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Data Sheet **Rev. 2024-08-05**

A__ UHD Core

720/10 Ultra-high Density IP DSP Engine

- **1024 ultra-high quality, full signal processing, low latency channels at 48 kHz sample rate**
- **512 ultra-high quality, full signal processing, low latency channels at 96 kHz sample rate**
- **Up to 256 buses with fully flexible channel routing**
- **Shared resource usage with up to 32 mc² consoles**
- **I/O with up to 2048 channels each direction, 4 redundant separated streaming network interfaces (SFP)**
- **Compatible with IP network technology (RAVENNA, AES67, SMPTE ST2110-30/-31)**
- **Redundant streaming technology based on SMPTE ST2022-7 Seamless Protection Switching (SPS)**
- **IEEE-1588-2008 (PTPv2) master/slave synchronization capability**
- **2 redundant management ethernet ports (RJ45)**
- **Redundant PSUs**

Revision History

Revision	Changes
2024-08-08	Maximum altitude
2024-04-10	General new document revision
2022-11-18	More details back-up battery
2022-10-26	Added Related Products
2022-02-10	USB serial control port – type corrected
2021-03-10	RAVENNA General latency corrected
2020-06-28	Safety Instructions corrected (Ethernet switch)
2020-02-25	Safety Instructions corrected
2020-02-14	Safety Instructions corrected
2019-11-14	Operating temperature corrected
2019-10-23	Spare parts added
2019-07-09	Strip to RLS-0.2 functionality
2019-05-29	Initial edition

General

T_A = 25°C. System sample frequency f_s=48 kHz or f_s=96 kHz unless otherwise noted.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Control interface format					
Ethernet	MGMT A, MGMT B		2		#
USB port	host port		1		#
RS232 serial control port	Rear side, RJ45		1		#
USB serial control port	USB device port, USB type-B connector		1		#
Service USB port	host port		1		#
Service DisplayPort			1		#
Dongle USB port	host port		1		#
Audio interface					
RAVENNA I/O	1 Gbit/s SFP fibre or copper		8		#
Mode of operation					
Sample rates	f_s		44.1/48, 88.2/96		kHz
Cooling requirements					
Power dissipation	depends on configuration and operating conditions			220	W
Type of cooling	internal fans with speed regulation		forced cooling		
Air flow	from front to rear			~45	m³/h
Environment					
Operating ambient air temperature	front side of case	0		40	°C
Operating outlet air temperature	rear side of case			60	°C
Humidity	no dewdrop	10		85	$\%_{RH}$
Storage temperature		-20		70	°C
Maximum altitude				2000	m
Mechanical data					
Height	overall		43.6		mm
Width	19” 1RU		483		mm
Depth	incl. PSU		379		mm
Weight	720/10		7.4		kg
General Data					
Boot-up time typical configuration			45		sec
Firmware update			tbc		sec
Servicing					
Fan life expectation	100% speed all the time	3			years
Display life expectation	100% brightness all the time	3			years

Power Supply

T_A = 25°C. System sample frequency f_s=48kHz or f_s=96kHz.

Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating supply voltage	recommended operating conditions		100		240	V_{AC}
Operating frequency			47		63	Hz
Operating supply current	only one power supply active	$100V_{AC}$			2.2	A
		$240V_{AC}$			1.0	A
Inrush current	cold start, $115V_{AC,}$ per power supply unit				33	A_p

Audio I/O Ports 1-8 (SFPs)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Format		RAVENNA			
		AES67			
		SMPTE ST2110-30/31			

USB Host Ports

Parameter	Conditions	Min.	Typ.	Max.	Unit
USB Type			3.0		
VBUS output voltage	DC		5		V
VBUS output current	short circuit protected, latch type	1.3	1.6	1.9	A

Ethernet Control Ports (MGMT A/B)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Data rate			10/100/1000		Mbit/s
Mode			Full-duplex		
Default IP configuration	MGMT A		DHCP		
	MGMT B		DHCP		
Default subnet mask			DHCP		
Default DHCP setting			DHCP on		
Recommended media	straight or crossed cable		CAT5e or better, RJ45		
Cable length				100	m

USB Control Port

Parameter	Conditions	Min.	Typ.	Max.	Unit
USB type			2.0		
USB power			self-powered		

RS232 Control Port

Parameter	Conditions	Min.	Typ.	Max.	Unit
Baud rate			115200, 8, N, 1		
Handshake			none		

Service Display Port

Parameter	Conditions	Min.	Typ.	Max.	Unit
Protocol			DisplayPort 1.2		
Resolution			up to 4096 x 2304 @ 60Hz		

Clock Recovery

T_A = 25°C. System sample frequency f_s= 48 kHz or f_s= 96 kHz unless otherwise noted.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Synchronization sources		SYNC IN (BNC), PTP			
Supported system sampling frequencies		44.1/48, 88.2/96			kHz
Input frequency capture range	compliant with AES11-2009 Grade 2 for all synchronization sources			± 50	ppm
Intrinsic jitter tolerance				TBD	UI
Jitter attenuation	100Hz		TBD		dB
	1kHz		TBD		dB
	10kHz		TBD		dB

Synchronization Input

T_A = 25°C. System sample frequency f_s= 48 kHz or f_s= 96 kHz unless otherwise noted.

Parameter	Conditions	Min.	Typ.	Max.	Unit
SYNC IN					
Input format		WCLK			
Input impedance	75 Ω termination must be applied externally on THRU	1			kΩ
Input bias		-5.0		+5.0	V
Input Amplitude		0.3		5	V_{pp}
Duty cycle	signal is “1”	10		90	%
Timing reference point	compliant with AES11-2009 Annex B	rising edge			
Phase	input to internal timing reference point		0.1		%
Jitter tolerance	50 Hz	10			UI
	1kHz	1			UI

Synchronization Output

T_A = 25°C. System sample frequency f_s= 48 kHz or f_s= 96 kHz unless otherwise noted.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Clock outputs					
THRU		Same as SYNC IN			
SYNC OUT					
Output format		WCLK, AES3id			
Output impedance			75		Ω
Output level low	into 75 Ω termination			0.4	V
Output level high	into 75 Ω termination	2.1			V
Duty cycle		50			%
Timing reference point		rising edge			
Phase	internal timing reference point to Word Clock Out rising edge		0		%

Signal Processing

T_A = 25°C. System sample frequency f_s=48kHz or f_s=96kHz unless otherwise noted.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Number of channels	f_s=48kHz			1024	#
	f_s=96kHz			512	#
Number of groups/auxes/sums	f_s=48kHz			256	#
	f_s=96kHz			256	#
Resolution external	fix point		24		bit
Resolution internal	floating point	32		44 equivalent	bit
Latency (input / processing / output)					
Input channel / direct out			6		$1/f_s$
Input channel / sum			13		$1/f_s$
Input channel / group / sum			20		$1/f_s$

Auxiliary data

T_A = 25°C. System sample frequency f_s=48kHz or f_s=96kHz.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Signal Processing Input					
Channel status data			ignored		
User data			ignored		
Handling of invalid data			no mute		
Signal Processing Output					
Channel status data			all bits low		
User data			all bits low		
Valid bit			always valid		

RAVENNA general

System sample frequency f_s= 48 kHz or f_s=96kHz.

Parameter	Conditions		Min.	Typ.	Max.	Unit
Supported SFPs				981/60-10 981/60-20 981/60-60		
Supported Link Speed				1 Gbit/s		
Default IP configuration				DHCP		
Number of streaming interfaces				8		
ST2022-7 SPS pairing	Samples per packet per channel			1 (PRI) / 2 (SEC) 3 (PRI) / 4 (SEC) 5 (PRI) / 6 (SEC) 7 (PRI) / 8 (SEC)		
ST2022-7 SPS path differential			0		8000 (166)	samples (msec)
			0		8000 (166)	
ST2022-7 Receiver class				A, B, C, D		
Streaming channels	Total unit, per direction in/out			2048		
Streaming channels [1]	Total limits per interface pair, per direction in/out				512	
Channels per stream [1]			1		128	
Samples per packet / Packet time	TX [1]	Samples per channel in one packet	1		48	samples
		Packet time f_s=48kHz	0.0208		1	ms
		Packet time f_s=96kHz	0.0104		0.5	ms
	RX	Samples per channel in one packet	1		96	samples
		Packet time f_s=48kHz	0.0208		2	ms
		Packet time f_s=96kHz	0.0104		1	ms
RTP payload size	MTU 1500 bytes (standard size), jumbo frames not supported				1460	Bytes
Streaming connection type				Multicast only		
Supported protocols				RTP/AVT & RTCP as defined in RFC 3550 IGMPv2 or IGMPv3 IEEE-1588-2008 (PTPv2)		
Payload formats [1]	Linear PCM			L16, L24, AM824		
Receive latency	RAVENNA In to DSP In		8 (0.16))			samples (msec)
Transmit latency	DSP Out to RAVENNA Out			8 (0.16))		samples (msec)

[1] channel / packet time / payload format combinations must be within MTU1500 and 1Gbit/s interface bandwidth limits, see table in appendix for further information.

Indicators

Parameter	Conditions	Status	
General			
Status LED	normal operation, no errors detected	blinking green	
	an internal error has occurred	off or static green	
	no power	off	

Backup Battery

Parameter	Conditions	Status	
Battery type	3V, Lithium / manganese (Coin), must support at least 5mA abnormal charging current, must be rated at least 70°C. For USE with UL certification the battery must be approved under UL Category Control Number BBCV2.	CR2032, 3V	
Recommended service interval	device is unpowered	5	years

System-Display

Parameter	Conditions	Status	
Type		RGB TFT with LED backlight	
Resolution		240 x 240	px
Active Viewing Area		27.7 x 27.7	mm

Supported Browsers

Requirements for a host system directly controlling the device via the web-based user interface.

Parameter	Conditions	Min.	Typ.	Max.	Unit
Web Browser	Current versions of	Microsoft Edge Apple Safari Google Chrome			

Spare Parts

Product	Conditions	Type / Part No.	Unit
PSU Module 160W		272-0200-000	
Fan Module		272-0400-000	
Backup Battery		444-0030-000	

Related Products

Product	Description	Type
A__line	A__stage48, 3 RU, 16x Mic/Line In (DB37), 16x Line Out (DB37), 8x AES3 I/O (DB25), 8x GPIO (DB37), MADI I/O, WCLK I/O	985/60, 985/60A
A__line	A__stage64, 4 RU, 32x Mic/Line In (XLR), 16x Line Out (XLR), 8x AES3 I/O (XLR), 8x GPIO (DB37), MADI I/O, WCLK I/O	985/62, 985/62A
A__line	A__stage80, 3 RU, 32x Mic/Line In (DB37), 32x Line Out (DB37), 8x AES3 I/O (DB25), 8x GPIO (DB37), MADI I/O, WCLK I/O	985/64, 985/64A
A__line	A__digital64, 3 RU, 32x AES3 I/O (DB25), 8x GPIO (DB37), MADI I/O, WCLK I/O	985/63
A__line	A__madi6, 3x 2 MADI I/O with 3 individual bridges	985/23
IEC Lock Schuko	Power Cord with European connector for e.g. D, AU, F, Benelux	436-7206-000
IEC Lock open ends	Power Cord with open wire ends	436-7207-000
IEC Lock US	Power Cord with USA connector	436-7208-000
IEC Lock UK	Power Cord with connector for United Kingdom	436-7209-000
IEC Lock AUS	Power Cord with connector Australia	436-7218-000
IEC Lock JPN	Power Cord with connector for Japan	436-7219-000

Further particulars/explanatory notes

Rotary Control Knob

No functionality at the moment.

Status-LEDs

A__UHD Core contains several status LEDs to show modes of operation, communication traffic etc.
See user manual for more details.

License Dongle

The device is shipped with a blank USB license dongle.
License processing: see user manual for details.

RAVENNA

The device is intended to be used with a mc² series control system and HOME. Streaming parameters are set up using the HOME UI.

Network requirements

Refer to Lawo networking guide.

Clocking the RAVENNA network

A PTP GM (grandmaster) clock is needed to provide precise timing information to all RAVENNA nodes within a network. For smaller installs, the A__UHD Core can be used as PTP GM.

Control Port

The A__UHD Core can be accessed via two standard Ethernet ports for system control, status reports or system updates. These ports are not intended for audio streaming operation.

Default IPv4 configuration: The control port has a default IP configuration as stated in the tables above.

MTU and Interface Bandwidth Limits

MTU size 1500 and 1Gbit/s interface speed limit the possible stream format combinations. The number of channels in a stream and the packet time have influence on the packet size. See the following tables for valid values.

MTU limits for Codec L24, fs= 48 kHz

Ptime → ↓Channels	0.02 ms 1 sample	0.04 ms 2 smpls	0.08 ms 4 smpls	0.125 ms 6 smpls	0.25 ms 12 smpls	0.33 ms 16 smpls	0.5 ms 24 smpls	0.67 ms 32 smpls	1 ms 48 smpls
1-10									
11-15									
16-20									
21-30									
31-40									
41-80									
81-120									
121-128									

Example 1: a stream with payload format L24 containing 32 audio channels can have a maximum ptime of 0.25ms at 48kHz or 12 samples

Example 2: streams with the ptime 1ms (or 48 samples) can contain between 1 and 10 audio channels

MTU limits for Codec AM824, fs= 48 kHz

Ptime → ↓Channels	0.02 ms 1 sample	0.04 ms 2 smpls	0.08 ms 4 smpls	0.125 ms 6 smpls	0.25 ms 12 smpls	0.33 ms 16 smpls	0.5 ms 24 smpls	0.67 ms 32 smpls	1 ms 48 smpls
1-7									
8-11									
12-15									
16-22									
23-30									
31-60									
61-90									
91-128									

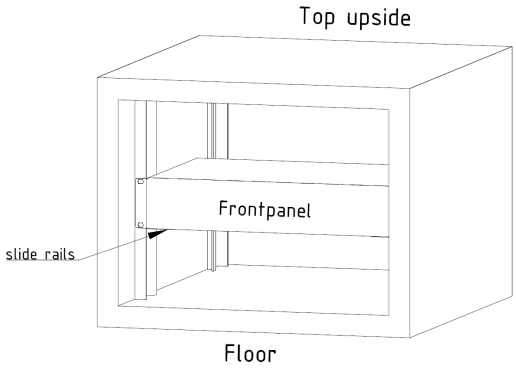
Bandwidth Limit
Up to 950 Mbit/s per interface can be used for RTP stream traffic. Each stream format generates a static bitrate.
Bandwidth per stream can vary in a wide range depending on channel count and packet time.
The device keeps track of the used bandwidth. If the total of 950 Mbit/s would be exceeded, adding further streams is refused.

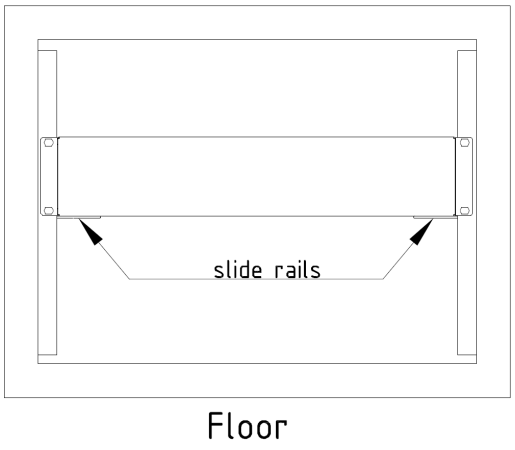
CAUTION: SAFETY INFORMATION

Installation guidelines

Device is foreseen for indoor use in dust-free ambiance.

Unit is foreseen to be installed in 19 Inch Racks. Device must be mounted horizontally. Use screws fitting the front panel to the 19” Rack rails. Use slide rails inside the rack to bear the unit to prevent that the front panel is bend by the weight of the cables at backside. Take care that slide rail supports the weight of the device.

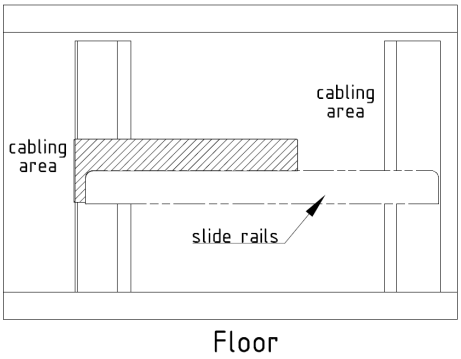




Keep area clear behind the device. Space needed behind the device depend on your connector and cable type.

Keep clear at least 75 mm in front of the frame for cables to the BNC connectors and air flow.

It is allowed to install other 19 inch units directly above or below the device.



Cooper Ethernet connection

It is mandatory, that copper based Ethernet connections (CAT 6, RJ45) are led inside a building to the next Ethernet switch. If the Ethernet connection needs to be led outside a building use a converter to optical fiber and connect it in a short way (inside the building) to the device.

Eye safety

This equipment may use Class 1 Laser products. It emits invisible laser radiation that may lead to eye injury.

- Never look directly into optical components or optical fibre cables.
- Keep optical components closed by protection plugs when unused.
- For your safety connect all fibre cables first before turning on the equipment

Multiple Power Source

Caution Shock hazard :
Disconnect all power sources to completely disconnect power from the system. E.g. before you open the unit for maintenance and service.

SFP modules

When SFP optical fiber transmitters are used within A__UHD Core, Type 720/10 the UL mark is valid only with use of UL certified SFP module of categories NWGQ, NWGQ2, AZOT or AZOT2. The class of laser product shall state: FDA 21 CFR 1010 or CFR 1040 for Laser Class 1 (I) or IEC 60825-2 for LED Class 1.

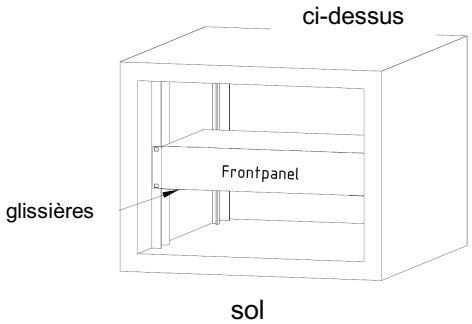
Please observe all of the instructions provided in the "General Safety Information for Lawo Equipment" booklet delivered with your devices.

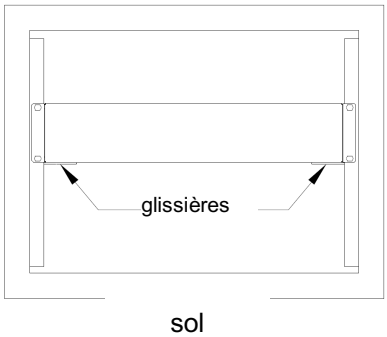
ATTENTION: CONSIGNES DE SÉCURITÉ

Notes d'installation

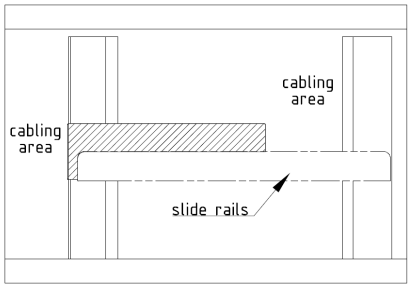
L'appareil est prévu pour une utilisation en intérieur, dans un environnent sans poussière.

Il est recommandé d'installer l'unité en rack 19 pouces. L'appareil doit être monté horizontalement. Utilisez des visseries adaptées pour fixer la face avant sur les rails du rack 19 pouces. Utilisez des glissières à l'intérieur du rack pour supporter l'unité afin d'éviter que la face avant ne se plie sous le poids des câbles à l'arrière. Veillez à ce que la glissière supporte le poids de l'appareil.





Libérez la zone derrière l'appareil. L'espace nécessaire derrière ce dernier dépend de votre connecteur et du type de câble.



Gardez un espace libre d'au moins 75 mm devant le boîtier pour l'accès aux connecteurs BNC et le flux d'air.

Il est permis d'installer d'autres unités 19 pouces directement au-dessus ou en-dessous de l'appareil.

connexions Ethernet

Il est obligatoire que les connexions Ethernet à base de cuivre (CAT 6, RJ45) soient conduites à l'intérieur d'un bâtiment jusqu'au prochain commutateur Ethernet. Si la connexion Ethernet doit être dirigée à l'extérieur d'un bâtiment, utilisez un convertisseur en fibre optique et connectez-le brièvement (à l'intérieur du bâtiment) à l'appareil.

Veuillez respecter toutes les instructions fournies dans le livret "Consignes générales de sécurité concernant les équipements Lawo" livré avec vos appareil.

glissières

sol

Sécurité des yeux

Cet équipement peut utiliser des produits laser de classe 1. Il émet un rayonnement laser invisible pouvant entraîner des lésions oculaires.

- Ne regardez jamais directement dans les composants optiques ou les câbles à fibres optiques.
- Gardez les composants optiques fermés par des bouchons de protection lorsqu'ils ne sont pas utilisés.
- Pour votre sécurité, connectez d’abord tous les câbles à fibres optiques avant d’allumer l’équipement

Source d'alimentation multiple

Attention Risque d’électrocution :

Déconnectez toutes les sources d'alimentation pour déconnecter complètement l'alimentation du système. Par exemple avant d'ouvrir l'appareil pour des raisons de maintenance et d'entretien.

Émetteurs-récepteurs fibre optique (SFP)

En utilisant des SFP en A__UHD Core, Type 720/10 le certification UL il seulement valable, quand les SPFs lui mèmes sont certifiés par UL dans les catégories NWGQ, NWGQ2, AZOT ou AZOT2. La classe pour le produit laser doit être FDA 21 CFR 1010 or CFR 1040 for Laser Class 1 (I) or IEC 60825-2 for LED Class 1.