



FERROFISH
advanced audio applications

PULSE16 AE

16x16 Channel A/D-D/A Converter & Router

Manual.





Introduction

Dear users,

we are very pleased that you have chosen our converter PULSE16 AE. Our goal is to offer you real added value in everyday life with this device. We hope that you will enjoy the device as much as we did during its development.

If you have any questions, suggestions or problems, please contact our support team using the following email address: info@ferrofish.de

Your Ferrofish team

Safety information

Safety information



Safety information:

Read and follow these instructions.
Follow all warnings and safety instructions.
Keep this manual.

► **ATTENTION!**

This device, in combination with headphones, amplifiers or speakers, can achieve levels that can damage hearing over prolonged exposure. Avoid both unpleasant and permanently high volumes. If there are signs of hearing damage, seek medical attention immediately.

► **WARNING!**

To avoid the risk of electric shock, avoid exposing the device, power supply and power cord to moisture.

Do not operate the unit or power supply near water or in environments with condensing humidity. Do not place containers of liquid on the device. Avoid direct contact with liquids. Avoid spraying or spraying the unit and the power supply with liquids of any kind, as this may damage the unit.

Use only a dry cloth for cleaning. The device is maintenance-free.

Never cover or block vents on the device. This could lead to overheating of the device. Disconnect the device from the mains when it is not in use for a longer period of time and in case of thunderstorms.

Only use the device within its intended voltage range. You will find this printed on the power supply.

If you are not sure which mains voltage prevails in your application area, please contact your local energy company. If the plug of the supplied power supply does not fit into the mains outlet, contact an electrician. Use only manufacturer-approved power supplies, spare parts and other accessories. Other power supplies may cause malfunction or even lead to a defect of the device. Pay attention to the maximum electrical load capacity of your operating environment. Do not exceed this load limit because Overload can lead to fires.

Do not make any electrical or other modifications to the device or power supply, otherwise the device will lose its CE approval. Do not insert objects or foreign objects through the vent openings of the device. This could lead to a short circuit inside the device and a defect. Only operate the device in safe positions. Prevent the fall of the device causing injury to persons or may cause damage to the device.

All service work and repairs must be carried out only by a service authorized by the manufacturer. Service work is necessary as soon as the device or its power supply has been damaged in any way, such as:

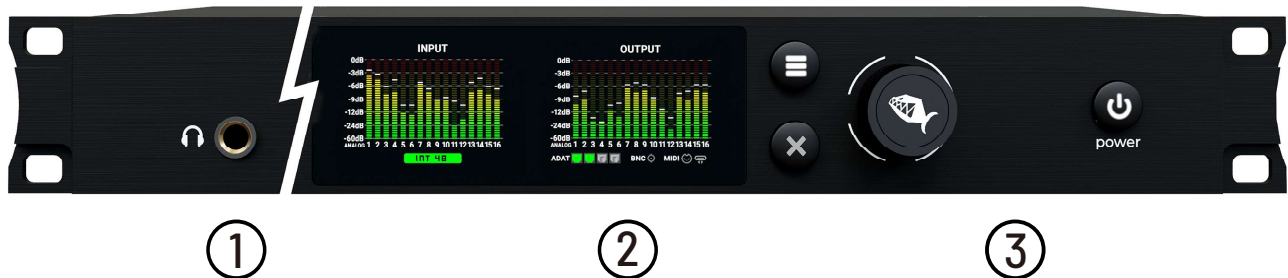
- Damage to the power supply or power cord.
- Liquid/object has penetrated the device.
- The appliance has been exposed to moisture.
- The device does not work normally or has been dropped.

Please contact your dealer and/or manufacturer for a repair.

WARNING! The device generates heat. When using, please check whether it becomes excessively warm and ensure that the resulting heat is sufficiently dissipated!



Front view



1 Headphone output

The headphone output is powered by a high-quality DAC and amplifier chip, and works independently of the analog outputs located on the backside. To adjust the headphone settings, go to the main display, and move the knob. You can find out more about headphone settings in the following chapters.

2 TFT screen

The TFT screen shows the levels of the 16 analog inputs and outputs as well as the status of the device. Pressing the MENU button takes you to the main menu from where the device can be setup.

3 Controls

The controls include the MENU button (three bars) as well as the ESC button (X symbol), the rotary knob, and the POWER button for turning the device on/off. To prevent switching off the device accidentally, you need to press the POWER button for approx. 3 seconds.



Back view



4 POWER Input

Please only connect the original power supply here. To secure the connection, be sure to lock it in order to prevent accidental disconnection.

5 USB-C PORT

The USB port serves as USB MIDI connection. After you connect the device to your PC/MAC, you can control it remotely using the RemoteFish software or update the firmware with the UpdateTool software. You can find both in the download area of the Ferrofish website. Please note that audio transmission via USB is not provided.

6 DSP STICK

This DSP STICK slot is intended for future extensions.

7 ADAT 1, 2, 3 and 4 IN/OUT

The PULSE16 AE has four ADAT input and output pairs (TOSLINK optical). This allows transmission of 32+32 audio channels at up to 48kHz. At higher frequencies, the number of channels is reduced, as described later.

8 MIDI IN/OUT (type A)

Modern and space-saving 3.5mm jacks are used for MIDI. Conventional 5-pin DIN cables can also be connected via an adapter cable, which you can purchase from your favorite supplier, or also from our online shop.

9 WORDCLOCK IN/OUT

The WORDCLOCK IN jack is used to receive and synchronize the clock from other digital devices. Set the clock source to BNC in the CLOCK view. The current clock is output to the WORDCLOCK OUT jack.

10 ANALOG IN/OUT

On the right back there are 16-analog inputs in the upper row, as well as 16-analog outputs at the bottom, which are designed balanced using 6.3mm TRS jacks. The outputs have a maximum output level of 20dBu, while the inputs also process a maximum of 20dBu input level.

► ***Balanced connections***

If possible, use only balanced cabling to ensure the best possible audio quality. If you still want to make an unbalanced cabling, please follow this:

► ***Unbalanced connection of analog outputs***

Connect only the tip (TIP) of the jack as a signal line, and the ground return line (SLEEVE) at the base of the jack, leaving the middle ring open (RING). The maximum output signal in this case is 6dB lower, i.e. 14dBu.

► ***Unbalanced connection of analog inputs***

Also connect only the tip (TIP) for signal, and the ground return (SLEEVE). It is recommended to connect the ring to ground to prevent interference on this line. Please note that the maximum level is only 14dBu. In the Gains menu, you should raise the corresponding gain by 6dB for a full signal.

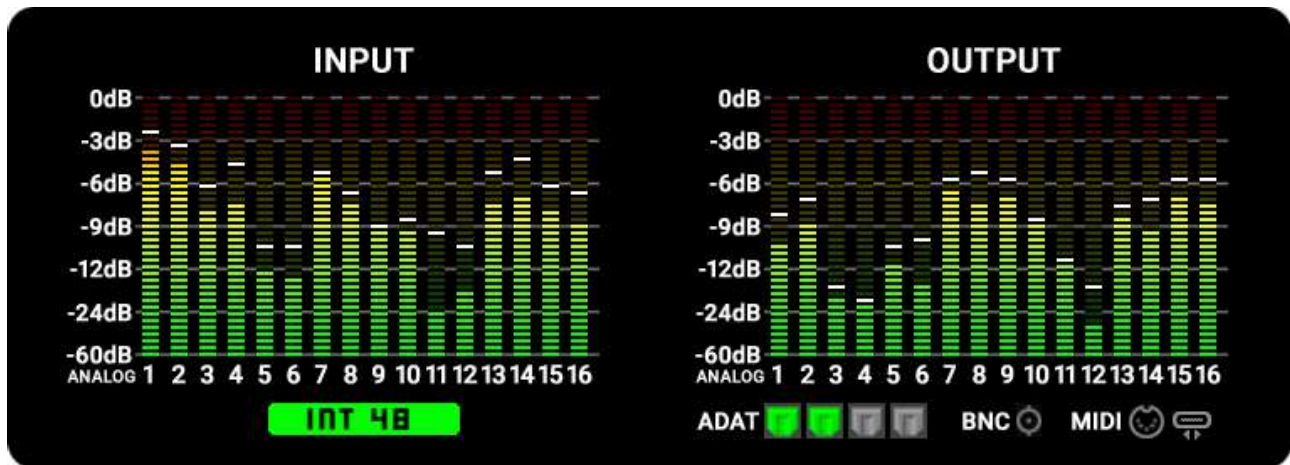
► ***Clipping***

Please always set the gain of the inputs in such a way that digital clipping is prevented by keeping enough headroom to full level. In contrast to analog devices, the signal is heavily distorted in the event of a clipping, which is why this situation must be avoided at all costs.

Any clipping that may occur is displayed in the level indicator as a red flashing bar. To delete this, briefly press the POWER button. You can also deactivate the clipping display function in the DAC or ADC view.



Main display



In the upper area the levels of the 16 inputs and 16 outputs are shown. As already described, you should absolutely avoid clipping, and therefore for example control the level only up to -6dB. Any clipping that may occur is indicated by a flashing bar at the top and can be deleted by briefly pressing the POWER button.

The status bar is located at the bottom:

The synchronization source and the current sample frequency are displayed in the middle. This can be selected in the CLOCK view.

To the left are the four ADAT, as well as the BNC input sockets shown. For a quick overview, the color of the socket indicates the state of the input signal:

Grey:	No signal found
Yellow:	Signal found but cannot be synchronized to selected clock source
Green:	Signal found and used

On the right side, activity of the MIDI and USB jack is displayed. Once USB is connected to a computer and mounted, a chain icon appears to the right of the USB icon to show the successful connection.

► *Higher Samplersates*

The ADAT interface was originally only specified for sampling rates up to 48kHz. To support higher sampling rates without changing the type of transmission, sampling rates up to 96kHz combines 2 channels, and respectively. 4 channels at 192kHz.

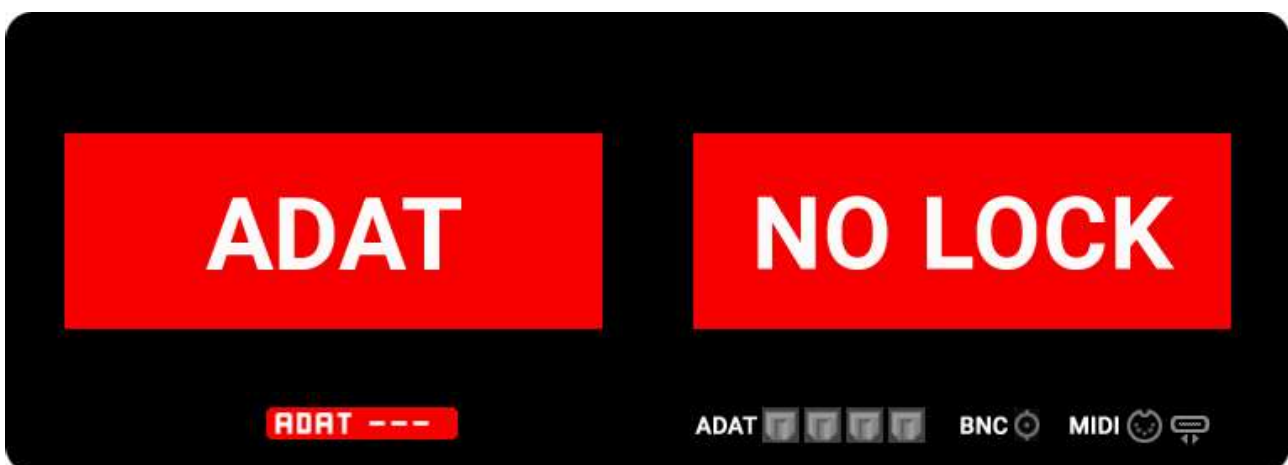
SMUX/1	32kHz, 44.1kHz, 48kHz	8 ADAT channels per jack
SMUX/2	64kHz, 88.2kHz, 96kHz	4 ADAT channels per jack
SMUX/4	128kHz, 176.4kHz, 192kHz	2 ADAT channels per jack

Since the PULSE16 AE has four ADAT input and four ADAT output jacks, even at 96kHz 16 channels per direction can still be transmitted via ADAT.

► *Resolution of DAC and ADC chips*

All ADC and DAC chips as well as the FPGA chip work internally with 32-bit. Future extensions via the DSP Stick port benefit from this very high bit depth. However, the ADAT specification only provides 24-bit, therefore the lower 8-bits are discarded when transmitted.

► *NO LOCK*



If no sampling frequency is detected at the selected clock source (ADAT or BNC), this error message appears.

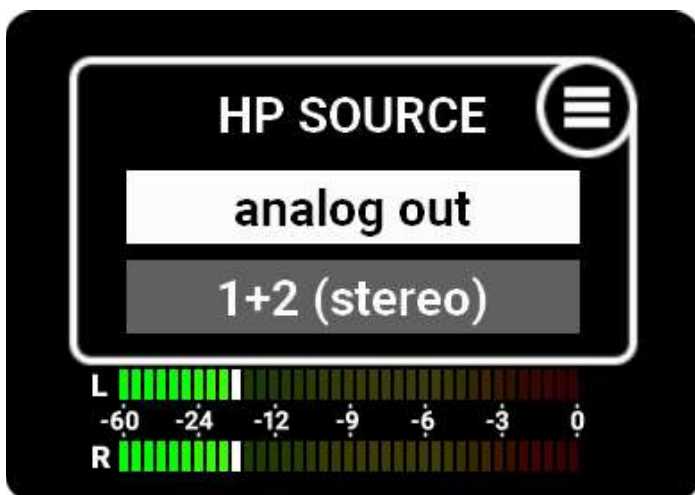


Headphones



To access the headphone display, turn the rotary knob in the main display.

In this display, you can adjust the volume of the headphone by turning the knob, and (un-)mute it by long pressing the MENU button.



Tap the MENU button to select the source of the headphone's signal.

Now you can first select the interface you want to listen to. Press the MENU button again to enter the channel selection. Using the knob, you can now choose either a single mono channel or two adjacent channels as a stereo pair. Exit the headphone display by tapping the ESC button.

► Attention

The headphone output in combination with the connected headphones may produce a very loud signal, which can harm your ears. Therefore, in the main menu under HP SETUP, limit the maximum volume accordingly.

Main Menu



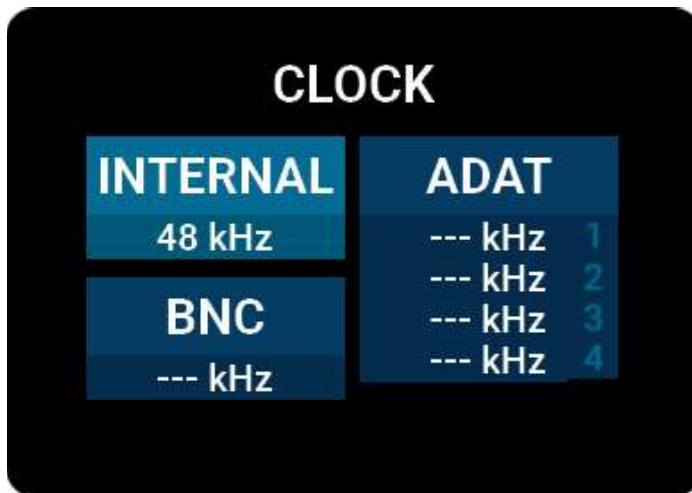
Press the MENU button in the main display to enter the main menu.
 Press the ESC key to return to the previous view.

In the main menu you will find the following settings:

CLOCK	Setting the clock source and sampling rate
HP SETUP	Headphone Settings
PRESET	Load, save and rename the eight presets
SETUP	Further settings in the setup menu (see following pages)
GAINS	Setting the maximum input level per analog input
LEVELS	Setting the maximum output level per analog output
ROUTING	Connecting the inputs and outputs in the routing matrix



CLOCK



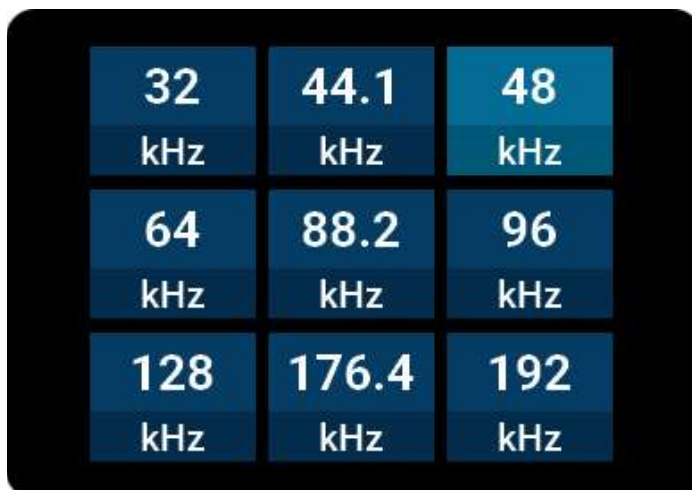
In the CLOCK display you can set the clock source and sample rate.

The measured sample rate is displayed in the lower field of the respective button. If there is no readable frequency "—" is shown.

At left of the displayed sample rate is a colored dot indicating the status of the attached signal:

If the dot is grey, no signal was detected. If it shows yellow, a signal has been detected, but cannot be synchronized. If it is green, it has been synchronized to this signal and the corresponding source can be used.

The "INTERNAL" field displays the current frequency of the word clock generator of the PULSE16 AE.



Pressing the MENU button again will bring you to the view in which you can select the internal sampling rate during INTERNAL operation.



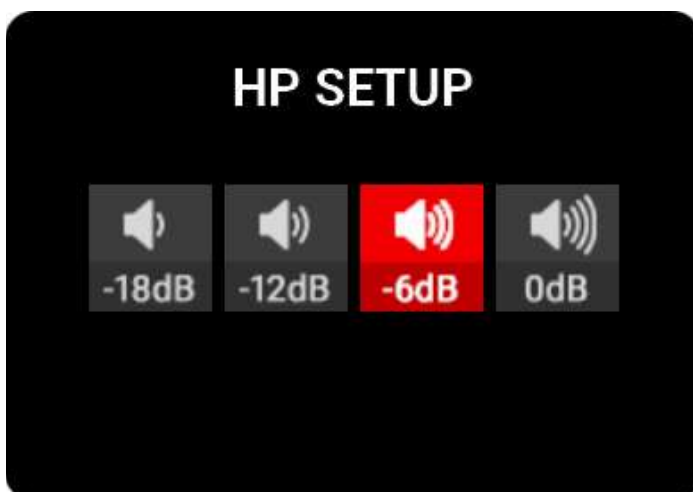
Accordingly, the ADAT and BNC settings display the sample rate detected at the corresponding input.

Since ADAT cannot distinguish between the different SMUX settings, you can set them manually here.

Please note: depending on sample rates, the number of available ADAT channels is as follows:

SMUX/1	up to 48 kHz	32x32 channels
SMUX/2	up to 96 kHz	16x16 channels
SMUX/4	up to 192 kHz	8x8 channels

HP SETUP



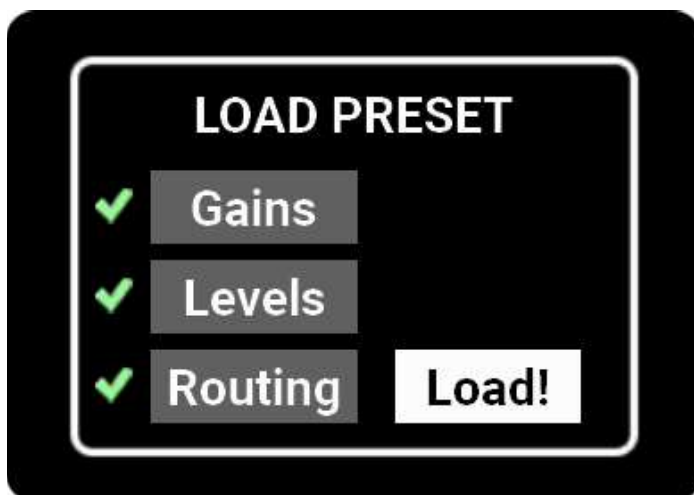
Here you can adjust the maximum level of the headphone output. Adjust to limit the maximum volume of the headphones to protect your ears.



PRESET



In the PRESET display you can save and load one of eight presets. For saving, use the knob to navigate to SAVE PRESET. Loading a preset is done simply by selecting one of the preset numbers.



When loading a preset, you can also choose which parts of the selected preset should actually be loaded.

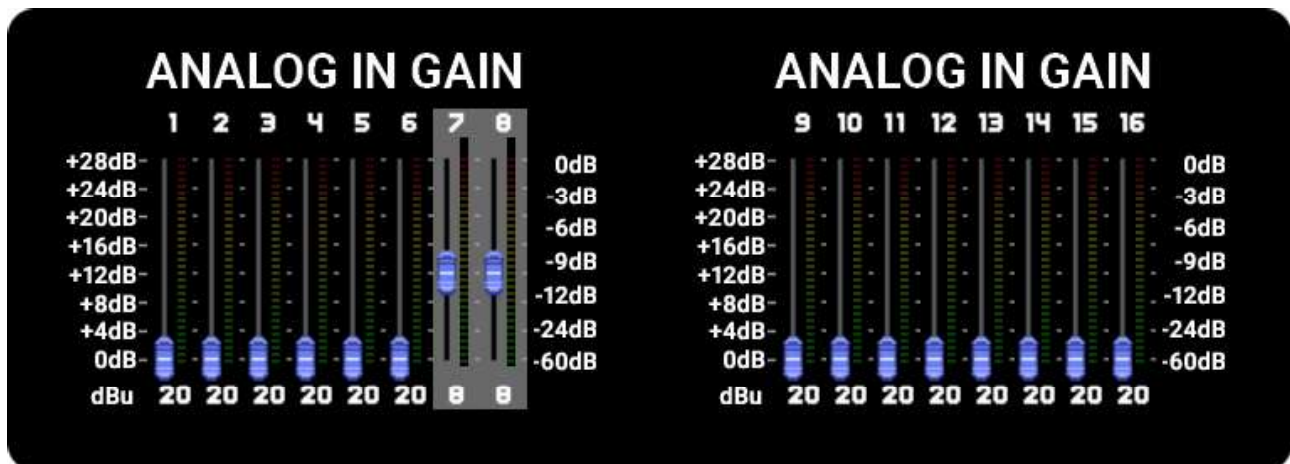
Navigate between the options with the rotary knob. Use the MENU button to select the selected option and select Load! to execute.

SETUP

Via SETUP you can access the basic settings of the device. Further information can be found in the next chapter.



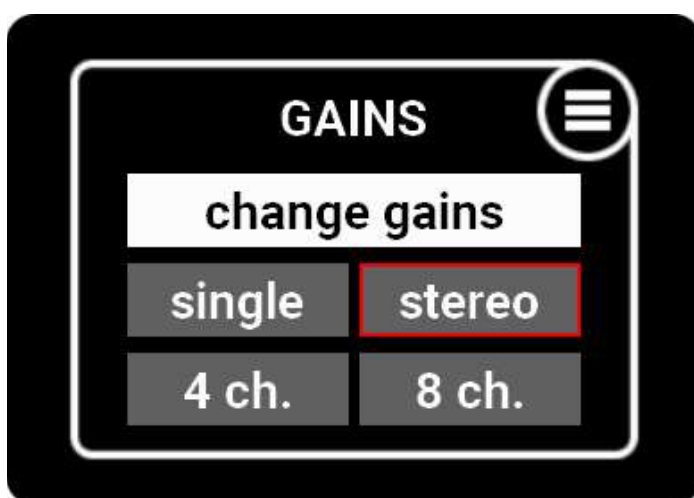
GAINS



The GAINS display is used to adjust the sensitivity of the analog inputs. These are individually adjustable in 1dB steps from +20dBu to -8dBu. The number given below the fader indicates the maximum level that the converter accepts. If, for example, a fader is set to a value of 19, the input can process a level of 19 dBu maximum and in this case would output 0 dBFS on the digital side. Higher values would lead to digital clipping, which you should avoid. In addition, you can see the level indicators of the analog inputs, so that you can adjust the level correctly. The dB scale of the display can be found on the right side of the view. The value of -8dBu corresponds approximately to the level of -10dBV used for consumer devices.

To make a setting, select the channel you want to adjust with the knob, and then press the MENU button. Then you can adjust the level using the knob.

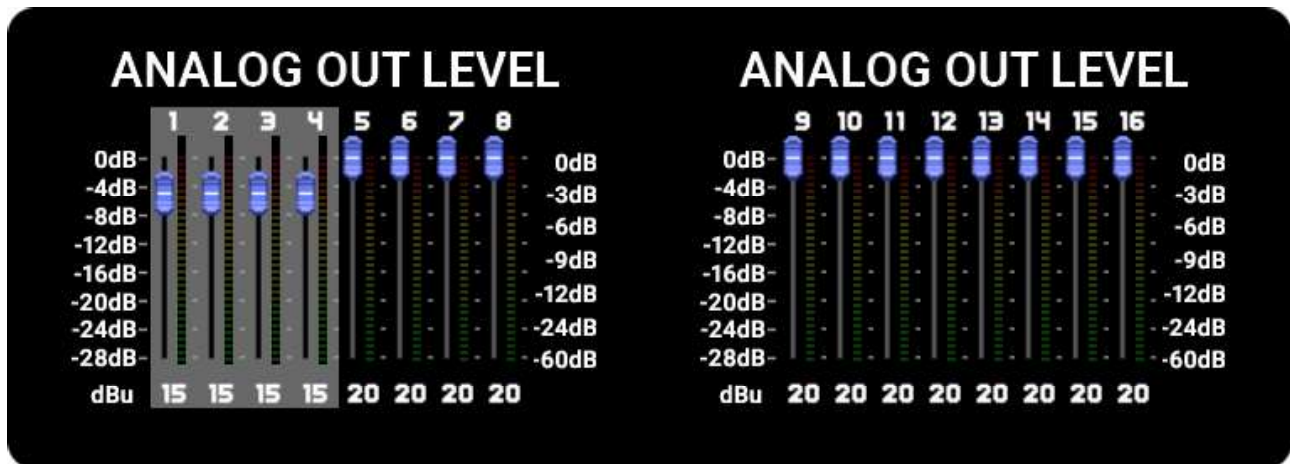
Pressing the MENU button again will move the selection to the next channel, which you can then set. When you are done with the settings, press the ESC button to return to the channel selection.



If you want to set multiple channels at the same time, press and hold the MENU button longer. In the menu you can select 1, 2, 4, or 8 channels. If multiple channels are selected, you can set them to the same level by short pressing the POWER button.

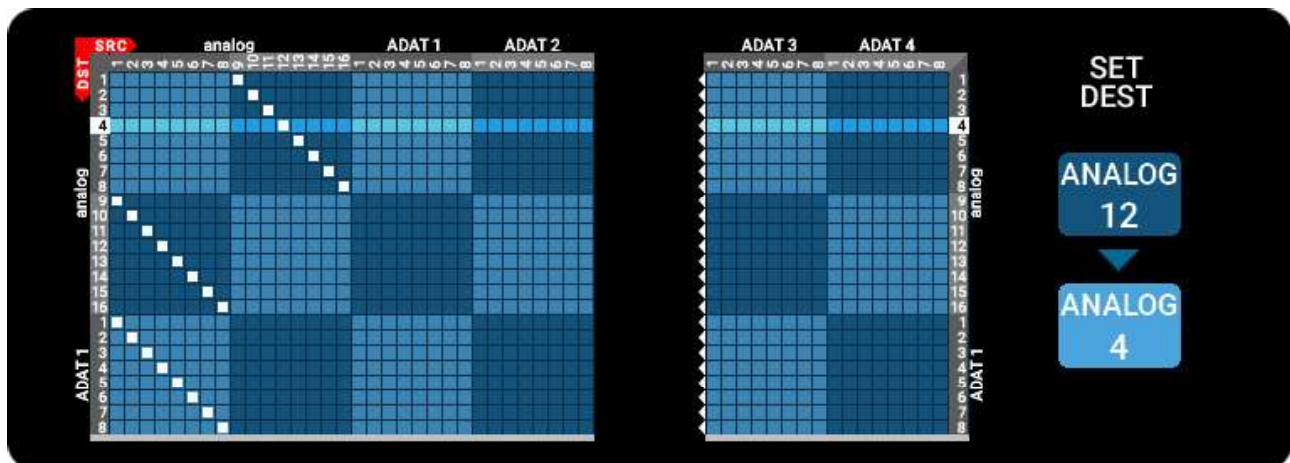


LEVELS



The LEVELS display is similar to the GAINS display and is used to adjust the output volumes. The outputs are also individually adjustable in 1 dB steps from +20dBu to -8dBu. Note that the levelmeter display does not change while you adjust, as the levels are shown before the attenuation is done.

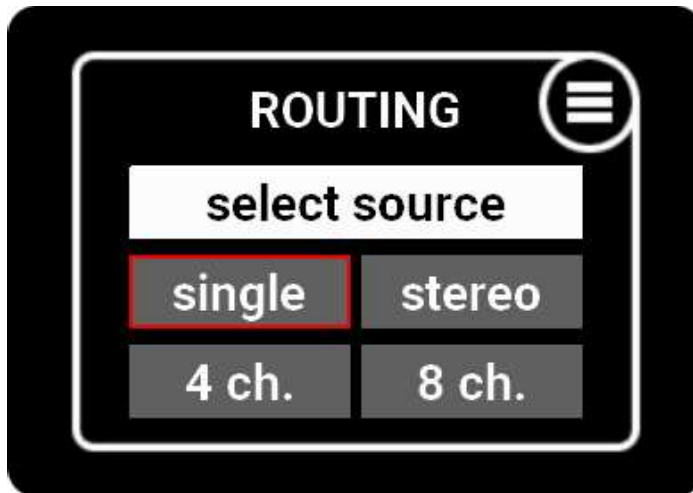
ROUTING



Here you can assign an input (top) to each output (left). A connection between input and output is indicated by a white square. Note that the view changes if you set a sample rate higher than 48 kHz, as the number of available ADAT channels is reduced in this case.

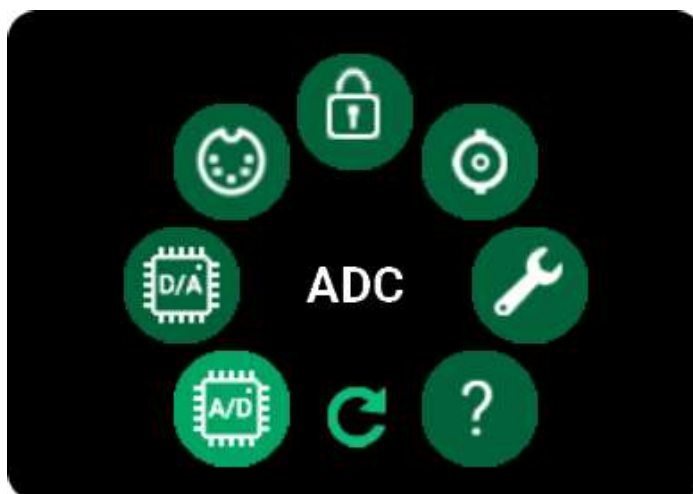
To do a routing, first select the output you want to adjust by moving the knob. After pressing the MENU button, you can now assign the input to the selected output by moving the white connection point. Another press of the MENU button then jumps to the next output, which can then be treated the same way.

To go back to the output selection, press the ESC button.



To simplify routing of a group of outputs, you can also choose multiple channels at the same time. To do this, press the MENU button until the routing menu appears. Here you have the choice to select 1, 2, 4, or 8 channels.

Setup Menu



This menu, accessible from the main menu, is intended for general settings. The menu items are described below

► ADC / DAC SETTINGS

Here you can choose one of the eight or seven different anti-aliasing filters for the ADC and DAC converters. These filters are necessary for the system to prevent frequencies above half of the sampling frequency from "mirroring" (aliasing) and thus being audible as distortion. In addition to their actual function, the filters have other characteristics that can be influenced by selecting a filter, in particular signal delay, phase behavior, pulse response and filter course. In case of doubt, please use the standard filter #1 recommended by the manufacturer.

Further information can be found in the data sheet of the ES9017 and ES9840Q chips used.

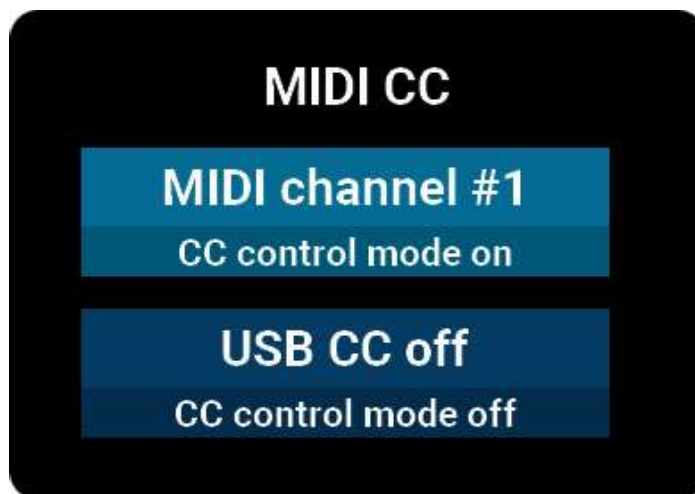


Furthermore, you can turn the Clip LED display on or off on the main screen. When enabled, a flashing LED for an analog input or output signals clipping. The LED's can be cleared by briefly pressing the POWER button.



To simplify routing of a group of outputs, you can also choose multiple channels at the same time. To do this, press the MENU button until the routing menu appears. Here you have the choice to select 1, 2, 4, or 8 channels.

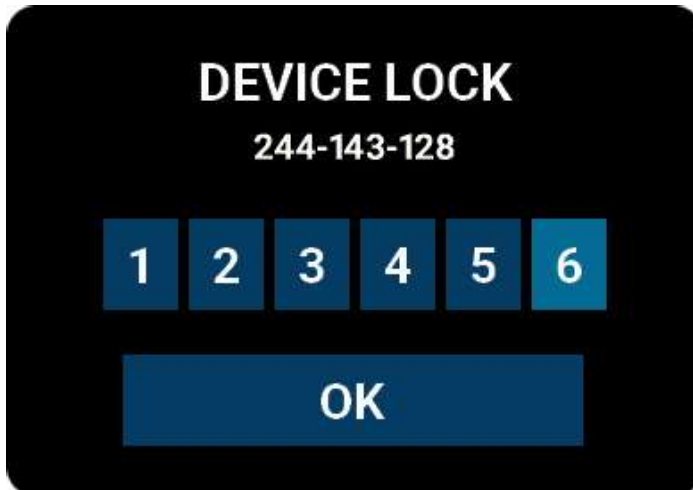
► MIDI CC



Here you can choose whether the device can be controlled via Control Messages. Select the desired channel, or "off" to deactivate. You can set this independently for the physical MIDI port (3.5mm jack on the back), or the USB connector. The table of CC commands can be found on our website. In addition to MIDI CC commands, the device can also be controlled remotely via the RemoteFish software.



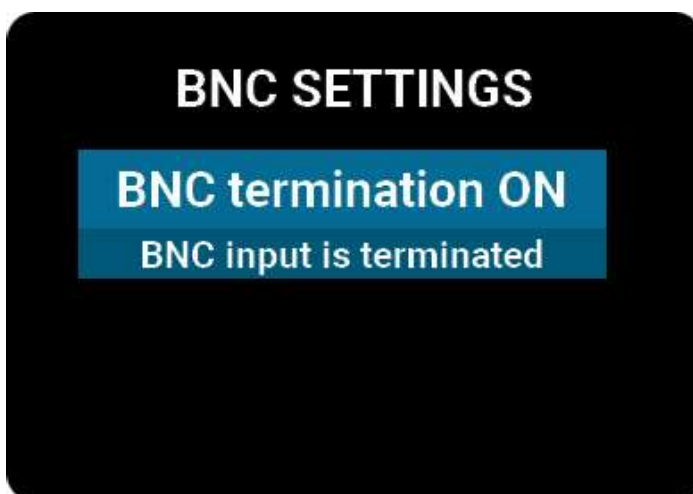
► **DEVICE LOCK**



This function allows locking of the unit. When lock is active, only the headphone menu is accessible. Locking can only be done using the code provided on the sticker on the bottom of the device. The same code is also used for unlocking.

To enter the number, move the rotary knob to the desired number and jump to the next position by pressing the MENU button.
Note that the code is not changeable. Please keep it well, as locking or releasing without a code is impossible.

► **BNC SETTINGS**



The BNC word clock input is internally terminated with a 75 Ohm resistor. Termination should normally be turned on. For example, if you connect an output of another device with a BNC cable directly to that input.

A rather unusual cabling is that the BNC cable is extended via so-called T-pieces in order to be able to connect several devices to a BNC output. In this case, only the last device in this chain is terminated.



► **MISC. CONFIGURATION**

MISC. CONFIGURATION

Factory reset

reset all settings to default

Vegas mode (OFF)

switch Vegas mode ON

Here you can reset the device to factory settings or start Vegas mode.

Factory reset resets the device to its factory settings.

Please note that all settings in the device including all presets will be overwritten with default settings!

Vegas mode displays a wave-like movement of the level meters in the main display for demonstration purposes.

► **INFO**

PULSE16 AE

Serial Number
244-143-128

Firmware Version
1.00

Hardware ID
A1



This view provides information about the device.

Remote control

The PULSE16 AE can be operated remotely via the RemoteFish software. The connection can be made either via USB (MIDI-over-USB) or the MIDI I/O ports of the device (via a separate MIDI interface). In principle, the functions that can be controlled via the front panel can also be controlled via the RemoteFish software.

► *Remote control via MIDI Control Messages*

The MIDI Implementation Chart can be found in the download area of our website.

Technical data

FERROFISH PULSE16 AE 16x16 Channel A/D-D/A Converter & Router

ADAT I/O	optical Toslink interfaces (4 x in, 4 x out) - 32x32 channels with 32 kHz, 44.1 kHz, 48 kHz - 16x16 channels with 64 kHz, 88.2 kHz, 96 kHz - 8x8 with 128 kHz, 176.4 kHz, 192 kHz Latency: 3 Samples
Wordclock	BNC sockets for IN and OUT, 75 Ohm termination of input switchable
MIDI I/O	3.5mm jacks for MIDI-IN and MIDI-OUT, adapter to MIDI-5Pin optionally available. Pin assignment follows the MIDI 2.0 Type A standard
D/AConverters	ES9017: 32Bit/192kHz ESS D/A Converter
Outputs (analog)	16 x jack 6.3mm, balanced TSR Maximum output level +20 dBu Digital gain 0 dB to -28 dB in 1dB steps SNR 120dB (typ.) THD+N -115dB (1kHz, 48kHz SR, a-weighted, typ.)
A/DConverters	ES9840Q: 32Bit/192kHz ESS A/D Converter
Inputs (analog)	16 x jack 6.3mm, balanced TSR Maximum input level +20 dBu Digital gain: 0 dB to +28 dB in 1dB steps SNR 112dB (typ.) THD+N -108dB (1kHz, 48kHz SR, a-weighted, typ.)
Display	TFT Screen (3", IPS technology)
USB	USB-C connector for MIDI-over-USB (class compliant).
Headphones	6.3mm jack output, gain power adjustable in four stages, digital Volume adjustment in 1dB steps. Dedicated path via separate ESS DAC

DSP	Expandable via optional DSP stick.
PLL	Digitally controlled PLL with active jitter reduction
Interne Wordclock	125MHz oscillator with high accuracy Initial accuracy: +/- 1.5 ppm Gradient during temperature range: +/- 2.5 ppm Ageing: +/- 1 ppm
Voltage supply	12 V at maximum 1A female for 2.54 mm hollow plug with union screw.
Fuse	Polyfuse, internal, self-resetting.
Power supply	12V, 3A, (or 12V, 1A) pin positive, included.
Power consumption	12 VA nominal, standby below 1 VA.
Temperature range	+5° to +45° Celsius
Humidity	<75%, non-condensing.
Weight	1.8kg
Dimensions	13,5 cm x 44cm x 4,4 cm (1 HE)(T x W x H)(without buttons and sockets)

CE Conformity

► EMV

This unit has been tested by a qualified test laboratory and complies with the standards for the harmonization of the laws of the member states relating to electromagnetic compatibility (EMC Directive 2014/30/EU) as well as DIN EN 55103-1 (EMC interference emission) and DIN EN 55103-2 (EMC interference immunity).

► RoHs II

Each appliance has been soldered lead-free and complies with the requirements of the EU Directive 2011/65/EU and the limit values defined therein for hazardous substances in electrical and electronic equipment. The documents on which this declaration is based are held by the manufacturer and can be viewed there at any time. Unauthorized modification of this product invalidates the validity of this CE declaration!

FCC Declaration

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

- (1) The unit may not cause any interference, and
- (2) The unit may be immune to any interference received, including interference that may cause undesired operation.

► Please note

This equipment complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC radio interference regulations.

The purpose of these limits is to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy. If it is not connected and used in accordance with the instructions provided herein, the device may cause significant interference to radio transmissions. However, there is a possibility of interference with certain equipment even if the instructions are followed. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Increase the distance between the unit and the receiver.
- Connect the unit to a mains source on a circuit other than the one to which the receiver is connected.
- Contact your dealer or an experienced radio and TV technician for help.

Use of an insulated cable is required to comply with the Class B limits in Subpart B of Part 15 of the FCC Rules.

Do not make any changes or modifications to the unit unless suggested in the operating instructions.

General Informations

► Old equipment disposal

According to the European WEEE Directive 2012/19/EU, electrical and electronic equipment may not be disposed of with household waste.

The consumer is legally obliged to dispose of these devices at the end of their life in the public waste collection system, collection points or to the point of sale free of charge. Details are regulated by the respective national law. The trashcan symbol on the product, the packaging or in the user manual indicates this provision. If it is not possible to return the product for recycling, it can be sent back to the manufacturer with sufficient postage:

FERROFISH GmbH, Brüderstrasse 10, 53545 Linz am Rhein, Germany.

► Maintenance

There are no serviceable components inside this unit.

Clean the unit with a slightly moistened microfiber cloth.

The screen can be cleaned with a microfiber cloth used for glasses. In case of heavy soiling, you can use an optician's eyeglass cleaning solution. However, avoid using damp spectacle cleaning cloths, as their chemical components can damage the coating of the lens.

► Service

Repairs and modifications may only be carried out by a service workshop authorized by FERROFISH or by the manufacturer itself.

A list of certified service partners is available on request at: info@ferrofish.com. The service conditions of FERROFISH GmbH apply.

► Limited Warranty

Each FERROFISH device is individually tested by us and undergoes a complete function check. FERROFISH grants a limited manufacturer's warranty of two years.

The proof of purchase / receipt serves as proof of warranty. Please contact your dealer in the event of a defect, when the defect appears within the warranty period. Damage caused by improper installation or improper handling is not covered by the warranty and is subject to a charge if repaired. Claims for damages of any kind, in particular consequential damages, are excluded. Liability beyond the value of the goods of the device is also excluded. The general terms and conditions of FERROFISH GmbH apply.

► State of the art

The product and this documentation are always adapted to the current state of the art. Changes in circuitry and design are therefore to be reserved without prior notice. The technical data as well as the appearance may therefore deviate if necessary.

► Disclaimer

This documentation describes the current state of product development. FERROFISH GmbH does not assume any guarantees, neither explicit nor implicit, for the correctness of the contents of this documentation. In no event shall FERROFISH GmbH be liable for any form of data loss or data errors in connection with the use of the product or this documentation. In particular, FERROFISH GmbH excludes any liability for consequential damages resulting from the use of the product or the use of this documentation.

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► Copyright

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► Scope of delivery

1 x PULSE16 AE
1 x Power Supply
1 x Power cord (country specific)
1 x Manual



FERROFISH
advanced audio applications

