

Simple Switch Tester

SPECIFICATIONS

Introduction

The Simple Switch Tester is a device that provides a user with a way to assess the functionality of standard assistive switches that are equipped with a 3.5 mm plug.

Specifications

1. Functionality

- 1.1. The device **must** provide a 3.5 mm jack for connecting a switch.
- 1.2. The device **must** provide feedback when a connected switch is activated.
- 1.3. The device **must** have an enclosure to enclose and protect the electronic components.
- 1.4. The device **should** provide a way to confirm that the tester is operational without requiring an external switch.
- 1.5. The device **should** be able to be mounted.

2. Performance

- 2.1. The device **should** operate
- 2.2. The device **should** last in standby mode for no less than 6 months before requiring a battery change.

3. Environment

- 3.1. The device **must** work in a typical indoor working environment.

4. Life expectancy

- 4.1. The device **should** last the user up to ten years with constant use¹.

5. Maintenance

- 5.1. The device battery **must** be easily accessible.
- 5.2. The enclosure **should** be able to be cleaned.
- 5.3. The enclosure **should** be able to be disinfected.

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6. Target product cost

- 6.1. The costs for a single device including materials and shipping **must** be less than \$55 CAD.
- 6.2. The costs for a single device including materials and shipping **should** be less than \$20 CAD.

7. Availability of components

- 7.1. The device **must** be comprised of components that are either commercially available off-the-shelf or that are 3D printable.
- 7.2. Commercially available off-the-shelf components **should** available locally or online.
- 7.3. 3D printable components **should** be printable on consumer-level fused filament fabrication (FFF) machines.
- 7.4. Compatible alternative components **should** be listed.

8. Packaging

- 8.1. The device **must** be easy to ship disassembled.

9. Transportation

- 9.1. The device **must** be compact enough for ease of transportation of several devices.
- 9.2. The device **should** be able to be transported in carry-on baggage (with lithium battery⁴.)
- 9.3. The device **should** be able to ship in a letter-sized envelope (without battery³).
- 9.4. The device **should** be able to ship in a half-letter sized envelope (without battery³).

10. Assembling/building

- 10.1. The device **should** be manufacturable by a novice maker with limited tools in a remote location (e.g. at home).
- 10.2. The device **should** be able to be assembled by a typical maker in less than an hour.
- 10.3. The device **should** have guide pins, tracks, or other alignment markers to help guide the device assembly.
- 10.4. The tools required to assemble the device **should** be limited to: a soldering iron, wire cutters, pliers, and/or a screwdriver.

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11. Troubleshooting

- 11.1. The primary user **should** be able to troubleshoot or reset critical product function(s) without requiring external help.
- 11.2. Secondary users (caretaker, disability professional, family members, etc.) **should** be able to troubleshoot critical product function(s) and general functions without requiring external help.
- 11.3. Troubleshooting support and documentation **must** be available online or in other forms for all stakeholders (primary user, secondary user, maker, etc.) and explained in non-technical terms.

12. Quantity

- 12.1. The device **must** be able to be built in minimal quantities (i.e. 1-2).
- 12.2. The device **should** be able to be built in larger quantities (i.e. 20-50).

13. Size and weight

- 13.1. The device kit (including 3D printed casing) **should** not weigh more than 50g⁵.
- 13.2. The device **should** be around the same size as a handheld device.

14. Aesthetics and finish

- 14.1. The device **should** have a sleek look and not look bulky.
- 14.2. The device **should** have Makers Making Change branding on the exterior.

15. Materials

- 15.1. The 3D printed case **must** be printable in common filaments, like PLA and ABS, but not limited to other filaments.

16. Product life span

- 16.1. The device **should** have a product lifespan of at least ten years¹.

17. Standards and specifications (provincial, national, international, etc.)

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- 17.1. The device **must** comply with Transport Canada regulation on shipping lithium metal batteries^{2, 3}.

18. Ergonomics

- 18.1. The device **must** not have any sharp edges.
- 18.2. The device **should** be comfortable to hold and use.

19. Quality and reliability

- 19.1. The device **must** function reliably and consistently as a switch tester without failure.

20. Shelf life

- 20.1. The device **should** have a shelf life of ten years¹.

21. Processes

- 21.1. The enclosure design **should** be designed and optimized for 3D printing using a fused filament fabrication (FFF) machine.
- 21.2. The enclosure design **should** use minimal or no support material to print.
- 21.3. 3D printed components **should** require minimal post-processing.

22. Testing

- 22.1. The device **must** be built and tested internally first before publication.

23. Safety

- 23.1. The device **must** not injure the user in any way.
- 23.2. The device **must** not pose a choking hazard.

24. Intellectual Property Protection

- 24.1. The device **must** be released with an open-source license.
- 24.2. All project deliverables **should** be licensed to comply with Open Source Hardware.

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25. Product liability

- 25.1. Any form of incorrect use of the device **must** not be the fault of Makers Making Change.

26. Installation and operation

- 26.1. The device **must** have an easy to understand user manual.
- 26.2. The device **should** have icons and arrows for instruction on the 3D printed case.

27. Disposal

- 27.1. The device and its components **must** be able to be disposed of by regular household waste collection agencies or recycling depot, excluding the 3D printed enclosure.

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Appendix

¹ Shelf life of lithium coin battery

<https://www.panasonic-batteries.com/en/specialty/lithium-coin/coin-lithium-cr2032>

“Shelf Life: 10 years”

² Transport Canada on lithium batteries

<https://tc.canada.ca/en/dangerous-goods/transportation-dangerous-goods/transporting-batteries>

“The consignor is responsible for classifying dangerous goods (batteries in this case) in accordance with Part 2 of the TDG Regulations.”

“Yes. In Canada, the shipping and importing of lithium batteries is subject to the Transportation of Dangerous Goods Act, 1992 (TDG Act) and its regulations. They are considered dangerous goods much like gasoline, propane and sulfuric acid.”

Shipping documents are always required when transporting batteries.

Battery shipments must fully comply with the TDG Regulations

When shipping batteries by marine or air transport, consult Parts 11 and 12 of the TDG Regulations as well as the following documents:

The International Civil Aviation Organization’s Technical Instructions for the Safe Transport of Dangerous Goods by Air (ICAO Technical Instructions); or

The International Maritime Organization’s International Maritime Dangerous Goods Code (IMDG Code).

“A paper copy of the shipping document must always accompany the dangerous goods.”

“When dangerous goods are shipped by air, the shipping document must have, in the left and right margins, red hatchings that slant to the left or right.”

At minimum, the shipping document must include:

The name and address of the consignor in Canada

The shipping date

A description of the dangerous goods, in the following order:

The UN number

The shipping name of the dangerous goods

The primary and subsidiary class

Where applicable, the packing group in roman numerals

The quantity in metric (e.g., kg or L) for transports originating in Canada

The “24-Hour Number” of a person who can provide technical information on the dangerous goods

The consignor’s certification

“Part 4 of the TDG Regulations requires that dangerous goods safety marks be displayed on the means of containment containing dangerous goods in transport.”

Packing Instruction 801 of Transport Canada Standard TP14850E

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Batteries may be handled, offered for transport or transported in a non-UN standardized container if they are placed in a rigid container, in a wooden slatted crate or on a pallet

Batteries must be protected against short circuits

Stacked batteries must be adequately secured in tiers separated by a layer of non-conductive material

Battery terminals must not support the weight of other superimposed elements

Batteries must be packaged or secured to prevent inadvertent movement

³ UPS: How to safely pack and ship batteries

<https://www.ups.com/ca/en/help-center/packaging-and-supplies/special-care-shipments/batteries.page>

https://www.ups.com/assets/resources/media/en_CA/pack_ship_batteries.pdf

“Regulations require packing cells and batteries in fully enclosed inner packaging made of nonconductive material (e.g. plastic bags) and ensuring that exposed terminals or connectors are protected with non-conductive caps or tape or by other similar means.”

“Do not use envelopes or other softsided packs.”

Air Shipments of Lithium Metal Batteries of <2g of Lithium metal (Figure 9)

<https://data.energizer.com/pdfs/cr2032.pdf>

“Typical Weight: 3.0 grams (0.10 oz.)”

“Typical Li Content: 0.109 grams (0.0038 oz.)”

“Your package does not need to be shipped as fully regulated Dangerous Goods. Please see IATA regulations for UN3091 Section II requirements. <http://www.iata.org/> All packages of 'Lithium metal batteries packed with equipment'* require the UN3091 Lithium battery mark. Also mark the package 'P.I. 969-II'. † For 'Lithium metal batteries contained in equipment', display the UN3091 Lithium battery mark for any single package that contains >4 cells or >2 batteries. Also, mark the package 'P.I. 970-II'. † Note: **If there are no more than 4 cells or 2 batteries and no more than 2 packages in a consignment, no markings or labels are required.**”

⁴ Canada Post shipping

[https://www.canadapost.ca/cpotools/apps/far/business/farLetter?execution=e1s1#:~:text=20%20mm&text=lb.&text=Maximum%20weight%20for%20a%20letter%20is%20500%20g%20\(1.1%20lb.\)](https://www.canadapost.ca/cpotools/apps/far/business/farLetter?execution=e1s1#:~:text=20%20mm&text=lb.&text=Maximum%20weight%20for%20a%20letter%20is%20500%20g%20(1.1%20lb.))

| | Canada | U.S. | International |
|---------------------|---|--------|---------------|
| 0—30g | \$1.07 / stamp \$0.92 / stamp in a booklet | \$1.30 | \$2.71 |
| Over 30g—50g | \$1.30 | \$1.94 | \$3.88 |

TSA lithium battery carry-on rules

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[https://www.tsa.gov/travel/security-screening/whatcanibring/items/lithium-batteries-more-100-watt-](https://www.tsa.gov/travel/security-screening/whatcanibring/items/lithium-batteries-more-100-watt-hours#:~:text=Checked%20Bags%3A%20No,the%20FAA%20regulations%20on%20batteries.)

[hours#:~:text=Checked%20Bags%3A%20No,the%20FAA%20regulations%20on%20batteries.](https://www.tsa.gov/travel/security-screening/whatcanibring/items/lithium-batteries-more-100-watt-hours#:~:text=Checked%20Bags%3A%20No,the%20FAA%20regulations%20on%20batteries.)

“Lithium batteries with more than 100 watt hours may be allowed in carry-on bags with airline approval. One spare battery, not exceeding 300 watt hours, or two spare batteries, not exceeding 160 watt hours each, are permitted in carry-on bags.”

<https://www.master-instruments.com.au/products/54908/CR2032/BN.html>

“0.66Wh”

