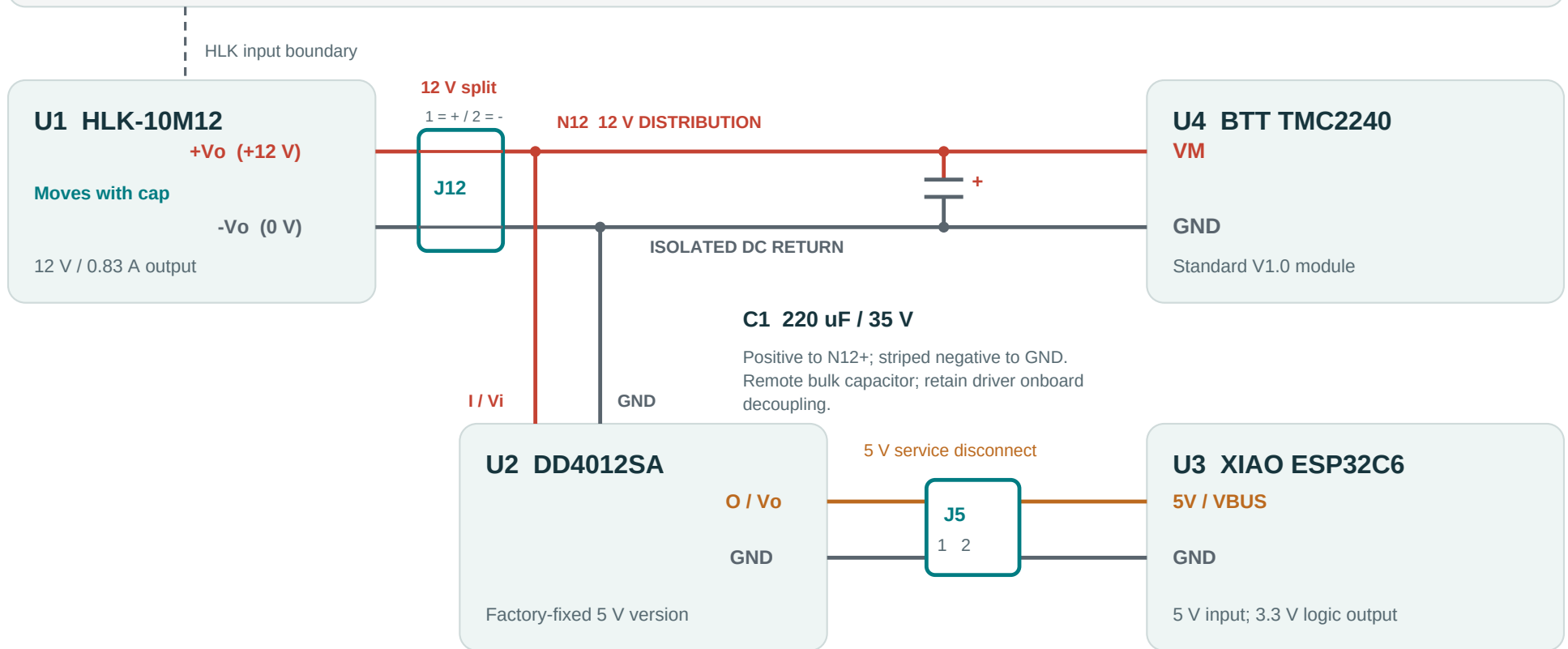


Power architecture

Selected baseline: owned HLK-10M12, DD4012SA fixed 5 V, XIAO ESP32C6 and standard BTT TMC2240 V1.0.

E26 pickup -> JE -> cap branch: HLK + JAC -> bulb

E26 pickup stays in a removable internal cartridge. The original IKEA shade ring clamps the smooth cap. Bulb remains separate from HLK 10 W output. Installation: page 9.

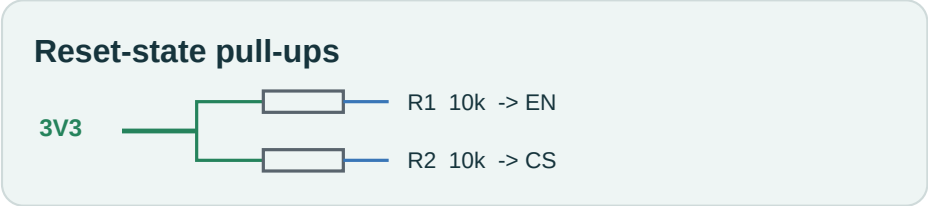


READING THE DIAGRAM

J12 is the keyed 12 V disconnect; J5 is 5 V. GND is the isolated return; labels are logical, not physical pin positions. JE rating remains unverified. Cartridge insertion is blocked: resolve the route on page 9 before wiring. JAC releases the bulb feed, pages 7-8. [1-4]

Controller to driver

Pin names were checked against Seeed documentation and the BTT standard-module schematic. Do not use the EZ-module pinout.



Driver setup

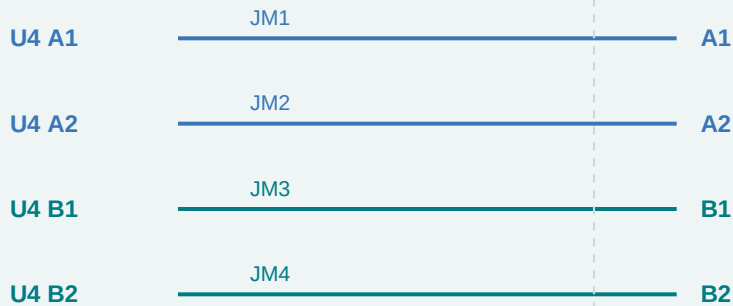
Tie driver **CLK** to GND with a short local link; this is its oscillator input. **SPI-CLK is a different pin**. Leave AIN open. Use SPI mode 3. Optional DIAG0 needs open-drain configuration and its own 10k pull-up; it is not the home switch. [1,2,5]

Motor, home and USB service

HOME mount/actuator are not implemented; actual RAMSELE shade sweep remains unverified. Wiring is defined below. Check motor coil pairs.

M1 Existing four-wire stepper

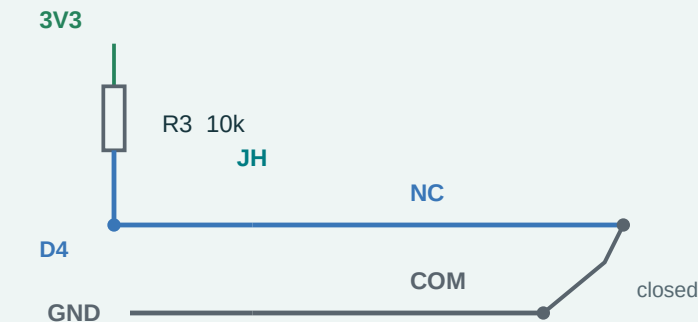
42 mm-frame / 48 mm-deep envelope remains provisional
JM motor disconnect



A1/A2 are one coil; B1/B2 are the other. Preserve the existing motor plug if sound. Otherwise use a compact keyed 4-way pigtail connector, retained by a printed feature. [2,5]

S1 Normally closed home switch

XIAO D4 / GPIO22; COM + NC contacts



Normal = LOW; activated or broken harness = HIGH. Set the lever before the hard stop and debounce in firmware. Confirm actuator position before the hard stop. D5/D6 unused; no pause switch. [1,6]

USB-C access at the housing split

1 Remove lamp power

Keep the ring-clamped cap and pickup stationary. Support the carrier; release its 15-degree joint and unplug J12/JAC at the initial separation.

2 Isolate the controller

Open J5 and unplug both JX controller housings, including every driver signal and 3V3/GND connection.

3 Connect USB

Program the standalone XIAO. Remove USB before reconnecting the harness and restoring lamp power.

J12 removes carrier power; J5 alone still does not isolate controller I/O. Follow the whole-controller disconnect sequence. Keep slack for the carrier turn and initial separation. JAC disconnects the bulb feed; J12 disconnects the carrier DC supply. Release both before moving the carrier farther. For cap/cartridge removal, follow page 9. [1]

Initial wire cutting schedule

CUT LENGTHS ARE ESTIMATES, NOT MEASURED FINAL ROUTES. Rev I side connector positions are used; dry-route before trimming.

ID / group	Qty	Cut each	AWG	Route / purpose
P01A +/-	2	90 mm	22	HLK output to J12 cap side; include turn/lift loop
P01B +/-	2	50 mm	22	J12 carrier side to N12 distribution node
P02 +/-	2	60 mm	22	N12 to TMC VM / GND
P03 +/-	2	100 mm	22	N12 to buck I / GND, around motor
P04 +/-	2	130 mm	24	Buck O / GND to source side of J5
P05 +/-	2	60 mm	24	J5 load side to XIAO 5V / GND
C01-C07	7	100 mm	26	STEP, DIR, EN, CS, SPI-CLK, MISO, MOSI
C08-C09	2	100 mm	26	XIAO 3V3 / GND to TMC VIO / GND
M01-M04	4	130 mm	22	Per conductor: cut 80 mm TMC->JM + 50 mm JM->motor
H01-H02	2	160 mm	26	Per conductor: cut 90 mm XIAO->JH + 70 mm JH->switch
K01	1	25 mm	26	Local TMC CLK oscillator input to GND
CAP +/-	2	115 mm	24	C1 to N12 around -Y motor perimeter; remote bulk cap
R links	6	25 mm	26	Two links per R1/R2/R3 if component leads cannot reach
C10 optional	1	100 mm	26	DIAG0 to D7, plus 2 x 25 mm links for optional 10k

LV baseline allowance: 3.125 m of single conductors (1.120 m of 22 AWG, 0.610 m of 24 AWG, 1.395 m of 26 AWG). Optional DIAG0 adds 0.150 m. A practical starting stock is 2 m / 1 m / 2 m respectively, divided among useful colors. Existing motor wire may reduce the quantity.

Unchanged board poses: split z=103; XIAO 108-129; HLK 105-127, center x=-7; TMC PCB about 101.3; C1 at x/y=-29/-10. P01A+B total 140 mm per rail including loop/ends. C1 requires a perimeter route, not the old 35 mm leads. Factory pigtails stay separate. Additional AC cuts total 0.800 m on page 8; all cuts 3.925 m. Side connector poses are set; actual wire bends and slack need dry routing.

Parts, connectors and verification

Keep the supplied architecture. Reuse the original IKEA shade ring. No added mounting screws, threaded inserts or external attachment hardware are specified.

Ref	Qty	Selected item / integration note
U1 / U2	1 each	Owned HLK-10M12; DD4012SA factory-fixed 5 V.
U3 / U4	1 each	Seeed XIAO ESP32C6; standard BTT TMC2240 V1.0, SPI + heatsink.
C1 / R1-R3	1 / 3	Panasonic EEUFR1V221, 220 uF / 35 V; 10k pull-ups, 1%, 0.25 W.
S1	1	Omron D2F-01L NC lever microswitch; mount and actuator are not implemented in the delivered CAD.
JX-L / JX-R	2	7-way 2.54 mm female socket housings; two 7-pin male strips at XIAO.
JD-L / JD-R	2	8-way 2.54 mm female socket housings, mating existing driver headers.
J12 / J5 / JH	1 each	J12: Micro-Fit 3.0; J5: red JST RCY; JH: JST SM2. See page 6 for exact housings/contacts. Installed connector positions remain provisional.
JM	0 or 1	Reuse motor plug; fallback JST SM4 wire-to-wire pair. Verify actual coil order; page 6 gives housing numbers.
Contacts / wire	as needed	Contacts matched to selected housings and wire gauge; precrimp pigtails preferred. Optional DIAG0 adds one signal lead and one 10k resistor.

Connector tier: JX/JD use compact header/socket bundles; J12/J5/JH use distinct selected families. No custom PCB or added mounting hardware is specified. Connector installation fit needs dry assembly.

Before operation: verify 5 V before attaching XIAO, confirm coil pairs and driver SPI readback, set conservative current, confirm NC-home polarity, then check both travel directions and temperatures. The 0.83 A supply rating is not the allowed motor phase current.

PRIMARY REFERENCES

[1] Seeed XIAO ESP32C6

[3] Hi-Link 10M specification

[5] Analog Devices TMC2240

[7] Panasonic EEUFR1V221

[2] BTT TMC2240 schematic / pinout

[4] Eletechsup DD4012SA

[6] Omron D2F

Connector and termination plan

One mated pair per inline connection. These are low-voltage selections; JE remains the existing factory feed connection.

Ref	Family / quantity	Selected housings	Logical allocation
J12	Molex Micro-Fit 3.0, 2 circuits	43020-0201 plug + 43025-0200 receptacle	1 = +12 V; 2 = GND
J5	JST RCY red, 2 circuits	SYP-02T-1 + SYR-02T	1 = +5 V; 2 = GND
JH	JST SM black, 2 circuits	SMR-02V-B + SMP-02V-BC	1 = D4/NC; 2 = GND/COM
JM	Reuse motor plug; SM4 fallback	SMR-04V-B + SMP-04V-BC if replacing	1=A1; 2=A2; 3=B1; 4=B2
JX-L/R	2 x 7-way, 2.54 mm female	Precrimp bundles + 2 x 7-pin XIAO male strips	Match actual board pad labels
JD-L/R	2 x 8-way, 2.54 mm female	Precrimp bundles on standard TMC headers	Match actual module labels

CRIMP CONTACTS PER MATED PAIR

Use	Selected contacts	Wire fit / quantities
J12	2 x 43030-0007 female + 2 x 43031-0007 male	22 AWG; insulation OD <=1.85 mm. [8,9]
J5	2 x SYF-001T-P0.6 + 2 x SYM-001T-P0.6	24 AWG; insulation OD 1.2-1.8 mm. [10]
JH / JM	SHF-001T-0.8BS socket + SYM-001T-P0.6 pin	JH: 2 each; JM fallback: 4 each; OD 1.2-1.8 mm. [11]

Use compatible precrimp pigtails or matching crimp tooling. Buy spare contacts. Use the socket-contact half on the powered side of J12/J5. J12 and J5 use different families to prevent cross-mating; label both ends. JM numbering is a harness convention: adapt it to the actual motor plug after checking coil continuity.

JX/JD socket contacts must suit their populated 22-26 AWG wires and actual header pins; printed capture provides retention. Use dedicated rail/return junctions rather than assuming a contact permits two wires. Exact installed connector locations and socket heights still require dry assembly.

Factory feed and route assumptions

The original IKEA shade ring clamps the smooth cap shoulder; E26 provides electricity only. JAC on page 8 releases the bulb branch across the split.

LAS610 factory feed

Seller labels: rigid plug **37 x 26 mm**; **200 mm** and **160 mm** describe the two whole pigtail assemblies, not wire-only cuts. One orange connector half is labelled 27 x 13.5 mm. Keep factory leads intact until dry routing. [12]

JE parks at **(0, 23.75, 117.5)**, rolled 90 degrees about X. Reserve is **42 x 11 x 15 mm** in X/Y/Z. Estimated mated body is 40 x 8 x 13.5 in this pose; thickness and mated length remain inferred.

Current perimeter routes

Datum z=0 is the original rim. Split near 103. HLK body 105-127, center x=-7; XIAO 108-129; TMC PCB about 101.3; buck 75-93.4. C1 center x/y=-29/-10, z 80-91.5.

JE and JAC park on +Y, with 0.5 mm between their reserve boxes. The +X finger route stays open. Keep pickup-side JE lead free during threading; park it only after seating. Other runs follow the motor perimeter.

CAP BRANCH AND TWO SERVICE DISCONNECTS

JE feeds two cap-side L/N junctions: one branch goes to the HLK AC input; the other crosses JAC to the existing bulb. JAC opens both bulb conductors and J12 opens DC. JE identity/rating and its conductor order remain part checks; JAC is the selected TE 250 VAC pair on page 8.

ADDITIONAL SOURCE LINKS

[8] Molex - Micro-Fit housings

[10] JST - RCY housings / contacts

[12] Seller - LAS610 assembly

Molex male contacts

[9] Molex - 22 AWG contacts

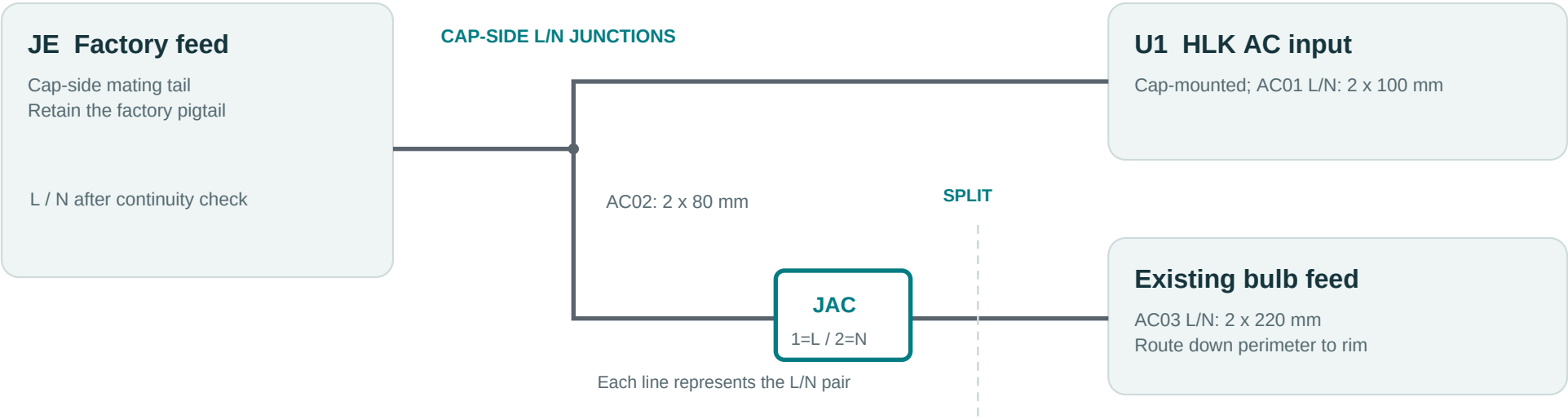
[11] JST - SM housings / contacts

Molex mating receptacle

Estimate method: perimeter path + end preparation + explicit opening/slack allowance, rounded up. P01A includes about 50 mm of opening loop. All routes, board socket heights, home actuation and intact factory pigtail storage require a dry-assembly check. Catalog facts do not establish tested physical fit.

Bulb-feed service connection

JAC is a separate 2-pole TE Micro MATE-N-LOK pair. The cap-side branch is fixed; opening JAC and J12 releases both electrical paths across the split.



Item	Selection / allowance
JAC, cap side	794617-2 receptacle + 2 x 794610-1 socket contacts
JAC, bulb side	794616-2 free-hanging plug + 2 x 1-794612-0 pin contacts
Catalog rating	250 VAC housings/contacts, 5 A contact maximum; selected for the 120 V bulb branch.
Wire selection	Alpha 5855, stranded 22 AWG PTFE, 600 V; OD 1.295 +/-0.127 mm fits the contacts.
Cut allowance	AC01: 2 x 100; AC02: 2 x 80; AC03: 2 x 220 mm = 0.800 m AC; all loose-wire cuts = 3.925 m.

Installed reserve: 32 x 8 x 13 mm in X/Y/Z, centered at (0,23.5,132), rolled 90 degrees about X. Catalog housing lengths total 30.93 mm before overlap; the box is conservative. AC01 now allows a route around the PSU end and withdrawal slack. AC02/03 retain their service allowances. Actual bends and unplugging reach still need a dry fit.

[13] TE receptacle / 250 VAC
 [16] TE pin contact

[14] TE free-hanging plug
 [17] Alpha 5855 wire

[15] TE socket contact

Proposed mount and service sequence

Two outer shells plus one removable internal pickup cartridge. The stock IKEA shade ring carries the lamp; the smooth cap has no printed mount threads.

ASSEMBLY BLOCKER - PROPOSED SEQUENCE ONLY

The cartridge fits seated, but its turn through the fixed PSU frame is unresolved: both tested low-frame and high-ring routes obstruct. Do not assemble or wire until an empty-part dry fit confirms a route, or the frame/cartridge is revised. Actual OEM ring and E26 seating remain unverified. Never force the pickup against its float stops.

Proposed stage	Action / current limit
1 Empty cap / ring	Power off; carrier, PSU and cartridge out. JE/JAC unplugged and unparked. Introduce the existing OEM ring through the service opening; keep the fixed frame in place.
2 Secure OEM ring	Proposed: align the smooth cap with the holder and tighten the OEM ring against its shoulder before the cartridge. The modeled ring route needs the R19 PSU-tab relief; real ring fit is unverified.
3 Pickup / cartridge	BLOCKED: cartridge insertion/turn is unresolved. Intended next step is to seat E26 with the cartridge still unlatched and JE tail free, then align its key and latch. Do not force either 9 mm float stop.
4 PSU / connections	Only after the route and seating are confirmed: install PSU, relax the pickup tail, mate JE outside its parking space and stow on +Y. Preserve factory leads.
5 Close carrier	Keep ring-clamped cap and pickup stationary. Fit carrier, mate JAC outside parking then stow it, connect J12 and close the 15-degree joint with loops clear of tracks.

Ordinary service after fit is resolved: power off; hold cap and pickup stationary. Release carrier catch, make its 15-degree turn, and open J12/JAC at initial separation. USB isolation: page 3.

Proposed removal: power off, open carrier/J12/JAC, unplug JE and free its complete pickup-side tail. Remove PSU; unlatch cartridge, independently unscrew pickup and withdraw cartridge before accessing OEM ring. The cartridge exit route is unresolved too.

Wire rule: JE is not a rotary joint. Its entire pickup-side lead and connector half must be free to turn while E26 turns. **Fit assumptions:** OEM ring max OD 44 mm; grip OD 31.5 x 10 mm, nominal float 9.0 mm, highest contact tip z=175.3. These are model assumptions, not purchased-part measurements.