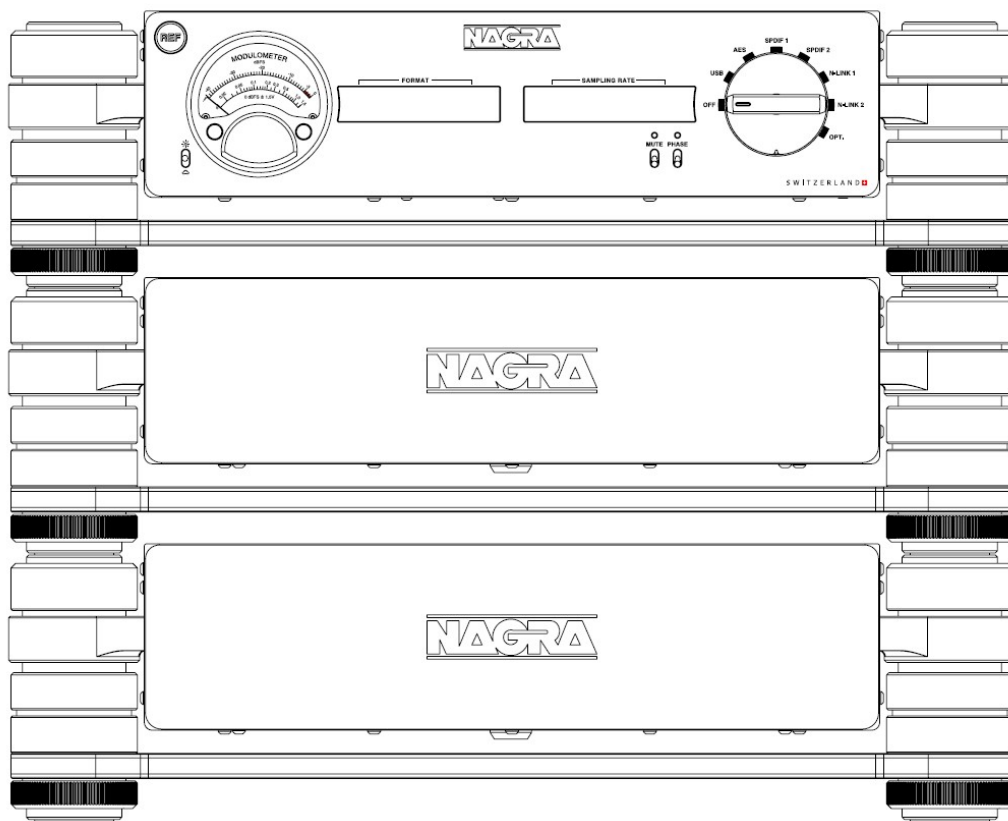




NAGRA REFERENCE DAC



USER MANUAL

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Safety warnings

- Read this manual carefully before operating the REFERENCE DAC.
- Should you have any questions on how to set up or use your REFERENCE DAC, please contact your Nagra dealer.
- Audio Technology Switzerland SA declines any responsibility in the event of an accident caused by the non-observance of these instructions or any other form of user negligence.
- The REFERENCE DAC has a specific power supply to work correctly in your country. The power supply voltage can only be changed at the factory. Make sure you have the right operating voltage before switching your device ON.
- The REFERENCE DAC is CLASS I equipment. It is essential that it is connected to a mains socket outlet with a protective earthing connection.
- The REFERENCE DAC must not be exposed to dripping or splashing liquids and no objects filled with liquids, such as vases, should be placed on the machine.
- Never try to open your REFERENCE DAC to prevent the risk of electric shock and burns. Only Nagra dealers and qualified technicians are authorized to open it for maintenance purposes.

Warranty

Please refer to the addendum enclosed in this User manual.

Congratulations

The Nagra **REFERENCE DAC** is the culmination of 75 years of uncompromising engineering excellence. It has been conceived and crafted by a team whose expertise spans professional audio and critical, high-precision applications where absolute performance, reliability, and integrity are essential.

Since 1951, Nagra has built instruments of reference — products that define standards rather than follow them. Our relentless pursuit of sonic truth has earned worldwide recognition, including two Academy Awards® and two Emmy® Awards for technical achievement, honoring both our innovation and our dedication to perfection.

Every Nagra component, whether for professional recording studios or for the most demanding music lovers, is developed by the same Swiss Research and Development team. Our High-Fidelity range was created to bring the precision, rigor, and technological advances of our professional heritage into the listening rooms of those who seek nothing less than the absolute best.

The REFERENCE DAC embodies this philosophy without compromise. Every circuit, every material, and every detail serves a single purpose: to reveal the full emotional depth, texture, and realism of music.

This technology exists for one reason - to serve the music you love.

We wish you countless unforgettable moments of listening pleasure with your Nagra REFERENCE DAC. Thank you for your confidence and your trust.

Package contents

The package of your REFERENCE DAC includes the following parts (on top of the manual):

- One REFERENCE DAC audio device chassis
- One REFERENCE PSU power supply chassis, or two when using the second power supply
- Four ceramic balls, eight with the second REFERENCE PSU to stack units
- One pair of microfiber gloves « Haute Horlogerie »
- One power cord* (two with the second PSU)
- Two umbilical cords with LEMO plugs (three with the second PSU)
- USB flash drive with drivers for PC when using USB input
- One set of fuses (for 100-127 V~ or 230-240 V~, depending on your country)
- One remote control unit and its docking station with 3 x AA batteries

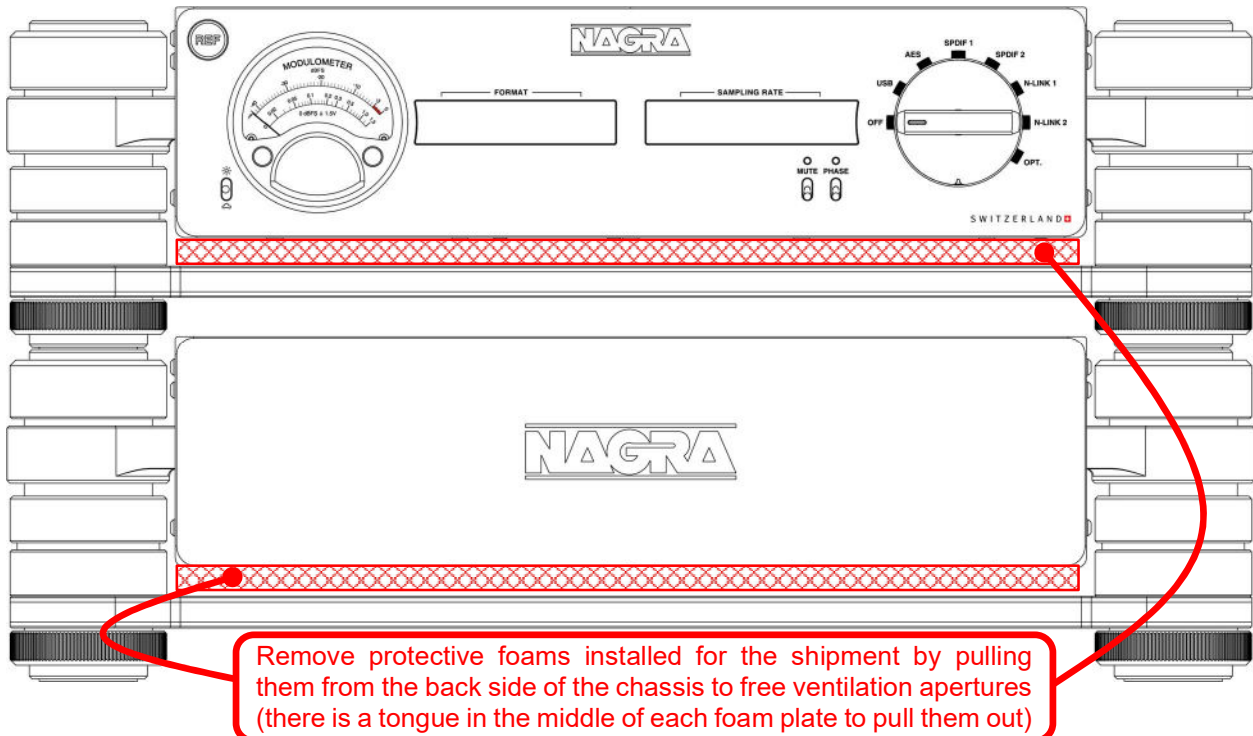
Please contact your Nagra dealer should anything be missing.

* Depending on your country, the power cord features either a US, European or Swiss plug.

INSTALLATION OF YOUR REFERENCE DAC

Choosing a location

The REFERENCE DAC is designed exclusively for indoor use in a moderate climate.

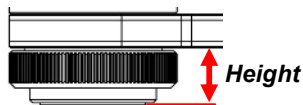


The REFERENCE DAC is contained in two or three chassis: one audio device and one or two power supplies. These chassis feature anti-vibration bases that allow for putting either one chassis on top of the other or one chassis next to the other, while remaining completely insensitive to vibration. They must be installed horizontally on a suitable flat, firm, and stable stand.

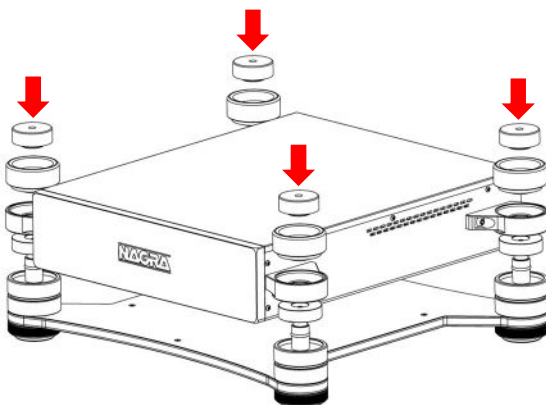
There must be enough space all around the chassis for adequate ventilation.

Ventilation should not be impeded by covering the ventilation openings with items such as newspapers, tablecloths, curtains, etc.

Horizontal adjustment of the REFERENCE DAC / REFERENCE PSU



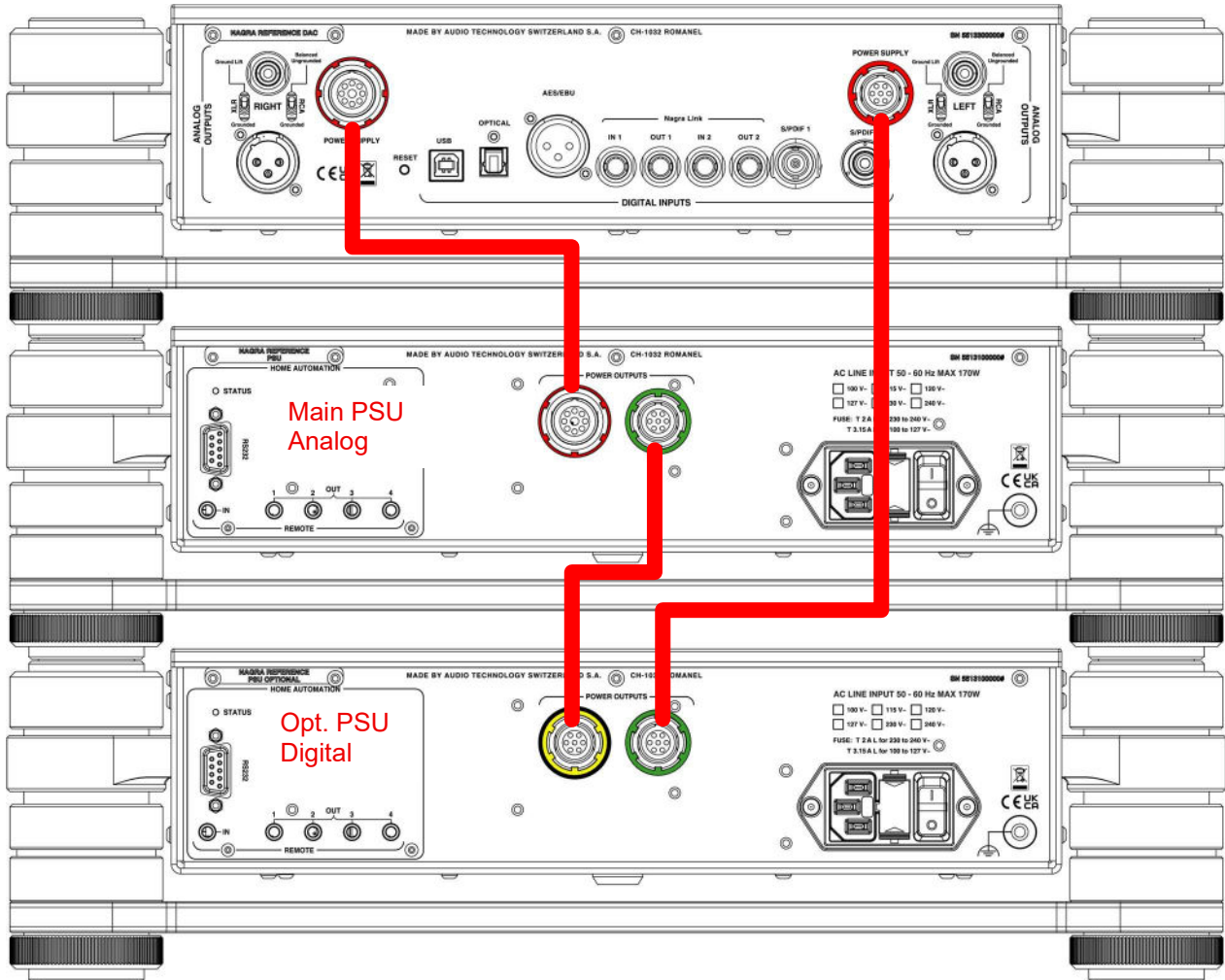
Each chassis has four decoupling feet whose height can be adjusted with a wheel (knurled part). Turning the wheel adjusts the height of the foot and thus the level of the chassis.



When the chassis are installed one on top of the other, the four feet of the upper chassis are in contact with the four feet of the lower chassis through four ceramic balls supplied with the REFERENCE DAC. The balls are seated in the small indentations at the top of each foot of the lower chassis (preferably the power supply chassis).

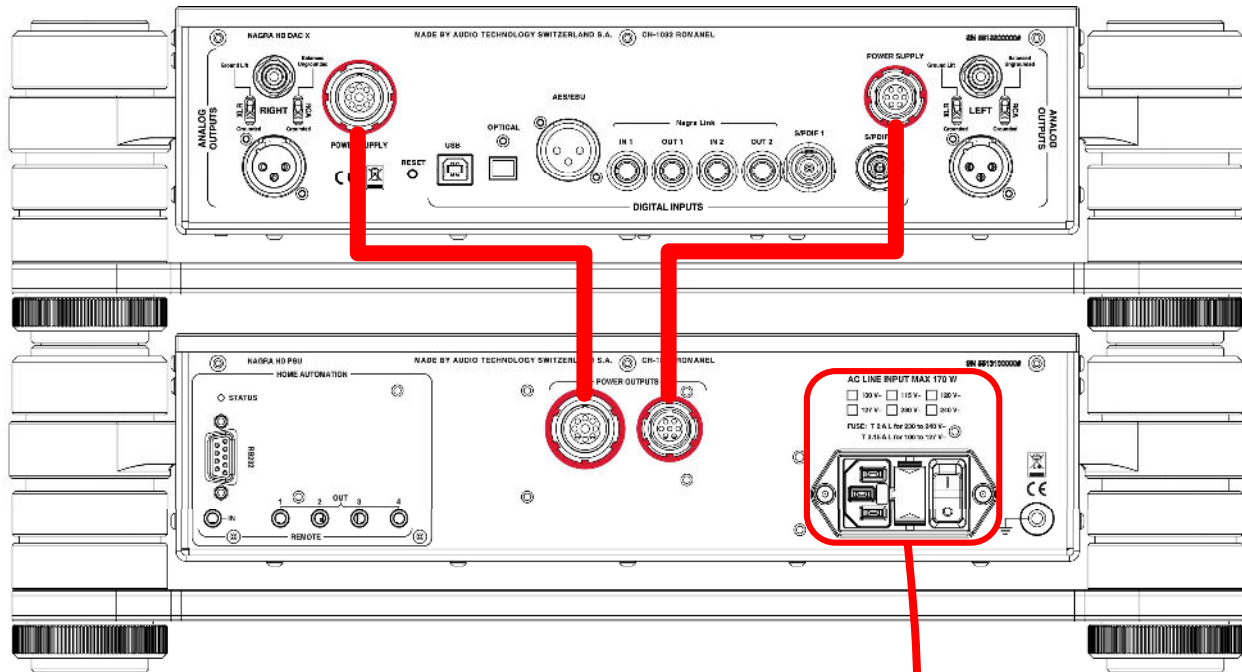
Powering the REFERENCE DAC – two power supplies

The power supply chassis converts the mains supply into several different regulated voltages sent to the audio device chassis through three umbilical cords with LEMO plugs. These cords are supplied with the REFERENCE DAC. When using two power supplies, one will be dedicated to audio, while the other one will handle digital and controls.

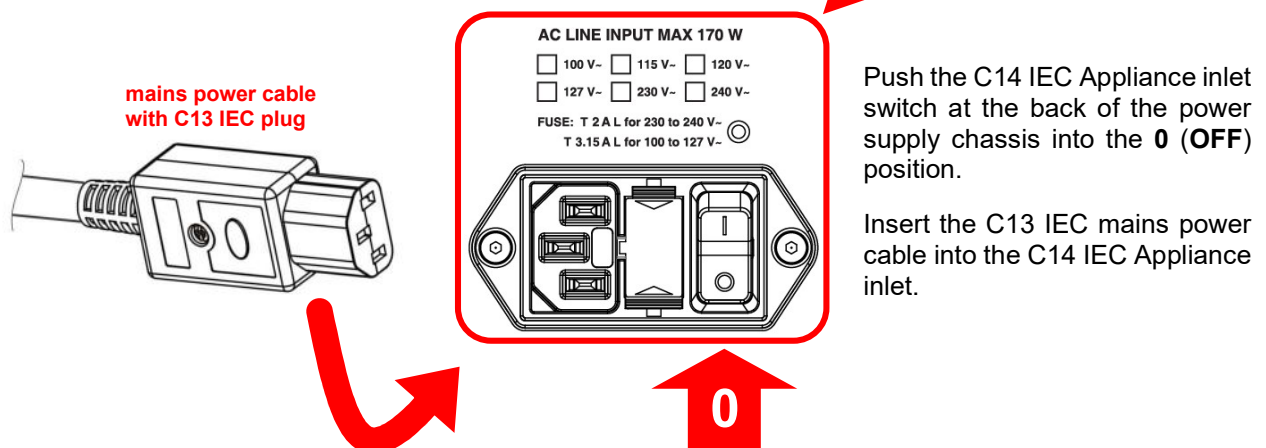


Powering the REFERENCE DAC – one power supply

The power supply chassis converts the mains supply into several different regulated voltages sent to the audio device chassis through two umbilical cords with LEMO plugs. These cords are supplied with the REFERENCE DAC.

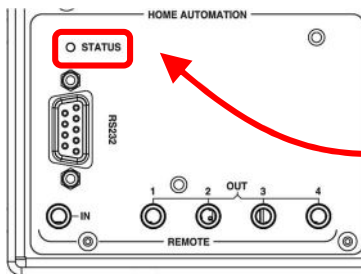


Connection to the mains



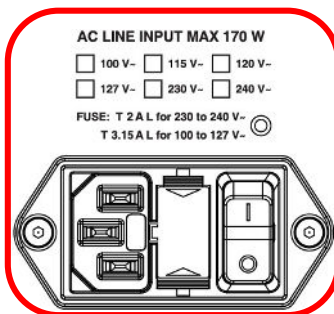
Connection/Disconnection of LEMO cables

To disconnect the LEMO plug, hold the knurled section of the plug and pull it backward.



The **STATUS LED** located on the rear panel of the power supply chassis may turn ON when you move the **REFERENCE DAC** front rotary selector to a position other than OFF with incorrect cabling. In this case, the audio device chassis does not switch ON for safety reasons.

Fuse replacement



The fuse holder located in the mains appliance inlet, between the IEC connector and the switch, includes a replacement fuse.

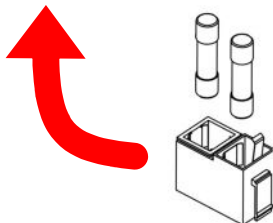
The fuse type is: **FST 5x20 mm 250 V**.

Should you need to replace it, use only the same fuse type and value.

T 3.15A L for 100 V~ to 127 V~ versions.

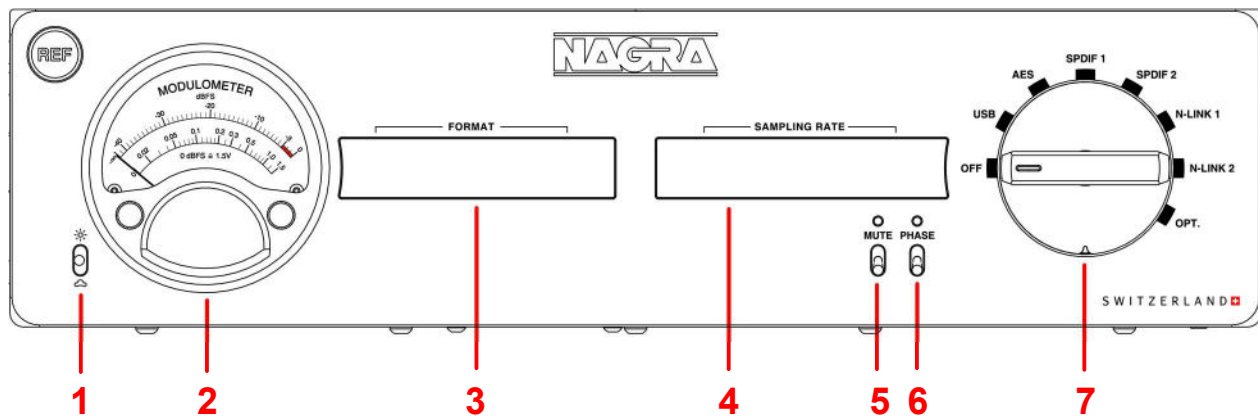
T 2A L for 230 V~ to 240 V~ versions.

Should the fuse blow more than once, please contact your Nagra dealer for assistance.



REFERENCE DAC Description

Front panel

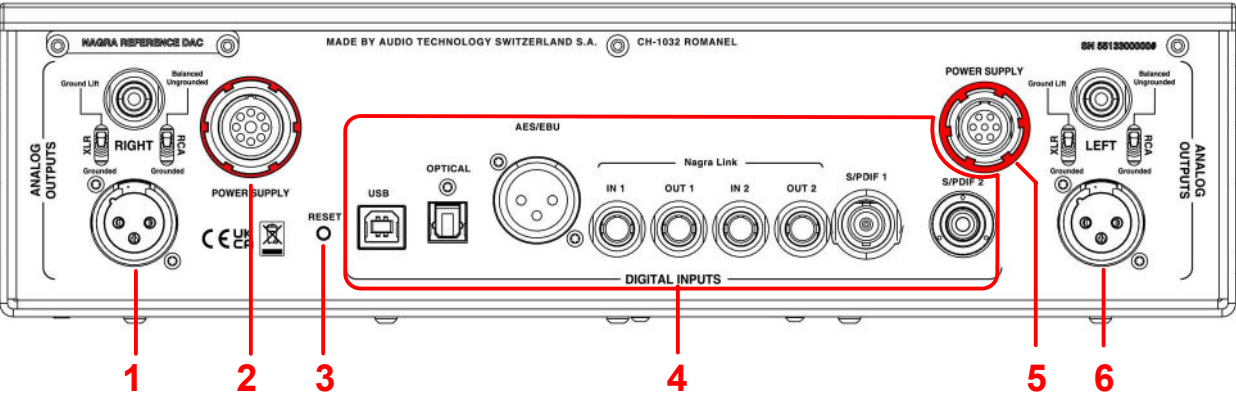


- 1 Modulometer™ & displays brightness switch. Push up for more intensity, down for less. There are seven intensity levels
- 2 Nagra Modulometer™. Indicates digital audio input level in dBFS (upper scale) and analog audio output level in V_{RMS} (lower scale). The reference for 0 dBFS is $1.5 V_{RMS}$
- 3 “FORMAT” display – will indicate PCM or DSD
- 4 “SAMPLING RATE” display – will indicate the sampling frequency
- 5 MUTE switch with reminder / preheating sequence LED
- 6 PHASE switch with reminder LED
- 7 Front rotary selector

When turned ON (a position other than OFF on its front rotary selector), the REFERENCE DAC enters a 2.5-minute preheating sequence in order to optimize tubes and warm up critical components. This will allow your REFERENCE DAC to offer excellent performance for years to come.

During that time, MUTE LED flashes with a 1s period.

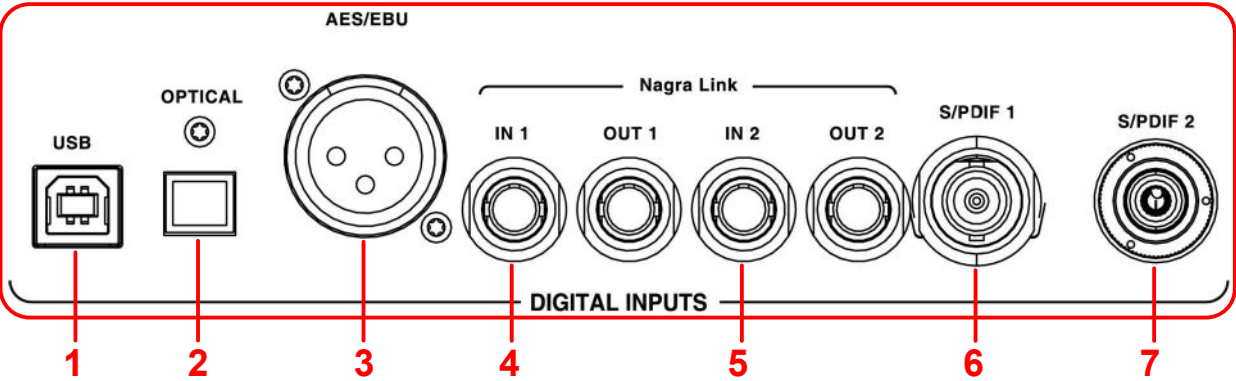
Rear panel (audio device chassis)



- 1 Right channel output on XLR and RCA
- 2 LEMO power supply input (Analog 9p)
- 3 RESET of digital inputs board
- 4 Digital inputs
- 5 LEMO power supply input (Digital 7p)
- 6 Left channel output on XLR and RCA

The input is selected with the front rotary selector (see page 13)

Audio inputs



Input type	Input format
1 USB B-type	DSD: up to DSD256 (DSD4x) PCM: up to PCM 384 kHz
2 TOSLINK EIAJ optical (MM fiber)	PCM: up to PCM 192 kHz
3 AES/EBU	PCM: up to PCM 192 kHz
4-5 Nagra Link (N-Link)	DSD: up to DSD256 (DSD4x) PCM: up to PCM 384 kHz
6 S/PDIF 1 BNC	PCM: up to PCM 192 kHz
7 S/PDIF 2 RCA	PCM: up to PCM 192 kHz

Note on the digital inputs.

Nagra Link

Nagra Link or N-Link will provide the best performance.

First, it can natively play DSD256. In addition, its optical fiber provides total isolation from the source. If you are using a Nagra Streamer, you should use the N-Link output for maximum performance.

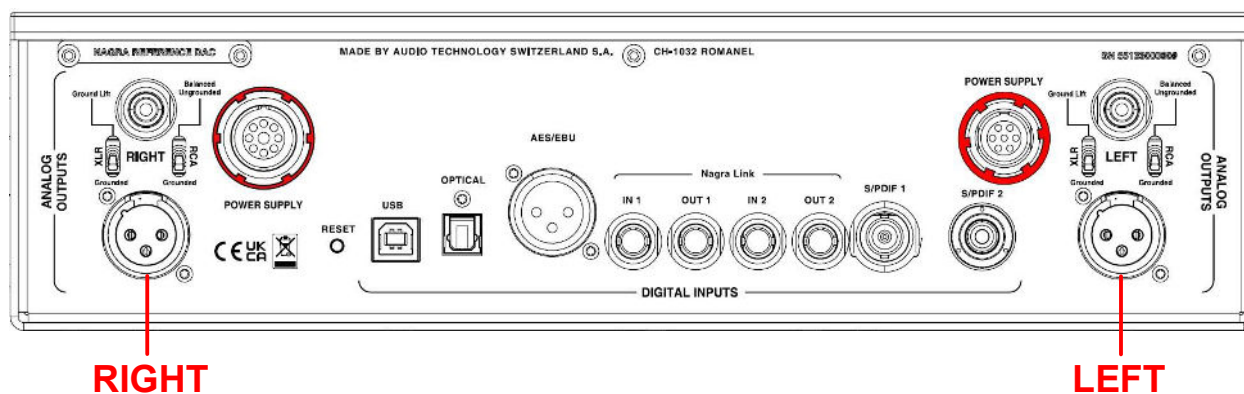
USB input

When connected to a MAC OS device, there is no driver involved. The REFERENCE DAC will be recognised automatically.

When using a PC, you need to install specific drivers designed for the Nagra DAC. Please note that **if you previously used** a Classic DAC II, TUBE DAC, or HD DAC X, then the driver is identical and does not need re-installation.

The driver and instructions are to be found on the USB flash drive delivered with your unit.

Audio outputs

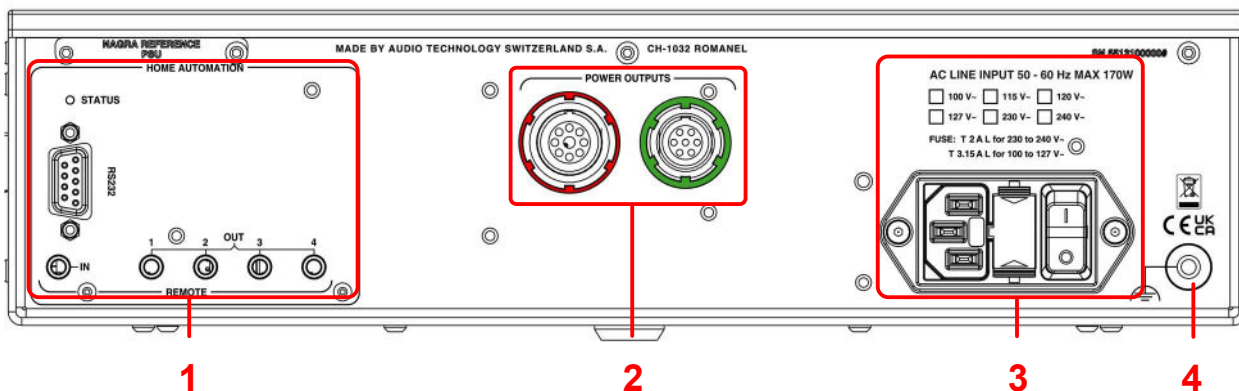


The REFERENCE DAC provides RCA and XLR audio output connectors. They should not be used simultaneously, as both outputs are connected in parallel.

We recommend using the RCA connectors for optimal performance.

In addition, always place the selectors on “GROUNDED” as shown on the image above.

Rear panel (power supply chassis)



- 1 STATUS LED for software upgrade & detection of wrong audio device connection
SUB-D9 for Home automation, more information page 20
REMOTE IN (1x) to be driven by a MAIN device - 3.5 mm (1/8") stereo Jack
REMOTE OUT (4x) to drive CONTROLLED devices - 3.5 mm (1/8") stereo Jack
More information on the REMOTE function, see page 19
- 2 LEMO power supply outputs (Analog 9p, Digital 7p)
- 3 C14 IEC Appliance inlet with switch and fuse + voltage version & fuse value information
- 4 Ground post

About the ground post

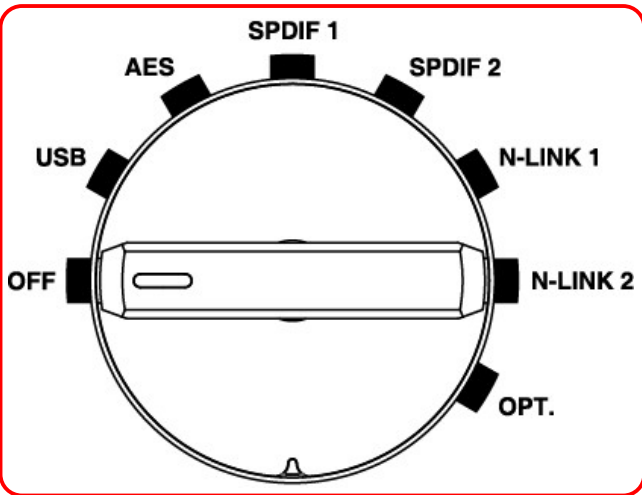
Best sound is often achieved by ensuring proper grounding of the different components in your system. Many cable manufacturers provide accessories to properly ground your system. Should you need to ground your set-up, use this post.

OPERATION OF YOUR REFERENCE DAC

Power on & Audio input selection

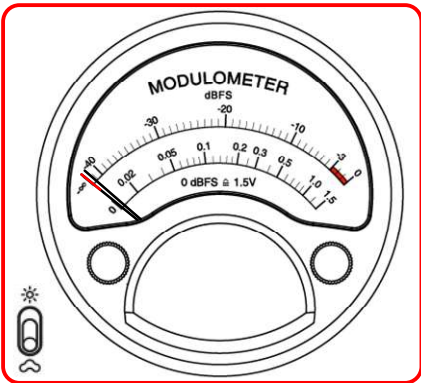
To use your REFERENCE DAC, first you must place the mains power switch to position **1 (ON)** on the back of the power supply unit(s).

The front rotary selector offers 8 positions to select the desired input or to switch your REFERENCE DAC OFF:



- | | |
|----------------|---|
| OFF | Similar to a STANDBY mode, the unit is powered and the consumption remains very low |
| USB | USB |
| AES | AES / EBU |
| SPDIF1 | SPDIF 1 on BNC |
| SPDIF2 | SPDIF 2 on RCA |
| N-LINK1 | Nagra LINK 1 |
| N-LINK2 | Nagra LINK 2 |
| OPT. | Optical on TOSLINK |

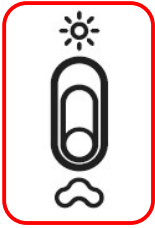
Nagra Modulometer™



The Nagra Modulometer™ is inherited from the second recorder developed by Nagra back in 1952, the Nagra II. The Modulometer™ is a typical Nagra precision instrument that displays the signal level to achieve the best possible recording. In the case of the REFERENCE DAC, the Modulometer™ displays the selected digital audio input level (upper scale) and the corresponding analog audio output level (lower scale). Reference 0 dBFS = 1.5 V_{RMS}.

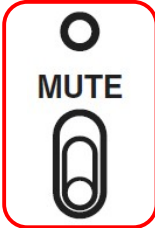
- Left channel – black needle
Right channel – red needle

Light intensity adjustment



This two-way toggle switch allows you to adjust the Modulometer and displays backlight intensities. Pushing the toggle up will increase the brightness, pushing it down will lower the brightness all the way to no illumination. There are seven different intensity levels.

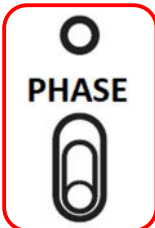
Mute



The outputs of the REFERENCE DAC can be muted when you activate the MUTE switch. Pulling up the switch will activate the muting (no more sound) and light the yellow LED. Pulling down the switch will deactivate the muting and turn the yellow LED off. The REFERENCE DAC outputs will be working again.

Note *The MUTE LED flashes during the preheating sequence with a 1s period.*

Phase



The absolute phase of both channels can be reversed. Pulling up the switch will reverse the phase and the yellow LED will light-up. Pulling down the switch will deactivate the phase inversion and turn off the yellow LED.

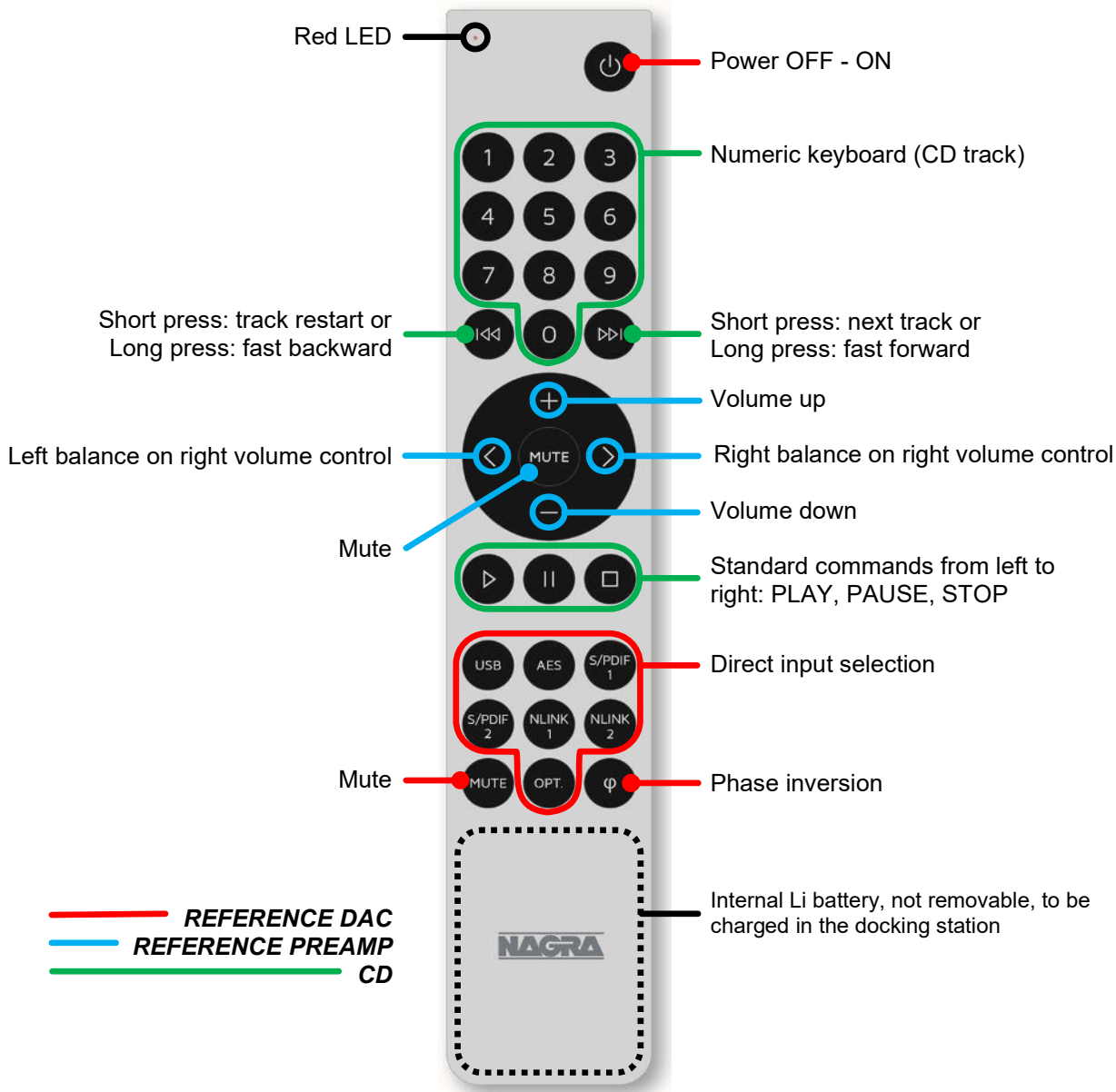
We encourage you to try both positions during listening.

You can also use the phase button on the remote control, which is very convenient from your listening position.

IR Remote Control Unit



The Remote Control Unit, with the battery installed, must not be exposed to excessive heat such as **direct sunlight**, fire, or similar sources.



NOTE To protect the Li battery in the device during transport, the Remote Control Unit keys have been locked. **To unlock them, press on central MUTE for 5 seconds until the red LED blinks twice.**

The REFERENCE DAC can also be operated by legacy Nagra remote controls RCU or RCU-II. As they require a different communication protocol (RECS-80), please contact your Nagra dealer for assistance.

Red LED on Remote Control Unit

The red LED lights ON when pressing any key on the Remote Control Unit. If not, it means either the Remote Control Unit keyboard is locked or the Remote Control Unit Li battery is empty. Insert the unit into the docking station to charge the Li battery.

REFERENCE DAC Power OFF - ON key

Toggle key to switch the REFERENCE DAC ON and OFF. When switching ON, the REFERENCE DAC automatically turns the front selector to the last input that was active before the previous power OFF.

Note: *This key is not operative when a REMOTE AUTOMATION jack cable is connected to the REMOTE IN socket of the power supply chassis!*

REFERENCE DAC “φ” key

The outputs of the REFERENCE DAC can be set to phase inversion mode when you press on the “φ” key.

REFERENCE PREAMP “+” and “-” volume keys

To move both left and right volume controls simultaneously, either up or down, press on key briefly for a ± 0.5 dB change, or longer for bigger volume differences. The volume controls can be set to work either in synchronized mode or in desynchronised mode.

REFERENCE PREAMP “<” and “>” keys

With synchronized volume controls = No effect

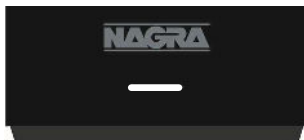
With desynchronized volume controls = step of ± 0.5 dB, on right volume control

Docking station usage

To charge the Remote Control Unit Li battery, insert the unit into the docking station (unit keyboard towards docking station front). Fully charged, the Remote Control Unit will work for around 2-3 months, depending on usage. The 3x AA-dry cells in the docking station will be able to charge the Li battery for about 3 years.

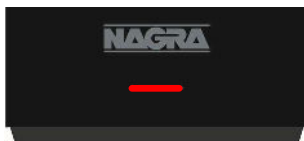
Docking station LED indicator

The LED on the front indicates the condition of the Remote Control Unit Li battery when the unit is inserted into the docking station:



WHITE blinking

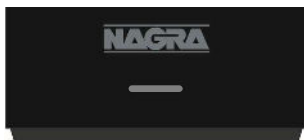
The Li Battery in the Remote Control Unit is charging.



RED blinking

A. The 3x AA-dry cells are almost exhausted and deliver a voltage too low to load the Li Battery in the Remote Control Unit, exchange them.

B. The Remote Control Unit is defective. Please contact your Nagra dealer.

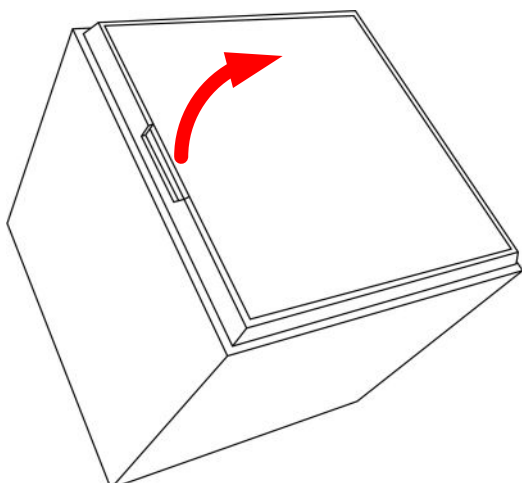


Permanently OFF

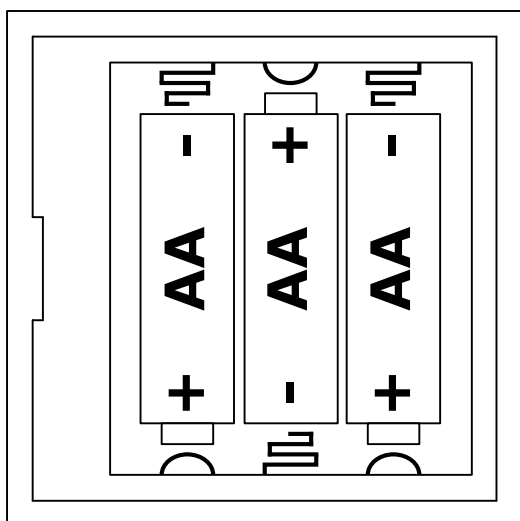
The Li Battery in the Remote Control Unit is fully charged or the Remote Control Unit is not properly inserted into the docking station. Remove and reinsert the unit into the docking station. If the LED blinks white everything is OK, if not, the 3x AA-dry cells are fully exhausted and must be exchanged.

NOTE	When the Li Battery in the Remote Control Unit is fully charged, the docking station only uses a small amount of current to maintain the full charge. There is no risk of overload even if the Remote Control Unit is inserted in the docking station for a long time.
-------------	--

Battery installation/exchange in docking station



Open the battery box by inserting your thumb nail into the groove and lift the bottom panel up (magnet lock).



Replace empty batteries with 3 x new AA batteries.



Warning

Do not use any tools to open the docking station battery compartment.



By ensuring battery is disposed of correctly, you will help prevent potential negative consequences for the environment and human health. The recycling of materials will help to conserve natural resources. For more detailed information about recycling of battery, please contact your local authority, your household waste disposal service or the shop where you purchased the battery.

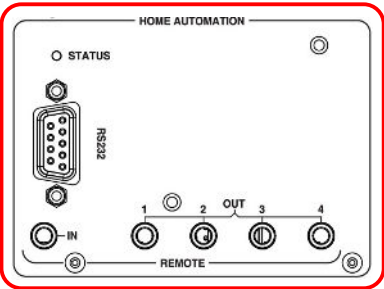
Use of a universal IR Remote Control Unit

The REFERENCE DAC responds to IR (Infra Red) signals encoded in Philips RC-5 format. A default code 19 has been allocated to the REFERENCE DAC as a Digital-to-Analog converter.

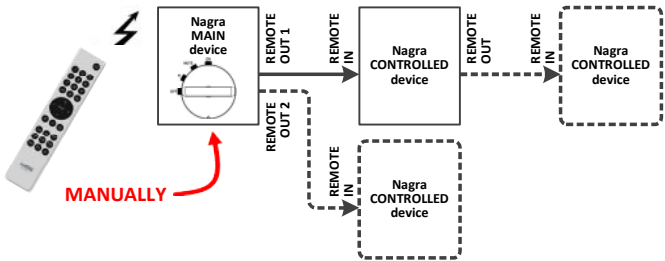
Should you wish to program your universal remote control, please use the following table:

Code	Device group number	Key
REFERENCE DAC		
1	19	USB
2	19	AES
3	19	S/PDIF 1
4	19	S/PDIF 2
5	19	N-LINK 1
6	19	N-LINK 2
7	19	OPT.
12	19	Power ON/OFF
13	19	Mute
37	19	Φ – Absolute phase inversion
REFERENCE PREAMP		
13	16	Mute
16	16	+ (Volume up)
17	16	- (Volume down)
26	16	> (Right balance)
27	16	< (Left balance)
CD		
0	20	0
1	20	1
2	20	2
3	20	3
4	20	4
5	20	5
6	20	6
7	20	7
8	20	8
9	20	9
32	20	>> (Short press: next track)
33	20	<< (Short press: track restart)
48	20	(Pause)
50	20	<< (Long press: fast backward)
52	20	>> (Long press: fast forward)
53	20	▷(Play)
54	20	◻(Stop)

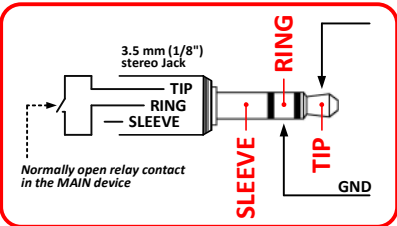
Remote automation



It allows you to switch a complete configuration of Nagra devices ON or OFF by controlling only the MAIN device manually or with an IR remote control unit.



Starting the REFERENCE DAC using the REMOTE IN trigger input



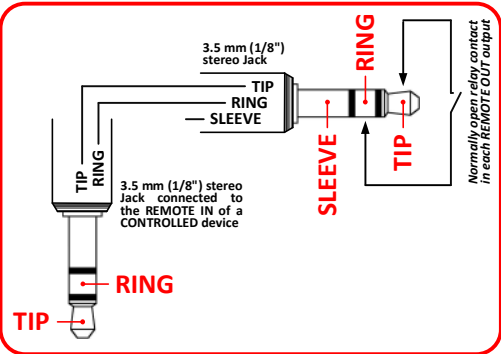
Please note that the RING contact of the 3.5 mm (1/8") stereo Jack inserted in the **REMOTE IN** input is connected to the ground in the power supply chassis.

Signal on the TIP	REFERENCE DAC
Loop closed between TIP and RING (MAIN device ON) or TIP connected to the GND in the MAIN device	ON
Loop open between TIP and RING (MAIN device OFF) or TIP connected to max +12V $\overline{\text{---}}$ in the MAIN device	OFF

If a 3.5 mm (1/8") stereo Jack connector is inserted into the **REMOTE IN** input, this control gains priority over the IR Remote Control Unit and RS232 commands (ON-OFF key switch on IR Remote Control Unit no longer works).

As soon as the REFERENCE DAC is switched ON, the front rotary selector turns itself to the selected input before it was last switched off. If you manually turn the front rotary selector to the OFF position when TIP and RING are shorted (loop closed), it will turn itself back to the last selected input.

Using the REMOTE OUT trigger outputs

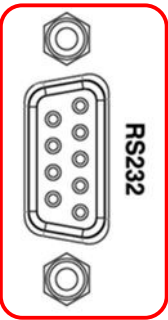


REFERENCE DAC	TIP & RING contacts
REMOTE OUT activated (REFERENCE DAC ON)	Loop closed between TIP and RING when the REFERENCE DAC or the MAIN device connected on the REMOTE IN are switched ON
REMOTE OUT not activated (REFERENCE DAC OFF)	Loop open between TIP and RING when the REFERENCE DAC or the MAIN device connected on the REMOTE IN are switched OFF

The relay contact activation is done during the start-up sequence, 30-60s after turning the REFERENCE DAC ON.

Note Use standard straight cable to connect the different devices. For more information, please ask your Nagra dealer who will provide you with a specific document on the topic.

Home automation



All commands are sent/received on the SUB-D9 connector located on the rear panel of the power supply chassis. The serial settings are: 115200 bits per second, 8 data bits, no parity, 1 stop bit.

All commands are executed after sending the command itself and terminating with a <CR> (carriage return).

Command	Description
BLUP	Increase backlight intensity
BLDOWN	Decrease backlight intensity
MUON	Mute ON
MUOFF	Mute OFF
PHON	Set phase inversion
PHOFF	Reset phase inversion
PWON	Power on the device
PWSTANDBY	Set device to standby (or power off)
SILEFT	Previous input
SIRIGHT	Next input
SI1	Select input 1
SI2	Select input 2
SI3	Select input 3
SI4	Select input 4
SI5	Select input 5
SI6	Select input 6
SI7	Select input 7

Tube ageing

Nagra selects the REFERENCE DAC tubes according to exacting criteria. Their theoretical minimum useful life is 5,000 hours. In fact, some tubes operate consistently for more than 10,000 hours.

Thus, the useful life of the tubes is somewhat unpredictable. Rather than replacing the tubes arbitrarily after 5,000 hours, we suggest that you identify the signs of ageing:

- Distortion gently increases to an audible level
- Presence of clicks (dry, brief noises similar to snapping wood)
- Presence of pops, brief noises in the low frequencies
- Presence of hiss, higher background noise
- Reduction of spaciousness, loss of naturalness

As soon as one of these signs appears, please contact your Nagra dealer to order a REFERENCE DAC replacement tube kit (see Accessories chapter for reference).

REFERENCE DAC software update

The update is carried out with two MicroSD memory cards, one for the audio device and one for the power supply. You will be advised of the availability of any updates by your dealer who will install them.

Case cleaning

Clean the REFERENCE DAC chassis, the IR Remote Control Unit and its docking station by using a soft, lint-free, slightly damp cloth. Do not use any cleaning products that could have a corrosive effect.

TECHNICAL SPECIFICATIONS

Digital inputs	1x AES/EBU 2x S/PDIF 2x NAGRA-LINK 1x Optics 1x USB	XLR BNC, RCA single-mode ST-1 opt. cable TOSLINK Audio USB (UCA2)
Analog outputs	1 stereo RCA 1 stereo XLR	Unbalanced Unbalanced
Output level	1.5 V _{RMS}	@ 0 dBFS
Output impedance	< 215 Ω	
Analog output Noise level	-128 dBr	@ 1 kHz / 1.5 V No ponderation
Distortion	< 0.02 % < 0.005 % (H2 filtered)	@ -20 dBFS @ -3 dBFS
THD + N	< 0.03 %	@ 192 kHz
Frequency Response	5 Hz - 40 kHz	+0 / -1 dB
Crosstalk	> 110 dB > 100 dB	@ 1 kHz @ 20 kHz
Inter-channel phase	< 0.05 ° < 0.3 ° < 0.5 °	@ 1 kHz @ 20 kHz @ 50 kHz
Remote automation		
Input	1x 3.5 mm (1/8") stereo Jack socket	Input command
Output	4x 3.5 mm (1/8") stereo Jack socket	Output switching by relay
Home automation	1x SUB-D9 connector	RS232 115200 bits/s, 8 data bits, no parity, 1 stop bit
Mains power	100 V~, 115 V~, 120 V~, 127 V~ 230 V~ or 240 V~ NOT ADJUSTABLE	±10 %, 50-60 Hz
Power consumption	170 W max	
Mains fuse		
230 V~ to 240 V~	T 2A L	FST 5x20 mm 250 V
100 V~ to 127 V~	T 3.15A L	FST 5x20 mm 250 V
Operating temperature	+15 °C to +35 °C +59 °F to +95 °F	Moderate climate
Operating environment	Indoor only	IP30
Overall dimensions with VFP		
LxWxH		
Each chassis	439 x 438 x 121-130 mm	17.3 x 17.3 x 4.8-5.1 in
Weight with VFP (net)		
Power supply chassis main	16.5 kg	36.4 lb
Power supply chassis Opt.	16.5 kg	36.4 lb
Audio device chassis	13.5 kg	29.8 lb

Specifications may change without notice

ACCESSORIES

ATS ref	Part description	Comment
4181311200	FST 5x20 mm T 2A L / 250 V fuse cartridge	For 230 V~ to 240 V~ versions
4181311315	FST 5x20 mm T 3.15A L / 250 V fuse cartridge	For 100 V~ to 127 V~ versions
7055133030	Tube kit for REFERENCE DAC	
7055427000	REFERENCE DAC IR Remote Control Unit + Docking station	

Specifications may change without notice



Disposal of old electrical & electronic equipment (Applicable in the European Union and other European countries with separate collection systems).

This symbol on the product or on its packaging indicates that it should be handed over to the applicable collection point for the recycling of electrical and electronic equipment. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health. The recycling of materials will help to conserve natural resources. For more detailed information about recycling of this product, please contact your local authority, your household waste disposal service or the shop where you purchased the product.

Applicable to the following devices:
REFERENCE DAC and all the package contents