

# DATA SHEET

## Fiber Optic Digital Extension Modules in 19" 1RU Frame for Indoor Broadcast

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## 19" 1RU Frame & Fiber Optic Extenders

### Description

OPTICIS 19" 1RU frame is a modular and systematic fiber-optic solution providing a variety of optical extenders with the flexibility to convert and transport multi-rate SDI formats such as 3G-SDI(SMPTE-424M), HD-SDI(SMPTE-292M), SD-SDI by 8-channel of CWDM, AES-3id audio compatible with SMPTE 276 and Dolby-E, RS-232/422 and 100Base Ethernet signals over 20km.

All extenders and dual power supply modules are hot-swappable to allow system maintenance without any disruption or disconnection. Each of the various extenders are also available in a compact stand-alone type to be incorporated into any broadcast workflow from small studio and OB vans to master control room.

BR-100 can deploy 1 slot sized extender up to 16 slots and indicates the status of mounted extenders in front panel by LED; LD(Slot ID), PD status, Power and FAN alarm. Dual AC power can be changed by removing the front panel, without cutting off the power to the system. Redundant power is included.

The adaptable modules are consisted of five (5) parts as follows;

- 1) One transmitter converting digital video signal to optical multi-rate SDI formats including 3G-SDI (SMPTE-424M), HD-SDI (SMPTE-292M), SD-SDI (SMPTE-259M) and DVI-ASI by 8-channel of CWDM with an equalizer: **VT-1xx** (1 slot taken)  
One receiver converting optical signals to digital video signals including Clock and Data Recovery: **VR-100** (1 slot taken)
- 2) One transmitter converting digital audio signal to optical 8-channel of AES-3id signals by CWDM: **AT-1xx** (5 slots taken)  
One receiver converting optical signals to digital audio signals: **AR-100** (5 slots taken)
- 3) One transmitter sending digital RS-232 or 422 signals to receiver: **DX-1** (3 slots taken)  
One receiver getting digital RS-232 or 422 signals from transmitter: **DX-2** (3 slots taken)
- 4) One transmitter sending Ethernet signal(100Base) to receiver: **EX-1** (2 slots taken)  
One receiver getting Ethernet signal from transmitter: **EX-2** (2 slots taken)
- 5) One multiplexer/de-multiplexer 8-different wavelength fiber-optic inputs into 1-fiber and also divides combined signal into 8-different wavelength outputs.

(where XX refers to wavelength of transmitter: 1330, 1350, 1370, 1430, 1450, 1470, 1490 and 1510.)

The package includes as follows;

- 19" 1RU frame, BR-100
- AC power cord
- User manual
- Individual packing for each module with DC 5V adaptor

## **Features**

- ◆ Adopts up to 16 optical extenders.
- ◆ Each of the various extenders is also available in a compact stand-alone type.
- ◆ Supports redundant power for Hot swapping & Load sharing.
- ◆ Wide wavelength operation from 1330nm to 1510nm.
- ◆ Transmits signals over 20km by single-mode cable.
- ◆ Status LEDs for signal monitoring.

## **Applications**

- ◆ Incorporation of broadcast workflow from Small/Sub studio and OB Vans including remote/ENG/EFP and pre/post-production to Main studio or Master Control Room.
- ◆ Fiber optic applications with free-interference using 3G-SDI signals including medical, military, government and security purposes.

## Technical Specifications

Specifications and designs are subject to change without notice.

### Power Supply Unit

#### - General Specifications

Product	Name		Power supply frame
	Model		BR-100
Front Panel Size	19" 1RU, Standard EIA Panel		
VT-1xx and VR-100 Module installation	Quantity		Up to 16 VT-1xx and/or VR-100 modules
	Hot Swap		Support hot swap of VT-1xx/VR-100 modules
LED indicator	1 <sup>st</sup> column	ID: Indicate the existence of Transmitter	
	2 <sup>nd</sup> column	SD: Indicate the existence of Receiver	
	3 <sup>rd</sup> column	Status: Indicate the status of Transmitter, Receiver and Transceiver (For more detail, refer to appendix in user manual)	
	Power	Power ON/OFF	
	FAN	Cooling FAN Alarm	
Dual AC Power	Dual redundant AC power is included.		
Power supply	Input power range	95-240VAC 50-60Hz	
Operation Temperature	0 ~ 50 °C		
Operation Humidity	0~90%RH		
Storage Temperature	-20~85 °C		
Storage Humidity	0~90%RH		
Dimensions	483mm x 44mm x 370mm (W x H x D)		
Weight	5.1Kg (including 2 AC power supplies and no modules)		

### VIDEO INPUT/OUTPUT

#### - General Specifications

#### Transmitter (E-to-O converter)/Receiver module (O-to-E converter): VT-1xx/VR-100

Product		Electric/Optical Unit	Optical/Electric Unit
Model		VT-1xx	VR-100
Transmission bandwidth	SMPTE Standard	259M, 292M, 424M	
	3G-SDI	2.97Gbps (SMPTE 424M)	
	HD-SDI	1.485Gbps (SMPTE 292M)	
	SD-SDI	270Mbps (SMPTE 259M)	
	DVB Standard		
	DVB-ASI	270Mbps (Reclocked)	
Hot Swap		Hot swappable with Opticis power supply unit, BR-100	
LED indicator		Power	Red

	Status	Green (LD: Video transmitting, SD: Signal detect)
Operation Temperature	T <sub>op</sub>	0 ~ 50°C
Storage Temperature	T <sub>sto</sub>	-20 ~ 80°C
Operation Humidity	RH <sub>sto</sub>	5 ~ 95%RH

**- Operating Conditions**

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
	Transmitter Supply Current	I <sub>TCC</sub>	-		400	mA
	Receiver Supply Current	I <sub>RCC</sub>	-		400	mA
	Transmitter Power Dissipation	P <sub>TX</sub>	-		2	W
	Receiver Power Dissipation	P <sub>RX</sub>	-		2	W
	Power Supply Rejection (Note1)	PSR	-	50	-	mV <sub>p-p</sub>
Electrical Link	Input Signal		SMPTE 424M/292M/259M			mV <sub>p-p</sub>
	Input Impedance	Z <sub>IN</sub>	-	75	-	Ω
	Input Signal Level		720	800	880	mV <sub>p-p</sub>
	Return Loss		10		-	dB
	Propagation Delay		-		1.5	ns
	Data rate		-		3	Gbps
	Cable Equalization		-		100	
	Alignment Jitter	SMPTE424M	-	0.2	-	UI
		SMPTE292M	--	0.1	-	UI
	Timing Jitter	SMPTE424M	-	0.2	-	UI
SMPTE292M		-	0.2	-	UI	
Optical Link	Output Optical Power	P <sub>o</sub>	-	0	-	dBm
	Wavelength	λ	1330,1350,1370,1430 1450,1470,1490,1510			nm
	Spectral width in RMS	Δλ	-		0.32	nm
	Extinction Ratio	Ext	-		5	dB
	Rising Time (Note2)	T <sub>rise</sub>	-		140	ps
	Falling Time (Note2)	T <sub>fall</sub>	-		150	ps
	Jitter in p-p value	T <sub>jitter</sub>	-		80	ps

Note1. Tested with a 50mV<sub>p-p</sub> sinusoidal signal in the frequency range from 500 Hz to 500 MHz on the V<sub>CC</sub> supply with the recommended power supply filter in place. Typically less than a 0.25 dB change in sensitivity is experienced.

Note2. 20% - 80%; Measured unfiltered @ 3Gbps

**AUDIO INPUT/OUTPUT**

**- General Specifications**

**Transmitter (E-to-O converter)/Receiver module (O-to-E converter): AT-1xx/AR-100**

Product	Electric/Optical Unit	Optical/Electric Unit
Model	AT-1xx	AR-100
Standard	AES-3id-2001	
Compatibility Standard	SMPTE276 / Dolby-E	
AES Standard	32kbps,44kbps, 48kbps	
Transmission bandwidth	400Mhz	
Hot Swap	Hot swappable with Opticis power supply unit, BR-100	

LED indicator	Power	Red
	Status	Green (ST: Normal status, SD: Signal detect, Ch1~8:Audio input output status)
Operation Temperature	-10~60℃	
Storage Temperature	-20~80℃	
Operation Humidity	0~90%	

**- Operating Conditions**

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Voltage	V <sub>CC</sub>	4.75	5	5.25	V
	Transmitter Supply Current	I <sub>TCC</sub>	-		300	mA
	Receiver Supply Current	I <sub>RCC</sub>	-		250	
	Transmitter Power Dissipation	P <sub>TX</sub>	-		1.5	W
	Receiver Power Dissipation	P <sub>RX</sub>	-		1.25	
	Power Supply Rejection (Note1)	PSR	-	50	-	mV <sub>p-p</sub>
Electrical Link	Input Signal	AES-3id-2001/ SMPTE276/ Dolby-E				
	Input Impedance	Z <sub>IN</sub>	-	75	-	Ω
	Input Signal Level		-	1	-	V <sub>p-p</sub>
	Output Signal Level		-	1	-	V <sub>p-p</sub>
	Sampling Rate		-		50	KHz
	Number of Channels		8			
	Connector		BNC			
	Return Loss		-20			dB
	Data rate				0.05	Gbps
Optical Link	Output Optical Power	P <sub>o</sub>	-9			dBm
	Wavelength	λ	1330,1350,1370,1430 1450,1470,1490,1510			nm
	Spectral width in RMS	Δλ	-		1	nm
	Power Budget		20			dB
	Fiber Type		Single Mode			
	Connector		SC			
	Extinction Ratio	Ext	12			dB
	Rising Time (Note2)	T <sub>rise</sub>	-		150	ps
	Falling Time (Note2)	T <sub>fall</sub>	-		150	ps
Jitter in p-p value	T <sub>jitter</sub>	-		800	ps	

**SERIAL DATA INPUT/OUTPUT**

**- General Specifications**

**Transceiver module of RS-422/232: DX-1/DX-2**

Product	Transceiver (1310nm FP-LD, 1550nm PD)	Transceiver (1550nm FP-LD, 1310nm PD)
Model	DX-1	DX-2
Standard	TIA-422 / SMPTE207M	
Transmission bandwidth	200MHZ	
Baud rate(RS232)	115200bps	
Baud rate(RS422)	10Mbps	

Hot Swap	Hot swappable with Opticis power supply unit, BR-100	
LED indicator	Power	Red
	Status	Green (SD: Signal detect, TxD: Data out, RxD: Data in)
Operation Temperature	0~90%RH	
Storage Temperature	-20~85℃	
Operation Humidity	0~90%RH	

**- Operating Conditions**

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Voltage	V <sub>CC</sub>	4.75	5	5.25	V
	Transmitter Supply Current	I <sub>TCC</sub>	-		350	mA
	Receiver Supply Current	I <sub>RCC</sub>	-		350	
	Transmitter Power Dissipation	P <sub>TX</sub>	-		1.75	W
	Receiver Power Dissipation	P <sub>RX</sub>	-		1.75	
Electrical Link	Input Signal	TIA-422 / SMPTE207M				
	Input Impedance	Z <sub>IN</sub>	-	75	-	Ω
	Input Signal Level		-		± 13	V <sub>p-p</sub>
	Data rate		-		10	Mbps
	Bit Error Rate		-		1/10 <sup>9</sup>	
	Number of Channels	1				
Optical Link	Connector	D-SUB 9Pin Female				
	Output Optical Power	P <sub>o</sub>	-9			dBm
	Wavelength	λ	1310/1550			nm
	Spectral width in RMS	Δλ	-		1	nm
	Power Budget		20		-	dB
	Connector	SC				
	Extinction Ratio	Ext	12		-	dB
	Rising Time (Note2)	T <sub>rise</sub>	-		150	ps
	Falling Time (Note2)	T <sub>fall</sub>	-		150	ps
	Jitter in p-p value	T <sub>jitter</sub>	-		800	ps

**ETHERNET INPUT/OUTPUT**

**- General Specifications**

**Transmitter/Receiver module of 100Base Ethernet: EX-1/EX-2**

Product	Transceiver (1310nm FP-LD, 1550nm PD)		Transceiver (1550nm FP-LD, 1310nm PD)	
Model	EX-1		EX-2	
Standard	IEEE 802.3 (100M BaseTX)			
Transmission bandwidth	125MHZ			
Baud rate	100Mbps			
Hot Swap	Hot swappable with Opticis power supply unit, BR-100			
LED indicator	Power	Red		
	Status	Green (SD: Signal detect, TP: CAT5 port link, FX: Fiber port link)		
Operation Temperature	0~90%RH			

Storage Temperature	-20~85 °C
Operation Humidity	0~90%RH

**- Operating Conditions**

	Parameter	Symbol	Minimum	Typical	Maximum	Units
Power Supply	Supply Voltage	V <sub>CC</sub>	4.75	5	5.25	V
	Transmitter Supply Current	I <sub>TCC</sub>	-		340	mA
	Receiver Supply Current	I <sub>RCC</sub>	-		340	
	Transmitter Power Dissipation	P <sub>TX</sub>	-		1.7	W
	Receiver Power Dissipation	P <sub>RX</sub>	-		1.7	
	Power Supply Rejection (Note1)	PSR	-	50	-	mV <sub>p-p</sub>
Electrical Link	Input Signal	IEEE 802.3 (100M BaseTX)				
	Speed	100				Mbps
	Duplex Mode	Half/Full Duplex., Auto-negotiation				
	Connector	RJ-45				
	Input Impedance	Z <sub>IN</sub>	-	120	-	Ω
	Input Signal Level		-	2000	-	mV <sub>p-p</sub>
	Return Loss		20			dB
Optical Link	Data rate		-		100	Mbps
	Output Optical Power	P <sub>o</sub>	-9		-	dBm
	Wavelength	λ	1310/1550			nm
	Power Budget		20			dB
	Fiber Type	Single Mode				
	Connector	SC				
	Spectral width in RMS	Δλ	-		1	nm
	Extinction Ratio	Ext	12		-	dB
	Rising Time (Note2)	T <sub>rise</sub>	-		150	ps
Falling Time (Note2)	T <sub>fall</sub>	-		150	ps	
Jitter in p-p value	T <sub>jitter</sub>	-		800	ps	

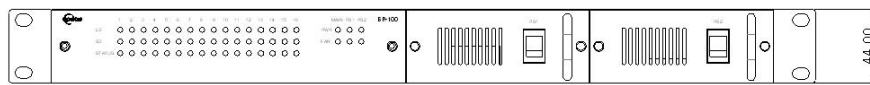
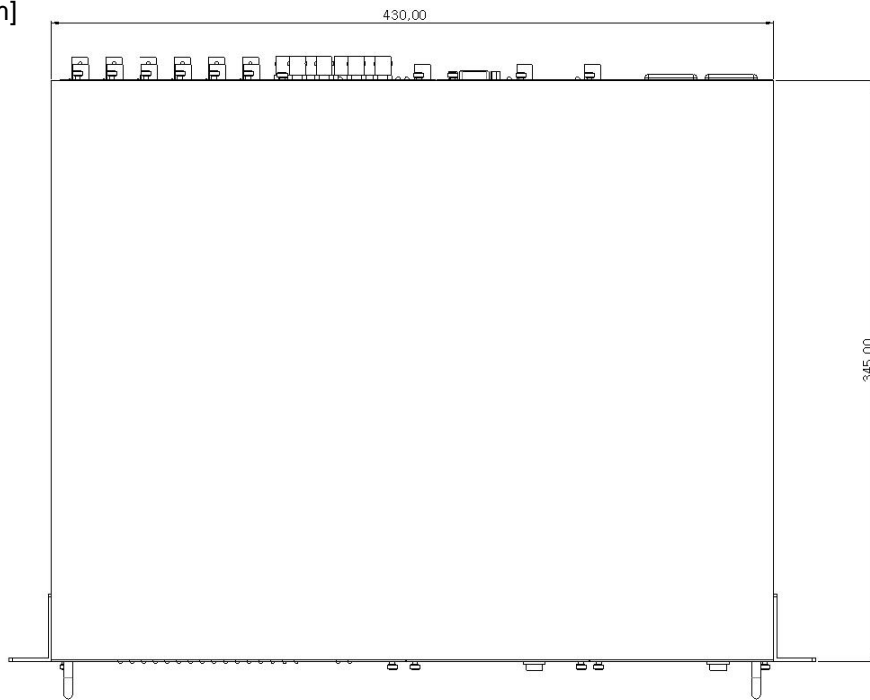
**- Recommended Specifications of Fiber-Optic Cables for all extenders**

Parameters	Conditions	Specifications
Fiber Type	Glass single-mode Fiber	9.5 ± / 125 ± 2 μm
Modal Bandwidth	λ = 1310~1510nm	Min. 400 MHz km
Fiber Cable Attenuation	λ = 1310~1510nm	>0.3dB/km
No. of Ferrules	SC Connector	1 ferrules
Skew		2%
Insertion Attenuation		1.6%
Total Optical Attenuation		30mm

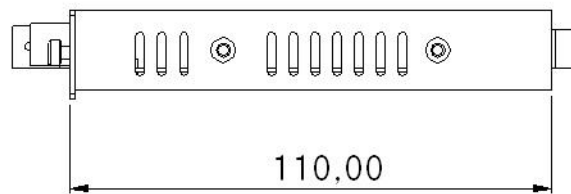
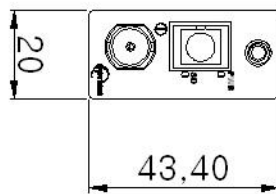


**Drawing of Modules**

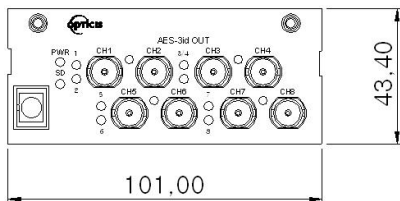
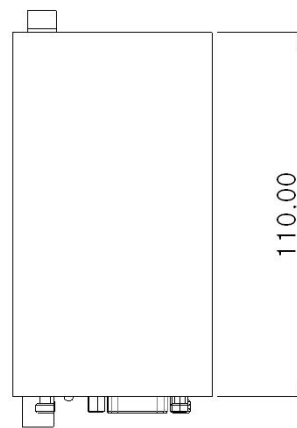
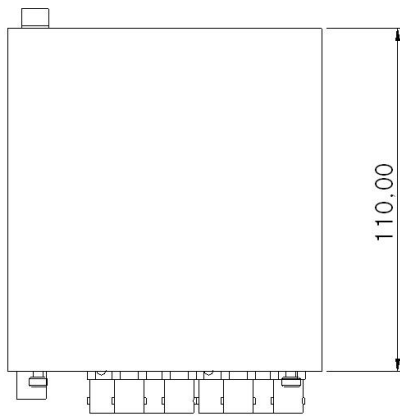
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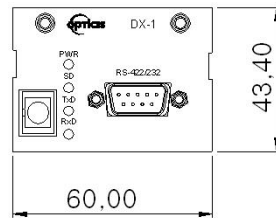
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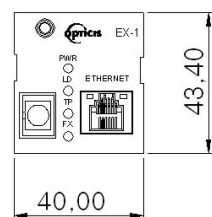
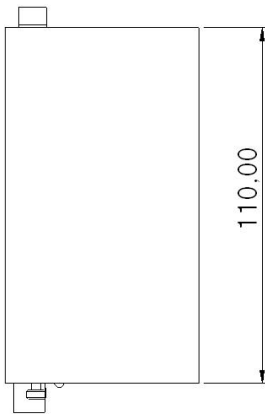
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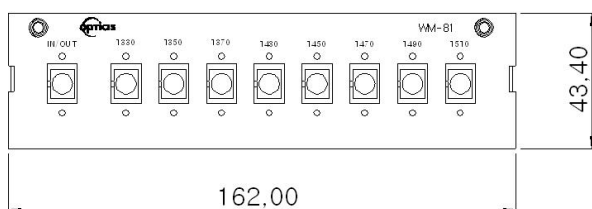
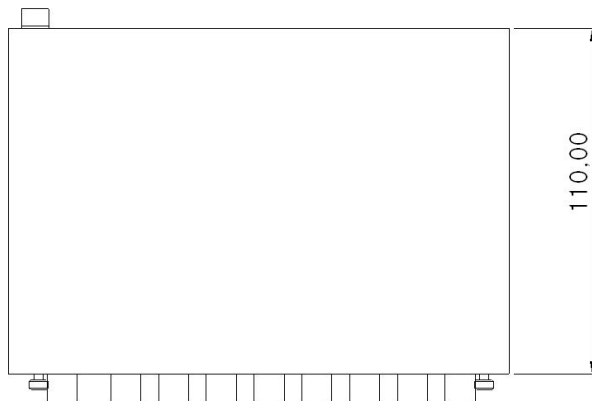
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<DX-1, DX-2>



<EX-1, EX-2>



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## Reliability Test

Opticis utilizes three types of test criteria for a reduction of variability and a continuous improvement of the process by its FEMA (Failure Mode and Effective Analysis) program.

- 1) Mechanical test (vibration, shock)
- 2) Temperature & humidity tests
- 3) EMC test (*FCC class A Verification and CE Documentation*)

### Mechanical and Temperature & Humidity Test Data

Heading	Test	Conditions	Duration	Sample Size	Failure	Remarks
<i>Operating Test</i>	Operating at each Temperature	* -20 ~ 65°C (Interval: 5 °C)	30 Min (Each Temperature)	n =8	0	Note: Visual Test on the Display Pixel Error Rate
	High Temperature	* T <sub>0</sub> = 65 °C	168 HR	n = 8	0	Note: Visual Test on the Display
<i>Storage Test</i>	Low Temperature	* T <sub>S</sub> = -20 °C	120 HR	n=8	0	1. TS: Storage Temperature
	High Temperature	* T <sub>S</sub> = 65 °C	120 HR	n=8	0	2. RH: Relative Humidity
	High Humidity High Temperature	* T <sub>S</sub> : 40 °C * RH: 95%	120 HR	n=8	0	
<i>Mechanical Test</i>	Mechanical Shock	* Pulse: 11 ms * Peak level: 30 g * Shock pulse: 3 times/Axis	-	n=2	0	
	Mechanical Vibration	* Peak acceleration: 20 g * Frequency: 20~2000 Hz * Sweep time: 30 Minutes * 4 Times/Axis	-	n=2	0	

**EMC Test Data**

**1) EMI: Meet FCC class A (ICES-003) and CE class A**

<b>STANDARDS</b>		<b>CONDITIONS</b>
EN 55 022 (CISPR22) FCC; PART 15 SUBPART B	CE (Conducted Emission) & RE (Radiated Emission)	Meet Class A
EN 61000-3-2 (IEC 61000-3-2)	Harmonics	Meet Class A
EN 61000-3-3 (IEC 61000-3-3)	Flickers	Meet Class A

**2) EMS: Meet CE standards (EN 55024) and CISPR24 equivalents**

<b>STANDARDS</b>		<b>CONDITIONS</b>
EN 61 000-4-2:1995	Electrostatic Discharge Immunity (Air: 8kv, Contact: 4kv)	Meet Criterion B
EN 61 000-4-3:1996	Radiated RF E-Field (80~1000 MHz) 3V/m (AM 80%, 1kHz)	Meet Criterion A
EN 61 000-4-4:1995	Fast Transients (5kHz, 60Seconds)	Meet Criterion B
EN 61 000-4-5:1995	Surge Transients	Meet Criterion B
EN 61 000-4-6:1996	Conducted Susceptibility (CS) Radiated Susceptibility (RS)	Meet Criterion A
EN 61 000-4-11:1994	Voltage Dips, Interruption & Variation	Meet Criterion C

**Terminology**

- Hot Swapping** Terms used to describe the functions of replacing system components without shutting down the system. More specifically, hot swapping describes replacing components without significant interruption to the system, while hot plugging describes the addition of components that would expand the system without significant interruption to the operation of the system.
- Redundant power** A type of system, which may include lighting, generators, fuel cells and other apparatus, to provide backup power resources in a crisis or when regular systems fail. They find uses in a wide variety of settings from residential homes to hospitals, scientific laboratories, data centers, telecommunication equipment and modern naval ships. Emergency power systems can rely on generators, deep cycle batteries, flywheel energy storage or hydrogen fuel cells. Finally, some homebrew emergency power systems use regular lead-acid car batteries.
- SDI** Serial Digital Interface referring to a family of video interfaces standardized by SMPTE.
- SMPTE** The Society of Motion Picture and Television Engineers or SMPTE, founded in 1916 as the Society of Motion Picture Engineers or SMPE, is an international professional association, based in the United States of America.

- SMPTE 424M Standard published by SMPTE expanding upon SMPTE 259M, SMPTE 344M, and SMPTE 292M allowing for bit-rates of 2.970 Gbit/s and 2.970/1.001 Gbit/s over a single-link coaxial cable. These bit-rates are sufficient for 1080p video at 50 or 60 frames per second. The signal formats carried over SMPTE 424M are specified in SMPTE 425M.
- DVB A suite of internationally accepted open standards for digital television. DVB standards are maintained by the DVB Project, an international industry consortium with more than 270 members, and they are published by a *Joint Technical Committee* (JTC) of European Telecommunications Standards Institute (ETSI), European Committee for Electrotechnical Standardization (CENELEC) and European Broadcasting Union (EBU). The interaction of the DVB sub-standards is described in the *DVB Cookbook*. Many aspects of DVB are patented, including elements of the MPEG video coding and audio coding.
- AES The digital audio standard frequently called **AES/EBU**, officially known as **AES3**, is used for carrying digital audio signals between various devices. It was developed by the Audio Engineering Society (AES) and the European Broadcasting Union (EBU) and first published in 1985, later revised in 1992 and 2003. Both AES and EBU versions of the standard exist. Several different physical connectors are also defined as part of the overall group of standards. A related system, S/PDIF, was developed and standardized as IEC 60958 essentially as a consumer version of AES/EBU, using connectors more commonly found in the consumer market, however S/PDIF is now used in professional situations where cost or limited space is a concern.
- AES-3id The AES3 standard parallels part 4 of the international standard IEC 60958. Of the physical interconnection types defined by IEC 60958, three are in common use:
- IEC 60958 Type I Balanced – 3-conductor, 110-ohm twisted pair cabling with an XLR connector, used in professional installations (AES3 standard)
  - IEC 60958 Type II Unbalanced – 2-conductor, 75-ohm coaxial cable with an RCA connector, used in consumer audio
  - IEC 60958 Type II Optical – optical fiber, usually plastic but occasionally glass, with an F05 connector, also used in consumer audio
- The AES-3id standard defines a 75-ohm BNC electrical variant of AES3. More recently, professional equipment (notably by Sony) has used this physical interconnection type. This uses the same cabling, patching and infrastructure as analogue or digital video, and is thus common in the broadcast industry.
- Dolby-E An audio encoding and decoding technology developed by Dolby Laboratories that allows up to 8 channels of audio to be compressed into a digital stream that can be stored on a standard stereo pair of audio tracks.
- Anything up to a 5.1 mix can be recorded in 16-bit, however, if anything more than 5.1 is required, the tape format must accept 20-bit audio.
- It is very important to ensure that a Dolby E stream is never played through monitors without being decoded.

**IEEE 802.3** A collection of IEEE standards defining the Physical Layer and Data Link Layer's media access control (MAC) sublayer of wired Ethernet. This is generally a LAN technology with some WAN applications. Physical connections are made between nodes and/or infrastructure devices (hubs, switches, routers) by various types of copper or fiber cable.

802.3 is a technology that supports the IEEE 802.1 network architecture.

The maximum packet size is 1518 bytes, although to allow the Q-tag for Virtual LAN and priority data in 802.3ac it is extended to 1522 bytes. If the upper layer protocol submits a protocol data unit (PDU) less than 64 bytes, 802.3 will pad the data field to achieve the minimum 64 bytes. The minimum Frame size will then always be of 64 bytes.

**100BaseTX** The predominant form of Fast Ethernet, and runs over two wire-pairs inside a category 5 or above cable (a typical category 5 cable contains 4 pairs and can therefore support two 100BASE-TX links). Each network segment can have a maximum distance of 100 meters (328 ft). In its typical configuration, 100BASE-TX uses one pair of twisted wires in each direction, providing 100 Mbit/s of throughput in each direction (full-duplex).

**EMI** Electro Magnetic Interference.

**EMS** Electro Magnetic Susceptibility.

**RFI** Radio Frequency Interference.