BSH-DRV-2 Bass Shaker Driver Data Sheet (V1.0)
BFF Design Ltd

Introduction

The BFF BSH-DRV-2 card is a direct driver for bass shakers (vibration transducers). It provides vibration/rumble effects for flight simulation cockpits or other game/audio systems. It can drive conventional bass shakers, or electric motor based vibration transducers with a combined load resistance down to 0.75 Ohms.

It is used with the BFF Shaker software to provide vibrations for flight simulator cockpits, and/or with an audio feed from sound cards or other audio sources to provide vibrations for other simulators, games or audio systems.

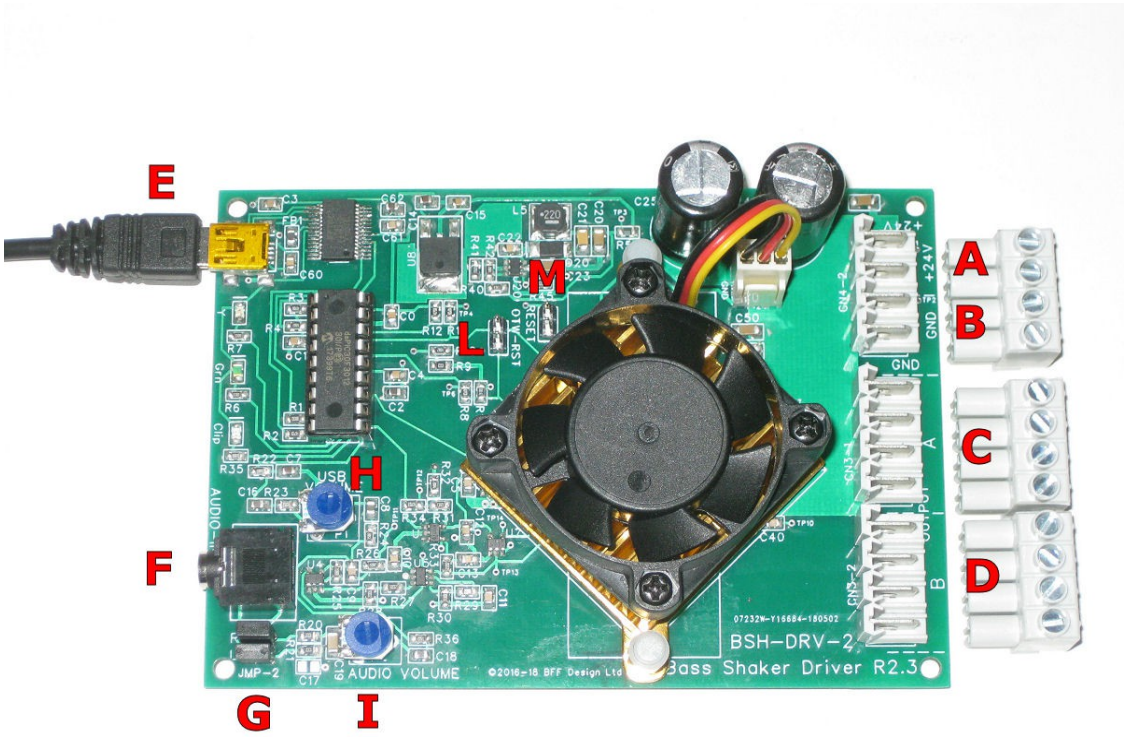
Vibration effects generated by the system when using the BFF Shaker software include engine and runway vibrations, landing gear transition and buffeting effects, flap and spoiler buffeting, engine start/stop shudders etc... For a fuller description of the effects please see the BFF Shaker software web pages.

A separate 12 to 36V regulated DC power supply is required to power the card.

A USB-USB Mini-B connection cable is included with the BSH-DRV-2 for PC connection to the BFF Shaker Software.

Card Connections

Refer to the lettered photo below –



A. 12 to 36V DC Power Input (CN4-2 upper 2 terminals). Do not exceed 36V.

NOTE the card is NOT reverse polarity protected – ENSURE CORRECT SUPPLY POLARITY.

Ensure the power supply has adequate current capacity for the driven transducers. A 10Amp supply should be adequate for most circumstances. If single or dual ButtKicker type bass shakers are being driven then lower current draws may be expected and a smaller PSU can be used, in this case 6 Amps should be adequate. Larger current draws will be seen with electric motor type vibration transducers or multiple/large ButtKicker types connected in parallel – ie with low resistance loads.

NOTE: The on-board under-voltage protection will trigger when the supply voltage drops below about 10V. This will produce a latched error condition.

ENSURE you use power cabling of adequate gauge for the card maximum operating currents.

See Section 6 for some suggested PSU's

B. Power Supply GND (CN4-2 lower 2 terminals).

Suitable grounding of the cards is very important. The main return line to the power supply -V terminal MUST be of suitable gauge and must not offer significant resistance to the return flow of current from the card to the power supply.

C. Bass Shaker wire A (CN3-1)

4 output terminals are provided for connection of multiple transducers. The signal to each is the same.

D. Bass Shaker wire B (CN3-1)

See Section 5 for typical wiring arrangements.

IMPORTANT: Outputs A & B are BTL outputs (bridge-tied load). Do not connect either to ground. The bass shakers should always be connected across outputs A & B only.

Connections A, B, C & D are pluggable screw terminals. They can be fitted horizontally as shown, or vertically - to suit wire layout requirements.

E. USB Mini-B cable connection (USB-IN).

The USB cable provides the connection for the BFF Shaker Software. This provides vibration demand derived from Microsoft FS related and X-Plane flight sims.

The card uses an on-board FTDI FT232 chip for comms using FTDI's Direct DX22 drivers (a virtual COM port is no longer used). When the card is first connected to USB most recent Windows OS's will automatically find and load the required DX22 drivers. Should your PC not do this then the drivers can be obtained from the FTDI web site here -

http://www.ftdichip.com/Drivers/D2XX.htm

F. Stereo Jack Socket for Audio-in connection (AUDIO-IN).

For vibration feed derived from PC audio line-out sources or other audio application sources.

Inputs E and F can be used together or separately. Volume trim pots H and I provide on-board volume balancing as required to balance the mix of the two signals in the vibration output if this cannot be done at source.

G. Right and Left channel selection jumpers.

These can be used to select a single channel from the stereo audio input or to mix both as a mono signal for the vibration feed.

H. USB input volume adjustment potentiometer. Turn CW to increase volume. See Section 4 LED Sequences – RED for more information.

I. Audio-In input volume adjustment potentiometer. Turn CW to increase volume. See Section 4 LED Sequences – RED for more information.

J. Not Used

K. Not Used

L. Over Temperature Warning reset (OTW-RST). Close to reset a latched over-temperature warning fault condition.

   If the main vibration drive chip approaches overheat the card will automatically stop the output and the yellow LED will light (slightly dimmed). The output will be restored when the drive chip cools to below the trigger temperature.

   In extreme cases over temperature may trigger a full over-temperature latched error. This can be reset by power-cycling the card, or by closing this jumper momentarily. This should not be attempted until the drive chip has been able to cool to below its trip temperature.

   Note this will not reset the driver if an error other than OTW has occurred (eg short-circuit protection or other chip fault).

M. Power Reset.

   Momentarily closing this jumper will restart the card without stopping and starting the external power supply.

   This can also be used as a softer power-up method than switching voltage at the main 24V input. Fit a normally open switch across the jumper – closing the switch will power-up the card so long as 24V is available at the A connections.

Specifications

- Input Voltage Range: 12V to 36V DC (do not exceed 36V)

- Non-clipped power output at 4 Ohm load:
  12V supply: 27W peak, 14W rms
  24V supply: 109W peak, 55W rms
  36V supply: 245W peak, 122W rms
  (Power values roughly double for 2 Ohm loads)

- Minimum total load resistance: 0.75 Ohm. (With suitable power supply and adequate cooling).

- Typical max current draw: 6 Amp rms, can be as high as 12 Amp peak with very low resistance loads driven hard

- Software (USB) Input - Frequency Range (3 dB bandwidth): 0.5 to 50 Hz

  (Vibration wave construction at 1000 points per sec)

- Audio Input - Frequency Range (3 dB bandwidth): 2 to 88 Hz

- Audio Input - Sensitivity: 500mV pp (180mV rms). Sensitivity can be controlled using on-board volume pot. (This is a change compared to the BSH-DRV-1 card and allows more of the audio pot range to be used for normal audio feeds.)

LED Sequences

The BSH-DRV-2 card has three on-board LED's; green, yellow and red.

GREEN:

Will go steady ON on card power-up. If only audio input is used it will stay ON when the card is in use.

If USB input is present from the BFF Shaker Software (V1.5 or later) it will flicker (dimmer appearance); it is flickering at the receive rate of the data packets from the BFF Shaker software.

YELLOW:

About 2 seconds after card power-up the yellow LED will start to blink intermittently at a steady frequency (it blinks once for every 500 vibration wave form updates).

The yellow LED also indicates error conditions:

- Steady ON but slightly dim – over-temperature warning, will result in output being switched OFF automatically until the drive chip cools, when the LED will resume normal operation and the output will be restored. If the over-temperature persists this may escalate to a full over-temperature shutdown of the card (see below).

- Flashes ON/OFF at 2 Hz – latched error condition. This can be either over-temperature, under-voltage, short-circuit protection or other fault condition detected by the main vibration driver chip.

  This error condition is latched and held until the card is reset. The vibration output will be stopped. The cause of the error should be investigated and resolved before restarting the card, the BFF Shaker software may be able to provide additional information on the nature of the fault.

RED:

The RED LED indicates clipping of the vibration output and lights when the input signals cause the vibration output to saturate (max-out). Increasing the vibration demand in this case will not increase the vibration output strength.

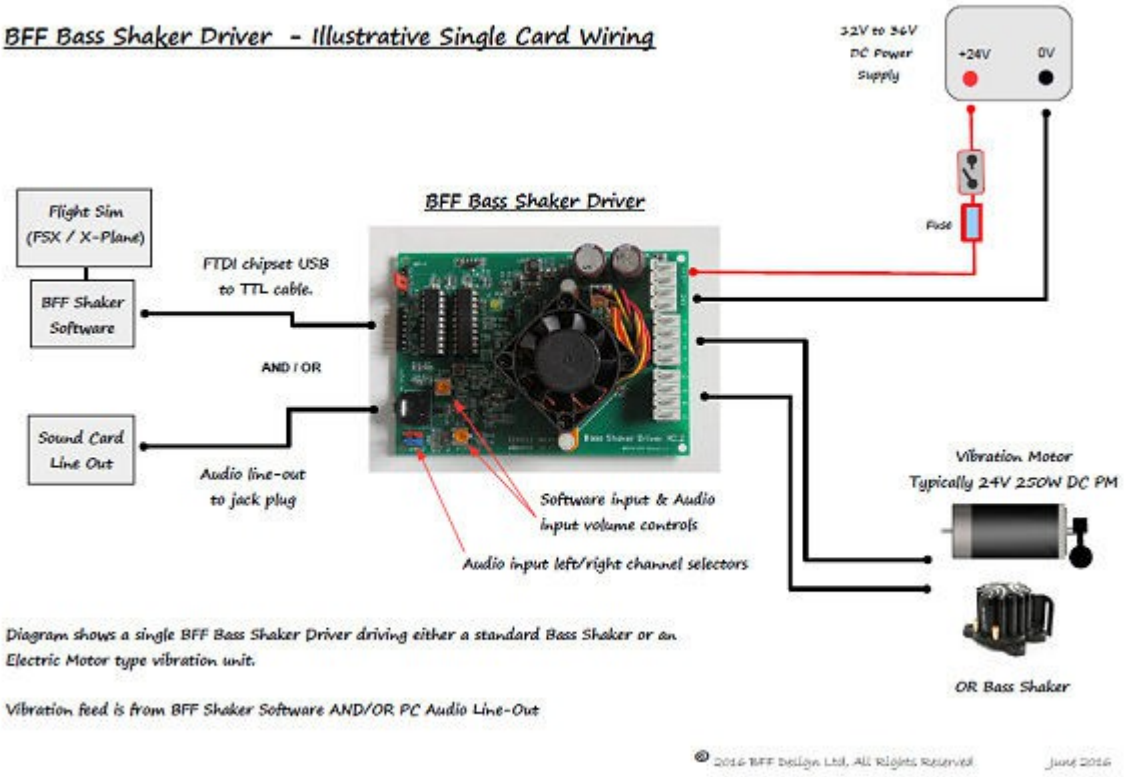
The Red clipping LED can be used to monitor for the maximum useful vibration demand volume from your source. Excessive activity on the clipping LED indicates the vibration demand signal is too strong and should be attenuated. The on-board trim pots can be used to do this, or you can reduce the volume output at your vibration source directly.

If there is excessive clipping activity and you still do not have sufficient vibration output then increased output might be obtained by increasing the voltage input (and therefore current) to the card (up to 36V MAXIMUM).

However it may be the case that the vibration output limits of your bass shaker or transducer have been reached, in which case increasing the card power output by increasing the voltage will not help and may actively damage your transducer(s).

Typical Wiring Arrangements

Typical single shaker drive (older BSH-DRV-1 card shown – connections are the same for the BSH-DRV-2 card other than a different USB cable type):



The card connections are:

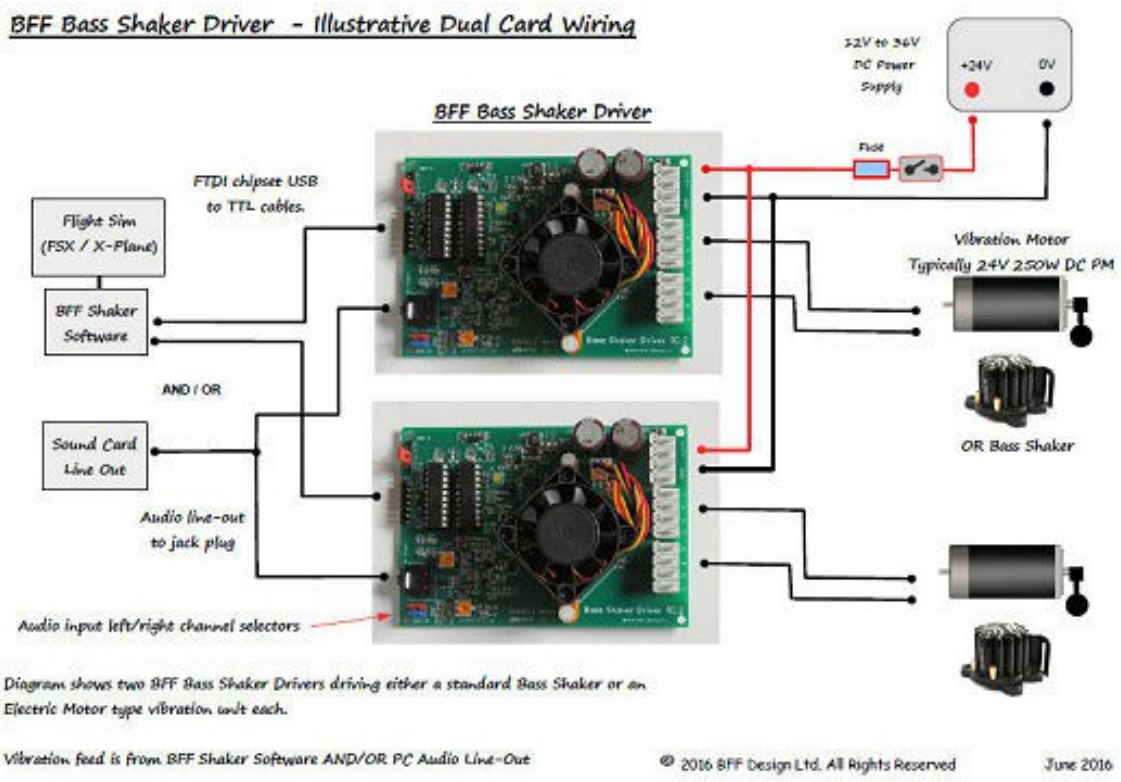
- 12-36V DC power supply wired to connections +V and GND (Section 2 connections A and B)
- Bass Shaker terminal/wire 1 wired to connector Output A (Section 2 connection C)
- Bass Shaker terminal/wire 2 wired to connector Output B (Section 2 connection D)
- BFF Shaker software output via USB/USB-Mini-B cable connected to USB-IN (Section 2 connection E)

  AND/OR

- Audio card Line-out output connected to AUDIO-IN (Section 2 connection F)

Additional bass shakers can be added to the OUTPUT A & B connectors. This connects the shakers in parallel. Note, the card can drive a combined load resistance of 0.75 Ohm minimum (with suitable power supply and adequate cooling).

Typical Dual (or Multiple) shaker drive (BSH-DRV-1 cards shown – connections are the same for the BSH-DRV-2 cards other than a different USB cable type):



Two cards can be driven together to provide some stereo vibration effect. The Left and Right channel selection from the AUDIO-IN signal can be made using the JMP-2 L & R jumpers. An audio splitter cable can be used (stereo jack male/female to dual stereo jack male as required).

Note right and left hand vibration effects will only be present in the output if they are present in the vibration feed.

The BFF Shaker Software (V1.2 or later) can support dual-instance operation (NB V1.5 or later is required for the BSH-DRV-2 card). This means two copies of the software can be run at the same time. This provides dual COM port outputs to dual USB/TTL cables and allows two BSH-DRV-1/2 cards to be run from the same flight sim source but with different vibration settings.

The cards can share the same power supply (given sufficient current capacity).

Power Supplies

The range of bass shakers and electric motor vibration transducers that the card can drive is wide, and so the power supply requirements can vary considerably. If you are only driving single small/medium sized bass shakers then fitting a full size PSU may be unnecessary, driving low resistance electric motor type shakers may need more current, whereas driving larger higher resistance shakers may need more voltage to generate the output power required.. The following are suggestions for PSU's..

Meanwell NES-150-24:

This is a 24V 6.5Amp PSU suitable for driving single or small numbers of the smaller to medium sized Buttkicker units or similar sized bass shakers.

Meanwell NES-200-24:

A 24V 8.8Amp supply which will give a bit more current capacity for driving single lower resistance electric motor based vibration transducers.

Meanwell NES-200-36:

This is a 36V 5.9Amp supply. The higher 36V voltage will allow bigger power outputs to be generated for larger 4 Ohm (or higher resistance) transducers.

Meanwell NES-350-36:

This is a 36V 9.7Amp supply which should be able to cover most of the power requirements for the BSH-DRV-1 card in a range of set-ups. Overkill for smaller systems though.

Data sheets for the NES 150, 200 and 350 series PSU's are here –

http://www.meanwell.co.uk/media/import/NES-150-spec.pdf

http://www.meanwell.co.uk/media/productPDF/NES-200-spec_5.pdf

http://www.meanwell.co.uk/media/productPDF/NES-350-spec_7.pdf

Alternatives are the similar models from the HRP and HRPG ranges from Meanwell -

https://www.meanwell.co.uk/media/productPDF/HRP-150-SPEC.PDF

https://www.meanwell.co.uk/media/productPDF/HRPG-200-SPEC.PDF

https://www.meanwell.co.uk/media/productPDF/HRP-300-SPEC.PDF