

Fencing body cord and weapon tester

Printed pocket build, 18650, 84 x 40 x 26 mm

Overview + BOM

Doc 00 Rev F 2026-08-30

What this unit does

Pocket go / no-go tester for three conductor fencing body cords and for foil and epee weapons. Two LEDs, two sockets, no logic. Green sits across the A and B lines, red across the B and C lines. Because the B line is shared by both loops, two lamps resolve all three conductors.

Both lit	Red only	Green only	Neither
A, B and C all good	A line open	C line open	B line open

It does not measure resistance, so it will pass a cord that is continuous but too resistive for a scoring box. Reference limits: foil and epee weapon circuit 2 ohms maximum, body cords under 1 ohm, lame under 5 ohms between any two points.

Bill of materials

Qty	Part	Notes
6	4 mm panel banana jacks	FIE Material Rules: the 3-prong plug has three pins of 4 mm diameter at 15/20 mm spacing - all six jacks are 4 mm, matching commercial testers. Standard spring-leaf jacks, not sheathed-safety types. Two real 3-prong fencing sockets are the drop-in alternative.
1	M3 heat set insert + M3 x 10 brass pan head	J3, the clip bites the head
1	Green LED 3 mm, yellow green GaP	Vf about 2.1 V. Not InGaN
1	Red LED 3 mm	Vf about 1.9 V
1	820 ohm resistor	Green branch, 1/8 W fits better than 1/4
1	1.2 k resistor	Red branch
1	TP4056 module, protected	Four pads, DW01A + FS8205 fitted
1	18650 cell 2000 mAh or more	
1	18650 holder 76 x 20 x 18 mm, wire leads	
1	100 nF ceramic	Across the rail
4	M2 heat set insert + M2 x 6 screw	Lid
-	26 AWG stranded wire	No board needed, point to point

Rev E correction: Rev C specified 2 mm jacks (nothing would seat); Rev D guessed a 3 mm middle pin. The FIE Material Rules settle it: the 3-prong plug has **three pins of 4 mm diameter**, polarised by its 15/20 mm spacing, so all six jacks are 4 mm. (The 3 mm pins in vendor catalogues belong to the 2-prong foil/sabre WEAPON plug, which polarises by pin size instead.) The printed shell's jack holes and the spacing coupon must match your jacks' bushings - see Doc 02 and Doc 04 before printing.

Rev F: the ON-OFF-ON switch is gone. It cost more than the battery (\$9 street price for the odd ON-OFF-ON type) and every one of its jobs has a free equivalent: the tester draws essentially nothing with no cord plugged in (unplugging IS the off switch), and the shorts test is now "plug only the J1 end" - shorted lines light their lamps through J1 alone, so the verdicts are identical (Doc 03). J2's B jack wires straight to the common node. Just don't store it with a good cord plugged in.

The charge module needs no modification. It ships set for 1000 mA, which against an 18650 of 2000 mAh or more is between 0.3 and 0.5 C, squarely inside what the format wants. Use the holder rather than soldering to the cell, since heat at the terminal damages the cell just under the cap.

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Inputs and outputs

Port	Face	What connects here
J1	Top edge	Weapon side. A body cord with a weapon on the far end, or one end of a cord under test
J2	Front	Cord end. The other end of the body cord under test
J3	Right	Lame alligator clip of a foil or sabre cord
USB-C	Left	Charge, and runs the tester while charging
D1 green	Front	A to B path is closed
D2 red	Front	B to C path is closed
SW1	Top edge	Link, off, isolate

Build order

Step	Document	Do this
1	Doc 00	Buy six 4 mm spring-leaf banana jacks (FIE: all three plug pins are 4 mm)
2	Doc 04	Adjust the shell and coupon jack holes to your jacks' bushing sizes, print the test coupon, confirm a real cord seats in it
3	Doc 04	Print body and lid, fit the heat set inserts
4	Doc 02	Fit the six jacks and the clip post
5	Doc 01	Wire the core circuit and the charge module
6	Doc 03	Run the full procedure against known good gear

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Block 1 - Core circuit

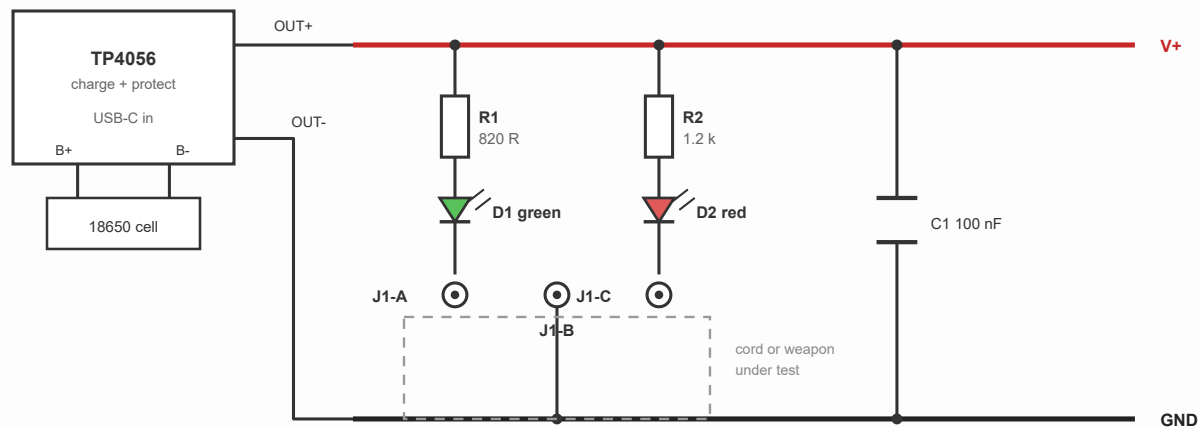
Doc 01 Rev D 2026-08-30

Purpose

The whole tester. The supply drives two indicator loops out of J1 and back through whatever is plugged in. J2 ties the far end of a body cord together so the cord itself closes both loops. **Rev D removes the switch entirely:** unplugging the cord is the off switch (nothing draws without one), and the shorts test is done by plugging in only the J1 end (Doc 03).

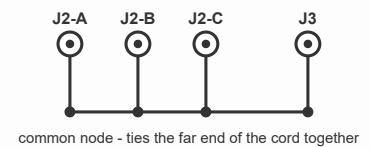
Take power from the module OUT+ and OUT- pads, never straight off the cell, so the protection circuit stays in the path and the tester still runs while charging.

Schematic



J1 row (top edge) faces the weapon side;
J2 row (front) + J3 clip tie to one common node.

Rev D: no switch anywhere - OUT+ feeds V+ directly.



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Block 1 - Core circuit

Doc 01 Rev D 2026-08-30

Wiring

From	To	Note
Cell	Module B+ and B-	Observe polarity; holder leads are not always coloured sanely
Module OUT+	V+ node	Rev D: direct - no switch in the power path
Module OUT-	GND node	
V+	R1 a, R2 a, C1 a	
R1 b	D1 anode, long lead	820 ohm, green
D1 cathode	J1 line A	
R2 b	D2 anode	1.2 k, red
D2 cathode	J1 line C	
J1 line B	GND node, C1 b	Line B is the return
J2 line A	J2 line B, J2 line C, J3 post	All four on one common node (Rev D: B included, no switch)

Why there is no power switch

Both lamp loops are only complete *through a plugged-in cord*. With the sockets empty the branches are open and the only battery drain is the protection circuit's few microamps - years of standby. The old ON-OFF-ON slide cost more than the battery and its two useful positions are replaced by how you plug in: both ends = continuity test, J1 only = shorts test. Just don't store the tester with a good cord attached (a plugged cord lights the lamps at about 4 mA - roughly three weeks of a 2000 mAh cell).

Build and verify

- ☐ Power up with nothing plugged in. Both lamps dark. A lamp lit on an empty socket means its LED is shorted or miswired to ground.
- ☐ Jumper J1 line A to J1 line B. Green alone lights. Jumper B to C, red alone lights. That proves the core with no cord at all.
- ☐ Plug a known good epee cord into both sockets. Both lamps steady and similar in brightness.
- ☐ Pull the J2 end out and let it hang. Both lamps dark. If either stays lit the cord has a short (or your J2 plug is touching something conductive).
- ☐ Plug in USB. The module status LED should be visible through the window in the left face, and the tester should keep working while charging.

Fencing body cord and weapon tester

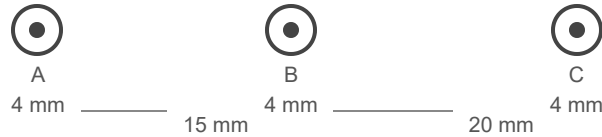
Printed pocket build, 18650, 84 x 40 x 26 mm

Block 2 - Sockets

Doc 02 Rev F 2026-08-30

Pin geometry

Both sockets are three individual panel banana jacks **sized to the cord's pins**. On a fencing three prong connector the B pin sits in the middle, A is 15 mm to one side and C is 20 mm to the other. That asymmetry is what stops a cord going in backwards, so it is the one dimension in this build you cannot fudge.



Pin diameters (Rev E, per FIE Material Rules): the 3-prong plug has "three pins of 4 mm diameter arranged in a straight line", polarised only by the 15/20 mm spacing - so all six jacks are 4 mm, exactly like commercial test boxes. Prefer standard spring-leaf banana jacks (sheathed safety jacks will not grip a bare pin). Note: the 2-prong foil/sabre WEAPON plug is different - its small (B) pin is undersized by design for polarity; a good leaf-spring 4 mm jack still grips it, which is how commercial testers handle foil plugs too.

Line assignment

Line	Role	In foil and sabre	In epee
A	Lame line	To the lame via the alligator clip	Up the blade to the tip
B	Weapon line	Up the blade to the tip	Up the blade to the tip
C	Ground	Bonded to guard and blade	Bonded to guard and blade

A two pin foil or sabre plug engages the B and C jacks only. Its A line terminates in the alligator clip, which is why J3 exists and why it must land on the same common node as J2 line A. On a sabre the two weapon-end contacts are commoned at the guard (FIE m.24.4), so a healthy sabre shows the B-C loop closed the moment it is plugged in - red lamp on is the expected resting state for a sabre weapon test.

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Block 2 - Sockets

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Jack positions

Jack	Face	Position on that face	Connects to
J1 A	Top edge	x 26, y 13	D1 cathode
J1 B	Top edge	x 41, y 13	GND
J1 C	Top edge	x 61, y 13	D2 cathode
J2 A	Front	x 34, z 30	Common node
J2 B	Front	x 49, z 30	Common node (Rev F: direct, no switch)
J2 C	Front	x 69, z 30	Common node
J3	Right	y 13, z 24	Common node

Build and verify

- ☐ All six jacks are 4 mm spring-leaf types (FIE: all three plug pins are 4 mm).
- ☐ **The Rev C shell and coupon STLs assume the old 2 mm-jack bushings.** Enlarge all six jack holes to your 4 mm jacks' bushing diameter (~8 mm typical) before printing, and print the Rev E spacing coupon with the real jacks fitted. The shell's slide-switch opening is unused in Rev F - fill it in the model or blank it with a printed plug.
- ☐ Both sockets take the same orientation, A on the same side. Mirroring one is the easiest mistake to make and the hardest to find later.
- ☐ Insulated or washer-isolated jacks. Printed walls are non conductive so bare bodies are survivable, but the tails sit close together and shoulder washers cost nothing.
- ☐ The two sockets are offset in x by 7 to 8 mm on purpose. Their solder tails would otherwise run into each other inside the case. Do not align them for looks.
- ☐ Offer up a real cord before soldering and confirm all three pins seat without strain.
- ☐ Meter every jack to its destination with the cell disconnected.

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Block 3 - Procedures

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How the weapons differ

Foil is a normally closed circuit. The B line runs to the tip and is connected to C through the point, so depressing the tip breaks it. Epee is normally open. The A and B lines run up separate wires to the tip and depressing it connects them. Everything below follows from that one difference.

Weapon test

Plug a known good body cord into J1 on the top edge and put the weapon on the far end. Leave J2 empty.

Weapon	Tip	Green	Red	Meaning
Foil	At rest	off	ON	Point closed, B to C intact
Foil	Pressed	off	off	Point opens correctly
Epee	At rest	off	off	Point open, no short to guard
Epee	Pressed	ON	off	Point closes A to B correctly

Weapon faults

Symptom	Likely cause
Foil, red stays lit when pressed	Short between B and C. Blade wire touching the guard, or grit in the point
Foil, red never lights	Open B or C line. Broken blade wire or a dirty socket
Epee, red lights at rest	Blade wire shorting to the guard
Epee, green lights at rest	Point jammed shut, or grit in the barrel
Epee, green never lights	Contact spring too short, or an open blade wire
Either, lamp flickers on flex	Wire about to break, usually at the guard

The weight and shim tests are mechanical and this box does not do them. Foil needs a 500 g weight, epee a 750 g weight and a 0.5 mm shim. A weapon can pass every electrical check here and still fail weapon control.

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Block 3 - Procedures

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Body cord test - continuity (both ends plugged in)

One end into J1, the other into J2. For a two pin foil or sabre cord the plug goes into the B and C jacks of J2 and the alligator clip goes onto J3.

Green	Red	Verdict
ON	ON	All three conductors continuous
off	ON	A line open
ON	off	C line open
off	off	B line open

Body cord test - shorts (ONLY the J1 end plugged in)

Unplug the J2 end and let it hang free, touching nothing. With the far end open, a healthy cord carries no current at all - so any lamp that lights is finding a short between two lines inside the cord. This replaces the old switch's Isolate position; the verdicts are identical because shorted lines close their loop through J1 alone.

Green	Red	Verdict
off	off	No shorts found
ON	off	A shorted to B
off	ON	B shorted to C

With both ends plugged again, flex and stretch the cord along its whole length and work it hard where it enters each plug. A lamp that flickers means a conductor about to fail. Tug the alligator clip lead to check the solder joint.

A short between A and C alone will not be caught. Both lines are driven through their own LED, so a link between them carries no current. A and C sit at opposite ends of the asymmetric pin spacing and rarely short to each other.

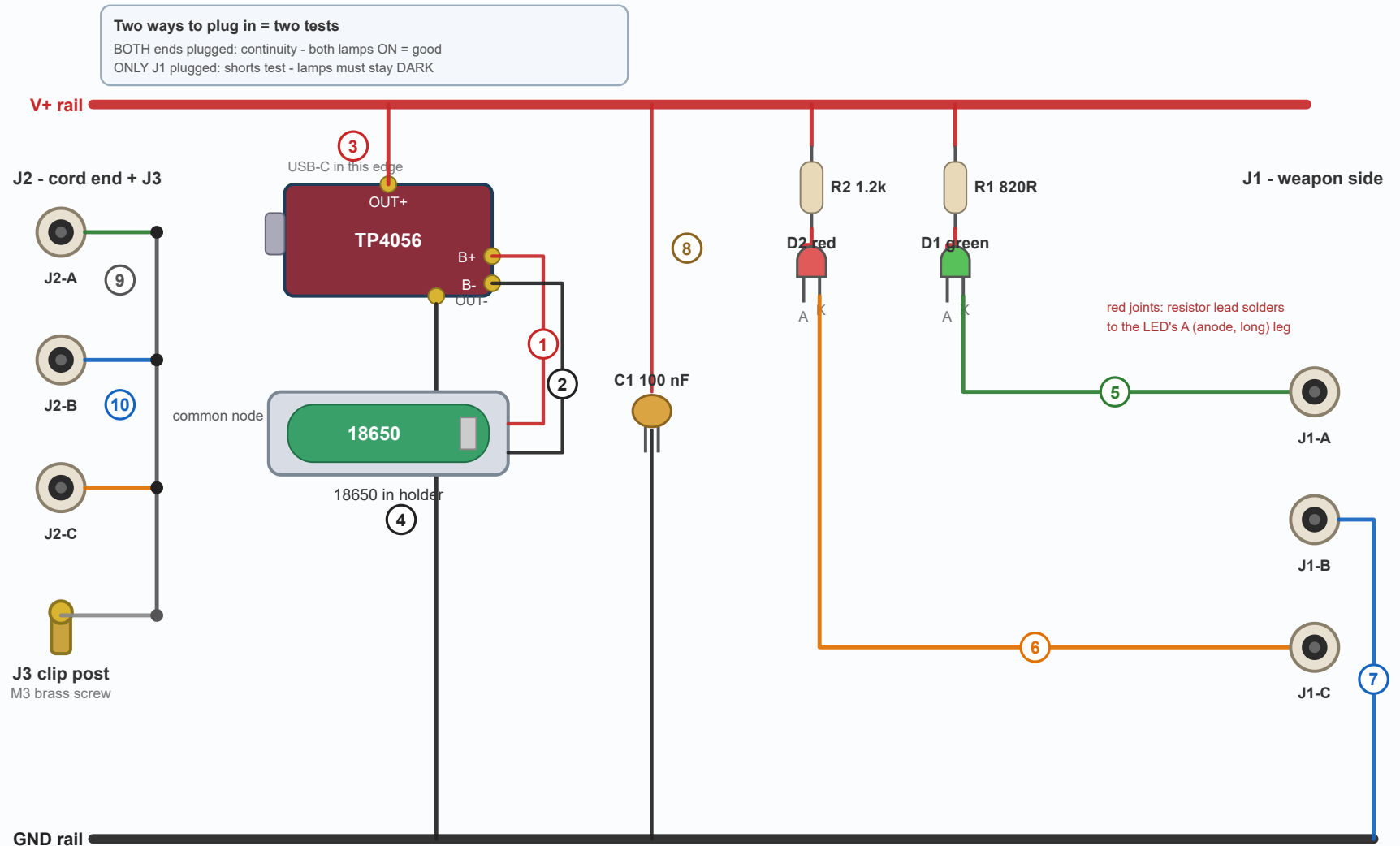
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Pictorial wiring diagram

Doc 05 Rev A 2026-08-30

Same circuit as the Doc 01 schematic, drawn as the parts actually look on the bench. Trace any numbered wire here, then find the same number in the checklist on sheet 2.



Ladder layout: power flows from the top rail through each branch to the bottom rail. J2 + clip on the left, J1 on the right - no wire crosses another.
(Panel positions differ: on the printed box J1 is the top edge and J2 the front face - see Doc 02 for the physical drilling map. All jacks 4 mm.)

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Pictorial wiring diagram

Doc 05 Rev A 2026-08-30

Wire-by-wire checklist - do them in this order, tick as you go

#	From	To	Colour	Why
1	Cell holder red lead	TP4056 B+	red	Battery + into the charger board
2	Cell holder black lead	TP4056 B-	black	Battery return
3	TP4056 OUT+	V+ rail	red	Always live; with no cord plugged in, nothing draws
4	TP4056 OUT-	GND rail	black	The other rail
5	V+ rail → R1 (820 R) → D1 green anode; D1 cathode (flat side)	J1-A	green	Green loop: out the A jack, through the cord, back via B
6	V+ rail → R2 (1.2 k) → D2 red anode; D2 cathode	J1-C	orange	Red loop: out the C jack
7	J1-B	GND rail	blue	B is the shared return for both loops
8	C1 100 nF	across V+ and GND rails	-	Right at the rails, any orientation
9	J2-A, J2-C and J3 clip post	one common junction	green/orange/bare	Ties the far end of the cord together so the cord closes both loops
10	J2-B	the same common junction	blue	Rev F: wired direct - the shorts test is now done by unplugging the J2 end instead of a switch

Reading the schematic after this

Every pictorial part maps to one schematic symbol: the zigzag/box is a **resistor** (the beige cylinder here); the triangle-with-a-bar is an **LED**, bar = cathode = the flat side of the dome; the angled line is the **switch**; V+ and GND rails are the long red and black lines. Once these four click, Doc 01 reads like this page.

Sanity checks as you wire

After wire 4: plug USB in - the TP4056 lights, nothing else happens. After wire 7: jumper J1-A to J1-B with a paperclip and green alone lights; jumper B to C, red alone. After wire 10: a known good cord in both sockets lights both lamps; pull the J2 plug out and both must go dark (the shorts test).

LED polarity is the classic gotcha: the LONG leg is the anode (A) and goes toward the resistor / V+ side; the flat spot on the dome marks the cathode (K) toward the jack. If a lamp never lights, it is almost always in backwards - no harm done, just flip it.