ELTIM high-end POWER AMPLIFIER modules

N E W Updated January 5th, 2025

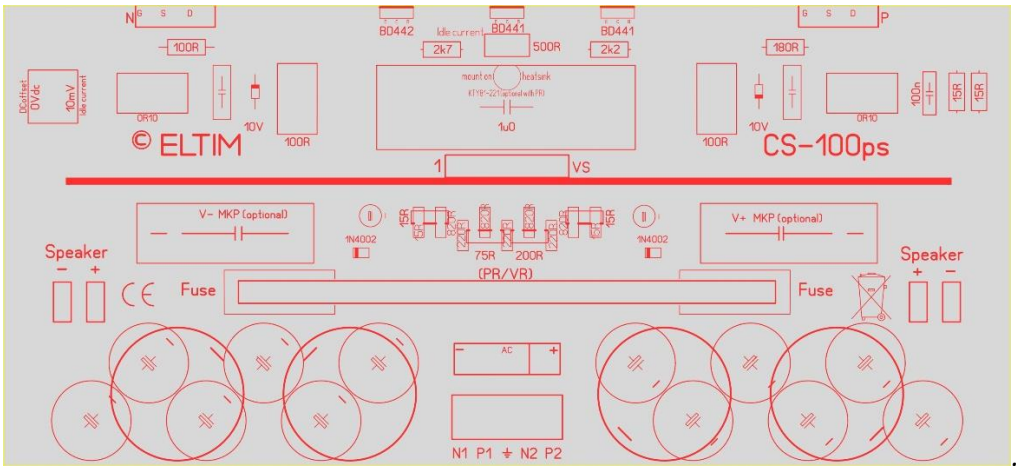
CS-120ps Current Stage module with power supply

Due to our completely different way of thinking when it comes to PCB design and layout, mechanical and thermal stress, magnetic interference, EMI, etc., an ELTIM amplifier built with these modules looks and acts a bit different, which is confirmed by our customers. According to them they make MUSIC, not just power ! And that for a (very) long period of time due to the stress free setup and quality components.

In order to make a true difference, we split our power amplifier schematics in a voltage- and a current stage board in order to obtain the maximum possible sound quality. This means that an ELTIM amplifier is based on these two (VS + CS) modules. A VS-input stage processes the sensitive and often small signal voltages and transfers it into signals powering a CS-module, which is leading the transient rich high currents.
This cooperation works very well indeed as many indicated as a “tube like” sound, added with solid bass.
While using large TO-247 or even TO-263 sized power Fets, our amplifier systems are extremely stable, can deliver lots of power and more important, together with our totally different PCB setup, they have way better control over your speaker system compared to most other amplifier designs.
We only use very high-quality materials lasting for 20 years and heat resistant, double sided FR4+ PCB’s made by a highly regarded European manufacturer, double sided (2x35um), tinned isles, text on both sides, etc.
On this CS-120ps module we also integrated a symmetrical power supply. Just connect a transformer.

PICTURE SOON

CS-120ps



This CS-120ps is especially made to fit even in MODU Slimline/Galaxy cabinets, 230mm deep.
Besides a Current Stage part there is also an integrated symmetrical power supply on board with space for 2x 2 Ø30mm pitch 10mm or 2x 6 Ø18mm pitch 7,5mm elco’s, up to 2200uF/50V.
In the idle current circuit fits up to Ø20x52mm MKP capacitor, stabilizing this circuit for ac signals.
Current measuring resistors are BOURNS PWR163 or CADDOCK MP725 induction free SMD resistors.
About all MOX resistors can be replaced by (rel. expensive) induction free TO220 types, f.e. CADDOCK.
Two significant sized MKP capacitors can be mounted over the power rails, improving sound details.
To be able to lead the possible speaker current there is a 2-pole 20A/4mm² speaker terminal.

This **CS-120ps** power (current) stage PCB highlights:

- Positions for GSD (mostly Mosfets) oriented types, TO-247 or TO-263. We use EXICON
- One pair of 8A/200V or 16A/200V fit.
- Integrated, symmetrical power supply with sufficient space for serious supply capacitors.
- Multiple positions power supply capacitor bank:
  - 2x6 Ø16/18mm, pitch 7,5mm affordable or high/audio grade radial capacitors.
  - 2x2 Ø30mm, pitch 10mm, low ESR, classy or high value capacitors.
- Quality MKP capacitor in the idle current network.
- Current driven feedback in the centre of PCB with multiple paralleled resistors, reducing noise.
- All significant standard 1% MOX resistors can be replaced by induction free types.
- Speaker output both left and right. Plus and minus each 2 positions, total 40A-2x 4mm²
- No coil in the output line results in way better impulse behaviour.
- Separate Current stage (CS) and Voltage stage (VS) voltage rails.
- Separate tracks for Power-, speaker-, RF-ground, feedback-, VS-stage and input ground.
- Wide and thick (35um) speaker-, ground- and power rails tracks.
- Milled, gold plated beryllium copper connectors, with multiple pin (12x 3A for supply) connections. Way higher quality than regular (1A) headers.

- Speaker signal for signalling/protection purposes at all connectors.
- Input signal available at main central connector for protection electronics.
- PCB position to mount an NTC/PTC at centre, connected to both horizontal connectors. Will be connected to a Protection module if mounted.
- Fits exactly in MODU Slimline/Galaxy 230mm deep cabinets with 2x Ø145mm or 1x Ø 150mm trafo´s.
- High efficient at average/low power due to low idle current, even better than class-D at low levels.
- Dimensions: 228x104mm. Effective height depends on parts used.

In the order process you can selects the types of Power Fets, supply capacitors, resistor types, etc.
So, there are numerous combinations; you will receive exactly the bespoke, unique module you have in mind.
Due to the specifications of the power transistors, resistors and capacitors types/voltage, the final “figures”, sound and pricing of your bespoke built CS-module can differ significantly, depending your choices.
The schematics and PCB layout of a CS-120ps is basically the same as a CS-40ps, but we left out the four extra Monoblock option connectors along the sides. Due to this and the extra 30mm width there is more space, and the supply and speaker tracks could become significantly wider.

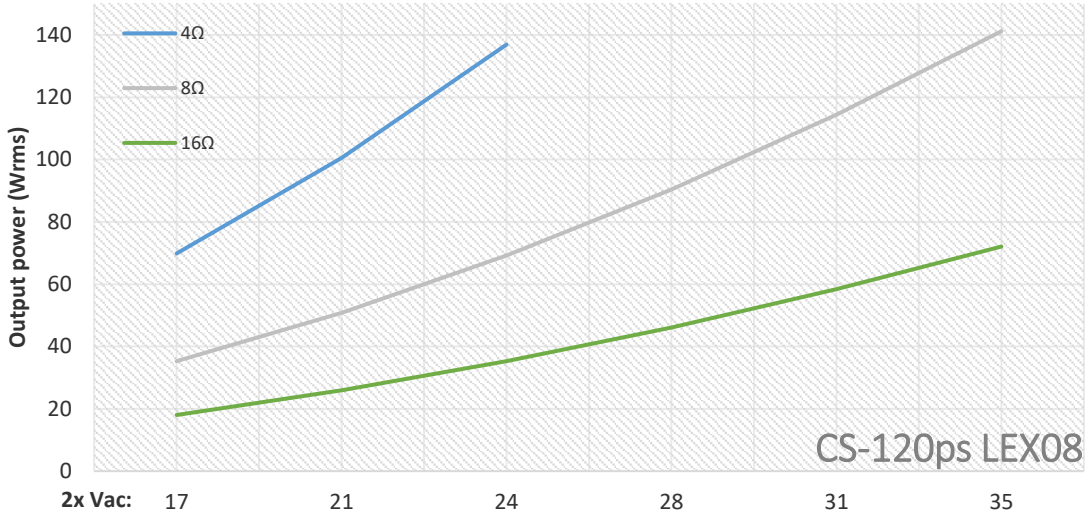
Integrated Power Supply
There is a sufficient symmetrical power supply on board already and you only need to connect a dual secondary windings transformer to it. It should be rated at around 150% of the expected max. Prms of your amplifier module.

Note that the data of the rectifier uses is not exceeded: **8A/140Vac**. This is normally way sufficient. The limited space it got causes a heat up, even though we provided several holes in the PCB around it where cool air can pass. Due to this heating up, the power supply could feed up to aprox. 200Wrms output.
Best is to cool the rectifier extra with an aluminium bar when used in constant high-power situations.

You (or we) can mount all kinds of qualities electrolytic supply capacitors. The choice of a specific type can make a huge difference in the final quality and pricing! We list some in the order process.
Some say that the ones we list are not OK. Well, then select “NONE” and mount the ones you prefer.
We recommend to use > 4700uF/100Wrms. On this board there is way more storage capacity possible.
Actually, while using top class MUNDORF MLGO 63V/Ø30mm types you can mount a total of 2x 20.000uF…..
Since electrolytic capacitors have a limited lifespan, even when stored, we recommend NOT to use cheap N.O.S. versions. Lifespan will be short, and the sound quality could be disappointing!

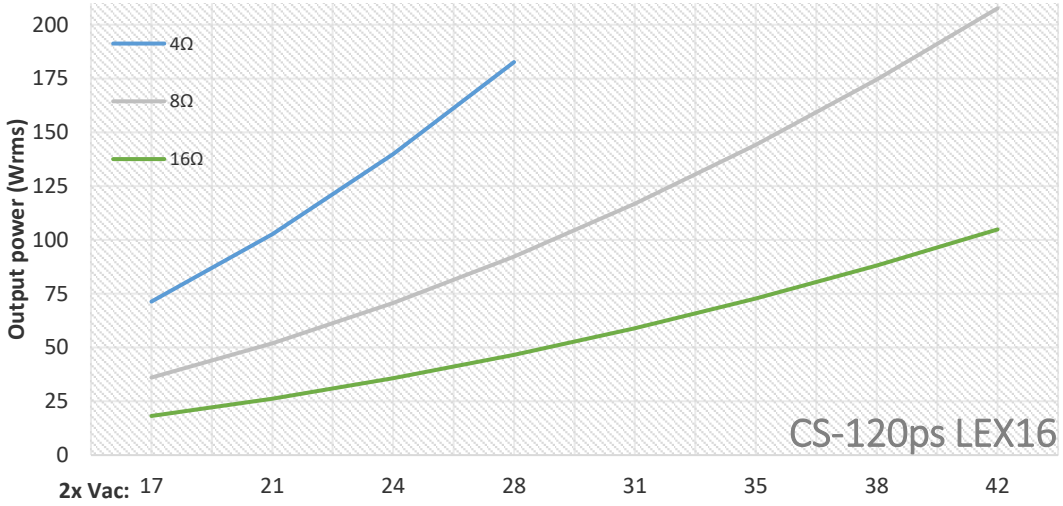
If it all becomes a bit narrow in mounting, we suggest to mount the transformer connector at the bottom side. Then the trafo wiring can be done nicer and out of sight.

Output power for models with audiophile [EXICON lateral Mosfets]:



CS-120ps LEX08, *with EXICON 8A/200V/125W, TO-247 lateral Mosfets* (ECX10N20 / ECX10P20)

The power is limited to around 140Wrms due to the thermal limits of the Mosfets L-mounted to the heatsink.



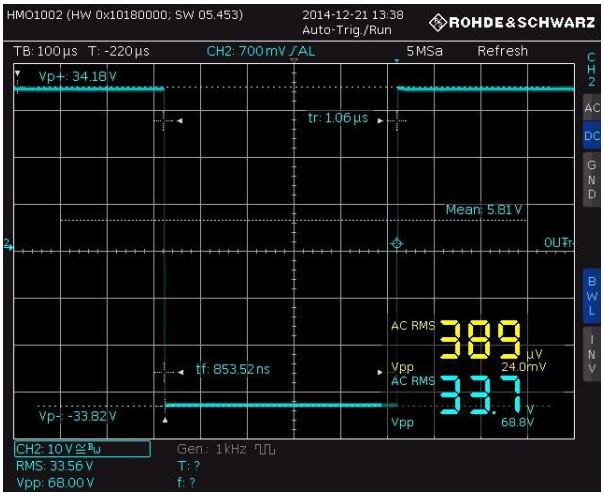
CS-120ps LEX16, *with EXICON 16A/200V/250W, TO-264 lateral Mosfets* (ECW20N20 / ECW20P20)

The power is limited to around 180Wrms due to the thermal limits of the Mosfets L-mounted to the heatsink.

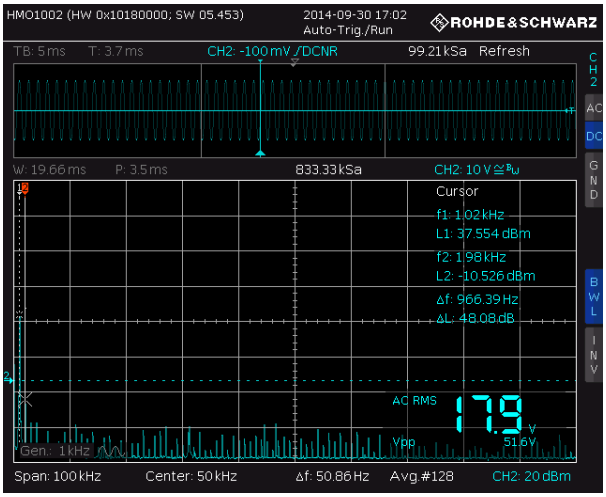
Technical specifications:

Frequency range:	DC - >170kHz within 0,2dB
-3dB point:	> 500kHz
Phase shift:	< -0,3º (DC-15000Hz), -3º @ 20kHz
Distortion figure (THD):	< 0,001% (1W/1kHz/8ohm)
	< 0,002% (80W/1kHz/8ohm)
Slew rate:	> 65V/uS (@ +/- 30V). Limited by AC-input filter on VS-module used.
Harmonics:	<< -60dB, NONE specific, see graph right below. Actually unmeasurable.
Damping factor:	> 350 (strongly depending on power Mosfets and supply capacitors used)
Input voltage:	1 Volt
Input impedance:	47kOhm
Output load:	depending on model and supplied voltages, see graphs
Supply voltage:	Dual secondary transformer, depending on the model, see graphs
Output power:	depending on the model and supplied voltages, see graphs.
Dimensions:	228x104mm, height depends on type of supply capacitors used.

Some measurement data

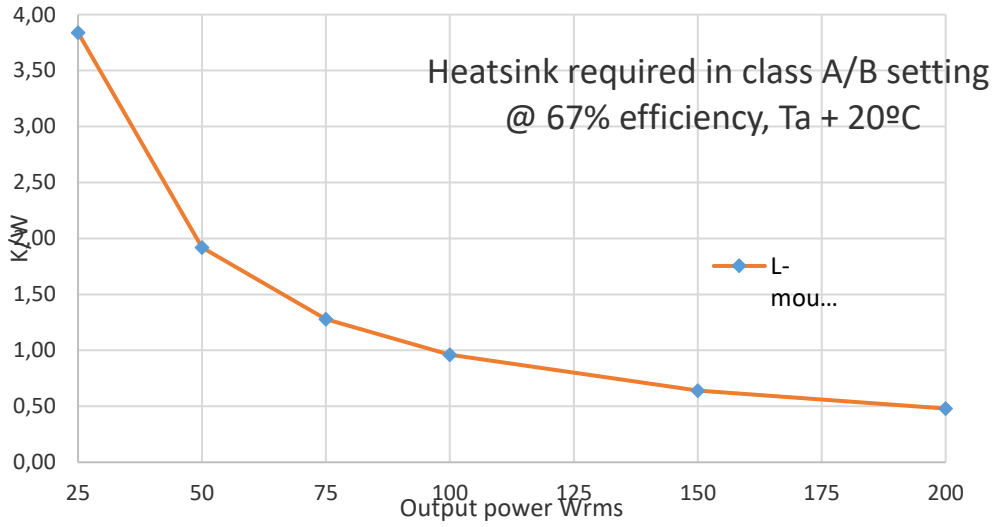


Square wave signal without ANY irregularities
It also shows a slew rate of around 60V/uS.
Limiting factor is the low-pass network in the input circuit!



Frequency domain (100kHz wide) without any significant harmonics.
Please note that we run on 40W/8ohms here, not 1W as others do!

Heatsink data

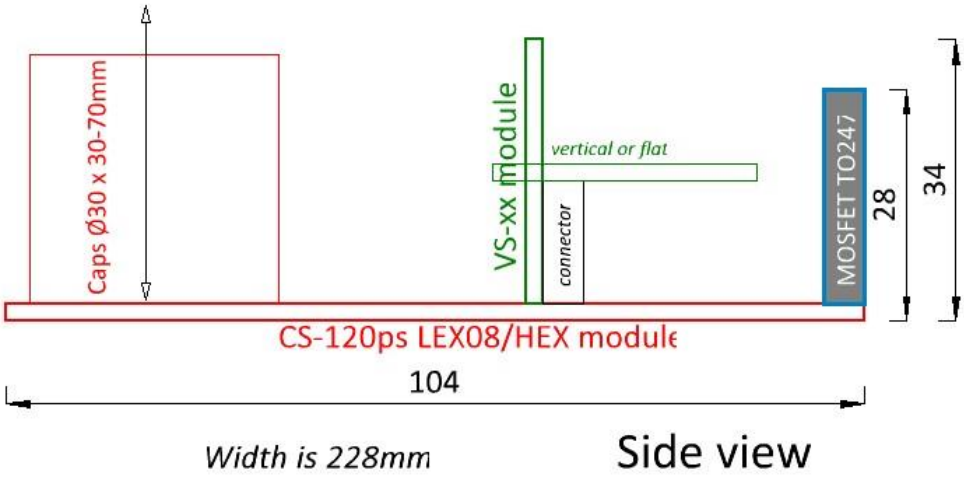


Connector functions

The 5-pole screw connector is where the two secondary windings of a suitable transformer is connected.
The bottom header connector on our CS-120ps modules is where one of our Voltage regulator modules can be mounted, feeding regulated voltages to the VS-input stage only. If a VS-module is used, you must cut away the two 1N4002 diodes just above this connector! Left and right there are two quality fuse holders.
While mounting our Protection Module here, the fuses must be removed and additional headers mounted.
Then, the Protection module takes over the function of the fuses, but in a way more complex manner.

Where is the input?

We split up a power amplifier schematics into a Voltage Stage (input, small voltages) and a Current Stage (output, large currents) in order to get the significantly different sound results compared to all the rest.
The centre connector is where one of our VS-5/VS10/20 Voltage Stage (input) modules is connected, L-mounted or sandwiched. This last option makes the pack a compact version of 34mm in height.
To build a complete and working ELTIM amplifier you always need the combination of a VS- and CS-module!
On our VS-modules you find an ac-input and on most of them even a dc-input. While using this, you could even use our amp as a servo motor drive, just and plain amplifying the input dc voltage……
Unlike most amp designs it works from DC on up to several hundreds of kHz, even limited by us.



Besides the needed VS-connections for basic amplifier function, there are also connections for a PTC which can be connected to any kind of overheating protection electronics like our Protection module.
The PTC also leads via the bottom header connector to our optional Protection module.
Future electronics could take the volume down if all becomes to hot and/or lower/increase the idle current depending the input signal present. The centre contact is leading to the idle current potmeter. Although in our eyes (ears) useless with the extremely linear functioning EXICON Mosfets you could make some kind of automatic Class-A setting system where the amp is set to that while playing at normal levels f.e.

At the left and right connectors the speaker leads are to be connected. Normally we mount a 20A/4mm² screw connector here. Instead we could mount 2x 2 6,3mm gold plated Faston blades.

Protection
First, we delivered a variety of our modules all over the world and use them ourselves for years already.
None of them ever broke down as far as we are aware of, not even under short term 2ohms loads under test.
If you want to protect your speaker, you need one of our Protection modules. It is in development stage.
This module detects differences between in- and output signals (distortion, errors), overload, broken Mosfets (max. 8), over temperature of interior and heatsinks, faulty supply and acts if one or more of these events occurs, f.e. overloading it or if the amp has a fault. It even supplies a variable fan voltage.
LED's for overload, over temperature, distortion and one summing all three indications.
The protection module separates the integrated power supply from the electronics instead of a relay with unsuitable nickel/wolfram contacts causing distortion, especially with small signals. We often wonder why just the speaker is disconnected if an amp has a fault. We take power down instead, which seems more logical.

The Mosfets we use show NO irregularities as many other Mosfets (easy breakdown and oscillations while overloaded) and regular transistors (thermal runaway and oscillations at high power) tend to show.
So far we, nor any of our customers experienced breakdown of power Fets in our designs.

Actually, we only recommend to use our protection module if you use expensive speakers.
Of course, and as stated in our general terms, ELTIM cannot be held accountable for any damage.

Since we build our High-End modules as bespoke versions only,
expect a lead time of about three weeks.

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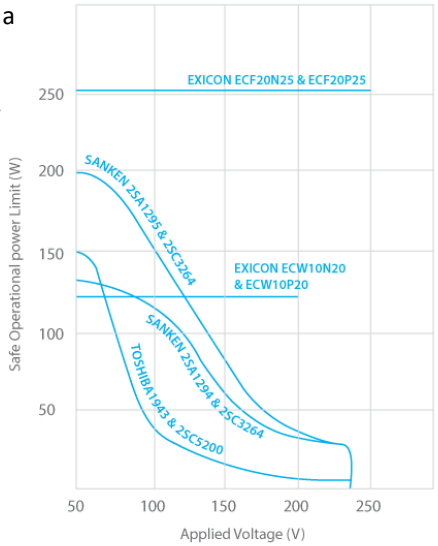
THE MISSING PARTS, or less is more….

While using the Mosfets we do, the schematics can be kept very simple. We don't need to feed the power transistors with a lot of current and they show a negative temperature characteristic. Due to this effect we also don't need to take precautions avoiding a so called "thermal runaway" effect as regular transistor based amps tend to show. We also don't need rows of Mosfets as seen everywhere and required to keep the Mosfets inside their Safe Operating Area (SOA). The ones we use have no SOA and so need only one pair.B y using a fully symmetrical design, electrical AND mechanical, there are no DC-irregularities in the output while switching the amp on or off, there is NO speaker "anti- plop" protection needed, mostly a (distorting) relay in the speaker line. With this amp module there is just a tiny "tick", without any woofer DC shifts when power comes on and about 1,5 secs. some minor distortion when power goes down (@ around 15Vdc) before signal stops, also without slow and far moving around of the woofer cone.
If this short period of distortion disturbs you, take away the input signal with power off or use our protection module, which prevents this event by discharging the power supply fast, instead of a relay in the speaker line.

There is also no output coil in the output line, meant to prevent current peaks. As a matter of fact, especially short impulse peaks make the music more real and this network is killing it……. So, we left this out.
The Fets we use can easily handle these peaks, actually 3-5x more than the supply chain can deliver, so the fuses will blow way before the Mosfets do. We did about all possible, 24 hours of clipping them, etc.

This coil comes from ancient times where the power transistors (f.e. famous mother of all 2N3055) just barely could handle the power even without serious peak currents……
And still they blew out even while rows of them were mounted.
The same counts for older Mosfet based amplifiers giving power Mosfets a bad name in recent past. Their bad "SOA" behaviour also made it necessary to mount multiple pairs instead of just one pair as we use.
The graph at right shows a comparison with famous ones, as many still use today.
This graph comes from Exicon.



LISTENING (yes, not measuring over and over, 5 figures behind the comma….)
We listen to the CS-120ps (MB) module for a real long time in our own living room now and simply forget that it's there. We use it as anyone else would do, listening to music, watch the news, series and movies. Unlike our Accuphase P-450 there are NO irregularities, especially noticed with spoken voices. The bass fundament is simply fantastic and correct and makes you smile at first bass note/drum, especially while looking at the simple setup. The "air" around voices and instruments is amazingly beautiful……. Cymbals singgggggg as they always should do. Not Tsshhh, etc. as heard so often. Even non-audiophile visitors get tears in their eyes ! Actually, we sold our P-450 (€ 10k).
Once an Accuphase Class-A adept noticed the nice P-450 needles waving, "Accuphase really does sound nice" he said. Yes, but our small monoblocks (VS-20/CS-40psMB) were driving the speakers -)
Most of you probably won't believe that this already sounds better than our highly regarded P-450.
Our experiences are confirmed by several true audiophile listeners. They all are amazed about the natural sound and fantastic 3D presentation. The "air" around voices and instruments amazes all, incl. us -)
The wide PCB tracks and quality LINEAR power supply provide a smiling deep and tight bass response.
We also got some replies confirming that the bass is deep and very well under control.
Some confirmed that it sounds better than the high-end stuff (even expensive, regarded brands) they use…….
One word came up more than once: EMOTIONAL. Just as we wanted it and always should be.

Right, marketing bla, bla. NO its not, we are audiophile technicians hating this bla, bla as you do.
Since DIY'ers often want to see (instead of listening), the measured results of our ideas and efforts can be, this is demonstrated in a video. We have more, just search for ELTIM on YouTube.

More specific info of every separate module you can find at our website.

CS-120ps connection:

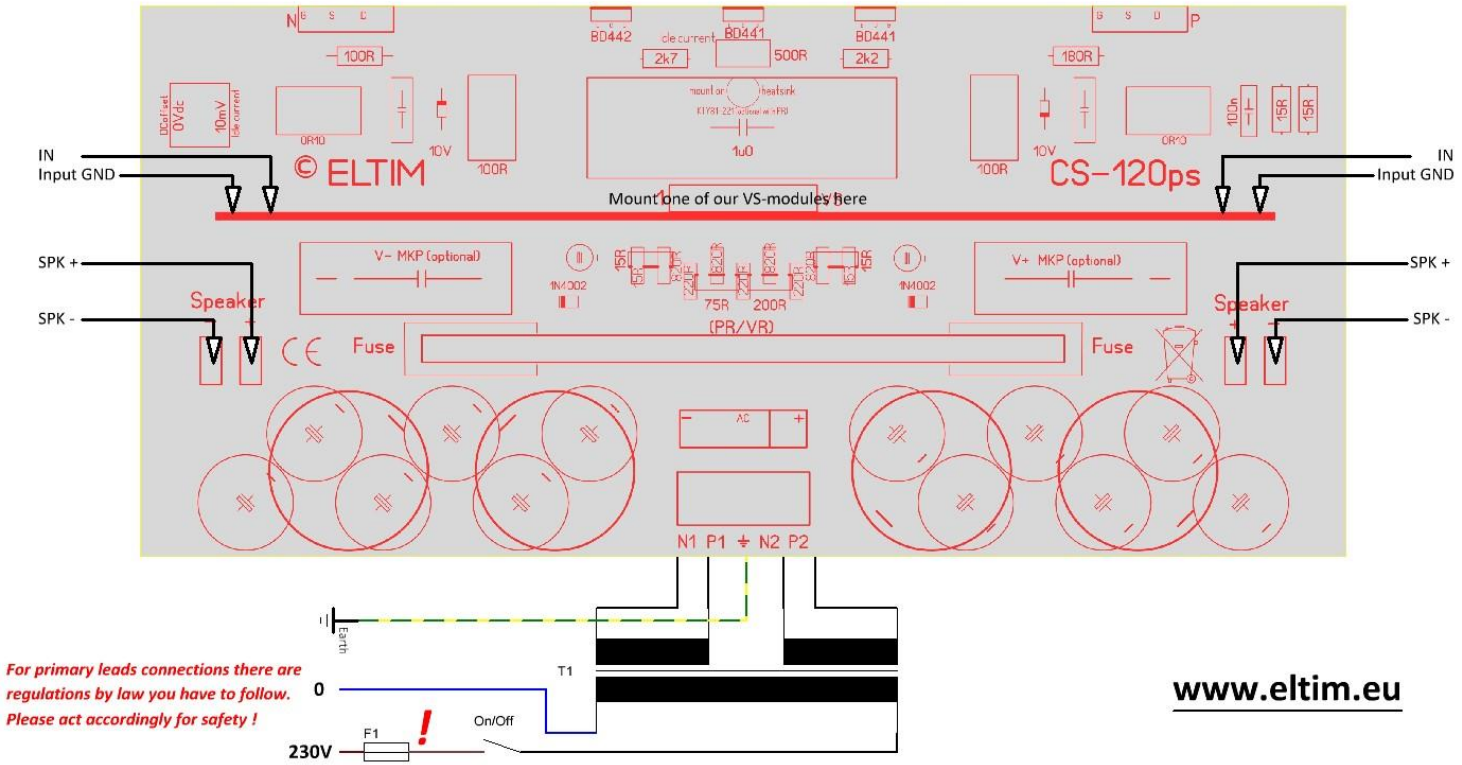
In a basic configuration you just mount a VS-module to the centre connector and the speaker leads left or right of the board.
While doing so, the connecting wires to the connectors can be as short as possible. SO, IT IS NOT A STEREO SETUP AS SOME BELIEVE !

The input signal is fed into the VS-model used, see the specific info of the module in question. The VS-module can be sandwich- or L-mounted.

If a Voltage Regulator board is mounted at the large horizontal connector, you have to remove the diodes just above this connector in order to feed the VS-module with the regulated voltages.

If a Protection module is mounted to the large horizontal connector, you have to remove both fuseholders and insert extra header connections.
In that case, the voltage drop (read: current flow) over the current sense resistors (Sense4+ resp. Sense 4- lines) are interpreted. Our PR-modules detect all kinds of faults and take action if required.

Use a double secondary winding transformer (VA=1,3 * Pmax.) and connect it to the bottom screw terminal as in the schematics below. DONT't FORGET TO USE A FUSE WITH THE CORRECT VALUE !
Also take all precaustions given in different legal documents about primary connections. We do NOT accept any legal actions or claims. It is YOUR responsibility to prevent any damage or injuries.



NOTE: despite the double connections, this is NOT a stereo amplifier!
You can connect the speaker left or right for shortest connection.

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