

Build one quad-R9700 server

Nick didn't write this. It's an AI compilation of the journey across research, design, and building all three computers. Where it says "I" or "we", that's Nick's build, told from his build chats, photos and notes.

Use this guide at your own risk. It records what we did with our own hardware in October 2026. It isn't professional, electrical or safety advice, and it comes with no warranty of any kind. Building and running these machines involves mains power, heavy parts and expensive components that can be damaged, and opening or changing hardware can void its warranty. The manufacturers' instructions and safety warnings come first; follow them wherever this guide differs. Have a qualified electrician check your circuits before you run a machine like this. Prices, parts and software change, so check them yourself. You are responsible for your own build; Nick Reese and his companies accept no liability for any damage, injury or loss from using this guide. No manufacturer sponsored, reviewed or endorsed it, and product names belong to their owners.

By Nick Reese. These machines keep USAArms.com up to date.

The photo guide for the machines in the video. One case, one EPYC, 128 GB of memory and four 32 GB Radeon AI PRO R9700 cards. I built three of these. Every step below shows what to do, a photo of what it looks like, and how to check it before you move on. No previous server-building experience is assumed.

How to use it: read the step → find the part in the photo → do it → check it. If anything doesn't match what you see, stop with the power unplugged and sort that one thing out before going on. Nothing here has a time limit.

Lesson one, before you buy anything: secure the motherboard first. While we were buying, there was a global shortage of this board. Prices went from about \$700 to \$1,300, almost no one actually had them in stock, and three of our orders were cancelled, one of them for the other board we looked at, the Supermicro **H12SSL-i**. I finally found four boards in Helsinki and paid big import fees to get them in. As of this writing (October 2026) they're back in stock on Newegg from about \$800, but supply chains change all the time, so lock in the board before you order the rest. This guide covers only the ASRock Rack **ROMED8-2T/BCM**.

Three rules for the whole build:

1. **The AC cord stays unplugged** unless a step tells you to power on. The power supply's fan switch is not an off switch.
2. **Never force anything.** If a part won't seat, line up or screw in, stop and look again. A screw is never used to pull a part into place.
3. **Labels beat colours.** Connectors are identified by their printed names, keys and pin rows, never by wire colour or by how they look in a photo.

Two ways to use this guide

- **Hand it to your AI.** This guide isn't really meant for you to read cover to cover. Download the text version (Markdown), give it to your AI along with your own parts, budget and room, and have it walk you through the build step by step, changing what we found worked to fit what you have.
- **Print the PDF for the bench.** It's the same guide with our photos: every chapter has its steps, photos of what it looks like, and a check before you move on. The BIOS screens are in chapter 07, the colour-coded motherboard wiring in chapter 06, and the GPU wiring photos at the back.

How we got here tells the story behind the guide: research, design and building all three computers.

Download these first

The guide cites page numbers in the manufacturers' own documents instead of copying their pages. Get them before you start:

- ASRock Rack ROMED8-2T/BCM user manual (motherboard: standoffs, CPU, memory, M.2, headers, rear panel)
- ARCTIC Freezer 4U-M Rev.2 support page (cooler: the **AMD** instructions) and ARCTIC MX-7 (paste pattern)
- SilverStone HELA 2050R manual (power supply: cable families and outputs)
- SilverStone RM44 (case: fan retainers, support bar)
- ASRock Radeon AI PRO R9700 Creator (the cards and their power adapter)
- AMD: how to install EPYC processors (a short video of the SP3 socket, carrier and rails)
- Ubuntu Server 26.04.1 (the operating system we installed)

The order at a glance

Stage	Chapters	What happens
1. Bench and case	00–02b	Sort the parts, open the case, fit the power supply and the three front fans.
2. Motherboard	03–04c	Standoffs, I/O shield and board, then CPU, memory and SSD while everything is easy to reach.
3. Cooling	04d–05c	Prepare the cooler <i>before</i> the paste, mount it, then its two fans, then the two rear fans.
4. Wiring	06a–06c	Short fan leads first, then the tiny front-panel plugs, then the big power cables.
5. BIOS and Ubuntu, no GPUs	07	Five BIOS settings, install Ubuntu, test the base machine, then shut it down and unplug it.
6. Four GPUs	08–09b	All four cards in one sitting, from the case wall toward the CPU, with AC unplugged the whole time.
7. Finish	10–12	Check every hidden connection, decide card support, leave the lid off until it fits freely.

Why this order:

- **Small before big.** Fan leads and front-panel plugs are tiny and short. Connect them before the thick power cables cover that edge of the board.
- **Rear fans whenever it's easiest.** Our 3D model said the cooler needed the rear fans out of its way, so earlier versions of this guide put them after it. In the real builds the cooler fit fine with the rear fans already in.

- **Prepare the cooler before the paste.** Fit its clips, take off its fans and peel its film first, so pasted parts never sit waiting.
- **Base machine before GPUs.** If the CPU, memory or BIOS has a problem, you find it without four heavy cards and nine cables in the way.
- **Lid sensor before the first card.** Its little plug hides behind the cards once they're in.
- **Cards from the wall toward the CPU.** PCIe1 → PCIe3 → PCIe5 → PCIe7, so there's always open space beside the next card.

The wiring map

The guide gives each card and cable a short name so you can track it. **These names are not printed on the parts.** Put a piece of tape on each cable as you go.

Card	Slot	Order	Power
G04	PCIe1 (wall side)	1st	ASRock adapter WA4 , fed by three separate PCIe cables WP4, WP5, WP6
G03	PCIe3	2nd	ASRock adapter WA3 , fed by three separate PCIe cables WP1, WP2, WP3
G02	PCIe5	3rd	Native 12V-2x6 cable WN2 , straight from the PSU
G01	PCIe7 (CPU side)	4th	Native 12V-2x6 cable WN1 , straight from the PSU
Motherboard socket		Cable	
ATXPWR1 (24-pin)		W03 , the main ATX cable. Two plugs at the PSU, one 20+4 plug at the board.	
ATX12V1 (8-pin CPU)		W01 , the first EPS 4+4 cable, both halves together.	
ATX12V2 (4-pin CPU)		W02 , a second, separate EPS 4+4 cable, one half only.	
GFX_12V1 (6-pin)		W04 , a dedicated PCIe cable. The board needs this when four cards are installed.	

That's seven PCIe cables (WP1–WP6 and W04) plus two EPS cables: nine of the PSU's shared eight-pin outputs. The two native outputs and the ATX sockets are separate. **A second plug on the same cable never counts as another feed.**

Know the parts and the words

The parts in this build: SilverStone **RM44** case · ASRock Rack **ROMED8-2T/BCM** motherboard · AMD **EPYC 7452** · eight Samsung **16 GB DDR4 RDIMMs** (M393A2K43BB1-CTD6Q, 128 GB total) · Samsung **990 PRO 1 TB** NVMe SSD · ARCTIC **Freezer 4U-M Rev.2** cooler · SilverStone **HELA 2050R** power supply · four ASRock **Creator R9700** 32 GB cards · three ARCTIC **P12 Pro PST** front fans · two Noctua **NF-A8 PWM** rear fans.

Tools: a hand screwdriver set, a **PH1** Phillips (for the cooler), the CPU socket's own **calibrated torque tool**, an anti-static wrist strap, plain isopropyl alcohol (90%+), lint-free cloth or a clean coffee filter, small labelled cups for screws, tape for cable labels, and a good light.

What it cost us

What we paid for each computer: the average of our receipts from September and October 2026, including the tax and shipping on them. Prices move, so check current ones before you buy. Tools, smart plugs, meters, network cables and spare parts aren't included.

Part	Per computer	Paid, per computer
ASRock Radeon AI PRO R9700 Creator, 32 GB	4	\$7,244.58
AMD EPYC 7452, 32 cores	1	\$127.17
ASRock Rack ROMED8-2T/BCM motherboard	1	\$1,162.39
Samsung DDR4-2666 ECC RDIMM, 16 GB (128 GB total)	8	\$860.59
Samsung 990 PRO 1 TB NVMe SSD	1	\$254.39
SilverStone RM44 4U case	1	\$388.40
SilverStone HELA 2050R Platinum power supply	1	\$578.92
ARCTIC Freezer 4U-M Rev.2 CPU cooler	1	\$56.96
ARCTIC P12 Pro PST, 120 mm front fans	3	\$11.51
Noctua NF-A8 PWM, 80 mm rear fans	2	\$38.06
SP3 / TR4 CPU carrier frame	1	\$4.58
99% isopropyl alcohol and ARCTIC MX-6 paste	shared	\$6.37
Total		\$10,733.91

Links to buy each part are in the blog post for this build: nicholasreese.com/why-i-started-moving-inference-in-house.

All three computers came to **\$32,201.72**. The four cards are two-thirds of the cost; the rest of the machine is cheap by comparison, which is why we also run our CI/CD jobs on its CPU.

Our memory came from a server-parts reseller, and some sticks carry the reseller's or a server maker's label instead of Samsung's. Match the part number and the specification (DDR4-2666 ECC registered, 16 GB), not the sticker.

What else you need

- **Two network cables** and a router or switch with free ports: one for the board's management port (**IPMI_LAN1**) and one for a data port. You run the whole setup from a browser on another computer, so no monitor or keyboard is needed.
- **A USB stick** of 8 GB or more for the Ubuntu installer.
- **Enough electrical capacity.** Each of our machines has its own 15 A, 120 V circuit; we never put two on one circuit. At our 210 W limit the four cards alone draw about 840 W under load, before the CPU, fans and power-supply losses, and the cards go back to their 300 W default after a cold power-off (see *What we run on them*). Have a qualified electrician confirm that your circuit and outlet can carry the load continuously.

The words

- **Standoff:** the short threaded post between the case floor and the motherboard. The screw goes in from above.
- **I/O shield:** the thin metal plate around the board's rear ports. It goes in the case first.
- **Socket / carrier / load plate:** the CPU sits in a plastic **carrier** (green on ours). The carrier slides into the socket's hinged **rail frame**. The outer metal **load plate** clamps it all down with three screws. The black **shipping cap** is a protector you remove; it is not the carrier.
- **RDIMM:** server memory. It has an off-centre notch on its gold edge that must match the slot.
- **M.2 / NVMe:** the small stick-shaped SSD. It slides in at an angle and is held by one tiny screw from the motherboard box.
- **Header / pin / key:** a header is a row of pins on the board. A **key** (a missing pin, a blocked hole, or a notch in the plastic) shows which way the plug goes.
- **ATX / EPS / PCIe 6+2:** three different power-cable families. They look alike. They are **not** interchangeable.
- **Native 12V-2x6 / adapter:** a native cable runs from the PSU straight to the card's 16-pin socket. The ASRock adapter combines **three separate** PCIe cables into that same socket.
- **Polarity:** LEDs have a plus and a minus side. Switches don't care.
- **Intake / exhaust:** air comes in the front and goes out the back. Every fan frame has a straight arrow showing which way the air moves.
- **ESD:** static electricity. Wear a grounded wrist strap and hold boards by their edges.
- **BMC / IPMI:** a tiny computer on the motherboard that lets you see the screen and press the power button over the network. Its port is labelled **IPMI_LAN1**; keep it on a private network.
- **POST:** the startup self-test that runs before the BIOS screen.

Before you touch a part

Leave every electronic part in its bag until its step. Set up a stable, well-lit bench with labelled cups for screws, the motherboard manual and ARCTIC's **AMD** instructions. Wear the wrist strap the way the manual shows. Never plug in the AC cord just to ground yourself.

Three things this guide won't guess for you: the CPU socket's torque setting (use the tool and setting for the socket you actually have), how your case lid comes off, and whether the case's GPU support bar fits these cards with this cooler. Where those come up, the step tells you to stop until you have the real answer.

How we got here

The short story of research, design and three builds, compiled from Nick's build chats, photos and notes. The chapters are what to do; this is why the guide looks the way it does.

Why we built them

Over the past year we spent more than \$100k on compute. We heavily tested Luna 6, Kimi, GLM 5.3 and Qwen 3.8 27B. On cost against performance Qwen 3.8 won; GLM 5.3 won on pure performance, but not at a price we could scale. Then the hosted model we relied on started refusing routine research for USA Arms, so we decided to move inference in-house, for privacy and business continuity. As Nick put it to his wife: "If the model can change at any time, we can't build business processes on it."

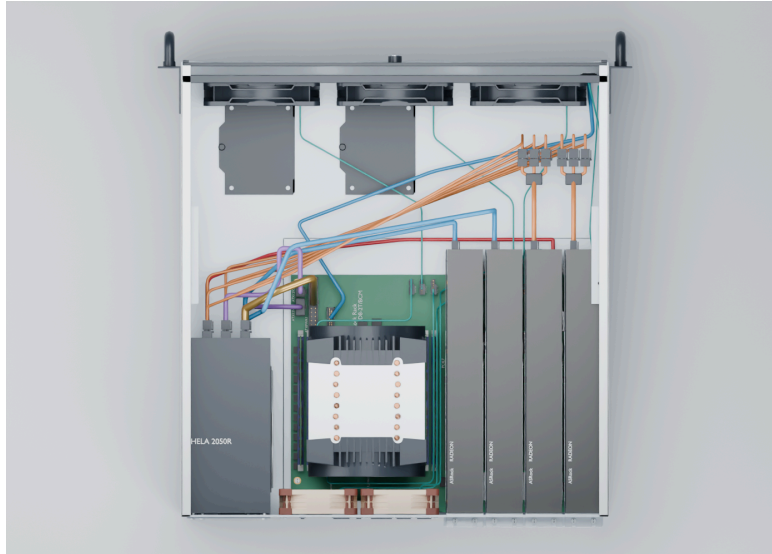
We benchmarked our six Macs, did the math, and realised scaling them meant spending a lot more. That's when the R9700 caught our attention, on the LocalLLaMA subreddit.

Research (late September)

- **Plans from agents.** Two agents spent about a day drafting complete build plans while two more gathered what the R9700 community had already learned. Their plans were compared side by side and became this build: an EPYC on a server board with eight memory channels, one large power supply and four cards per machine.
- **Cards first.** Nick ordered eight cards to secure them while they were in stock, then four more. A few orders were cancelled and replaced along the way.
- **The board was the hard part.** Lesson one at the top of this guide is that story.

Design (September 29 – October 3)

- **A digital twin.** While we waited for motherboards, we built the whole machine in Blender so the assembly could be planned before any part went in a case. iPhone 3D scans of the real parts "work like garbo", so the model came from the manufacturers' CAD files and drawings, checked against photos of our parts.
- **It changed the order.** At frame 476 of the model's assembly, the cooler's fan ran into the rear case fans and their wiring, so the rear fans moved after the cooler. (In the real builds the cooler fit either way, so the rear fans can go in whenever it's easiest.)
- **Videos, then this.** Nick's direction was "it does not have to be 1 to 1... but assembly must be great", so the twin became chapter-by-chapter assembly videos. Halfway through the first build: "the videos are kinda bleh... honestly the screenshots and chat handle most of it better." This written, photo-first guide replaced them.



The design: the digital twin, modelled in Blender before the first build.



The build: the real thing, with its four cards, cooler, rear fans and power supply.

Computer 1 (October 6–7)

Built over an evening and into the night, with the chat open on a phone.

- **What tripped us up**, and where it's fixed now:
 - the case's own rear fans had to come out first (chapter 01);
 - a four-pin fan plug on a six-pin header (chapter 06a);
 - which row of the stacked front-panel pins to use (chapter 06b);
 - the case's front USB-C cable has nowhere to go on this board (chapter 06b);
 - "oh crap we shoulda wired all of this up before it is obstructed by the case": small leads before big cables (chapter 06).
- **No monitor needed.** The board's management port and its browser console did everything. The USB stick wouldn't boot, so Ubuntu went in through the console's virtual media (chapter 07).

- **Overnight**, the agent tested the CPU and memory and wrote the setup scripts later reused on computers 2 and 3.
- **The morning's scare.** Nick didn't want to do the cards one at a time, so all four went in together. One card was already in before we realised it would hide the lid-sensor plug, so the lid sensor now comes before the first card. Then: no picture and no SSH. All sixteen of the cards' DisplayPort outputs were tried. The cards came out, a memory module was reseated, the BIOS was set to onboard graphics with CSM off, and with the cards back in, Ubuntu came up with all four. Several things changed at once, so we can't say which one fixed it. That's why chapter 07 sets the BIOS before any card goes in.

Tuning computer 1 (October 7–8)

- **One card ran hot.** On the first long test, the card in PCIE3 hit our 90 °C junction cutoff twice. With the case open we cleared loose cables away from the front fans and the cards' intakes, and swapped that card with the one in PCIE1. No card fault showed up after that. For the card area's heat, see Fans and heat.
- **Test every card early.** Load-test each card soon after it arrives, so a real fault shows up while it's simple to deal with.

Computers 2 and 3 (October 8–9)

Both were built the same day, from this guide, fixing it as we went:

- the photo of the eight standoffs, highlighted (chapter 03);
- the guide had skipped mounting the motherboard (chapter 03b);
- which row the lid-sensor plug goes on (chapter 06b);
- "D2" isn't printed on the power supply; it's a guide marker (chapter 06c).

One machine was powered on with its cards already in, before its BIOS was set: no picture again, and a BIOS error_9 in the management event log. The other, still without cards, was set up screen by screen, and those screenshots are chapter 07. Then the same CPU, memory, SSD and reboot checks from computer 1's logs ran on both.

Where it landed

Twelve R9700s in three computers now run Qwen 3.8 27B for USA Arms. Across a full run of real jobs, all six Macs together averaged about 32 written tokens a second; the twelve R9700s averaged 493. The Macs didn't go anywhere: they took on other work.

Thank you to the Radiance and vLLM-Radiance projects, whose R9700 work is what we run, and to the Launch80 Discord, full of helpful people helping each other out.

00 – Prepare a safe, organized bench

Use: the RM44 case, every part still in its bag, the screw packets, a hand screwdriver, the PH1 driver, the anti-static strap and your CPU socket's calibrated torque tool.

Why now: you learn the landmarks and sort the look-alike parts before anything delicate is out of its bag.

How

1. Find the front and back of the case. The rack handles and power button are on the front. The motherboard ports and the PSU's power inlet will be on the back. Set the case on a solid table so its whole body is supported, not just the rack ears.
 - **Find:** the front handles and the rear port opening.
 - **Check:** you can point to front and back without looking at a photo, and the case can't tip or slide.
2. Make sure the AC cord is **not** plugged into the power supply. Keep the cord away from the bench. Never open the power supply.
 - **Find:** the power inlet on the back of the PSU.
 - **Check:** nothing is plugged into it.
 - **Stop:** you can't tell for sure that it's unplugged.
3. Put on the wrist strap the way the motherboard manual shows. Hold boards and memory by their edges, never by the chips or gold contacts.
 - **Find:** your grounded work area and a safe place to set each part down.
 - **Check:** no bare board will be lying on loose metal.
 - **Stop:** you aren't sure the strap is grounded. Don't plug in mains power to fix that.
4. Sort the screws into labelled cups: case, motherboard, cooler, fans and GPU brackets. **Keep the tiny M.2 screw from the motherboard box in its own cup.** It's easy to lose, and the case has look-alike screws for 2.5-inch drives that don't fit.
 - **Find:** the original packets for each part.
 - **Check:** you know where every cup of screws came from. No mystery screw goes into a delicate part.
5. Check the board's printed model: **ROMED8-2T/BCM**. Keep the PSU with its own cables and the cards with their own adapters. Never mix modular cables from a different power supply, even if they fit.
 - **Find:** the model name printed on the board and the labels on each cable.
 - **Check:** only this build's parts and cables are on the bench.
6. Separate the tools. PH1 is for the cooler. The CPU socket needs its own calibrated torque tool at the setting for your socket. Use hand drivers everywhere else; if a screw binds, stop rather than reaching for a power drill.
 - **Find:** the PH1 driver and the socket tool with its instructions.
 - **Check:** you know which tool goes with which job.
 - **Stop:** you don't have the socket's tool or setting. You can build up to chapter 04a, but don't open the CPU socket until you do.

Before moving on

The case is stable, AC is unplugged, your strap is on and the parts are sorted. You know the front from the back.

Source: BCM manual pages 8 and 25–29; HELA rear panel; RM44 hardware sheet; ARCTIC Rev.2 AMD tool list.

01 – Open the case and preserve its support hardware

Use: the RM44 lid, the GPU support bar inside the case, their screws and a labelled cup.

Why now: the empty case gives you room to work without reaching around heavy cards.

How

1. Take off the lid using the case's own fasteners. Keep its screws.
 - **Find:** the lid screws and how the lid slides or lifts.
 - **Check:** you know how it releases without bending or prying it.
 - **Stop:** a screw or release isn't clear. Don't lever a panel that's still held.
2. Support the GPU support bar that runs across the case. Undo its four fixing screws, two at each end, as the RM44 sheet shows. These are different from the small screws on its pads.
 - **Find:** the bar across the case and its two ends.
 - **Check:** the bar is free and all four screws are in the cup.
3. Lift the bar out and keep every bracket, pad and screw together. It's coming out for now; you'll decide about card support in chapter 08.
 - **Find:** a safe, labelled spot beside the bench.
 - **Check:** nothing from the bar was thrown away or left loose in the case.
4. Look over the empty case floor and edges. Take out any packing or loose hardware.
 - **Find:** the case floor and the PSU bay.
 - **Check:** the case is clear and stable.
5. If the case came with rear fans, take them out and keep their screws. This guide puts the two Noctua rear fans in at chapter 05c, but the cooler fits fine if you mount them now.
 - **Find:** the two small fan openings beside the rear port opening.
 - **Check:** the rear fan spots are empty and nothing is loose in the case.

Before moving on

The lid and support bar are safely aside with their screws, and the case is empty and clean.

Source: RM44 support-bar and hardware sheet. The case papers don't show how the lid comes off.

02a – Seat and secure the power supply

Use: the HELA 2050R, its mounting screws and its original modular cables.

Why now: you can still see all sides of the power supply and its cable sockets.

How

1. Find the three faces of the PSU that matter: the **big fan grille** (where it breathes in), the **power inlet** (goes to the case back) and the **cable sockets** (face into the case). Don't open it.
 - **Find:** the fan grille, power inlet and labelled cable panel.
 - **Check:** you can tell all three apart.
2. Set the PSU in its bay beside the motherboard area with the fan grille facing open space inside the case, not a solid wall. Hold its weight; don't balance it on a screw.
 - **Find:** the PSU bay.
 - **Check:** the fan has room to breathe and the power inlet faces the case back.
3. Line up the PSU's mounting holes with the case while you support it.
 - **Find:** the screw holes on the back of the PSU and the case.
 - **Check:** the holes line up without pushing the PSU sideways.
 - **Stop:** it only lines up when forced.
4. Start the PSU screws by hand, then tighten them evenly. Don't use longer screws, and don't use a screw to pull the PSU into line.
 - **Find:** the PSU screw cup, not the motherboard screws.
 - **Check:** the PSU is solid and the case metal isn't bent.
5. Lay out the PSU's cables by type so the labels show: the ATX main cable, two EPS (CPU) cables, two native GPU cables and the PCIe cables. Keep AC unplugged.
 - **Find:** the cables that came in this PSU's box.
 - **Check:** you can follow each cable end to end, and no foreign cable is mixed in.

Before moving on

The PSU is screwed in, its fan can breathe and its cable sockets are easy to reach. The power inlet is still empty.

Source: HELA mechanical drawing and cable list; RM44 mounting sheet.

02b – Fit the three front intake fans

Use: three ARCTIC P12 Pro PST fans and the case's fan screws.

Why now: they set up the front-to-back airflow while the case is still empty.

How

1. Find the straight arrow on the first fan's outer frame (not the curved arrow, which shows the blades spinning). Point it **into** the case, toward the back.
 - **Find:** the arrow moulded into the fan frame.
 - **Check:** air will come in the front and blow toward the motherboard.
2. Before screwing it in, make sure its cable can come out without getting pinched. Hold the frame, line up all four holes and start the screws by hand. Tighten evenly without bending the frame.
 - **Find:** the first front fan position.
 - **Check:** the fan is solid, and no screw or wire touches the blades.
3. Fit the second and third front fans the same way, one at a time, checking each arrow.
 - **Find:** the other two front positions.
 - **Check:** all three arrows point the same way, front to back.
4. Bring each fan's cable out where you can reach it. Each P12 has an extra "PST" socket for chaining a second fan; leave it unused. This build runs one fan per motherboard header.
 - **Find:** each fan's cable and its spare PST socket.
 - **Check:** no cable is trapped behind a frame or hanging in a blade.
5. Leave the two rear fan spots empty for now.
 - **Find:** the two small rear openings.
 - **Check:** they're still open, so you can reach the cooler later.

Before moving on

Three front fans blow into the case, their cables are reachable and the rear fan spots are still empty.

Source: ARCTIC P12 Pro PST references; RM44 fan positions.

03 – Match the eight motherboard standoffs

Use: the motherboard (still aside), the highlighted tray photo below, the case's standoffs and the BCM mounting-hole drawing.

Why now: once the board is in, you can't see what's under it.

Your RM44 tray — eight mounts highlighted

Green 1–8 are the eight posts this board needs. **Red "NO POST"** marks the two spots that must stay empty under this board. In this photo the rear ports are on the left and the PSU is at the top. Ignore holes outside the board's outline and the big pressed dimples in the tray.

Compare your own tray and board before you lower the board. The photo can't show post height or threads.

How

1. Keep the motherboard aside. Compare the case floor with the board's mounting-hole drawing. A **standoff** is the post under the board; the screw goes in from above.
 - **Find:** green 1–8 and the two red spots on the photo, and the eight circled holes in the BCM drawing.
 - **Check:** you're matching this board's pattern, not a generic ATX pattern.
2. Make sure every post lines up with a hole in the board. Remove any post that doesn't. **No post may touch the bottom of the board where there's no hole;** it can short it out.
 - **Find:** every post on the tray, including the two the manual says to remove.
 - **Check:** each post has a matching board hole.
 - **Stop:** you're not sure about a post's height, thread or location. Don't experiment under the board.
3. Count them: two posts in the row nearest the PSU, three in the middle row and three on the far side. Eight in total, both red spots empty.
 - **Find:** the three rows of posts.
 - **Check:** eight posts, nothing extra under the board's outline. The board is still aside.
 - **Stop:** a post is missing, or an extra one is still under the board's outline.

Before moving on

Eight posts are in the right places and nothing extra sits under the board. **The board isn't in yet; that's chapter 03b.**

Source: BCM manual pages 8, 24 and 25 (circled holes and standoffs to remove).

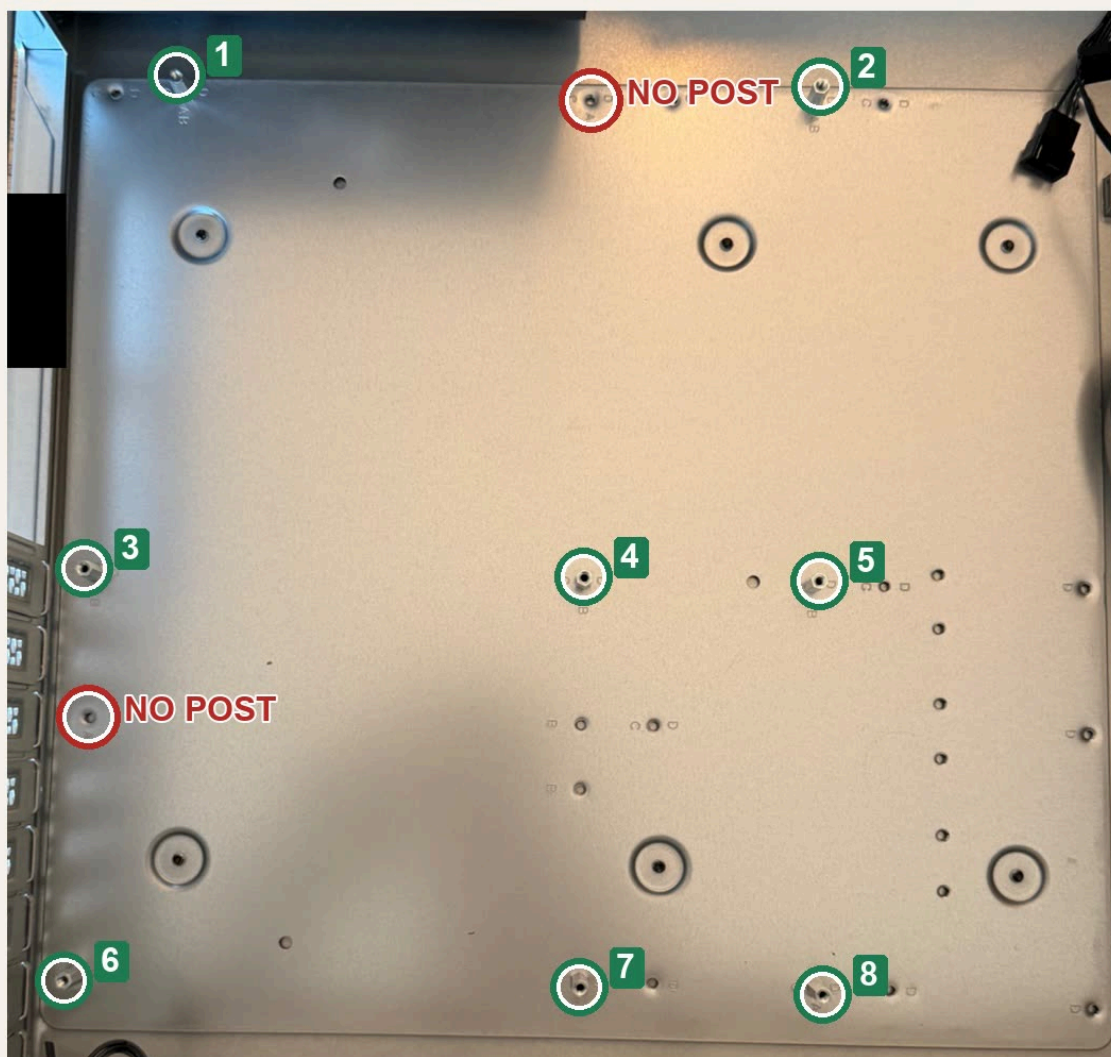
Our RM44 tray: the eight posts this board needs

Green 1–8: the posts this board needs. Red NO POST: keep empty. Rear I/O on the left, PSU at the top. Compare your own tray and board before mounting.

BCM: EIGHT MOTHERBOARD STANDOFFS

GREEN 1–8: match board holes. RED: keep empty.

Rear I/O LEFT · PSU ABOVE · AC disconnected



Our tray had eight posts and two empty positions.

Check each new tray; no post may bear against solid PCB.

03b – Fit the I/O shield and mount the motherboard

Use: the ROMED8-2T/BCM board, its rear I/O shield, the eight posts from 03 and eight motherboard screws.

Why now: the CPU, memory and cooler steps need the board flat and screwed down in the case.

In short: shield in → lower the board onto eight posts → line up ports and holes → start all eight screws → tighten evenly. AC stays unplugged.

How

1. Find the rectangular port opening at the back of the case, next to the card-slot openings. Turn the I/O shield so each cut-out matches a port on the board, and press it into the opening **before** the board goes in.
 - **Find:** the thin plate that came with this board (not a slot cover).
 - **Check:** every cut-out matches its port and the whole edge of the shield is clipped in.
 - **Stop:** it doesn't match or won't seat without bending.
2. Hold the board by its edges. Bring the port edge up to the shield, line up the ports, then lower the board gently onto the posts. Keep the shield's springy metal tabs out of the USB and network sockets. Don't slide the board across the posts.
 - **Find:** ports toward the back, card slots next to the slot openings.
 - **Check:** the board sits flat. All eight holes sit right over their posts.
 - **Stop:** a port catches, a tab goes into a socket, or a hole doesn't line up. Lift the board by its edges and fix it; don't pull it into place with screws.
3. Start one motherboard screw in each of the eight holes by hand. Leave them all loose until all eight have started.
 - **Find:** the motherboard screw cup (not the tiny M.2 screw, not PSU or fan screws).
 - **Check:** all eight screws caught their threads without force.
 - **Stop:** a screw won't start or binds early. Back it out and find out why; don't use a power driver.
4. Tighten the eight screws evenly until the board is held firmly. Stop there. Don't keep cranking, and don't bend the board.
 - **Find:** each screw head.
 - **Check:** all eight are snug and the board is still flat.
5. Look over the rear ports, all eight screws and the case floor. Pick up any loose screw or tool before the CPU step.
 - **Find:** the mounted board, the shield and the spaces around them.
 - **Check:** eight screws in, ports clear, card slots lined up, nothing loose in the case.

Before moving on

The motherboard is mounted: shield clipped in, ports clear, eight screws snug, board flat, nothing loose. Then go on to the CPU.

Source: BCM manual pages 8, 24 and 25; the tray photo in 03. No screw torque is given for these; snug is enough.

Photo — rear I/O shield lined up

Fit the shield **before** the board. This shows the finished result from outside the case: the COM/VGA, the stacked management-LAN/USB and the two network ports each sit in their own opening. Check that no tab is poking into a port.

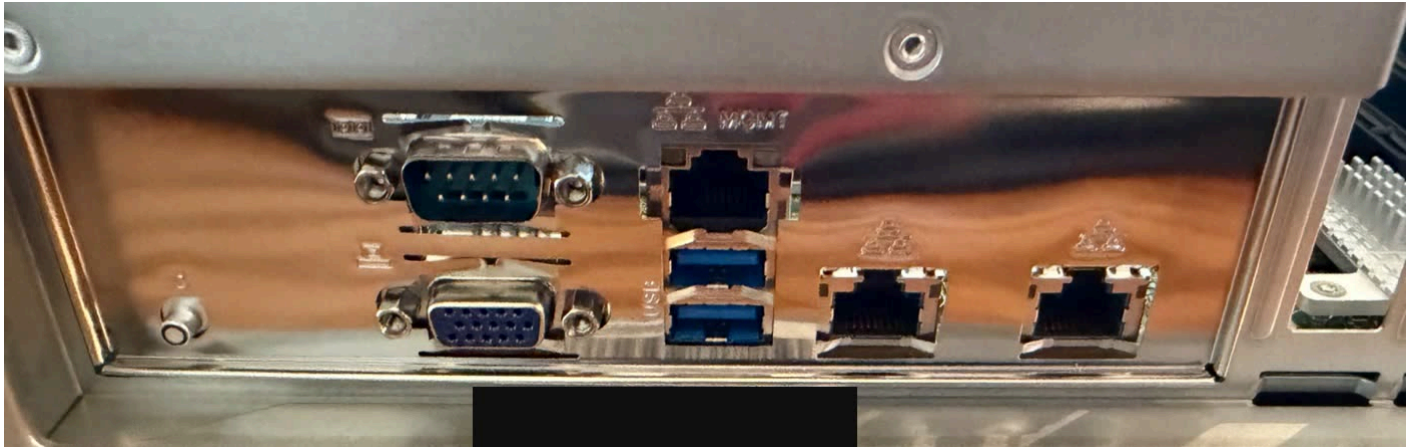
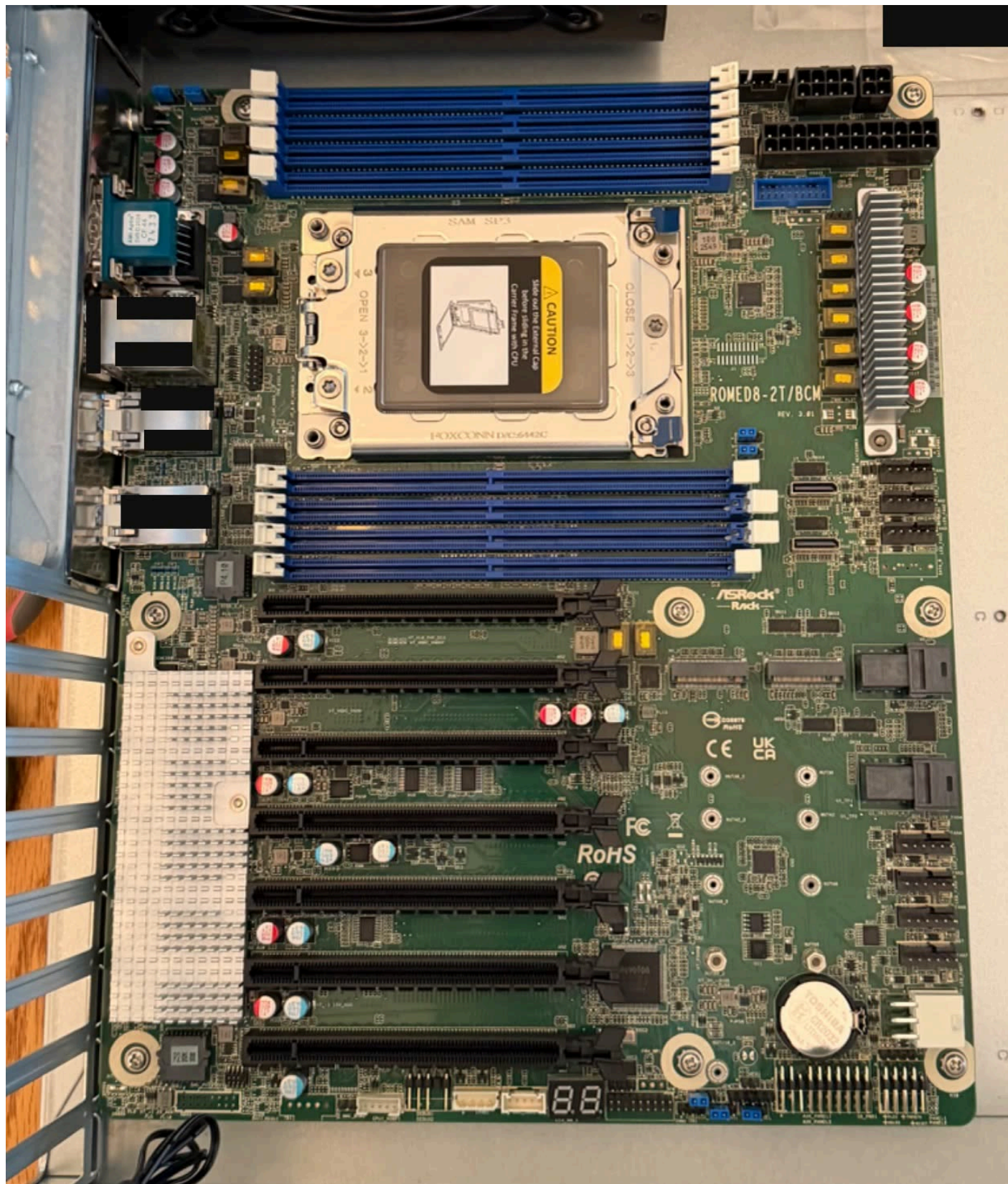


Photo — the board mounted, before CPU, memory and cooler

Rear ports on the **left**, PSU at the top. The eight screws sit in two rows of three and one row of two, matching the posts from 03.



04a – Insert the CPU and carrier into the socket rails

Use: the EPYC 7452 in its carrier, the SP3 socket on the board, and the socket's own calibrated torque tool and setting.

Why now: this is the most delicate part of the build. Do it while nothing is in the way, one movement at a time.

Before you start: you need the torque tool and setting for the socket you actually have. The BCM manual shows the steps but doesn't give a torque number. A T20 bit is just the screw head size. Don't borrow a number from a different board or from the cooler.

In short: this is a server socket, not a desktop one. The CPU stays in its carrier, the carrier slides into the rails, and the screws follow the numbers printed on the socket.

How

1. Look at the socket and find three things: the outer **load plate** (with three captive screws), the inner hinged **rail frame**, and the black **shipping cap**. Keep the CPU in its carrier and hold it by the carrier's edges. Never touch the pins in the socket or the contacts under the CPU.
 - **Find:** the three load-plate screws (not the four cooler mounts around the socket).
 - **Check:** the CPU and carrier are together, and your torque tool and setting are ready.
 - **Stop:** you don't have the socket's procedure, tool or setting, or the carrier doesn't look right. Don't open the socket.
2. Loosen the three load-plate screws in the **OPEN** order printed next to them (ours read 3, 2, 1). They're captive: they stay in the plate.
 - **Find:** the numbers printed beside each screw.
 - **Check:** the screws are loose but still in the plate.
 - **Stop:** the numbers differ, the driver doesn't fit cleanly, or a screw binds.
3. Lift the outer load plate. Leave the inner rail frame down for now.
 - **Find:** the outer metal frame with the three screws.
 - **Check:** the outer plate is up and the inner frame is still down.
4. Lift the inner rail frame. Keep fingers and tools away from the socket pins.
 - **Find:** the inner hinged frame holding the shipping cap.
 - **Check:** the rails are open and nothing touched the pins.
5. Slide the shipping cap out of the rails and keep it. It's a protector, not the CPU carrier.
 - **Find:** the black cap in the raised rail frame.
 - **Check:** the cap is set aside and the rails are empty.
 - **Stop:** you see dirt or damaged pins. Don't brush or straighten them.
6. Slide the CPU-and-carrier into **both** rails until it's fully in. Keep the CPU in the carrier.
 - **Find:** both edges of the carrier and both rails.
 - **Check:** both edges are guided by the rails and the carrier is all the way in.
 - **Stop:** it resists, tilts or rides outside a rail. Hold it still and stop. Don't press, rock or pull it out by guessing; get the socket maker's recovery steps first.

7. Lower the rail frame with the carrier in it down onto the socket.
 - **Find:** the inner frame; the outer plate stays up.
 - **Check:** it lies flat without tilting or catching anything.
8. Lower the outer load plate over it.
 - **Find:** the outer frame.
 - **Check:** the plate and its screw holes line up without force.
9. Tighten the three screws in the **CLOSE** order printed beside them (ours read 1, 2, 3) using the torque tool at its setting. Stop when the tool says you're there. No power driver, and not the cooler's setting.
 - **Find:** the CLOSE numbers and your torque tool.
 - **Check:** the plate is secured and the CPU and carrier didn't move.
 - **Stop:** a screw won't catch or the carrier shifts. Stop and get the socket maker's guidance before reopening.

Before moving on

The CPU is in its carrier, the carrier rode in both rails, the plate is torqued in the printed order and the shipping cap is saved. If you're unsure about torque or how it seated, stop. "Close enough" isn't.

Source: BCM manual pages 26–29; Foxconn SP3 drawing for the printed open/close order example. The manual gives no torque number.

Photo — CPU in the closed load plate

The EPYC's metal top shows inside the closed plate, with the carrier's green edge beside it. This is what "done" looks like; the photo can't show the torque or how the carrier seated underneath.



04b – Seat all eight memory modules

Use: eight Samsung 16 GB RDIMMs (M393A2K43BB1-CTD6Q). One goes in every slot, DDR4_A1 through DDR4_H1.

Why now: once the cooler is on, the memory latches are hard to see and reach.

How

1. Read the label on the first module. It must say **M393A2K43BB1-CTD6Q**. Desktop memory looks similar and won't work. Keep the other seven in their packaging until you need them.
 - **Find:** the label, the gold edge and the slot names printed on the board.
 - **Check:** right module, and you know which slot it's going in.
2. Open the slot's latch. Some slot ends hinge and some are fixed; only open the one that moves.
 - **Find:** the hinged clip at the end of the slot.
 - **Check:** nothing closed is blocking the module's edge.
 - **Stop:** an end doesn't swing open. It may be fixed. Don't force it.
3. With the module still **outside** the slot, line up the notch in its gold edge with the bump in the slot. If it's backwards, turn it around before it touches the slot.
 - **Find:** the notch in the gold edge and the key in the slot.
 - **Check:** notch and key line up before you press.
 - **Stop:** the notch doesn't match. Never push against the key.
4. Press down evenly on both top corners until it seats and the latch clicks closed. Don't push on the chips. If one end catches, stop rather than rocking it.
 - **Find:** the two top corners of the module.
 - **Check:** both ends are down evenly and held. One closed latch doesn't prove the other end is in.
 - **Stop:** one end won't go down. Stop pushing.
5. Do the same for the other seven, one at a time.
 - **Find:** DDR4_A1 through DDR4_H1. Read the printed names; don't count slots from a photo.
 - **Check:** eight modules, each seated and latched.

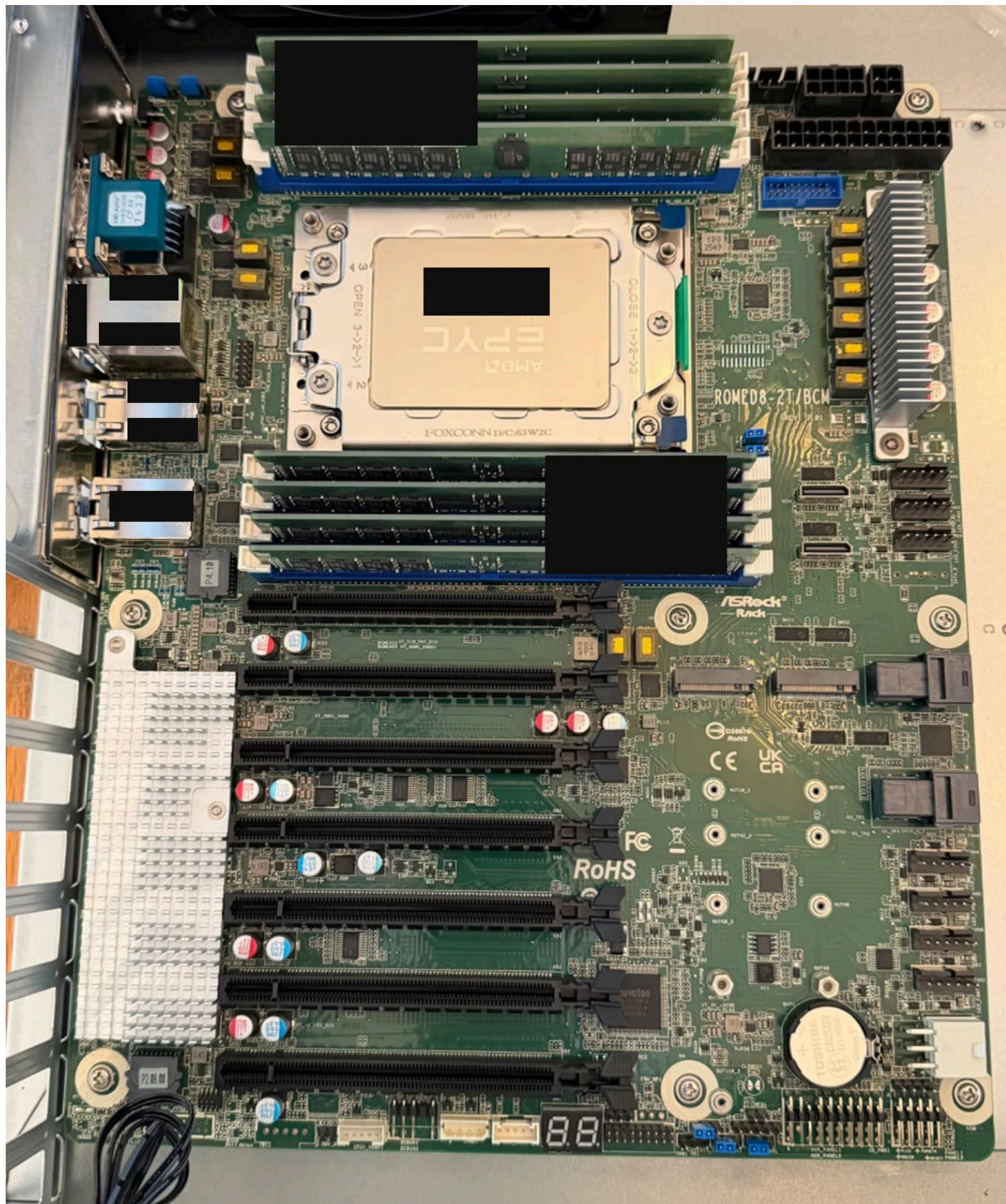
Before moving on

All eight modules sit level and every latch is closed. Whether the machine sees all 128 GB gets checked in chapter 07.

Source: BCM manual pages 30–31; Samsung CTD6Q module reference.

Photo — four modules on each side of the CPU

Four modules above the CPU and four below in this view, rear ports on the left, PSU at the top. Use it to see the layout; check each module's two ends with your own eyes.



04c – Install the SSD at twenty degrees, then secure it

Use: the bare Samsung 990 PRO 1 TB, slot **M2_2**, support post **D**, and the tiny M.2 screw from the motherboard box.

Why now: the little slot, post and screw are still easy to see and reach.

Nick's tip: "If you've never mounted an NVMe, you slide it in roughly at that angle and then put the screw in, and the screws came with the motherboard." Save those tiny screws when you unbox the board.

How

1. Find slot M2_2 and its 80 mm support post, position D. D is where the board ships, so you shouldn't need to move it. Put the tiny screw somewhere it can't roll into the case.
 - **Find:** the M2_2 slot, post D and the M.2 screw.
 - **Check:** the SSD's far-end notch will land on post D.
2. Hold the SSD by its sides. Match its notch to the slot and slide the gold edge in at about **twenty degrees**, angled up from the board. Keep the far end raised while it goes in.
 - **Find:** the notch in the SSD's gold edge and the key in the slot.
 - **Check:** the edge is in the slot before you lower the far end.
 - **Stop:** it doesn't match or won't go in. Don't lever or force it.
3. Lower the far end gently until its half-moon notch sits on post D.
 - **Find:** the notch at the end opposite the gold edge.
 - **Check:** the SSD lies flat and isn't bent.
4. Put in the tiny screw by hand and tighten it just until it holds. Don't use the screw to pull the SSD down.
 - **Find:** post D through the SSD's notch.
 - **Check:** the SSD is held flat, not bowed.

Before moving on

The SSD is in M2_2, flat on post D and held by its screw. Whether the machine sees it gets checked in chapter 07.

Source: BCM manual pages 8 and 50–51; Samsung 990 PRO reference; Nick's NVMe clip.

04d – Prepare the cooler before applying paste

Use: the ARCTIC Freezer 4U-M Rev.2, its **AMD** clips, the four clip screws, its two fans and the PH1 driver.

Why now: get the cooler completely ready *before* paste goes on the CPU. Then the pasted CPU never sits waiting while you hunt for a screw.

How

1. Open ARCTIC's **AMD / SP3** instructions. Find the two clips (they're not the same shape), the four small screws that hold the clips to the cooler, and the four spring-loaded screws already on the clips. None of these are the CPU's load-plate screws.
 - **Find:** the AMD kit next to the cooler.
 - **Check:** the PH1 driver and the AMD parts are ready. No Intel parts or Intel settings.
2. Match your board to ARCTIC's drawing **A, B, C or D** before fitting clips. In type A, clip A goes on the air-out side and clip B on the air-in side; in C and D they swap.
 - **Find:** the rear ports and socket in ARCTIC's orientation drawings.
 - **Check:** the drawing you picked matches your board and front-to-back airflow.
 - **Stop:** you can't tell which drawing matches. "AMD/SP3" alone doesn't decide it.
3. Take both fans off the cooler using their clips. Don't pull them by their cables.
 - **Find:** the fan frames on the two sides of the fins.
 - **Check:** the bare heatsink is free and both fans and cables are fine.
 - **Stop:** you can't see how a fan releases. Don't pry at the fins.
4. Screw the first clip to the cooler's base with its two small screws, using PH1.
 - **Find:** the first clip and its two base screws (not the spring screws).
 - **Check:** the clip matches your drawing and both screws are in.
5. Screw the second clip on the other side with the other two small screws.
 - **Find:** the opposite side of the cooler base.
 - **Check:** both clips match the drawing, and the four spring screws are free for later.
6. Peel the plastic film completely off the cooler's flat copper base. Don't touch the bare metal.
 - **Find:** the underside that will press on the CPU.
 - **Check:** no film is left anywhere on the base.
7. Hold the cooler over the CPU, **without paste**, and check that all four spring screws line up with their four mounts. Don't screw it down. Then set it aside with the base clean.
 - **Find:** the four spring screws and the four mounts around the socket.
 - **Check:** all four line up without twisting a clip or pulling the cooler.
 - **Stop:** a screw or clip doesn't line up. Fix it now, before the paste.

Before moving on

Clips on, both fans off, film peeled, and all four screws line up dry. The cooler is ready to go on the moment the paste is down.

Source: ARCTIC Freezer 4U-M Rev.2 AMD instructions: PH1, the A/B versus C/D orientation, clip fitting and film removal.

05 – Prepare the thermal interface

Use: one ARCTIC paste (the **MX-7** that came with the cooler, or MX-6), plain isopropyl alcohol (90%+), and a lint-free cloth or clean coffee filter.

Why now: paste goes on right before the cooler, with everything else ready.

How

1. With AC unplugged and the socket closed, clean the CPU's metal top and the cooler's base. Dampen the cloth with alcohol; never pour liquid on the CPU. Keep the mess out of the socket.
 - **Find:** the CPU's metal top and the cooler's copper base only.
 - **Check:** both are dry, clean and free of fibres. A paper towel is a last resort; check it for lint. A harmless stain doesn't need polishing off.
 - **Stop:** liquid or dirt got into the socket, or your cleaner has additives. No hand sanitizer and no scraping.
2. Double-check that the load plate is tight and the cooler's film is gone. Keep fingers off both clean surfaces.
 - **Find:** the closed socket and the cooler's bare base.
 - **Check:** no film will end up under the cooler.
3. Use **one** paste only, never MX-6 and MX-7 together. For MX-7, follow ARCTIC's cross-pattern picture: paste on the CPU top, short of the edges. Don't spread it; the cooler's pressure does that. The **0.8 g** on the tube is how much is in the tube, not how much to use.
 - **Find:** the label on your paste and ARCTIC's picture for it.
 - **Check:** paste is only on the CPU top, not near its edges.
4. Bring the prepared cooler over, without touching its base or smearing paste on anything nearby.
 - **Find:** the cooler you prepared in 04d.
 - **Check:** the clips, four screws and PH1 driver are right there.

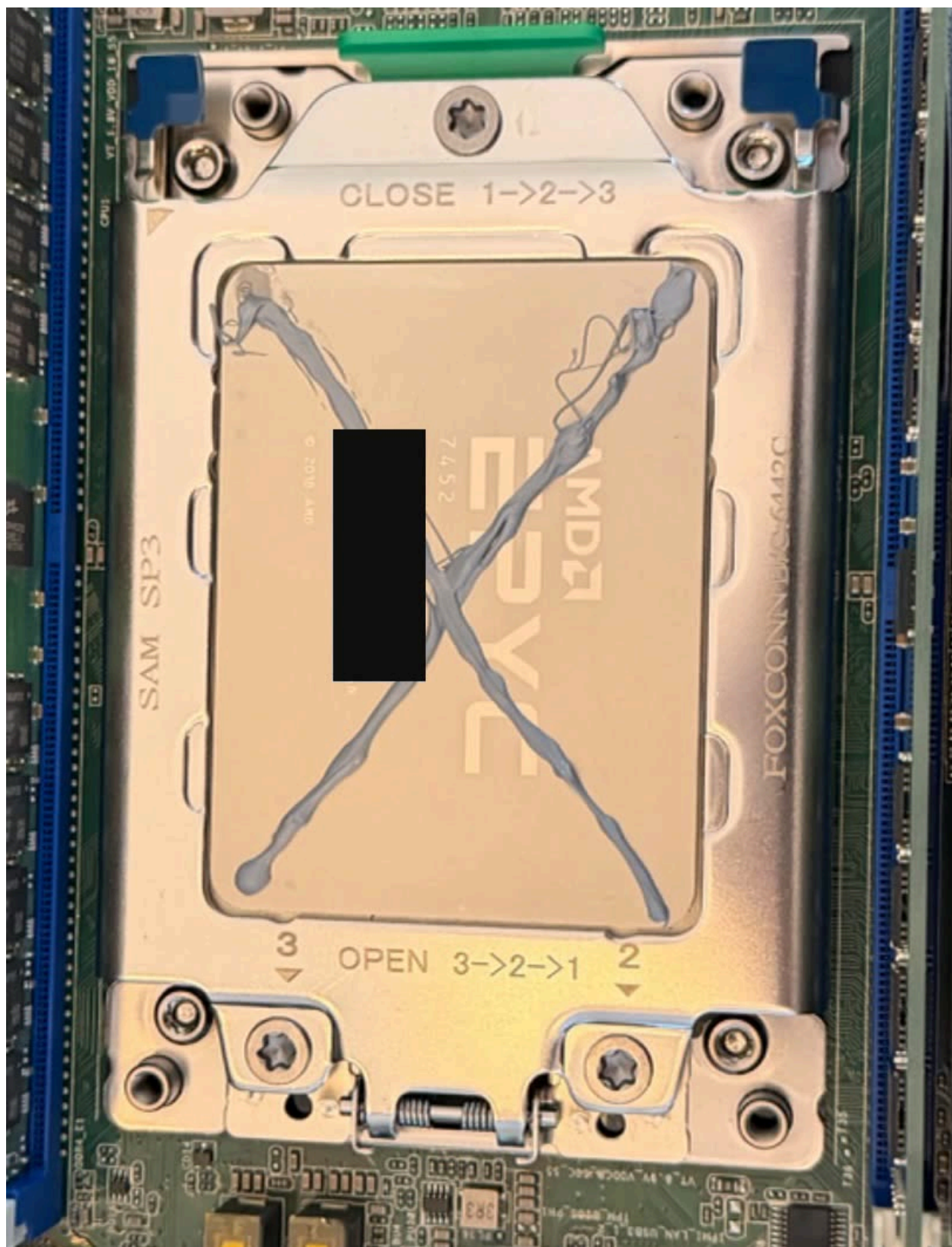
Before moving on

The CPU has its paste, the cooler is clean with no film, and it's ready to go straight on.

Source: first-build cleaning lessons; ARCTIC MX-7 guidance; ARCTIC AMD MX-6 picture; MX-6 guidance.

Photo — paste on the CPU before the cooler

A cross of paste on the CPU's metal top. This shows the pattern, **not an amount to copy**: follow ARCTIC's picture for your paste and keep it short of the edges.



05b – Mount the bare heatsink

Use: the prepared Freezer 4U-M without its fans, the AMD mounting hardware and the PH1 driver.

Why now: with both cooler fans and both rear case fans still out, nothing blocks the screwdriver.

How

1. Find the four mounts around the closed CPU socket. These hold the cooler. They are not the CPU's three load-plate screws.
 - **Find:** the four mounts in ARCTIC's AMD picture.
 - **Check:** you know where the cooler attaches without touching the CPU plate.
2. Hold the cooler in the orientation you chose and line up all four spring screws over their mounts.
 - **Find:** the front-to-back airflow direction and the four mounts.
 - **Check:** all four line up before the base touches the paste.
 - **Stop:** a clip or screw is off. Don't pull it into place with a screw.
3. Lower the cooler straight down onto the CPU. Don't slide it around on the paste.
 - **Find:** the CPU top and the cooler base.
 - **Check:** it's sitting the right way round and no wire is under it.
4. Start all four spring screws with PH1. Keep the cooler level instead of tightening one corner all the way first.
 - **Find:** the four cooler screws.
 - **Check:** all four caught their threads without cross-threading.
 - **Stop:** one won't start. Don't force it or use a different screw.
5. Tighten the four screws evenly, a little at a time, as ARCTIC's AMD instructions show. Then check the clips are seated and the cooler doesn't wobble. Don't use the CPU socket's or Intel's torque setting here.
 - **Find:** all four corners, with both cooler fans still off.
 - **Check:** the cooler is solid and the board isn't bending.
 - **Stop:** you can't tell when it's tight enough. ARCTIC doesn't give a torque number and this guide won't invent one.

Before moving on

The bare cooler is screwed down evenly. Nothing got in the way, and the CPU plate wasn't touched.

Source: ARCTIC Rev.2 AMD installation steps.

05c – Attach cooler fans, then rear exhaust fans

Use: the cooler's two fans, two Noctua NF-A8 PWM rear fans and their own mounting hardware.

Why now: the power cables aren't routed yet, so the rear wall is easy to reach. The cooler doesn't need the rear fans out of its way: in the real builds it fit fine either way.

Nick's tips from fitting the rear fans: the NF-A8s come with "little rubber pegs... to make it more silent". On the bottom "there is an airflow" arrow: "make sure that's pointing out of the case". And keep "the cable's down low": with it mounted the other way, his "won't run with the other one". And: "If I was going to do this again, I would probably just take off this cover and mount this first."

How

1. Clip the first cooler fan onto the side facing the front of the case. Its arrow points through the fins toward the back.
 - **Find:** the cooler side facing the front fans.
 - **Check:** the fan is held in place and its cable is outside the blades.
 - **Stop:** you can't see how it clips on. Don't pull the cable or bend fins.
2. Clip the second cooler fan onto the back side. Its arrow points the same way, so the two fans push and pull together.
 - **Find:** the cooler side facing the rear fan openings.
 - **Check:** both fans are held and both arrows agree.
3. Bring both cooler-fan cables out where you can reach them, clear of the blades and memory latches.
 - **Find:** each fan's own cable.
 - **Check:** neither cable is trapped between fan and fins.
4. Mount the first NF-A8 at the back of the case so it **blows out**. Use its rubber mounts if they fit your case. Point its cable down low so it can reach its header.
 - **Find:** the first small rear fan opening.
 - **Check:** its frame arrow points out of the case and no screw sticks into the blades.
5. Mount the second NF-A8 the same way, also blowing out.
 - **Find:** the other rear opening.
 - **Check:** both rear fans blow out the back, not back toward the cooler.
6. Gather all seven fan cables where you can reach them. Leave the Noctua low-noise adapters out.
 - **Find:** two cooler, three front and two rear fan cables.
 - **Check:** no cable or loose screw can reach a fan blade, and all seven are ready to plug in.

Before moving on

Bare cooler, then its two fans, then the two rear fans: done. Every arrow points front to back.

Source: ARCTIC push/pull fan pictures; Noctua NF-A8 instructions; Nick's rear-fan clip.

06a – Route short fan leads before bulky power cables

Use: the seven fan cables, and the Noctua **NA-EC1** extension cables that came with the rear fans.

Why now: the fan cables are the shortest wires in the build. Route them before the thick power cables take over that edge of the board. One fan per header lets the motherboard watch each fan separately.

Nick's tip: "Annoyingly, the back one is really short, so when we route this, we're going to have to have an extension." The small Noctua fans "end up having an extension inside" the box, so use that on the one that needs it.

How

1. With AC unplugged, lay each fan cable toward its header before plugging anything in. Run it along the edge of the board, away from fan blades, memory latches and empty card slots. Leave a little slack at both ends.
 - **Find:** the two cooler cables first, then the rear fans, then the front fans.
 - **Check:** every cable reaches its header without pulling. If one needs the NA-EC1 extension, you actually have it in hand.
 - **Stop:** a cable can't reach. Don't use a splitter, re-crimp, or stretch it.
2. Find headers FAN1 to FAN7 along the board edge. Each header has **six** pins, but the fan plug has **four** holes. The plug goes on **pins 1–4** (the end the manual marks as pin 1), lined up with the plastic guide. Pins 5–6 stay uncovered.
 - **Find:** the plug's four holes, the plastic guide, and pin 1 in the BCM drawing.
 - **Check:** the plug is on pins 1–4, not centred and not on 3–6.
 - **Stop:** you can't tell where pin 1 is. Wire colour doesn't tell you.
3. **FAN1:** the cooler's front fan. Hold the plug, not the wires, line it up with the guide and push it straight on.
 - **Find:** the cooler fan facing the front, and FAN1 printed on the board.
 - **Check:** the plug is fully on and the cable is away from the blades.
4. **FAN3:** the cooler's rear fan. Keep its cable outside the cooler and memory latches. If you used an extension, check that joint too.
 - **Find:** the rear-facing cooler fan and FAN3.
 - **Check:** both ends and any extension joint are fully pushed together, with slack.
 - **Stop:** it only reaches stretched, or needs an extension you don't have.
5. **FAN6:** the rear fan nearest the PSU. Use its extension only if needed.
 - **Find:** that NF-A8's cable and FAN6.
 - **Check:** it reaches without pulling and stays clear of both rear fans.
6. **FAN7:** the other rear fan, on its own header. Don't join the two rear fans with a splitter.
 - **Find:** the rear fan nearer the cards, and FAN7.
 - **Check:** it has its own header and a relaxed route.

7. **FAN2:** the front fan nearest the PSU. Use the plug with four holes, not the spare PST socket.
 - **Find:** that front fan's cable and FAN2.
 - **Check:** the cable stays clear of the fan and the future card path. The PST socket stays empty.
8. **FAN4:** the middle front fan.
 - **Find:** the centre fan of the three and FAN4.
 - **Check:** the plug is on pins 1–4 with no pull on it.
9. **FAN5:** the front fan farthest from the PSU. Leave its PST socket empty too.
 - **Find:** the last front fan and FAN5.
 - **Check:** one fan on FAN5, nothing chained to it.
10. Follow all seven cables once more before tying anything. Loosely tie extra length and the three unused PST tails beside their own cables. Then check every plug again and spin each fan by hand to be sure nothing touches it.
 - **Find:** seven separate fan-to-header cables, any extensions and three spare PST tails.
 - **Check:** tidying didn't pull a plug loose, and no loose end can reach a blade or a card slot.
 - **Stop:** tidying needs a stretched cable or a tie pulled tight against the board.

Before moving on

Seven fans, seven headers, all on pins 1–4, spare tails tied back. Check these again after the power cables are in.

The fan map: FAN1 cooler front · FAN2 front fan nearest the PSU · FAN3 cooler rear · FAN4 middle front fan · FAN5 front fan farthest from the PSU · FAN6 rear fan nearest the PSU · FAN7 rear fan nearest the cards. Connect them in that order, not number order.

Nick's tip: "I have all my fans numbered, so I know which ones they are." Put a numbered piece of tape on each fan as you mount it.

Extension versus speed reducer: **NA-EC1** is a 30 cm extension: fan → extension → header. **NA-RC7** is a low-noise adapter that slows the fan; leave it out of this build.

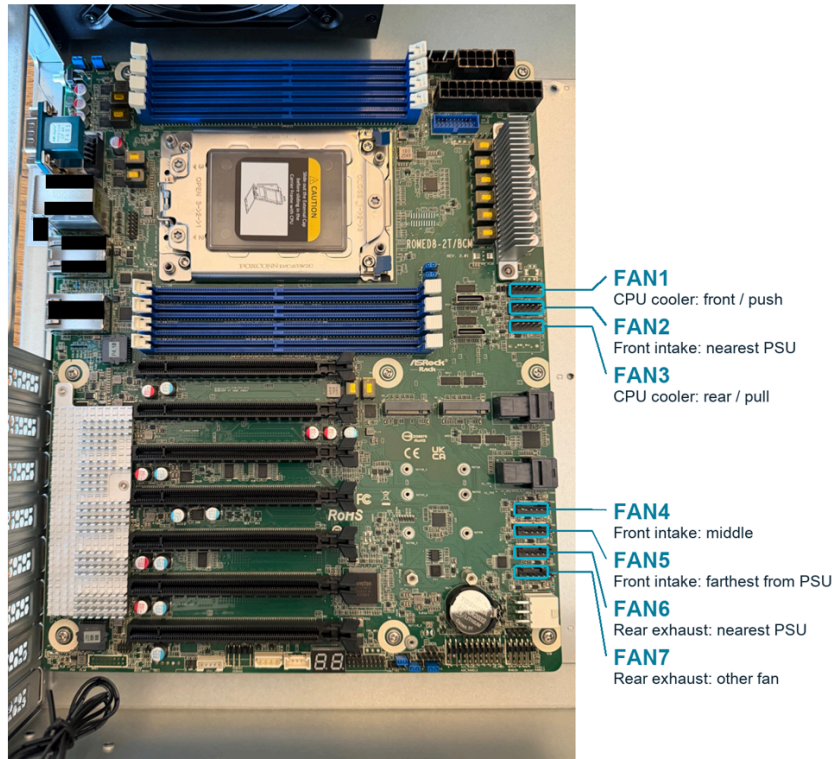
Source: BCM manual pages 14 and 37; ARCTIC P12 Pro PST cable and PST socket; Noctua NF-A8 cable and extension instructions; Nick's fan clips.

Our board: which fan goes on which header, and the keyed pins 1–4

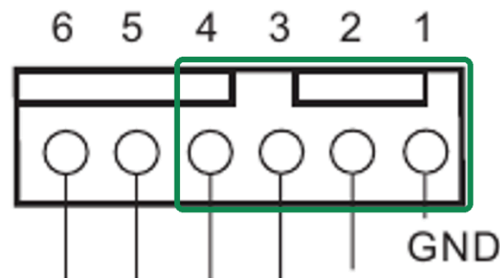
Connect them in the order FAN1, 3, 6, 7, 2, 4, 5, the easiest order to reach. The physical key and pin 1 set the orientation. Pins 5–6 stay bare. Noctua's NA-EC1 extension is fine; leave the NA-RC7 low-noise adapter out.

YOUR BCM BOARD: FAN CONNECTIONS

One fan per header. PSU unplugged. Match the printed FAN number.



WHICH FOUR PINS? Use 1, 2, 3 and 4. Leave 5 and 6 bare.



GREEN = your 4-pin plug

- 1 Ground
- 2 +12 V supply
- 3 Speed feedback (tach)
- 4 Speed control (PWM)

Do not center the plug.

Inset: ASRock BCM manual. Diagram orientation is not the photo orientation.
Match the physical key / pin 1, not left or right from the drawing. Do not force the plug.

06b – Connect the small front controls, then USB-A

Use: the RM44's front-panel cables, the lid-sensor cable, and the BCM manual's **PANEL1**, **AUX_PANEL1** and **USB3_3_4** drawings.

Why now: the fan cables have their routes. Do the tiny switch and light plugs while you can still read their labels, then the thicker USB cable, before the big power cables or cards get in the way.

Nick's tip: "This is plus and minus on there, and that actually represents the different LEDs that you need to do. And so one of these, this LAN 1 and 2, one needs to be flipped over, if I recall correctly." It's all shown below.

How

1. Follow each front-panel cable from the front of the case to its labelled plug. Don't go by colour. Keep them along the board edge, away from where the cards will go. Turn the **PANEL1** and **AUX_PANEL1** drawings to match the board in front of you.
 - **Find:** the small plugs, separate from the thick USB cable.
 - **Check:** you can tell **PANEL1** from **AUX_PANEL1**.
 - **Which row:** on **PANEL1**, the raised row is pins 2/4/6/8 and the lower row, nearer the board, is 1/3/5/7/9. The lone pin 9 in the lower row (with no pin above it) tells you which way round it is. **PANEL1** faces sideways, so slide each plug along the pins toward the battery, not down on top.
2. **POWER SWITCH** goes on **PANEL1**'s **PWRBTN#** and **GND** pair. A switch has no plus or minus, but it must be on the right two pins.
 - **Find:** the cable labelled **POWER SWITCH** and **PWRBTN#/GND** in the drawing.
 - **Check:** it covers exactly that pair.
3. **RESET SWITCH** goes on **PANEL1**'s **GND** and **RESET#** pair.
 - **Find:** the cable labelled **RESET SWITCH** and its pair in the drawing.
 - **Check:** neither switch plug is shifted onto a neighbouring pin.
4. **POWER LED** goes on **PLED+** and **PLED-**. LEDs care which way round they go: match the plus and minus marked on the plug.
 - **Find:** the plus/minus markings on the plug and the **PLED** pair.
 - **Check:** plus on plus, minus on minus, on the right pair.
 - **Stop:** you can't tell which side is plus. Wire colour doesn't tell you.
5. **HDD LED** goes on **HDLED+** and **HDLED-**, the same way.
 - **Find:** the drive-activity light cable.
 - **Check:** right pair, right way round, no bent pin.
 - **Stop:** the cable's label or polarity isn't clear.
6. **LAN1 LED** goes on **AUX_PANEL1**, block B: **LAN1_LINK** and **LED_PWR**.
 - **Find:** block B on **AUX_PANEL1** (not **PANEL1**).
 - **Check:** it's on the documented pair, the right way round.
 - **Stop:** you can't match the plug's markings to the drawing.

7. **LAN2 LED** goes on block B's **LED_PWR** and **LAN2_LINK**.
 - **Find:** the second LAN light cable and its own pair.
 - **Check:** both LAN lights are on AUX_PANEL1 and not shifted.
 - **The flip:** both LAN plugs use the four **raised** pins of block B. The two plus pins are next to each other in the middle, the minus pins on the outside, so **LAN2's plug is turned 180° compared with LAN1's**.
 8. **Lid sensor:** follow the lid-switch cable to its two-hole plug. It goes on **AUX_PANEL1 block C: CASEOPEN (C3) and GND (C4)**, in the **lower, shorter row nearer the board**. Both holes go on that same row.
 - **Find:** block C and the photo below.
 - **Check:** the plug covers CASEOPEN and GND together. The taller row is not used, and the cable is clear of the future cards.
 9. **Front USB-A:** after the small plugs are done, follow the thick cable from the two front USB-A ports to the blue **USB3_3_4** header. Match its blocked hole to the missing pin and the plastic notch to the header, then push it straight in. Support the cable so it can't bend the header.
 - **Find:** the USB-A cable, its blocked hole and the header (printed **USB1** on our board, **USB3_3_4** in the manual).
 - **Check:** the keys match and it's fully in, with no bent pins.
 - **Stop:** you can't see the key, or it pushes back.
 10. **Front USB-C:** leave it unplugged. This board has no header for it. Tie it back away from fan blades and sharp edges.
 - **Find:** the cable from the small oval USB-C port.
 - **Check:** its loose end can't reach a fan, and it isn't forced onto the USB-A header.
- Nick's tip:** "Unfortunately, the case has USB-C, but this does not have a USB-C setup on this board, so that was an oversight on my part, but I don't need one."

Before moving on

The switches are on their named pins, the lights are the right way round, the lid sensor is on CASEOPEN/GND in the shorter row, USB-A is in, and USB-C is tied back.

Source: BCM manual pages 35–37; RM44 front-panel references; Nick's front-panel clip.

Photo — the lid-sensor pins: use the shorter row

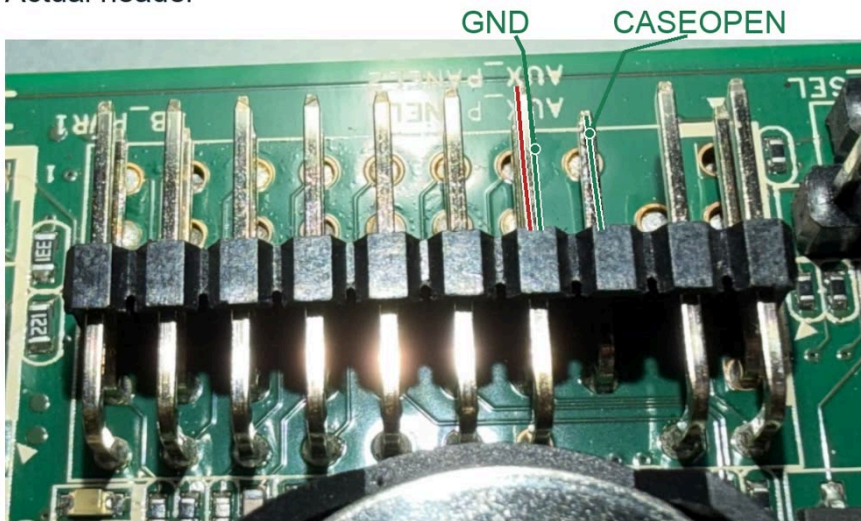
Use the two green pins together. Leave the taller red row alone. The inset zooms in on the two rows. The metal legs under the black plastic are solder joints, not pins to plug onto.

LID SENSOR: LOWER / SHORTER CONTACT ROW

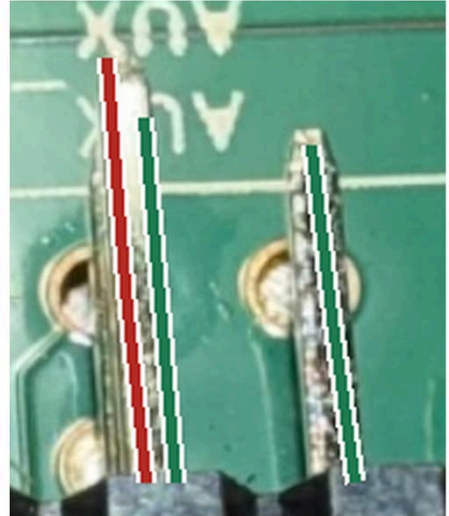
GREEN = use GND + CASEOPEN together, in ONE row.

RED = upper / taller contact row. Do not use it.

Actual header



Same pair, enlarged



Both mating rows are ABOVE the black plastic in this photo.

BELOW the plastic = bent solder legs. Do NOT plug onto them.

AUX_PANEL1 block C: CASEOPEN C3 + GND C4, nearer the board.

AC unplugged. Fit across the green pair; never across two rows.

Photo — the lid-sensor plug fitted beside the battery

The black two-hole plug on AUX_PANEL1, above the LAN light plugs in this view. Once it's on you can't see which row it's on, so use the photo above to get it right first.

Lid / CASEOPEN lead: black two-hole housing

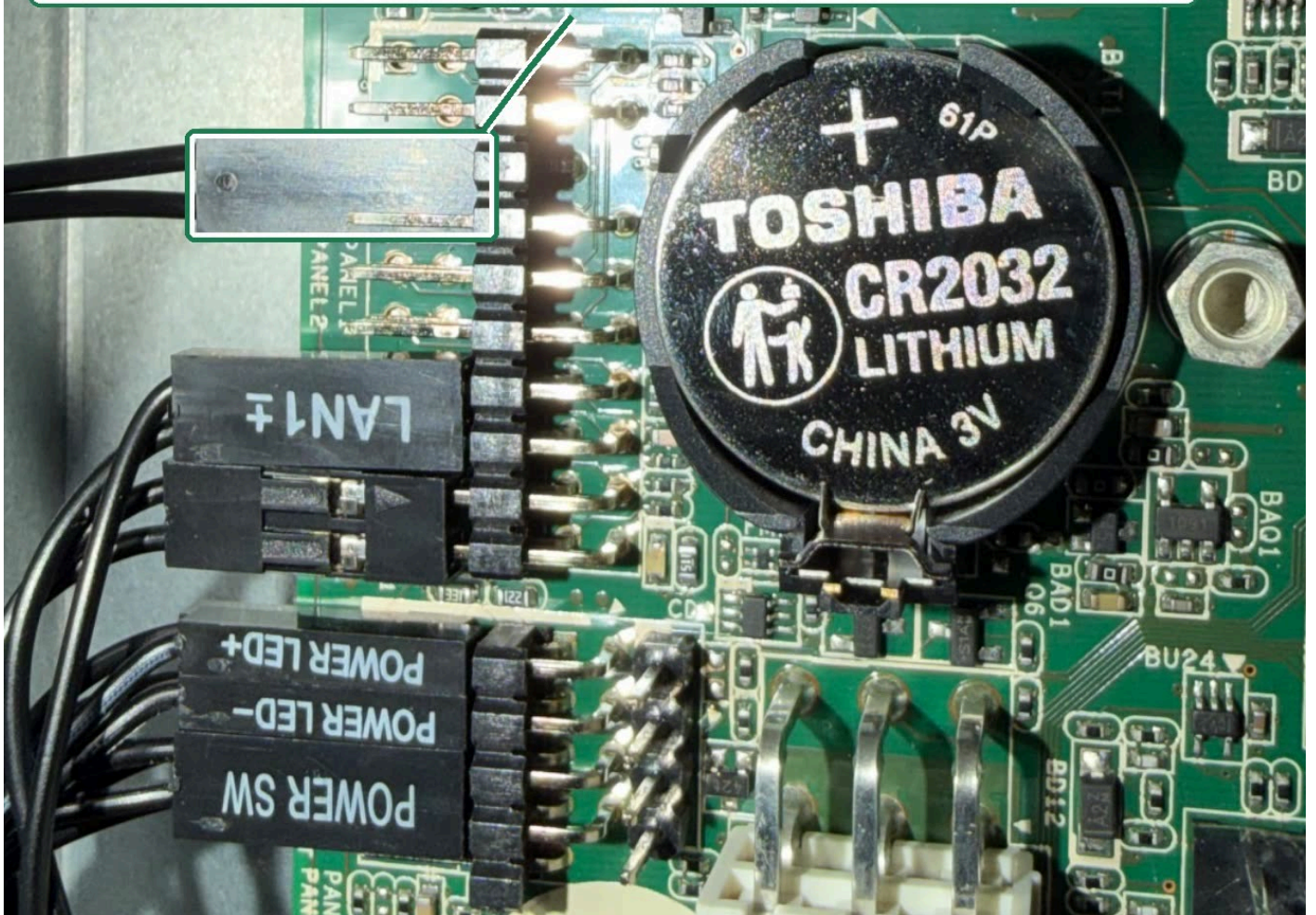
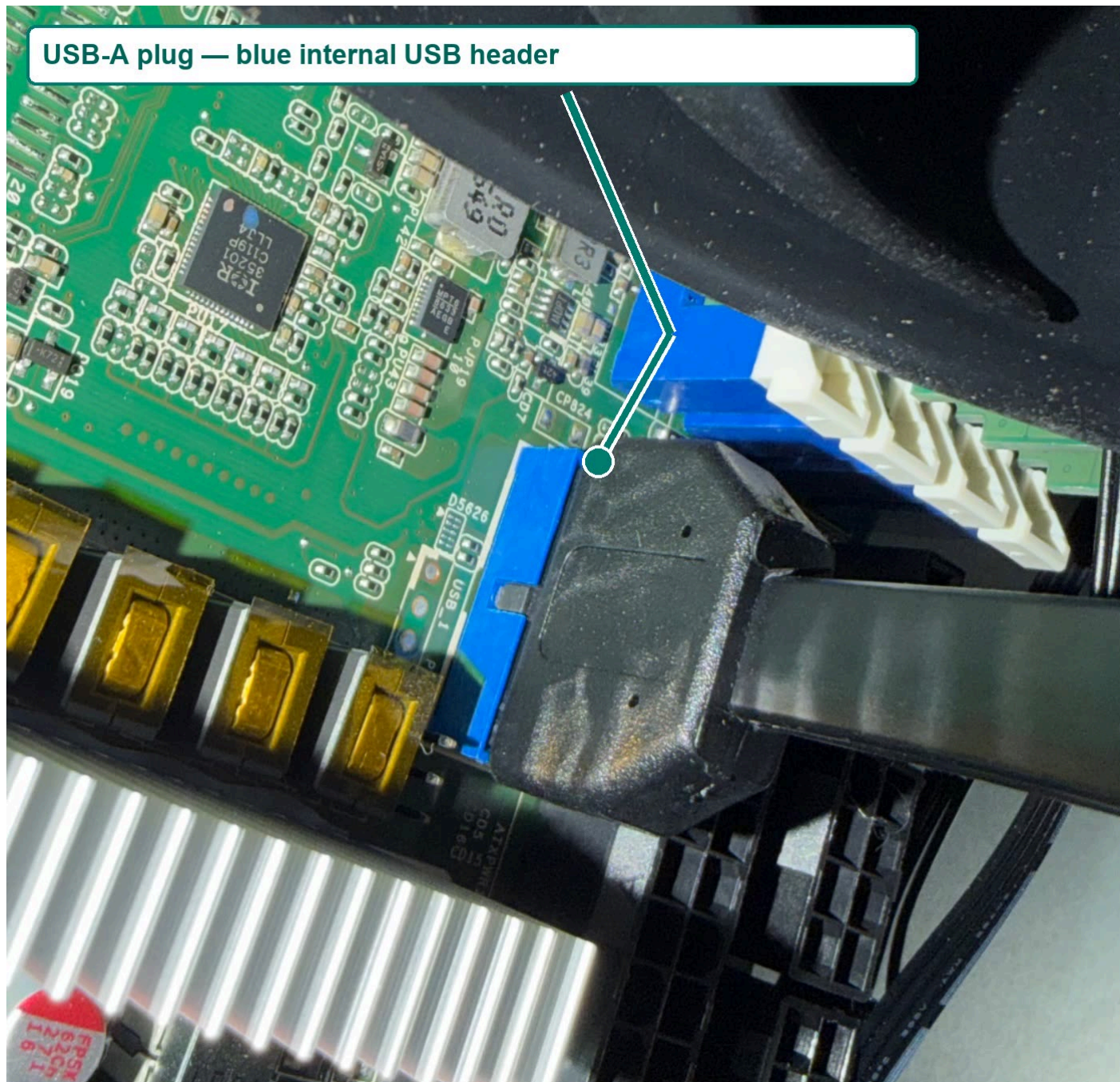


Photo — the front USB-A plug in its blue header

The big black USB-A plug in the blue header beside the memory and the motherboard-power corner. The board prints **USB1** there; the manual calls it **USB3_3_4**. This is not the USB-C cable.

USB-A plug — blue internal USB header



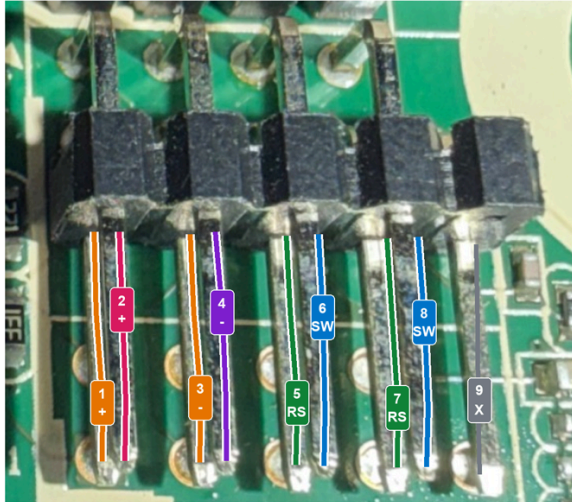
PANEL1: the case's front-panel plugs coloured to match the pins

Raised row: pins 2, 4, 6, 8. Lower row: 1, 3, 5, 7, 9. Grey pin 9 is unused. The drawing is from the ASRock manual, PDF page 35 (printed page 28).

PANEL1: YOUR WIRES + COLOURED PINS + PDF

Match colours between your cable photo and the corrected pin photo.

YOUR ACTUAL PINS

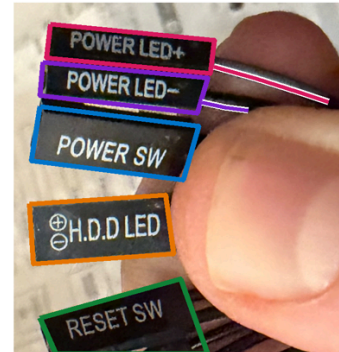


Raised row: pink 2, purple 4, blue 6 + 8.

Lower row: orange 1 + 3, green 5 + 7, grey 9 unused.

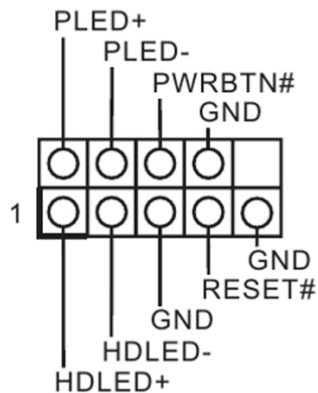
Hand-hidden wire sections are NOT drawn or guessed; their photographed plugs are colour-marked.

YOUR ACTUAL WIRES / PLUGS



- **POWER LED+**
one pink pin: 2
- **POWER LED-**
one purple pin: 4
- **POWER SW**
two blue pins: 6 + 8
- **H.D.D LED**
two orange pins: 1 (+) + 3 (-)
- **RESET SW**
two green pins: 5 + 7

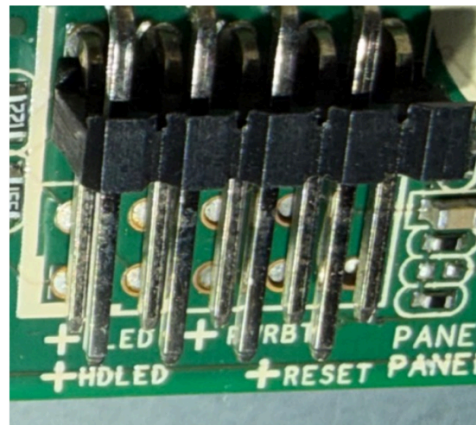
ACTUAL PDF: ROMED8-2TBCM.pdf, page 35 / printed page 28



PDF upper row: PLED+, PLED-, PWRBTN#, GND

PDF lower row: HDLED+, HDLED-, GND, RESET#, GND

SIDE PHOTO: lone far-right pin 9 anchors the lower row.



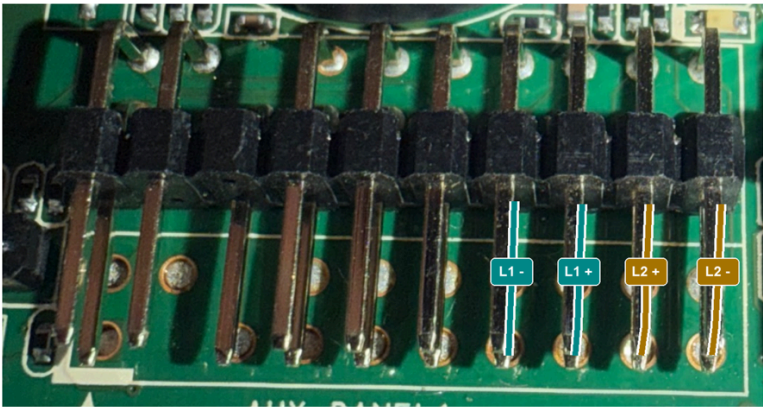
Wall power unplugged. Two-pin plugs stay in ONE height row. Slide along pins; never force.

LAN1 and LAN2 light plugs: the pins, the cable labels and the manual's drawing

Both plugs use the four raised block-B pins. LAN2 faces the opposite way to LAN1: positives together in the middle, negatives outside. The drawing is from the ASRock manual, PDF page 36 (printed page 29). AC unplugged; never force a plug.

CORRECTED LAN PINS + ACTUAL ASROCK PDF

Use these FOUR RAISED pins. Ignore the uncoloured lower pins beside them.



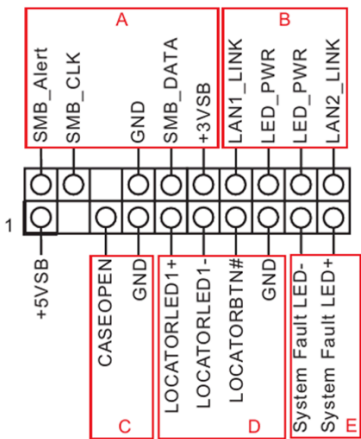
MATCH YOUR CABLE MARKINGS:



LAN1 -> teal L1- and L1+
LAN2 -> gold L2+ and L2-

YES: LAN2 turns 180 degrees relative to LAN1
so its + conductor meets LED_PWR.
The printed label may face the opposite way.

ACTUAL PDF: ROMED8-2TBCM.pdf, page 36 / printed page 29



Read the PDF block B:

LAN1_LINK | LED_PWR
LAN1: - +

LED_PWR | LAN2_LINK
LAN2: + -

Both positives are in the middle.
Both negatives are on the outside.

The two plugs stay in ONE height row.

The PDF gaps identify the rows:
upper row: third position absent;
lower row: second position absent.

Wall power unplugged. Do not bridge upper and lower pins. Never force a connector.

06c – Connect motherboard power without burying smaller headers

Use: the HELA's ATX main cable (**W03**), two EPS CPU cables (**W01**, **W02**) and one PCIe cable (**W04**).

Why now: the small plugs are done. Connect GFX_12V1 before a card hides it, and the two small CPU sockets before the wide ATX cable crowds that corner.

Read the power-map labels

A1/A2/A3, B1/B2, C1/C2 and D1/D2 on the power map are guide markers, not labels printed on the PSU. One letter and colour is one whole cable; the number tells its two ends apart.

- **Pink D1:** the PCIe cable's PSU end, into any free eight-pin output printed **PCIE / CPU**.
- **Pink D2:** the same cable's **six-pin** board end, into the white **GFX_12V1** socket. Its +2 piece and any spare plug stay unused and tied back.

There's no PSU socket called D2. D1's position on the map is an example; any free PCI-E/CPU output works. Follow the printed names and keep AC unplugged.

How

1. **W04 → GFX_12V1.** Run the PCIe cable from a free PSU output to **GFX_12V1** and use only its six-pin part. This white socket opens **sideways**: line up the latch and push the plug in horizontally, not down from above.
 - **Find:** GFX_12V1 near the lower card slots (not a CPU socket).
 - **Check:** the six-pin plug is fully in. The +2 piece and any spare plug are tied back and not used for anything else.
 - **Stop:** you're holding an EPS plug, you can't see the opening, or the cable only reaches stretched.
2. **W02 → ATX12V2.** Run the second EPS cable from its own PSU output to the small four-pin **ATX12V2** socket. Use just the half that fits its key. Tie the other half back.
 - **Find:** ATX12V2 next to ATX12V1, and the "CPU" label on the cable.
 - **Check:** that half is clicked in, and the unused half isn't jammed against anything.
 - **Stop:** neither half fits. Don't trim a key or use a PCIe plug.
3. **W01 → ATX12V1.** Run the first EPS cable from its own PSU output. Hold its two four-pin halves together as one eight-pin plug, line up the latch and push it into the eight-pin **ATX12V1** socket.
 - **Find:** the EPS cable's split 4+4 end and the eight-pin socket.
 - **Check:** both halves are fully in and the cable goes to its own PSU output.
 - **Stop:** the halves won't line up, a key fights you, or the board starts to bend.

4. **W03 at the PSU.** The ATX cable has **two** plugs at the PSU end: the main one and a smaller six-pin companion. Both go into their own PSU sockets (not the eight-pin CPU/PCIe outputs). Both are needed even though there's one plug at the board end.
 - **Find:** the main and six-pin companion sockets on the HELA.
 - **Check:** both branches of this one cable lead to its single 24-pin board plug.
 - **Don't mix up the four-pin pieces:** the ATX board plug is **20 + 4 held together in ATXPWR1**. That +4 is part of the ATX plug, not a CPU cable. ATX12V2 uses half of the **second, separate** EPS cable, not the spare half of the first.
 - **Stop:** you're not sure which cable or socket it is.
5. **W03 → ATXPWR1.** Route the ATX cable so it doesn't press on the small plugs you just did. Line up its latch and push it straight into the long 24-pin socket. If the board flexes, don't push harder.
 - **Find:** the long 24-pin ATXPWR1 socket beside the CPU-power sockets.
 - **Check:** the latch has caught and the plug is fully in on every side you can see. The CPU plugs and USB cable aren't strained.
 - **Stop:** a key fights you, the board bends, or you can't tell it's fully in.
6. Follow all four cables from board to PSU. Fold extra length in loose loops beside the route, not across the path the GPUs breathe through. Tie them loosely only once everything works. Recheck each plug after moving its cable.
 - **Find:** W03 (ATX), W01 (ATX12V1), W02 (ATX12V2) and W04 (GFX_12V1).
 - **Check:** no bundle presses on a small plug, crosses a fan or a card slot, or pulls a plug sideways.
 - **Stop:** the only route needs a sharp bend, a stretched cable or the lid holding it down.

Before moving on

ATX, both CPU sockets and GFX_12V1 are connected and checked. The fan and front-panel plugs are still seated after the big cables went in. EPS and PCIe plugs weren't swapped.

Source: BCM power and header layout, manual pages 14 and 35–38; HELA cable and socket list.

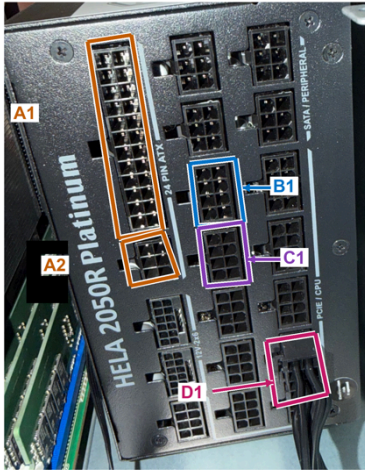
ALL motherboard power in ONE view — colours and A1–D2 are guide markers, not hardware markings

One colour is one whole cable. A1 and A2 are the ATX cable's two PSU plugs and A3 its joined 20+4 board plug. Purple C is the second, separate EPS cable: one 4-pin half goes on ATX12V2 and the other stays loose. Leave working plugs where they are; don't move a plugged-in PSU cable just to match the picture. AC unplugged.

MOTHERBOARD POWER — ONE COLOUR = ONE WHOLE CABLE

A1–D2 are GUIDE markers, not PSU markings. Use printed hardware names. AC UNPLUGGED.

YOUR PSU

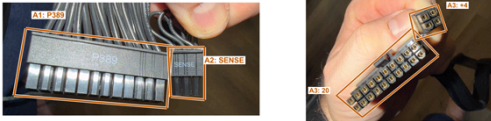


PSU END LABELS

A1 P389 → 24 PIN ATX
A2 SENSE → its small companion socket
B1 Blue CPU cable → this empty 8-pin
C1 OTHER CPU cable → separate 8-pin
D1 Existing feed: trace to white GFX first

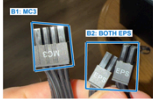
B1 / C1 are chosen free PCI-E / CPU outputs.
Do not move an occupied lead to copy the picture.

ORANGE A • ONE ATX HARNESS
TWO PSU plugs (A1 + A2). ONE board connection (A3).



A3 needs BOTH the 20-pin and +4. That orange +4 is NOT CPU.

BLUE B • ONE WHOLE CPU / EPS CABLE



B1 MC3 → blue PSU socket
B2 BOTH EPS halves → 8-pin CPU
4 + 4 = 8
Use BOTH halves on this ONE socket.

PURPLE C • A SECOND, SEPARATE CPU / EPS LEAD

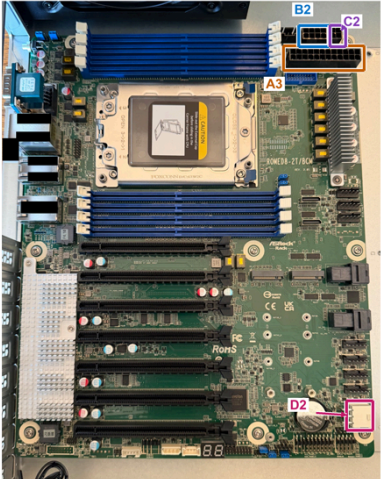
C1 MC3 → purple PSU socket
C2 ONE matching EPS half → 4-pin CPU
Other 4-pin half stays loose.
NOT a spare half from the blue cable.

PINK D • DEDICATED PCI-E CABLE FOR WHITE GFX



D1 MC3 → pink PSU output
D2 SIX-pin part → white GFX
Grey +2 stays loose.
Whole spare 6+2 stays loose.
This cable is NOT for a GPU.

YOUR MOTHERBOARD
Earlier photo: socket locations, not current seating.



BOARD END LABELS

A3 20 + 4 together → ATXPWR1 (24)
B2 BOTH EPS halves → ATX12V1 (8)
C2 ONE EPS half → ATX12V2 (4)
D2 PCI-E SIX → white GFX_12V1

D2 opens SIDEWAYS. Do not push into its roof.

ORIGINAL HELA LEADS ONLY. Natural keys and latch fit; never force. Colours show identity, NOT proof of seating.
Motherboard power only; GPU power is later.

Orange A3: 20 + 4 join in the SAME 24-pin motherboard socket

Our joined plug: the four-pin piece of the main ATX cable sits beside its 20-pin piece, making one 24-pin plug in ATXPWR1. It isn't spare and doesn't go in ATX12V2, the separate four-pin CPU socket. Don't unplug a checked connection to copy the picture.



07 – Set up GPU-free BIOS and provision the base

Use: the finished base machine with **no GPUs**, two network cables, a browser on another computer, and the Ubuntu 26.04.1 Server installer on a USB stick (download the amd64 Server ISO and write it with a USB-imaging tool such as balenaEtcher; copying the file onto the stick doesn't work).

Why now: set the BIOS and install Ubuntu while the machine is simple. If the CPU, memory or SSD has a problem, you find it now, not under four cards. Do this separately for each machine; one machine passing doesn't pass another.

Power checkpoint: look over the unplugged base first. Plug in AC only when the build in front of you is ready for its first start.

The screenshots below are the real BIOS, installer and remote-console screens from our build, placed at the step where you'll see them. **Blue** outlines a row or key to select, **green** a value to check, **amber** something to leave alone or watch out for.

How

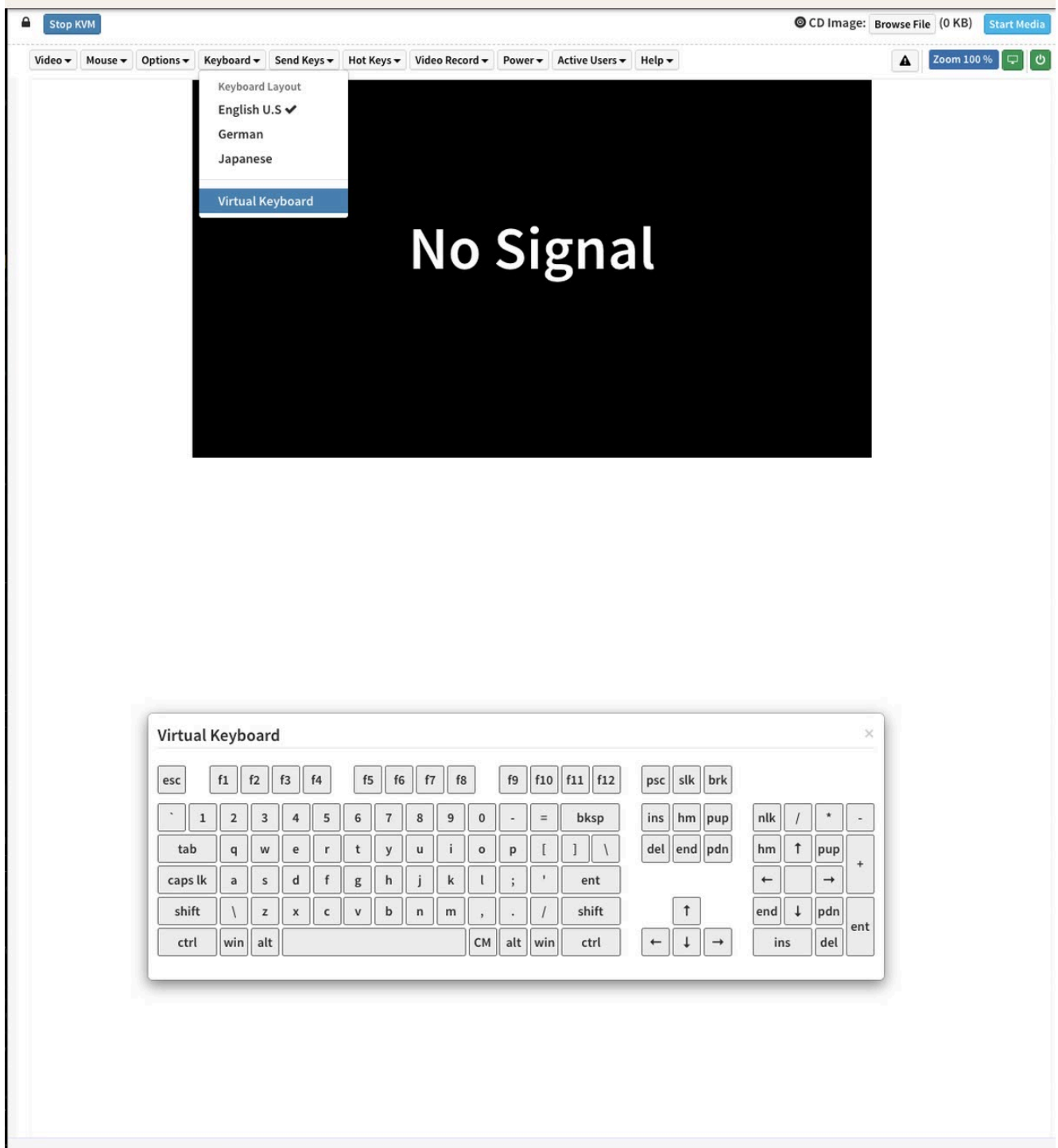
1. Look over the base one last time: eight board screws, nothing loose, CPU plate and cooler secure, memory and SSD seated, all motherboard power in, fan blades clear, front-panel plugs on. Plug the **IPMI_LAN1** port into your private network and plug in AC. The management controller (BMC) starts on standby power, before the machine itself is on. Find the address your router gave it, open that address in a browser, log in, and open the remote console (**Remote Control → Launch KVM**) **before** the first start. If plugging in AC starts the machine by itself, don't press Power again.

- **Find:** the dedicated IPMI_LAN1 port on the back (above the two USB-A ports; the board manual's rear-panel page shows it), and the BMC's address in your router's list of connected devices.
- **Check:** the remote console shows the screen and accepts your keys. If it says you only have partial control, fix that first.
- **Stop:** anything mechanical, electrical or network-related isn't sorted.
- **Login:** use the BMC username and password that came with your board (check the label on the board or in its box, and the board manual). Change the password once you're in, never put the management port on the internet, and keep the password out of photos and notes.

In the console, open **Keyboard → Virtual Keyboard**. While the machine starts, send **f2** or **del** to enter the BIOS, or **f11** for a one-time boot menu. The **del** you want is the one under **ins**, left of **end**, not backspace and not the number-pad del. Use one of them, not all at once.

The first screenshot says **No Signal**: opening the keyboard doesn't fix a blank screen by itself. If someone is installing Ubuntu on a machine, don't reset it.

OPEN: KVM → KEYBOARD → VIRTUAL KEYBOARD



The screenshot shows a KVM (Keyboard Video Mouse) interface. At the top, there is a navigation bar with the following items: **Stop KVM**, **CD Image: Browse File (0 KB)**, and **Start Media**. Below this is a menu bar with the following options: **Video**, **Mouse**, **Options**, **Keyboard**, **Send Keys**, **Hot Keys**, **Video Record**, **Power**, **Active Users**, and **Help**. The **Keyboard** menu is open, showing the following options: **Keyboard Layout**, **English U.S. ✓**, **German**, **Japanese**, and **Virtual Keyboard** (which is highlighted). The main display area is black with the text **No Signal** in white. Below the main display, there is a **Virtual Keyboard** window. This window contains a virtual keyboard layout with the following keys: **esc**, **f1**, **f2**, **f3**, **f4**, **f5**, **f6**, **f7**, **f8**, **f9**, **f10**, **f11**, **f12**, **psc**, **slk**, **brk**, **ins**, **hm**, **pup**, **nlk**, **/**, *****, **-**, **tab**, **q**, **w**, **e**, **r**, **t**, **y**, **u**, **i**, **o**, **p**, **[**, **]**, ****, **del**, **end**, **pdn**, **hm**, **↑**, **pup**, **+**, **caps lk**, **a**, **s**, **d**, **f**, **g**, **h**, **j**, **k**, **l**, **;**, **'**, **ent**, **←**, **→**, **end**, **↓**, **pdn**, **ent**, **shift**, ****, **z**, **x**, **c**, **v**, **b**, **n**, **m**, **,**, **.**, **/**, **shift**, **↑**, **ins**, **del**, **ctrl**, **win**, **alt**, **CM**, **alt**, **win**, **ctrl**, **←**, **↓**, **→**.

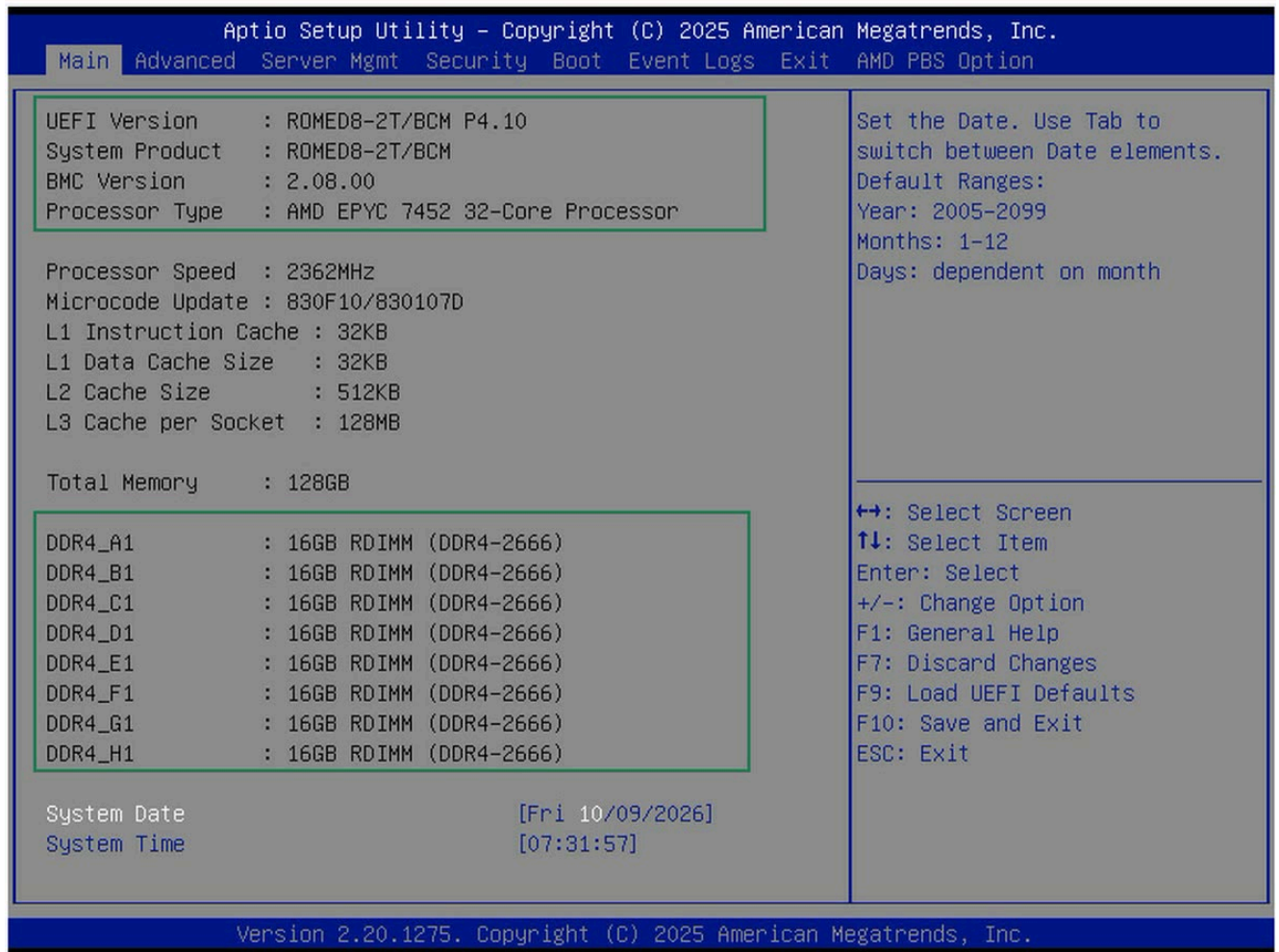
F2 / DELETE: BIOS · F11: BOOT MENU

Virtual Keyboard



2. Press F2 or del during startup. On **Main**, check the board (ROMED8-2T/BCM, BIOS P4.10, BMC 2.08.00), the CPU (EPYC 7452) and **128 GB on eight 16 GB DDR4-2666 modules, A1 to H1**. Don't copy the date, time or network details from the screenshot.
- **Find:** Main → Processor Type, Total Memory and the eight DDR4 rows.
 - **Check:** all eight modules show up. That's detection, not a memory test; you test memory in step 13.

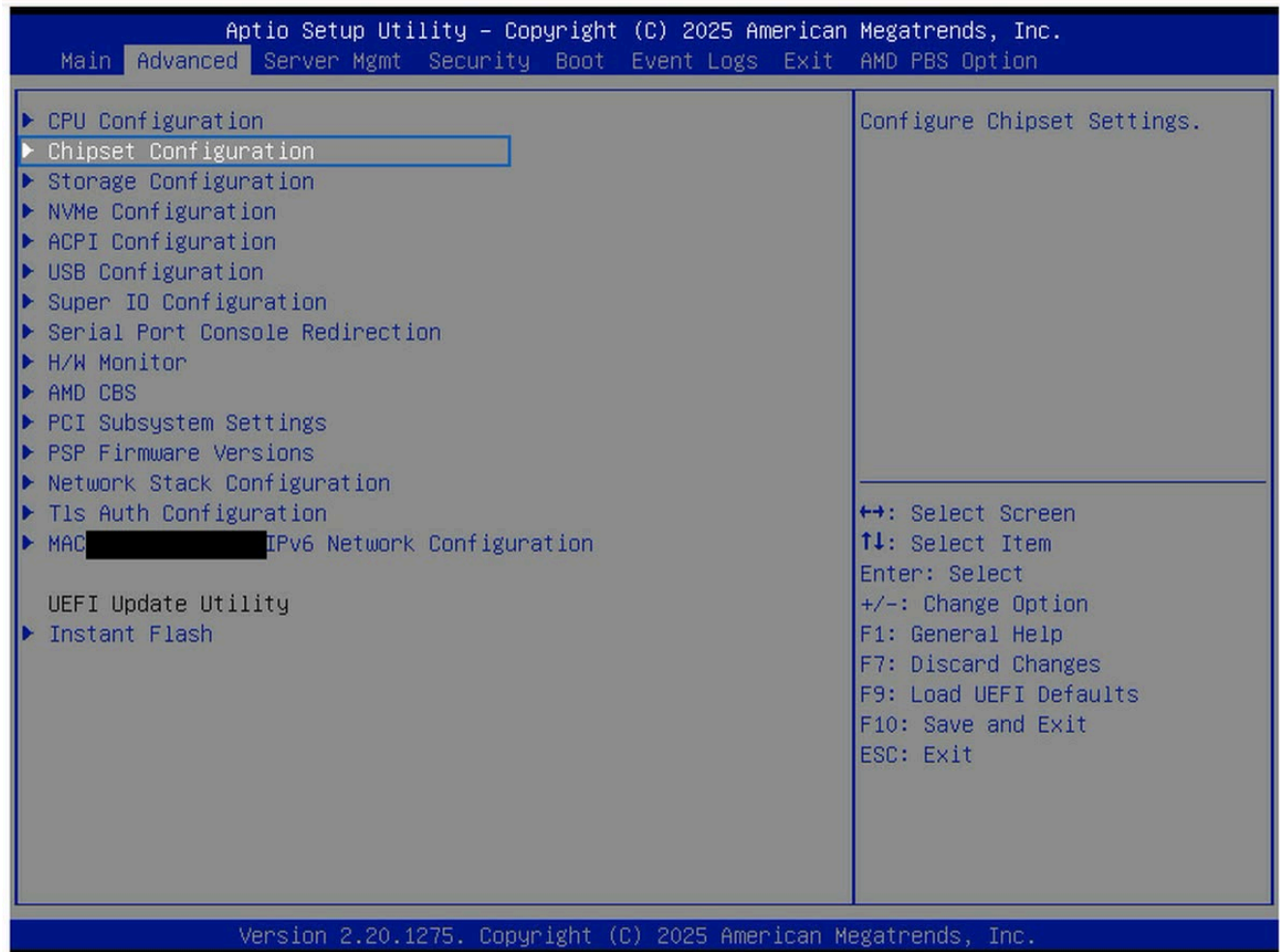
VERIFY: CPU / 128 GB / ALL EIGHT DIMMS



3. **Change 1 of 5 — graphics.** Use the arrow keys to go to **Advanced**, open **Chipset Configuration**, and set **Primary Graphic Adapter** to **Onboard**. If it already says Onboard, leave it. Don't touch the LAN, TPM, link or power-restore settings.

- **Find:** Advanced → Chipset Configuration → Primary Graphic Adapter.
- **Check:** it says Onboard. Press Esc to go back to Advanced.

OPEN: ADVANCED → CHIPSET CONFIGURATION



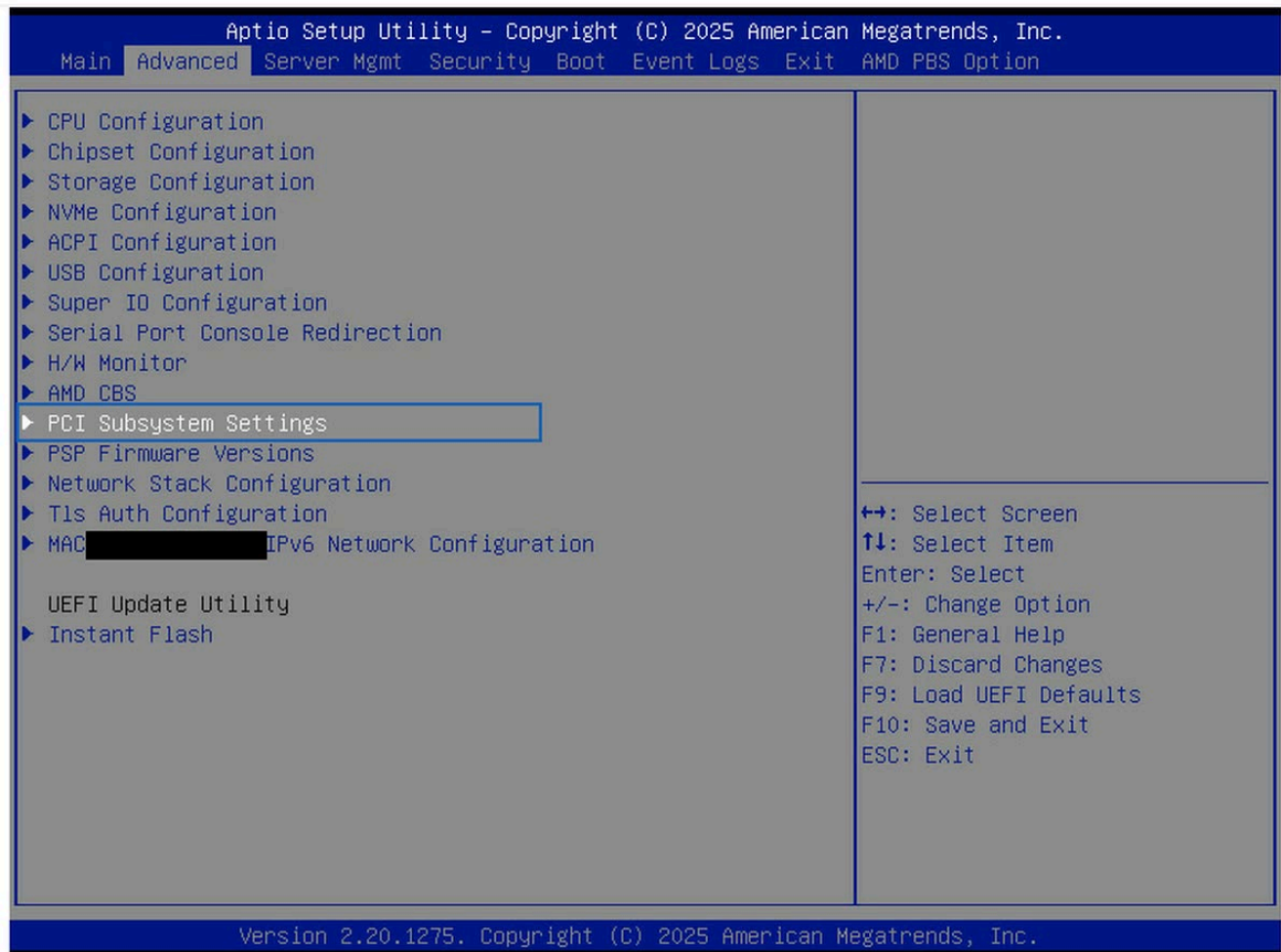
VERIFY: PRIMARY GRAPHIC ADAPTER = ONBOARD

Aptio Setup Utility - Copyright (C) 2025 American Megatrends, Inc.		
Advanced		
Primary Graphic Adapter	[Onboard]	Select between onboard or external VGA support.
Onboard LAN	[Enabled]	
SPI/LPC TPM switch	[LPC TPM]	
▶ AMD PCIE Hotplug		
▶ AMD PCIE Link Width		
▶ AMD PCIE Link Speed		
Onboard Debug Port LED	[Auto]	
Restore AC Power Loss	[No change]	
Restore AC Power Current State	Last State	
		↔: Select Screen ↑↓: Select Item Enter: Select +/-: Change Option F1: General Help F7: Discard Changes F9: Load UEFI Defaults F10: Save and Exit ESC: Exit
Version 2.20.1275. Copyright (C) 2025 American Megatrends, Inc.		

4. **Changes 2, 3 and 4 — PCI settings.** Open **PCI Subsystem Settings** (below AMD CBS). Set **Above 4G Decoding** to **Enabled**, **SR-IOV Support** to **Disabled** and **Re-Size BAR Support** to **Disabled**. On our board all three were already set that way.

- **Find:** Advanced → PCI Subsystem Settings.
- **Check:** all three match. Press Esc, then go to **Boot**.

OPEN: PCI SUBSYSTEM SETTINGS



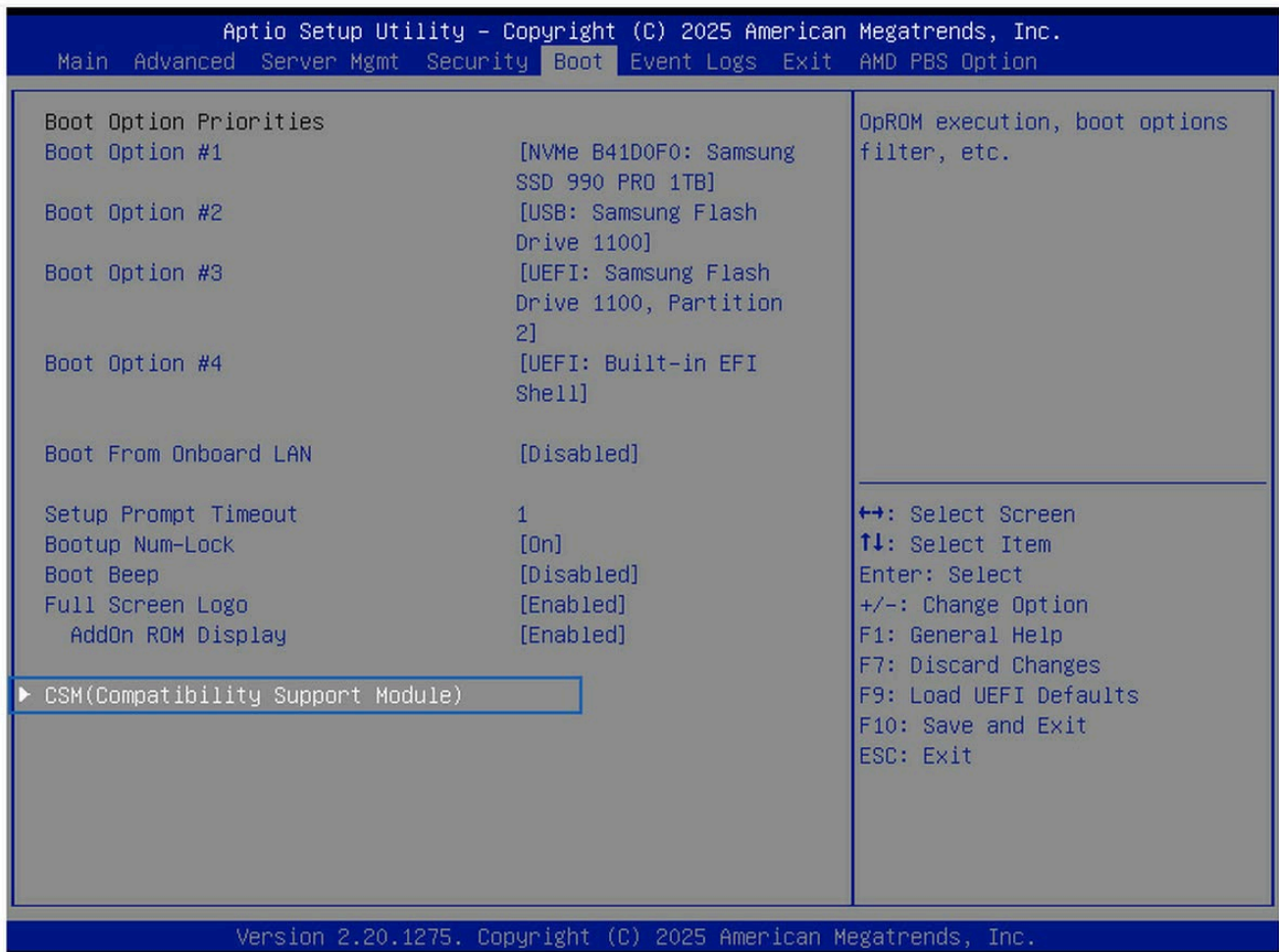
VERIFY: ABOVE 4G ENABLED

Aptio Setup Utility - Copyright (C) 2025 American Megatrends, Inc.	
Advanced	
Above 4G Decoding	[Enabled]
SR-IOV Support	[Disabled]
Re-Size BAR Support	[Disabled]
If system has Resizable BAR capable PCIe Devices, this option Enables or Disables Resizable BAR Support.	
 ↔: Select Screen ↑↓: Select Item Enter: Select +/-: Change Option F1: General Help F7: Discard Changes F9: Load UEFI Defaults F10: Save and Exit ESC: Exit	
Version 2.20.1275. Copyright (C) 2025 American Megatrends, Inc.	

5. **Change 5 — CSM off.** On **Boot**, open **CSM (Compatibility Support Module)** near the bottom and set **CSM** to **Disabled**, so the machine boots native UEFI. Leave the slot OpROM rows on Auto and the security settings alone. Don't load defaults.

- **Find:** Boot → CSM (Compatibility Support Module) → CSM.
- **Check:** it says Disabled. Press Esc, then go back to Advanced.

OPEN: BOOT → CSM



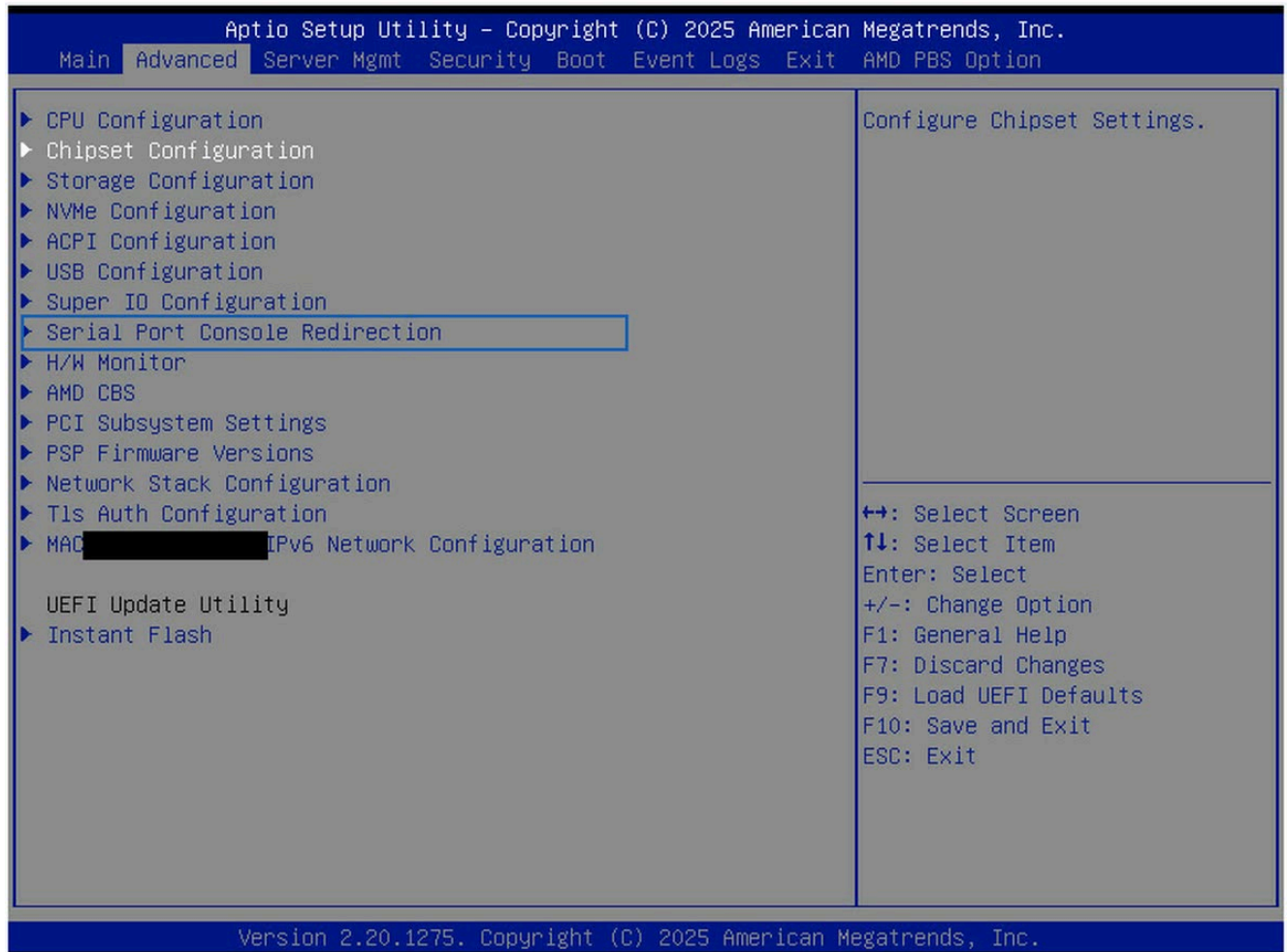
VERIFY: CSM = DISABLED / NATIVE UEFI

Aptio Setup Utility - Copyright (C) 2025 American Megatrends, Inc.		
Boot		
CSM	[Disabled]	Enable to launch the Compatibility Support Module. If you are using Windows 8 64-bit UEFI and all of your devices support UEFI, you may also disable CSM for faster boot speed.
PCIe1 Slot OpROM	[Auto]	
PCIe2/M2_1 Slot OpROM	[Auto]	
PCIe3 Slot OpROM	[Auto]	
PCIe4 Slot OpROM	[Auto]	
PCIe5 Slot OpROM	[Auto]	
PCIe6 Slot OpROM	[Auto]	
PCIe7 Slot OpROM	[Auto]	
OCU1 Slot OpROM	[Auto]	
OCU2 Slot OpROM	[Auto]	
M2_2 Slot OpROM	[Auto]	
		↔: Select Screen ↑↓: Select Item Enter: Select +/-: Change Option F1: General Help F7: Discard Changes F9: Load UEFI Defaults F10: Save and Exit ESC: Exit
Version 2.20.1275. Copyright (C) 2025 American Megatrends, Inc.		

6. **Serial console (we turned this on).** Open **Serial Port Console Redirection** (below Super IO Configuration). Under **SOL**, set **Console Redirection** to **Enabled**. Leave COM1 and Windows EMS Disabled. Then open the **Console Redirection Settings** row directly under SOL's Enabled row (not COM1's).

- **Find:** Advanced → Serial Port Console Redirection → SOL.
- **Check:** SOL shows Enabled.

OPEN: SERIAL PORT CONSOLE REDIRECTION



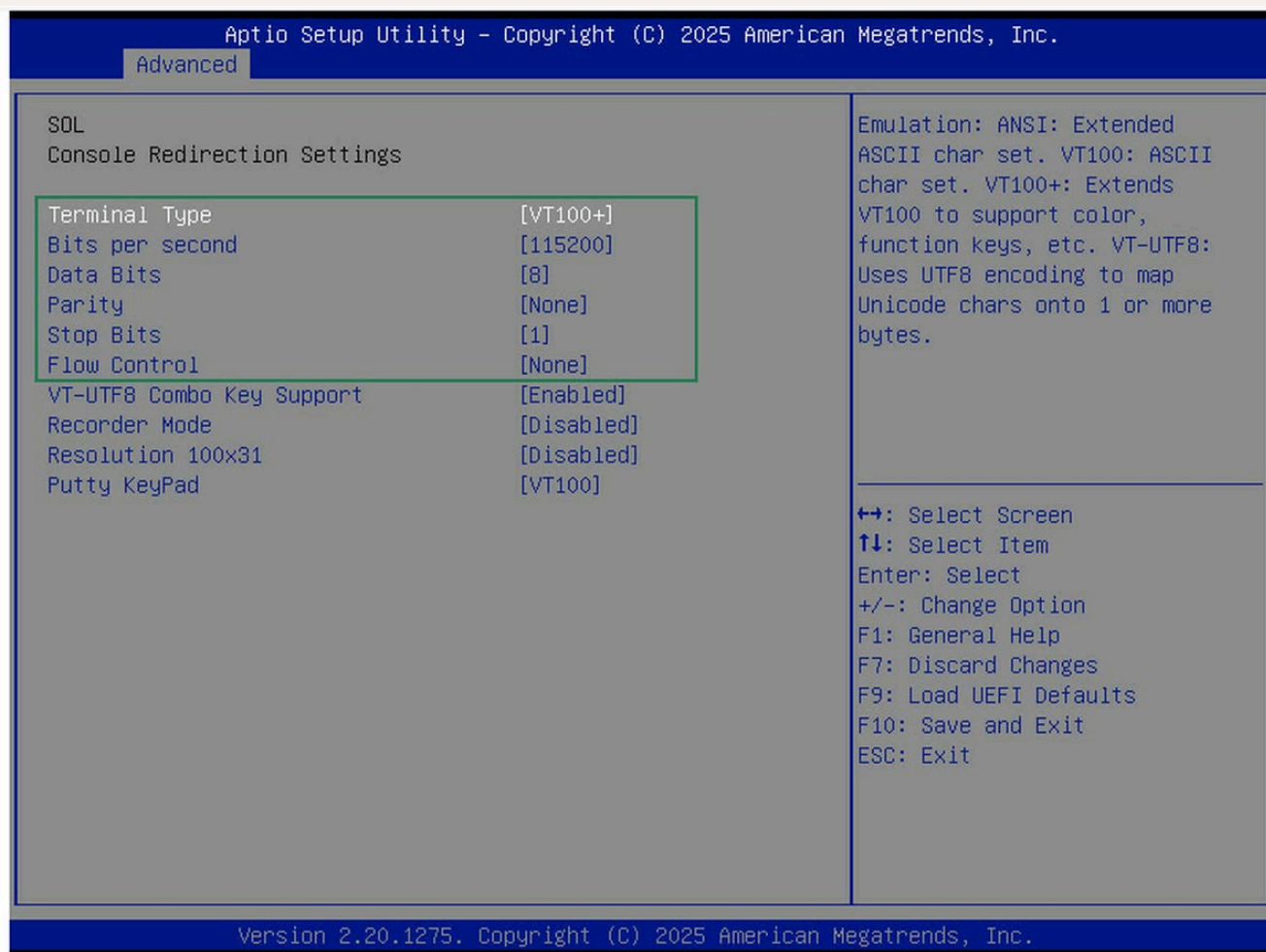
VERIFY: SOL ENABLED / COM1 AND EMS DISABLED

Aptio Setup Utility - Copyright (C) 2025 American Megatrends, Inc.	
Advanced	
COM1 Console Redirection [Disabled] ► Console Redirection Settings	Console Redirection Enable or Disable.
SOL Console Redirection [Enabled] ► Console Redirection Settings	
Serial Port for Out-of-Band Management/ Windows Emergency Management Services (EMS) Console Redirection [Disabled] ► Console Redirection Settings	
↔: Select Screen ↑↓: Select Item Enter: Select +/-: Change Option F1: General Help F7: Discard Changes F9: Load UEFI Defaults F10: Save and Exit ESC: Exit	
Version 2.20.1275. Copyright (C) 2025 American Megatrends, Inc.	

7. Check the SOL settings: **VT100+**, **115200** bits per second, **8** data bits, parity **None**, **1** stop bit, flow control **None**. Leave the rest alone.

- **Find:** SOL → Console Redirection Settings.
- **Check:** all six match. (This only sets up the BIOS side; Linux needs its own serial setup.) Press Esc twice, then go to **Exit**.

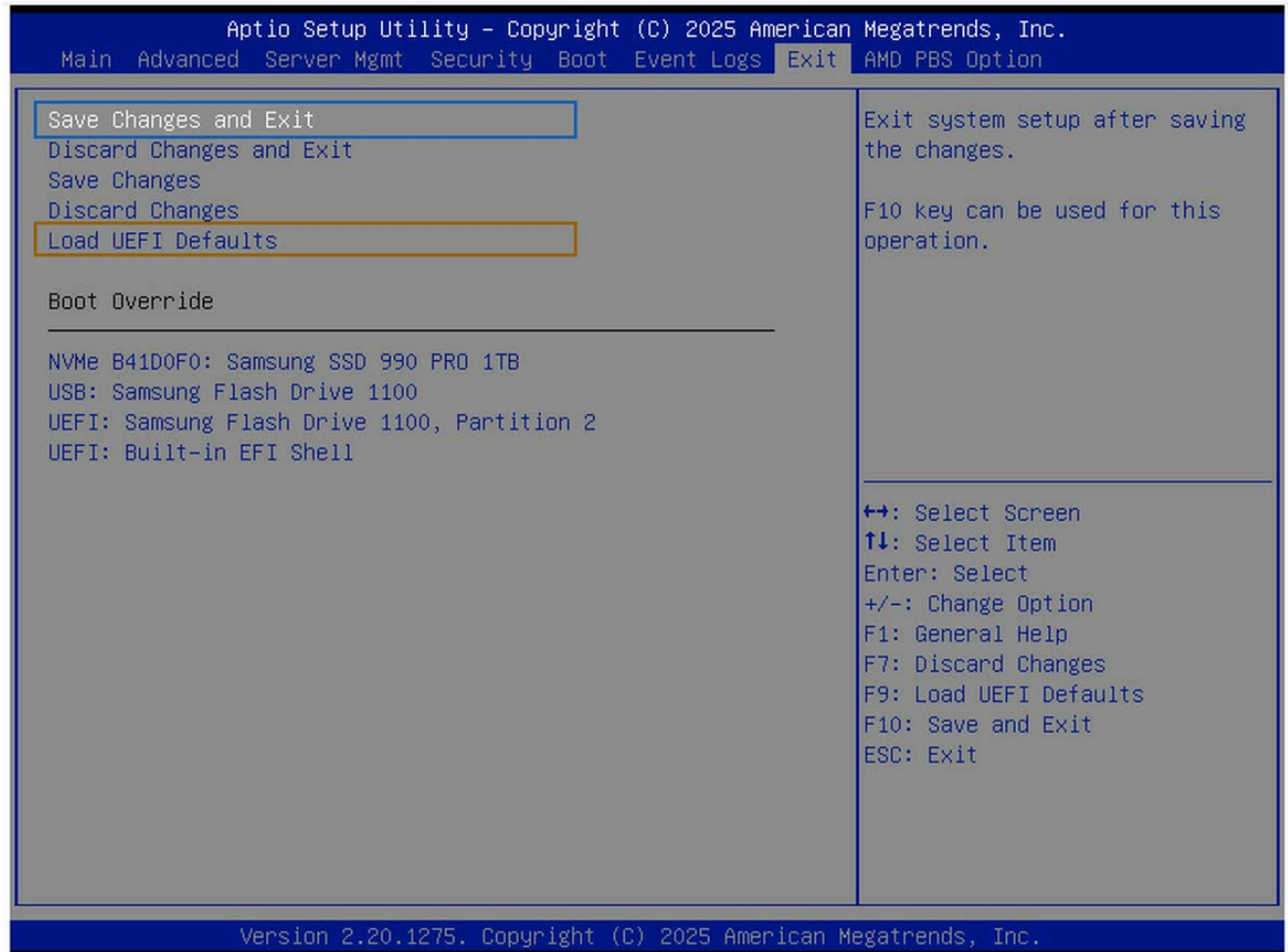
VERIFY: SOL VT100+ / 115200 / 8N1 / NONE



8. Choose **Save Changes and Exit** (or F10) and read the confirmation before accepting. As the machine restarts, send **F11** for the one-time boot menu. If your Mac or browser grabs the function keys, use the console's virtual keyboard.

- **Find:** Exit → Save Changes and Exit, then F11 at the ASRock startup screen.
- **Check:** the startup screen says **Entering Boot Menu**. "Load UEFI Defaults" is not what you want here.

SAVE: REVIEW CHANGES / DO NOT LOAD DEFAULTS



PRESS F11: OPEN THE ONE-TIME BOOT MENU



BMC IPv4 IP1:

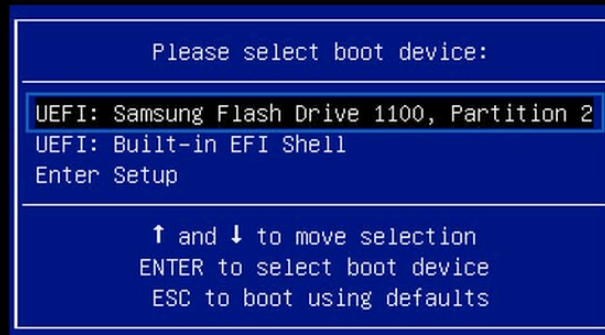
BMC IPv6 IP1:

Entering Boot Menu ...

Pushing firmware layout to OData server.

9. Pick the installer's **UEFI** entry. Ours was **UEFI: Samsung Flash Drive 1100, Partition 2**. Don't pick the Built-in EFI Shell, a plain (non-UEFI) USB entry, or the SSD itself.
- **Find:** F11 → Please select boot device → the entry starting with **UEFI:** for your installer.
 - **Check:** the Ubuntu installer starts.
 - **Stop:** you're not sure the installer USB is the one you made, or which disk you're about to install to.
 - **No USB entry?** On computer 1 the USB stick wouldn't boot, so we mounted the ISO through the remote console instead: in the KVM window, **Browse File → the Ubuntu ISO → Start Media**, then restart into F11 and pick the virtual drive's **UEFI** entry. Choosing the file isn't enough; check it shows up in the boot menu. Afterwards, stop the virtual media so the machine boots from its SSD.

BOOT: SELECT THE UEFI INSTALLER USB



10. On **Network configuration**, plug a second cable from your normal network into one of the board's two data ports (LAN1 or LAN2). Keep the IPMI cable in too. Use whichever Broadcom port (**eno1np0** or **eno2np1**) gets a link and an address.
- **Find:** the two Broadcom ports. In this screenshot both say **not connected** because no data cable was in yet.
 - **Check:** one of them shows an address before you continue.
 - **Leave alone:** the AMI virtual Ethernet adapter (its name starts with **enx**). Don't create a bond.

NETWORK: USE A BROADCOM DATA-LAN PORT

```
Network configuration [ Help ]

Configure at least one interface this server can use to talk to other machines, and which preferably
provides sufficient access for updates.

NAME      TYPE      NOTES
[ eno1np0  eth      not connected ▶ ]
  DHCPv4   |
           / Broadcom Inc. and subsidiaries / BCM57416 NetXtreme-E Dual-Media 10G RDMA
Ethernet Controller (NetXtreme-E Dual-port 10GBASE-T Ethernet OCP 3.0 Adapter (BCM957416N4160C))

[ eno2np1  eth      not connected ▶ ]
  DHCPv4   -
           / Broadcom Inc. and subsidiaries / BCM57416 NetXtreme-E Dual-Media 10G RDMA
Ethernet Controller (NetXtreme-E Dual-port 10GBASE-T Ethernet OCP 3.0 Adapter (BCM957416N4160C))

[ enx      eth      - ▶ ]
  disabled autoconfiguration failed
           / American Megatrends, Inc. / Virtual_Ethernet

[ Create bond ▶ ]

[ Continue without network ]
[ Back ]
```

11. On **Guided storage configuration**, choose **Use an entire disk** and pick the **Samsung SSD 990 PRO 1TB**, **not** the USB installer. Leave **Set up this disk as an LVM group** unchecked. Choose Done.
- **Find:** the 990 PRO by its model and size (about **931 GB**).
 - **Check:** that's the disk you mean to erase, and nothing on it needs keeping.
 - **Stop:** you're not sure which disk it is.

STORAGE: VERIFY THE SSD / NO LVM

Guided storage configuration [Help]

Configure a guided storage layout, or create a custom one:

☒ Use an entire disk

[Samsung_SSD_990_PRO_1TB_] [1 local disk 931.513G ▼]

☐ Set up this disk as an LVM group

☐ Encrypt the LVM group with LUKS

Passphrase:

Confirm passphrase:

☐ Also create a recovery key
The key will be stored as ~/recovery-key.txt in the live system
and will be copied to /var/log/installer/ in the target system.

☐ Custom storage layout

[Done]

[Back]

12. On **Storage configuration**, check the 990 PRO gets two **new** partitions: **/boot/efi** (about 1 GB, FAT32) and **/** (the rest, ext4), with no LVM or RAID. The USB stick shows as **existing, in use**: that's normal, it isn't being erased.
- **Find**: the new partitions under the 990 PRO.
 - **Check**: only the SSD is being formatted.
 - **Last chance**: when you choose Done, the installer asks you to confirm. **Confirming erases the 990 PRO.**

REVIEW: EFI + EXT4 / USB UNCHANGED

Storage configuration [Help]

FILE SYSTEM SUMMARY

MOUNT POINT	SIZE	TYPE	DEVICE TYPE
[/	930.460G	new ext4	new partition of local disk ▶]
[/boot/efi	1.049G	new fat32	new partition of local disk ▶]

AVAILABLE DEVICES

DEVICE	TYPE	SIZE
[Samsung_Flash_Drive_ -0:0	local disk	239.016G ▶]
partition 2 existing, unused ESP, already formatted as vfat		5.027M ▶
partition 3 existing, unused		300.000K ▶

[Create software RAID (md) ▶]
[Create volume group (LVM) ▶]

USED DEVICES

DEVICE	TYPE	SIZE
[Samsung_Flash_Drive_ -0:0	local disk	239.016G ▶]
partition 1 existing, already formatted as iso9660, in use		2.721G ▶
partition 4 existing, already formatted as ext4, in use		236.287G ▶

[Samsung_SSD_990_PRO_1TB_ 1	local disk	931.513G ▶]
partition 1 new, primary ESP, to be formatted as fat32, mounted at /boot/efi		1.049G ▶
partition 2 new, to be formatted as ext4, mounted at /		930.460G ▶

[Done]
[Reset]
[Back]

13. Finish the install with this machine's own hostname and your own login. On the SSH screen, tick **Install OpenSSH server**, import your public key, and leave password login over SSH off. Remove the installer, set **ubuntu** first in the BIOS boot order, and check the machine boots from the SSD and you can SSH in over the data network. Then run the base checks below and keep their results.

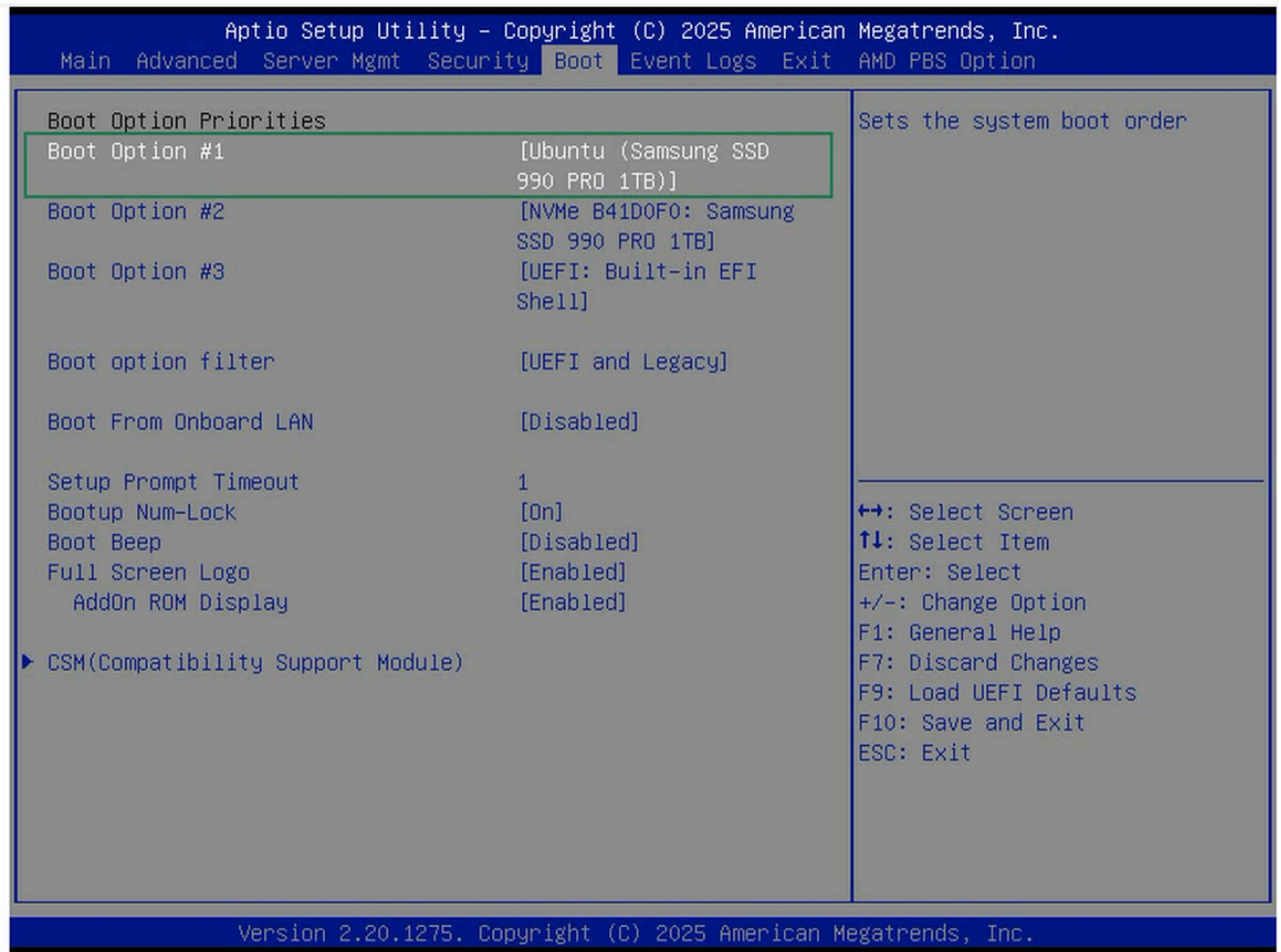
- **Find:** the machine's data-network address (not the IPMI address).
- **Check:** it boots from the SSD, SSH works, and the base checks pass.

Our base checks, on each machine, before any card went in:

- **Inventory:** the CPU, all eight memory modules (128 GB), the 990 PRO and both data ports show up as expected (`lscpu`, `free -g`, `lsblk`, `ip link`).
- **CPU:** `stress-ng --cpu-method all --verify` on 8, then 32, then every thread.
- **Memory:** memtester in eight workers that together lock and test **96 GiB** of the 128 GB (the rest stays free for Ubuntu). This online test doesn't reach every memory address; a bootable memory tester does.
- **Throughout:** watch sensors and the BMC's temperatures and fan speeds. A pass is no errors, the memory error counters under `/sys/devices/system/edac/mc/` still at zero, nothing new in `journalctl -k`, and no temperature near its limit.
- **SSD:** the NVMe short self-test (`nvme device-self-test -s 1`), then a `fio` run that writes a 1 GiB test file and reads it back with checksums (`--verify=crc32c`).
- **Fans:** every fan you connected shows a speed in the BMC's sensor list.
- **One warm reboot:** `sudo reboot`, wait, SSH back in, and check that everything above still shows up the same way.

Hand this list to your AI to turn into commands for your machine.

AFTER INSTALLATION: VERIFY UBUNTU FIRST



14. Before going back inside the case, stop anything running, shut down normally and **unplug the AC cord**. Wait for the fans and standby lights to go out.

- **Find:** the PSU power inlet.
- **Check:** the cord is out and the lights are off before you touch a card or cable.

Before moving on

BIOS set, Ubuntu installed, SSD boot and SSH working, base checks passed, and the machine is shut down and **unplugged**. Only then go on to the cards.

Source: our BIOS, boot, installer and remote-console screenshots; the base checks we ran on all three machines; BCM CPU, memory and power instructions.

08 – Prepare the support position and install the wall-side card

Use: card **G04**, slot **PCIE1** (by the case wall), its bracket screws, adapter **WA4** and three separate PCIe cables **WP4**, **WP5**, **WP6**.

Why now: start at the wall while the slot beside it is still empty. Decide about the case's GPU support bar now, while its end brackets are still easy to reach.

Before you start: the base checks in 07 passed and the AC cord is unplugged.

About the GPU support bar

The case's support bar normally sits above the cards. **In its normal position it doesn't clear this 145 mm cooler** (the case allows 137 mm with the bar fitted, 148 mm without). In the finished machine in our photos the bar is **not fitted**: the four cards are held by their slots and rear bracket screws. If you want to use the bar, its end brackets can move to other positions; check the case sheet and make sure it clears the cooler, the PSU and every power plug, and that its arms only touch solid metal on the cards.

How

1. Decide about the support bar now. If you're using it, move both end brackets to a position that clears the cooler and PSU, using their original screws. If not, keep it with its hardware for later.
 - **Find:** the support bar's two end brackets and the RM44 sheet.
 - **Check:** either both brackets are screwed into matching positions, or the bar is set aside with all its parts.
 - **Stop:** the bar would touch the cooler, a cable or a plug. Don't force it or drill new holes.
2. Find **PCIE1**, next to the case wall. Remove the two slot covers behind it and keep their screws. Make sure nothing is in the card's way: no loose screw, no cable hanging into the slot.
 - **Find:** the slot labelled PCIE1 and its two rear openings.
 - **Check:** the slot and openings are clear, and the slot next to it (PCIE3) is still empty.
3. Wire up the adapter **before** the card goes in. Plug **WP4**, **WP5** and **WP6** into three different free eight-pin **PCIE / CPU** outputs on the PSU. Then plug each cable's eight-pin end (its 6+2 pieces held together) into one of **WA4's three inputs**. Park the adapter's single GPU plug out of the slot's way.
 - **Find:** the ASRock adapter and three separate PCIe cables (not W04, which feeds the motherboard).
 - **Check:** three adapter inputs, three different cables, three different PSU outputs. Every +2 piece is in. Spare plugs on those cables stay unused and tied back.
 - **Stop:** you're not sure a cable is separate, or a plug won't seat. A second plug on the same cable is **not** a separate feed, and an EPS plug is never a substitute.
4. Check how PCIE1 holds a card. Only PCIE7 is documented with a latch; don't assume PCIE1 has one.
 - **Find:** the slot's key and any retention clip.
 - **Check:** you can line up the card without trapping a wire.

5. Hold G04 by its metal edges or cooler body, not its fan or gold contacts. Line up the gold edge and the rear bracket together and press it straight down into the slot. Keep holding it while it seats.
 - **Find:** both ends of the slot and the bracket's bottom tab.
 - **Check:** it goes in evenly and nothing is trapped.
 - **Stop:** it tilts or catches. Hold it; don't rock it or use a screw to pull it down.
6. Look at both ends of the slot before screwing the bracket.
 - **Find:** the card's gold edge at both ends of the slot.
 - **Check:** it's fully seated, not just resting there.
7. Screw the rear bracket in. Keep holding the card whenever you push on a plug. Leave WA4's GPU plug unplugged for now.
 - **Find:** the bracket screw holes.
 - **Check:** the card is screwed in, its fan is clear and no cable is hanging off it.

Before moving on

G04 is seated in PCIE1 and screwed in, and its three-cable adapter is ready. AC is still unplugged.

Source: BCM slot layout (manual page 14) and card installation (page 32); ASRock graphics-card guide; Creator adapter specs; RM44 support-bar sheet. RM44 cooler limits: 148 mm without the bar, 137 mm with it.

GPU wiring at a glance

RED (MC3): the PSU end of each PCIe cable, in a free PCIE / CPU output. BLUE (PCIe 6+2): an adapter input; three separate cables per adapter card, spare plugs unused. The two native 600 W cables power the other two cards. All four cards go in during one sitting with AC unplugged. Fit any support and inspect before the first start, then check detection, errors and temperatures before load. The wiring photos are at the back of this guide.

09 – Connect the wall-side adapter; keep support clear

Use: G04 in PCIE1, the wired-up WA4 adapter, and the support bar if you're using it.

Why now: check the first card's power plug before the next card blocks your view.

One sitting: do steps 1–3 now, then go straight on to the other three cards in 09b with AC still unplugged. Steps 4–6 (fitting the support bar) happen once, after all four cards are in. There's no need to power on with one card.

How

1. Follow WA4's three inputs back to WP4, WP5 and WP6 and their three PSU outputs. Hold the cable bundle so its weight doesn't hang on the card.
 - **Find:** the three adapter inputs, three PSU plugs and the free GPU plug.
 - **Check:** every input is fully in, has its +2 piece, and comes from a different cable.
 - **Stop:** you're unsure about any plug or cable.
2. Hold G04 steady, line up the adapter's GPU plug with the card's 16-pin socket and push the plug housing straight in until it latches.
 - **Find:** the card's power socket and the plug's latch.
 - **Check:** it's fully in and latched, and the card didn't twist.
 - **Stop:** the key fights you or the latch won't catch. A click alone isn't proof.
3. Give the plug a relaxed exit and support the adapter beside its route. Keep the card's fan, the slot latches and the support bar's space clear. Recheck all four adapter plugs and the three PSU plugs.
 - **Find:** the GPU plug, the adapter body, its three inputs and any unused spare plugs.
 - **Check:** nothing pulls sideways on a plug or presses on the card's fan.
 - **Stop:** it only fits with a sharp bend, a hidden plug, or the lid pressing on it.
4. *(After all four cards, if using the bar.)* Lower the bar onto its end brackets and fit its four screws. It should sit there on its own before you tighten; don't use the screws to pull it down.
 - **Find:** both end brackets and the bar's four screw holes.
 - **Check:** all four screws are in, and the bar clears the cooler, PSU, plugs and cables.
 - **Stop:** a bracket moved, a hole doesn't line up, or the bar touches something.
5. *(Same.)* Loosen each retaining arm's adjustment screw, slide the arm onto solid metal on its card, and tighten it. Keep unused arms clear of empty slots and cables.
 - **Find:** each card's arm and its adjustment screw.
 - **Check:** the arm holds the card without pushing it out of line or pressing on its fan, plug or bare circuit board.
 - **Stop:** the arm can't reach solid metal or won't hold.
6. *(Same.)* Recheck each card after the bar is on: seated, bracket screwed, arm contact, power plug latched, cable relaxed, fan clear.
 - **Find:** each card and the spots the bar now hides.
 - **Check:** fitting the bar didn't move a card or pinch a cable.

Before moving on

G04 is in, screwed and powered through its three-cable adapter. AC is still unplugged. Go straight to 09b.

Source: ASRock graphics-card guide; Creator three-input adapter; HELA output list; RM44 support-bar sheet.

GPU wiring at a glance

RED (MC3): the PSU end of each PCIe cable, in a free PCIE / CPU output. BLUE (PCIe 6+2): an adapter input; three separate cables per adapter card, spare plugs unused. The two native 600 W cables power the other two cards. All four cards go in during one sitting with AC unplugged. Fit any support and inspect before the first start, then check detection, errors and temperatures before load. The wiring photos are at the back of this guide.

09b – Continue from the case wall toward the CPU

Use: cards **G03**, **G02** and **G01**; adapter **WA3** with cables **WP1**, **WP2**, **WP3**; native cables **WN2** and **WN1**; bracket screws.

Why now: working from the wall toward the CPU always leaves open space beside the next card.

Nick's tip: "I got a full wiring guide on how to wire it all." It's the colour-coded GPU wiring photos at the back of this guide and the wiring map at the front.

How

1. Wire up adapter **WA3** first: plug **WP1**, **WP2** and **WP3** into three more free PSU outputs, fill WA3's three inputs with their eight-pin ends, and park its GPU plug clear of PCIE3.
 - **Find:** WA3 and three more separate PCIe cables.
 - **Check:** G04 hasn't moved; all three new plugs are in at both ends; nothing hangs into PCIE3.
 - **Stop:** you're unsure about a cable, or don't have three separate ones left.
2. Install **G03** in **PCIE3** the same way as G04: hold it by its body, seat it straight, check both ends, then screw its bracket.
 - **Find:** PCIE3, its key and its rear openings.
 - **Check:** it's seated and screwed in, and no G04 cable or WA3 plug is trapped.
 - **Stop:** it catches. Hold it; don't rock it.
3. Plug WA3's GPU end into G03 while holding the card.
 - **Find:** G03's power socket.
 - **Check:** both cards are seated and screwed in, each with its own three-cable adapter, relaxed cable and clear fan.
4. Check both adapter groups before going on. AC stays unplugged.
 - **Find:** WA4 with WP4–WP6, and WA3 with WP1–WP3.
 - **Check:** six adapter inputs from six separate PCIe cables, every +2 piece in.
 - **Stop:** any cable or plug is uncertain.
5. Keep the support bar and its screws out of the way, both installed cards screwed in, and both adapters clear of the next slots.
 - **Find:** the parked bar and its screws.
 - **Check:** nothing loose is leaning on a card, and the case is flat.
6. Plug the two native cables **WN2** and **WN1** into the PSU's two **native 12V-2x6 outputs** before the last two cards go in. Keep their card ends out of the way.
 - **Find:** the two native cables and the PSU's two matching outputs (not the shared eight-pin outputs).
 - **Check:** both PSU ends are fully in, and each cable reaches its card without stretching.
 - **Stop:** you're unsure which outputs are native, or the reach is tight. Don't use another PSU's cable.
7. Run WN2 toward **PCIE5** and check that slot. Keep WN1 clear for the last card.
 - **Find:** PCIE5, the next slot in from G03, and WN2's free plug.
 - **Check:** the slot, its bracket and your hand space are clear.

8. Install **G02** in **PCIE5**: seat it, check both ends, screw the bracket.
 - **Find**: G02's gold edge, PCIE5 and its rear bracket.
 - **Check**: no cable underneath is pinched or carrying the card's weight.
 - **Stop**: it catches. Hold it.
9. Plug **WN2** into G02, pushing only on the plug housing, until it latches. Check the PSU end again after tidying.
 - **Find**: G02's power socket.
 - **Check**: G02 has its own native cable and its fan is clear.
10. Find **PCIE7**, next to the CPU, and open its retention latch before the card goes in.
 - **Find**: the PCIE7 label, its latch and its rear openings.
 - **Check**: you can see and work the latch, and WN1 is out of the way.
 - **Stop**: you can't reach the latch. Don't push through the other cards.
11. Install **G01** in **PCIE7**: seat it, check both ends and that the latch closed, then screw its bracket.
 - **Find**: the card edge, the slot key, the bracket tab and the PCIE7 latch.
 - **Check**: it's seated evenly, latched and screwed in.
 - **Stop**: it catches. Hold it; don't lever it.
12. Plug **WN1** into G01 while holding the card. Check the plug, its exit and the PSU end.
 - **Find**: G01's power socket.
 - **Check**: each native cable powers only its own card, and no cable bundle presses on a neighbouring card or plug.
13. If you're using the support bar, fit it now (09 steps 4–6). Then recheck every card and every power plug.
 - **Find**: the end brackets, four bar screws and one arm per card.
 - **Check**: all four cards are held, with no pressure on fans, plugs or bare circuit board.
 - **Stop**: the bar doesn't fit cleanly. Leave it off; don't force it or close the case on it.
14. Tie back the unused spare plugs beside their own cables and trace every plug one last time. Count: **seven** PCIe cables (WP1–WP6 and W04) plus **two** EPS cables use nine shared PSU outputs; the two native outputs and the ATX sockets are separate.
 - **Find**: the unused spare plugs (not the +2 pieces, which are in use).
 - **Check**: every adapter input is in, all four GPU cables leave their cards relaxed, and no loose end can reach a fan.

Before moving on

All four cards went in during one unplugged sitting, wall to CPU: G04/PCIE1, G03/PCIE3, G02/PCIE5, G01/PCIE7. Power is PCIE1/WA4, PCIE3/WA3, PCIE5/WN2, PCIE7/WN1. Next: the final inspection, then the first start with four cards.

Source: BCM slot layout and PCIE7 latch; ASRock card installation and adapter specs; HELA native and shared outputs; RM44 support-bar sheet; Nick's GPU clips.

Photo — the four cards

The four ASRock Creator R9700s, 32 GB each. They're blower cards: the fan pulls air in at one end and pushes the heat straight out of the bracket end, out the back of the case. That's why four can sit side by side.



Photo — the PSU's GPU power sockets

The HELA's modular panel. The two **native 12V-2x6** outputs each feed one card directly (WN1, WN2). The eight-pin **PCIE / CPU** outputs feed the adapters, three separate cables per adapter card, plus W04 and the two EPS cables. The GPU wiring photos at the back of the guide show every plug.



GPU wiring at a glance

RED (MC3): the PSU end of each PCIe cable, in a free PCIE / CPU output. BLUE (PCIe 6+2): an adapter input; three separate cables per adapter card, spare plugs unused. The two native 600 W cables power the other two cards. All four cards go in during one sitting with AC unplugged. Fit any support and inspect before the first start, then check detection, errors and temperatures before load. The wiring photos are at the back of this guide.

10 – Resolve support and inspect every hidden connection

Use: the support bar (if used), cable ties and a bright light.

Why now: check everything the cards and lid will hide before the first start with four cards.

Nick's tip: "The big thing here is to make sure that the airflow here is good, because there's a lot of cables if you're not careful. My first build, I really had to deal with that."

How

1. Settle card support. Either the bar is fitted and checked (09 steps 4–6), or it's off and each card is seated and screwed in at its bracket.
 - **Find:** each card's bracket screw, and the bar's mounts and arms if fitted.
 - **Check:** no arm, bar or cable is pressing on a card's fan, power plug or bare circuit board.
 - **Stop:** the bar is half-fitted or touching something. Don't close the case.
2. Look for loose hardware and anything that moved: board screws, CPU plate and cooler, all eight memory modules, the SSD screw. Remove every stray screw, tool and bit of packing.
 - **Find:** the whole case, including under and beside the parts.
 - **Check:** no loose metal, and nothing has shifted.
3. Trace every power connection one more time: ATX (both PSU plugs and the board plug), both EPS, GFX_12V1, both native GPU cables, both adapter GPU plugs, and all six adapter inputs.
 - **Find:** each plug, with a light, using the wiring map.
 - **Check:** each one is keyed, fully in and latched. Look at the plug itself, not just the cable label.
4. Tidy the spare cable length and unused plugs, keeping the front intakes, the cards' fan intakes, the PSU fan, the rear fans and all latches clear. Gather the big cables to one side, out of the airflow.
 - **Find:** cable exits, spare loops and unused plugs.
 - **Check:** nothing is pinched, stretched or squashed by another part.
 - **Stop:** tidying needs a cut, a sharp bend, or the lid holding a cable down.

Before moving on

Support decided, every plug checked, cables out of the airflow, nothing loose.

Source: RM44 support-bar sheet; BCM, HELA and Creator requirements; Nick's finished-machine clip.

Photo — the finished machine

Four cards on the left, cooler in the middle, PSU on the right. The power cables are twisted into the corner by the PSU so the air can flow front to back, past the cards and the cooler, and out the rear.



11 – Keep the lid off until fit is resolved

Use: the lid and its screws.

Why now: a lid that presses on the cooler, a card or a cable can damage it. Fit the lid only when it closes freely.

Power checkpoint: the first start with four cards, GPU detection and load tests are separate steps after this one. Keep the AC cord unplugged until you're ready for them.

How

1. Leave the lid off while support, cables or clearance are still in question.
 - **Find:** the lid and the tallest parts under it (on paper the cooler has only about 3 mm to spare under the lid).
 - **Check:** nothing is pressing up against where the lid will sit.
 - **Stop:** you feel any resistance. Never pull the lid down with its screws.
2. When you're sure, lower the lid gently. It must sit down freely **before** you put its screws in. If it doesn't, take it off and find what's touching.
 - **Find:** the case's own lid fasteners and anything that could touch.
 - **Check:** it closes without pressing on the cooler, fans, cables or GPU power plugs.
3. Keep the two networks separate: the data ports (LAN1/LAN2) are for Ubuntu; **IPMI_LAN1** is the management port and stays on your private network.
 - **Find:** the rear data ports and the separate IPMI_LAN1 port.
 - **Check:** the management port isn't reachable from the internet, and no password shows up in photos or notes.
4. Before plugging in AC for the four-card start, make sure your outlet and circuit can handle it; each of ours has its own 15 A, 120 V circuit, and an electrician should confirm yours (see *What else you need*). Then do the first start and check that all four GPUs show up, with no errors, at normal temperatures, before any real load.
 - **Find:** your circuit's rating and the PSU's input rating.
 - **Check:** four GPUs detected (`lspci -d 1002: | grep -E 'VGA|Display'` lists four), an `amdgpu` block for each in `sensors`, no `amdgpu` or `PCIe` errors in `journalctl -k`, and idle temperatures well below the limits.
 - **Stop:** you're unsure about the electrical side, the support, or the fit.

Before moving on

The lid closes freely with nothing pressing on it, the networks are separate, and the first four-card start comes only after the electrical check.

Source: our three builds; BCM network ports; HELA input documentation.

12 – Understand the service boundary before removing a card

Use: this page, before you ever take a card out.

Why now: a good build leaves room to work on it later. Taking cards out has its own risks.

How

1. Service starts with a normal shutdown and then **unplugging the AC cord**. A software shutdown or the PSU fan switch isn't the same thing.
 - **Find:** the PSU inlet and the card you want to work on.
 - **Check:** the cord is out and the lights are off.
2. Trace that card's power before touching it: its native cable, or its adapter and three feeds. To unplug, press the latch and pull the **plug**, never the wires.
 - **Find:** the card's own cable or adapter and feeds.
 - **Check:** you know which cables are that card's and which belong to its neighbours.
3. Only **PCIE7** is documented with a slot latch. Don't assume the others have one, and don't lever a latch through the other cards.
 - **Find:** the PCIE7 latch and what's around it.
 - **Check:** you can reach the latch you need with your hand or a tool before you start.
 - **Stop:** a latch is hidden or blocked.
4. There isn't a tested step-by-step for taking cards out of a full bank, and installing in reverse isn't proof that removing works. Work out the order, your grip and the latch access on the real machine before loosening anything, and keep every card supported.
 - **Find:** the card you need and everything around it.
 - **Check:** no card is left loose or hanging by a cable.
 - **Stop:** you can't support the card or reach its latch.

Before moving on

Unplug first, know each card's cables, and never lever a latch through the bank.

Source: manufacturer connection and retention requirements.

When the guide and your hardware disagree

- **The hardware wins.** The board's printed labels, connector keys, the cables' own labels and the manufacturer's instructions beat any photo, colour or diagram here. Your parts may be a newer revision than ours.
- **Colours and names are ours.** The colours in the wiring photos and names like W03 or WA4 group cables so you can follow them. They aren't printed on the parts and say nothing about seating; check each plug itself.
- **Our photos show one good way, not the only way.** The cable routes and fan positions are what worked in our case. If your case or parts differ, keep the rules (labels over colours, one separate cable per adapter

input, AC unplugged) and adapt the rest.

- **One fan per header.** Each fan has its own motherboard header (chapter 06a). We didn't use splitters.
- **Every machine is checked on its own.** We built three identical machines, and each one went through the base checks and the first four-card start by itself. One passing doesn't pass another.

Fans and heat

The short version: the motherboard's stock fan curve follows the CPU. With four cards working, the CPU barely warms up, so the case fans stay slow while the card area heats up. On our first long test, the card area reached its 68 °C warning and the work paused. Tuning the case fans to follow the cards fixed it while they still ran well below full speed. Since October 13 our software also has a full-speed setting, because Nick would rather hear the fans than run the cards this warm.

What we measured

One machine, four cards drawing 836 W, the same 2,000-request test run three ways:

	Stock fan curve	Case fans at full speed	Case fans tuned to the cards
Requests completed	1,400, then a heat pause	2,000	2,000
Case fans	900–1,400 RPM	2,550 RPM	1,890 RPM
Card area (<i>Card Side Temp</i> , warning at 68 °C)	66–67 °C	57–58 °C	62–63 °C
Hottest GPU junction / memory (critical 110 °C)	90 °C / not recorded	87 / 88 °C	87 / 88 °C

Tuned, the case fans run 26% slower than full speed, with the same GPU temperatures and no pause. By the fan laws that is about 6.5 dB quieter; that's an estimate, not a measurement. Full speed buys a card area about 5 °C cooler for that noise. Either works; pick by how close to people the machines sit.

What the case fans do, and don't

- They cool the **card area**. Doubling their speed took *Card Side Temp* from 67 °C to 57 °C.
- They barely change the **GPUs themselves** (1–4 °C), because each card's own blower cools its GPU. Leave the blowers on the cards' automatic control.
- A hotter card area makes the blowers spin faster, because that's the air they breathe in. That's one reason not to let the card area run hot.

How we tune them

Our serving software takes the seven case fans over from the BMC. Its **full-speed setting** holds all seven at 100%. Its **tuned setting**:

1. Holds *Card Side Temp* at **62 °C**. Once a minute, it moves the fan duty 2% for every degree it's off. A fixed curve on this slow, whole-degree sensor either flapped between steps or ran the fans faster than needed.
2. Raises the fans as soon as the cards draw power: **30% at 200 W** of total GPU power, **55% at 840 W**. The card area takes minutes to warm, so don't wait for the sensor.
3. Goes to **full speed at once** if *Card Side Temp* reaches 65 °C or can't be read.

4. Keeps a backstop on the GPUs: hottest junction or memory at 90 °C means at least 30%; 95 °C means 100%.

5. **Hands the fans back to the BMC** whenever it stops, or if a fan command fails.

Idle stays at 30%, the same as the BMC's own idle. Rule 5 applies to both settings. Either way, the software also stops all work if a GPU reaches 100 °C (98 °C for its memory), a case fan drops below 300 RPM, or a BMC sensor goes critical, and pauses work while *Card Side Temp* is above its 68 °C warning.

The fan commands are ASRock's own IPMI commands for this board: `ipmitool raw 0x3a 0xd6` sets the duty and `ipmitool raw 0x3a 0xd8` switches between manual and automatic (ASRock FAQ TSDQA-72). The optional fan audition under First boot and recovery shows how to set them by hand and hand them back.

- **Stop:** a different motherboard or BMC firmware. These OEM commands are for the ROMED8-2T/BCM; don't send them to anything else.
- **Tip:** hand this page and your board's manual to your AI and ask it to write the fan service for your machine. Keep rules 3 and 5: full speed when in doubt, and the fans go back to the BMC whenever the service stops.

First-build questions answered

What confused the first build	What to do on the next one
Which standoff holes?	Match the eight holes in this board , not a generic ATX pattern, and take out any post that would sit under solid board. The M.2 SSD's support is M2_2 position D . Page 24 of the board manual shows which posts to use and which to leave out; chapter 03 has our tray.
The cooler instructions came after the paste	Take the case's rear fans out early. Fit the cooler's clips, take its fans and film off, and check all four mounting points before the paste goes on. Mount the bare heatsink, then its fans. The rear fans can go in before or after; the cooler fits either way.
Used CPU, paper towel, which paste?	Keep the socket closed until the CPU goes in. Clean with plain isopropyl alcohol on a lint-free cloth and let it dry completely. The MX-7 that comes with the cooler is fine. Don't mix pastes, and don't empty a syringe just because its label says 0.8 g. Chapter 05 has the steps.
Four fan holes, six motherboard pins	Use the keyed pins 1–4 and leave 5–6 bare. Chapter 06a says which fan goes on which header. Noctua's extension cable (NA-EC1) is fine; leave its low-noise adapter (NA-RC7) out, because it slows the fan.
Which row of the stacked pins?	Follow the photos and the board manual's drawings in chapter 06b, not older pictures. PANEL1 faces sideways, and LAN2's light plug turns round compared with LAN1's.
Front USB-C, and a USB-A cable that seems to go nowhere	This board has no header for the case's front USB-C cable, so tie it back. The case's USB-A cable goes to the internal USB3_3_4 header, not the rear ports; route it before the big power cables.
Two coloured ends turned out to be one cable	A colour marks one whole cable. The ATX cable has two plugs at the PSU and one 20+4 plug at the board . Both CPU (EPS) cables are separate from that +4. Chapter 06c shows the joined plug.
Does a GPU cable need one exact PSU socket?	No. The PSU end of each eight-pin cable goes in any free PCIE / CPU output, as long as the motherboard's own cables stay where they are. At the other end, EPS 4+4 and PCIe 6+2 plugs are not interchangeable. Each adapter card gets three separate PCIe cables; a second plug on the same cable doesn't count.
The lid-sensor lead disappeared behind the first card	Connect it to AUX_PANEL1 block C: CASEOPEN (C3) and GND (C4) , in the shorter row nearer the board, before any card goes in. Chapter 06b has the sideways photo.
Too many stops installing cards one or two at a time	Do the base checks first, then install and wire all four cards in one sitting with AC unplugged, wall to CPU, and fit the support bar (if you use it) once at the end. Testing one card at a time is only for tracking down a real failure.
One card ran hotter than the rest	Clear loose cable loops away from the front fans and the cards' intakes, then swap the hot card with a neighbour to see whether the heat follows the card or the slot. Load-test every card early. How we got here has computer 1's case.
128 GB installed but only 96 GiB tested	The online memory test leaves room for Ubuntu. Seeing 128 GB and passing 96 GiB are good signs, not a test of every address; a bootable memory tester does that.

What confused the first build

What to do on the next one

Same address for the BMC and Ubuntu?

No. **IPMI_LAN1** is the BMC's own port, with its own address. LAN1 and LAN2 are Ubuntu's. Look each one up in your router. One cable reaches one of them at a time; use two cables to reach both.

No rocminfo on Ubuntu

That's expected. Ubuntu's own amdgpu driver and firmware run the cards, and ROCm comes inside the serving container. Don't install a second driver stack on the machine just to get the command.

The cards' power limit after a restart

Check it after **every** restart, before any load. Ours went back to the 300 W default after a cold power-off, which is why a small service sets 210 W at every boot (see *What we run on them* below).

First boot and recovery

Set the BIOS with no cards in (chapter 07) before the first four-card start; chapter 07 has every BIOS screen.

Getting in

- **The BMC** (IPMI_LAN1) gives you the remote console, the power button and the sensors. Log in with your board's own credentials; usernames are case-sensitive. Keep passwords out of notes, scripts and photos, and never expose the port to the internet.
- **Ubuntu** is `ssh you@DATA_ADDRESS` over a data port (LAN1 or LAN2), not the BMC's address. The BMC's own SSH is a firmware management shell, not Ubuntu.
- **Keep the BIOS baseline:** Onboard primary graphics, CSM Disabled, Above 4G Decoding Enabled, Re-Size BAR and SR-IOV Disabled, and **ubuntu** first in the boot order. SOL (serial over LAN) is Enabled in the BIOS, but Linux needs its own serial-console setup before anything shows there, and we didn't set that up.

No picture or no SSH: which branch?

What you see	What to check
The remote console says No Signal, but Ubuntu SSH answers	The machine is fine. The cards' DisplayPort outputs aren't the console; check the BIOS still says Onboard graphics. Don't power-cycle just to refresh a stale console picture.
Neither the console nor SSH answers	Check the cable and the address first, then the BMC's sensors and event log. A stale "Powered Off" picture isn't a reason to press Power or Reset again. Keep one browser session open; several at once kept logging us out.
error_10 in the BMC event log	It means "No video device selected" , not a corrupt BIOS. Keep the log; don't clear it, reset CMOS or flash firmware as a guess.
Cards installed before the BIOS was set: no picture, and error_9 in the event log	Seen on the second build day, like computer 1's blank screen. Set the BIOS with no cards in (chapter 07). Keep the log; don't clear it, reset CMOS or flash firmware as a guess.
Ubuntu disappeared after moving the network cable	Plug into a data port and check that port has its own address. On ours, LAN2 simply wasn't set up to get an address yet; it wasn't a dead socket.
The four-card boot really fails after all of the above	Shut down, unplug AC , wait for the standby lights and fans to go out, then take out whole cards following chapter 12. Never leave a card seated with only its power plug pulled. Leave the four motherboard power cables in, and check the memory modules beside the cards are still seated after handling.

Computer 1's recovery changed the cards, a memory module and the BIOS all at once, so it shows the end result works, **not which change fixed it**. All sixteen DisplayPort outputs had already been tried; trying them again isn't the next step.

Shutting down for service

Stop any work, run `sudo systemctl poweroff` **once** and wait for a normal shutdown. Then unplug AC and wait for the standby lights and fans to go out. A dropped SSH connection doesn't mean standby power is off.

What we run on them

- **Ubuntu Server 26.04.1** with its own amdgpu driver. Nothing else is installed for the GPUs on the machine itself.
- **A 210 W power limit on every card.** The cards accept 210–300 W (300 W by default). A small service sets 210 W at every boot, because the limit goes back to the default after a cold power-off; each card's limit is its `power1_cap` under `/sys/class/drm/card*/device/hwmon/`, in microwatts. At 210 W every card sat at its power limit almost all the time under load, with junctions averaging 81–90 °C (92 °C peak), so the limit sets the speed, not the temperature. The cards link to the EPYC at PCIe 4.0 x16.
- **Two inference engines per machine**, each on two cards (tensor parallel 2): Qwen 3.8 27B in Qwen's own FP8 checkpoint, with an FP8 KV cache and its built-in MTP draft head, on vLLM with the Radiance patches for the R9700 (the vLLM-Radiance Docker image on ROCm). Each engine takes up to 8 requests at once and up to 262,144 tokens of context.
- **A supervisor** that starts the engines, drives the case fans (see *Fans and heat*) and stops everything on a hardware fault: a GPU at 100 °C, a case fan below 300 RPM, a critical BMC sensor, an uncorrected memory error, a PCIe or GPU driver fault, or a card's power limit that isn't 210 W.

Optional: hear the case fans at full speed for two minutes

This check is for the ROMED8-2T/BCM only; don't send these ASRock commands to another board, and use them at your own risk. With nothing running, it sets the case fans to 100% for two minutes and then hands them back to the BMC by itself. The automatic return is set up **before** the fans change:

```
sudo systemd-run --unit=fan-audition-restore --on-active=2m \
  /usr/bin/ipmitool raw 0x3a 0xd8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 &&
sudo ipmitool raw 0x3a 0xd6 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 &&
sudo ipmitool raw 0x3a 0xd8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

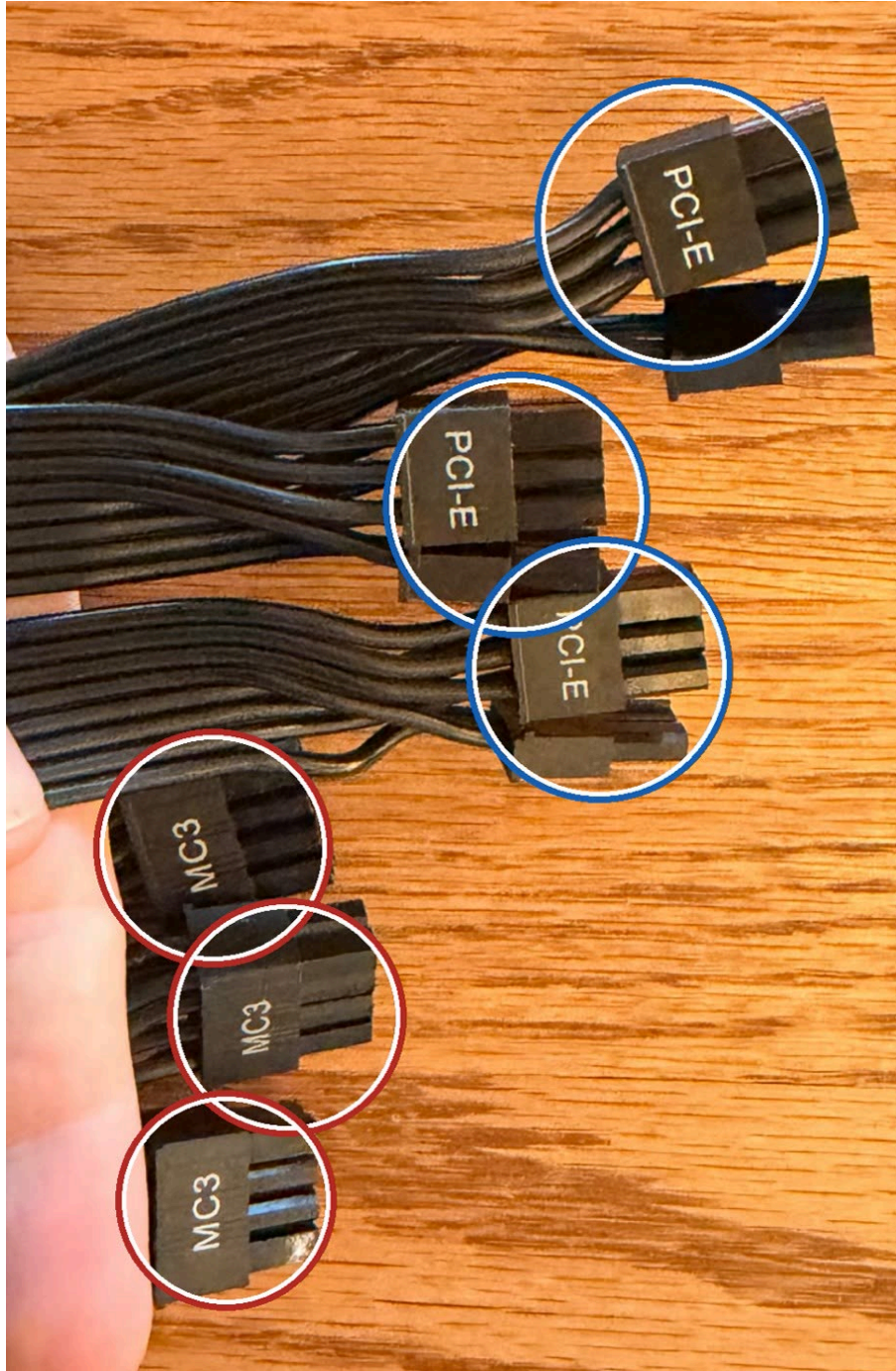
If the timer can't be created, the `&&` chain stops before the fans change. To hand the fans back to the BMC's automatic, temperature-controlled mode at once:

```
sudo ipmitool raw 0x3a 0xd8 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
sudo ipmitool -I open sensor
```

Check the fan speeds in that sensor list afterwards; a command finishing doesn't prove the fans changed. If you had set a custom fan profile in the BMC, automatic mode may not bring it back.

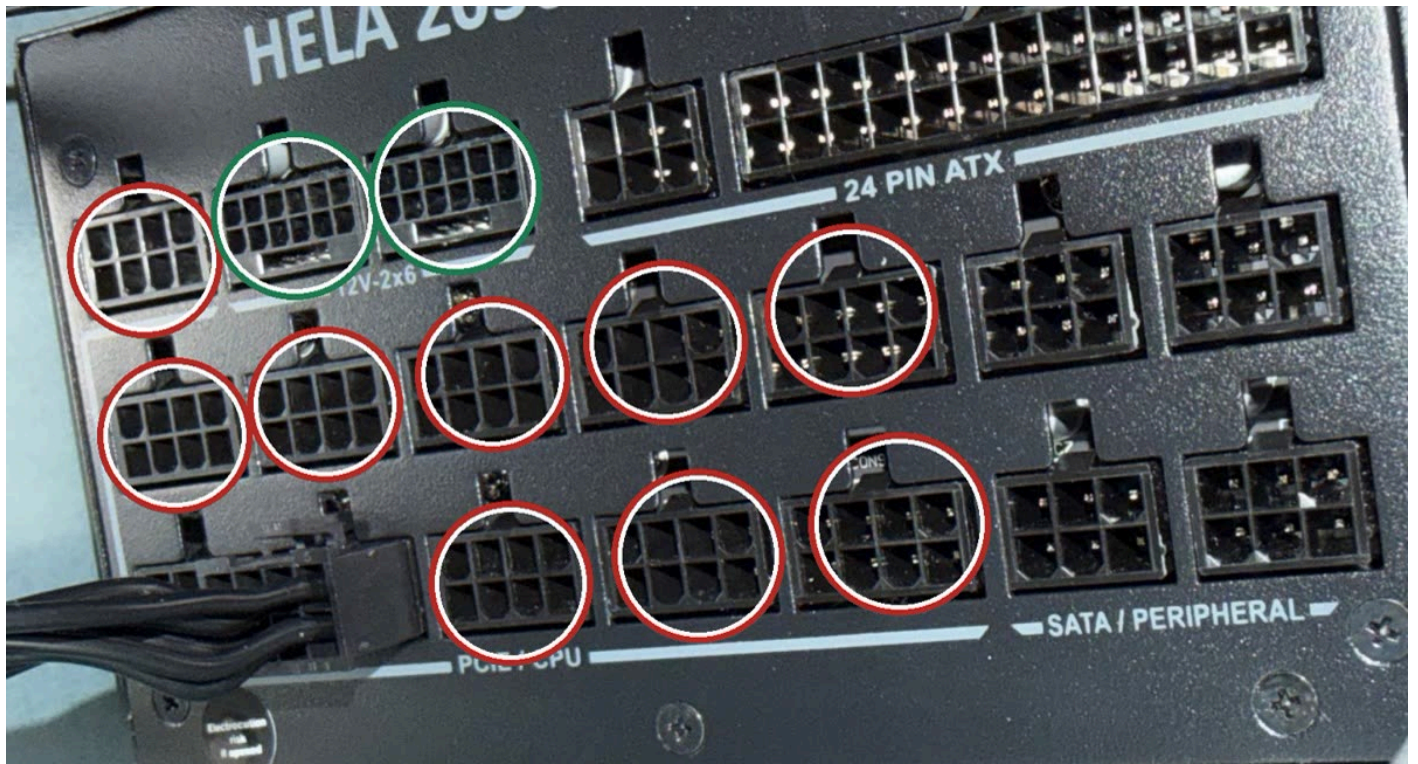
GPU photo – cable

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.



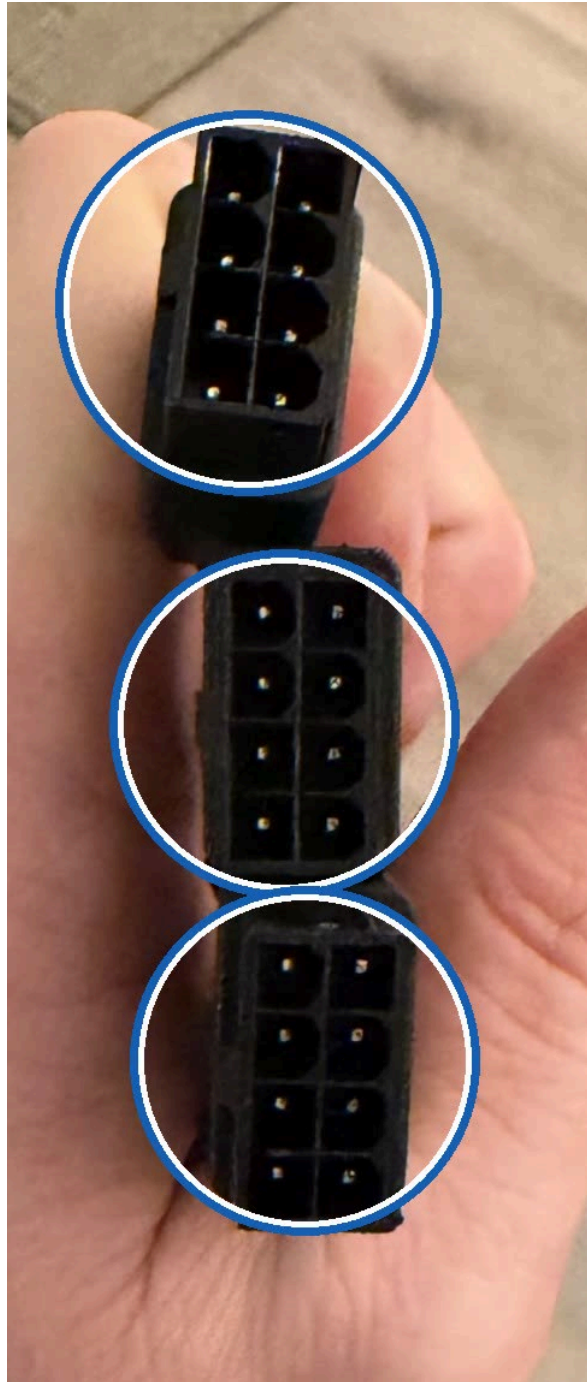
GPU photo – psu

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.



GPU photo – adapter inputs

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.



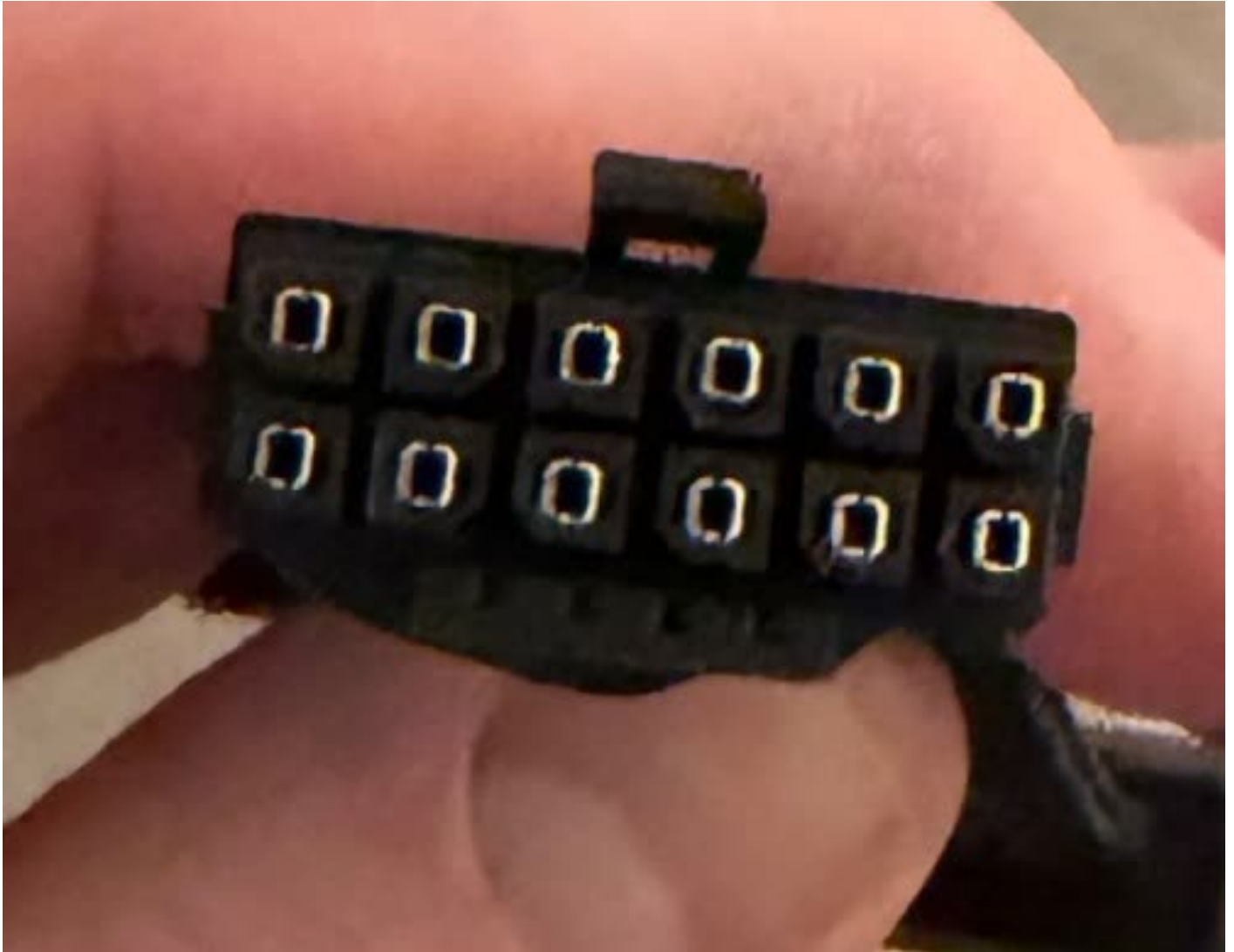
GPU photo – native

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.



GPU photo – adapter plug

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.



GPU photo – gpu socket

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.



GPU photo – board

AC unplugged. Red (MC3): a free shared PSU output. Blue (PCIe 6+2): an adapter input. Green: the native cables and GPU plugs in their matching sockets. Leave the motherboard power cables where they are. Each adapter card gets three separate PCIe cables; spare second plugs stay unused. Connect the lid sensor (CASEOPEN C3 / GND C4) before the GPUs. Install from the wall toward the CPU; fit the support bar, if used, once after all four.

