



THE SWITCHINGLOW PROJECT REVISITED POWER BRIDGE & POWER EXPANSION

The **SWITCHINGLOW PROJECT REVISITED POWER BRIDGE** -SPR PB- is an half-H bridge circuit that uses triodes as power switching devices for the development and evaluation of class-D power audio amplifiers based on the AmpDiVa technology.

The triodes are switched by the means of a proprietary Floating Grid Driver -FGD- circuit, a fast voltage level shifter that applies positive or negative pulses between the grids – cathodes of the tubes following an opto insulated TTL input signal.

Positive pulses drive the tubes in a strong conduction state between anode and cathode, while the negative ones put the tubes in an off state.

If the pulses follow a PWM scheme provided by a PWM audio modulator, and audio signal is obtained at the output node of the half-H bridge.

The power bridge is a power inverter circuit at all, that means if a constant duty cycle PWM is applied at the inputs of the FDGs, a constant voltage is provided at the output.

Having a 0Hz low pass lower limit, the circuit provides high amplitude output signals at very low frequencies, in a way that is not possible for any other linear tubes amplifier with an output transformer.

The circuit employs ECC99 double triode tubes; the main board operates one tube for each bridge arm, the two triodes inside each tube are connected in parallel.

RC snubbers are provided across the tubes and a simple Π EMI filter couples the switching node to the loudspeaker output. Optional inductors can be added on the power rails.

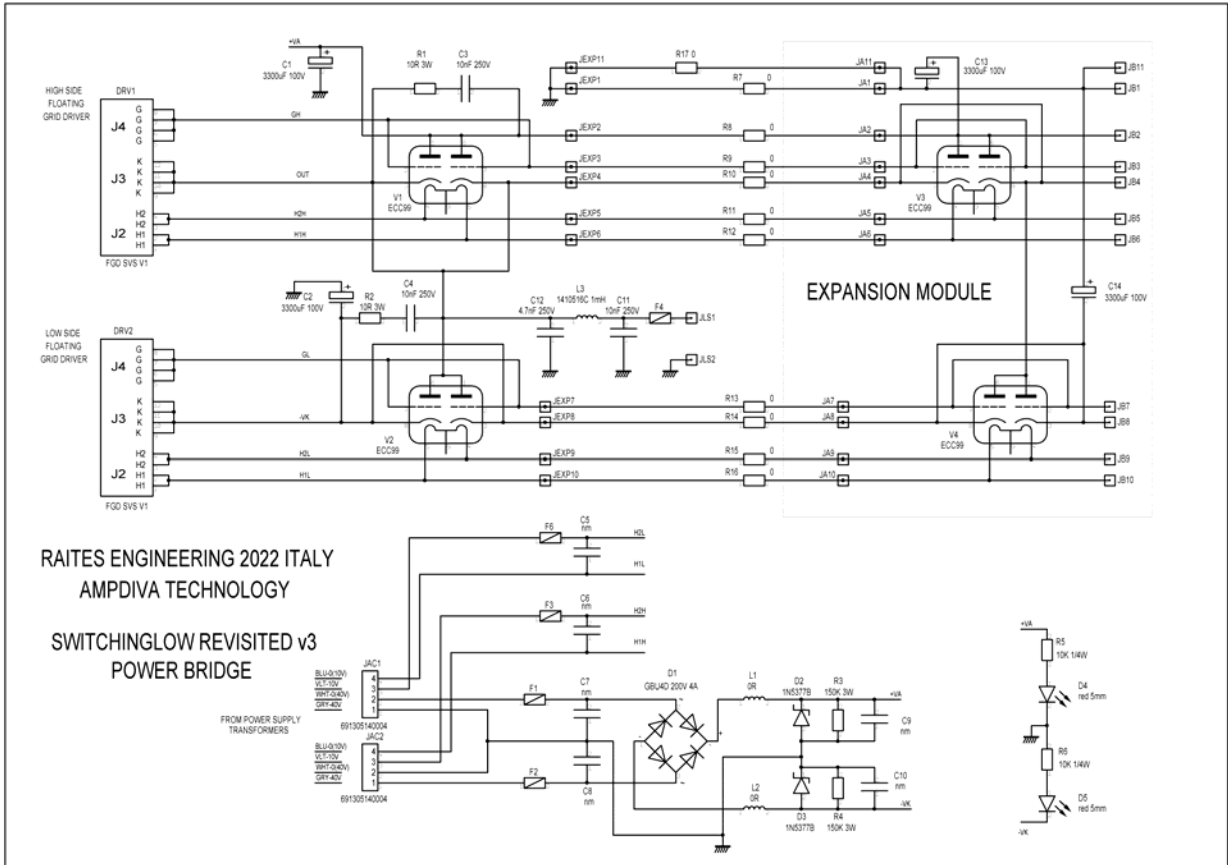
The kit is provided with two 30VA dual secondary transformers with 10Vac for heaters / FDG and 40Vac to provide +/- 57Vdc at the +Vaa and -Vkk power supply rails.

The heaters of the tube are powered with the same power supply of the FDGs; two galvanic separated sources have to be used as the two FDGs have to keep their grounds (cathode output) insulated; maximum heaters voltage must not exceed 12.6Vac to avoid shorten the life of the tubes.

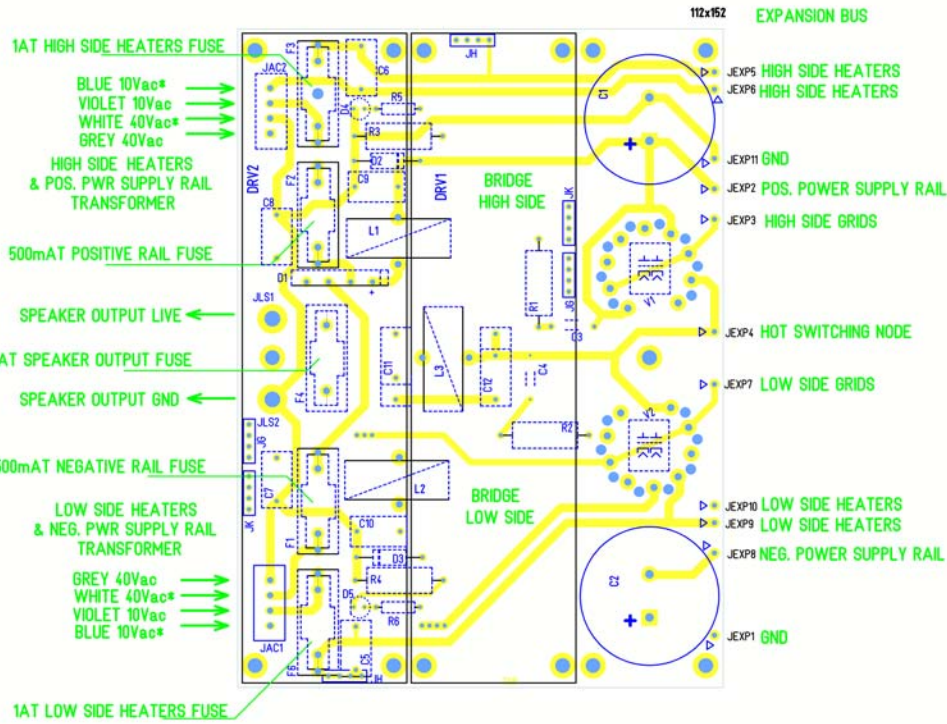
The absolute value of +Vaa and -Vkk have to be less than 90Vdc (max 60Vac at the rectifier bridge input), that is the voltage of the zener diodes used to protect the 100V bulk capacitors of the power supply rails.

Slow blow fuses are placed on the power supply rails and on the heaters / FDG Vac lines and on the loudspeaker output.

SPR PB Circuit Diagram with one SPR PE

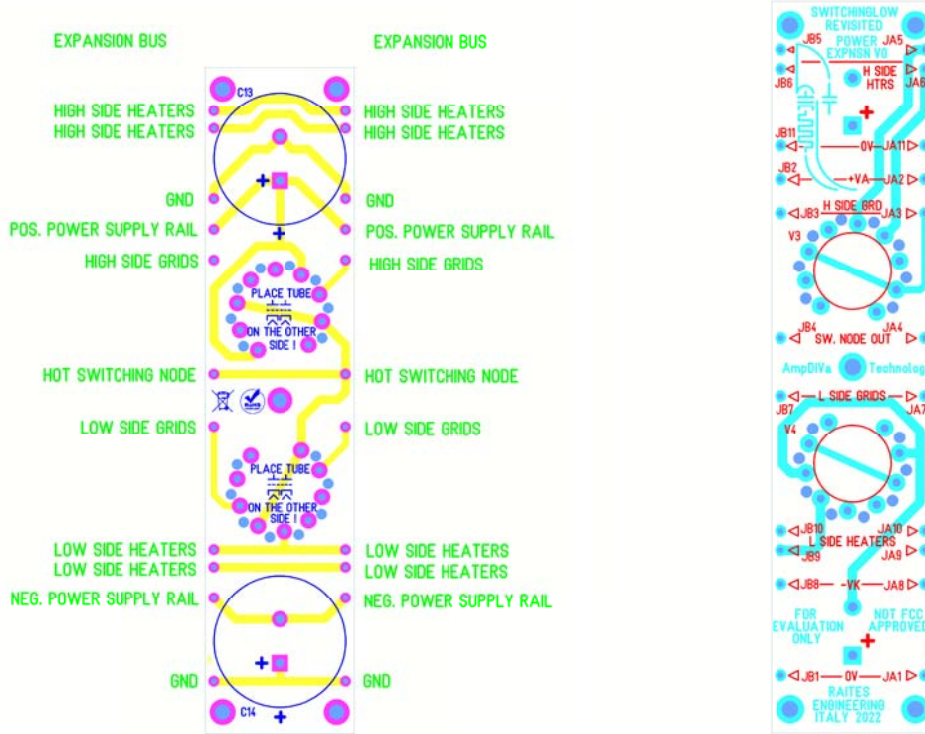


SPR PB assembly and rail connections (bottom view from the FGDs mounting side)



The **SWITCHINGLOW PROJECT REVISITED POWER EXPANSION** -SPR PE- boards can be added to the main board in order to increase the number of tubes connected in parallel for each arm of the bridge; up to four tubes per arm can be used, that means up to three SPR PE boards can be connected to a main board.

SPR PE assembly and connections



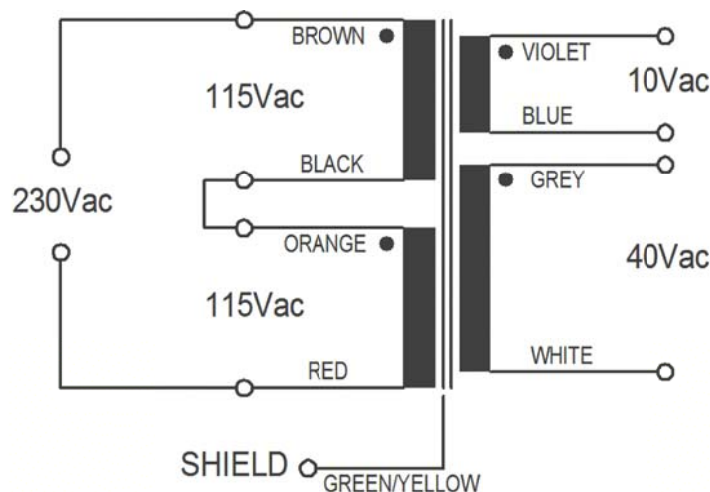
Bottom view – bulk capacitors side

Top view – tube sockets side

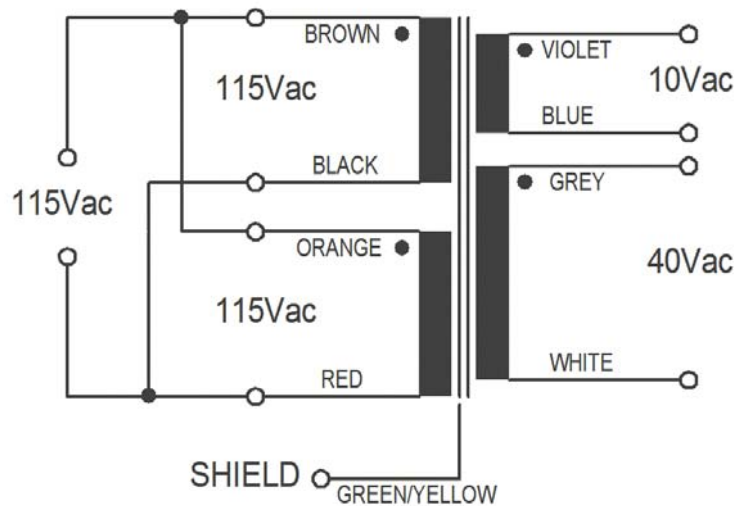
TRANSFORMERS PRIMARY WINDINGS 115Vac / 230Vac WIRING

The SPR can be powered by 115Vac or 230vac mains using the 30VA custom made toroidal transformers provided within the Project.

Please refer to these diagrams to wire the power supply FGD transformer primary coils.



Power Supply Transformer wired for 230Vac operation



Power Supply Transformer wired for 115Vac operation

The SHIELD connection can be tied to the mains earth in order to reduce EMI.

WARNING

The total power supply voltage on the Power Bridge and on the Expansion boards is equal to the difference $+V_A$ minus $-V_K$, that means its twice the absolute value of the positive or negative rail voltage.

With the suggested 40Vac transformers the maximum total power supply voltage is $2\sqrt{2} \times 40 = 113V$.

WARNING

Carefully avoid short circuits !

The energy stored inside the electrolytical capacitors on the power supply rails can damage the pcb melting the copper traces.

WARNING

The Floating Grid Drivers are floating respect the 0V common ground of the bridge.

Their JK pins are the ground for their JG output pins: the JK pins of the high side FGD are connected to the output switching node while the JK pins of the low side FGD are connected to the $-V_K$ power supply rail. Do not connect at the same time the ground clips of the oscilloscope probes to the JK pins of both FGDs or to the 0V common ground.

Use only an oscilloscope with insulated input channels to measure at the same time the waveforms on the JG-JK pins of the FGDs and the output switching node.

For further info please contact raites@studio-rts-ing-rampin.it
or visit www.switchinglow.com

%%%%%%%%

FCC / EMC Statement

The SPR-PB and the SPR-PE electronic boards are intended for evaluation only and does not require FCC Equipment Authorization (FCC Rule 2.803).

The SPR-PB and the SPR-PE electronic boards are designed to allow product developers to evaluate electronic components, circuitry or software associated with these boards to determine whether to incorporate such items in their finished products.

The SPR-PB and the SPR-PE boards are not a finished product and may not be resold, used as they are in or otherwise marketed as a final product unless all required FCC equipment authorizations or other countries EMC compliance certifications are first obtained.

Operation is subject to the condition that this board not cause harmful interference to licensed radio stations and that this board accept harmful interference. Unless the board is designed to operate under part 15, 18 or 95 of this chapter, the operator of the board must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter (Chapter I of Title 47, CFR).

IMPORTANT NOTICE – READ CAREFULLY

Evaluation kits are intended solely for use by qualified technicians and professional electronics experts who are familiar with the dangers and application risks associated with handling and use of electrical components, circuits and systems.

Purchasers and users are solely responsible for the choice and use of Raites Engineering s.r.l.s. products and Raites Engineering s.r.l.s. assumes no liability for application assistance or the design of purchasers' and users' products; in no case the Raites Engineering products can be used in life support equipments or transportation systems.

No licence, express or implied, to any intellectual property right is granted by Raites Engineering s.r.l.s.

The names Switchinglow Project, Switchinglow Project Revisited, SWTGLW USB MOD and the Raites Engineering s.r.l.s. logo are trademarks of Raites Engineering s.r.l.s. All other icons, logos, layouts, trademarks, names of products or services are the property of their respective owners.

Raites Engineering s.r.l.s. reserve the right to make modifications to its products and /or to this document at any time without notice.

© 2022-2023 Raites Engineering s.r.l.s. - All rights reserved

