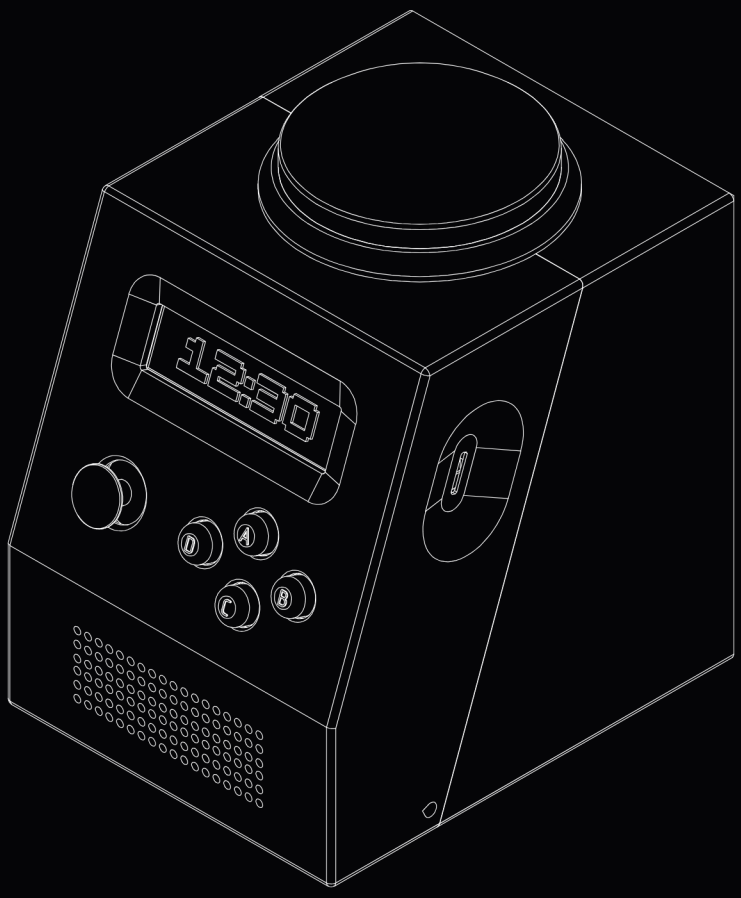
ENDOTHERMAL SYSTEMS



CINDERCLOCK

A programmable alarm clock that works with no app, no account, and no internet connection.

Product dossier

Version 1.0 · 10 August 2026

endothermalsystems.com

CinderClock is a programmable alarm clock. It keeps time, runs alarms on any calendar pattern, plays your own audio files, and does all of it on the device, with no app, no account, and no server behind it. It is the first product of Endothermal Systems.

The device is finished. The unit photographed throughout this document runs firmware v2.1.3 in a printed enclosure, with every feature working. This dossier covers the product, the competitive position, the manufacturing plan, the sourcing, and the campaign numbers. The sections are written to be read in any order.

WHAT IT IS

A standalone programmable desk and bedside alarm clock, built on an ESP32-S3 and a 256 by 64 monochrome OLED.

STATUS

Finished prototype, 4 August 2026. Firmware v2.1.3, enclosed, all features working.

PLATFORM

Crowd Supply. Application in preparation.

PRICE

$229 assembled and $149 kit during the campaign. Planned, pending Crowd Supply review.

TARGET

100 backers at a 70/30 split of assembled units to kits, raising $20,500. About $12,000 of that is left after parts.

OPEN SOURCE

Firmware and documentation under Apache 2.0, published. Board and enclosure files at launch.

WHAT NOTHING ELSE DOES

Three capabilities have no competitor at any price: recurrence beyond weekday and weekend, sunrise and sunset tracking computed offline from your coordinates, and an alarm you must win a game to dismiss. Two more, published design files and modules that lift out on pin headers, have no competitor in any consumer category.

WHAT IT DOES NOT DO

It does not light a room, track sleep, take voice commands, or sell a content library. Battery runtime has not been measured, so no runtime figure appears in this document.

The core stack is given below. Every active component is a breakout module seated in pin headers on a through-hole main board, so any one of them can be replaced with a store-bought equivalent.

FUNCTION	PART	NOTE
Processor	ESP32-S3 N16R8, dev board format	16 MB flash. Chosen for headroom. The firmware also runs on the smaller N8R8
Display	3.12 inch 256 by 64 monochrome OLED, SSD1322 over SPI	64 pixels of height carry either a large time face or a full menu
Timekeeping	DS3231 real time clock, coin cell	Temperature compensated, keeps time with the device off
Audio	MAX98357A I2S class D amplifier, 4 ohm speaker	Bare WAV playback with no audio library
Storage	microSD, push to eject	Alarm sounds as 16-bit mono PCM at 44.1 kHz
Sensors	BME280, BH1750	Temperature, humidity and pressure. Ambient light for automatic dimming
Controls	Analog joystick, four keys on a riser board, 100 mm illuminated arcade button	The riser is separate, so the key layout changes without a main board revision
Power	Four-cell 18650 holder, USB-C charging	Cells drop in and lift out. No welded pack
Enclosure	140 by 160 by 170 mm, 3D printed in two parts	PLA, with PETG as the fallback. Sliding dovetail joint, printed in-house

The finished unit. 140 by 160 by 170 mm, printed in two parts, with the 100 mm arcade button on top and the control face raked back 70 degrees for a bedside viewing angle.

Contents

Why it exists

The phone is the default alarm clock and it has a documented failure mode. In April 2024 Apple confirmed to the Wall Street Journal that it was aware of a problem causing some iPhone alarms not to play the expected sound. Attention Aware Features, introduced with iOS 17, lowers alert volume when the phone decides the user is looking at the screen, and is the widely suspected cause. Apple has not confirmed that connection. Reports of silent alarms continued into 2025, and the standard advice is still to turn Attention Aware off by hand.

The most capable computer most people own has an unresolved fault on the one job a bedside clock has.

Three further costs come with using a phone for this. Notifications accumulate overnight and arrive at the moment of waking. Touch controls need aim and attention from someone half asleep. A phone screen puts several million backlit pixels in front of eyes that have been shut for eight hours.

The replacement market does not answer this. The low end sells clocks that cannot express a weekday alarm. The premium end sells clocks that need an app, an account, or a subscription. Philips lists the SmartSleep HF3650 at $199.99 and Loftie lists its clock at $169.99, while Hatch charges $49.99 a year for its content library and Loftie $59.99 for its own. Prices in this document were read in July 2026.

The requirement that follows from this is narrow. A clock that keeps time, plays audio, and holds a user-written program, with nothing between the owner and the device.

What it does

The design problem in a programmable clock is that the owner cannot tell what they have set. Every decision in this section is shaped by that.

Alarms and recurrence. One setting called Cycle takes the value Weeks or Days and changes the meaning of every row under it. In Cycle: Weeks an alarm fires on the weekdays that are ticked, every Nth week, which expresses "weekdays at 7:00" and "every other Tuesday" with the same two controls. In Cycle: Days it fires every N days counted from a start date and ignores the day of the week, which expresses "every 3 days" and "3 days on, 2 days off". When Cycle is set to Days the day-of-week row disappears, because it no longer carries meaning.

Two features guard against a mis-set alarm. The alarm list writes each pattern back in plain language, as Daily, Weekdays, Every 3 days, or 3d on/2d off. Each editor shows a live next-ring line computed by the same code the scheduler uses to decide whether to fire, so the preview and the behaviour cannot disagree.

Cycle: Weeks. The day row reads MTWTF, so this alarm runs on weekdays. The bottom line is the scheduler's own answer to when it next rings.

Cycle: Days. Two days on, two days off, counted from a start date. No consumer clock on sale expresses this.

Five alarm types are available: simple, repeating, on and off duty cycle, sunrise, and sunset. Each alarm carries its own sound file and its own volume under a master cap. A pre-alarm gives a gentler cue a set number of minutes ahead with its own sound. An alarm rings for 5 minutes and then logs itself as missed, and the history keeps the last ten events with their outcome.

Alarms are never silent. A built-in siren plays if the card is missing or the file is unreadable, and muting the interface sounds does not mute alarms. The firmware has no mute path for an alarm.

Getting it to stop. Dismissal is the 100 mm button on top, sized to be hit without aiming. Snooze is deliberately harder and offers three modes: a single press, three presses at least half a second apart, or a sequence of randomly drawn joystick directions that each have to be fully released before the next one counts. The random sequence asks for 10 to 30 moves and redraws the direction each time. Snooze is capped at three per alarm. An alarm can also be gated behind a game, and a third loss dismisses it, because being trapped by a game at 6 a.m. is a worse outcome than getting up late.

Ringing. The set time is the large figure, the current time sits bottom right, and the two ways out are on the bottom row.

Joystick snooze. The prompt names a direction and a count. Both are drawn at random, and the count only falls when the stick is fully released between moves.

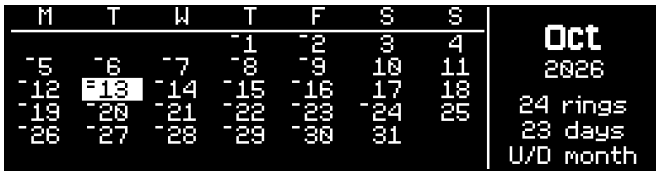
A game in the way. From-alarm mode puts a finish flag on the display. The audio does not stop while you play.

Pre-alarm. A gentler cue some minutes ahead, with its own sound and its own volume.

Sun follow. Sunrise and sunset are computed on the device from latitude and longitude entered in degrees, minutes and seconds, with the UTC offset derived from longitude and editable. A world map with a crosshair sets a position by eye, so the coordinates do not have to be known. Times recompute daily, so a sunrise alarm drifts with the season. No part of this touches a network.

Sun Follow. Coordinates on the left, a world map with a crosshair on the right, so a position can be set without knowing the numbers.

Calendar. A month grid carries short ticks beside each day number, one per alarm, stacked up to four, with monthly totals. The ticks are drawn from the scheduler code, so the calendar doubles as a check on a recurrence setting. An alarm set to every 3 days should march across the month in threes, and a pattern that does not is a setting that is wrong.



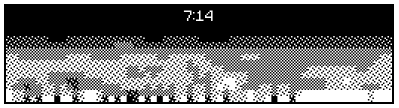
October, checked. Today is boxed. The ticks come from the scheduler.

Timers, stopwatch, ambient and chime. Saved and editable timers run in the background while the menus are used for something else. A Pomodoro cycle takes work and rest periods from 1 to 999 minutes and announces each phase change with its own jingle. The stopwatch holds four laps and shows centiseconds, which can be hidden, because a digit changing 100 times a second is a distraction on a desk. One joystick move from standby opens a quick menu for alarm, timer and stopwatch.

Ambient plays a sound loop under a slow full screen animation for sleep or focus: Fire, Rain, Blobs, Life and Waves, at about 10 frames per second. Reactive mode drives the animation from the audio, so a sudden sound seeds a spark in the fire or a glider in Life. Sessions run 15, 30, 45, 60 or 90 minutes, or endlessly, with optional fade-out and auto-dim. The hourly chime has five modes: off, every hour, a daytime window, sunrise to sunset from your coordinates, or specific chosen hours. It ships set to 08:00 to 22:00 and always yields to an alarm, a snooze, a game, or a firmware update.

A timer running. It keeps running while you go elsewhere in the menus.

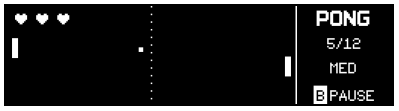
Pomodoro, work phase. The icon changes with the phase and each change gets its own jingle.



Fire. The clock is knocked out of the animation so it stays legible over any effect.

One move from standby. Four destinations and no tree to remember.

Games. Eight games at three difficulties each: Ping Pong, Maze, Fly Bird, Space Dudes, Frank, Bricked Out, Wild Runner and Meltdown. High scores are kept per game and per difficulty. Each is playable from the menu or as an alarm dismissal.



Ping Pong. Lives on the left, rally target on the right.

Fly Bird. The 100 mm dome button flaps.

Wild Runner. Jump the cactus, duck the spider.

Meltdown. Hold the core inside the striped band.

The clock itself. Two standby faces, 12 or 24 hour, with seconds and date optional. Six brightness levels, plus automatic dimming from the light sensor and a night level below the manual minimum. Two font themes. Four screen savers, Checker, Distribute, Jump and Thermal, which double as burn-in management by moving and inverting what is displayed so pixel wear evens out.

Face one, left split. The right pane carries the next two alarms.

Face two, centered. The same information around the largest possible digits.

Files and updates. Alarm sounds are WAV files on a removable card: PCM, 16-bit, mono, 44100 Hz, with an ffmpeg command in the manual for conversion. To get files onto the card without removing it, the clock raises its own WiFi hotspot with a file portal on it. The radio is off at boot, it is switched on by hand, and it closes itself after 5 minutes idle.

The case has no external USB port, so firmware arrives two ways. The default is a file dropped into that same portal, which needs no internet, no server and no account. The other is the clock joining a home WiFi network to fetch a release over TLS, which is optional and off by default. The clock never checks for updates on its own. Both paths verify a checksum before a single byte of flash is written, install to a second partition, and revert to the previous image unless the new one reaches its main loop and survives 60 seconds. Alarms, settings, history and saved timers are not touched. Losing power at any point leaves the device on the firmware it already had.

Browsing the card. A breadcrumb, a scroll position, and the owner's own files. Picking a sound does not require knowing its path.

A 28 section manual runs on the clock's own screen, and the full manual is served from the firmware over that hotspot with no card and no internet needed.

How it is built

Every project at Endothermal Systems starts from three headings: intentions, constraints, and systems. The intentions here were to take control of sleep back from the phone, and to make the hardware conform to the owner's sleep needs. The constraints were that the device must be standalone, that every input must be mechanical, and that every significant component must be a replaceable module. The system is a method of ideal outcomes: define the ideal form of a solution within the rules of physics, and if the ideal form does not satisfy the intention, discard the approach before spending anything on it.

The display was chosen first, because it is the part the owner interacts with most and every other constraint touches it. It has to be bright enough to read across a room and dim enough not to wake a sleeper. It has to be low power, because the device runs from a battery. It has to carry a menu. Seven technologies could do part of that.

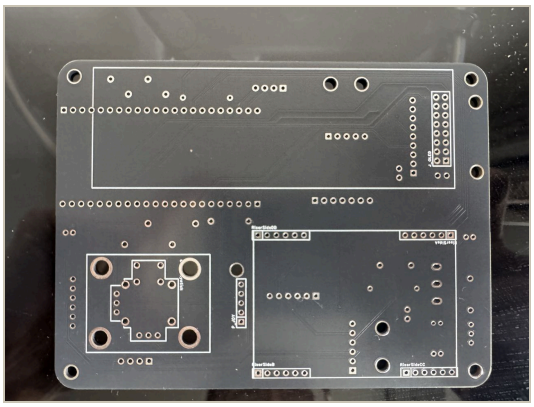
OPTION	CAN SHOW MENUS	POWER	COST	THE FAILING
7-segment, 4 digit	No	Low	Low	Commercial parts stop near 14 mm digits and show nothing but digits
Chained 7-segment modules	Barely	Medium	Medium	Many modules wired by hand, and the face degrades as the count grows
Character LCD (1602 / 2402)	Limited	Backlight always on	Low	Low contrast despite the backlight
VFD	Yes	High	Medium	Thermally inefficient, closer to an incandescent lamp, so it drains a battery
7-segment plus small OLED	Yes	Low	Medium	Two screens split the face and the gains cancel
Monochrome OLED	Yes	Low	Low	Pixel burn-in under uneven use
MicroLED	Yes	Low	Prohibitive	Fabrication complexity prices it for AR headsets and luxury televisions

Every option fails somewhere, so the job is to choose the failure that can be managed. Burn-in is the only failure in that table that software can address, which selects the monochrome OLED. The management ships as the four screen savers described above.

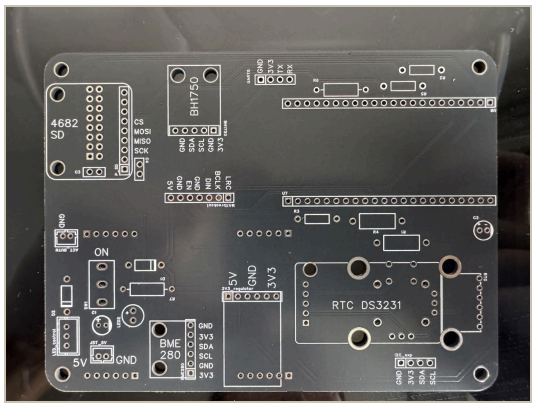
Finding the part took longer than choosing the technology. A 3.12 inch 256 by 64 SSD1322 panel surfaced through a chain of related listings after a direct search failed, because the panel is not sold under a term a buyer would guess.

Modularity. The main board is through-hole only and every active component sits in pin headers: the processor, the clock chip, the amplifier, both sensors, and the control risers. The board also breaks out its live buses on

labelled expansion headers, including I2C twice, SPI, UART, spare GPIO, and the I2S audio bus. The audio header means the amplifier can be swapped for a different one with no board revision.



The bare main board, front



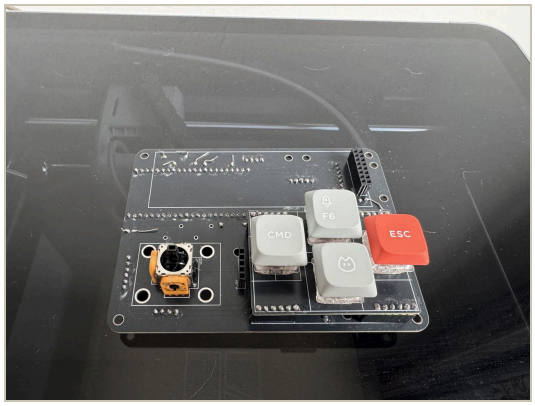
The back, with a silkscreen label at every module position

Interface. Setting a time takes two motions: move between fields, and change the value under the cursor. That observation removed direct digit entry before any comparison started.

CONTROL	TWO MOTIONS	FAST SCROLLING	PINS	THE FAILING
Four buttons	Yes	By auto-repeat	Four	Fixed scroll rate
Clickable dial	Yes	Yes	Three	One axis, so field movement and value changes share a motion
D-pad	Yes	By auto-repeat	Four or five	Same behaviour as four buttons at the same or higher pin count
Analog joystick	Yes	By holding a direction	Three	Analog axes cannot wake the processor from sleep

The joystick won on the strength of variable intensity: holding it at the extreme of its travel changes a value faster than holding it part way, so the hand sets the rate. Four keys give dedicated Action, Back, Confirm and Menu functions, and the 100 mm arcade button is wired in parallel with Action. The two serve different situations. The small key is for operations inside the interface, and the dome is for dismissing an alarm early in the morning without aiming at anything.

Dismissing an alarm takes no aim



The control riser fitted with hot swap key sockets

Audio. Audio took the longest of anything in the project, and went through three architectures. The standard ESP32 audio library was the first, and it carried 500 kb of MP3 decoding the device does not need, plus its own real time operating system that fought the one already running. An external MP3 player module was the second, and its mounting time made interface clicks impossible. The third approach reads WAV files directly, because a WAV file is a 44 byte header followed by samples and there is nothing to decode.

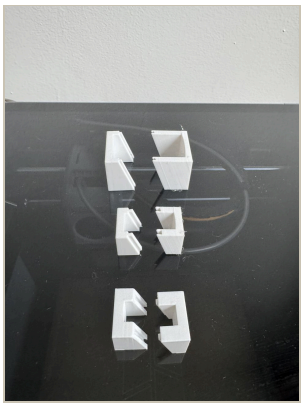
Audio now runs as one FreeRTOS task pinned to its own core, doing nothing else. It opens the file, reads the header, and loops: take the card mutex, read 8 kb, release the mutex, apply volume as an integer multiply, duplicate each mono sample into left and right, and hand the block to the I2S driver. That last call blocks until the DMA has room, which throttles the task at exactly the audio rate. A 256 by 64 OLED redraw over SPI takes tens of milliseconds and the amplifier consumes 44100 samples a second, so the two jobs cannot share a loop. The ESP32-S3 has two cores, so they do not have to take turns.

Enclosure. The finished box measures 140 by 160 by 170 mm and is printed in PLA. The front face is not flat: the speaker section is vertical and the interface panel is raked back 70 degrees, which is the viewing angle from a bedside table.

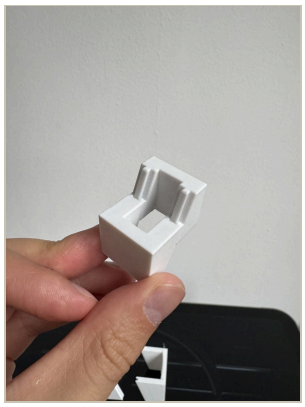
That angle decided how the box is made. The interface plate carries the holes for the screen and the controls, so it cannot sit at an angle to the build plate without running layer lines diagonally across the visible face. Printed as one piece it also needs a great deal of support built on internal faces. The first single-piece print took 26 hours and came out unusable.

The box is therefore cut along the same 70 degree plane, into front and back halves joined by a sliding dovetail, with a stopper piece at the top and a pair of M2 screws at the bottom. Small test pairs of the joint alone were

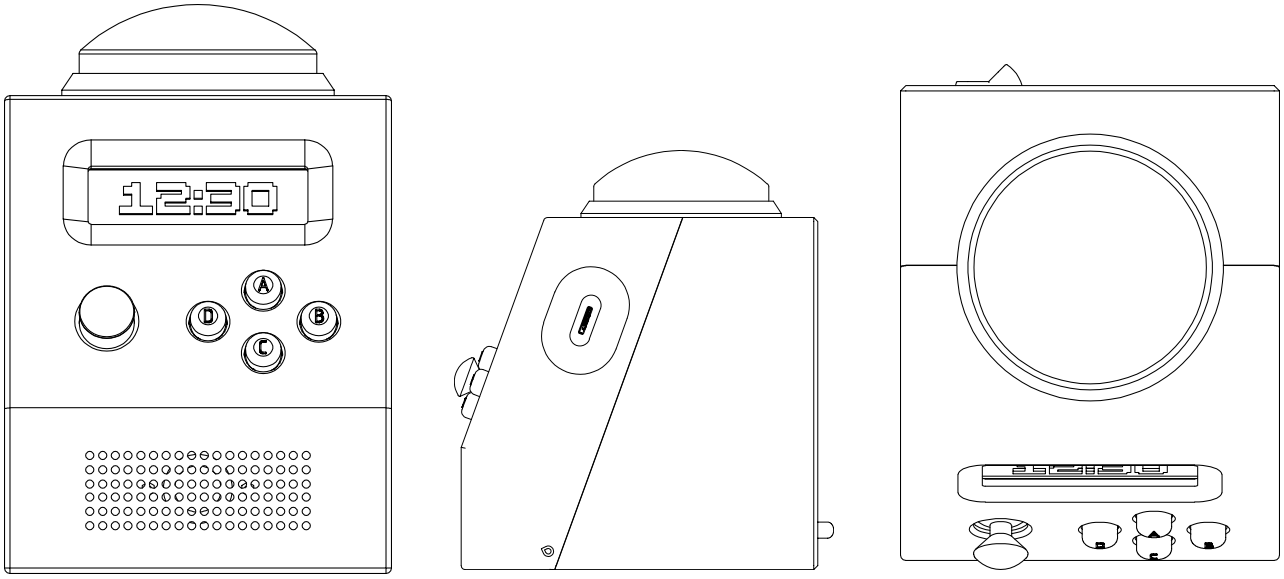
printed to dial the fit, and it took three tries. The back panel now prints with almost no support, and the front uses grid support with the top interface layers raised to 6, so the support lifts off in one piece.



Three test pairs at different tolerances



The fit that was kept



Front Left Top

Power. The device takes standard 18650 cells in holders, because an 18650 can be bought anywhere and the lithium polymer market is a thousand incompatible variants. The cells are not welded into a pack, so any one of them can be removed and replaced. The charger board came from Taobao after nothing on AliExpress carried the full protection set, and it provides over-current, over-voltage, over-temperature and short circuit protection with separate leads for battery input and load output.

What the build corrected

Three decisions were wrong and the build reported each one. They are published because a design record without them is a brochure, and because the rule each produced is the part that transfers to the next project.

A fix caused the fault. Audio stuttered early on, so a software ring buffer went in between the card reads and the DMA, generously sized. It got worse in a specific way: the stutter became rhythmic at roughly three times a second, which is the ring buffer oscillating between its own watermarks at the rate the audio drains it. Deleting the buffer fixed it. The DMA ring already underneath holds 64 kb, which is 371 ms of audio against a card read of about 40 ms. **The rule: measure the headroom you have before adding a layer meant to increase it.**

A part was specified for a reason that did not hold. The processor was chosen as an ESP32-S3 N16R8 with 8 mb of PSRAM, on the expectation that smooth audio would need large buffers there. It does not. A DMA copy path through the PSRAM cache creates coherency problems that are not worth the space, so the working path uses 16 kb of internal SRAM and a 64 kb DMA ring. The part survived on other grounds, at $5 with headroom for everything else the device does. **The rule: record the reason a part was chosen, so you find out when it stops being true.**

A related result sits next to it. Doubling the DMA ring to 128 kb works, then fails after about three minutes, when the channel is torn down for light sleep and cannot reopen because the heap has fragmented and no longer holds 128 kb of contiguous DMA-capable memory. 64 kb reallocates every time. The answer to a fragmentation problem was to ask for less.

Reasoning twice is not verification. The OLED header was placed mirrored on the first board. The orientation had been reasoned through repeatedly, in the software and against the physical module, and it still ended up wrong. **The rule: check it again on a different day.**

The competitive position

CinderClock has no direct competitor, and that is a positioning problem. Nothing on the market does what it does, so a feature-for-feature table against a Hatch or a Philips compares products answering different questions. The comparison that decides this purchase is what the clock still does in five years.

The relevant set is four groups that each solve part of the problem. All prices were read in July 2026.

Group A, the premium sleep tier. Philips SmartSleep HF3650 at $199.99 list and seen at $179.95, which operates standalone with an optional app and simulates a sunrise without tracking the real one. Hatch Restore 2, now discontinued and available refurbished at $110.49, which needs an app and an account and puts its content behind Hatch+ at $49.99 a year. Loftie Clock at $169.99, which needs WiFi and an app to set up and sells Loftie+ at $59.99 a year.

Group B, the smart display tier. Amazon Echo Spot at $79.99, which needs an account and the cloud, and which Amazon discontinued in 2019 and revived in 2024.

Group C, the maker and pixel display tier, adjacent to Crowd Supply. LaMetric Time at $199.99, which needs app setup and cloud apps. Tidbyt, formerly around $179, which routed all requests through company servers, was acquired by Modal, and has ceased manufacturing. Tidbyt owners wrote their own local server so the devices would survive.

Group D, the loud and the gimmick tier. Sonic Bomb with a bed shaker at $44.99. Clocky and Ruggie between roughly $40 and $99. MP3 clock radios with SD or USB between roughly $45 and $127, which play the owner's audio and do nothing else on this page.

The feature matrix is given below. Rows are the things CinderClock does, and columns are whether anything else does them.

CAPABILITY	PHILIPS	HATCH	LOFTIE	ECHO SPOT	LAMETRIC	MP3 CLOCK	CINDERCLOCK
Works with no app, account, or network	partial	no	no	no	no	yes	**yes**
Recurrence beyond weekday and weekend	no	no	no	no	no	no	**yes**
Sunrise and sunset tracked for your location, recalculated daily	simulated only	no	no	no	no	no	**yes, offline**
Wakes you with your own audio files	no	no	no	partial	no	yes	**yes**
Requires you to win a game to dismiss	no	no	no	no	no	no	**yes**
Month calendar showing every scheduled alarm	no	no	no	no	no	no	**yes**
Pomodoro, saved timers, stopwatch	no	no	no	via voice	timer only	no	**yes**
Ambient sound with animation	no	yes	yes	yes	no	no	**yes**
Temperature, humidity, pressure trend	no	no	no	temp only	no	no	**yes**
Every active part replaceable on pin headers	no	no	no	no	no	no	**yes**
Firmware, board files, and case models published	no	no	no	no	no	no	**yes**
Subscription available to buy	no	**yes**	**yes**	Prime tie-ins	no	no	**no**

What the category has done to its customers

Since 2016 this market has repeatedly shut off hardware that people had paid for. The record is given below and none of it is our opinion.

DATE	WHAT HAPPENED
May 2016	Google's Nest bricked the $299 Revolv hub with about a month's notice. The FTC investigated and declined to act
June 2017	Hello shut down. Its Sense bedside sleep device had raised $2.4M on Kickstarter
April 2022	Insteon shut its servers with no warning. Local hardware kept working as dumb switches while everything cloud-dependent died
August 2023	Amazon Halo devices and app ceased functioning on 1 August. All health data was deleted
December 2024	Spotify remotely bricked every Car Thing ever sold on 9 December, advising owners to follow local e-waste guidance. Refunds came only after backlash and a lawsuit
2025	Tidbyt was acquired by Modal and manufacturing ceased. Owners built replacement local servers to keep the devices working
Undated	Kello, a smart alarm clock funded by more than 1,800 backers and over $200,000, now serves a farewell page

Two of those, Hello's Sense and Kello, were bedside devices in this exact category, both crowdfunded and both gone. That is the sharpest available form of the question a backer should ask us, and the answer is that this device keeps working when we stop existing, because the files are public before the first unit ships.

The Insteon entry carries the engineering argument on its own. The hardware that ran locally survived the company.

Where competitors genuinely win

This is stated plainly, because the campaign will be read by people who will notice.

- **No room illumination.** Philips and Hatch project real light into a dark room. CinderClock has a monochrome OLED and an illuminated button. For a buyer whose actual want is waking to light, Philips and Hatch remain the right product.
- **No sleep tracking and no content library.** Hatch sells meditations and stories, which is a different business.
- **A low resolution monochrome display** against colour screens. The choice is documented in the design, and it is still a downgrade to a shopper comparing photographs.
- **No voice control.**
- **Free open alternatives exist.** Several ESP32 alarm clock projects are on GitHub, some with cases and board files. None approaches this feature set, none is supported, and none arrives in a box. "I could build this myself" is a real objection from exactly this audience.

Roughly 49% of new launches in this category include app integration and 44% add sleep tracking, so the category is moving toward more dependency. Published market size estimates disagree by a factor approaching two, so no market size figure appears in this document.

What is open

Firmware and documentation are published under Apache 2.0 today, at github.com/Endothermal-Systems/CinderClock. The openness claim is verifiable in one click before a backer pays anything.

PCB design files and enclosure models publish at launch. The board takes one more revision first, so the wording here is a commitment for launch day. The bill of materials is public, so the parts list can be checked against the price.

Two bundled pixel fonts remain under Creative Commons Attribution-ShareAlike with their attributions intact: BoldPixels by Yūki under CC BY-SA 4.0, and Gumball by Aaron Amar under CC BY-SA 3.0. Their intermediate BDF files ship as well, so the conversion into the firmware is reproducible.

Attribution has to travel with the work, and a sealed appliance has one place to put it. It is on a screen the owner can reach.

About, top of the page. The blob on the right is live, drawn by the same heat engine as the Meltdown core.

About, bottom of the page. The font credits, on the device, where the licence requires them.

Manufacturing

The plan has four parts. Main boards are assembled at a factory. Modules are bought wholesale. Enclosures are printed in-house. Final assembly, which means seating the modules and closing the case, is done in-house.

The enclosure is the part that was modelled in detail, because it is the largest single cost in the bill and the only one under our own control.

The part is designed for PLA. PETG is the fallback where heat or stiffness argues for it, and it prints from the same models on the same machines. Resin is the third route and it is priced below an outsourced print, so it stays on the table as a finish upgrade rather than a plan.

ROUTE	COST PER ENCLOSURE
In-house FDM, optimistic	about $20
In-house FDM, realistic	about $30
Resin, cheapest material	about $50
Printed by a service, JLCPCB	about $100

Three printers cost about $2,400 and repay themselves after 34 units at the realistic figure. They cover a 200-unit campaign in roughly three months. Above roughly 400 backers, injection tooling replaces the printer fleet, and the crossover point is 750 enclosures. That decision has to be made mid-campaign, because tooling takes six to ten weeks.

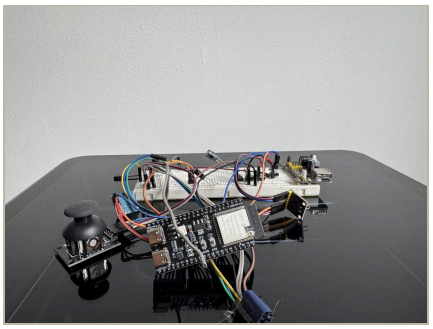
The enclosure is the one line in the bill of materials with no firm quote, which is why the $80 parts figure in the campaign section excludes it.

The cost of goods per unit is given below. Two lines that earlier working omitted are included: $5 for packaging and $5 for final assembly labour on assembled units, and $2 for kitting labour on kits.

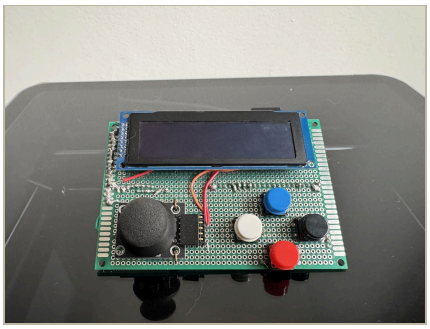
SKU	COST OF GOODS
Supporter	about $0
Kit, modular, no enclosure	$77.60
Assembled, modular build	$110.60
Assembled, integrated respin	$86.00

The modular build is what ships. An integrated respin, which replaces breakout modules with bare ICs, would improve margin by about $49 a unit, and at $229 it is an improvement and not a precondition. It is therefore a post-campaign

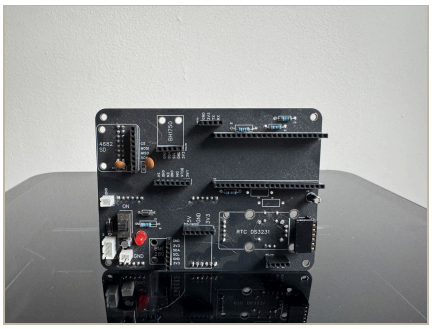
project and off the critical path, which removes the largest schedule risk in the plan. The modularity that makes the shipped build more expensive is also the feature the product is sold on.



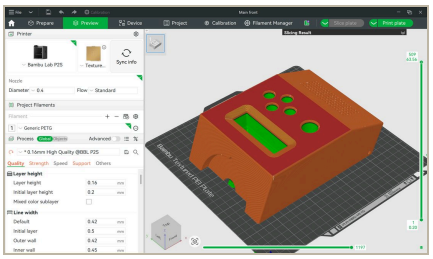
The first working stack on a breadboard: processor, display, clock chip and joystick



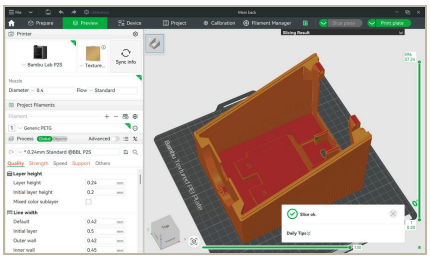
The perfboard stage, populated and running



The first custom main PCB, populated



The front half sliced at 0.16 mm, with apertures for the screen, the four keys and the joystick



The back half at 0.24 mm, with almost no support anywhere

The finished unit from the left, showing the card slot

Sourcing

Crowd Supply distributes through Mouser, so the bill of materials was reconciled against the Mouser catalogue. The finding decides which build is the manufacturable one.

BUILD	ACTIVE FUNCTIONS AVAILABLE ON MOUSER
Modular prototype, breakout boards	roughly 10 to 15%
Integrated respin, bare ICs	roughly 90%

Of the nine active modules in the modular build, only the ESP32 DevKitC-1 is a real Mouser catalogue item. The other eight are generic modules Mouser does not stock. The bare ICs reverse this: eight of the nine active functions map to a verified in-catalogue Mouser part, including ESP32-S3-WROOM-1, DS3231SN, MAX98357A, TPS563201, BME280 and BH1750FVI-TR, with the SSD1322 reachable through Newhaven NHD-3.12-25664UCB2 at roughly twice the module price.

Five categories will never be Mouser parts, and they are carved out as a short specialty list:

- The 100 mm illuminated arcade button, from arcade parts vendors.
- Mechanical key switches, hot-swap sockets and keycaps, from keyboard vendors.
- Protected 18650 cells and the microSD card, which are regulated or logistics items best shipped separately.
- The IP5306 power and charge IC, which is available through LCSC only.
- The cheap SSD1322 display module, unless the Newhaven part is accepted at its higher price.

Three supply risks are named here so that they surface before a purchase order rather than after one. The IP5306 is single-source, and a Mouser-only bill would need a power stage redesign around a TI BQ25895 or BQ24295, which is a topology and firmware change. The LCSC 1x9P header C39576 is discontinued, and the Sullins PPTC091LFBN-RC substitutes for it. The DS3231SN costs several times the clone module, and DS3231M+ is the fallback where temperature-compensated accuracy is not essential.

Part numbers in the reconciliation are price-break estimates and need a catalogue check before an order. The reconciliation is a sourcing analysis, and the purchasing file follows it.

The campaign

The tier ladder is given below. These prices are planned and subject to Crowd Supply review.

The published funding threshold is $12,000, which is the number the campaign has to clear to fund at all. The 100 backer target below is what the campaign is built to reach, and it raises more than that. The two numbers are not the same thing and the sections below keep them apart.

TIER	CAMPAIGN PRICE	AFTER THE CAMPAIGN	WHAT IT IS
Supporter	$25	n/a	Name in the repository credits and the sound pack. No hardware
Kit	$149	$169	Assembled main board, all modules tested and matched, and the files. The buyer prints the case
Assembled	$229	$279	Built, tested, in a printed case
Founder's 50	$199	never again	The assembled unit, numbered 001 to 050 on the back plate, for the first 50 backers

The goal, on backer orders alone

The target is 100 backers at a 70/30 split of assembled units to kits. The figures below count only what backers pay. The Crowd Supply house order is a separate transaction and is kept separate, in the section under this one.

	UNITS	PRICE	RAISED
Assembled	70	$229	$16,030
Kit	30	$149	$4,470
Total	**100**		**$20,500**

The bill of materials is the same $80 a unit on either build, because a kit is the same set of parts without the assembly step. That figure excludes the enclosure, which has no firm quote yet, and it is rounded from $82 because the parts have not been bought at these quantities.

Raised from 100 backers	$20,500
Parts, 100 units at about $80	$8,000
Left for everything else	**about $12,000**

That remainder funds four things: certification, enclosures, logistics, and labour. Certification is the fixed item and it is not optional. The board carries an ESP32 with an on-board antenna, which makes the device an

intentional radiator and puts FCC Part 15B in the path before a unit can ship to a US backer.

The campaign covers its costs at 100 backers and does not do much more. That is the intended result. Success here is 100 units in the hands of enthusiasts and a group of contributors giving feedback, and a version for the general population comes after that.

The Crowd Supply house order, counted separately

Crowd Supply also buys stock at wholesale to sell through its own store and through Mouser. That order is roughly the same size again as the campaign, and it buys at about 57% of retail. It is a second channel rather than part of the funding goal, so none of it appears in the table above.

The house order is what sets the assembled price. At $229 the wholesale price is $130.53. Against a modular cost of goods of $110.60 it clears $19.93, and against the integrated respin at $86.00 it clears $44.53, so the distributor side is profitable on either build. At $199 the same order clears the modular build by $2.83. $229 is the first price at which nobody at the table is working for nothing. The step to $279 after the campaign is 22%, which leaves a distributor $159 of wholesale to work with.

The kit is priced above what a buyer expects, and the reason is structural. Breakout modules cost more than the bare chips inside them, so once the integrated version exists the kit will cost more to build than the assembled unit does. The kit ships without a case, because the case models are public and a kit buyer with a printer would rather print it in a colour they chose.

Next steps are the final board revision, factory-assembled boards, the printer purchase, and the Crowd Supply application itself.

What we do not claim

- Battery runtime has not been measured on the fitted cells, so no figure is stated anywhere. Two weeks stands as a design target.
- The device does not light a room. Philips and Hatch put a real sunrise into a dark room and this does not.
- Sunrise and sunset accuracy degrades above roughly 65 degrees of latitude, where the sun may not rise or set on a given day.
- WAV only. Decoding MP3 in real time alongside the rest of the processes is not work for this processor.
- History holds ten entries, the stopwatch holds four laps, and two Pomodoro presets are stored.
- No claim is made about sleep quality.
- PCB files are not public yet. They publish at launch.
- No ship date is quoted until it is locked with Crowd Supply.

Common questions

Does it need an app or an account? No. Every feature runs on the device. There is no companion app, no account, and no service behind it. It can reach the internet for exactly one thing, an update the owner asks it to fetch, and it works fully without ever doing so.

It has WiFi. Is it really offline? The radio is off at boot and is started deliberately. It serves a local file transfer portal and an optional firmware pull, and nothing else.

Why does it cost more than a marketplace alarm clock? It is a different class of object. A marketplace clock is a screen with a small computer behind it and a fixed feature set. CinderClock is a programmable device with a published parts list, replaceable modules, and open design files, and it does the work of a sunrise clock, a sound machine, a desk timer, an environment monitor and a small games console at once.

Why $229 when premium clocks sell for $170 to $200? The price has to survive a distributor buying about half the units at 57% of retail, which is arithmetic. The working is in the campaign section above.

How long does the battery last? We do not know yet, so we do not say. The device is designed around a two week target and the processor sleeps between seconds to reach it. No number is published until it is measured.

Can the hardware be modified? Yes. Every active component is a breakout module on pin headers, the main board is through-hole, and the control riser is a separate board. The live buses are broken out on labelled headers, including the audio bus, so even the amplifier can be swapped without a board revision.

Who makes it? Endothermal Systems, a Wyoming engineering company. CinderClock is its first product and a demonstration of how it designs everything else.

Where to go next

This document is a condensed dossier. The full design study runs to about 7,300 words with the complete photographic record, and the firmware is public today.

The full design study

endothermalsystems.com/work/cinderclock.html

Firmware and documentation, Apache 2.0

github.com/Endothermal-Systems/CinderClock

Launch list

endothermalsystems.com/work/cinderclock.html

Contact

endothermalsystems.com