

Bricasti Design

## M12 Dual Mono Source Controller



## User Guide

8/27/18



## Unpacking and Inspection

After unpacking the M12 save all packing materials in the event you ever need to ship the unit. Thoroughly inspect the M12 and packing materials for any signs of damage in shipment. Report any damage to the carrier at once.

## Precautions

The Bricasti Design M12 is a rugged device with extensive electrical protection. However, reasonable precautions applicable to any piece of audio equipment should be observed.

- Always use the correct AC line voltage as set by the manufacturer. Refer to the power requirements section of the manual and adhere to any power indications on the rear or bottom of the chassis. Using the incorrect AC line voltage can cause damage to your M12, so please check this carefully before applying power.
- Do not install the M12 in an unventilated rack or directly above any heat-producing equipment like power amps, tube preamps etc. Maximum ambient operating temperature is 40 C, this would yield an internal temp of 60 C as indicated on the M12 temp display. Exceeding the maximum ambient temperature may cause the M12 to enter thermal shutdown and stop processing sound as a safety precaution, and may cause damage to the internal processors and components.
- To prevent fire or shock hazard, do not expose the M12 to rain or moisture.

## Notices

In the interest of continued product development, Bricasti Design reserves the right to make improvements to this manual and the product it describes at any time and without notice.

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# Conformity

## EMC / EMI

This equipment has been tested and found to comply within the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in residential installations.

## Canadian Customers

This Class B digital apparatus complies with Canadian ICES-003.  
Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada.

### Certificate Of Conformity

Bricasti Design, 2 Shaker Rd, Shirley, USA, hereby declares on its own responsibility the following products:

#### **M12 –Dual Channel Source Controller**

-that is covered by this certificate and marked with the CE-label conforms to the following standards:

- EN 60065 Safety requirements for mains operated electronic and related apparatus for household and general use
- EN 55103-1 Product family standard for audio, video, audiovisual and entertainment lighting control apparatus for professional use. Part 1: Emission
- EN 55103-2 Product family standard for audio, video, audiovisual and entertainment lighting control apparatus for professional use. Part 2: Immunity

With reference to the regulations in the following directives:  
73/23/EEC, 89/336/EEC

January 2016  
Brian S Zolner  
President

## Introduction

This M12 user guide covers theory of design and setup and use. In the future you can always find the latest version available at our web site [www.bricasti.com](http://www.bricasti.com).

Congratulations on the purchase of your new M12 Dual Mono Source Controller. We at Bricasti Design have set out to design the world's best of analog and digital and to offer the finest products made for the professional and consumer audio markets.

## Product Overview

The M12 Source Controller has 2 completely isolated fully differential channels, each with its own dedicated linear power supply, D/A converter, DDS clocking, and analog level control circuitry. This design insures that analog cross talk is virtually non existent, that the necessary power requirements for each channel are well met and isolated from each other and the digital processing is isolated, having its own power supply. With our twin DAC design, the dynamic range for each channel is optimized by using the stereo ADI 1955 D/A converter in a mono configuration for PCM conversion, clocking is for each channel done directly at each DAC with a technique called DDS (direct digital synthesis) which takes clock induced jitter to immeasurable levels, and DSD is converted with our own one bit analog converter.

## Build Quality

The M12 is robustly constructed of milled and CNC machined aluminum sections, no typical bent metal chassis and top cover found on most products. All sections of the construction, the front and rear panels, the sides and even the bottom and top plates start out as solid blocks of aluminum which are precision machined to shape, with exact tolerances for a perfect fit. These parts are then anodized and the text and markings is laser etched for a clean and enduring look.

## The Sound

The intention of the M12 is to provide a state of the art, utilizing the best designs and materials that can be found today. The converter and following analog stages are a very critical part of the digital and analog audio chain, the sound of the M12 is intended to be transparent and revealing, and fully dynamic. This in part is made possible by lowering the jitter to extremely low levels, providing a pure digital signal chain without sample rate converters, superior digital filter design, pure DSD conversion, coupled to a fast transparent analog signal path with a R2R level control, discreet analog output section and plenty of good clean linear power for optimum analog performance.

Many hours of listening were done to tune the M12 to an exacting sound, with all types of music, and with extensive testing done in the studio and in the home. We hope you find the M12 to be pleasing and enjoyable to hear and use in the home, or as a precision tool for high level reference monitoring for the professional.

## Important Safety Instructions:

### Notice!

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow these instructions.
- Do not use this apparatus near water.
- Clean only with dry cloth.
- Do not block ventilation openings; install in accordance with manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers, pre amps) that produce heat.
- Do not defeat the safety purpose of the polarized or grounded type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade and prong are for your safety. If the provided plug does not fit in your outlet, consult an electrician for replacement of the obsolete outlet.
- Protect power cord from being walked on or pinched.
- Use only attachments/accessories specified by the manufacturer.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Service is required when the apparatus has been damaged in any way, such as by being dropped, exposed to rain, liquid being spilled on it, or otherwise does not operate normally.

### Service

- There are no user serviceable parts inside.
- All service must be performed by qualified personnel.

### Warning!

- To reduce the risk of fire or electrical shock do not expose this equipment to dripping or splashing water and ensure that no objects such as vases are placed on the equipment.
- This apparatus must be earthed.
- **This equipment requires the correct AC line voltage as set by the manufacture and is not auto sensing or scaling.**
- Use a three-wire grounding-type line cord like the one supplied with this product.
- Be aware that different operating voltages require the use of different types of line cords and attachment plugs.
- Check the voltage in your area and use the correct type. See table below:

Voltage	Line plug standard
110-125V	UL817 and CSA C22.2 no 42
220-230V	CEE 7 page VII, SR section 107-2-D1/IEC 83 pg C4
240V	BS 1363 of 1984 Specification for 13A fused plugs and switched and unswitched outlet plugs

- This equipment should be installed near the socket outlet and disconnection of the device should be easily accessible.
- To completely disconnect from AC mains, disconnect the power supply cord from the AC receptacle.
- Do not install in a confined space.
- Do not open the unit -risk of electrical shock inside.

### Caution

- You are cautioned that any change or modification not expressly approved in this manual could void your authority to operate this equipment.

## Design Overview

There are 4 basic internal sections to the M12, the digital input and processing section, and the left and right analog and PCM DAC sections, and left and right analog line amp, pure DSD conversion and level control:

### Digital Input Section:

This is the center section of the unit; it provides 6 digital inputs selectable from the front panel. This section has its own linear power supply and is isolated from the analog sections, providing excellent low noise performance and helps to eliminate digital noise from entering the analog chain via the power supplies and ground plane. This section features an Analog Devices Sharc DSP that is used to run the front panel, general DSP operations of the M12, to control and synchronize the DDS clocking on each channel, and to provide a selection of our own over sampled anti-aliasing filters.

### Analog Input and Output Sections:

On the left and right sides of the rear you will find the analog inputs and outputs. The lower sets of connectors are the analog outputs, upper the analog inputs. Both channels are independently powered by their own linear power supply insuring clean double regulated low ripple power and isolation from any digital noise from the digital supply.

There are 2 PCBs in each analog section of the M12, layered on top of the other. The top one provides the analog inputs, pure analog DSD conversion and the R2R ladder resistor level control yielding a pure analog path when using the M12 as an analog line stage, the signal then passes to the output buffer and connectors on the lower board. There are 2 inputs, one balanced and one unbalanced and are selected from the front panel input control.

The lower board contains the PCM dac, clocking and analog output buffers. Each channel's digital section has its own Analog Devices 1955 DAC used for PCM conversion, it is coupled with a dedicated DDS clocking circuit located millimeters away from the DAC, assuring extremely low jitter and minimal trace length for the clock signal and precise clock synchronization of the left and right boards is handled by the Sharc DSP on the main digital processing board.

The next stage after conversion is the current to voltage stage which creates the analog wave form, and this is followed by an analog filter section. This is a fully differential analog design with fast high slew rate analog operational amps. At this hi gain stage is where the R2R resistor ladder for level control is inserted for the analog gain control. This is followed by discreet 2 transistor designed output buffer sections, balanced and unbalanced, each separately buffered and isolated. The balanced output level will reach a maximum of +16.5 dbm and the unbalanced of 8dbm with the front panel controlled analog attenuator set at full scale of +8 dB.

Typical circuit boards in most products are made from FR4 fiber glass. But, the M12s analog boards are made from a ceramic substrate typically used for RF applications. This material has excellent very high frequency impedance characteristics, and was chosen for use in the M12 to yield an open and clear sound and to allow its very high slew rate audio circuit design to perform at optimal levels.

### Trigger Out

On the rear panel the M12 has a stereo connector (Tip/Ring/Sleeve) for the trigger out of M12 used to place and external device like our M28 power amps into standby. Sleeve is connected to chassis ground, Tip/Ring is 5v trigger.

## Front Panel Overview

The front panel has a large, simple, easy to read display, an encoder for adjusting and selecting settings, 6 keys that are labeled for their use, and a power stand-by switch that will set the M12 in to low power mode and mute the analog outputs. There is an IR receiver built in to the left side center of the display for using the M12 remote controller.



## Rear Panel Overview

Looking at the rear you will find on the left and right side the analog in and output sections, each with its own balanced and unbalanced connectors. In the center input section are the 5 digital audio inputs, AES, SPDIF 1 and 2, Toslink, and USB and RJ 45 network connectors. There is a small jack below the circuit breaker and this is for a trigger out to remotely place a power amp into like the M28 into standby. The main power on/off switch are at the rear, note that the front panel standby button is used to set the M12 low power stand by. Full power on off is done from the rear panel. There are no fuses in the M12 as safety is insured by the use of a rear panel mounted circuit breaker.





# Setup and Operation

## AC power and the M12

The AC power is connected at the rear of the unit; the filtered AC inlet also has the main power on-off switch. This filtered inlet helps provide clean AC power to the M12's power supplies and as well will prevent any digital noise from the M12s digital processing section from going back out the AC inlet to contaminate the mains. Take note that the M12 utilizes linear power supplies so care should be taken to use only the power range indicated on the unit otherwise damage can occur to the power supplies and other circuits in the M12. Please note and adhere to any voltage indications on the outer box, rear panel or chassis all of which will indicate how the M12 is set at manufacture.

The main AC power switch is at the rear and the front panel switch is a low power consumption stand by switch. For complete power on of you must cut power with the rear panel switch or from an external AC power on off switch that may be used to power other devices in your setup.

## Connecting the M12 and power up

When you power up the M12 it will come up in the Level adjustment mode. The default from the factory should be set to a nominal level of -20dB. Connect the M12's analog outputs either balanced or unbalance to the appropriate inputs to your power amp using high quality cables and connectors. Care should be taken with levels before playing any music to avoid too high a level to the power amps and speakers.

## Operating the M12

There are 6 front panel keys from left to right: input, status, level, balance, reference and mute.

- **Input select**

When the M12 first powers on, it will default to LEVEL display on the front panel will be set at the last level set by the user. Pressing the INPUT key will take you to input select mode. Turn the adjust knob and you will scroll through all inputs, the M12 will auto select them with an audible click of the mute relays. Inputs are:

- Digital 1 AES Selects the XLR connector
- Digital 2 SPDIF Selects the RCA connector
- Digital 3 EIAJ Selects the Toslink connector
- Digital 4 USB Selects the USB connector .
- Digital 5 SPDIF2 Selects the BNC connector
- Analog 1 XLR for the balanced analog inputs
- Analog 2 RCA for the unbalanced analog inputs

- **Status**

The status display key has 6 levels in the menu, this menu is for settings that are typically set once and left alone. On first press it will display input type selected and the running sample rate. For PCM this will range from 44.1k to 384K and DSD will simply display DSD for DSD 64fs or DSD 2 for 128fs.

Pressing the status key from any other state will take you to the input and sample rate display page.

Pressing STATUS a second time will display and allow for selection of the PCM playback oversampling filter. There are 2 choices in the M12, a Linear and Minimum Phase type. This filter only affects PCM playback and not DSD. See more about DSD in the later section about DSD.

Pressing STATUS a third time will show an internal temperature monitor, there are no adjustments as this is just a monitor of internal temps.

Pressing STATUS a 4th time will show the current software version installed in the M12.

Pressing a 5th time will bring you to the Phase Invert control. The M12 is absolute phase meaning that it does not invert the phase. With this adjustment you can invert the phase in the digital domain of PCM playback signal; there is no phase inversion of the analog path in the M12.

Pressing STATUS a 6th time allows you to set the display intensity in 3 levels and set it to a sleep or off mode. use the knob to select the brightness of the display, selecting OFF will shut the display off after a 20 sec time out, leaving one LED dimly lit. Pressing any front panel key will wake up the display so you can make adjustments to the M12, and then after a short period of no use, it will go to off mode again.

Pressing STATUS 7th time allows you to set the DSD mode. NDS DSD is for using our pure 1 bit analog conversion and NDS PCM is for using the ADI 1955 converter path.

Pressing a 8th time will allow for setting the sync mode, fine is for a very tight or narrow time window, and wide is for larger time window for re-clocking of the incoming clock.

- **Level**  
The M12 has an analog level control, it will affect both the balanced and unbalanced outputs exactly the same and insures perfect channel balance at all gain settings. Operation is simple: press Level and it will display the level in dB. Normally this will be set to the last level set. Turn the knob and you can seamlessly adjust level in one dB steps. Pressing the Level key a second time will set the output to MUTE, pressing again will un-mute. Upon power up, if the M12 will power back at the last used level setting.
- **Balance**  
The M12 has an analog balance control, it will affect both the balanced and unbalanced outputs exactly the same. Press the balance button and use the adjust knob to change the balance in 1 dB steps. The display will show the amount of attenuation of the left or the right channel to change the relative balance of the channels.
- **Reference**  
This is a user memory for a reference level setting. Press and hold (long press) the reference button and it will memorize the current operating level. A quick press will recall this setting. This is useful for a favorite listening level or as a way to use the analog inputs as a home theater and memorize the analog gain settings for later recall.
- **Mute**  
Pressing this key will mute the analog output with a fast fade out and fade in using the M12 resistor ladder level control. Mute can also be engaged by pressing the level key a second time.

## USB Features

On the rear panel you will find the USB 2 type interface and it is based on the latest generation of asynchronous design and supports sample rates up to 384k/24 bit. For superior noise performance the interface is electrically isolated from the host computer, eliminating any grounding or power induced noise issues that could be transmitted to the M12 from the computer. No driver is needed for Macs or Linux but for PC use a driver is necessary and the latest version for Win 8 support can be acquired from our website in downloads section.

## Network Interface Features

On the rear panel you will find the RJ 45 Ethernet connector. This connector is for using the M12 as a DNLA compatible network player. When The M12 is connected to a network router it will appear as a player in the media player and server that it's connected to as a device to "play to" from the server. This server can be a PC or even an android type UNpN or DNLA network player installed on your pad or phone. The M12 player is also known as a "renderer" or "streamer". To set this up your server application must have network sharing functions enabled and there is no need to down sample and should be set to play native sample rates. The M12's player supports sample rates up to 192k PCM and DSD 64 as DoP.

## **DSD playback and the M12**

DSD playback with the M12 is done via DoP and as such can be read with any input, but most common is the USB. DoP is DSD over PCM and for DSD 64 is the 1 data bit stream embedded in a 176.4k 16 bit PCM data stream with the extra 8 bits out of the 24 bits used for identifying that it is DSD not PCM. This is true DSD and not PCM conversion. When using a computer audio setup, the media player should be set to send out the DSD as DoP, the M12 will see that as 176.4k pcm for DSD 64fs or 352.8k for DSD 128fs, read the data header and see that it is actually DSD and unpack the data in our digital signal processor as the original DSD data, and send it out to the DAC for conversion to analog.

The M12 features 2 digital audio conversion paths, one for PCM which utilizes the ADI 1955 converter, and the other is a true one bit modulator of our own design and unique to the industry. This DSD conversion is done on the M12s analog level boards and is a true 1 bit analog converter followed by an analog post noise filter. The result is a true a pure DSD play back unlike any other converter in the market. It is recommended that this feature be selected in the status menu labeled NDS D. The other choice is DSD PCM and this will set the path to use the ADI 1955 as the multi-bit converter which will impart a different sound character than the native one.

To use it all you need is DFF or DSF files, set the media player to play the files as DoP, and the M12 will play them. When DSD is received for playback the status and filter displays will read DSD, and when it next plays a PCM file it will revert to your last used PCM filter and display will update accordingly. Playback is seamless as any other PCM sample rate change.

When using USB and the LAN the M12 supports both DSD 64, one bit at 64 times 44.1k sample rate, and DSD 128 or double that rate. DSD 64 is the SACD standard and 99% of all content is released and mastered at this rate. There is some content appearing that is DSD 128 or 2x the rate but for the most part you will find DSD 64 as the standard.

When selecting NDS D DSD setting, the DSD post noise filtering is done in the analog domain so there are no DSD filter settings. An artifact of DSD processing is the buildup of ultrasonic noise and with DSD 64; this noise starts at 24 kHz and rises to peak level at -50 dB at 50k and beyond. In the M12 set to NDS D DSD this is done with a simple low pass analog filter for the very best sonic performance.

A great source for DSD downloads is: [www.channelclassics.com](http://www.channelclassics.com)

## **Digital Oversampling Filters for PCM conversion**

There are 2 types of filters that can be chosen for PCM playback, a Minimum Phase and Linear Phase. For example at 44.1k decoding these are 20kHz bandwidth, stop-band at Nyquist frequency with low ripple and high attenuation filters. You will find despite having similar specs, that they both have very unique and different sound characteristics, and you may find one more suitable for different kinds of music than others as well.

The M12 uses delta sigma 8 x oversampling conversion so it is not recommended to “up-sample” the digital audio that is being sent to the M12 within a media player option. Defeat all up-sampling features in your media player or CD transport. Up-sampling the data before the M12 will yield poor results and always use the original source audio bit and sample rates, so for example if the source is 44.1k then have the media player send this data unprocessed to the M12 and let the M12 reconstruct the data correctly.

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## The M12 Remote

The M12 is supplied with a dedicated IR (infrared) remote control. This is a simple remote and allows for most commonly used functions of the M12 to be controlled remotely from your listening position. This is an IR device so it is important that line of sight to the M12 front panel where the IR receiver is mounted is maintained. With any device like this there are distance and parallax limitations. For example if you are far off to one side, too high or low, or too far away then the remote may not work correctly and there will be errors in the light emitted pulses causing missed or wrong data. Be sure to be within reasonable distance, about 25' and within a + or - 45 degree angle from the front panel. Operation has the same paradigm as the front panel control, with all the same labeled functions for both.



## Replacing the remote batteries

The remote comes complete with batteries installed but in the event you need to replace them here simply open the casing of the remote with a 5/64" hex key and remove and replace the batteries noting the polarity marking on the battery holders that the + side of that battery is face up, - side down or in contact with the PCB. Reassemble taking care not to over tighten the 4 small socket cap screws that hold the casing together as they are small and could easily strip out the threads of aluminum housing of the remote casing.



Inside the remote with one partially inserted battery showing correct polarity

## Technical Specifications

### Digital Inputs

Connectors:

XLR: AES/EBU 24 bit Single Wire

BNC: SPDIF

RCA: SPDIF

Optical: Toslink 44.1- 96k

USB: USB 2

Sample Rates AES, SPDIF, AUX in:

44.1 kHz, to, 192kHz, DSD 64fs as DoP

Sample Rates USB:

44.1 kHz, to, 384kHz, DSD 64fs 128Fs as DoP

Sample Rates Ethernet:

44.1 kHz, to, 192kHz, DSD 64fs 128Fs as DoP

Jitter:

8 psec @ 48k / 6psec @ 96k

### Balanced Analog Outputs

Connectors:

XLR balanced (pin 2 hot)

Impedance:

40 ohm

Output:

@ full scale ( +8db front panel )+16.5 dbm (5.2V RMS)

D/A Conversion:

PCM 24 bit delta sigma 8x oversampling, DSD direct 1 bit

Frequency Response @44.1k:

10 hz- 20 kHz +0dB, -.2 dB

Dynamic Range:

>120dB A-Weighted

THD+N @ 1k:

.0008% @ 0dbfs / .0004% @-30dbfs

### Unbalanced Analog Outputs

Connectors:

RCA

Impedance:

40 ohm

Output level:

Full scale ( +8db front panel ) = +10.7 dbm (2.6 V RMS)

D/A Conversion:

PCM 24 bit delta sigma 8x oversampling, DSD direct 1 bit

Frequency Response @ 44.1k:

10 hz- 20 kHz -.2 dB

Dynamic Range:

>120dB A-Weighted

THD+N @ 1k:

.0008% @ 0dbfs / .0004% @-30dbfs

## General Specifications

### EMC

Complies with:

EN 55103-1 and EN 55103-2 FCC part 15, Class B

### RoHS

Complies with:

EU RoHS Directive 2002/95/EC

### Safety

Certified to:

IEC 60065, EN 55103-2

### Environment

Operating Temperature:

32 F to 105 F (0 C to 40 C)

Storage Temperature:

-22 f to 167 F (-30 C to 70 C)

### General

Finish:

Anodized Aluminum

Dimensions:

17" x 12" x 4.5"

Weight:

15 lbs

Shipping Weight:

18 lbs

Shipping Dimensions:

22"x 17"x 7"

Mains Voltage:

100, 120, 220, 240 VAC, 50 Hz – 60 Hz factory set

Trigger out:

TRS connector for 5V external trigger.

Power consumption:

28 Watts (6W standby)

Warranty parts and labor:

2 years non transferable



# Bricasti Design