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GAMBIT
DAC1-MK3
OPERATING MANUAL



Software Version: OS: 3.5
DSP: 2.5

Version July 2013

INTRODUCTION

Congratulations on purchasing the Weiss Gambit Series DAC1-MK3 D/A Converter !

The DAC1-MK3 is a stereo 24 bit / 192khz D/A converter designed with the aim of keeping an absolutely uncompromised audio signal path. Much detail and thought was spent on the digital input as well as the analogue output stage. Both have in common the purest possible approach in audio design, aspiring for nothing less than excellence. This is coupled with an ergonomic design that gives the user immediate access to all necessary functions, while keeping an uncluttered and thus easy-to-use front panel. This combination makes a truly professional D/A converter catering for the highest expectations.

Features

* Inputs:

There are three digital inputs on XLR connectors, and one on Toslink (optical). The accepted sampling frequencies are 44.1, 48, 88.2, 96, 176.4 and 192kHz. For all sampling frequencies signals on a single connector are supported. For 88.2, 96, 176.4 or 196kHz signals also two connectors (dual wire scheme) can be used. Each XLR input is actively routed to a corresponding XLR digital output, allowing monitoring at multiple stages in a digital studio setup.

* Synchronization:

Several signal reclocking schemes are combined for extremely high jitter attenuation, making the DAC1-MK3 virtually immune to jitter frequencies in the range from fractions of a Hertz up to tens of kHz.

* Converters:

The correlation technique (using four converters per channel) which was already successfully employed in the ADC1 A/D Converter gives the DAC1-MK3 an edge over other D/A converters with equal wordlength and sampling rate specifications, resulting in improved SNR and THD.

* Outputs:

The discrete Class A outputs have a very low output impedance, but can still drive complex loads without stability problems. Output levels can be set between -4dBu and +27dBu. The outputs are symmetrical, but do not have any sound degrading servo mechanisms built in. For asymmetrical operation only pin 2 of the XLR connector plus ground on pin 1 are used, pin 3 must be left open.
The analog circuitry of the DAC1-MK3 uses eight of our OP1-BP discrete operational amplifier modules for unprecedented performance.

* Remote Control:

By hooking up an analog potentiometer or fader to the remote connector, the output level can be remote controlled. A stereo potentiometer or fader allows to control the two channels independently. This level control happens in the digital domain and is dithered in order to avoid any sound degrading quantization effects. The input source selection can also be remote controlled. Four input selection pushbuttons and associated status LEDs are brought to the remote connector.

* Firewire option:

The Firewire option adds a Firewire input for sampling rates of up to 192kHz. The volume and polartity of the firewire input can be controlled via an (optional) IR remote control unit. In addition the player software on the connected computer can be checked for bit transparent playback.

Frontpanel Elements

* Four switches for input selection

* Four LEDs for sampling frequency display (44.1 / 48 / x2 / x4)

* Three LEDs for input wordlength display (1..16, 17..20, 21..24 bits)

* One "zero input" LED

Backpanel Elements

* Three digital inputs on XLR

* One digital input on Toslink

* Three digital outputs on XLR, buffered from XLR inputs

* One switch for monitor source selection on DO3

* Two analog outputs on XLR

* Output level rotary switch (encoder)

* Remote connector with the following signals:

  - Power supply to external faders

  - Tapers from two external faders

  - Four input selection switches

  - Four LEDs for input selection switches

* Optional: Firewire connector in place of input # 3



Discrete Weiss OP1-BP operational amplifier as used in the analog section of the DAC1-MK3:



OPERATION

Input Source Selection

The input source pushbuttons correspond to the three XLR and the single Toslink input connectors.

If a valid AES/EBU or S/PDIF formatted signal is present at the selected input, its sampling rate and wordlength are indicated via the status LEDs.

The wordlength LEDs are blank if the input signal is muted.

If the sampling rate is valid, the analog outputs are activated. Blank sampling rate LEDs indicate that the format or sampling rate at the input are not valid. In that case the analog outputs are muted.

For dual wire scheme signals (88.2 up to 192 kHz) the two channels are connected as follows: Left channel to input 1, Right channel to input 2. To activate, press the input 1 key. If such a signal is present at the input of the DAC1-MK3, the software automatically detects that and switches the D/A accordingly. Also both input 1 and input 2 keys are lit. If you press the input 2 key with such a two wire signal present at inputs 1 and 2, the DAC1-MK3 interprets the signal at input 2 as a normal two channel AES/EBU signal. I.e. do not select input 2 when feeding a two wire signal.

For the three XLR inputs a corresponding XLR output is available. These outputs are buffered clones of the input signals. The purpose is to loop in the DAC1-MK3 at various points in the signal chain for monitoring.

For the third output (DO3) the source can be selected to be either Input 3 (DI3) or the currently selected input. This allows to use the DAC1-MK3 as a monitor switch.

Synchronization

The DAC1-MK3 is always slaved to the selected input. Because the jitter reduction circuitry in the DAC1-MK3 is of the highest possible quality, sepaarate external or internal synchronization is not necessary.

The states of all buttons are stored in non-volatile memory, i.e. the setup is retained when powering the unit off.

Output Level and Output Connection

The output level is set via the rotary encoder on the backpanel between -4dBu and +27dBu in 1 dB steps. These output level figures are reached for a 0dBFS signal at the input of the DAC1-MK3.

Note that the output amplifiers of the DAC1-MK3 are powerful class A type discrete circuits. This means that the power dissipation is quite high, so it is absolutely normal for the DAC1-MK3 unit to heat up.

Important: For unbalanced operation of the DAC1-MK3 connect pin 1 (ground) and pin 2 (hot) of the output connectors to your amplifier. Pin 3 must be left open!

Remote Control

There are two types of remote controls avauilable for the DAC1-MK3. One is via a wired remote control, connected to the D-SUB connector at the back of the unit (controls input source and volume). The other is an optional IR remote control for the volume.

The wired remote control

A self-made remote control can be hooked up to the remote control connector. Following is the description of how such a circuitry should look like. The pin numbers refer to the 15 pin remote connector pin numbers.

The remote level control changes the level in the digital domain, i.e. it is independent of the other level control facilities of the DAC1-MK3. Because of the 24 bit digital resolution of the DAC1-MK3, controlling the level in the digital domain is not critical for the sonic quality or the signal to noise ratio. This level remote can be used as a monitor room level control.

The input source switches and lamps work in parallel to the frontpanel controls of the DAC1-MK3.

Level control:

Connect one or two faders or potentiometers with a linear characteristic and an impedance between 1kOhm and 10kOhm as follows:

ground to pin 7

taper CH1 to pin 14

taper CH2 to pin 15

hot end to pin 8

If a single fader or potentiometer is used then connect its taper to both pin 14 and 15.

Input source selection:

Connect four momentary switches as follows:

one side of all switches to pins 1,2 (ground) the other sides for:

Input 1 to pin 10

Input 2 to pin 3

Input 3 to pin 11

Input 4 to pin 4

The maximum voltage across the switch is 5V, the maximum current is 5mA.

Input source indication lamps:

Connect either an ordinary light bulb or an LED. Depending on the required voltage a series resistor might be necessary. The DAC1-MK3 internal circuit consists of a switching transistor which connects the lamp output to +5V via a 10 Ohm resistor. The other side of the lamp goes to ground.

E.g. you might use a 6V lamp rated at 100mA without any additional resistor. If in doubt then just try, you can't break anything.

For LEDs an additional 100 Ohm series resistor is recommended.

Connect as follows:

Anode Input 1 to pin 5

Anode Input 2 to pin 12

Anode Input 3 to pin 6

Anode Input 4 to pin 13

All cathodes to pins 1,2 (ground)

The IR Remote Control

The optional IR Remote Control allows to control the volume of the output of the DAC1-MK3, via the DAC chip volume control feature. The volume up / down switches control the volume accordingly. The maximum gain is 0 dB (a gain factor of 1.0), i.e. the DAC1-MK3 can not amplify the signal and thus makes sure that there are no "overs" occuring within the DAC1-MK3. The "mute" switch allows to toggle between fully off (muted) and the volume set with the volume control.

The volume setting is retained when switching the DAC1-MK3 off / on.

With the Remote Control unit the gain can be controlled between 0dB and –60dB in 1 dB steps.

TECHNICAL DATA

Three AES/EBU Inputs

Input fs range:	44.1kHz +- 80ppm
	48.0kHz +- 80ppm
	88.2kHz +- 80ppm
	96.0kHz +- 80ppm
	176.4kHz +- 80ppm
	192.0kHz +- 80ppm
Maximum Input Wordlength:	24 Bits
Channel Status Data:	Input accepts professional or consumer format.
Connector:	XLR female
Impedance:	110 Ohm
De-Emphasis:	not supported

Three AES/EBU Outputs

Clones of the corresponding input, actively buffered. DO3 can be switched between DI3 and selected input.

Connector:	XLR male

One Toslink Optical Input

Connector:	Standard plastic fiber Toslink type

Two Analog Outputs

Symmetrical, not earth free, no servo circuit, short circuit proof, DC coupled, class A.

Output impedance:	< 100 Ohm
Output level:	variable from -4dBu to +27dBu in 1 dB steps
Connector:	XLR male, pin1 ground, pin 2 hot, pin 3 return

For asymmetrical use connect pin 1 to ground, use pin 2 as hot and leave pin 3 unconnected!
Do not connect pin 2 or pin 3 to ground!

Remote Connector

15 pin DSUB connector pinout:

1 ground
2 ground
3 key # 2 (switch to ground, selects input # 2)
4 key # 4 (switch to ground, selects input # 4)
5 LED # 1 (anode of LED for key # 1, cathode at ground)
6 LED # 3 (anode of LED for key # 3, cathode at ground)
7 ground
8 +5V supply for external fader (connect fader between +5V and ground)
9 n.c.
10 key # 1 (switch to ground, selects input # 1)
11 key # 3 (switch to ground, selects input # 3)
12 LED # 2 (anode of LED for key # 2, cathode at ground)
13 LED # 4 (anode of LED for key # 4, cathode at ground)
14 fader channel 1 taper
15 fader channel 2 taper

Power

Mains Voltage:	110 / 220 Volts with voltage selector
Fuse rating:	At 220V mains: 500 mA slow blow At 110V mains: 1 A slow blow
Power Consumption:	80VA max.

Measurements

Measurements taken at the following conditions (unless otherwise noticed):
+27dBu output level, 0dBFS input level, 44.1kHz sampling frequency (fs), 22kHz measurement bandwidth

Frequency Response:	@ fs = 44.1kHz: DC ... > 20kHz +- 0.25dB @ fs = 48.0kHz: DC ... > 20kHz +- 0.25dB @ fs = 88.2kHz: DC ... > 30kHz +- 0.75dB @ fs = 96.0kHz: DC ... > 30kHz +- 0.75dB @ fs = 176.4kHz: DC ... > 40kHz +- 0.75dB @ fs = 192.0kHz: DC ... > 40kHz +- 0.75dB
THD+N @ 1kHz:	-112 dB @ -3 dBFs input (0dBFS corresponds to +27dBu) -115 dB @ 0 dBFs input (0dBFS corresponds to +27dBu)
SNR @ -40dBFS input:	> 129dB unweighted (relative to full scale output) > 132dB A - weighted (relative to full scale output)
Linearity:	from 0 to -100dBFS input level: < +-0.05dB deviation from ideal from -100 to -120dBFS input level: < +-0.2dB deviation from ideal
Crosstalk:	< -110dB, 0..20kHz
Output Level Range:	-4dBu to +27dBu in 1 dB steps
Output impedance:	< 100 Ohm, outputs are short circuit proof

Addendum for the Firewire input option

The Firewire version of the DAC1-MK3 adds a Firewire input for direct audio file playback from a computer at sampling rates of up to 192kHz. Additional features of the Firewire version are:

- Firewire socket in place of one of the XLR sockets
- IR remote sensor socket in place of a XLR socket
- IR remote for volume and polarity (active for Firewire input only)
- Bit transparency check

There are two versions of the Firewire option depending on the hardware version of the DAC1-MK3. The "single wire" version uses input # 3 as the firewire input, the "dual wire" version uses inputs # 1 and # 2 for a dual wire input. Where there are differences in the operation the two versions are mentioned separately. The versions can be distinguished by the looks of the backpanel, i.e. the firewire socket is either at the input # 3 position or at the input # 1 position.

Synchronization

When the firewire input is selected, the synchronization master always is the DAC1-MK3 unit, i.e. the computer is slaved to the DAC1-MK3. The sampling rate is set via the Weiss Firewire IO window. On a Mac system the sampling rate set in AudioMidi sets the one in the Weiss Firewire IO window and vice versa. With the proper (advanced) player software the sampling rate of the DAC1-MK3 is switched automatically depending on the track played. For more information on this topic see the paragraph on bit transparency checking. The DAC1-MK3's firewire interface intrinsic jitter is very low.

Software features

The software in the DAC1-MK3 firewire interface allows for level control and for signal polarity reversal. These features are only accessible via the IR remote control unit.

The level control is properly dithered, i.e. there are no artefacts due to the level control. A paper on the topic of digital level control (including sound examples) can be found here:

http://www.weiss-high-end.ch/computerplayback/Digital_Level_Control.pdf

In addition the software allows for the testing of the bit transparency of the music player program running on the computer. This is useful to find out the proper settings / configuration of the player program to achive bit transparency. Bit transparency means that the bits fed from the harddisk to the INT202 are not changed in any manner.

Firewire Connection

First install the software on your computer as described in a separate paragraph below.

Then connect the computer to the DAC1-MK3 via an appropriate Firewire cable. There are three types of cables applicable:

- 4 pin Firewire 400 (computer side) to 6 pin Firewire 400 (DAC1-MK3 side)
- 6 pin Firewire 400 (computer side) to 6 pin Firewire 400 (DAC1-MK3 side)
- 9 pin Firewire 800 (computer side) to 6 pin Firewire 400 (DAC1-MK3 side)

Chose the proper cable as required by your computer.

Make sure to plug in the Firewire cable in the proper orientation! If the connector is plugged in reversed the DAC1-MK3 firewire interface can be distroyed because of the bus power on the Firewire bus.

The DAC1-MK3 should now be recognized by the computer, i.e. if you start the Weiss Firewire I/O application the DAC1-MK3 shows up as a "INT202" device. INT202 because the hardware used for the DAC1-MK3 Firewire interface is a INT202 board.

You now should be able to play music from the computer through the DAC1-MK3.

For the single wire version select input # 3 to play the firewire input. For the dual wire version (older DAC1 main board versions) you need to select input # 1.

Bit Transparency Check

In order to test the bit transparency of the player software on the computer the enclosed WAV files (see driver CD) have to be ripped to the computer and played from the player program. The DAC1-MK3 then looks for specific bit patterns coming from the firewire source. To check for bit transparency proceed as follows:

Play the appropriate test file, there are a total of 12 files supplied. One set for 16 bit and one set for 24 bit transparency checking. One set includes all supported sampling rates, namely 44.1, 48.0, 88.2, 96.0, 176.4, 192.0 kHz. This allows to make sure the player is bit transparent for all sampling rates. We suggest to check first with the 24 bit files. If those yield a bit transparent result then it is not necessary to check with the 16 bit files.

- For the single wire version: press and hold the input # 3 selection button. If the LED starts to flash, the player software is indeed bit transparent. If the LED stays lit, the player is not bit transparent.
- For the dual wire version: : select input # 1 (independent of the sampling rate you are testing at) and wait until the Medea locks. Then press and hold the input # 1 selection button. If the LED starts to flash, the player software is indeed bit transparent. If the LED stays lit, the player is not bit transparent.

During the test the output of the DAC1-MK3 is muted.

If the player does not seem to be bit transparent then this can have several causes, like:
- a volume control not at 0dB gain
- a equalizer
- a sampling rate conversion
- a "sound enhancer" feature and more

Make sure all those processing elements are bypassed. Particularly the sampling rate conversion can creep in "unnoticed". I.e. the sampling rate in the Weiss Firewire IO window has to match the sampling rate of the file played, else a conversion is going on in the operating system. For iTunes there is another thing to know: Whenever the sampling rate is changed in the AudioMidi setup or the Weiss Firewire IO window, the iTunes program has to be restarted to achieve bit transparency again. For iTunes running on a Mac computer a program like Sonic Studio's "Amarra" is highly recommended. With Amarra it is possible to switch the sampling rate in AudioMidi (i.e. in the DAC1-MK3) automatically depending on the sampling rate of the file played. Amarra works in conjunction with iTunes.
On a Windows based system the use of ASIO or WASAPI is highly recommended. These systems make it simple to achieve bit transparent playback. In addition the sampling rate of the DAC1-MK3 is switched automatically depending on the sampling rate of the file played.

Software installation

Perform the following installation procedure before connecting the DAC1-MK3 to the computer. The necessary files are supplied on the enclosed drivers CD.

Windows:
0. Do not connect the device.
1. Double click "WeissFirewireInstaller.exe"
2. Click "Next"
3. Select the directory where you'd like to install the tools. Usually you can use the default values and click "Next"
4. Select if you'd like to create a desktop icon. "Next"
5. Click "Install"
6. You will be asked if you'd like to continue the installation because the driver/software didn't pass the Windows-Logo-Test. Select "Continue".
7. Select "Yes, restart the computer now" and click "Finish"

Mac:
0. Mount the WeissFirewire.dmg diskimage by double clicking it
1. From the mounted drive double click Weiss-Firewire-3.3.3.3586.pkg (the version numbers can be different of course)
2. Click "Continue"
3. Select the drive (usually you leave it at the defaults)
4. Click "Continue"
5. Click "Upgrade" or "Install"
6. You'll be asked to login as administrator
7. Confirm "Continue Installation" when warned that the computer requires a reboot after install.
8. Click Restart

After installation of the software connect the DAC1-MK3 to the computer. Make sure to plug in the Firewire cable in the proper orientation!

If the connector is plugged in reversed the DAC1-MK3 firewire interface can be distroyed because of the bus power on the Firewire bus.

The DAC1-MK3 should now be recognized automatically. In Windows tell the installation window that you do not want to check the Microsoft website for drivers and then let the drivers be installed automatically. Ignore warnings concerning "Windows Logo Test" and continue the installation until completed. You will be asked to install drivers for "Weiss Engineering Ltd. --Firewire Unit--" and "Weiss Firewire IO MIDI". There will be two passes of installation, which is normal.

Software setup

The connected DAC1-MK3 device can be controlled through the "Weiss Firewire I/O" Control Panel.

Windows:

The control panel can be accessed by clicking on the "Weiss Firewire IO" icon on the desktop.

Device Settings / General: The device settings should be pretty self explanatory.

Device Settings / Firmware Loader: Allows to upload new firmware to the DAC1-MK3. Not used for normal operation.

Global Settings / Bus:
Master: Is the device which is sync master on the virtual bus in case multiple devices ("DAC1-MK3s") are connected.

Sync Source: The clock to which the DAC1-MK3 should sync to. Usually this is the DAC1-MK3's internal clock generator.

Sampling Rate: The sampling rate of the device when internally clocked.

Buffer Size: Larger buffer sizes increase robustness against dropouts, lower buffer sizes provide low latency.

Operation Mode: determines the stability of the system. Try other modes if there are clicks in the music.

Global Settings / WDM: Enables the WDM driver.

Global Settings / DPC: Determines your computers performance and recommends a operation mode.

Global Settings / System: Some utilities to determine the chipset in your computer and to get information on the sup-ported chipset. Required for debugging if prob-lems with the Firewire connection are encoun-tered.

Global Settings / Info: Information about the driver version.

Mac OSX:

Configure the DAC1-MK3 via the "Audio MIDI Setup" (Applications > Utilities) and the "Weiss Firewire Control Panel" (Applications).

Device Settings / General: The device settings should be pretty self explanatory.

Device Settings / Firmware Loader: Allows to upload new firmware to the DAC1-MK3. Not used for normal operation.

Global Settings / Bus:
Master: Is the device which is sync master on the virtual bus in case multiple devices ("DAC1-MK3s") are connected.

Sync Source: The clock to which the DAC1-MK3 should sync to. Usually this is the DAC1-MK3's internal clock generator.

Sampling Rate: The sampling rate of the device when internally clocked.

Operation Mode: determines the stability of the system. Try other modes if there are clicks in the music.

Global Settings / Info: Information about the driver version.