



TAC user manual

1 Introduction

TAC is a tactical eurorack power supply meant to simplify and unify your power solutions while travelling and in the studio. Simply unplug your rack, grab your favourite power bank,¹ and go!

2 Features

- Dimensions: 128.5 *mm* x 20 *mm* (3U high, 4 HP wide), 35 *mm* deep
- +12 *V*, -12 *V* and +5 *V* outputs
- USB C powered
- Ripple and noise: 4 *mV_{RMS}* max, 2 *mV_{RMS}* typical
- Efficiency: > 85 % for ±12 *V*, 33 % for +5 *V*
- Operating temperature: below 40°C
- LED indicators for all rails and fault conditions
- CE and RoHS certified

3 Installation

The module needs to be installed in a eurorack case compatible with the Doepfer specification ([link](#)) using two M3 screws. While connecting ribbon cables, it's important to support the printed circuit board from the other side; otherwise, the module can be irreversibly damaged due to excessive

¹The power bank has to support USB-C PD with 15 *V* or 20 *V* output and sufficient power capacity.

torque. Screw terminals, if used, should be properly tensioned to make sure wires don't slide out during operation or present excessive contact resistance. When using with DC power source with a PSU inside the case, make sure that the PSU is secured to the case.

4 Warranty

The device is covered by a 2-year warranty for any factory defects. The extended 10-year warranty covers any failures while the device is used reasonably. The definition of reasonability will be handled on a case by case basis. While the device incorporates a lot of protections, malfunction resulting from user error is not covered by the warranty. Possible mistakes include, but are not limited to: improperly tightening screw terminals, bending pins or otherwise damaging connectors while plugging or unplugging them, shorting output pins and blocking device cooling. Please contact support@noiseofantimatter.com with any questions, warranty inquiries, or any requests and comments.

5 Electrical specifications

The TAC is meant to power eurorack modular systems and consequently adheres to its power supply requirements. Eurorack (IDC) power connectors are provided for either plugging modules directly or attaching a "flying" busboard. The red stripe, indicating -12 V should go to the bottom of the connectors, indicated by the arrow and "red" text.

The power supply supports two modes of operation: high power and low power. Both power modes both work with a USB-C power source and are primarily provided to accommodate different capabilities of USB C chargers available on the market², but their properties also differ slightly. The low power mode has lower maximum load on 5 V rail, than the high power mode.

6 Heat management

TAC packs a lot of power in a very small volume and while it's very efficient, it still generates some waste heat. It's been designed to cope with that heat,

²many laptop chargers seem to support 20V mode only, while many phone power banks seem to support 15V mode only

but it's important that you don't stress it more than it needs to be. This way, you can make sure that your TAC will perform happily for years to come. Few things to keep in mind:

- Don't cover the aluminium panel with poor heat conductors, for e.g. stickers or cloth.
- Dust the insides periodically. Depending on how often you play, in what environment and how open the case is, we recommend cleaning every 6 months to 3 years. Don't soak the module, instead gently brush or blow the dust off. It doesn't have to look brand new, but reasonable maintenance is expected.
- Don't block the airflow inside or outside the case.

Finally, keep in mind that although the module can get hot while operating, it should still be touchable (should be below 60°C). If you feel like you can't safely keep your hand on the front panel for a prolonged time, something is wrong. In such case, please disconnect power immediately, make sure you are not overloading the TAC and contact support at: support@noiseofantimatter.com

Table 1: Summary of power supply modes

mode	power source	V_{in}	+5 V max	+12 V max	-12 V max	combined max
low power	USB-C	20 V	0.2 A	2 A	0.7 A	2 A
high power	USB-C	15 V	0.3 A	2 A	0.3 A	2 A
external power	screw term.	14.5 – 30 V	$\frac{4.5W}{V_{in}-5V}$	3 A	depends	3 A

7 Advanced and DIY users

Reading this section is not required to use the product. Its sole purpose is to satisfy curiosity of inquiring engineers and give a bit more information to anyone modding TAC or seeking to use the external mode.

7.1 Input voltage

The device has input undervoltage protection configured at 13 V. What it means is that any input below 13 V should not activate the device and any power drawn should be minimal. Between 13 V and 14.5 V, the output voltage may be poorly regulated, falling below 12 V due to duty cycle requirements. Operation in this region is not recommended, but shouldn't be a problem to experiment at light loads. The maximum input voltage is 30 V. Operation with any supply between 14.5 V and 30 V is allowed with certain limitations, as described further.

7.2 The +5 V rail

Our observations show that usage of +5 V rail is increasingly rare. Nevertheless, we decided to provide it for the odd module or two requiring it. It is generated using a linear regulator, meaning that efficiency is very poor, decrease further with increasing input voltage. That's why in high power mode, there's lower amperage available on it. The heat generated by the regulator can be calculated using this simple equation:

$$P_{5V} = (V_{in} - 5V) I$$

Where V_{in} is input voltage and I is current drawn from +5 V rail. For constructions requiring a lot of power at +5 V it's recommended to use the lowest possible input voltage.

7.2.1 Additional limits on output currents

As can be clearly seen in the previous section, the available output current depends on supply voltage. The full set of equations describing that is rather

complex:

$$4.35 A \geq I_{+12V} + I_{-12V} \frac{V_{in}}{12 V} + \frac{144 V^2}{V_{in} 26.4\Omega}$$

$$4.2 A \geq I_{+12V} + I_{-12V} \frac{V_{in}}{12 V}$$

$$3.2 A \geq I_{+12V}$$

$$I_{-12V} \leq I_{+12V} \frac{12 V}{V_{in}} + 0.6 A$$

Additionally stability of $-12 V$ decreases with decreasing input voltage due to increasing duty cycle.

Fortunately, a few general rules and conclusions can be easily derived:

- the $+12 V$ rail should not be loaded above $3 A$
- the $-12 V$ rail stresses the system more with higher input voltage
- increasing input voltage generally decreases available output power on $-12 V$

7.3 Additional headers

TAC has place provisioned for screw terminals for both input supply and output rails. They can be used to put the power supply inside the case and power it from external DC source or connect via wires to busboard.

8 Warnings

Warning: The device isn't liquid-resistant. Don't use the device if wet. Disconnect power source immediately upon contact with any liquid.

Warning: Only one of the connectors (either USB C or the DC power input) can be used. Make sure you never plug in both the USB C and the DC-input connector at the same time! Doing so may lead to damage of either power source.

Warning: While the device is protected against accidental short circuits, operating in such condition for prolonged time may shorten the device's lifespan or destroy it! If you see that LEDs corresponding to any of the output rails don't turn on, unplug the USB C cable within 30 seconds.

Warning: Make sure to not pull excessively on USB C connector. While reinforced, it's still small and fragile, just like on your phone!

9 Compliance

Noise of Antimatter verifies that a properly constructed modular system, adhering to the Doepfer standard, based on cases, TAC power supply, power distribution boards and a coherent selection of modules (including ones from other manufacturers) meets the requirements defined by international certification bodies. The device refers to the Eurorack module, properly installed, powered, and patched as part of a system. Changes / modifications could void the user's authority to operate the equipment. This device meets the requirements of the following standards:

- EN55032. Electromagnetic compatibility of multimedia equipment. Emission requirements.
- EN55103-2. Electromagnetic compatibility - Product family standard for audio, video, audiovisual and entertainment lighting control apparatus for professional use.
- EN55015. Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.
- EN61000-3-2. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
- EN61000-3-3. Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection.
- EN62311. Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz).