit 4:2:2)
- MPEG-2 encoder or decoder (8-bit 4:2:2)

### ASI Interface Accelerator

- 4 ASI input/output ports (direction configurable)

### Audio Interface Accelerator (planned)

- Used in combination with HBR accelerator
- RPRO: mix of analog audio, AES3 audio and GPIO, with output video black/tri-level sync
- AES3: 16 channels - direction configurable
- Analog: 8 input + 8 output mono channels

# Nevion Virtuoso - Media Functions

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Media Function	App Name	Virtuoso MI	Virtuoso FA	Accelerator
Network Uplink 10GE	UPLINK-10G	Yes	-	HBR
Network Uplink 25GE	UPLINK-25G	R	-	HBR25
IP Media Edge Firewall/NAT	IPME-RTP	Yes	Yes	HBR
SDI-IP ST2022 (TR-04)	SDI-IP-2022	Yes	Yes	HBR
SDI-IP ST2110	SDI-IP-2110	Yes	Yes	HBR
SDI-IP ST2022 to/from ST2110	SDI-IP-2022-2110	R	R	HBR
MADI IP audio processor	AUD-PROC-MADI-IP	Yes	Yes	HBR
ASI/TS over IP gateway	ASI-IP-2022	Yes	-	HBR
J2K HD encoder	J2K-HD-E4	Yes	Yes	HBR
J2K HD decoder	J2K-HD-D4	Yes	Yes	HBR
J2K HD encoder/decoder	J2K-HD-E2D2	Yes	Yes	HBR
J2K 2K DCI encoder	J2K-2K-DCI-E2	R	Yes	HBR
J2K 2K DCI decoder	J2K-2K-DCI-D2	R	Yes	HBR
TICO UHD encoder/decoder	TICO-UHD-E1-D1	Yes	Yes	HBR
TICO UHD encoder	TICO-UHD-E2	R	-	HBR
TICO UHD encoder ST2110	TICO-UHD-E2-IP	R	R	HBR25
TICO UHD decoder ST2110	TICO-UHD-D2-IP	R	R	HBR25
XS HD encoder ST2110	XS-HD-E3	Yes	R	HBR, HBR25
XS HD decoder ST2110	XS-HD-D3	Yes	R	HBR, HBR25
XS UHD encoder ST2110	XS-UHD-E2	R	R	HBR25
XS UHD decoder ST2110	XS-UHD-D2	R	R	HBR, HBR25
H.264 HD encoder	H264-E1	R	Yes	H264
H.264 HD decoder	H264-D1	R	Yes	H264
ASI over IP gateway	Virtuoso FA	-	Yes	FA uplink
TS over IP gateway	Virtuoso FA	-	Yes	FA uplink
TS monitoring (TR 101 290)	Virtuoso FA	-	Yes	FA uplink
TS input switching	Virtuoso FA	-	Yes	FA uplink
TS BISS1 scrambling	Virtuoso FA	-	Yes	FA uplink
TS BISS2/CA scrambling	Virtuoso FA	-	Yes	FA uplink
Yes = Available now R = Roadmap				

## Network Uplink

- RTP/IP stream input/output aggregation.
- TS over IP adaptation (ST2022-1/2/7).

## IP Media Edge

- RTP-IP media firewall/NAT with 4x 10GE/1GE
- Hitless protection (ST2022-7), FEC (ST2022-1/5)

## SDI-IP ST2022-6 (TR-04)

- SDI-IP adaptation (ST2022-6/7) with AES67 audio embedding and processing.

## SDI-IP ST2110

- SDI-IP adaptation to/from ST2110 with audio and ANC data embedding and processing.

## MADI and IP audio processor

- MADI-IP adaptation to/from ST2110-30/31.
- High density ST2110 audio processor with, flexible routing and processing.
- Breakout adapter for AES3 and analog audio.

## JPEG 2000 HD

- Multi-channel JPEG 2000 (J2K) compression for SD/HD/3G 10-bit 4:2:2 complaint with VSF TR-01.
- 4 channel encoder, 4 channel decoder or 2+2 channel bidirectional encoder/decoder.

## JPEG 2000 2K DCI

- Multi-channel JPEG 2000 (J2K) compression for HD and 2K formats, 12-bit 4:4:4 RGB/YCbCr.
- 2 channel encoder, or 2 channel decoder.

## TICO UHD

- TICO compression is compliant with ST RDD 35.
- Bidirectional TICO UHD encoder + decoder, with Quad-link 3G-SDI for UHD input/output and transport over 3G-SDI or IP ST2022-6/7.
- Dual channel TICO UHD encoder, or dual channel decoder, with ST2110 for UHD input/output.

## XS HD

- Multi-channel TICO XS compression for HD/3G 10-bit 4:2:2, with SDI and ST2110 baseband interfaces and ST2110-22 transport.
- 3-channel encoder, or 3-channel decoder.
- Future compliant to JPEG XS standard.

## XS UHD

- Multi-channel TICO XS compression for UHD 10-bit 4:2:2, with 12G-SDI and ST2110 baseband interfaces and ST2110-22 transport.
- 2-channel encoder, or 2-channel decoder.
- Future compliant to JPEG XS standard.

## H.264/AVC HD encoder/decoder

- High quality H.264/AVC compression (10bit 4:2:2).
- Encoder or decoder on H.264 accelerator.
- BISS1 and BISS2/CA scrambling.

## TS Gateway

- ASI-IP and TS over IP gateway.
- TS monitoring and analysis (TR 101 290).
- Alarm-based TS input switching.
- TS scrambling/descrambling with BISS1, BISS2/CA.

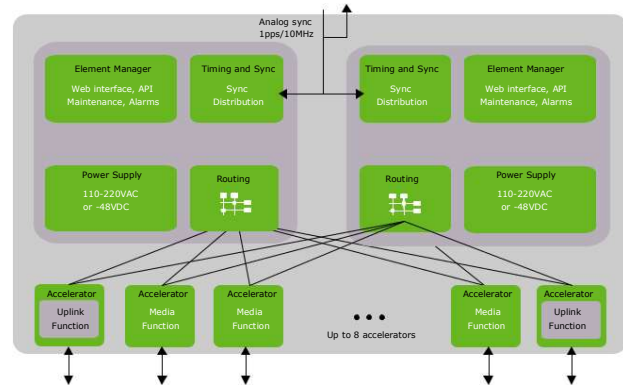
# Virtuoso MI - Carrier Grade Modular Appliance

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## Nevion Virtuoso MI Media Server

Description	Nevion Virtuoso MI carrier-grade media appliance with redundant load-sharing hot-swappable AC or DC power supplies. Redundant frame controllers and internal high-speed data and media routing. The 1RU appliance can hold up to 8 accelerator modules. 2 of the 8 slots available for network uplink functions.
Product codes	VIRTUOSO-HW-1U-MI-AC2 (24574) VIRTUOSO-HW-1U-MI-DC2 (24575)
Expansion slots	Up to 8 media accelerator modules
Ethernet ports	2 x 100/1000Base-T, RJ.5 connecting to each of the frame controllers (RJ.5 to RJ45 cable included)
Interface type	Gigabit Ethernet, 802.3ab (electrical), Fast Ethernet (FE) 802.3u
Protocols	IPv4, DSCP/TOS, ICMP, ARP 802.1Q (VLAN tag), 802.1P (VLAN priority) HTTP/HTTPS, FTP/FTPS, Telnet/SSH, SNMP v2c/v3, TCP, UDP, SNTP
Control features	Configuration and monitoring via dynamic rich web user interface. HTTP/XML, HTTP RESTful API or SNMP. Secure communication protocols Out-of-band or in-band access. Local or centralized user authentication. Extensive alarm management. Searchable log with 100.000 entries, Integrated in Nevision Maestro VideoPath.
License handling	License management for all the Media Functions supported.
Sync input	1 x multi-function sync input with passive loop out. Analog bi-level (black burst) or tri-level or 1PPS or 10 MHz Female BNC connectors (75 Ohm) PTP / IEEE 1588v2 via HBR accelerator Timing & sync distribution in chassis
Maintenance port	Micro-USB to each frame controller
Front panel LEDs	Power on (Green), Alarm status (Clear on
Physical dimensions	1RU 19" rack-mount chassis WxDxH = 448 x 565 x 43 mm
Weight	11.5 kg (max. including accelerators)
Rack installation	Install in clean and dust free environment. Removable front panel with fan filter. Rack rails are required for mounting in mobile production trucks.



Power configuration	Dual load-sharing AC or DC power supplies Hot swap, accessible via front.
Input Voltage	100-240V AC +/- 10%, 50/60 Hz
Power consumption	Up to 500W (max including accelerators)
Cooling	Temperature-controlled fans. Hot-swap fan modules.
Airflow	Front to rear side
Operating temp.	0°C to 50°C
Storage temp.	-20°C to 70°C
Relative humidity	5% to 95% (non-condensing)
Compliance Safety	Preliminary information - targeting: Europe/USA/Canada: EN 62368-1
Compliance EMC	Europe: EN 55032:2012, EN 61000-3-2:2014, EN 61000-3-3:2013, EN 55103-2:2009 USA: FCC CFR 47 Part 15B Canada: ICES-003, Issue 6:2016

## Ordering Options

VIRTUOSO-HW-1U-MI-AC2	Nevion Virtuoso carrier-grade media appliance with redundant load-sharing hot-swappable AC power supplies. The 1RU appliance can hold up to 8 accelerator modules. Redundant frame controllers (each with GigE port (100/1000Base-T). Requires VIRTUOSO-SW-OS-MI
VIRTUOSO-HW-1U-MI-DC2	Nevion Virtuoso carrier-grade media appliance with redundant load-sharing hot-swappable DC power supplies. The 1RU appliance can hold up to 8 accelerator modules. Redundant frame controllers (each with GigE port (100/1000Base-T). Requires VIRTUOSO-SW-OS-MI
VIRTUOSO-SW-OS-MI	Nevion Virtuoso operating system providing web user interface, alarm handling and logging, configuration and monitoring APIs (HTTP/XML, SNMP), security and user management, maintenance and inventory management.
VIRTUOSO-MAINT	Nevion Virtuoso software maintenance agreement. Provides access to all major and minor software updates. Costs an annual percentage fee of all installed SW licenses (list price).

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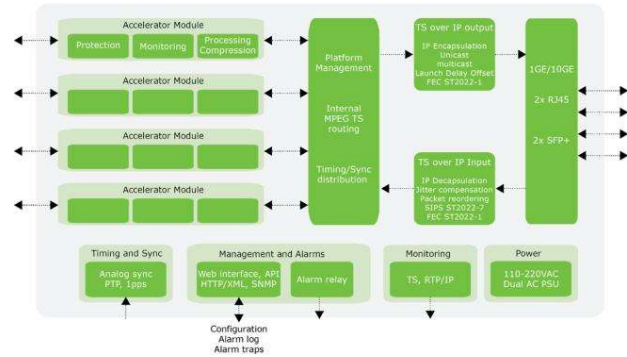
# Virtuoso FA - Flexible Media Server Appliance

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## Nevion Virtuoso FA Media Server

Description	Nevion Virtuoso FA media server with redundant load-sharing AC power supplies.
Product codes	VIRTUOSO-HW-1U-M4-AC2 (24201) VIRTUOSO-HW-1U-M4-AC2-FPD (24202) FPD version includes front panel display
Expansion slots	Up to 4 media accelerator modules
Ethernet ports	2 x 100/1000Base-T, RJ-45 2 x 1000Base-X / 10GBase-R SFP+
Interface type	Gigabit Ethernet, 802.3ab (electrical), 802.3z (optical), Fast Ethernet (FE) 802.3u
Protocols	IPv4, DSCP/TOS, ICMP, ARP, IGMPv2/3 IPv6, ICMPv6 ND, MLDv1/v2 802.1Q (VLAN tag), 802.1P (VLAN priority) HTTP/HTTPS, FTP/FTPS, Telnet/SSH, SNMP v2c, TCP, UDP, RTP, Sntp
Control features	Configuration and monitoring via dynamic rich web user interface. HTTP/XML, HTTP RESTful API or SNMP. Secure communication protocols Out-of-band or in-band access. Local user authentication. Extensive alarm management. Searchable log with 100.000 entries, Integrated in Nevision Maestro VideoPath.
License handling	License management for all the Media Functions supported in this server.
TS input/output	MPEG TS in RTP/UDP/IP (ST2022-1/2) Four (4) integrated ASI ports configurable as input or output. DVB-ASI ETSI EN 50083-9 (Annex B), 188/204 B/pkt Female BNC connectors (75 Ohm)
Sync input	1 x Analog bi-level (black burst) or tri-level Female BNC connector (75 Ohm) 1 x 1PPS (1 pulse per second) Female BNC connector (50 Ohm) PTP / IEEE 1588v2 via HBR accelerator Timing & sync distribution in chassis
Alarm relay	9-pin D-SUB
Maintenance port	USB (Mini B)
Front panel display	Basic setup, device status & information
Front panel LEDs	Power on (Green), Alarm status (Clear on OK, Red on critical alarm)



Physical dimensions	1RU 19" rack-mount chassis WxDxH = 448 x 424 x 43 mm
Weight	7.5 kg (max. including accelerators)
Rack installation	Install in clean and dust free environment. Optional external fan filters available on request. Rack rails are required for mounting in mobile production trucks and flight cases.
Power configuration	Dual load-sharing AC power supplies
Input Voltage	100-240V AC +/- 10%, 50/60 Hz
Power consumption	Up to 300W (max. including accelerators)
Cooling	Temperature-controlled fans
Airflow	Front to rear side
Operating temp.	0°C to 50°C
Storage temp.	-20°C to 70°C
Relative humidity	5% to 95% (non-condensing)
Compliance Safety	Europe: IEC 60950-1:2005 / EN 60950-1:2006 (2nd Edition) incl. Amd 1:2009 and Amd 2:2013 USA: UL Std. No. 60950-1 (2nd edition) incl. AM 1:2011 and AM 2:2014 Canada: CAN/CSA.C22.2 No. 60950-1-07 incl. Amd 1 (2011) and Amd 2 (2014)
Compliance EMC	Europe: EN 55032:2012, EN 61000-3-2:2014, EN 61000-3-3:2013, EN 55103-2:2009 USA: FCC CFR 47 Part 15B Canada: ICES-003, Issue 6:2016

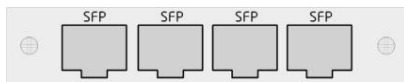
## Ordering Options

VIRTUOSO-HW-1U-M4-AC2	Nevion Virtuoso 1U 4-slot media server appliance (dual AC). Can hold up to 4 accelerator modules. 2x GigE ports (100/1000Base-T) and 2x 1/10 GigE ports (SFP+). Requires VIRTUOSO-SW-OS-M4.
VIRTUOSO-HW-1U-M4-AC2-FPD	Nevion Virtuoso 1U 4-slot media server appliance (dual AC with front panel display). Can hold up to 4 accelerator modules. 2x GigE ports (100/1000Base-T) and 2x 1/10 GigE ports (SFP+). Requires VIRTUOSO-SW-OS-M4.
VIRTUOSO-SW-OS-M4	Nevion Virtuoso operating system for 1U M4 servers providing web user interface, alarm handling, configuration, monitoring, security, maintenance and user management.
VIRTUOSO-MAINT	Nevion Virtuoso software maintenance agreement. Provides access to all major and minor software updates. Costs an annual percentage fee of all installed SW licenses (list price).

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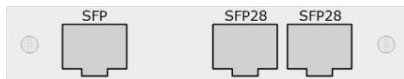
## HBR Media Accelerator

Description	10G Media Accelerator hardware module. The 4x SFP+ ports can accommodate a combination of 10GE SFP+, SDI video and MADI audio interfaces. Software Media Functions are sold separately.
Product codes	VIRTUOSO-HW-HBR-SFP4 (24204)
Connectors	Four (4) SFP+ supporting 10GE, Video/MADI SFPs and breakout cables.
Ethernet network	10GE (10GBase-SR/LR) 1GE (1000Base-X)
Video SFP support	Non-MSA 270 Mb/s to 12 Gb/s SD-SDI, HD-SDI, 3G-SDI, 12G-SDI, MADI, ASI Optical and electrical variants See Media Function datasheets for details
Sync input format	PTP (IEEE 1588v2:2008, SMPTE 2059-2)
Power consumption	Maximum 45W



## HBR25 Media Accelerator

Description	25G Media Accelerator hardware module. 2x25G SFP slots + one additional SFP port for 10GE or SDI video interfaces. Software Media Functions are sold separately
Product codes	VIRTUOSO-HW-HBR25-SFP3 (24645)
Connectors	Two (2) SFP28 supporting 25GE or 10GE. One (1) SFP+ supporting 10GE or Video SFP or breakout cable.
Ethernet network	25GE (25GBase-SR/LR) 10GE (10GBase-SR/LR)
Video SFP support	Non-MSA up to 12 Gb/s, HD-SDI, 3G-SDI, 12G-SDI, Optical and electrical variants See Media Function datasheets for details
Sync input format	PTP (IEEE 1588v2:2008, SMPTE 2059-2)
Power consumption	Maximum 45W



## H.264/AVC Accelerator

Description	Single channel H.264/AVC low latency contribution Media Accelerator (HW module). Additional licenses required for H.264/AVC and MPEG-2 encoding/decoding profiles.
Product codes	VIRTUOSO-HW-H264-X1 (24205)
Connectors	Four (4) Female BNC (75 Ohm) Three (3) SDI/ASI inputs/outputs One (1) SYNC input or ASI output
SDI support	SD-SDI, HD-SDI, 3G-SDI
ASI support	DVB-ASI ETSI EN 50083-9, Annex B, 188 B/pkt
Sync input format	Analog bi-level (black burst) or tri-level
Power consumption	Maximum 28W



## ASI Interface Accelerator

Description	ASI input/output module with four (4) ports (BNC, 75 Ohm). The direction of each port can be configured by the user.
Product codes	VIRTUOSO-HW-ASI-X4 (24206)
Number of ports	4 - configurable as input or output
Interface Type	DVB-ASI ETSI EN 50083-9, Annex B, 188 or 204 B/pkt
Connector type	Female BNC (75 Ohm)
Power consumption	Maximum 15W



## 2-in-2-out breakout cable

Description	Quad channel electrical breakout cable supporting two input and two output 3G/HD/SD-SDI, ASI or MADI signals, with pigtail and connectors.
Connector options	BNC male, BNC female, HD-BNC male
Cable length	1 or 3 meter pigtail option available. Input max 100m Belden 1694A for 3G-SDI.
Product codes	BRK-3G-TRX2-BF1 (24323) BNC female, 1m BRK-3G-TRX2-BM1 (24182), BNC male, 1m BRK-3G-TRX2-HBM1 (24290), HD-BNC, male, 1m

## 2-in-2-loop-out breakout cable

Description	Two channel electrical breakout cable supporting two input and two passive loop through outputs for 3G/HD/SD-SDI, ASI or MADI signals, with pigtail and connectors.
Connector options	BNC male, BNC female
Cable length	1 m pigtail option available. Input max 100m Belden 1694A for 3G-SDI.
Product codes	BRK-PL-BF1-BF1 (24461) BNC female, 1m BRK-PL-BM1-BM1 (24460) BNC male, 1m



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