



EPD

# ENVIRONMENTAL PRODUCT DECLARATION

Production site: Xiamen City, Fujian Province, China

<b>HF P/N</b>	UEM5-100L/80-430501B-111	UEM5-400L/350-430501C-002	UEM5-800L/630-430501C-002
<b>Code</b>	131106	131120	131124



<b>DOCUMENT KIND</b> Environmental Product Declaration	<b>IN COMPLIANCE WITH</b> ISO 14025 and EN50693		
<b>PROGRAM OPERATOR</b> EPDItaly	<b>PUBLISHER</b> EPDItaly		
<b>EPDITALY REGISTRATION NUMBER</b> EPDITALY 0380	<b>ISSUE DATE</b> 2023-12-15		
<b>VALID TO</b> 2028-12-15	<b>INTERNAL/ EXTERANL USE</b> EXTERNAL		
<b>OWNING ORGANIZATION</b> HONGFA	<b>DECLARATION NUMBER</b> HFESC 20220820	<b>REV.</b> 1.0	<b>LANG.</b> en

<b>EPD Owner</b>	HONGFA
<b>Manufacturer name and address</b>	Xiamen Hongfa Electrical Safety & Controls Co., Ltd. No.566 Donglin Road, Jimei North Industrial District, Xiamen,China
<b>Company contact</b>	Fei Luo +86 5926296043 <a href="mailto:3106679@hongfa.cn">3106679@hongfa.cn</a> Vingo Lin <a href="mailto:1001452@hongfa.cn">1001452@hongfa.cn</a>
<b>Program operator</b>	EPDItaly – <a href="mailto:info@epditaly.it">info@epditaly.it</a> via Gaetano De Castillia n° 10 - 20124 Milano, Italia
<b>Declared product &amp; Functional unit or declared unit</b>	DU: The declared unit is specified in terms of pcs. The declared unit is 1pc of manufactured product incl. packaging material with RSL of 20 years
<b>Product description</b>	3 switches in 1 synthesis EPD report , product types include: UEM5-100L/80-430501B-111, UEM5-400L/350-430501C-002, UEM5-800L/630-430501C-002
<b>CPC code</b>	46212
<b>Independent verification</b>	EXTERNAL, Third party verification carried out by: ICMQ accredited by: ACCREDIA. This declaration has been developed referring to EPDItaly, following the "REGULATIONS OF THE EPDItaly PROGRAMME" Revision 5.2; further information and the document itself are available at: <a href="http://www.epditaly.it">www.epditaly.it</a> . EPD document valid within the following geographical area: Italy. Independent verification of the declaration and data carried out according to ISO 14025: 2006.
<b>Reference PCR and version number</b>	Core PCR: EPDItaly007 – PCR for Electronic and Electrical Products and Systems, Rev.3, 2023/1/13. Sub PCR: EPDItaly012 - Electronic and electrical products and systems –Switches, Rev. 0, 2020/03/16.
<b>Other reference documents</b>	EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems. Regulations of the EPDItaly Programme rev. 5.2 published on 2022/02/16
<b>Product RSL description</b>	20 years
<b>Markets of applicability</b>	B2B, Italy
<b>LCA study</b>	This EPD study is based on the LCA study described in the LCA report
<b>EPD type</b>	Product specific

<b>EPD scope</b>	Cradle to grave
<b>Year of reported primary data</b>	2022/9-2023/8
<b>Technical support</b>	TÜV Rheinland (China) Ltd.
<b>LCA software</b>	SimaPro 9.4.0.1(2022)
<b>LCI database</b>	Ecoinvent v3.8 (2021)
<b>LCIA methodology</b>	EN 15804 + A2 Method V1.03
<b>Comparability</b>	EPDs published within the same product category, though originating from different programs, may not be comparable. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible.
<b>Liability</b>	EPDItaly declines any responsibility regarding the manufacturer's information, data and results of the life cycle assessment.
<b>Additional disclaimer</b>	The database used is regarded as representative on the basis of a comparative study, which examined the data for a reference product of the EPD Owner

## CONTENTS

<b>Contents</b> .....	<b>4</b>
<b>HONGFA Purpose &amp; Embedding Sustainability</b> .....	<b>5</b>
<b>General Information</b> .....	<b>6</b>
Product characteristics .....	7
Materials composition .....	10
<b>LCA background information</b> .....	<b>10</b>
Declared unit (Functional unit) .....	10
System Boundaries .....	10
Temporal and geographical boundaries .....	12
Boundaries in the life cycle .....	12
Data quality .....	13
Environmental impact indicators.....	13
Allocation rules .....	13
Limitations and simplifications .....	13
<b>Inventory analysis</b> .....	<b>14</b>
Manufacturing stage .....	14
Distribution .....	14
Use .....	14
End of life .....	15
<b>Environmental indicators</b> .....	<b>15</b>
UEM5-100L/80-430501B-111 .....	15
UEM5-400L/350-430501C-002.....	19
UEM5-800L/350-430501C-002.....	22
<b>Sensitivity analysis</b> .....	<b>Errore. Il segnalibro non è definito.</b>
UEM5-800L/350-430501C-002.....	<b>Errore. Il segnalibro non è definito.</b>
Power consumption during installation stage and deinstallation stage .....	<b>Errore. Il segnalibro non è definito.</b>
Waste transportation distance .....	<b>Errore. Il segnalibro non è definito.</b>
End-of-Life Scenario.....	<b>Errore. Il segnalibro non è definito.</b>
<b>References</b> .....	<b>25</b>

## HONGFA PURPOSE & EMBEDDING SUSTAINABILITY

Xiamen Hongfa Electroacoustic Co., Ltd.(The abbreviation is Hongfa Group) is in the process of seeking their own survival and sustainable development. HONGFA considers to achieve the goal of enterprise management and improve enterprise market position, and to keep the enterprise in the leading field of competition and the future expansion of the business environment always maintain sustained earnings growth and improvement of ability, ensure longevity enterprise for a long time.

Hongfa establishes CSR management manual to ensure compliance with laws, regulations and customer requirements and continuous improvement.

### 1. The CSR policy

People-oriented, green operation, to promote the harmonious and sustainable development of economy, society and environment

### 2. CSR vision

To build a sustainable social responsibility system and become a first-class enterprise in the global relay field respected by the society and loved by employees

### 3. The CSR strategy

Develop employee value, promote green environmental protection, pursue win-win ecology and create a better life.

### 4. CSR practice path

For employees, people-oriented, growth together

For the environment, green environmental protection, clean production

For partners, development together, to achieve win-win

For shareholders, stable operation, create value

For the government, honest and honest, legitimate business

For community, being selfless contribution

## GENERAL INFORMATION

Hongfa Group has more than 30 subsidiaries worldwide, and its business covers more than 120 countries and regions, including relays, medium and low voltage products, high and low voltage switchgears, connectors, capacitors, precision parts and automation equipment. Hongfa is the only enterprise that owns postdoctoral working station and academican working station of the industry in China.

### Company development history

- 1) In 1984, Xiamen Hongfa Electroacoustic Co., Ltd (Hongfa Group for short) was established.
- 2) In 1987, product and company orientation aligned, committed to be an export-oriented enterprise with relays as the main product.
- 3) In 1999, enterprise reform implemented; Employee stock ownership started.
- 4) In 2008, Hongfa is nominated as “China’s Most Well-Known Trademark.”
- 5) In 2012, Hognfa Group was Listed on Shanghai Stock Exchange. accelerated its capital structure adjustment, and started its business again.
- 6) In 2013, Xiamen Hongfa Electrical Safety & Controls Co.,Ltd (called HFESC for short) became fully own by Hongfa Group. HFESC is a professional low voltage device manufacturer of Hongfa Group.

Hongfa is committed to providing customers with satisfactory products and solutions through continuous innovation and unremitting pursuit of high quality to bring people a more comfortable and convenient life.

As a responsible company to society and environment, HFESC applied EPD Italy and conduct LCA study from May.1 2021 to April.30 2022 and are willing to disclosure the actual Environmental impact to the public and customers for low voltage products.

Declared in this EPD includes the following products and for each product the characteristics and composition were listed from table2-table5.

**Table 1: LCA Study related types**

Type for LCA Study	Related Types	code
UEM5-100L/80-430501B-111	UEM5-100L/80-430501B-111	131106
UEM5-400L/350-430501C-002	UEM5-400L/350-430501C-002	131120
UEM5-800L/630-430501C-002	UEM5-800L/630-430501C-002	131124

PRODUCT CHARACTERISTICS

**Table 2: Product characteristics of Hongfa UEM5-100L/80-430501C- 111**

Series	UEM5-100L/80-430501C-111
Frame maximum current $I_{nm}$ (A)	100
Rated current $I_n$ (A)	80
current setting $I_r$ (A)	/
rated insulation voltage $U_i$ (V)	800
Rated impulse withstand voltage $U_{imp}(kV)$	8
Rated operating voltage $U_e$ (V)	400
Poles	4P
Rated ultimate short circuit breaking capacity $I_{cu}(kA)$	10
Mechanical life	8500 cycles
Electrical life	1500 cycles
mode of operation	local operations
additional function	Thermal magnetic + VDS

**Table 3: Product characteristics of Hongfa UEM5-400L/350-430501C -002**

Series	UEM5-400L/350-430501C-002
Frame maximum current $I_{nm}$ (A)	400
Rated current $I_n$ (A)	350
current setting $I_r$ (A)	/
rated insulation voltage $U_i$ (V)	800
Rated impulse withstand voltage $U_{imp}(kV)$	8
Rated operating voltage $U_e$ (V)	400
Poles	4P
Rated ultimate short circuit breaking capacity $I_{cu}(kA)$	25
Mechanical life	4000 cycles
Electrical life	1000 cycles
mode of operation	local operations
additional function	Thermal magnetic + VDS



**Table 4: Product characteristics of Hongfa UEM5-800L/630-430501C- 002**

Series	UEM5-800L/630-430501C-002
Frame maximum current $I_{nm}$ (A)	800
Rated current $I_n$ (A)	630
current setting $I_r$ (A)	/
rated insulation voltage $U_i$ (V)	800
Rated impulse withstand voltage $U_{imp}(kV)$	8
Rated operating voltage $U_e$ (V)	400
Poles	4P
Rated ultimate short circuit breaking capacity $I_{cu}(kA)$	25
Mechanical life	4000 cycles
Electrical life	1000 cycles
mode of operation	local operations
additional function	Thermal magnetic + VDS

## MATERIALS COMPOSITION

Table 5: The Switches material composition

Class name, in grams	ID according to IEC62474	UEM5-100L/80-430501B-111	UEM5-400L/350-430501C-002	UEM5-800L/630-430501C-002
PolyAmide (PA)	M-208	553.3	726.1	2378.2
Unsaturated polyester (UP)	M-301	779.6	2828.6	4825.5
PolyOxyMethylene (POM)	M-205	0.24	0.3	0.3
Polyphenylenesulfide (PPS)	M-213	8.54	7	61.2
PC-ABS	M-231	32.2	88.6	101
Epoxy resin (EP)	M-302	13.5	146.3	189.3
Polyphthalamide (PPA)	M-218		56.4	115.2
Other unfilled thermoplastics	M-249			
Other inorganic materials	M-199	16.17	618.64	0.26
PolyVinylChloride (PVC)	M-200	379.7	380.6	379.7
Other duromers	M-319	1.6		7
Other organic materials	M-399	0.2	0.2	0.2
Other precious metals	M-159	5.4	7.9	15.2
Other non-ferrous metals and alloys	M-149	1.47	4	6.2
Other ferrous alloys, non-stainless steels	M-119	538.8	1446.2	3046.3
Copper and its alloys	M-121	627	1667.1	2821.6
Stainless steel	M-100	7.3	21	26
Aluminium and its alloys	M-120	76	216.4	
Cast and sintered irons	M-101		208.2	
Other substances or mixtures for product operation	M-449	27.4	27.4	27.4
Paper	M-341	860.8	1476.6	2245.6
Other liquids	M-429	0.5		0.734
Oils and greases	M-410	2	3	3.5
Liquid Silicone Rubber (LSR)	M-323	0.15	0.17	0.7
Wood	M-340	500	1111.1	1666.7
PolyEthylene (PE)	M-201	82	110	102
Total		4513.87	11151.81	18019.794
<b>Total</b>		<b>4513.87</b>	<b>11151.81</b>	<b>18019.79</b>

## LCA BACKGROUND INFORMATION

## DECLARED UNIT (FUNCTIONAL UNIT)

The declared unit is specified in terms of pcs. The declared unit is 1 pcs of manufactured product incl. packaging material in a reference service life 20 years.

## SYSTEM BOUNDARIES

The life cycle of the Switch, an EEPs (Electronic and Electrical Products and Systems), is a “from cradle to grave” analysis and covers the following main life cycle stages.

The following table shows the stages of the product life cycle and the information stages according to EN 50693 for the evaluation of electronic and electrical products and systems.

**Table 6: System Boundaries**

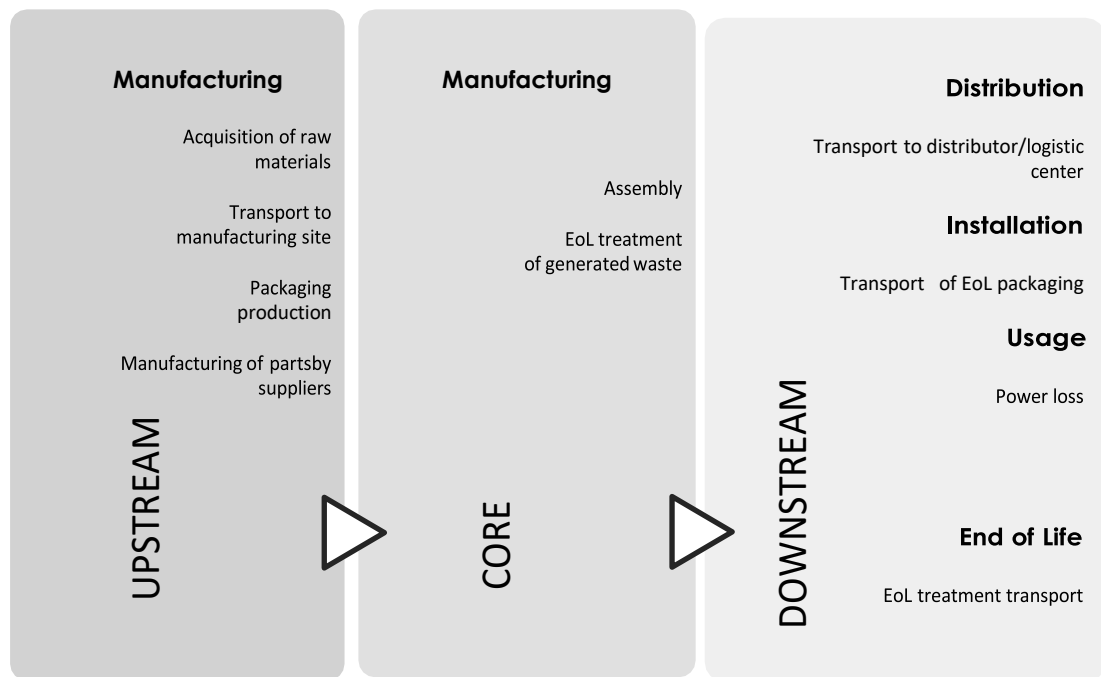
MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE & Maintenance STAGE	END-OF-LIFE STAGE De-installation	
UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE				
extraction of raw materials, including waste recycling processes and the production of semi-finished and ancillary products, as well as their packaging	Manufacturing of the product constituents, including all the stages	DISTRIBUTION	INSTALLATION	USE & Maintenance	De-installation	END-OF-LIFE
Transportation of raw materials to the manufacturing company	Product assembly					
	packaging					
	waste recycling processes					
X	X	X	X	X	X	X

X = module include in EPD

The stages of the product life cycle and the information considered for the evaluation of the cluster are:

- Manufacturing upstream includes raw materials, and production activities of HONGFA suppliers, including transport of semifinished items and subassemblies to HONGFA. This includes also the packaging production.

- Manufacturing core includes local consumptions due to manufacturing of the products , the relevant assembling and waste due to manufacturing
- The distribution stage includes the impacts related to the distribution of the product from manufacture to the logistic center of the receiver .
- The installation stage includes the impact related to the transportation of packaging waste to recycling place.
- The use stages include the impact related to energy consumption during the service life of the product.
- End of life includes the deinstallation, transportation and operations for the disposal of the product at the end of its service life.



## TEMPORAL AND GEOGRAPHICAL BOUNDARIES

The HONGFA component suppliers are sourced: China. All primary data collected from HONGFA are from 2022.9~2023.8, which is a representative production year. Secondary data are also representative for this year, as provided by ecoinvent v3.8.

The selected ecoinvent processes in the LCA model have a global representativeness, due to the unclear origin of each component. In this way, a conservative approach has been adopted.

## BOUNDARIES IN THE LIFE CYCLE

As indicated in the PCR EPDItaly012, capital goods, such as buildings, machinery, tools and infrastructure, the packaging for internal transport which cannot be allocated directly to the production of the reference product, may be excluded from the system boundary.

Infrastructures, when present, such as processes deriving from the ecoinvent database have not been excluded.

---

## DATA QUALITY

In this EPD, both primary and secondary data are used. Site specific foreground data have been provided by HONGFA. Main data sources are the bill of materials available on the enterprise resource planning. For all processes for which primary are not available, generic data originating from the ecoinvent v3.8 database, allocation cut-off by classification, are used. The ecoinvent database is available in the SimaPro 9.4.0.1 software used for the calculations.

---

## ENVIRONMENTAL IMPACT INDICATORS

The information obtained from the inventory analysis is aggregated according to the effects related to the various environmental issues. According to PCR EPDItaly012 and EN 50693 the environmental impact indicators must be determined using the characterization factors and impact assessment methods specified in EN 15804 + A2 Method V1.03 based on EF3.0 method.

PCR EPDItaly012 and the EN 50693 standard establish four indicators for climate impact(GWP-GHG): GWP (total) which includes all greenhouse gases; GWP (fossil fuels); GWP(biogenic carbon) which includes the emissions and absorption of biogenic carbon dioxide and biogenic carbon stored in the product; GWP (land use).

---

## ALLOCATION RULES

The energy demand and waste for products are allocated by mass on the basis of the total production amount from 2022/9-2023.8 We choose to calculate 1kg of product power consumption and waste generation and then calculate the power and waste output data by product weight respectively.

---

## LIMITATIONS AND SIMPLIFICATIONS

The data of energy consumption and pollutants emission in the raw material acquisition stage are from the Ecoinvent 3.8 database published by the European Ecoinvent Center.

The emission factor of China electricity is from the Ecoinvent 3.8 database.

The emission factor of Italy electricity is from the Ecoinvent 3.8 database.

The uncertainty has been adjusted accordingly. This dataset describes the electricity available on the low voltage level in China and Italy. This is done by showing the distribution of 1kWh electricity at low voltage.

The transport of raw material use very different kinds of lorry. In total two types of lorries are applied in considering <7.5ton and >16ton levels

Switches contain more than numerous components. Thus, simplifications are made to categorize the components as steel, stainless steel, aluminium, copper and plastic based on its main constituents. The plastic components are assumed to be manufactured through injection moulding.

During the installation stage, since there is no primary data, an assumption is made by assuming that the switches are amounted through manual labor. The packaging materials are discarded after installation.

The de-installation is assumed to be the same as installation process, and the dismantling process of the waste processing is modelled by using generic data (Used industrial electronic device {GLO}| treatment of, mechanical treatment | Cut-off, U) from Ecoinvent database;

During the end-of-life stage, the transportation of the waste to treatment facilities including recycling, landfill, or incineration center is assumed to be 200 km for simplification purposes.

## INVENTORY ANALYSIS

The ecoinvent v3.8 by cut-off classification system processes are used to model the background system of the processes.

Due to the large amounts of components in the Switch, raw material inputs are modelled with data from ecoinvent representing a global market (GLO) and rest-of-world (ROW) coverage. These datasets are assumed to be representative.

## MANUFACTURING STAGE

Nylon6 is the most frequently used material, followed by steel and copper and other plastics.

The single use packaging is also included in the analysis in the manufacturing stage- core. HONGFA receives packaging components from outside suppliers and packages the Switchs before shipping them.

The transport distances and weight from raw materials suppliers to the manufacturing are assumed as below:

In kgkm	UEM5-100L/80-430501B-111 /kgkm	UEM5-400L/350-430501A-P3-002 /kgkm	UEM5-400L/350-430501C-P3-002 /kgkm
<7.5t	70	216.7	220.6
>16t	318.3	1132.7	1135.4

The manufacturing of the Switches is located in HONGFA facility of Xiamen, China. In the factory, the different components and subassemblies are assembled into the Switch.

For the manufacturing phase, the general China low voltage electricity mix from ecoinvent v3.8 is used.

The waste generated by the production and assembly processes is included in the calculation.

## DISTRIBUTION

The transport distances and weight from HONGFA plant to the place of use are shown as below:

**Table 7: Transportation activity data**

ROUTE	TRANSPORT	DISTANCE (KM)
MANUFACTURER TO XIAMEN PORT	LORRY	19
XIAMEN PORT TO ITALY PORT	SHIP	14397
ITALY PORT TO DISTRIBUTION SITE	LORRY	200

## USE

Use and maintenance are modelled according to the PCR EPDIaly012 - Switches.

For the use phase, the general Italy low voltage electricity mix from ecoinvent v3.8 is used.

During the use phase, the Switches dissipates some electricity due to ohmic losses. They are calculated according to the own internal resistance of the Switch and the following PCR rules:

- nominal current reduced by a factor of 0.5;
- RSL of 20 years;
- functioning time of 30% of the RSL.

The formula for the calculation of the electricity consumed is shown in sub-PCR EPDIItaly012 and it is described as follows, where  $P_{use}$  is the power consumed by theSwitch at a given value of current:

$$E_{use} [kWh] = \frac{P_{use} * 8760 * RSL * \alpha}{1000}$$

**Table 8: Power electricity losses of the switches**

	UEM5-100L/80-430501B-111	UEM5-400L/350-430501A-P3-002	UEM5-800L/630-430501C-002
P (W)	5.6	14.8	27.8
electricity (kWh)	292.2	873.48	1460.6

Since no maintenance happens during the use phase, the environmental impacts linkedthis procedure have been omitted from the analysis.

## END OF LIFE

De-construction of the electric products during the end-of-life stage is assumed to be the same as in the installation stage. 200km transportation distance from the plant site to the waste treatment site is assumed, and the waste processing (C3) stage is modeled by mechanical shredding based on the data from the Ecoinvent database. For the material recovery process, the recovery rate is 55% for the entire product system including plastics and metals according to the WEEE directive. The leftover materials are assumed to be treated with incineration.

## ENVIRONMENTAL INDICATORS

The following tables show the environmental impact indicators of the life cycle of a single Switch, as indicated by PCR EPDIItaly007, sub-PCR EPDIItaly012 and EN 50693:2019.

The indicators are divided into the contribution of the processes to the different modules (upstream, core and downstream) and stages (manufacturing, distribution, use and end-of-life).

### UEM5-100L/80-430501B-111

**Table 9: LCIA results for UEM5-100L/80-430501B-111**

Potential environmental impacts for 1 switch							
STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
		UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
ITEMS							

GWP-total (kgCO2 eq)	1.67E+02	3.06E+01	3.56E+00	7.35E+00	7.64E-01	1.21E+02	3.07E+00
GWP -fossil (kgCO2 eq)	1.56E+02	3.12E+01	3.58E+00	7.35E+00	9.21E-02	1.11E+02	3.02E+00
GWP -biogenic (kgCO2 eq)	9.89E+00	-6.66E-01	-2.05E-02	-1.83E-04	6.72E-01	9.86E+00	5.12E-02
GWP -luluc (kgCO2 eq)	1.48E-01	1.23E-01	4.54E-04	4.79E-03	1.01E-05	1.98E-02	4.90E-04
ODP(kgCFC11 eq)	1.92E-05	2.37E-06	1.98E-08	1.47E-06	2.00E-08	1.52E-05	5.38E-08
AP(mol H+ eq.)	1.33E+00	5.31E-01	1.88E-02	2.35E-01	5.82E-04	5.46E-01	2.43E-03
EP -freshwater (kg P eq.)	8.13E-02	5.17E-02	6.69E-04	2.33E-04	1.65E-06	2.86E-02	1.18E-04
EP – marine (kg N eq)	2.00E-01	5.52E-02	3.97E-03	5.87E-02	2.34E-04	8.06E-02	8.18E-04
EP – terrestrial (mol N eq)	2.25E+00	6.45E-01	4.24E-02	6.52E-01	2.57E-03	8.98E-01	7.87E-03
POCP (kg NMVOC eq.)	6.21E-01	1.85E-01	1.10E-02	1.68E-01	9.05E-04	2.53E-01	2.08E-03
ADP –minerals and metals (kg Sb eq.)	1.80E-02	1.69E-02	1.08E-05	9.81E-06	8.03E-08	1.09E-03	3.45E-06
ADP –fossil (MJ)	2.23E+03	4.05E+02	3.16E+01	9.45E+01	1.25E+00	1.70E+03	5.17E+00
WDP(m³ eq.)	9.10E+01	1.40E+01	3.76E-01	1.53E-01	1.13E-03	7.58E+01	6.37E-01

GWP total= Global Warming Potential total;  
GWP fossil=Global Warming Potential fossil;  
GWP biogenic=Global Warming Potential biogenic;  
GWP luluc= Global Warming Potential land use and land use change;  
ODP= Depletion potential of the stratospheric ozone layer;  
AP=Acidification potential;  
EP freshwater= Eutrophication potential freshwater compartment;  
EP marine = Eutrophication potential marine compartment;  
EP terrestrial = Eutrophication potential terrestrial compartment;  
POCP= Formation potential of tropospheric ozone;  
ADP minerals & metals= Abiotic Depletion for non fossil resources potential;  
ADP fossil=Abiotic Depletion for non fossil resources potential,  
WDP=Water deprivation potential.

Use of resources for 1 switch



STAGE/ MODULE  ITEMS	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
		UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
PENRE (MJ)	2.20E+03	3.67E+02	3.16E+01	9.45E+01	1.25E+00	1.70E+03	5.17E+00
PERE (MJ)	6.15E+02	3.96E+01	3.24E+00	6.28E-01	4.89E-03	5.71E+02	3.37E-01
PENRM (MJ)	3.85E+01	3.85E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ)	1.87E+01	1.87E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ)	2.23E+03	4.05E+02	3.16E+01	9.45E+01	1.25E+00	1.70E+03	5.17E+00
PERT (MJ)	6.34E+02	5.83E+01	3.24E+00	6.28E-01	4.89E-03	5.71E+02	3.37E-01
FW (m3)	2.46E+00	3.86E-01	9.01E-03	5.30E-03	4.66E-05	2.04E+00	1.98E-02
SM (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	PENRE = Use of non-renewable primary energy excluding raw materials, PERE = Use of renewable primary energy excluding raw materials, PENRM = Use of non-renewable primary energy resources used as raw materials, PERM = Use of renewable primary energy resources used as raw materials, PENRT = Total use of non-renewable primary energy resources, PERT = Total use of renewable primary energy resources, FW = Use of net fresh water, SM = Use of secondary material, RSF = Use of renewable secondary fuels, NRSF = Use of non-renewable secondary fuels, INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.						
	Generation of waste for 1 switch						

STAGE/ MODULE  ITEMS	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
		UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
HWD (kg)	8.02E-01	1.51E-01	2.52E-03	3.39E-03	3.89E-05	1.70E-01	4.75E-01
NHWD (kg)	1.14E+01	4.66E+00	2.93E-01	3.40E-01	6.37E-03	5.85E+00	2.60E-01
RWD (kg)	6.52E-03	9.41E-04	1.84E-05	6.57E-04	8.86E-06	4.87E-03	2.41E-05
MER (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR (kg)	3.16E+00	0.00E+00	2.94E-02	0.00E+00	1.44E+00	0.00E+00	1.69E+00
CRU (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<p>HWD = Hazardous waste disposed,                      NHWD = Non-hazardous waste disposed,                      RWD = Radioactive waste disposed,                      MER= Materials for energy recovery,                      MFR =Material for recycling,                      CRU =Components for reuse,                      ETE =Exported thermal energy,                      EEE= Exported electricity energy.</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>							

UEM5-400L/350-430501C-002

Table 10: LCIA results for UEM5-400L/350-430501C-002

		Potential environmental impacts for 1 switch						
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
	GWP-total (kgCO <sub>2</sub> eq)	4.62E+02	6.20E+01	1.13E+01	1.82E+01	1.55E+00	3.61E+02	8.44E+00
	GWP -fossil (kgCO <sub>2</sub> eq)	4.33E+02	6.31E+01	1.13E+01	1.82E+01	1.72E-01	3.32E+02	8.26E+00
	GWP -biogenic (kgCO <sub>2</sub> eq)	2.94E+01	-1.50E+00	-6.49E-02	-4.53E-04	1.37E+00	2.94E+01	1.77E-01
	GWP -luluc (kgCO <sub>2</sub> eq)	4.45E-01	3.72E-01	1.43E-03	1.18E-02	1.89E-05	5.89E-02	1.27E-03
	ODP(kgCFC11 eq)	5.37E-05	4.43E-06	6.06E-08	3.63E-06	3.73E-08	4.55E-05	1.30E-07
	AP(mol H+ eq.)	3.55E+00	1.28E+00	5.96E-02	5.80E-01	1.09E-03	1.63E+00	6.36E-03
	EP -freshwater (kg P eq.)	1.97E-01	1.08E-01	2.11E-03	5.75E-04	3.08E-06	8.53E-02	3.01E-04
	EP – marine (kg N eq)	5.14E-01	1.14E-01	1.26E-02	1.45E-01	4.37E-04	2.40E-01	2.19E-03
	EP – terrestrial (mol N eq)	5.82E+00	1.37E+00	1.34E-01	1.61E+00	4.80E-03	2.68E+00	2.11E-02
	POCP (kg NMVOC eq.)	1.62E+00	4.07E-01	3.48E-02	4.16E-01	1.69E-03	7.56E-01	5.54E-03
	ADP –minerals and metals (kg Sb eq.)	3.69E-02	3.36E-02	3.41E-05	2.42E-05	1.50E-07	3.26E-03	8.87E-06
	ADP –fossil (MJ)	6.23E+03	8.24E+02	9.98E+01	2.33E+02	2.34E+00	5.06E+03	1.34E+01
	WDP(m <sup>3</sup> eq.)	2.65E+02	3.67E+01	1.19E+00	3.78E-01	2.11E-03	2.26E+02	8.67E-01

<p>GWP total= Global Warming Potential total;                  GWP fossil=Global Warming Potential fossil;                  GWP biogenic=Global Warming Potential biogenic;                  GWP luluc= Global Warming Potential land use and land use change;                  ODP= Depletion potential of the stratospheric ozone layer;                  AP=Acidification potential;                  EP freshwater= Eutrophication potential freshwater compartment;                  EP marine = Eutrophication potential marine compartment;                  EP terrestrial = Eutrophication potential terrestrial compartment;                  POCP= Formation potential of tropospheric ozone;                  ADP minerals &amp; metals= Abiotic Depletion for non fossil resources potential;                  ADP fossil=Abiotic Depletion for non fossil resources potential,                  WDP=Water deprivation potential.</p>								
Use of resources for 1 switch								
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
PENRE (MJ)		1.02E+04	1.19E+03	1.69E+02	3.78E+02	3.49E+00	8.46E+03	2.15E+01
PERE (MJ)		3.02E+03	1.51E+02	1.73E+01	2.51E+00	1.36E-02	2.85E+03	1.33E+00
PENRM (MJ)		7.43E+01	7.43E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ)		3.58E+01	3.58E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ)		1.03E+04	1.26E+03	1.69E+02	3.78E+02	3.49E+00	8.46E+03	2.15E+01
PERT (MJ)		3.06E+03	1.87E+02	1.73E+01	2.51E+00	1.36E-02	2.85E+03	1.33E+00
FW (m3)		1.16E+01	1.35E+00	4.81E-02	2.12E-02	1.30E-04	1.02E+01	2.16E-02
SM (kg)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

NRSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
<p>PENRE = Use of non-renewable primary energy excluding raw materials,                  PERE = Use of renewable primary energy excluding raw materials,                  PENRM = Use of non-renewable primary energy resources used as raw materials,                  PERM = Use of renewable primary energy resources used as raw materials,                  PENRT = Total use of non-renewable primary energy resources,                  PERT = Total use of renewable primary energy resources,                  FW = Use of net fresh water,                  SM = Use of secondary material,                  RSF = Use of renewable secondary fuels,                  NRSF = Use of non-renewable secondary fuels,                  INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>								
Generation of waste for 1 switch								
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
	HWD (kg)	3.52E+00	4.42E-01	1.35E-02	1.35E-02	1.08E-04	8.47E-01	2.21E+00
	NHWD (kg)	5.01E+01	1.71E+01	1.56E+00	1.36E+00	1.77E-02	2.92E+01	8.78E-01
	RWD (kg)	2.98E-02	2.69E-03	9.76E-05	2.63E-03	2.46E-05	2.43E-02	9.90E-05
	MER (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	MFR (kg)	7.44E+00	0.00E+00	9.31E-02	0.00E+00	2.69E+00	0.00E+00	4.65E+00
	CRU (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	ETE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

		<p>HWD = Hazardous waste disposed,</p> <p>NHWD = Non-hazardous waste disposed,</p> <p>RWD = Radioactive waste disposed,</p> <p>MER= Materials for energy recovery,</p> <p>MFR =Material for recycling,</p> <p>CRU =Components for reuse,</p> <p>ETE =Exported thermal energy,</p> <p>EEE= Exported electricity energy.</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>
--	--	--

UEM5-800L/350-430501C-002

**Table 11: LCIA results for UEM5-800L/350-430501C-002**

		Potential environmental impacts for 1 switch						
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
	GWP-total (kgCO2 eq)		7.63E+02	9.47E+01	1.90E+01	2.94E+01	2.31E+00	6.04E+02
GWP -fossil (kgCO2 eq)		7.13E+02	9.62E+01	1.91E+01	2.94E+01	2.56E-01	5.55E+02	1.38E+01
GWP -biogenic (kgCO2 eq)		4.92E+01	-2.21E+00	-1.10E-01	-7.33E-04	2.06E+00	4.92E+01	2.94E-01
GWP -luluc (kgCO2 eq)		7.40E-01	6.18E-01	2.43E-03	1.92E-02	2.81E-05	9.86E-02	2.04E-03
ODP(kgCFC11 eq)		8.83E-05	6.02E-06	1.03E-07	5.87E-06	5.56E-08	7.60E-05	2.00E-07
AP(mol H+ eq.)		5.83E+00	2.06E+00	1.01E-01	9.38E-01	1.62E-03	2.72E+00	1.03E-02
EP -freshwater (kg P eq.)		3.21E-01	1.73E-01	3.57E-03	9.30E-04	4.59E-06	1.43E-01	4.82E-04
EP – marine (kg N eq)		8.41E-01	1.79E-01	2.13E-02	2.35E-01	6.50E-04	4.02E-01	3.58E-03
EP – terrestrial (mol N eq)		9.50E+00	2.15E+00	2.27E-01	2.61E+00	7.14E-03	4.48E+00	3.45E-02
POCP (kg NMVOC eq.)		2.66E+00	6.55E-01	5.88E-02	6.73E-01	2.52E-03	1.26E+00	9.06E-03

ADP –minerals and metals (kg Sb eq.)	6.13E-02	5.57E-02	5.76E-05	3.92E-05	2.23E-07	5.45E-03	1.42E-05	
ADP –fossil (MJ)	1.03E+04	1.26E+03	1.69E+02	3.78E+02	3.49E+00	8.46E+03	2.15E+01	
WDP(m <sup>3</sup> eq.)	4.33E+02	5.21E+01	2.01E+00	6.12E-01	3.14E-03	3.78E+02	6.37E-01	
<p>GWP total= Global Warming Potential total;  GWP fossil=Global Warming Potential fossil;  GWP biogenic=Global Warming Potential biogenic;  GWP luluc= Global Warming Potential land use and land use change;  ODP= Depletion potential of the stratospheric ozone layer;  AP=Acidification potential;  EP freshwater= Eutrophication potential freshwater compartment;  POCP= Formation potential of tropospheric ozone;  ADP minerals &amp; metals= Abiotic Depletion for non fossil resources potential;  ADP fossil=Abiotic Depletion for non fossil resources potential,  WDP=Water deprivation potential.</p>								
Use of resources for 1 switch								
ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBUTION STAGE	INSTALLATION STAGE	USE STAGE	END-OF-LIFE STAGE
			UPSTREAM MODULE	CORE MODULE	DOWNSTREAM MODULE			
PENRE (MJ)		1.01E+04	1.11E+03	1.69E+02	3.78E+02	3.49E+00	8.46E+03	2.15E+01
PERE (MJ)		3.00E+03	1.33E+02	1.73E+01	2.51E+00	1.36E-02	2.85E+03	1.33E+00
PENRM (MJ)		1.53E+02	1.53E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERM (MJ)		5.41E+01	5.41E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRT (MJ)		1.03E+04	1.26E+03	1.69E+02	3.78E+02	3.49E+00	8.46E+03	2.15E+01
PERT (MJ)		3.06E+03	1.87E+02	1.73E+01	2.51E+00	1.36E-02	2.85E+03	1.33E+00
FW (m3)		1.16E+01	1.35E+00	4.81E-02	2.12E-02	1.30E-04	1.02E+01	2.16E-02

SM (kg)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

PENRE = Use of non-renewable primary energy excluding raw materials,  
 PERE = Use of renewable primary energy excluding raw materials,  
 PENRM = Use of non-renewable primary energy resources used as raw materials,  
 PERM = Use of renewable primary energy resources used as raw materials,  
 PENRT = Total use of non-renewable primary energy resources,  
 PERT = Total use of renewable primary energy resources,  
 FW = Use of net fresh water,  
 SM = Use of secondary material,  
 RSF = Use of renewable secondary fuels,  
 NRSF = Use of non-renewable secondary fuels,  
 INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.

Generation of waste for 1 switch

ITEMS	STAGE/ MODULE	Total	MANUFACTURING STAGE		DISTRIBU TION	INSTALLA TION	USE	END-OF- LIFE
			UPSTREA M MODULE	CORE MODULE	STAGE	STAGE	STAGE	STAGE
HWD (kg)		3.52E+00	4.42E-01	1.35E-02	1.35E-02	1.08E-04	8.47E-01	2.21E+00
NHWD (kg)		5.01E+01	1.71E+01	1.56E+00	1.36E+00	1.77E-02	2.92E+01	8.78E-01
RWD (kg)		2.98E-02	2.69E-03	9.76E-05	2.63E-03	2.46E-05	2.43E-02	9.90E-05
MER (kg)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR (kg)		1.19E+01	0.00E+00	1.57E-01	0.00E+00	4.01E+00	0.00E+00	7.71E+00
CRU (kg)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ETE (MJ)		0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00



EEE (MJ)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	<p>HWD = Hazardous waste disposed,  NHWD = Non-hazardous waste disposed,  RWD = Radioactive waste disposed,  MER= Materials for energy recovery,  MFR =Material for recycling,  CRU =Components for reuse,  ETE =Exported thermal energy,  EEE= Exported electricity energy.</p> <p>INA = Indicator not accessed due to a limitation of the LCA tools and databases used to calculate the required resource flows. INA does not imply zero impact.</p>						

## REFERENCES

- Life cycle assessment (LCA) of Low voltage Switches and the voltage detecting system, 2023
- ISO 14040:2006, Environmental Management - Life Cycle Assessment - Principles and Framework
- ISO 14044:2006, Environmental Management - Life Cycle Assessment - Requirements and Guidelines
- ISO 14025:2006, Environmental labels and declarations — Type III environmental declarations — Principles and procedures.
- ISO 14040:2006/Amd 1:2020 Environmental management — Life cycle assessment — Principles and framework — Amendment 1
- ISO 14044:2006/Amd 2:2020 Environmental management — Life cycle assessment — Requirements and guidelines — Amendment 2
- EN 50693:2019 - Product category rules for life cycle assessments of electronic and electrical products and systems
- EN 15804:2012+A2:2019, Sustainability of construction works — Environmental product declarations — Core rules for the product category of construction products
- PCR EPDItaly007 - Electronic and electrical products and systems (rev.3), Jan 13 2023
- PCR EPDItaly012 - Electronic and electrical products and systems (rev.0) - Switches, March 2020
- Ecoinvent, 2021. Swiss Centre for Life Cycle Assessment, v3.8 ([www.ecoinvent.ch](http://www.ecoinvent.ch)).
- PRé Consultants, 2021. Software SimaPro versione 9.3.0.2 ([www.pre.nl](http://www.pre.nl)).
- <https://www.isprambiente.gov.it/it>
- <https://www.mise.gov.it/index.php/it/>

- EPDItaly regulations rev. 5.2, issued on 2022/02/16
- WEEE Directive(2012/19/EU)