ENVIRONMENTAL PRODUCT DECLARATION

as per *ISO 14025* and *EN 15804+A2*

Owner of the Declaration	Salto Systems
Publisher	Institut Bauen und Umwelt e.V. (IBU)
Programme holder	Institut Bauen und Umwelt e.V. (IBU)
Declaration number	EPD-SAL-20260322-IBA1-EN
Issue date	22.06.2026
Valid to	21.06.2031

XS4 Mini (standard and metal versions)

Salto Systems

Institut Bauen und Umwelt e.V.

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1. General Information

Salto Systems

Programme holder

IBU – Institut Bauen und Umwelt e.V.
Hegelplatz 1
10117 Berlin
Germany

Declaration number

EPD-SAL-20260322-IBA1-EN

This declaration is based on the product category rules:

Building Hardware products, 01.08.2021
(PCR checked and approved by the SVR)

Issue date

22.06.2026

Valid to

21.06.2031

Dipl.-Ing. Hans Peters
(Chairman of Institut Bauen und Umwelt e.V.)

Dr. Martina Bender
(Managing Director Institut Bauen und Umwelt e.V.)

XS4 Mini (standard and metal versions)

Owner of the declaration

Salto Systems
Arkotz, Polígono Lanbarren 9
20180 Oiartzun
Spain

Declared product / declared unit

The declared unit consists of 1 piece of Salto XS4 Mini.

Scope:

This declaration is based on LCA data for Salto XS4 Mini.

Final assembly takes place in Salto Spain manufacturing facilities in Oiartzun, being external suppliers who provide the different elements to be incorporated into the device.

The owner of the declaration shall be liable for the underlying information and evidence; the IBU shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

The EPD was created according to the specifications of EN 15804+A2. In the following, the standard will be simplified as *EN 15804*.

Verification

The standard EN 15804 serves as the core PCR
Independent verification of the declaration and data according to ISO 14025:2011
☐ internally ☒ externally

Mrs Kim Allbury,
(Independent verifier)

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2. Product

2.1 Product description/Product definition

The SALTO XS4 Mini is a smart door lock, that provides tailor-made wire-free access control.

With an easy-to-install design, the XS4 Mini is the simplest way for professionals to upgrade and replace mechanical-key-operated locks with the latest in electronic access control. It is ready to upgrade a single door or an entire facility, delivering smart, secure access with minimal disruption and maximum efficiency.

The reader circuit includes a proximity reading module to detect when an object is near the circuit, and tries to find a proximity device (card, tag, fob, mobile, etc.). If it finds one, it sends the information of the card to the control circuit and the control unit either grants or denies access – opening the door, or keeping it closed.

The reader can communicate in several forms: RFID Based Scalable Technologies, Bluetooth low energy (BLE) or JustIn Mobile Solutions, and the credentials formats can be: cards, tags, fobs, smartphones.

This representative EPD is for the metal cover product version which is the worst case scenario compared to the plastic covering (XS4 Mini standard) alternative. This scenario corresponds to the Salto product: XS4 Mini Metal European / Din.
This Representative EPD includes:
- XS4 Mini – European/DIN
- XS4 Mini Met European /DIN
- XS4 Mini Met Finnish
- XS4 Mini Met Scandinavian
- XS4 Mini Met Australian

The XS4 Mini – Tubular and XS4 Mini Metal – Tubular alternatives (which include a latch/mortise lock) are excluded from this representative EPD.

For the placing on the market in the European Union/European Free Trade Association (EU/EFTA) 2014 (with the exception of Switzerland) the following legal provisions apply: Directive 2014/53/EU, 16 April 2014, on the harmonisation of the laws of the Member States relating to the marking available on the market of radio equipment and repealing Directive 1995/5/EC, and the harmonised standards based on these provisions: ETSI EN 300 328 / ETSI EN 300 330 / ETSI EN 301 489-1 / ETSI EN 301 489-3 / ETSI EN 301 489-17 / EN IEC 62368-1:2020 + A11:2020 / EN IEC 62311:2020 / EN IEC 63000:2018.

The CE-marking considers the proof of conformity with the respective harmonized standards based on the legal provisions above. For the application and use the respective national provisions apply.

2.2 Application

The XS4 Mini need no hard wiring and provide a totally wire-free networked electronic locking solution with a range of features.

Its installation mechanisms permit to install the product using the previously installed product template with no need to cut or adapt the door again.

The product has been designed to be installed in indoor environments.

SALTO has an international market and is primarily an exporter. This product is sold all over the world, in more than 80 different countries, in 12 different sectors or industries. Thus, this EPD has a global coverage.

2.3 Technical Data

The technical properties of Salto XS4 Mini are detailed in the next table:

Technical data

Name	Value	Unit
Power supply (batteries - VDC)	4.5	V
Current Requirements ...Peak opening	0.4	A
Current Requirements ...Standby	0.00007	A
Operating Temperature	-35 - 60	°C
Operating Humidity up to	80	%
Transmit Frequency	13560	kHz
Power Consumption NSC - w/IPM	0,3/0,23 standby	mW
Peak Power Draw during card read	0.4	W

VDC - Volts Direct Current
NSC - Normal Standby Current
IPM - Intelligent Power Management Mode

CE marked product *RED Directive* compliance.
Additional internal testing for humidity.
Performance data of the product with respect to its characteristics in accordance with the relevant technical provision which can be applied are mentioned above.

2.4 Delivery status

Units are packed individually in cardboard boxes together with specifications, mounting scheme and batteries.

Cardboard packaging dimensions are: 215 mm x 160 mm x 61 mm.

2.5 Base materials/Ancillary materials

Materials

The material composition of a single device is given in percentages (%); packaging and labelling are not included in this table.

Name	Value	Unit
Steel	27.21	%
Stainless steel	31.82	%
Batteries (Other)	3.1	%
Bronze	0.04	%
Electronic	1.21	%
Zamak	31.66	%
Plastics	4.88	%
Magnet	0.06	%

REACH compliance

This product contains substances listed in the *candidate list* (date: 28.06.2023) exceeding 0.1 percentage by mass: no.

This product/article/at least one partial article contains other carcinogenic, mutagenic, reprotoxic (CMR) substances in categories 1A or 1B which are not on *the candidate list*, exceeding 0.1 percentage by mass: no' Biocide products were added to this construction product or it has been treated with biocide products (this then concerns a treated product as defined by the (EU) Ordinance on Biocide Products No. 528/2012): no

2.6 Manufacture

XS4 Mini escutcheons are fully designed and assembled in SALTO Systems' facilities in Oiartzun, Spain. Most of the components included in the device are produced in Spain by different companies except for the handles (made inChina) and the motor.
The factory of SALTO has a certification of QualityManagement system in accordance with ISO 9001.

2.7 Environment and health during manufacturing

Salto Systems is highly committed to the health and safety of the people working in its facilities and offices.

All relevant risks have been evaluated and controlled, training activities promoted and communication plans defined to keep workers protected.

There is a Code of Conduct covering human rights, adequate labour conditions, ethics and respect for the environment, for supplies in risk areas defined by UNESCO.

Environmental protection.

Salto's factory is *ISO 14001* certified, meaning that environmental aspects (water, energy, wastes, etc.) are identified, monitored and audited periodically, and that there is a verification of
complete compliance with environmental legislation.

In addition, Salto has calculated the carbon footprint of the main products focusing on the life cycle. There are plans to reduce greenhouse gas emissions in the manufacturing and transport processes and other different plans about environmental sustainability in design and manufacture. There is also a Climate Change Policy.
All wastes generated are controlled, minimized when possible and recycled.

2.8 Product processing/Installation

The installation of Salto XS4 Mini is performed with the aid of hand tools by trained installers. The assembly instructions and mounting scheme are included inside the packaging of each unit.

2.9 Packaging

Product packaging consists of a cardboard box including product labels, batteries, a mounting scheme and instructions in a plastic bag, all of which are transported in a wooden pallet with more plastic film.
The total weight of the packaging is 0.449 kg - cardboard/paper (68 %), plastic (3 %) and wood (29 %).

All packaging materials are recyclable.

European waste codes:

- Cardboard packaging 15 01 01
- Plastic packaging 15 01 02

2.10 Condition of use

During the use of the device under normal conditions, no maintenance is needed, with the exception of replacement batteries when required.

Special cleaning is not needed.

2.11 Environment and health during use

There are no interactions between the device and the environment or health while it is operating.

2.12 Reference service life

According to EN 16867 and DIN 18273, 200.000 cycles have been certified for the SALTO XS4 Mini. This adds up to 400.000 openings and movements. A battery change is calculated every 4 years approximately, depending on use, cycle frequency, door weight etc., and therefore, the battery has been changed 4 times in the product's lifetime.
Description of the influences on the ageing of the product when applied in accordance with the rules of technology.

2.13 Extraordinary effects

Fire
The Fire resistance is *EN 1634-1 Ei60.*

The product is Solid particle resistant IP66, meaning that the quantity of dust ingress is not sufficient to interfere with normal operation.
Water
There is no interaction between the device and water under normal conditions or in case of flood.

Mechanical destruction
During unexpected mechanical destruction, batteries might be broken and their content released.

2.14 Re-use phase

The device can be re-used, moving it from one door to another one until the end of its service life, though this is not a typical procedure.

2.15 Disposal

Disposal of the device is under Waste of Electrical and Electronic Equipment - WEEE) European
Directive (*Directive 2012/19/EU WEEE*).

The device can be disassembled and most of the components are recyclable or reused; the rest are used for energy recovery by incineration.

According to *EWC- European Waste Codes,* waste codes are:

- *EWC/ 16 02 13* discarded equipment containing hazardous components (1) other than those mentioned in 16 02 09 to 16 02 1*
- *EWC/ 17 04 05 iron, steel*
- *EWC/ 17 04 01 copper, bronze*
- *EWC/ 17 04 11 cables*
- *EWC/ 17 04 04 zinc*
- *EWC/ 17 02 03 plastic*

2.16 Further information

Additional information about Salto XS4 Mini can be found in:

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3. LCA: Calculation rules

3.1 Declared Unit

The declared unit refers to 1 piece of XS4 Mini cylinder as specified in IBU PCR PART B requirements on the EPD for Building Hardware products.

Declared unit

Name	Value	Unit
Declared unit	1	pce.
Mass total system	1.1	kg
Conversion factor to 1 kg	0.9091	-
Mass reference	1,1	kg/pce

3.2 System boundary

The EPD is of type "cradle to gate - with options". The following life cycle stages have been considered under this declaration as part of the system boundaries:

Module A1-A3 – The product stage includes provision of all materials, products and energy, as well as waste processing up to the end-of-waste state or disposal of final residues during the product stage.

Module A4 - includes the transportation of the finished product from the manufacturing site to the installation location, covering all transport modes and distances involved.

Module A5 – installation, only packaging waste treatment included.

Module B6 – operational energy use, including the production of batteries and their disposal over their lifetime. XS4 Mini is powered using batteries and is not connected to main electricity.

Modules C1 to C4 for End-of-Life (EoL) stages, including waste processing for thermal recovery of plastic parts and incineration of the printed wired board and recycling of metals. It starts when the product is replaced, dismantled, or deconstructed from the building or construction works and does not provide any further function. This stage comprises: De-installation (C1), Transport to waste processing (C2), Waste processing for reuse, recovery and/or recycling (C3), Disposal (C4).

Module D includes benefits and loads beyond the system boundaries resulting from the recycling and recovery processes taking place under modules A5 and C3.

3.3 Estimates and assumptions

For electricity production, SALTO has a photovoltaic system installed on site that generated 22% of their electricity requirements during the year of this study. The impact is represented with photovoltaic electricity grid mix production as a worst-case due to lack of available datasets for 'generation only'. The remaining electricity is purchased from a Spanish electricity provider that has guarantees of origin for 100% of the electricity sold to Salto coming exclusively from photovoltaics and has been modelled accordingly.
Emission Factor for Photovoltaic electricity grid utilized through the model is 0,02234 CO2eq./kWh.

The Bill of Materials (BOM) contains multiple mono-material parts. Parts of the same material are grouped per type and modelled as input of one part per material. This has no impact on the result.

Metal parts in the BOM are purchased as finished parts. MLC datasets are available for finished bronze parts including underlying waste assumptions. Steel and stainless-steel screw datasets available were also used in the model. For zamak parts, a zinc die-casting process is used, and for other steel parts, steel sheet punching and rolling processes were considered. For all such processes, 5% waste generation per piece in the final product was assumed. This waste is looped back in the model, reducing the total primary material input.

At EoL, bronze is assumed to be treated as low copper content scrap as a proxy. Similarly, zamak recycling is considered with steel recycling as a proxy, due to the absence of a recycling process specific to this material.

The plastic parts are mostly injection moulded parts modelled via a standard MLC dataset process for injection moulding of small plastic parts.

The BOM also includes an electric motor and four populated printed wiring boards (PWB) which have specified weight and dimensions. The motor is modelled according to the weight reported, but electronic components are modelled based on their dimensions. For each PWB, high-definition pictures and detailed BOMs were additionally provided to allow the detailed modelling of each one, including component manufacturing and assembly.

3.4 Cut-off criteria

In the assessment, all available data from production process are considered, i.e., all raw materials used and electric power consumption using best available LCI datasets. Only small amounts under 1 % of total mass inputs have been excluded from the model.

Production of capital equipment, facilities and infrastructure required for manufacture are outside the scope of this assessment.

Transport processes of pre-products and to End-of-Life are considered.

Transport processes for the packaging materials at their EoL are neglected.

3.5 Background data

The background data has been taken from the latest available Sphera LCA FE (GaBi) database CUP 2025.1. The requirements for data quality and background data correspond to the specifications of *IBU Part A*.

3.6 Data quality

The level and criteria of the global guidelines of the United Nations for the development of life cycle assessment databases (UN Environment Global Guidance on LCA database development) were applied.

The results of the data quality assessment result in average values of 4,87; 4,9 and 4,04 out of 5 for the Technological, Time and Geographical reference

3.7 Period under review

The collection of the foreground data refers to the year 2024 (annual average - 12 motnhs).

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3.8 Geographic Representativeness

Land or region, in which the declared product system is manufactured, used or handled at the end of the product´s lifespan: Global

3.9 Allocation

Background Data Allocation:
Sphera LCA Databases Modelling Principles follow the ISO 14040 series concerning multifunctionality.

Subdivision for black box unit processes to avoid allocation is often possible but not always. Subdivision is therefore always the first choice and applied in MLC work. This includes the use of the by-products in the same system (looping). System expansion (including substitution) is applied in MLC work, wherever suitable. In MLC, work system expansion is frequently applied to energy by-products of combined or integrated production, where direct use in the same system is not feasible. Allocation is the third method to deal with multi-functionality. Wherever possible, physical relationships are utilized to reflect meaningful shares of the burden. Whereas physical relationships alone cannot be established or used as the basis for allocation, the inputs are allocated between the products and functions in proportion to the economic value of the products and are mentioned explicitly in the datasets. More details on Sphera's modelling principles can be found in Managed LCA Content – (MLC) LCA Databases Modeling Principles 2025 (web).

Foreground Data Allocation:

The overall production of SALTO comprises further products beside the product considered in this study. Data for electrical energy as well as packaging refer to the declared product. During data collection the allocation is done via pieces yearly produced (125,197 pieces of XS mini met and 1,056,392 total pieces)

Waste Material Allocation:
Production waste is not considered in this study.
For all EoL waste streams, 100% scenarios were accounted for, applying the following logic to determine the respective treatment process:

- Metals: material recycling
- Substances with calorific value: thermal treatment with energy recovery unless otherwise specified
- Substances without calorific value: landfill
- Battery: landfill

For metals, European scenarios were used to calculate benefits where available. If European scenarios were not available (e.g., steel, copper), global average data were used. After collection in the EoL stage, the needed external scrap is fed back into the production. The recycling potential is then calculated considering the net scrap and the value of scrap methodology. Of the metals used, only steel and stainless steel have recycled content.

In the end-of-life phase, the input parameters of the production phase are used to calculate the waste streams. A function ensures that all inputs also undergo EoL treatment. Both the scrap input upstream and recovered material (after recycling burden) is considered.

All applied incineration processes are displayed via a partial stream consideration for the combustion process, according to the specific composition of the incinerated material. For the waste incineration plant an R1-value of 0.6 is assumed. Environmental burden of the incineration of packaging and the product in the end of life scenario are assigned to the system (A3, A5 or C3); resulting benefits for thermal and electrical energy are declared in module D.

The benefits for thermal and electrical energy are calculated via inversion of the life cycle inventory of European average data. For the calculation of benefits, in the case of thermal treatment of materials with calorific value, balancing was based on European scenarios for electricity mix and thermal energy from natural gas.

3.10 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets to be compared were created according to *EN 15804* and the building context, respectively the product-specific characteristics of performance, are taken into account. The background data has been taken from the latest available *Sphera LCA FE* (GaBi) database MLC CUP 2025.1 (Sphera Managed Lifecycle Content (MLC)).

4. LCA: Scenarios and additional technical information

Characteristic product properties of biogenic carbon
The calculation of the biogenic carbon content is based on the assumption, that the wood/paper/cardboard mass consists of 45-48% biogenic carbon.
Aside from the packaging, the product's life cycle does not have any other sources of biogenic carbon content.

Information on describing the biogenic Carbon Content at factory gate
Amount of carton in the packaging: 0,304 kg
Amount of wood in the packaging: 0,131 kg

Name	Value	Unit
Biogenic carbon content in accompanying packaging	0.205	kg C

Note: 1 kg of biogenic carbon is equivalent to 44/12 kg of CO_2.

The following technical information is a basis for the declared modules and can be used for developing specific scenarios in the context of a building assessment if modules are not declared (MND).

Transport to the building site (A4)
Transport to the building site (Module A4) covers the distribution of the product from the manufacturing site to the point of installation. Two transport modes are considered based on sales representativity: road transport and air freight by cargo plane. Fuel consumption values and transport distances are summarised in the table below.

Name	Value	Unit
Litres of fuel (truck, 20–26t)	40.8	l/100km
Litres of fuel (plane, 65 t payload)	756	l/100km
Transport distance (truck)	1343	km
Transport distance (plane)	2354	km
Capacity utilisation (including empty runs)	55	%

Installation into the building (A5)

Name	Value	Unit
Output substances following waste treatment on site (Paper packaging)	0.031	kg
Output substances following waste treatment (Plastic packaging)	0,001	kg
Output substances following waste treatment (wood packaging)	0,013	kg

According to EN 16867 and DIN 18273, 200.000 cycles have been certified for the SALTO XS4 Mini. This adds up to 400.000 openings and movements. A battery change is calculated every 4 years approximately, depending on use, cycle frequency, door weight etc., and therefore, the battery has been changed 4 times in the product's lifetime.

Reference service life

Name	Value	Unit
Reference service life (according to EN16867 and DIN18273 for 400.000 cycles, 400.000 openings)	15	a

Operational Energy use (B6)

SALTO's smart locks are powered using batteries and are not connected to mains electricity. These batteries are provided by SALTO to the customer as part of the product (production of the replacement batteries is considered under B6). During the operation of the product, the only energy consumption is from the batteries themselves. These must be exchanged four times over the RSL

Name	Value	Unit
Power supply batteries - VDC	4,5	V
Current requirements, Peak opening	0,4	A
Current requirements, Standby	0.00007	A
Power Consumption NSC - w/IPM	0,3/0,23 standby	mW
Peak Power Draw during card read	0,4	W

End of life (C1-C4)

Name	Value	Unit
Recycling steel	0.299268	kg
Recycling Zamak & stainless steel	0.698292	kg
Energy recovery plastics	0.05542	kg
Landfilling Batteries	0.033252	kg
Recycling electronic and metals	<0,011084	kg
Recycling light copper	0,011084	kg

Distance from user to EoL site (C2) 50 km.

5. LCA: Results

DESCRIPTION OF THE SYSTEM BOUNDARY (X = INCLUDED IN LCA; MND = MODULE OR INDICATOR NOT DECLARED; MNR = MODULE NOT RELEVANT)

Product stage			Construction process stage		Use stage							End of life stage				Benefits and loads beyond the system boundaries
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	MND	MND	MNR	MNR	MNR	X	MND	X	X	X	X	X

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT according to EN 15804+A2: 1 piece XS4 Mini

Parameter	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
GWP-total	kg CO_2 eq	6.89E+00	1.89E+00	6.85E-01	1.02E+00	0	6.27E-03	2.49E-01	6.26E-04	-2.69E+00
GWP-fossil	kg CO_2 eq	7.62E+00	1.88E+00	5.59E-02	1.01E+00	0	6.18E-03	2.47E-01	6.06E-04	-2.68E+00
GWP-biogenic	kg CO_2 eq	-7.42E-01	1.04E-02	6.29E-01	6.57E-03	0	3.18E-05	1.07E-03	1.79E-05	-1.81E-03
GWP-luluc	kg CO_2 eq	1.25E-02	1.66E-03	2.02E-05	9.12E-04	0	6.58E-05	3.58E-04	2.48E-06	-4.37E-03
ODP	kg CFC11 eq	1.19E-10	1.64E-13	8.79E-14	3.71E-12	0	1.06E-15	2.42E-12	1.69E-15	-2.82E-12
AP	mol H^+ eq	4.03E-02	6.95E-03	1.61E-04	9.61E-03	0	6.7E-05	2.57E-04	4.28E-06	-1.48E-02
EP-freshwater	kg P eq	2.64E-05	7.32E-07	1.58E-08	6.97E-07	0	1.72E-08	2.3E-07	9.01E-10	-2.42E-06
EP-marine	kg N eq	7.63E-03	3.11E-03	5.58E-05	1.28E-03	0	3.41E-05	6.23E-05	1.12E-06	-2.04E-03
EP-terrestrial	mol N eq	8.04E-02	3.4E-02	7.23E-04	1.39E-02	0	3.72E-04	7.48E-04	1.22E-05	-2.21E-02
POCP	kg NMVOC eq	2.27E-02	8.97E-03	1.49E-04	4.04E-03	0	6.37E-05	1.56E-04	3.35E-06	-6.53E-03
ADPE	kg Sb eq	1.89E-03	5.83E-08	1.02E-09	5E-05	0	4.25E-10	2.22E-08	3.75E-11	-1.7E-04
ADPF	MJ	1.04E+02	2.45E+01	1.95E-01	1.26E+01	0	8.19E-02	2.2E+00	7.95E-03	-2.82E+01
WDP	m^3 world eq deprived	1.55E+00	3.53E-03	8.07E-02	1.71E-01	0	2.92E-05	4.03E-02	6.55E-05	-5.91E-01

GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources; WDP = Water (user) deprivation potential)

RESULTS OF THE LCA - INDICATORS TO DESCRIBE RESOURCE USE according to EN 15804+A2: 1 piece XS4 Mini

Parameter	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
PERE	MJ	4.95E+01	2.35E-01	7.88E+00	1.89E+00	0	6.17E-03	1.48E+00	1.53E-03	-2.58E+00
PERM	MJ	8.73E+00	0	-7.83E+00	0	0	0	0	0	0
PERT	MJ	5.83E+01	2.35E-01	5.07E-02	1.89E+00	0	6.17E-03	1.48E+00	1.53E-03	-2.58E+00
PENRE	MJ	1.02E+02	2.45E+01	8.03E-01	1.26E+01	0	8.19E-02	3.71E+00	7.95E-03	-2.82E+01
PENRM	MJ	2.24E+00	0	-6.08E-01	0	0	0	-1.51E+00	0	0
PENRT	MJ	1.04E+02	2.45E+01	1.95E-01	1.26E+01	0	8.19E-02	2.2E+00	7.95E-03	-2.82E+01
SM	kg	2.06E-01	0	0	0	0	0	0	0	9.43E-01
RSF	MJ	0	0	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0	0	0
FW	m^3	3.99E-02	1.85E-04	1.9E-03	4.85E-03	0	3.05E-06	1.47E-03	1.92E-06	-2.59E-02

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water

RESULTS OF THE LCA – WASTE CATEGORIES AND OUTPUT FLOWS according to EN 15804+A2: 1 piece XS4 Mini

Parameter	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
HWD	kg	1.44E-07	8.11E-10	1.01E-10	3.96E-08	0	3.29E-12	2.83E-09	1.74E-12	-1.4E-04
NHWD	kg	3.54E-01	2.06E-03	1.86E-02	1.73E-01	0	1.14E-05	1.76E-02	3.97E-02	-1.42E-02
RWD	kg	4.74E-03	2.43E-05	9.97E-06	2.77E-04	0	1.55E-07	3.38E-04	8.44E-08	-1.47E-04
CRU	kg	0	0	0	0	0	0	0	0	0
MFR	kg	0	0	0	0	0	0	1.01E+00	0	0
MER	kg	0	0	0	0	0	0	0	0	0
EEE	MJ	4.37E-02	0	3.84E-01	0	0	0	2.22E-01	0	0
EET	MJ	7.83E-02	0	6.9E-01	0	0	0	5.1E-01	0	0

HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed; CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy

RESULTS OF THE LCA – additional impact categories according to EN 15804+A2-optional: 1 piece XS4 Mini

Parameter	Unit	A1-A3	A4	A5	B6	C1	C2	C3	C4	D
PM	Disease incidence	4.72E-07	2.87E-08	9.39E-10	7.86E-08	0	6.49E-10	2.22E-09	5.33E-11	-2.41E-07
IR	kBq U235 eq	4.94E-01	3.17E-03	1.57E-03	3.05E-02	0	2.22E-05	5.57E-02	9.35E-06	-2.64E-02
ETP-fw	CTUe	5.68E+01	1.91E+01	7.97E-02	2.38E+00	0	1.07E-01	3.9E-01	6.14E-03	-1.02E+01
HTP-c	CTUh	3.97E-09	2.86E-10	5.76E-12	2.63E-10	0	1.45E-12	3.63E-11	1.06E-13	-2.06E-08
HTP-nc	CTUh	6.34E-08	5.98E-09	1.7E-10	4.36E-09	0	8.05E-11	8.93E-10	3.95E-12	-6.65E-09
SQP	SQP	1.24E+02	9.28E-01	5.69E-02	2.79E+00	0	3.62E-02	8.73E-01	1.96E-03	-2.01E+00

PM = Potential incidence of disease due to PM emissions; IR = Potential Human exposure efficiency relative to U235; ETP-fw = Potential comparative Toxic Unit for ecosystems; HTP-c = Potential comparative Toxic Unit for humans (cancerogenic); HTP-nc = Potential comparative Toxic Unit for humans (not cancerogenic); SQP = Potential soil quality index

Disclaimer 1 – for the indicator 'Potential Human exposure efficiency relative to U235'. This impact category deals mainly with the eventual impact of low-dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure or radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, radon and from some construction materials is also not measured by this indicator.

Disclaimer 2 – for the indicators 'abiotic depletion potential for non-fossil resources', 'abiotic depletion potential for fossil resources', 'water (user) deprivation potential, deprivation-weighted water consumption', 'potential comparative toxic unit for ecosystems', 'potential comparative toxic unit for humans – cancerogenic', 'Potential comparative toxic unit for humans - not cancerogenic', 'potential soil quality index'. The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high as there is limited experience with the indicator.

6. LCA: Interpretation

The results indicate that the manufacturing stage is the primary contributor to the overall environmental impact of the product system. This is followed by the distribution phase (module A4) and the use phase (module B6) that represents a contribution to the overall impact due to batteries replacement during the operation of the product. It should be mentioned that the module A4 is an scenario and therefore the real impact might vary depending on the real distance used. After those main contributors, the incineration of packaging waste generated during the assembly process (module A5). End-of-life (EoL) processes show a relatively low impact in module C2, as most of the associated environmental burdens are linked to products part incineration and electronics shredding activities in module C3. Modules C1 and C4 present no significant impact, owing to manual disassembly and the low amounts of materials sent to landfill, respectively. Finally, the EoL processes and packaging incineration provide the environmental benefits reflected in module D.

The patterns observed for the Global Warming Potential (GWP) show that the manufacturing stage, particularly the production processes within modules A1–A3,constitutes the main contributor to the overall environmental impact of the declared product. This tendency is consistent across all other impact indicators, with the exception of the Global Warming Potential, Biogenic (GWP-biogenic). In this case, the impact primarily stems from the packaging materials, which are incinerated after disposal during the installation phase. This is explained by the composition of the packaging, which is mainly based on wood and cardboard.

Within the manufacturing stage, transport related to the product is the major contributor to the declared product's impacts. This transport group includes both the transport of upstream materials to the manufacturing site (A2) and the transport of the manufactured and assembled product to the client's final destination (A4). The main driver of these impacts is the transport scenario for the final delivery (module A4), which is based on sales data for the analyzed year. As noted, these two transport scenarios account for roughly 25% of the total impact, primarily due to air transport used to deliver the manufactured product to various continents. As mentioned before, it should also be noted that this impact may vary depending on the actual sales numbers and real distribution patterns of the products.

After the transport modules, the electrical and electronic components represent the primary contributors to most impact categories in the life cycle assessment (LCA), with the exception of GWP-biogenic, ODP, and ADP-elements.

Across the impact categories GWP-total, GWP-fossil, GWP-luluc, ODP, AP, EPm, EPt, POCP, ADP-elements, ADP-fossil, and water use, electrical and electronic components account for approximately 1% to 26% of the total impact. In EPf, their relative contribution increases to about 31%. Within these categories, the major contributors among the electronic components are the integrated circuits (ICs) and the unpopulated printed circuit board (PCB) used to model the antenna circuit and the printed circuit board assembly of the knob. Similarly, for the motor, the highest contributions stem from the ICs and connectors.

In addition to these, the mechanical components of the product contribute between 0.27% and 19% across all impact categories. The contribution of metals remains relatively consistent across most categories, except for ADP-elements, where zamak (a zinc-based alloy) is the dominant contributor with a 78% share of the total impact. This is mainly attributed to upstream elements such as lead and silver present in the zamak component. Electrical and electronic components follow with a 9% contribution in ADP-elements, primarily due to precious metals such as gold used in upstream processes.

For the biogenic global warming potential, the main contributors are the cardboard packaging and wooden pallet used in the final product (A3/A5), reflecting the absorption of atmospheric CO_2 during biomass growth. In other impact categories, packaging materials contribute relatively little, typically below 5%.

It is also important to highlight the role of green electricity in the manufacturing phase. The use of on-site solar photovoltaic (PV) systems and the purchase of electricity backed by Guarantees of Origin (GDOs) significantly reduces the environmental burden associated with energy consumption. As a result, the contribution of electricity to all impact categories is effectively 0%, with the only exception being the ODP indicator, where minor residual impacts are reflected. This demonstrates the substantial environmental benefits of sourcing renewable energy for production processes, underscoring its key role in minimizing the overall life cycle impact of the product.

In terms of the depletion potential of the stratospheric ozone layer (ODP), approximately 65% of the impact is associated with electricity use, while 16% arises from electrical and electronic components. However, given that the phase-out of ozone-depleting substances is expected to be completed by 2030, this indicator still includes minor residual background data, which limits further meaningful interpretation. Nevertheless, it is retained for completeness.

The use phase, primarily associated with battery operation and disposal, exhibits a moderate contribution across the assessed impact categories, ranging between 0.4% and 13%, except for GWP-biogenic, GWP-luluc, ODP, ADP-elements, and EPf, where upstream elements have no significant influence in this dataset.

In summary, during the manufacturing stage, the main environmental hotspots are the electrical and electronic components, zamak parts, and the electricity used for processing. An exception is observed for GWP-biogenic, which is mainly driven by packaging materials. The remaining mechanical components, although representing 92 wt% of the total product mass, contribute only marginally to the overall impact. The distribution phase constitutes the second most relevant stage after manufacturing across all impact categories.

7. Requisite evidence

There are no negative impacts on the environment or human health during the use phase of the product.

8. References

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