FENCING LAB

FLTB-01 Smart Fencing Equipment Tester

PRODUCT USER MANUAL

Model: FLTB-01
Brand: Fencing Lab
Supported Weapons: Épée / Foil / Sabre
Design Reference: FIE Material Rules — August 2026

1. Product Overview

The Fencing Lab FLTB-01 is a multifunctional portable electronic testing device specifically designed for fencing equipment. It is suitable for routine inspection, troubleshooting and maintenance of épées, foils, sabres and associated electrical accessories.

The device integrates multiple testing functions, including tip contact detection, low-resistance measurement, circuit insulation checks, conductive jacket (lamé) testing, body wire testing, intermittent circuit interruption monitoring and auxiliary tip pressure measurement.

With its electronic measurement system and colour display, the FLTB-01 allows users to monitor electrical resistance and circuit conditions in real time, helping identify common electrical faults quickly and efficiently.

The FLTB-01 is suitable for:

- Routine equipment maintenance at fencing clubs
- Pre-training equipment checks by fencers
- Troubleshooting by coaches and equipment technicians
- Personal equipment pre-checks before competitions
- Electrical testing of weapon tips, body wires and conductive jackets

Product Classification: Portable fencing equipment electrical testing and maintenance device.

The FLTB-01 is not an official FIE equipment certification device. Test results obtained using the FLTB-01 do not constitute official FIE inspection approval or certification.

2. Main Testing Functions

Testing Mode	Main Functions	Display
Épée	Tip contact detection, resistance measurement and abnormal short-circuit detection	OPEN / CLOSED / Ω
Foil	Tip contact detection, circuit interruption detection and resistance measurement	OPEN / CLOSED / Ω

Lamé	Conductive jacket resistance measurement and surface conductivity scanning	Ω / PASS / FAIL
Body Wire	Wire resistance, open-circuit, short-circuit and incorrect wiring detection	A / B / C, Ω
Continuity	General circuit continuity and resistance testing	OPEN / CLOSED / Ω
Foil Flicker	Dynamic monitoring of momentary circuit interruptions	Event Count / Duration
Sabre	Conductivity testing of the sabre blade, guard and associated electrical connections	Ω / PASS / FAIL
Pressure	Auxiliary tip pressure testing for épée and foil	g / PASS / FAIL

Actual functions depend on the installed firmware version and connected testing accessories.

3. FIE Electrical Testing Standards

The FLTB-01 uses selected requirements from the FIE Material Rules (August 2026) as references for its electrical testing parameters.

3.1 Electrical Resistance Standards

Equipment	FIE Requirement	Reference
Épée Weapon	≤2Ω	m.5.4(a)
Foil Weapon	≤2Ω	m.5.4(a)
Sabre Weapon	≤1Ω	m.5.4(a)
Foil / Sabre Lamé	≤5Ω	m.28.5, m.34.4
Épée Body Wire	≤1Ω per conductor	m.31.1
Foil / Sabre Body Wire	≤1Ω per conductor	m.29.1, m.35
Mask Wire	≤1Ω	m.27, m.32
Sabre Mask Conductivity	<5Ω	m.32.5

Important: These requirements apply to the specific testing paths and inspection methods defined in the relevant FIE rules. Resistance limits for different types of equipment are not interchangeable.

The FLTB-01's main testing thresholds are based on selected provisions of the FIE Material Rules, August 2026 edition.

3.2 Weapon Tip Pressure Standards

Weapon	FIE Requirement	Standard Test Weight
Épée	Tip activation force >750g	750g ±3g
Foil	Tip activation force >500g	500g ±2g
Sabre	Spring-loaded tip pressure test not applicable	N/A

Important Information

The 750g and 500g values represent the nominal masses of the standard test weights specified by the FIE rules. They do not mean that a weapon tip automatically complies with the rules when its activation force is exactly equal to the stated value.

For épée, the standard 750g test weight must not cause the tip to close the electrical contact.

For foil, the standard 500g test weight must not cause the tip to break the electrical contact.

Where the FLTB-01 uses an electronic pressure sensor, the displayed force measurement is intended for reference and auxiliary testing purposes only.

Official compliance testing must still be performed using the prescribed procedures and appropriate measuring equipment that meets the specified tolerances.

The FLTB-01's electrical tip monitoring function does not directly measure mechanical tip travel.

Tip travel must be checked using appropriate gauges or dedicated measuring instruments. Compliance with tip travel requirements cannot be determined solely from an OPEN or CLOSED electrical indication.

4. Épée Testing Mode

4.1 Function Description

Épée Mode is designed to inspect the electrical tip circuit, circuit insulation and electrical resistance of an épée.

The main testing functions include:

- Detection of circuit closure when the tip is pressed
- Detection of circuit opening when the tip is released
- Tip contact resistance measurement
- Detection of abnormal electrical connections between the blade and tip circuits
- Identification of sticking tips and poor electrical contacts
- Detection of possible blade wire or socket connection faults

4.2 Connection Instructions

Connect the épée to the device's Weapon (W) testing terminals using the appropriate body wire or testing cable.

FLTB-01 terminal assignments:

Terminal	Function
W1	Blade and guard earth circuit
W2	First tip signal conductor
W3	Second tip signal conductor

These terminal identifiers are specific to the FLTB-01.

Connections must follow the actual pin assignments of the corresponding testing cable and weapon socket.

The W1, W2 and W3 labels should not be interpreted as universal FIE three-pin connector numbering.

4.3 Normal Circuit Conditions

Tip Condition	W2–W3	W1–W2 / W1–W3
Tip released	OPEN	Insulated
Tip pressed	CLOSED	Insulated
Abnormal contact	Unstable	Further inspection required
Abnormal short circuit	Unexpected closure	Possible unintended conductivity

Under normal operating conditions, the épée tip signal circuit remains open when the tip is released and closes when the tip is pressed.

4.4 Fault Identification

The device displays status messages according to the measured electrical conditions.

Display Message	Description
OPEN	The measured circuit is not conducting
CLOSED	The measured circuit is conducting
HIGH RESISTANCE	Resistance in an established conductive path exceeds the permitted limit
SHORT CIRCUIT	An unintended electrical connection exists between circuits that should be insulated

TIP STUCK / SHORT	The tip signal circuit remains unexpectedly closed when the tip is not pressed

Important Distinction

OPEN does not mean SHORT CIRCUIT.

OPEN indicates that there is no electrical continuity between the measured points.

SHORT CIRCUIT indicates an unintended electrical connection between two points that should normally remain electrically isolated.

The FLTB-01 evaluates circuit conditions according to the selected testing mode and the expected electrical state.

A normal open circuit must not be incorrectly identified as a short circuit.

4.5 Testing Procedure

1. Select **Épée** from the main menu.
2. Connect the épée correctly to the Weapon testing terminals.
3. Confirm that the display shows OPEN when the tip is not pressed.
4. Press the tip and verify that the display changes to CLOSED.
5. Observe the measured resistance while the circuit is closed.
6. Press and release the tip several times to check the stability of the electrical connection.
7. If an abnormal condition is detected, inspect the tip assembly, internal wires, socket connections and body wire.

If compliance with competition requirements for tip spring pressure or tip travel must be confirmed, additional testing using the prescribed inspection tools is required.

5. Foil Testing Mode

5.1 Function Description

Foil Mode is designed to inspect the electrical contact condition, circuit continuity and resistance of a foil.

The foil tip operates differently from an épée tip.

Under normal conditions, the foil tip signal conductor is electrically connected to the blade earth circuit when the tip is not pressed.

Pressing the foil tip breaks this electrical connection.

5.2 Normal Circuit Conditions

Tip Condition	Circuit Status
Tip released	CLOSED
Tip pressed	OPEN
OPEN when tip is released	Possible broken wire or poor electrical contact
CLOSED when tip is pressed	Tip may not be opening correctly

5.3 Testing Procedure

1. Select **Foil** from the main menu.
2. Connect the foil using the appropriate testing cable.
3. Confirm that the display shows CLOSED when the tip is not pressed.
4. Press the tip and verify that the display changes to OPEN.
5. Release the tip and confirm that the circuit returns to CLOSED.
6. Repeat the procedure to check circuit continuity and resistance stability.

If the display continuously shows OPEN when the tip is not pressed, inspect the tip spring, internal blade wire and plug connections.

If the display remains CLOSED when the tip is pressed, inspect the tip's mechanical assembly and electrical contact mechanism.

Important: The FLTB-01 Foil Mode primarily evaluates electrical contact operation and resistance.

It does not automatically verify compliance with requirements relating to tip dimensions, blade insulation length, insulation condition or mechanical tip travel.

6. Foil Flicker — Dynamic Intermittent Circuit Detection

6.1 Function Description

Foil Flicker Mode is designed to detect momentary electrical circuit interruptions that may occur when a foil is moved, bent or subjected to vibration.

During training or competition, intermittent electrical faults may result from:

- Damage to the internal blade wire
- Loose tip connections
- Poor plug or socket contacts
- Intermittent conductor contact
- Other electrical connection problems

These faults may occur for very short periods and may not be detected during conventional static testing.

Foil Flicker Mode continuously monitors the circuit to help identify intermittent electrical abnormalities under dynamic conditions.

6.2 Monitoring Data

Parameter	Description
Break Count	Total number of recorded circuit interruption events
Last Duration	Duration of the most recently recorded interruption
Min Duration	Shortest recorded interruption
Max Duration	Longest recorded interruption

The device records abnormal circuit changes according to the event detection and sampling capabilities of its firmware.

The minimum detectable interruption duration depends on the sampling frequency, detection thresholds and timing accuracy of the device.

These performance characteristics must be confirmed through actual testing and validation.

6.3 Testing Procedure

1. Select **Foil Flicker** from the testing menu.
2. Connect the foil correctly to the device.
3. Confirm that the circuit initially displays the normal CLOSED condition.
4. Gently move, shake or moderately bend the blade.
5. Observe whether any momentary OPEN events are detected.
6. Review the recorded interruption count and duration values.
7. If abnormal events are recorded, inspect the tip, internal blade wire and plug connections.

Do not deliberately overbend the blade or subject it to excessive impact in an attempt to reproduce a fault.

6.4 Interpretation of Results

If an abnormal OPEN event occurs while the tip is not being intentionally pressed, it may indicate an unstable electrical connection.

However, the FLTB-01 can only confirm that an electrical state change occurred during the monitoring period.

The number and duration of interruption events cannot independently identify the exact location of a fault.

Furthermore, the recorded interruption duration alone cannot determine whether an official scoring apparatus would register the same event.

Foil Flicker is an auxiliary diagnostic function provided by Fencing Lab. It is not an independent FIE equipment compliance inspection requirement.

7. Sabre Testing Mode

7.1 Function Description

Sabre Mode is designed to measure the electrical resistance and conductivity of the sabre blade, guard and associated conductive connections.

Unlike épée and foil, the sabre uses an electrically conductive blade for hit detection rather than a spring-loaded electrical tip switch.

According to FIE Material Rules Article m.5.4(a), the maximum permitted electrical resistance of a sabre weapon is 1Ω.

7.2 Connection Instructions

The FLTB-01 uses the following connection arrangement for Sabre Mode:

- **W3:** Fixed reference connection to the sabre's conductive circuit
- **B3:** Movable testing probe used to scan the sabre blade

When the connections and testing accessories are correctly configured, the B3 probe can be moved along the sabre blade to measure electrical resistance at different contact points.

The actual W3 and B3 terminal connections must follow the markings on the device and the supplied testing accessories.

7.3 Testing Standard

According to the FIE Material Rules:

Maximum permitted sabre weapon resistance: ≤1Ω.

Measured Resistance	Display
≤1Ω	PASS
>1Ω	FAIL

For measurements close to the permitted limit, measurement uncertainty and probe contact resistance must be considered.

Where necessary, the result should be verified using appropriate official inspection equipment.

7.4 Testing Procedure

1. Select **Sabre** from the main menu.
2. Connect the sabre according to the device's connection instructions.
3. Place the testing probe in contact with the blade.
4. Slowly move the probe along different sections of the blade.
5. Observe the real-time resistance value and displayed status.
6. Repeat the measurement at any location where an abnormal value is detected.

If the measured resistance exceeds the configured failure threshold, the screen displays a red FAIL indication.

An audible warning may also be activated through the device's buzzer.

The sabre guard's insulated areas, grip insulation, blade dimensions and mechanical condition must be checked separately.

8. Lamé Testing Mode

8.1 Function Description

Lamé Mode is designed to test the electrical conductivity of conductive jackets used in foil and sabre fencing.

The mode can be used to identify:

- Surface electrical resistance
- Localised high-resistance areas
- Abnormal contact between conductive fibres
- Reduced conductivity caused by wear or oxidation
- Discontinuities in the conductive surface

8.2 FIE Testing Standard

According to FIE Material Rules Article m.28.5, the electrical resistance measured between any two points of the conductive jacket material must not exceed 5Ω.

The testing probe is moved across the conductive surface while maintaining continuous electrical contact.

A quick inspection using ordinary handheld probes may be useful for routine maintenance and troubleshooting.

However, such testing is not equivalent to an official standard inspection performed under the prescribed contact conditions.

8.3 Testing Procedure

1. Select **Lamé** from the main menu.

2. Attach one testing probe to a designated conductive area of the jacket.
3. Use the second probe to scan different areas of the conductive surface.
4. Observe the real-time resistance value.
5. Repeat the measurement at locations showing unusually high resistance.
6. Inspect the jacket for damage, oxidation or localised conductivity failure.

8.4 Display Information

Display	Description
PASS	Resistance of the measured path is within the configured limit
FAIL	Resistance of the measured path exceeds the configured limit
Ω	Current measured resistance

Important: A conductive jacket meeting the electrical resistance requirement does not necessarily comply with all applicable competition regulations.

The complete coverage of the valid target area, garment dimensions, surface condition and other relevant requirements must also be checked.

9. Body Wire Testing Mode

9.1 Function Description

Body Wire Mode is designed to inspect conductor resistance, circuit integrity and abnormal electrical connections in fencing body wires.

Common body wire faults include:

- Broken internal conductors
- Increased conductor resistance
- Poor plug or socket contact
- Unintended short circuits between conductors
- Incorrect conductor connections
- Intermittent circuit interruptions during movement

9.2 Three-Conductor Body Wire Testing

For a standard épée three-conductor body wire, the FLTB-01 tests each corresponding conductor separately.

Circuit	FLTB-01 Testing Path	Resistance Requirement
A	W1 → B1	≤1Ω

B	W2 → B2	≤1Ω
C	W3 → B3	≤1Ω

The W and B terminal identifiers are specific to the FLTB-01.

Before testing, ensure that the terminal assignments correspond to the actual body wire connector pins and testing adapter.

9.3 Foil and Sabre Body Wires

Foil and sabre use a body wire arrangement that differs from the standard épée three-pin weapon connection.

These body wires also include a crocodile clip used to establish an electrical connection to the conductive jacket.

Depending on the selected body wire configuration, the FLTB-01 checks:

- Conductors between the three-pin plug and the weapon connector
- Conductors between the three-pin plug and the lamé crocodile clip
- Individual conductor resistance
- Electrical insulation between separate circuits
- Correct conductor connections according to the expected wiring configuration

Each conductor that is required to provide electrical continuity must meet the applicable resistance requirement of ≤1Ω.

9.4 Short-Circuit and Incorrect Wiring Detection

The FLTB-01 identifies abnormal electrical conditions according to its predefined wiring configurations.

Display Message	Description
OPEN CIRCUIT	A conductor that should provide electrical continuity is not conducting
SHORT CIRCUIT	An unintended electrical connection exists between conductors that should remain insulated
WRONG CONNECTION	The actual conductor connections do not match the selected standard wiring configuration
HIGH RESISTANCE	The resistance of a conductor exceeds its configured permitted limit

These results help users narrow down potential fault causes.

However, they do not directly identify the exact physical location of an internal wire defect.

9.5 Dynamic Body Wire Testing

Some body wires may appear to function normally while stationary but develop intermittent faults when bent, stretched or moved.

Dynamic testing helps identify these problems.

Testing Procedure

1. Connect the body wire correctly to the device.
2. Confirm that all conductors initially show normal circuit conditions.
3. Gently bend or move the body wire.
4. Monitor the electrical status of each conductor.
5. Check for momentary circuit interruptions or abnormal resistance changes.
6. If a fault is detected, inspect the plugs, cable and crocodile clip connections.

Dynamic body wire testing is an extended diagnostic function of the FLTB-01.

The results indicate that an electrical abnormality occurred during the monitoring period.

The duration of an interruption alone cannot determine the exact location of the fault.

10. Pressure Testing Mode

10.1 Function Description

Pressure Mode provides auxiliary measurement of the force required to activate the spring-loaded tip mechanisms of épée and foil weapons.

Using a compatible electronic pressure sensor or dedicated testing accessory, the FLTB-01 measures the applied force at the weapon tip.

10.2 Épée Tip Pressure Testing

According to FIE Material Rules Article m.19, the force required to close the épée tip circuit and register a hit must be greater than 750g.

When tested using the prescribed 750g test weight, the épée tip must support the weight without completing the electrical contact.

10.3 Foil Tip Pressure Testing

According to FIE Material Rules Article m.11, the force required to break the electrical contact of a foil tip must be greater than 500g.

When tested using the prescribed 500g test weight, the foil tip must support the weight without breaking the electrical contact.

10.4 Interpretation of Results

Electronic force readings can help identify possible problems such as:

- Weak tip springs
- Spring fatigue
- Abnormal tip activation force
- Inconsistent mechanical operation

However, electronic pressure measurement and conventional standard-weight testing may produce different results due to:

- Direction of applied force
- Loading speed
- Sensor measurement error
- Testing procedures and conditions

The electronic pressure results obtained using the FLTB-01 must not be used as a substitute for official FIE tip pressure testing.

11. Measurement Accuracy and Operating Precautions

11.1 Resistance Measurement Accuracy

The FLTB-01 is designed for low-resistance measurement, with a target relative measurement accuracy of **±1.5%**.

Actual measurements may be affected by:

- Additional resistance from testing cables and connectors
- Probe contact pressure
- Oxidation of metallic surfaces
- Conductive jacket material and surface contact conditions
- Device zero-point adjustment and calibration
- Environmental conditions and equipment condition

For measurements close to the maximum resistance permitted under FIE rules, verification using calibrated professional testing equipment is recommended.

11.2 General Operating Precautions

1. Inspect testing cables and connectors before use.
2. Select the correct testing mode for the equipment being inspected.
3. Ensure that testing terminals are connected correctly.
4. Maintain stable electrical contact when using testing probes.

5. Do not perform resistance measurements while the equipment is connected to an externally powered circuit.
6. Avoid damaging equipment through excessive bending, force or impact during testing.
7. If an abnormal condition is detected, perform additional checks using appropriate methods to confirm the cause.

12. Official Competition Equipment Inspection and Scope of Use

According to Chapter 3 — Checking of Material (Articles m.36–m.43) of the FIE Material Rules, official competition equipment inspection covers multiple independent requirements.

These may include:

- Weapon length, guard dimensions and other mechanical measurements
- Blade curvature and flexibility
- Tip pressure, lighting stroke and mechanical tip construction
- Electrical performance of weapons, body wires and conductive jackets
- Fencing mask construction and relevant safety requirements
- Protective clothing and equipment safety standards
- FIE quality labels and certification markings
- Official equipment inspection markings

The FLTB-01 is primarily designed to perform selected electrical tests and provide auxiliary fault diagnostic functions.

The device does not automatically verify all mechanical dimensions, blade material properties, protective equipment safety requirements or certification labels.

A PASS result for a particular electrical resistance or circuit condition does not indicate that the complete item of fencing equipment complies with every applicable FIE requirement.

13. Important Notice

Limitations of Equipment Testing

The FLTB-01 cannot fully replace the official equipment inspection required before fencing competitions.

The Fencing Lab FLTB-01 is an auxiliary testing device intended for routine fencing equipment maintenance, troubleshooting, pre-training checks and personal equipment inspections before competitions.

Although certain testing parameters are based on the FIE Material Rules, the FLTB-01 primarily evaluates electrical performance and selected auxiliary testing functions.

It does not cover all FIE requirements relating to mechanical construction, tip travel, equipment dimensions, protective equipment safety or other mandatory inspection criteria.

A PASS result displayed by the FLTB-01 does not mean that the tested equipment has passed an official FIE inspection or an inspection conducted by the competition organiser.

Fencers participating in official competitions must continue to submit their equipment for inspection in accordance with the applicable competition regulations.

All equipment remains subject to the inspection procedures and decisions of authorised officials, competition organisers and referees.

Results obtained using the FLTB-01 do not replace official inspection markings, equipment certification or the final decisions of the relevant competition authorities.

The FLTB-01 is an equipment testing and diagnostic tool, not a substitute for official competition equipment inspection or certification.

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Fencing Equipment Testing & Maintenance

Important: FLTB-01 is a diagnostic and pre-check device. It does not replace official competition equipment inspection or certification.