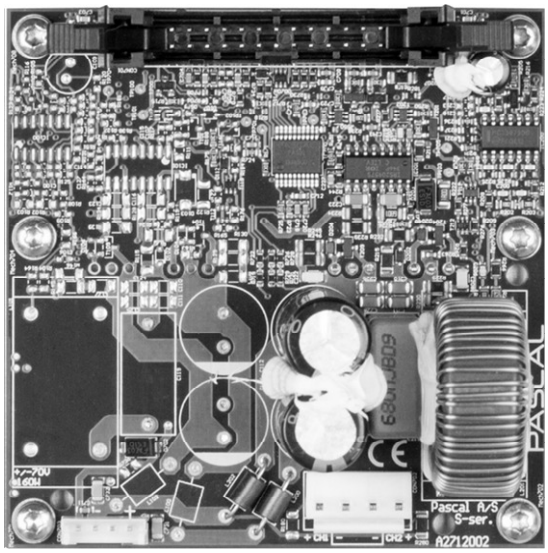
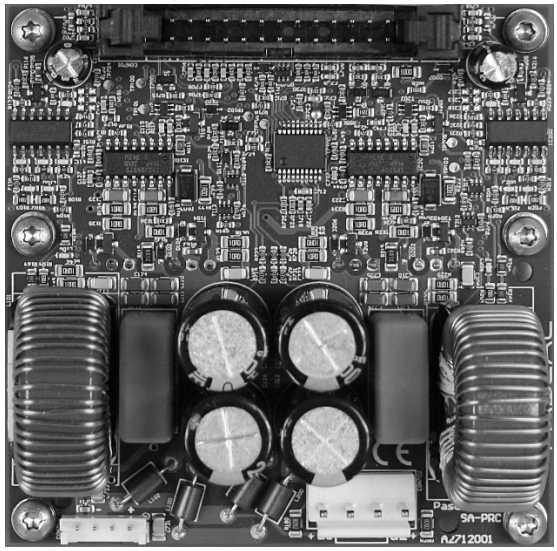
S-A1/2 Extension Module Application Manual





Read this Application Manual before starting design process

Table of Contents

1 Introduction

This Application Manual is written as a reference work, and is intended to be used as such. Each section is written to aid in the best possible way for each design phase, to ease and speed up the design process.

This manual is an extension to the S-PRO2 Application Manual. It is therefore mandatory to read and follow the S-PRO2 Application Manual before starting to integrate the S-A series extension modules.

The S-A1/2 Extension Module is a replicate of the S-PRO2 amplifier channels. For detailed information on protection features, timings, interfacing to external circuitry, readouts, suggestions to designs etc. refer to the S-PRO2 Application Manual.

The S-A1 is a single amplifier channel version of the S-A2 having two amplifier channels. The mechanical outline of the S-A1 is almost identical to the mechanical outline of S-A2, the difference being that components for amplifier channel 1 are not mounted on the S-A1, thus for the S-A1 module only connection for amplifier Ch2 should be used, and connections listed specifically for amplifier Ch 1 should be "No Connect"

To ensure a reliable and safe operation of the combination of S-PRO2 and S-A1/2, the modules control signals must be interfaced as illustrated on page 9 Figure 3-1 S-PRO2 and S-A1/2 overview block diagram.

2 How to setup and test the amplifier module

2.1 In the Evaluation Kit box

The Pascal S-A1/2 evaluation kit allows for a quick and easy test setup of the S-A1/2 module.

The evaluation kit contains:

1. Two Pascal S-PRO2 I/O Boards with a 26 pin connector.
2. Pascal S-A1/2 interface board to connect the S-A1/2 with the S-PRO2 module through the 26 pin connector.
3. Four 26 pin Ribbon Cables for connecting the I/O Boards to the modules through the interface board.
4. Two SE speaker cables with two speakON connectors.
5. Two BTL speaker cables with a speakON connector.
6. Mains cable with powerCON connector.
7. S-A1/2 Power Cable.

Figure 2-1 Evaluation kit.

A schematic of the Pascal S-PRO2 I/O Board is shown in appendix 7.

A schematic of the Pascal S-A1/2 Interface Board is shown in appendix 8.

2.2 Quick Guide

This section describes the different connections to and from the S-A1/2 module, and describes how to easily make a test setup using the S-A1/2 module with an S-PRO2 module and two Pascal S-PRO2 I/O Boards.

2.2.1 Connections on the S-A1/2 module

The tables below provides information about the available connections to and from the S-A1/2 module.

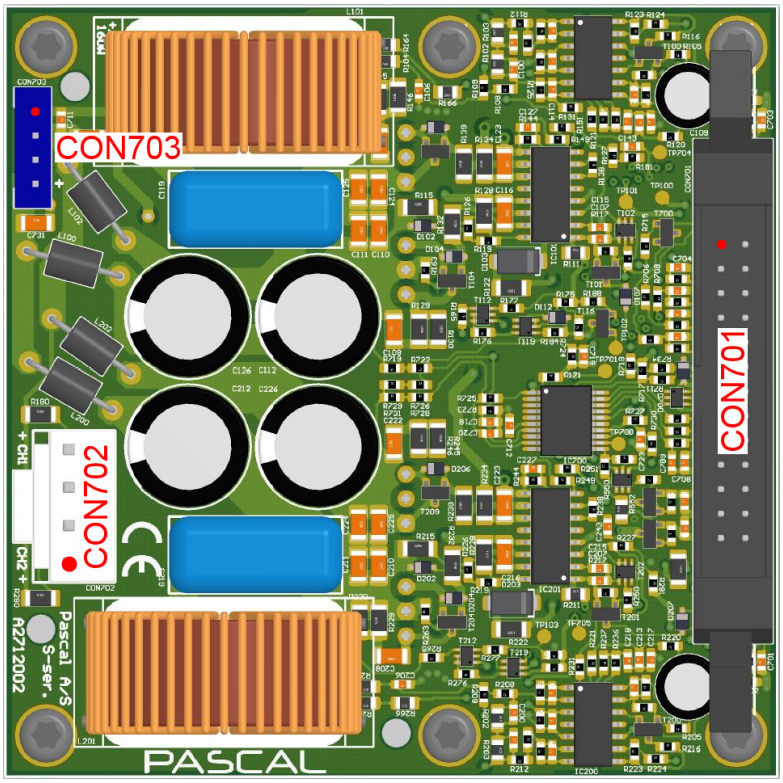


Figure 2-2 S-A1/2 extension module with connector naming - pin 1 marked with red dot

CON701			Description
Name	**Pin #**	**I/O**	
SGND Ch1	1	I	This pin is the channel 1 audio signal ground, and should be connected only to the front end output buffer ground.
IN+ Ch1	2	I	This pin is the channel 1 audio input signal to the S-A1/2 module. The maximum allowable signal on this pin is ±5V_p.
AGND	3	-	This pin acts as an audio ground reference, and should be connected only to the front end output buffer ground.
SGND Ch2	4	I	This pin is the channel 2 audio signal ground, and should be connected only to the front end output buffer ground.
IN+ Ch2	5	I	This pin is the channel 2 audio input signal to the S-A1/2 module. The maximum allowable signal on this pin is ±5V_p.
Temp Mon.	6	O	This pin reads out the highest temperature of the two amplifier channels in the range of 0-3.3V corresponding to 0°C-100°C. The pin will readout 3V3 when in temperature protection.
Vout Monitor Ch1	7	O	This pin reads out the amplifier channel 1 output voltage. The signal will be in the range ±10V_p corresponding to ±70V_p on the output of the amplifier. The signal is high impedance and requires a buffer if used.

Vout Monitor Ch2	8	O	This pin reads out the amplifier channel 2 output voltage. The signal will be in the range ±10V_p corresponding to ±70V_p on the output of the amplifier. The signal is high impedance and requires a buffer if used.
Clip Ch1	9	O	This pin signals an active low whenever the amplifier channel 1 is clipping.
Clip Ch2	10	O	This pin signals an active low whenever the amplifier channel 2 is clipping.
DIS read/protect	11	O	This pin signals an active low whenever the S-A1/2 or S-PRO2 module is disabled or in protection.
No Connect	12	-	This pin is used internally and must be left as a No Connect.
Disable (Mute)	13	I	This pin must be connected to the DIS read/protect pin 11 on the S-PRO2 module. When released the module is ready within a few milliseconds.
No Connect	14	-	This pin is used internally and must be left as a No Connect.
No Connect	15	-	This pin is used internally and must be left as a No Connect.
Standby mode/DC Protect	16	I/O	This pin must be connected to the Standby mode pin 16 on the S-PRO2 module. When released the module is ready within a few seconds.
+7.5V	17,18	O	This pin may be used to supply external circuitry.
GND	19,20	-	This pin is the +7.5V ground return.
+15V	21,22	O	This pin may be used to supply external circuitry.
GND	23,24	-	This pin is the ±15V ground return.
-15V	25,26	O	This pin may be used to supply external circuitry.

Table 2-1 S-A1/2 ribbon-cable connector overview.

CON702			**Description**
Name	**Pin #**	**I/O**	
Ch2 GND	1	O	This pin is used for the GND signal of the channel 2 speaker.
Ch2 +	2	O	The amplified speaker signal of channel 2 is available on this pin.
Ch1 GND	3	O	This pin is used for the GND signal of the channel 1 speaker.
Ch1 +	4	O	The amplified speaker signal of channel 1 is available on this pin.

Table 2-2 S-A1/2 speaker connector overview – see S-PRO2 Application Manual for connection details.

CON703			**Description**
Name	**Pin #**	**I/O**	
V_{drive}	1	I	The V_{drive} voltage from the S-PRO2 module must be connected on this pin.
-70V	2	I	The negative rail voltage from the S-PRO2 module must be connected on this pin.
GND	3	-	Rail voltage reference pin – Used if the S-A1/2 and S-PRO2 modules aren't mounted on the same conducting mechanics, or have GND connected via the modules CON701 connectors.
+70V	4	I	The positive rail voltage from the S-PRO2 module must be connected on this pin.

Table 2-3 S-A1/2 extension module connector overview.

2.2.2 Connections on the Pascal S-A1/2 Interface Board

Below is a description of the available connections on the Pascal S-A1/2 Interface Board.

The 26 pin connector CON2 has the same connections as CON701 mentioned in the above section 2.2.1.

The 26 pin connector CON1 has the same connections as the 26 pin connector on the S-PRO2 module.

The 26 pin connector CON3 has the same connections as the 26 pin connector CON1 but with pin 11 left "No Connect".

The 26 pin connector CON4 has the same connections as the 26 pin connector CON1 but with pin 13 left “No Connect”.

In appendix 8 the schematic of the Pascal S-A1/2 Interface Board is shown.

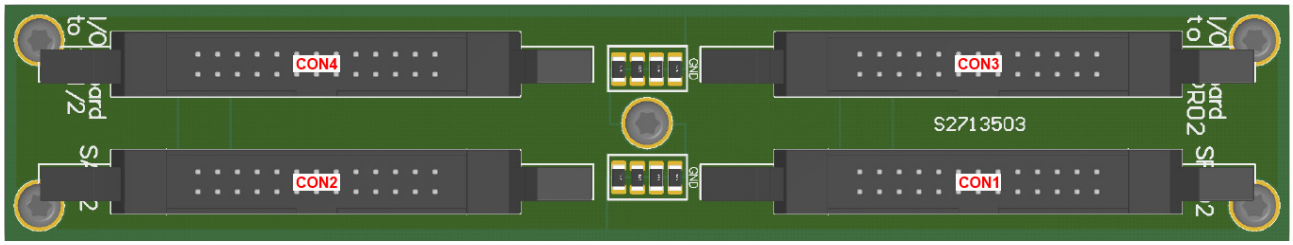


Figure 2-3 Pascal S-A1/2 Interface Board

GND from the S-PRO2 and S-A1/2 are connected through the eight 1206 0Ω resistors. If the S-PRO2 and S-A1/2 are fixed to the same electrical conducting plate, they share GND through this plate. In this type of setup the eight resistors should be removed to avoid a GND loop.

NOTE: If the S-PRO2 and S-A1/2 aren’t fixed to the same electrical conducting plate, the resistors must be mounted for the S-A1/2 not to be floating and subsequently damaged.

As Pin 11 in CON3 is removed the Dis/Protect signal readout isn’t available in this connector. All Dis/Protect signal readouts have to be made from pin 11 in CON4.

2.2.3 Communication between the S-PRO2 and S-A1/2

To protect both the S-PRO2, the S-A1/2 and the speaker some of the pins in the 26 pin connector on the S-PRO2 and S-A1/2 are connected through the Pascal S-A1/2 Interface Board.

For detailed figures see section 3 on how to interface the two modules or appendix 8 for Pascal S-A1/2 Interface Board schematic.

Both Standby pins (Pin 16) are connected together. This means that both modules will simultaneously enter and leave standby.

The Dis/Protect pin 11 on the S-PRO2 module is connected to the S-A1/2’s Mute pin 13. This means that both modules are muted through the Mute pin 13 at the S-PRO2 module. This also means if the S-PRO2 enters protection (HF protection, Thermal protection etc.) this will mute the S-A1/2 module.

If the S-A1/2 enters protection this will only mute the S-A1/2. The S-PRO2 will keep playing.

DC Protection, however, will put both modules into standby no matter which module triggers this protection.

2.3 How to setup the amplifier module for listening tests

Below is illustrated how to interface the S-A1/2 with the S-PRO2 for listening tests. Depending on the configuration the modules can be loaded as:

- 3 or 4 SE channels
- 1 BTL channel and 1 or 2 SE channels
- 2 BTL channels

For Bridge Tied Load, the BTL switch on the Pascal S-PRO2 I/O Board must be set in “ON” position – see S-PRO2 Application Manual for detailed information.

Pascal recommends using the S-PRO2 module for low frequencies and the S-A1/2 module for mid - and high frequencies.

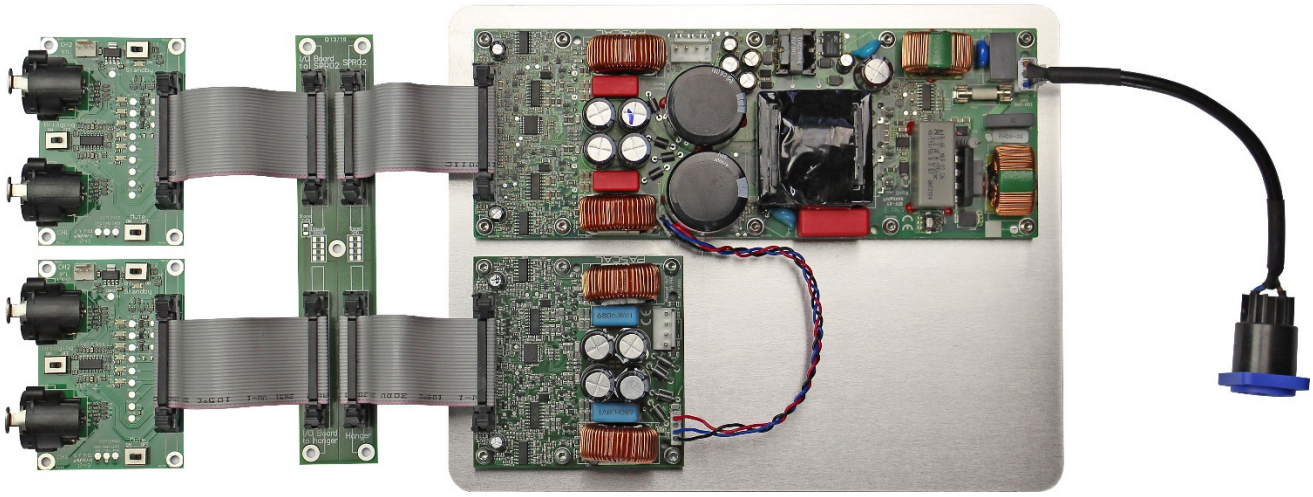


Figure 2-4 S-PRO2 and S-A2 fixed on an electrical conducting plate. In this test setup the eight 1206 O Ohm resistors on the S-A1/2 interface board should be removed to avoid a GND loop

Depending on the configuration the appropriate SE or BTL output SpeakON cables must be chosen.

3 How to interface to the amplifier module

The following sections will provide guidelines to the electrical interfacing and application of the S-A1/2 module connected to the S-PRO2 module.

Below is shown a block diagram of the S-PRO2 module and S-A1/2 module for an easy overview.

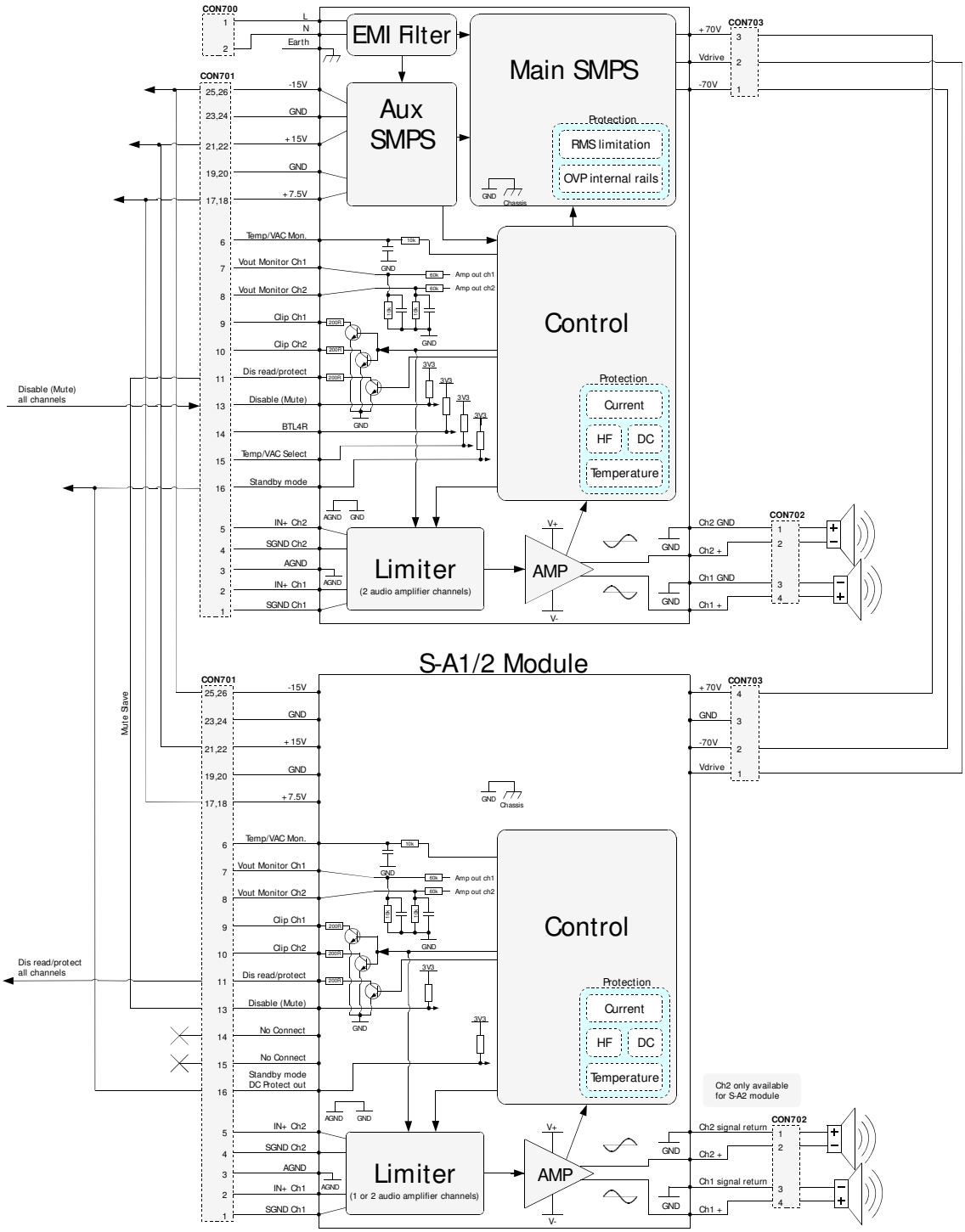


Figure 3-1 S-PRO2 and S-A1/2 overview block diagram.

Channel 1 and 2 at both modules are single ended amplifier designs, which can pump back energy on the power supply rails. At low frequencies this may cause asymmetrical power supply voltage rails, resulting in premature clipping of the amplifier outputs or over-voltage protection of the power supply – see S-PRO2 Application Manual for details.

When both channels are used, at each module respectively, audio input for both the S-PRO2 channel 2 and S-A2 channel 2 should be inverted as shown on the above Figure 3-1 or below on Figure 3-2. This will cancel the supply pumping between the two channels.

In order to maintain correct output phasing in Single Ended mode, the output of channel 2, should be phase inverted by interchanging the + and – connections for the speaker. See Figure 3-1 above or section 3.1.1 below.

3.1.1 SE Operation

As described earlier, it is important to invert channel 2 of the S-PRO2 module and the S-A2 module to cancel the supply pumping between their respective channels.

In order to maintain correct output phasing in Single Ended mode, the output of channel 2, should be phase inverted by interchanging the + and – connections for the speaker - see Figure 3-2 below.

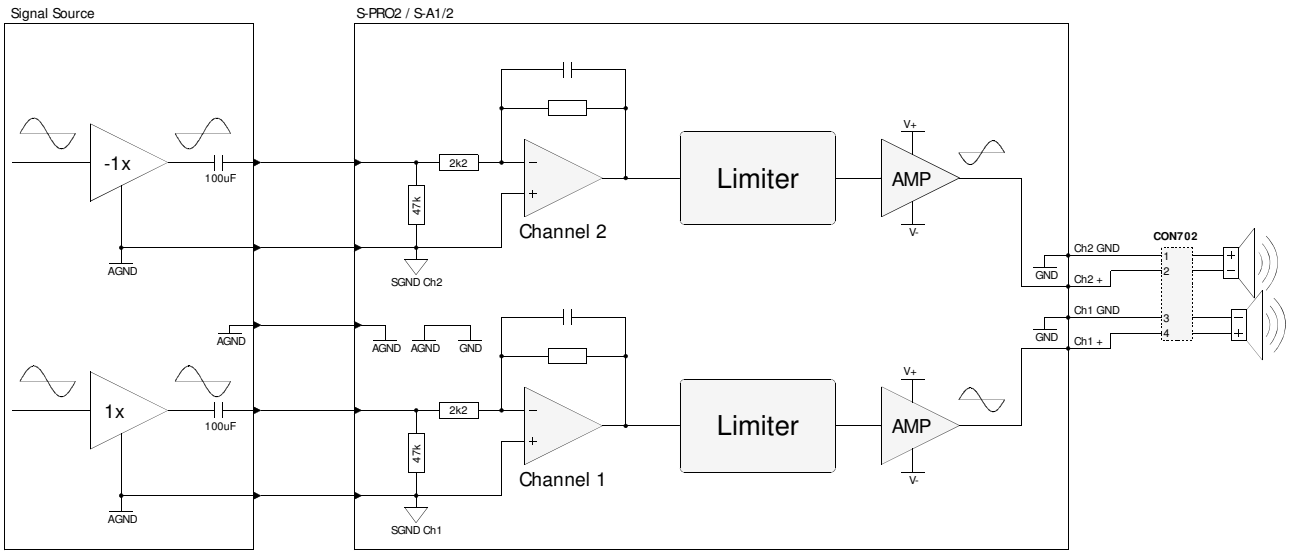


Figure 3-2 Single Ended (SE) connection diagram.

3.1.2 BTL Operation

When using the S-PRO2 module and S-A2 in BTL mode, it is important to phase the two inputs and outputs according to the Figure 3-3 below, for correct BTL operation.

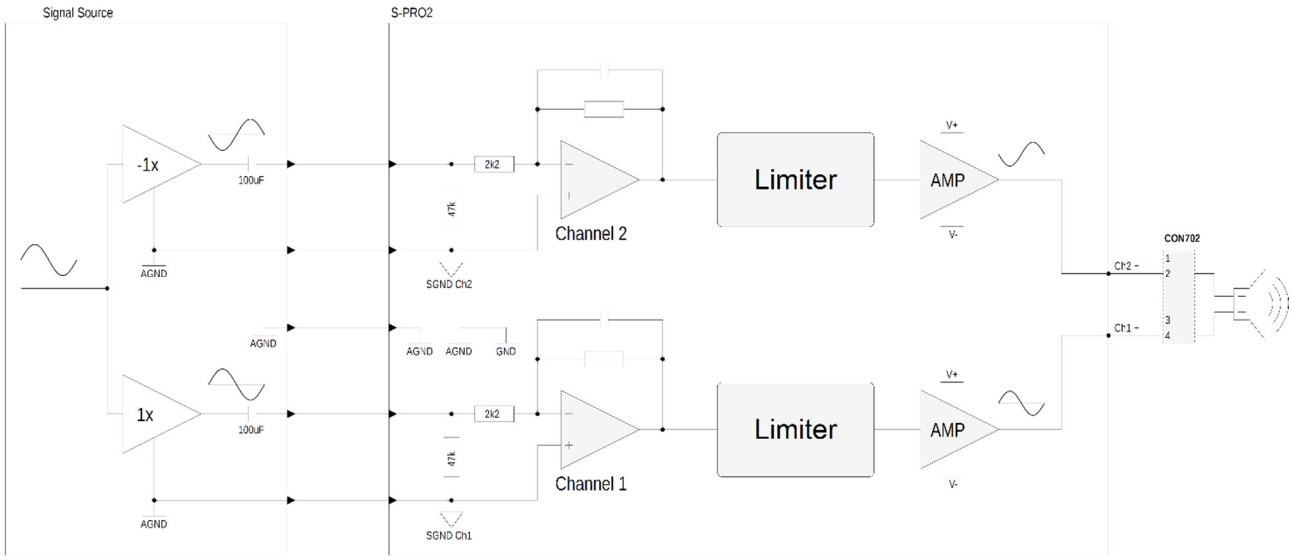


Figure 3-3 Bridge Tied Load (BTL) connection diagram.

3.1.2.1 BTL Mode 4Ω load

When the S-PRO2 module and/or S-A2 module is to be used with a 4Ω speaker in BTL operation, it is important to select this mode by pulling the pin 14 ($\overline{\text{BTL4R}}$) low during startup. An open-collector circuit or a hard-wire short to GND should be used to pull the pin low. See S-PRO2 Application Manual for further details. If the 4Ω BTL mode is not selected while using a 4Ω speaker in BTL mode, the S-PRO2 module and/or S-A2 module may enter unwanted protection.

When selecting the 4Ω BTL mode during startup of the module, the S-PRO2 module runs at lower internal rail voltages (approximatively +-60 Volt), to maximize efficiency of the power stages. This will improve the thermal characteristics during 4Ω BTL operation, and will thereby help to maximize the performance of the amplifier.

NOTE: Using either the S-PRO2 module or S-A2 module in 4Ω BTL mode requires pin 14 at the S-PRO2 module to be shorted to GND. Pin 14 at the S-A1/2 module is “No Connect” and won’t activate 4Ω BTL mode.

NOTE: When activating 4Ω BTL mode both the S-PRO2 module and S-A1/2 module will run with lower internal rail voltages. This limits the peek voltage swing and thereby the output power for all S-PRO2 and S-A1/2 amplifier channels with 4Ω or 8Ω SE load and 8 Ω BTL load.

3.2 S-PRO2 Auxiliary Power Supply Limits

The auxiliary power supply has been designed to be able to supply external circuitry, by offering ±15V for external analog circuitry and a +7.5V for higher current demanding applications such as a DSP Front End.

It is important to separate the AGND (used for e.g. analog low current circuitry) and GND (used for high current circuitry e.g. DSPs) on the front end audio input board, to ensure correct audio input grounding and to minimize DC offset at the audio input. Please see the S-PRO2 Application Manual, both under “Audio Front End grounding” and section 7, for proper grounding schemes.

The S-A1/2 uses the S-PRO2 Aux supply for its internal small signal circuitry. This lowers the maximum allowable current draw for external circuitry compared to using the S-PRO2 alone. See Table 3-1 below for details.

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*
$I_{+7.5V}$	+7.5V current rating	-	-	425	mA
I_{+15V}	+15V current rating[1]	-	-	80	mA
I_{-15V}	-15V current rating[1]	-	-	-80	mA
$P_{st.by}$	Standby consumption S-PRO2 + S-A1 @ 230 VAC	-	0.32[2] 0.35[3]	-	W
$I_{st.by\_max}$	Current consumption during Standby from +7.5V to meet ErP (1275/2008/EC)	-	15	-	mA
P_{tot}	Maximum total output power	-	-	5.6	W

Table 3-1 Auxiliary power supply ratings for the S-PRO2 when combined with an S-A1 Extension module at normal operation at 25°C unless other is specified

Note 1: It is allowed to draw up to max. 125mA on each of the ±15V outputs in addition the current drawn by the S-A1, by lowering the current draw on the +7.5V correspondingly, so that the maximum rated output power P_{tot} does not exceed the above rating.
Note 2: Measured with no I/O Boards attached.
Note 3: Measured with two Pascal I/O Board attached and both standby switches in ON position.

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*
$I_{+7.5V}$	+7.5V current rating	-	-	420	mA
I_{+15V}	+15V current rating[1]	-	-	55	mA
I_{-15V}	-15V current rating[1]	-	-	-55	mA
$P_{st.by}$	Standby consumption S-PRO2 + S-A2 @ 230 VAC	-	0.33[2] 0.36[3]	-	W
$I_{st.by\_max}$	Current consumption during Standby from +7.5V to meet ErP (1275/2008/EC)	-	15	-	mA
P_{tot}	Maximum total output power	-	-	4.8	W

Table 3-2 Auxiliary power supply ratings for the S-PRO2 when combined with an S-A2 Extension module at normal operation at 25°C unless other is specified

Note 1: It is allowed to draw up to max. 110mA on each of the ±15V outputs in addition the current drawn by the S-A2, by lowering the current draw on the +7.5V correspondingly, so that the maximum rated output power P_{tot} does not exceed the above rating.
Note 2: Measured with no I/O Boards attached.
Note 3: Measured with two Pascal I/O Board attached and both standby switches in ON position.

The maximum rated currents specified in the above Table 3-1 and Table 3-2 are applicable both in normal operation and in standby mode. See the S-PRO2 Application Manual for further details regarding auxiliary power supply ratings in standby mode.

4 How to do a Thermal & Mechanical design

For detailed design description and practical measurements - see S-PRO2 Application Manual.

4.1 Acoustic air pressure

IMPORTANT: It is of absolute importance that the circuit board are not being exposed to extreme vibration.

Therefore in the case where the circuit board are placed directly in the acoustic volume of the loudspeakers it must be secured that the mechanics are sufficiently rigid and stiff to avoid excessive vibrational levels at the circuit boards or at single components mounted on the circuit board. See S-PRO2 Application Manual for mechanical design suggestions.

4.2 Water, rain, humidity and dust

The S-A1/2 Series circuit board are not protected against water, rain or excess humidity in any way and should under no circumstances be exposed to such.

Proper design precautions must be taken to prevent dust and dirt from clogging up on the circuit board. Dust and moisture are often the main cause for high voltage creepage and severe electric hazards. In case the amplifier design comprises a fan, dust filters must be applied.

If the product is exposed to salty weather conditions a silicone coating may be sprayed on the module to improve lifetime.

4.3 Shock, bump and vibration

The circuit boards are designed to be built into loudspeakers and subwoofers and have been shock, bump and vibration tested according to IEC/EN60065.

It is important that proper design precautions are taken when designing the amplifier chassis and the loudspeaker cabinet to ensure that the circuit boards are not exposed to excessive shocks, bumps or vibrations. Proper design precautions should always be taken to protect the amplifier unit against such stress. See S-PRO2 Application Manual for detailed mechanical design suggestions.

4.4 General mechanical mounting instructions

The S-A1/2 modules aluminum heatsink features 3mm threads for mounting. It is possible to go 4mm deep into these threads. It is recommended to use minimum the 4 corner threads (as marked – see below for details.

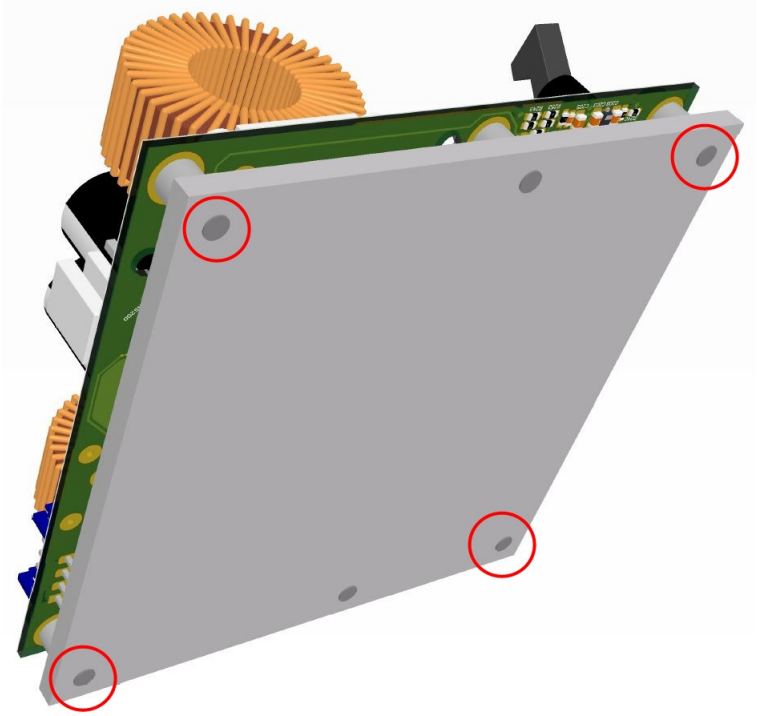


Figure 4-1 Mechanical fixation

4.4.1 Mechanical dimensions of S-A1/2

For optimal thermal performance the S-A1/2 module must be mounted directly on a heatsink using an adequate amount of thermal joint compound between heatsink and the S-A1/2 aluminum heatsink.

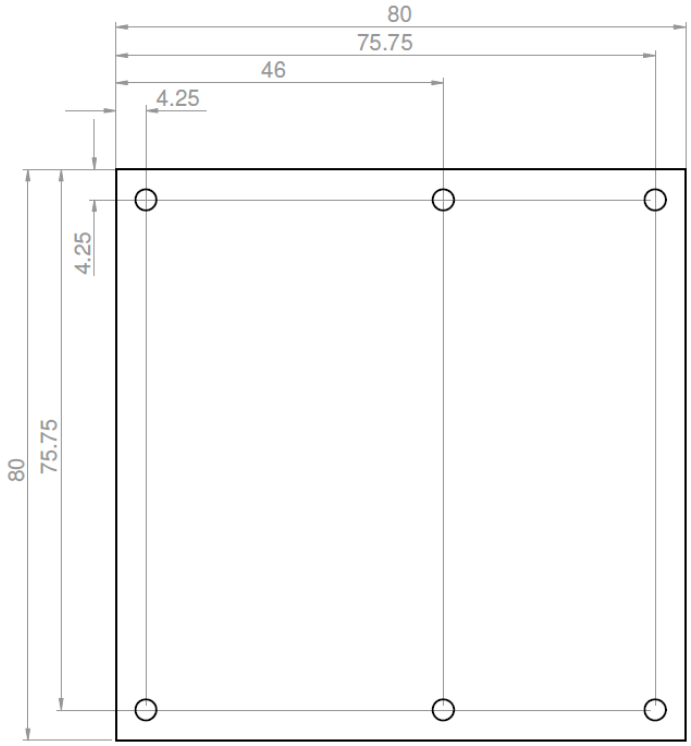


Figure 4-2 Mechanical outline – all dimensions in mm – bottom view

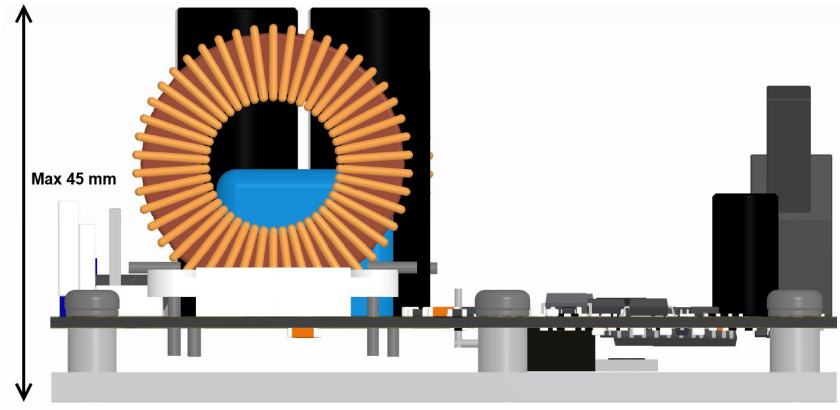


Figure 4-3 Mechanical outline – all dimensions in mm – side view

5 How to ensure EMC compliance

The final product containing the S-PRO2 module and the S-A1/2 module must comply with the relevant standards of the product's category.

Note that it is the customer's responsibility to verify that the end-product complies with the required standards of the market for which the product will be commercialized in.

The limits for the different EMC tests are described in the standard (see S-PRO2 Application Manual) and especially the limits for radiated emission and conducted emission needs extra attention.

The normal limits for E2 equipment are the ones called "B-limits". The S-PRO2 with S-A1/2 complies with "B-limits" on radiated emission and "A-limits" on conducted emission when installed properly as described in this manual. A-limits are higher (allows more noise) and may be used if a notice is inserted in the manual - see S-PRO2 Application Manual for details.

"B-limits" on conducted emission is possible to achieve with a small external mains filter – see S-PRO2 Application Manual for details.

For detailed description of decoupling and filter designs – see S-PRO2 Application Manual.

5.1 Pascal EMC reference design

The S-PRO2 module with S-A1/2 has been EMC tested using 2 different reference designs. Both designs were mounted in a "4-way loudspeaker box" made of wood to simulate a real application situation. The box does not contain loudspeaker drivers but instead 4 large wire wound power resistors of 4Ω7 each.

The input signal is pink noise delivering $1/8^{th}$ of 500W per channel (4x62.5W).

5.1.1 Design 1 – open box – faraday cage

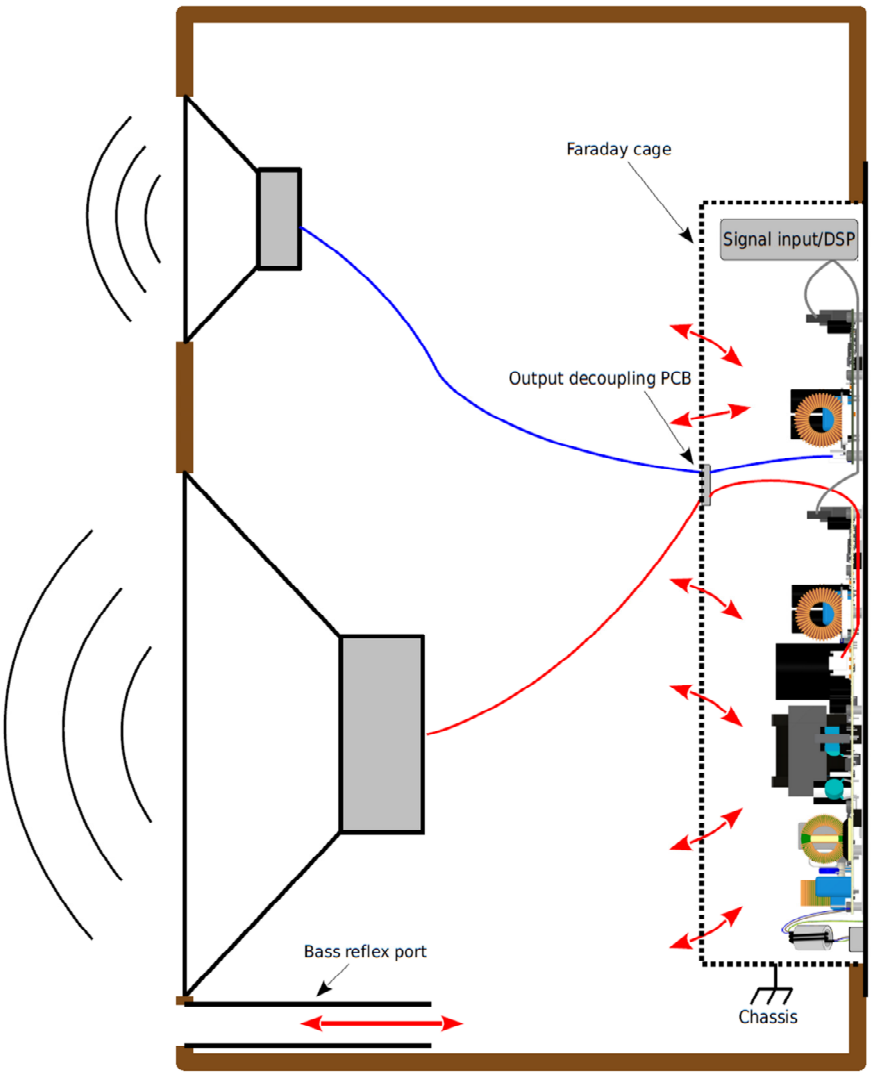


Figure 5-1 EMC - design 1 – open box – faraday cage.

A faraday cage is added to create a high frequency “sealed” box to reduce radiated emissions. This design passes the radiated EMI tests with good margin to the B-limits when mounted in the simulated loudspeaker box.

There are a few things important to notice:

1. The shield of the XLR cables and “pin 1” is connected to the chassis through the XLR mounting screws.
2. A ferrite is needed on the mains cable to reduce the radiated emissions. Here a 74270095 from Würth has been used. Similar types from other manufacturers may also be used. The mains cable – including the earth wire if used – is wound 3 times through the ferrite. The placement of the ferrite should be as close to the mains connector (PowerCon etc.) as possible.
3. To make the enclosure high frequency “sealed” the holes in the enclosure should not be larger than 8 mm and the connection between the faraday cage and the back plate must be consistent all the way around by e.g. using screws every 10 cm. It is also very important that any paint or oxidization of the metal parts is removed at the contact points between the faraday cage and the back plate to

ensure a proper electrical connection. The faraday cage should be made of 1mm thick iron plate or similar.

4. A small decoupling PCB, including speaker connector to the outside and a few filter capacitors, is needed to reduce the radiated emissions. See S-PRO2 Application Manual for details.
5. All cables shall be kept as far away from the PCB as possible. Avoid running cables across the S-PRO2 and S-A1/2 module.

5.1.2 Design 2 – closed box – fan

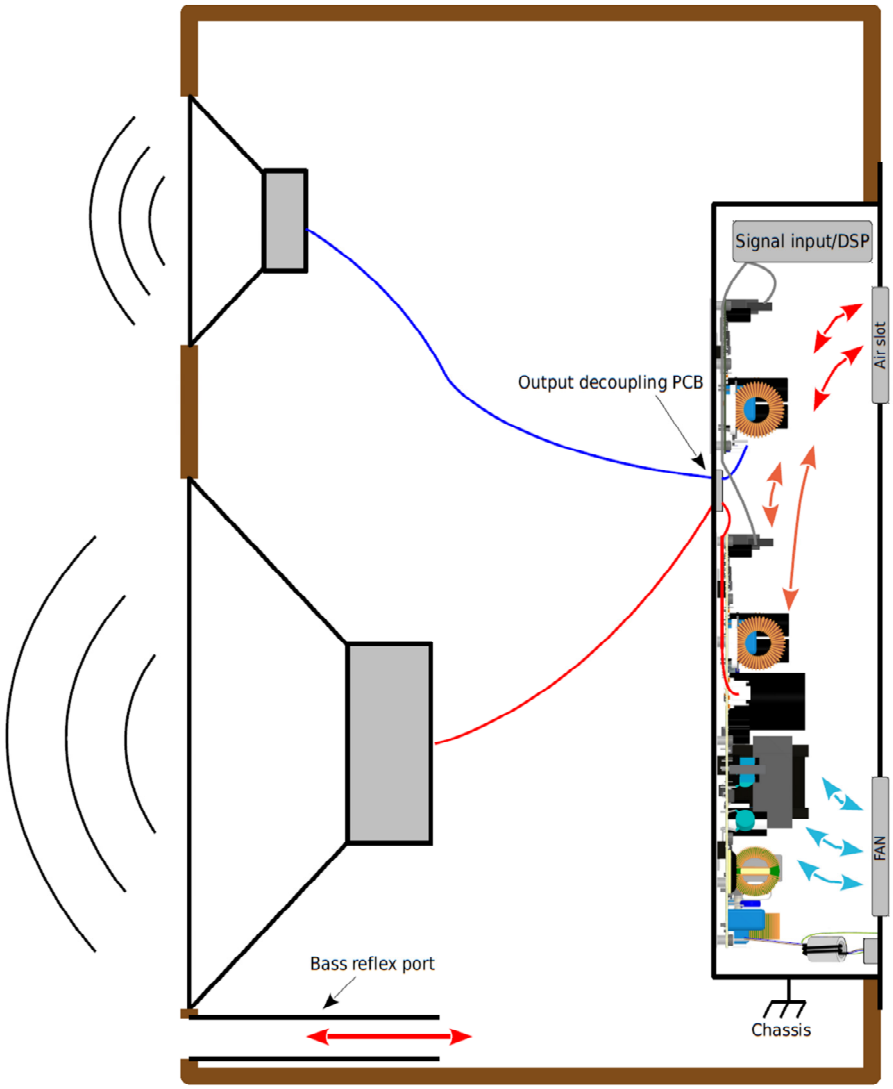


Figure 5-2 EMC - design 2 – closed box – fan.

This design is basically design 1 with fan cooling except the perforated box is now solid. This design passes the radiated EMI tests with good margin to the B-limits when mounted in the simulated loudspeaker box.

There are a few things important to notice:

1. The shield of the XLR cables and “pin 1” is connected to the chassis through the XLR mounting screws.
2. A ferrite is needed on the mains cable to reduce the radiated emissions. Here a 74270095 from Würth has been used. Similar types from other manufacturers may also be used. The mains cable –

including the earth wire if used – is wound 3 times through the ferrite. The placement of the ferrite should be as close to the mains connector (PowerCon etc.) as possible.

3. To make the enclosure high frequency “sealed” the holes in the enclosure should not be larger than 8 mm and the connection between the front plate and the back plate must be consistent all the way around by e.g. using screws every 10 cm. It is also very important that any paint or oxidization of the metal parts is removed at the contact points between the front plate and the back plate to ensure a proper electrical connection. The enclosure should be made of a 3 mm thick aluminum plate or similar.
4. A small decoupling PCB, including speaker connector to the outside and a few filter capacitors, is needed to reduce the radiated emissions. See S-PRO2 Application Manual for details.
5. All cables shall be kept as far away from the PCB as possible. Avoid running cables across the S-PRO2 and S-A1/2 module.

6 How to comply to safety requirements

The S-A series has been pre-approved according to the following standard in combination with a Pascal module capable of delivering the power for the S-A series modules e.g. the S-PRO2 series:

IEC/EN60065 for Europe and USA/Canada including national deviations for China and Korea.

This manual suggest how to apply the S-A series extension modules. In order to obtain the advantages that the pre-approval provides during the safety approval of the end-product, it must be ensured that the end-product complies with IEC60065 including national deviations.

This manual is an extension to the application and safety manuals for Pascal modules capable of delivering the power for the S-A series modules e.g. S-PRO2 series application and safety manuals. It is therefore mandatory to read and follow these manuals before starting to integrate the S-A series modules.

6.1 Use of the product

The S-A series amplifier modules can drive one (S-A1) or two (S-A2) loudspeaker(s) in single ended mode each driving a nominal impedance of 4Ω or higher – or with one loudspeaker in bridge mode having a nominal impedance of 8Ω or higher. 4Ω BTL or 2Ω per channel is possible when used in special low supply rail mode with e.g. the S-PRO2 series “4 ohm BTL mode”.

The loudspeakers are connected to CON702 and the input signal to CON701 and the power supply to CON703. The connection to the S-PRO2 series module is shown below:

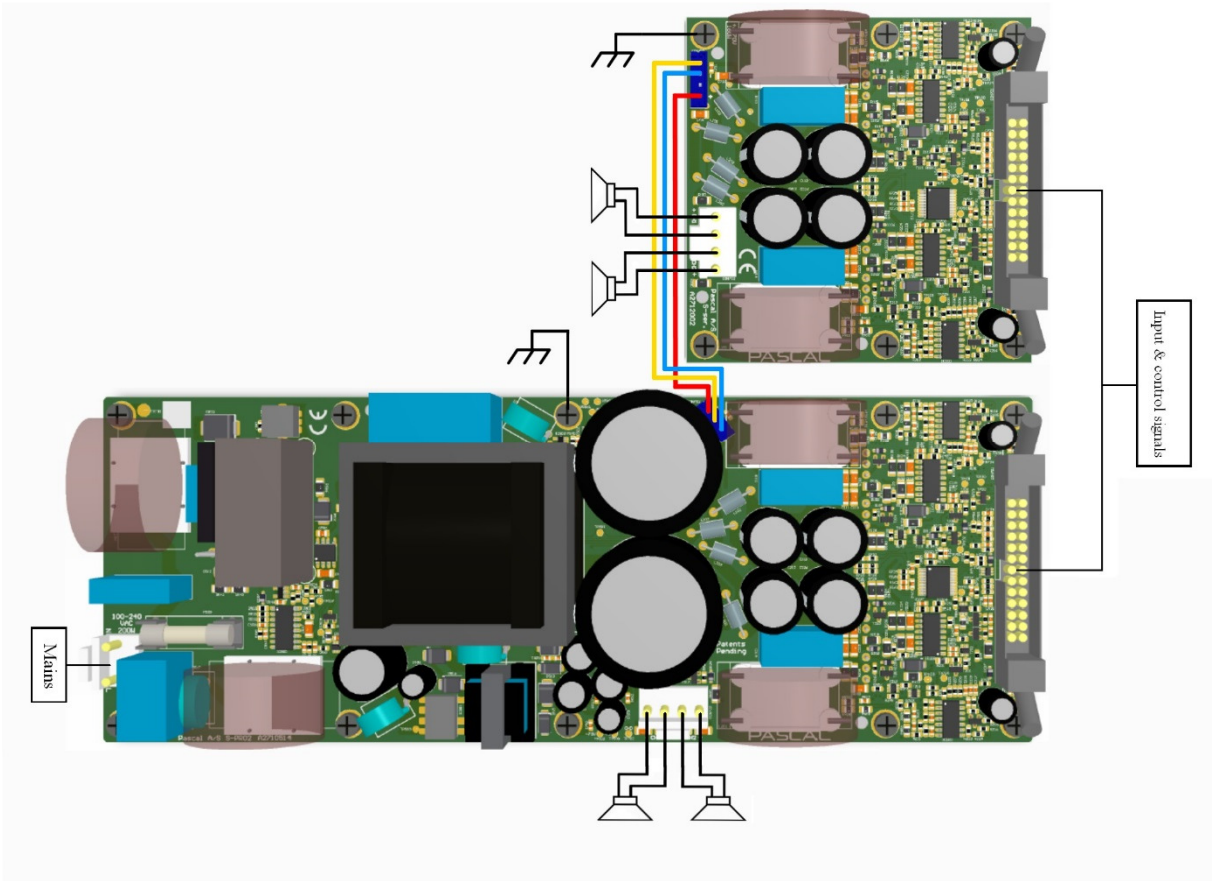


Figure 6-1. S-A series connection to S-PRO2 series overview.

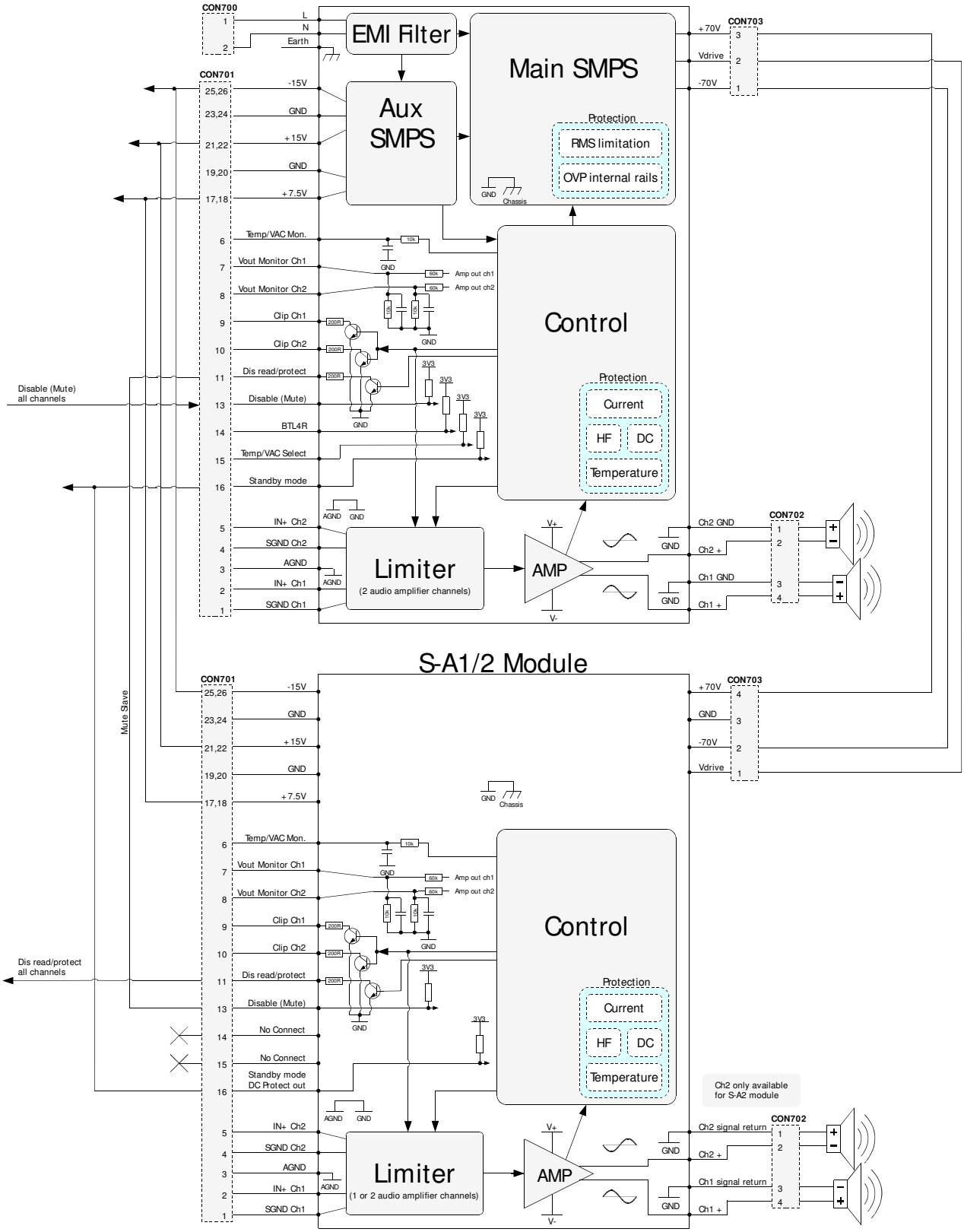


Figure 6-2. S-A series connection to S-PRO2 series detailed wiring.

It is important to follow the wiring shown on Figure 6-2 to ensure proper functionality.

6.2 Output power

The power rating for which the product has been safety tested is 1/8th of the rated total power (1000W - 2x500W@4ohm), when channel 1 and channel 2 are driven.

Channel 1 (Pink noise) 62.5W_{RMS}@4Ω

Channel 2 (Pink noise) 62.5W_{RMS}@4Ω

6.3 Power rating

The power ratings for S-A1 and S-A2 modules:

	S-A1		S-A2	
Supply Voltage	Current	Power	Current	Power
+70V	0.55A	34W	1.1A	77W
-70V	-0.55A	34W	-1.1A	77W
+15V	23mA	345mW	37mA	555mW
-15V	-16mA	240mW	-26mA	390mW
+7.5V	11mA	83mW	11mA	83mW
Vdrive (12V ref. -70V)	29mA	348mW	57mA	57mW
Total Power (rounded)		**75W**		**160W**

Table 3 Total Power rating for S-A1 and S-A2 (At 1/8th of 1000W total and 4Ω loading (500W/channel)) and typical current consumption for all supply voltages.

The power consumption of the S-A2 is noted on the rating label (the PCB silkscreen) since this is the greater one.

6.4 Temperature

The S-A1 and S-A2 modules are part of a larger system when used with a Pascal module supplying the power. Temperature tests of the whole system is required according to the description shown in the safety chapter of the S-PRO2 series manual.

6.5 S-A1-NHS and S-A2-NHS

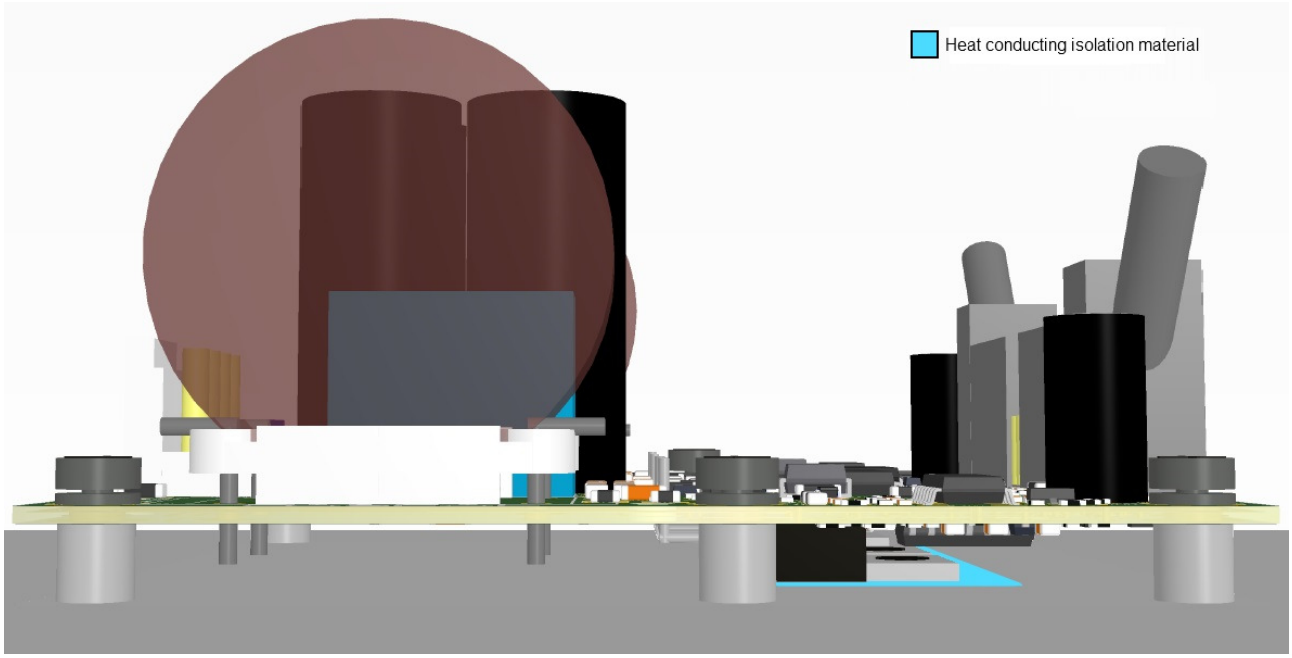
For high volume production the S-A series products may be delivered without the aluminum heatsink for mounting directly at the chassis of the final product enclosure. These products are named S-A1-NHS and S-A2-NHS.

Using the S-A1-NHS and S-A2-NHS:

1. The implementation on the chassis of the final product enclosure must comply with IEC60065.
2. It is recommended to use the same isolation materials for the semiconductors as used in the standard S-A1 and S-A2 versions. The specification for these materials are available from Pascal. The placement of these materials shall comply with IEC60065 – placement drawings are available from Pascal. If other materials are chosen they have to comply with the requirements of IEC60065.
3. Temperature tests must be performed as described in the “Temperature” section.

The drawing below shows the suggested implementation of the S-A2-NHS on the chassis of the final product.

The required isolation materials for the semiconductors are shown, but not with exact dimensions.



7 Appendix: Pascal S-PRO2 I/O board

7.1.1 Schematic

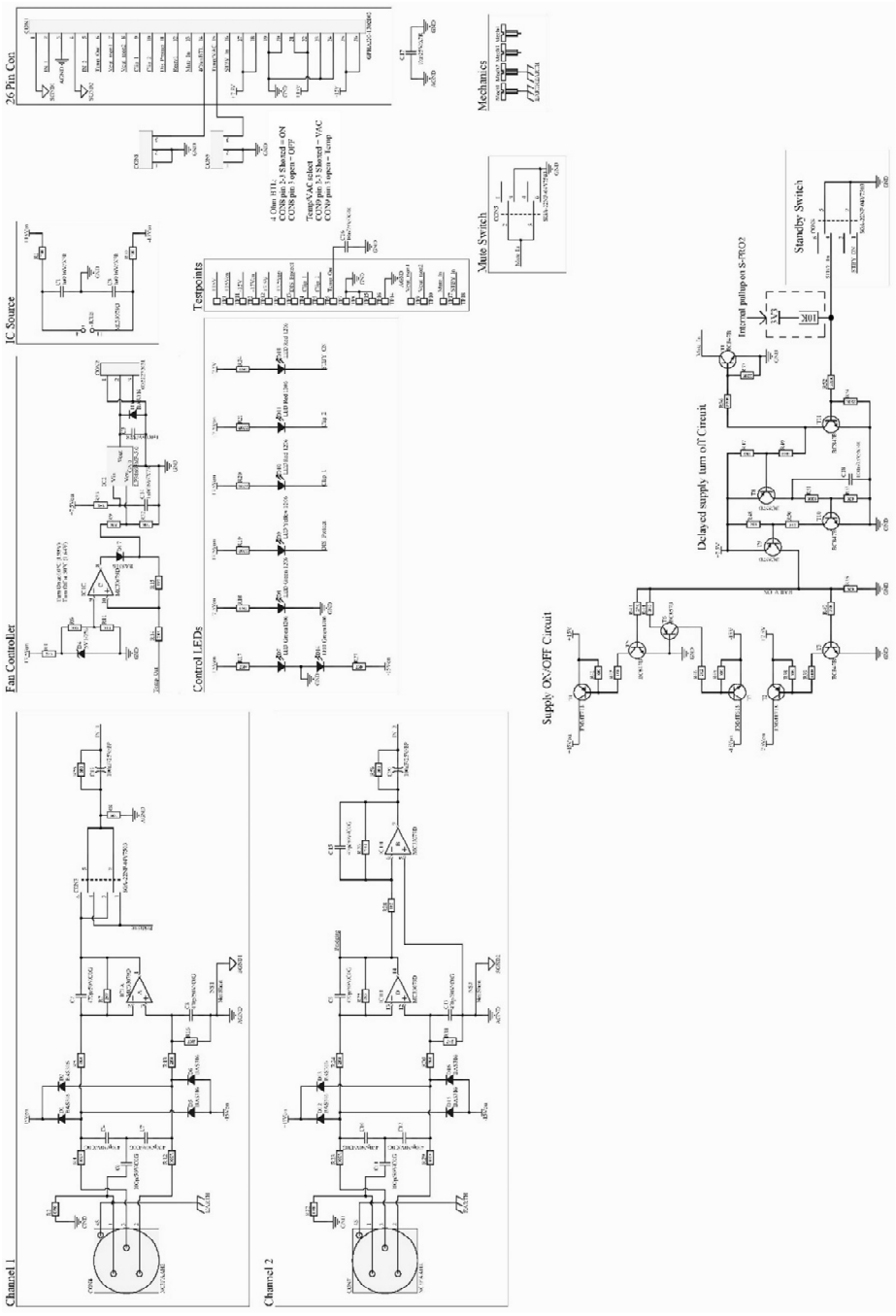


Figure 7-1 Pascal S-PRO2 I/O board

7.1.2 Layout

The layout of the Pascal S-PRO2 I/O Board is available on request. We provide the Gerber files and Service-Plans upon request.

Please contact our Sales department for more information.

8 Appendix: Pascal S-A1/2 Interface Board

8.1.1 Schematic

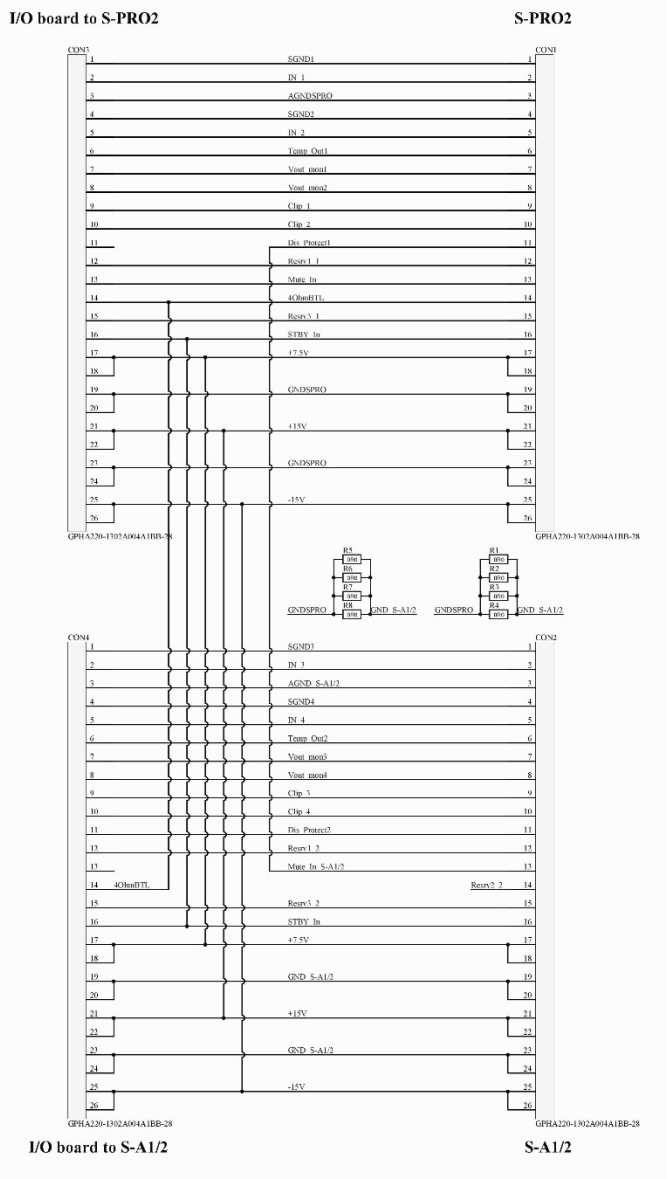


Figure 8-1 Pascal S-A1/2 Interface Board Schematic

8.1.2 Layout

The layout of the Pascal S-A1/2 Interface Board is available on request. We provide the Gerber files and Service-Plans upon request.

Please contact our Sales department for more information.

9 Appendix: External part list suggestion

The below Table 9-1 lists the suggested parts to be able to connect to the S-A1/2 module.

Description	Name	Manufacturer	Part Number	Farnell Part Number
Speaker female connector	CON702	JST	VHR-4N	630494
Crimp pin for JST VHR connector	-	JST	SVH-21T-P1.1 or SVH-41T-P1.1	630500 -
Control I/O 26 pin ribbon female connector	CON701	Greenconn Corporation	CQHA214-1302A001A1BA-23	Alternative: 1099240 or 1097028
S-A1/2 module female connector	CON703	JST	EHR-4	Digikey: 455-1002-ND
Crimp pin for JST EHR connector	-	JST	SEH-001T-P0.6	1863249
Pascal S-PRO2 I/O Board Fan female connector	CON2	Molex	22-01-2035	143127
Crimp pin for Molex connector	-	Molex	08-50-0032	9773789

Table 9-1 Part list of connector parts suggested to connect to the S-A1/2 module.