<u>CS-120MB</u> 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 <u>confirmed by our customers</u>. 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.

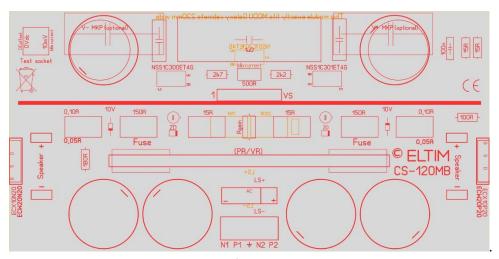
To make a true difference, we split our power amplifier schematics in a voltage- and a current stage board to obtain the maximum possible sound quality. This means that an ELTIM amplifier is based on these two (VS + CS) modules. A VS-input stage processes the sensitive and often small signal voltages 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 and symmetrical 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-120MB module we also integrated a symmetrical power supply. Just connect a transformer. This CS-120MB is the evolved version of our successful CS-40ps MB.

PICTURE SOON

CS-120MB



This CS-120MB is especially made to fit in MODU Galaxy cabinets, 230mm wide.

The power Mosfets are mounted left and right and the profiled aluminium flanks are cooling them.

We used the most linear functioning, rare driving transistors we could find.

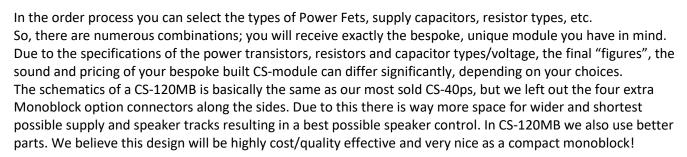
Besides a Current Stage part there is also an integrated symmetrical power supply on board with space for 2x two Ø30/35mm pitch 10mm electrolytic capacitors.

In the idle current circuit fits up to Ø18x55mm MKP capacitor, "just" stabilizing this circuit.

Two significant sized MKP capacitors can be mounted over the power rails, improving sound details.

This **CS-120MB** 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 TO247 or 16A/200V TO263 fit.
- o Driving stage with short tracks and extremely linear functioning, yet rare driving transistors.
- o Integrated, symmetrical power supply with sufficient space for serious supply capacitors.
- o 2x2 Ø30mm, pitch 10mm, low ESR elco's + 2x serious High-End MKP capacitors fit (rec. with 8A).
- 2x2 Ø35mm, pitch 10mm, low ESR elco's + 2x serious High-End MKP capacitors fit (rec. with 16A).
- Large, high quality MKP capacitor in the idle current network possible, stabilising it.
- o Current driven feedback in the centre of PCB with multiple paralleled resistors, reducing noise.
- Power resistors are low induction <u>BOURNS PWR163</u> or induction free <u>CADDOCK MP725</u> SMD.
- The few other resistors are military grade <u>DALE RN60D</u> resistors.
- o Speaker output both left and right (for shortest connection) by 6,3mm gold plated Faston blades.
- No coil in the output line results in way better impulse behaviour.
- Separate Current stage (CS) and Voltage stage (VS) voltage rails.
- o Separate tracks for Power-, VS-supply and input ground.
- Wide, very short 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.
- o Input signal available at main central connector for protection electronics.
- Solder tabs for an NTC/PTC, connected to PR connector.
- o Fits exactly in MODU Galaxy 230mm wide (internal 210mm) cabinets
- o 1x Ø 150mm transformer will fit in 280mm deep Galaxy.
- o High efficient at average/low power due to low idle current, even better than class-D at low levels.
- o Dimensions: 208x104mm. Effective height depends on elco's and VS-module used.



Integrated Power Supply

There is a sufficient symmetrical power supply on board already and you only need to connect a dual secondary windings <u>transformer</u> to it. It should be rated at around 130-150% 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 using > 4700uF/100Wrms. On this board there is way more storage capacity possible.

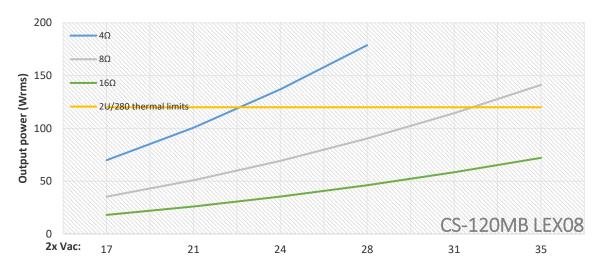
Actually, while using top class MUNDORF MLGO 63V/Ø35mm types you can mount a total of 2x 30.000uF.....

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 mounting the transformer connector at the bottom side. Then the trafo wiring can be done nicer and out of sight.

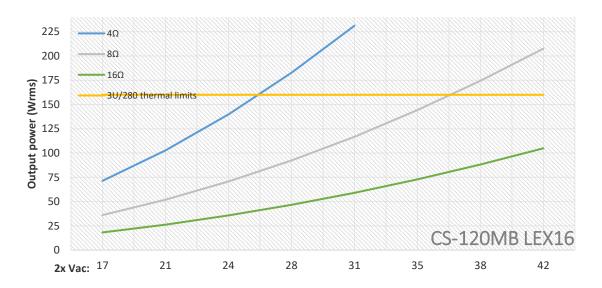


Output power for models with audiophile EXICON lateral Mosfets:



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

The power is limited to around 150Wrms due to the thermal limits of the 8A Mosfets L-mounted to 280x120mm flanks.



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

The power is limited to around 200Wrms due to the thermal limits of the 16A Mosfets L-mounted to 350x165mm flanks.

Technical specifications:

Frequency range: DC - >170kHz within 0,2dB

-3dB point: > 500kHz

Phase shift: < -0,3º (DC-20.000Hz), -3º @ 25kHz

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. << -60dB, NONE specific, see graph right below. Actually unmeasurable. > 350 (strongly depending on power Mosfets and supply capacitors used)

Input voltage: 1 Volt

Input impedance: See VS-module specifications

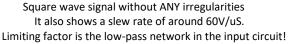
Output load: Depending on model and supplied voltages, see graphs

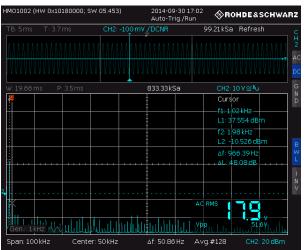
Supply voltage: Dual secondary transformer, depending on the model, see graphs
Output power: Depending on the model and supplied voltages, see graphs.

208x104mm, height depends on type of supply capacitors used.

Some measurement data

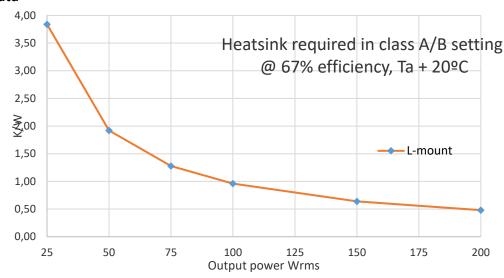






Frequency domain (100kHz wide) without any significant harmonics. Please note that we run on 40W/80hms here, not 1W as others do!

Heatsink data

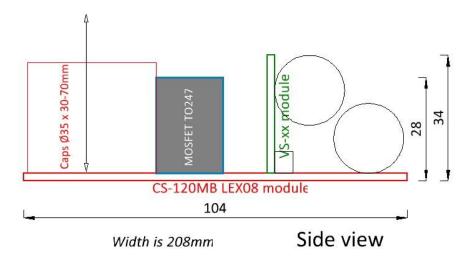


Connector functions

The 5-pole screw connector is where the two secondary windings of a suitable transformer is connected. The bottom header connector on our CS-120MB modules is where one of our Voltage regulator or Protection modules can be mounted, both feeding regulated voltages to the VS-input stage only. If a VS/PR-module is used, you must cut away the two ZD marked diodes just above the VS-connector! Left and right of the VR-connector there are two quality fuse holders. While mounting our Protection Module here, the fuse holders must be replaced by additional headers. Then, the Protection module takes over the function of the fuses, but in a way more complex manner, controlling overheating, overload, distortion, etc.

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. They all have line inputs. You can make a balanced input by use of one of our input buffer modules. 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, limited by us. Taking out all frequency limiting parts, this CS-120MB module runs over 2MHz.....



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. This PTC leads via the bottom header connector to our optional Protection module.

The centre contact of the VS-connector is leading to the idle current potmeter. Standard our amps are set in classical A/B setting. From that point on EXICONS are extremely linear already, where increasing of the idle current to a heat consuming class-A setting is useless because linearity will hardly increase. Still, you could make some kind of automatic Class-A setting system while playing f.e. at lower levels.

At the left OR right the speaker leads are to be connected by 6,3mm gold plated Faston blades. NOTE: it is obvious that despite the double speaker connections this is a single channel setup......
We did this because you can make the speaker leads as short as possible only or better: use double wiring!

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 20hms loads under test. In that case about always the thermal limits of the cooling surface are limiting the max. power. Unlike about all commonly used Mosfets, EXICON's have hardly a SOA and will not break down easily. 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. 4 pairs), 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 provides 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 the 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, bad SOA and oscillations at high power) tend to show. Since January 2025 the production process is improved making them even more reliable.

We only recommend using our protection module if you use expensive and/or unique 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 unique, bespoke versions only, expect a lead time of about four weeks.

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CS-120MB connection:



The AC and DC input lines are at the VS-module, see the specific info of the module in question

The Monoblock structure improves specs by use of power Mosfets mounted left and right, directly themal contacting MODU Galaxy 230mm wide cabinets,

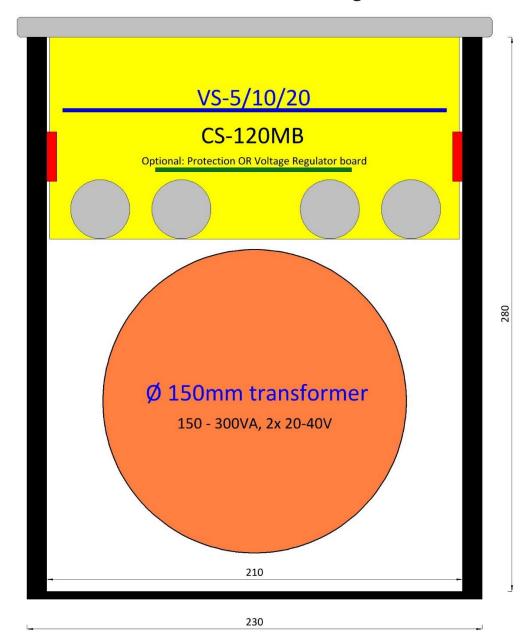
which are 10mm thick aluminium profiled flanks. In the MONOBLOCK configuration you also mount a VS-module to the centre, L-mounted.

If you are using more than ±35Vdc, it might be possible that you need this VR-module since otherwise the VS-module used could be damaged. Read the bulletin of the VS-module you want to use. Left and right of the voltage regulator connector are secondary fuses. A mounted Protecion module takes over this function and the fuse holders have to be replaced by extra headers then. If a Protection or Voltage regulator module is mounted to the large horizontal connector, you have to remove the two diodes ZD on the CS module. A better high-end input cap can be mounted seperately and connected to DCin.

Use a double secondary winding transformer and connect it to the bottom screw terminal as in the schematics below. DONT't FORGET TO USE A PRIMARY 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. SPK+ IN ac IN dc Sgnd SPK Side mounted Mosfet MODU Galaxy 10mm profiled flank 882 For primary leads connections there an regulations by law you have to follow www.eltim.eu Please act accordingly for safety! CS-120MB Fuse V NZ On/Off ELTIM Fuse 0 ≥ □ Side mounted Mos MODU Galaxy 10mm profiled flank IN ac IN dc Sgnd SPK + SPK

NOTE: despite the double input and speaker connections, this is NOT a stereo amplifier! It is a MONOBLOCK. You can connect the input signal and speaker leads at left OR right.

CS-120MB Monoblock configuration



Cabinet recommendations: CS-120MB 8A: MODU Galaxy 230 x 280 x 120 CS-120MB 16A: MODU Galaxy 230 x 350 x 165



MODU Galaxy 230x280x120mm



MODU Galaxy 230x350x165mm

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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. By using a fully symmetrical electrical and PCB design, 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.

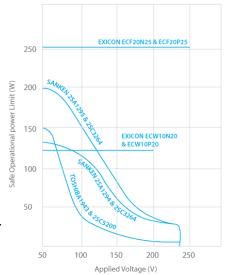
The Fets we use can easily handle these peaks, actually 3-5x more than the supply chain can deliver, so the fuses will blow way before the Mosfets do. We did about all possible, 24 hours of clipping them, etc.

This output 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 "<u>SOA</u>" 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. 2025 versions perform even better.



LISTENING (yes, not measuring over and over, 5 figures behind the comma....)

We listen to the simpler CS-40ps 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. 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 "tube like"...... Cymbals singgggggggg as they always should do. Not Tsshhh, etc. as heard so often.

Even non-audiophile visitors get tears in their eyes! This CS-120MB is schematically the same as best sold CS-40ps, but uses better parts and allows for way wider and shortest possible speaker and supply tracks.

Once an Accuphase Class-A adept noticed our nice P-450 needles waving, "Accuphase really does sound nice" he said. Yes, but surprise: 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 <u>confirmed by several true audiophile</u> listeners. They all are amazed about the natural sound and fantastic 3D presentation. The "air" around voices and instruments amazes all, incl. us while listening with our <u>Solo speakers</u>. The wide PCB tracks and quality LINEAR power supply provide a smiling deep and tight bass response, even where "just" but unique MOREL SCM634 16cm widebanders are used.

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......

Two words came up more than once: MUSICAL and EMOTIONAL Just as we wanted it and always should be.

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