Environmental Product Declaration (EPD)
According to ISO 14025 and EN 15804+A2

# AMTRON® Professional+ TC / AMTRON® Professional+ EV charging station

| | |
|---|---|
| Registration number: | EPD-Kiwa-EE-000442-EN |
| Issue date: | 30.06.2025 |
| Valid until: | 30.06.2030 |
| Declaration owner: | MENNEKES Elektrotechnik GmbH&Co.KG |
| Publisher: | Kiwa-Ecobility Experts |
| Program operator: | Kiwa-Ecobility Experts |
| Status: | verified |




# 1 General information

## 1.1 PRODUCT

AMTRON® Professional+ TC / AMTRON® Professional+

## 1.2 REGISTRATION NUMBER

EPD-Kiwa-EE-000442-EN

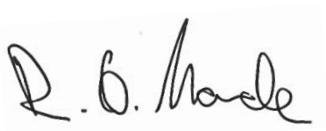
## 1.3 VALIDITY

Issue date: 30.06.2025

Valid until: 30.06.2030

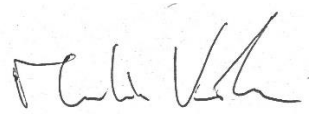
## 1.4 PROGRAM OPERATOR

Kiwa-Ecobility Experts
Wattstraße 11-13
13355 Berlin
Germany



Raoul Mancke

*(Head of program operations, Kiwa-Ecobility Experts)*



Martin Köhrer

*(Verification body, Kiwa-Ecobility Experts)*

## 1.5 DETAILS OF THE DECLARATION OWNER

**Declaration owner:**

MENNEKES Elektrotechnik GmbH&Co.KG

**Address:**

Aloys-Mennekes-Straße 1
57399 Kirchhundem
Germany

**E-mail:** e-post@mennekes.de

**Website**

https://www.mennekes.de/emobility/ (German Website)

https://www.mennekes.org/emobility/ (international Website)

A selection of other languages/countries can be accessed by clicking on the selection (top left, globe) on the opened page.

**Production location:**

MENNEKES Elektrotechnik Kirchhundem und MENNEKES Neudorf Elektrotechnik Sachsen GmbH

**Address production location:**

- MENNEKES Elektrotechnik GmbH&Co.KG
  Aloys-Mennekes-Straße 1
  57399 Kirchhundem / Germany
- Elektrotechnik Sachsen GmbH
  MENNEKES Straße 1
  09465 Sehmatal-Neudorf / Germany

## 1.6 VERIFICATION OF THE DECLARATION

The independent verification is in accordance with the ISO 14025:2011. The LCA is in compliance with ISO 14040:2006 and ISO 14044:2006. The EN 15804:2012+A2:2019 serves as the core PCR.

☐ Internal ☒ External

Elisabet Amat

(Third party verifier)

## 1.7 STATEMENTS

The owner of this EPD shall be liable for the underlying information and evidence. The program operator Kiwa-Ecobility Experts shall not be liable with respect to manufacturer data, life cycle assessment data and evidence.

## 1.8 PRODUCT CATEGORY RULES

Kiwa-Ecobility Experts (Kiwa-EE) – General Product Category Rules (2022-02-14)

EN 50693:2019 Product category rules for life cycle assessments of electronic and electrical products and systems

## 1.9 COMPARABILITY

In principle, a comparison or assessment of the environmental impacts of different products is only possible if they have been prepared in accordance with EN 15804 / EN 50693. For the evaluation of the comparability, the following aspects have to be considered in particular: PCR used, functional or declared unit, geographical reference, the definition of the system boundary, declared modules, data selection (primary or secondary data, background database, data quality), scenarios used for use and disposal phases, and the life cycle inventory (data collection, calculation methods, allocations, validity period). PCRs and general program instructions of different EPDs programs may differ. Comparability needs to be evaluated. For further guidance, see EN 15804+A2 (5.3 Comparability of EPD for construction products) and ISO 14025 (6.7.2 Requirements for comparability).

## 1.10 CALCULATION BASIS

**LCA method:** ISO 21930, ISO 14025, ISO 14040 and ISO 14044, EN 50693, EN 15804

**LCA software:** openLCA 2.4

**Characterization method:** 15804GD Unit-Process 2024-10-23

**LCA database profiles:** ecoinvent versión 3.10 EN

**Version database:** 15804GD Unit-Process 2024-10-23

## 1.11 PROJECT REPORT

This EPD is generated on the basis of the following report: Life Cycle Assessment Report for Wall boxes and charging stations from April 2025.

# 2 Product

## 2.1 PRODUCT DESCRIPTION

The AMTRON® Professional+ charging stations are electric vehicles charging stations (EVSE) which can be mounted on walls or columns (wallboxes). Our product series consist several numbers of single wallboxes with one charging point and Twincharge wallboxes with two charging points.

The AMTRON® Professional+ product series deliver several features for the user and the operator of charging infrastructure, such as

- Equipped charging point reg. IEC 62196 (socket outlet with/without shutter or charging cable)
- RFID card system for access protection
- Dynamic, phase-exact load management for up to 100 charge points
- Optionally with integrated mobile communication modem for the backend link
- Optional: plug & charge (PnC) function
- Compatible with OCPP 1.5s and OCPP 1.6s+j
- Locally networkable via LAN (RJ45)
- Connection of external power meters for overload protection
- Integrated RCCBs and MCBs protection devices
- Multifunction button (for resetting after a malfunction etc.)
- MID-certified power meter

**Product specification**

The composition of the product is described in the following table:

| Materials | Weight [m-%] |
|---|---|
| PA and PA-blends | 4.01 |
| technical thermoplastics (PC, ABS, PMMA, TPU) | 32.37 |
| flexible plastics (TPE, PUR) | 0.12 |
| Polyolefins | 0.38 |
| others (polyester, PVC) | 1.75 |
| Electronic parts | 52.24 |
| brass | 1.38 |
| paintings | 0.02 |
| steel/stainless steel | 7.51 |
| zinc die-cast | 0.23 |

## 2.2 APPLICATION (INTENDED USE OF THE PRODUCT)

**Semi-public charging infrastructure** is located on private property but is accessible to the public. Typical examples include customer parking lots of shops or hotels. These charging points are intended for specific user groups such as customers or visitors.

**Public charging infrastructure**, on the other hand, is located on public property and is accessible to everyone. Examples include charging points at roadsides or in public parking garages.

## 2.3 REFERENCE SERVICE LIFE (RSL)

**RSL PRODUCT**

According to the PCR, the RSL is taken from the PSRs of PEP, PSR0018 (PSR-0018-ed1.2-EN-2024-09-26, 'Specific rules for electric vehicle charging infrastructures'). The RSL was assumed to be 10 years.

**USED RSL (YR) IN THIS CALCULATION**

10 years

## 2.4 TECHNICAL DATA

The present analysis considers only fully equipped articles with a maximal configuration reg. features, functions and components as reference products for the named product lines. All other articles of the named product lines that are not fully equipped can be seen as less curtail reg. this consideration.

Technical data of the reference product considered:

| AMTRON® Professional+ TC PnC 22 T2S | | 151822602 |
|---|---|---|
| Max. charging power Mode 3 [kW] | Charging point 1 | 22 |
| | Charging point 2 | 22 |
| Connection | Charging point 1 | 1-phase / 3-phase |
| | Charging point 2 | 1-phase / 3-phase |
| Rated current $I_{nA}$ [A] | | 63 |
| Rated current of a Mode 3 $I_{nC}$ charging point [A] | | 32 |
| Rated voltage $U_N$ [V] AC ± 10% | | 230 / 400 |
| Rated frequency $f_N$ [Hz] | | 50 |
| Max. back-up fuse [A] | | 100 |
| Rated insulation voltage $U_i$ [V] | | 500 |
| Rated impulse withstand voltage $U_{imp}$ [kV] | | 4 |
| Conditional rated short-circuit current $I_{CC}$ [kA] | | 10 |
| Rated diversity factor RDF | | 1 |
| Types of system earthing | | TN/TT |
| EMC classification | | A+B |
| Protection class | | I |
| IP rating | | IP44 |
| Overvoltage category | | III |
| Mechanical impact protection | | IK10 |
| Contamination rating | | 3 |
| Installation | | open air |
| Stationary / Mobile | | fixed |
| Use (according to IEC 61439-7) | | ACSEV |
| External design | | wall mounting |
| Dimensions H x W x D [mm] | | 539 x 492 x 235 |
| Weight [g] | | 14000 |
| Standard | | IEC 61851, IEC 61439-7 |

The specific standards according to which the product was tested can be found in the declaration of conformity for the product.

| AMTRON® Professional+ 22 C2 | | 1386202 |
|---|---|---|
| Max. charging power Mode 3 [kW] | Charging point 1 | 22 |
| Connection | Charging point 1 | 3-phase |
| Rated current $I_{nA}$ [A] | | 32 |
| Rated current of a Mode 3 $I_{nC}$ charging point [A] | | 32 |
| Rated voltage $U_N$ [V] AC ± 10% | | 230 / 400 |
| Rated frequency $f_N$ [Hz] | | 50 |
| Switching device load circuit (load contactor) | | 32A, 4p (100-250V 50/60Hz) |
| Max. back-up fuse [A] | | 80 |
| Rated insulation voltage $U_i$ [V] | | 500 |
| Rated impulse withstand voltage $U_{imp}$ [kV] | | 4 |
| Conditional rated short-circuit current $I_{CC}$ [kA] | | 10 |
| Rated diversity factor RDF | | 1 |
| Types of system earthing | | TN/TT |
| EMC classification | | A+B |
| Protection class | | I |
| IP rating | | IP54 |
| Overvoltage category | | III |
| Mechanical impact protection | | IK10 |
| Contamination rating | | 3 |
| Installation | | open air, interior |
| Stationary / Mobile | | fixed |
| Use (according to IEC 61439-7) | | ACSEV |
| External design | | wall mounting |
| Dimensions H x W x D [mm] | | 475 x 259 x 220 |
| Weight [g] | | 11615 |
| Standard | | IEC 61851, IEC 61439-7 |

The specific standards according to which the product was tested can be found in the declaration of conformity for the product.

Breakdown of article-numbers with example:

Example - short definition

**AMTRON® Professional+ TC PnC 22 T2S**

serialnumber of the example: **1 5 1 8 2 2 6 0 2**

| | configuration option |
|---|---|
| | [ ] configurable item |
| X | [1] not configurable item |
| | **model series** |
| | [4] AMEDIO |
| X | [5] AMTRON TwinCharge |
| | **mounting type** |
| | [0] installation on ground |
| X | [1] installation on wall |
| | **classification** |
| | [6] Professional |
| X | [8] Professional+ |
| | **calibration law** |
| | [0] without calibration law |
| | [1] with calibration law |
| X | [2] without calibration law, with ISO 15118 (PnC) |
| | [3] with calibration law, with ISO 15118 (PnC) |
| | **electric power** |
| | [1] 11 kW |
| X | [2] 22 kW |
| | [3] 3,7 kW |
| | [7] 7,4 kW |
| | **connector type** |
| | [1] C1 (with cable type 1) |
| | [2] C2 (with cable type 2) |
| | [4] T2 (socket with hinged lid) |
| | [5] T2 (socket with swing flap) |
| X | [6] T2S (socket with Shutter) |
| | **surge-/lightning protection** |
| X | [0] without surge protection |
| | [1] with surge protection |
| | [2] lightning protection |
| | [5] customized |
| | **protection** |
| | [0] without RCD + MCB + DC 6 mA |
| | [1] with RCD Typ A + DC 6 mA* |
| X | [2] with RCD Typ A + DC 6 mA + MCB |
| | [3] with RCD Typ B |
| | [4] with RCD Typ B + MCB |
| | [5] with DC 6 mA , without RDC + MCB |
| | [6] with RCD Typ A + DC 6 mA |

* = for shutter systems (France) with FI Typ B

serialnumber of the example: **1 3 8 6 2 0 2**

Example - short definition

**AMTRON Professional+ PNC 22 C2**

| | configuration option |
|---|---|
| X | [1] not configurable item |
| | **classification** |
| | [36] AMTRON Professional with RCD/MCB |
| | [37] AMTRON Professional without RCD/MCB |
| X | [38] AMTRON Professional with RCD/MCB, with calibration law |
| | [39] AMTRON Professional without RCD/MCB, with calibration law |
| | **technical functions** |
| | [4] without modem, without ISO 15118 (PnC) |
| | [5] without modem, with ISO 15118 (PnC) |
| X | [6] with modem, without ISO 15118 (PnC) |
| | [7] with modem, with ISO 15118 (PnC) |
| | **connector type** |
| | [1] C1 (with cable type 1) |
| X | [2] C2 (with cable type 2) |
| | [4] T2 (socket with hinged lid) |
| | [5] T2 (socket with swing flap) |
| | [6] T2S (socket with Shutter) |
| | **additional functions** |
| X | [0] without working current breaker |
| | [7] with working current breaker |
| | **electric power** |
| | [1] 11 kW |
| X | [2] 22 kW |
| | [3] 3,7 kW |
| | [7] 7,4 kW |

## 2.5 SUBSTANCES OF VERY HIGH CONCERN

Our certified management systems document our commitment to always deliver the highest quality while taking responsibility for our environment and future generations.

https://www.mennekes.org/company/about-us/quality-and-responsibility/

Material number 151822602 and 1386202

## 2.6 DESCRIPTION PRODUCTION PROCESS

Our production process includes following essential production steps:

- Plastic coating of components and housings
- Fabrication of contact materials
- Assembly of parts and assembly groups (containing self-produced and purchased parts)
- Assembly of the product including mechanical assembling, electrical wiring and software installation and configuration (containing self-produced and purchased parts)
- End-Of-line testing of the product
- Packing of the produced product

## 2.7 CONSTRUCTION DESCRIPTION

The assembly, manufacturing and functional test of AMEDIO® / AMTRON® takes place at the production and development sites in Kirchhundem and Neudorf (Germany).

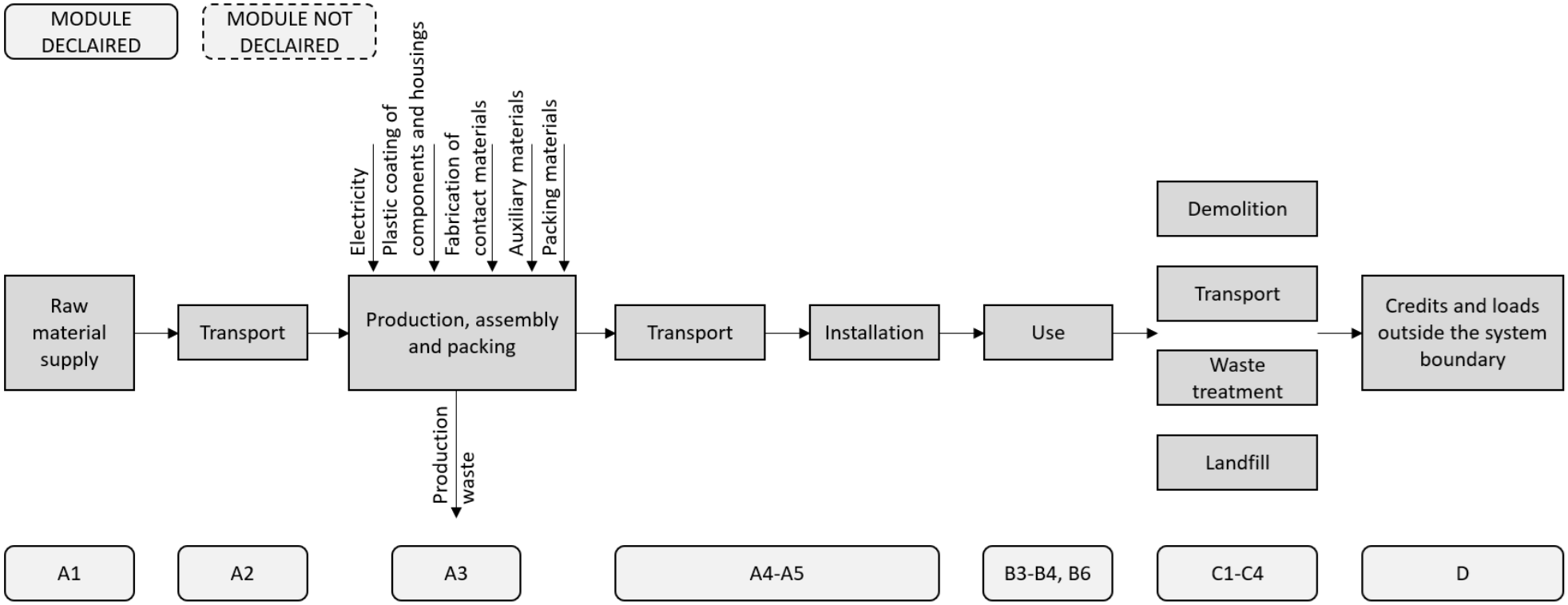



Figure 1 Process flow diagram

# 3 Calculation rules

## 3.1 DECLARED UNIT

**One piece**

The declared unit is 1 piece of wall box or charging station AMTRON® Professional+.

The functional unit is one piece. Results must not be converted as product groups were built wherein the modelled reference product represents the full expansion stage. All other products assigned to a product group is covered by the worst-case results of its reference product.

## 3.2 CONVERSION FACTORS

| Description | Value | Unit |
|---|---|---|
| Reference unit | 1 | pc |
| Weight per reference unit | 17.731 | kg |
| Conversion factor to 1 kg | 0.056 | pc |

## 3.3 SCOPE OF DECLARATION AND SYSTEM BOUNDARIES

This is a cradle to gate with options EPD, all modules except module B1 are declared.

The life cycle stages included are as shown below:

(X = module declared, ND = module not declared)

| A1 | A2 | A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

The modules of the EN 15804+A2 contain the following:

| | |
|---|---|
| Module A1 = Raw material supply | Module B5 = Refurbishment |
| Module A2 = Transport | Module B6 = Operational energy use |
| Module A3 = Manufacturing | Module B7 = Operational water use |
| Module A4 = Transport | Module C1 = De-construction / Demolition |
| Module A5 = Construction - Installation process | Module C2 = Transport |
| Module B1 = Use | Module C3 = Waste Processing |
| Module B2 = Maintenance | Module C4 = Disposal |
| Module B3 = Repair | Module D = Benefits and loads beyond the product system boundaries |
| Module B4 = Replacement | |

## 3.4 REPRESENTATIVENESS

This EPD is representative for AMTRON® Professional+ charging stations, a product series of MENNEKES Elektrotechnik GmbH & Co. KG.

In accordance with EN 15941, chapter 5.4 this EPD represents the type of a Worst case EPD. As a reference, the fully equipped article with a maximal configuration reg. features, functions and components was chosen as it refers to the highest impact.

The results of this EPD are representative for Europe.

## 3.5 CUT-OFF CRITERIA

It can be assumed that the neglected materials or energies and water per value do not exceed 1 percent. The sum of the neglected processes is less than 5 percent.

If the mass of the substances containing biogenic carbons in the product is less than 5 % of the mass of the product, the declaration of the biogenic carbon content may be omitted.

If the mass of biogenic carbon in the packaging is less than 5 % of the total mass of the packaging, the declaration of the biogenic carbon content of the packaging may be omitted.

## 3.6 ALLOCATION

The allocation is performed in accordance with the provisions of EN 15804. Incoming energy, water, and in-house waste production are equally allocated among all products using a power output allocation method. For the end-of-life allocation of background data (energy and materials), the "allocation cut-off by classification" model, as specified in the ISO standard, is applied. Specific details regarding allocations within the background data can be found in the documentation of the ecoinvent datasets.

No allocations are used for co-products.

## 3.7 DATA COLLECTION & REFERENCE TIME PERIOD

Primary data including all raw materials, packaging materials, energy consumption and ancillary materials was comprehensively collected for the reference year from 2024-01-01 to 2024-12-31.

## 3.8 ESTIMATES AND ASSUMPTIONS

Building or plant components that are not relevant for product manufacture are excluded by means of estimates (e.g. electricity consumption for IT, building heating).

In accordance with the PCR, applied infrastructure was deleted for upstream processes. Therefore, all input-datasets modelled in A1, A3 and A5 were analysed regarding infrastructure in the first previous level of the upstream chain.

## 3.9 DATA QUALITY

| Quality requirement | Specific requirement | Data quality level | Notes |
|---|---|---|---|
| **Time-related coverage** | Age of data and minimum time period for data collection. | Very Good | The data is not older than 0 years, as indicated in the ILCD field ("Record valid until" and the difference between "valid until" and the "reference year" is no more than 8 years). |
| **Geographical coverage** | Upstream: Unit process for raw material should be collected for respective geographic region | Good | The processes included in the dataset are quite representative of the region specified in the metadata under "Location". |
| | Core: Unit process for production should represent the real site. | Good | The processes included in the dataset are quite representative of the region specified in the metadata under "Location". |
| | Downstream: End-of-life disposal should represent the region of disposal. | Good | The processes included in the dataset are quite representative of the region specified in the metadata under "Location". |
| **Technical representa-tiveness** | Qualitative assessment of the degree to which the data set reflects the true population of interest (technology) | Fair | The technological aspects are like those described in the title and metadata, but there is room for improvement. Some of the relevant processes are not modelled with specific data but using proxy data. |

## 3.10 POWER MIX

For electricity, the consumption in DE was modelled with manufacturer-specific data. Guarantees of origin were provided covering 50.9 % of the total consumption. This share of electricity consumption was modelled by “market for electricity, medium voltage, renewable energy products (CH)”. Remaining electricity consumption was modelled with the residual mix of Germany “electricity, medium voltage, residual mix (DE)”. Therefore, the marked based approach is given and proved by valid certificates (GOs) for module A3.

The residual mix (DE) contains the following shares of energy sources:

- 12.00 % nuclear, 60.89 % hard coal, 1.59 % oil and 25.51 % natural gas

Renewable energy contains the following shares of energy sources:

- 55.75 % wind power, 24.42 % photovoltaic, 11.50 % biogas, 8.32 % hydro power

The GWP value of the electricity consumed in module A3 is about 7.99E-01 kg $CO_2$-eq. (GWP-t) per declared unit (1.91 kWh/pc). The emission factor of carbon footprint of the applied electricity mix is 0,47 kg CO2e/kWh.

For electricity consumption in module B6 the local based approach was applied using the dataset ‘market group for electricity, low voltage | electricity, low voltage | EN15804GD, U - Europe without Switzerland’.

# 4 Scenarios and additional technical information

## 4.1 RAW MATERIAL SUPPLY (A1)

The data for the extraction of raw materials originate, if available, from upstream suppliers and the raw materials, auxiliary materials, etc. These were modelled in the software.

## 4.2 TRANSPORT (A2)

The upstream transport routes come from various logistics data. Here, only the preliminary products, including packaging, were considered as 100 per cent of the raw materials.

The average transportation distances to the plant are determined for all pre-products and raw materials in the company. Distances of materials of which more than one supplier was considered average values were built.

All transports were assumed by a lorry (>32 metric ton, EURO6, 29.96 t gross vehicle weight, 15.96 t average load, fix average load factor about 53,3 %)

Other transportation routes were not considered, either because they are marginal and have no relevant impact on the balances or because they were not available

## 4.3 MANUFACTURING (A3)

The production-relevant data is according to MENNEKES. It also includes the complete waste treatment up to the end of the waste status or disposal.

## 4.4 TRANSPORT TO CONSTRUCTION SITE (A4)

The downstream transport routes are based on data from the manufacturer and the transport scenario of EN 50693. EN 50693 specifies local transport without shipping with 1,000 km by lorry (85 % payload). Results are shown in chapter 5. As means of transport a lorry (>32 metric tons, EURO6, 29.96 t gross vehicle weight, 15.96 t average load, fix average load factor about 53,3 %, diesel driven) is used in all scenarios.

## 4.5 ASSEMBLY (A5)

No energetical effort for assembly/installation is required. Material efforts for dowels (PA6, 1.12E-02 kg) and screws (chromium steel, 3.00E-02 kg) are considered.

The transportation of packaging to the recycling plant was considered. A lorry (>32 metric tons, EURO6, 29.96 t gross vehicle weight, 15.96 t average load, fix average load factor about 53,3 %, diesel driven) and 50 km distance were assumed.

In line with the conservative approach, packaging waste is only recycled thermally. Benefits from A5 are shown in Module D (D of A). Electricity replaces “market group for electricity, medium voltage (Europe without Switzerland)”. Thermal energy replaces “market group for heat, district or industrial, natural gas (RER)”. For waste resulting from the installation process 0.618 kg plastics and 1.680 kg paper and cardboard was considered.

## 4.6 USE (B1)

Emissions in the utilisation phase are caused indirectly by electricity consumption during the charging process. Depending on the type of electricity consumed (renewable/non-renewable) and the composition of the electricity (nuclear, coal, wind/solar energy, etc.), different types of emissions of varying amounts are generated. A scenario for electricity supply and consumption was modelled in module B6. Calculated environmental impacts including emissions can be found in the results of this module. Direct emissions from utilisation are assumed to be zero.

## 4.7 MAINTENANCE (B2)

No cleaning is required. All values were set to zero.

## 4.8 REPAIR (B3)

No repair is required as no routine replacement is planned by the manufacturer. All values were set to zero.

As part of the product development process, the manufacturer selects high-quality and reliable components. In addition to the component itself, the reliability of the respective supplier is also taken into account when selecting suppliers. By ensuring and continuously reviewing internal and standardised specifications (e.g. tests for pull and plug-in cycles, mechanical strength tests, tests regarding the expected environmental conditions, etc.), the durability of the devices is ensured for appropriate and expected use.

Note: Calibration-compliant devices must be calibrated every 8 years (DE and AT). For this activity, the ecological costs were assumed to be negligible.

## 4.9 REPLACEMENT (B4)

Module B4 represents the exchange of the whole item after having reached end-of-life stage after RSL (10 years). Withing the building service life of 50 years a 4-times exchange is required.

In accordance with EN 15804+A2 B4 represents the sum of results over all A- and C-modules plus D (except benefits from use stage).

## 4.10 REFURBISHMENT (B5)

The product is not required as part of an improvement or modernization of the building. All values were set to zero.

## 4.11 OPERATIONAL ENERGY USE (B6)

Operational energy use is required for electronic components. Only standby mode or networked standby mode applies with 87.6 kWh/a. Regarding the building service life

about 50 years, energy consumption is about 4,380 kWh/50a.

## 4.12 OPERATIONAL WATER USE (B7)

No water is required. All values were set to zero.

## 4.13 DE-CONSTRUCTION, DEMOLITION (C1)

The product will be deconstructed after use. After deconstruction materials have to be transported to landfill (1 % per product) and to recycling plants (99 % per product). No power consumption is assumed for dismantling.

## 4.14 TRANSPORT END-OF-LIFE (C2)

Deconstructed material is transported for further processing or disposal. The transport to downstream plants is assumed by lorry (>32 metric tons, EURO6, 29.96 t gross vehicle weight, 15.96 t average load, fix average load factor about 53,3 %, diesel driven) and 50 km.

## 4.15 END OF LIFE (C3, C4)

Waste management was calculated according to pre-defined material groups and default values of EN 50693. Shown amounts represent deconstructed amounts for recycling (99 %).

| Material group | AMTRON® Professional+ | share to recycling | share to thermal treatment | share to landfill | source |
|---|---|---|---|---|---|
| unit | [kg] | [-] | [-] | [-] | |
| Steel and other ferrous metals | 1.32E+00 | 0.8 | - | 0.2 | EN 50693 |
| Copper and other non-ferrous metals | 4.28E-01 | 0.6 | - | 0.4 | |
| PP | 1.98E-03 | 0.2 | 0.4 | 0.4 | |
| ABS | 5.54E-02 | 0.2 | 0.4 | 0.4 | |
| PU | 1.49E-02 | - | 0.5 | 0.5 | |
| Rubber | 5.94E-03 | - | 0.5 | 0.5 | |
| Other plastics | 6.70E+00 | - | 0.5 | 0.5 | |
| Remaining electrical parts | 9.02E+00 | 0.87 | - | 0.13 | (1) |
| Painting | 2.97E-03 | - | - | 1 | (2) |

(1) Umweltbundesamt (UBA), 2018, “Elektro-Bauteile”
(2) worst-case assumption

According to given rates 9.173 kg were recycled (MFR/avoided products), 3.385 kg were treated thermally (including 13.304 MJ exported electrical energy and 25.965 MJ exported thermal energy) and 4.996 kg were deposited.

The non-recoverable quantities and losses in the recovery/recycling chain (C1 and C3) are modelled as "landfilled" (waste plastic, consumer electronics, sanitary landfill, GLO).

## 4.16 BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY (D)

Benefits to be accounted to module D occur in modules A5 and C3. All recycled materials (in A3 and C3) create benefits for related materials modelled in module A1. Their amounts credit 100 % of environmental impacts (no correction factor). Benefits from waste incineration plant occur in modules A5 and C3.

| benefits in module | A3 | A5 | C3 |
|---|---|---|---|
| material credit (MFR) [kg] | 0.247 | - | 9.173 |
| energy credit (electrical) [MJ] | - | 5.772 | 13.304 |
| energy credit (thermal) [MJ] | - | 11.442 | 25.965 |

# 5 Results

For the impact assessment, the characterization factors of the LCIA method EN 15804 +A2 Method v1.0 are used. Long-term emissions (>100 years) are not considered in the impact assessment. The results of the impact assessment are only relative statements that do not make any statements about endpoints of the impact categories, exceedance of threshold values, safety margins or risks. The following tables show the results of the indicators of the impact assessment, of the use of resources as well as of waste and other output flows.

## 5.1 ENVIRONMENTAL IMPACT INDICATORS PER ONE PIECE OF AMTRON® PROFESSIONAL+

**CORE ENVIRONMENTAL IMPACT INDICATORS EN15804+A2**

| Abbreviation | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AP | mol $H^+$ eqv. | 2.69E+00 | 1.94E-02 | -8.32E-02 | 2.62E+00 | 1.99E-03 | 1.59E-03 | 0 | 0 | 0 | 2.41E+00 | 0 | 8.43E+00 | 0 | 0 | 8.81E-05 | 2.15E-03 | 4.48E-04 | -2.02E+00 |
| GWP-total | kg $CO_2$ eqv. | 1.09E+02 | 1.54E+01 | 2.23E+00 | 1.27E+02 | 1.57E+00 | 4.38E+00 | 0 | 0 | 0 | 3.61E+02 | 0 | 1.49E+03 | 0 | 0 | 6.96E-02 | 8.12E+00 | 6.09E-01 | -5.13E+01 |
| GWP-b | kg $CO_2$ eqv. | 3.17E-02 | 4.74E-03 | -5.86E-01 | -5.50E-01 | 4.85E-04 | 2.66E+00 | 0 | 0 | 0 | 7.95E+00 | 0 | 5.08E+01 | 0 | 0 | 2.15E-05 | 2.89E-03 | 3.35E-04 | -5.73E-02 |
| GWP-f | kg $CO_2$ eqv. | 1.09E+02 | 1.53E+01 | 2.80E+00 | 1.27E+02 | 1.57E+00 | 1.72E+00 | 0 | 0 | 0 | 3.52E+02 | 0 | 1.43E+03 | 0 | 0 | 6.96E-02 | 8.12E+00 | 6.08E-01 | -5.11E+01 |
| GWP-luluc | kg $CO_2$ eqv. | 1.10E-01 | 8.73E-04 | 1.49E-02 | 1.25E-01 | 8.94E-05 | 1.11E-04 | 0 | 0 | 0 | 2.46E-01 | 0 | 4.37E+00 | 0 | 0 | 3.96E-06 | 2.43E-04 | 3.67E-05 | -6.42E-02 |
| EP-m | kg N eqv. | 1.82E-01 | 4.43E-03 | -2.17E-04 | 1.86E-01 | 4.54E-04 | 6.02E-04 | 0 | 0 | 0 | 3.81E-01 | 0 | 1.32E+00 | 0 | 0 | 2.01E-05 | 1.10E-03 | 2.31E-02 | -1.16E-01 |
| EP-fw | kg P eqv. | 2.10E-01 | 2.05E-04 | -6.20E-03 | 2.04E-01 | 2.10E-05 | 4.46E-05 | 0 | 0 | 0 | 1.78E-01 | 0 | 1.34E+00 | 0 | 0 | 9.30E-07 | 8.05E-05 | 2.20E-04 | -1.59E-01 |
| EP-T | mol N eqv. | 2.28E+00 | 4.81E-02 | -2.89E-02 | 2.29E+00 | 4.92E-03 | 5.35E-03 | 0 | 0 | 0 | 3.10E+00 | 0 | 1.19E+01 | 0 | 0 | 2.18E-04 | 9.38E-03 | 1.83E-03 | -1.54E+00 |
| ODP | kg CFC 11 eqv. | 4.81E-06 | 3.20E-07 | 1.14E-07 | 5.25E-06 | 3.28E-08 | 2.80E-09 | 0 | 0 | 0 | 1.20E-05 | 0 | 2.64E-05 | 0 | 0 | 1.45E-09 | 4.04E-09 | 1.51E-09 | -2.29E-06 |
| POCP | kg NMVOC eqv | 7.59E-01 | 4.08E-02 | 4.61E-03 | 8.04E-01 | 4.18E-03 | 1.53E-03 | 0 | 0 | 0 | 1.39E+00 | 0 | 3.90E+00 | 0 | 0 | 1.85E-04 | 2.39E-03 | 7.36E-04 | -4.66E-01 |
| ADP-f | MJ | 1.89E+03 | 2.09E+02 | 6.93E+01 | 2.17E+03 | 2.14E+01 | 3.33E+00 | 0 | 0 | 0 | 5.49E+03 | 0 | 3.34E+04 | 0 | 0 | 9.48E-01 | 3.04E+00 | 1.32E+00 | -8.25E+02 |
| ADP-mm | kg Sb-eqv. | 3.26E-02 | 2.63E-06 | -1.36E-03 | 3.12E-02 | 2.70E-07 | 2.12E-06 | 0 | 0 | 0 | 2.26E-02 | 0 | 1.93E-02 | 0 | 0 | 1.19E-08 | 7.18E-07 | 1.25E-07 | -2.56E-02 |
| WDP | $m^3$ world eqv. | 5.39E+01 | 3.08E-01 | 9.62E-01 | 5.51E+01 | 3.15E-02 | 2.85E-01 | 0 | 0 | 0 | 1.04E+02 | 0 | 9.08E+02 | 0 | 0 | 1.40E-03 | 5.68E-01 | 7.41E-03 | -3.06E+01 |

**AP**=Acidification (AP) | **GWP-total**=Global warming potential (GWP-total) | **GWP-b**=Global warming potential - Biogenic (GWP-b) | **GWP-f**=Global warming potential - Fossil (GWP-f) | **GWP-luluc**=Global warming potential - Land use and land use change (GWP-luluc) | **EP-m**=Eutrophication marine (EP-m) | **EP-fw**=Eutrophication, freshwater (EP-fw) | **EP-T**=Eutrophication, terrestrial (EP-T) | **ODP**=Ozone depletion (ODP) | **POCP**=Photochemical ozone formation - human health (POCP) | **ADP-f**=Resource use, fossils (ADP-f) | **ADP-mm**=Resource use, minerals and metals (ADP-mm) | **WDP**=Water use (WDP)

**ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS EN15804+A2**

| Abbreviation | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ETP-fw | CTUe | 5.15E+03 | 1.08E+01 | -1.20E+02 | 5.05E+03 | 1.11E+00 | 6.60E+00 | 0 | 0 | 0 | 1.05E+04 | 0 | 5.96E+03 | 0 | 0 | 4.90E-02 | 1.64E+01 | 1.11E+01 | -2.46E+03 |
| PM | Disease incidence | 8.68E-06 | 1.68E-07 | -9.41E-08 | 8.75E-06 | 1.72E-08 | 1.44E-08 | 0 | 0 | 0 | 1.37E-05 | 0 | 3.01E-05 | 0 | 0 | 7.63E-10 | 1.06E-08 | 9.50E-09 | -5.37E-06 |
| HTP-c | CTUh | 1.68E-06 | 1.53E-08 | -4.47E-09 | 1.69E-06 | 1.57E-09 | 1.99E-09 | 0 | 0 | 0 | 6.03E-06 | 0 | 3.41E-06 | 0 | 0 | 6.95E-11 | 1.98E-09 | 4.17E-10 | -1.89E-07 |
| HTP-nc | CTUh | 2.56E-05 | 2.70E-08 | -1.00E-06 | 2.47E-05 | 2.76E-09 | 1.11E-08 | 0 | 0 | 0 | 1.74E-05 | 0 | 2.52E-05 | 0 | 0 | 1.22E-10 | 2.47E-08 | 1.85E-08 | -2.04E-05 |
| IR | kBq U-235 eqv. | 1.08E+01 | 9.11E-02 | 3.73E-01 | 1.12E+01 | 9.33E-03 | 1.55E-02 | 0 | 0 | 0 | 2.20E+01 | 0 | 9.22E+02 | 0 | 0 | 4.13E-04 | 4.37E-02 | 1.59E-03 | -5.79E+00 |
| SQP | Pt | 1.01E+03 | 1.25E+01 | 6.45E+01 | 1.09E+03 | 1.28E+00 | 5.54E-01 | 0 | 0 | 0 | 1.56E+03 | 0 | 7.42E+03 | 0 | 0 | 5.69E-02 | 6.92E-01 | 3.00E+00 | -7.00E+02 |

**ETP-fw**=Ecotoxicity, freshwater (ETP-fw) | **PM**=Particulate Matter (PM) | **HTP-c**=Human toxicity, cancer (HTP-c) | **HTP-nc**=Human toxicity, non-cancer (HTP-nc) | **IR**=Ionising radiation, human health (IR) | **SQP**=Land use (SQP)

**CLASSIFICATION OF DISCLAIMERS TO THE DECLARATION OF CORE AND ADDITIONAL ENVIRONMENTAL IMPACT INDICATORS**

| ILCD classification | Indicator | Disclaimer |
|---|---|---|
| ILCD type / level 1 | Global warming potential (GWP) | None |
| | Depletion potential of the stratospheric ozone layer (ODP) | None |
| | Potential incidence of disease due to PM emissions (PM) | None |
| ILCD type / level 2 | Acidification potential, Accumulated Exceedance (AP) | None |
| | Eutrophication potential, Fraction of nutrients reaching freshwater end compartment (EP-freshwater) | None |
| | Eutrophication potential, Fraction of nutrients reaching marine end compartment (EP-marine) | None |
| | Eutrophication potential, Accumulated Exceedance (EP-terrestrial | None |
| | Formation potential of tropospheric ozone (POCP) | None |
| | Potential Human exposure efficiency relative to U235 (IRP) | 1 |
| ILCD type / level 3 | Abiotic depletion potential for non-fossil resources (ADP-minerals&metals) | 2 |
| | Abiotic depletion potential for fossil resources (ADP-fossil) | 2 |
| | Water (user) deprivation potential, deprivation-weighted water consumption (WDP) | 2 |
| | Potential Comparative Toxic Unit for ecosystems (ETP-fw) | 2 |
| | Potential Comparative Toxic Unit for humans (HTP-c) | 2 |
| | Potential Comparative Toxic Unit for humans (HTP-nc) | 2 |
| | Potential Soil quality index (SQP) | 2 |

**Disclaimer 1** – 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 nor due to radioactive waste disposal in underground facilities. Potential ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator.

**Disclaimer 2** – The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

## 5.2 INDICATORS DESCRIBING RESOURCE USE AND ENVIRONMENTAL INFORMATION BASED ON LIFE CYCLE INVENTORY (LCI)

### PARAMETERS DESCRIBING RESOURCE USE

| Abbreviation | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERE | MJ | 1.70E+02 | 8.90E-01 | 5.33E+00 | 1.76E+02 | 9.11E-02 | -6.09E+00 | 0 | 0 | 0 | 2.54E+02 | 0 | 8.87E+03 | 0 | 0 | 4.03E-03 | 3.78E-01 | 2.23E-02 | -1.07E+02 |
| PERM | MJ | 2.60E+01 | 6.50E-02 | 1.57E+01 | 4.18E+01 | 6.66E-03 | -1.60E+01 | 0 | 0 | 0 | 5.01E+01 | 0 | 2.78E+02 | 0 | 0 | 2.95E-04 | 2.59E-02 | 0 | -1.33E+01 |
| PERT | MJ | 1.96E+02 | 9.55E-01 | 2.10E+01 | 2.18E+02 | 9.78E-02 | -2.21E+01 | 0 | 0 | 0 | 3.04E+02 | 0 | 9.15E+03 | 0 | 0 | 4.33E-03 | 4.04E-01 | 2.23E-02 | -1.21E+02 |
| PENRE | MJ | 1.80E+03 | 1.88E+02 | 6.46E+01 | 2.05E+03 | 1.93E+01 | -6.80E+01 | 0 | 0 | 0 | 4.85E+03 | 0 | 3.27E+04 | 0 | 0 | 8.52E-01 | 2.91E+00 | 1.32E+00 | -7.91E+02 |
| PENRM | MJ | 9.42E+01 | 2.10E+01 | 4.81E+00 | 1.20E+02 | 2.15E+00 | -5.14E+00 | 0 | 0 | 0 | 3.30E+02 | 0 | 6.48E+02 | 0 | 0 | 9.54E-02 | 1.23E-01 | 0 | -3.48E+01 |
| PENRT | MJ | 1.89E+03 | 2.09E+02 | 6.94E+01 | 2.17E+03 | 2.14E+01 | -7.31E+01 | 0 | 0 | 0 | 5.18E+03 | 0 | 3.34E+04 | 0 | 0 | 9.48E-01 | 3.04E+00 | 1.32E+00 | -8.25E+02 |
| SM | kg | 6.72E+00 | 6.22E-02 | 2.41E+00 | 9.20E+00 | 6.37E-03 | 1.32E-02 | 0 | 0 | 0 | 2.21E+01 | 0 | 4.80E+02 | 0 | 0 | 2.82E-04 | 2.62E-02 | 1.01E-03 | -3.10E+00 |
| RSF | MJ | 2.56E+00 | 2.31E-02 | 5.46E-01 | 3.13E+00 | 2.36E-03 | 4.19E-03 | 0 | 0 | 0 | 6.92E+00 | 0 | 2.79E+02 | 0 | 0 | 1.04E-04 | 1.33E-02 | 2.14E-04 | -1.05E+00 |
| NRSF | MJ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FW | $m^3$ | 1.63E+00 | 8.28E-03 | 1.95E-02 | 1.66E+00 | 8.48E-04 | 5.24E-03 | 0 | 0 | 0 | 2.76E+00 | 0 | 2.88E+01 | 0 | 0 | 3.75E-05 | 1.03E-02 | -1.16E-02 | -9.82E-01 |

**PERE**=renewable primary energy ex. raw materials | **PERM**=renewable primary energy used as raw materials | **PERT**=renewable primary energy total | **PENRE**=non-renewable primary energy ex. raw materials | **PENRM**=non-renewable primary energy used as raw materials | **PENRT**=non-renewable primary energy total | **SM**=use of secondary material | **RSF**=use of renewable secondary fuels | **NRSF**=use of non-renewable secondary fuels | **FW**=use of net fresh water

### OTHER ENVIRONMENTAL INFORMATION DESCRIBING WASTE CATEGORIES

| Abbreviation | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HWD | kg | 1.26E+01 | 5.31E-02 | -3.01E-01 | 1.23E+01 | 5.44E-03 | 8.48E-02 | 0 | 0 | 0 | 1.57E+01 | 0 | 3.68E+01 | 0 | 0 | 2.41E-04 | 1.23E-01 | 1.57E-03 | -8.62E+00 |
| NHWD | kg | 2.02E+02 | 5.63E-01 | 1.95E+01 | 2.22E+02 | 5.76E-02 | 2.77E+00 | 0 | 0 | 0 | 5.23E+02 | 0 | 2.93E+02 | 0 | 0 | 2.55E-03 | 3.65E+00 | 1.82E+01 | -1.16E+02 |
| RWD | kg | 2.77E-03 | 2.25E-05 | 9.82E-05 | 2.89E-03 | 2.30E-06 | 3.97E-06 | 0 | 0 | 0 | 5.67E-03 | 0 | 2.37E-01 | 0 | 0 | 1.02E-07 | 1.12E-05 | 3.89E-07 | -1.49E-03 |

**HWD**=hazardous waste disposed | **NHWD**=non-hazardous waste disposed | **RWD**=radioactive waste disposed

**ENVIRONMENTAL INFORMATION DESCRIBING OUTPUT FLOWS**

| Abbreviation | Unit | A1 | A2 | A3 | A1-A3 | A4 | A5 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | C1 | C2 | C3 | C4 | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CRU | kg | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| MFR | kg | 6.43E+00 | 5.69E-02 | 1.28E+00 | 7.77E+00 | 5.82E-03 | 1.49E-02 | 0 | 0 | 0 | 5.37E+01 | 0 | 4.67E+02 | 0 | 0 | 2.58E-04 | 9.20E+00 | 7.37E-04 | -2.95E+00 |
| MER | kg | 1.15E-03 | 1.04E-05 | 2.45E-04 | 1.41E-03 | 1.06E-06 | 1.88E-06 | 0 | 0 | 0 | 3.11E-03 | 0 | 1.25E-01 | 0 | 0 | 4.69E-08 | 5.96E-06 | 9.61E-08 | -4.73E-04 |
| EET | MJ | 1.33E+00 | 1.26E-02 | 2.67E-01 | 1.61E+00 | 1.29E-03 | 5.77E+00 | 0 | 0 | 0 | 8.07E+01 | 0 | 1.48E+02 | 0 | 0 | 5.70E-05 | 1.33E+01 | 5.45E-04 | -5.36E-01 |
| EEE | MJ | 1.90E+00 | 2.02E-02 | 1.51E-01 | 2.07E+00 | 2.06E-03 | 1.14E+01 | 0 | 0 | 0 | 1.56E+02 | 0 | 5.35E+00 | 0 | 0 | 9.14E-05 | 2.60E+01 | 3.58E-04 | -5.46E-01 |

**CRU**=Components for re-use | **MFR**=Materials for recycling | **MER**=Materials for energy recovery | **EET**=Exported Energy Thermic | **EEE**=Exported Energy Electric

## 5.3 INFORMATION ON BIOGENIC CARBON CONTENT PER KILOGRAM

**BIOGENIC CARBON CONTENT**

The following information describes the biogenic carbon content in (the main parts of) the product at the factory gate per kilogram:

| Biogenic carbon content | Amount | Unit |
|---|---|---|
| Biogenic carbon content in the product | 0 | kg C |
| Biogenic carbon content in accompanying packaging | 0.579 | kg C |

**UPTAKE OF BIOGENIC CARBON DIOXIDE**

The following amount carbon dioxide uptake is taken into account. Related uptake and release of carbon dioxide in downstream processes are not taken into account in this number although they do appear in the presented results. One kilogram of biogenic carbon content is equivalent to 44/12 kg of biogenic carbon dioxide uptake.

| Uptake biogenic carbon dioxide | Amount | Unit |
|---|---|---|
| Product | 0 | kg $CO_2$ (biogenic) |
| Packaging | 2.122 | kg $CO_2$ (biogenic) |

# 6 Interpretation of results

## 6.1 Contribution analysis

The main environmental impact within the impact indicator GWP-t of the manufacturing processes (A1-A3) was analyzed. The biggest impact is caused by the raw material polycarbonate (R6, 26.90 %) for AMTRON Professional+.

For the use stage, only the exchange in B4 and energy consumption in B6 has relevant results. As a 4-times exchange was assumed for a 10-year RSL within a 50-years building service life, impacts of B4 cause around 19 % of caused impacts in the core environmental impact indicators plus PERT/PENRT. Impacts in B6 cause around 76 % of caused impacts in the core environmental impact indicators plus PERT/PENRT.

Due to recycling processes in A3, A5 and C3, credits were obtained offsetting on average 58 % of caused impacts in the core environmental impact indicators plus PERT/PENRT in the manufacturing stage A1-A3.

## 6.2 Sensitivity analysis

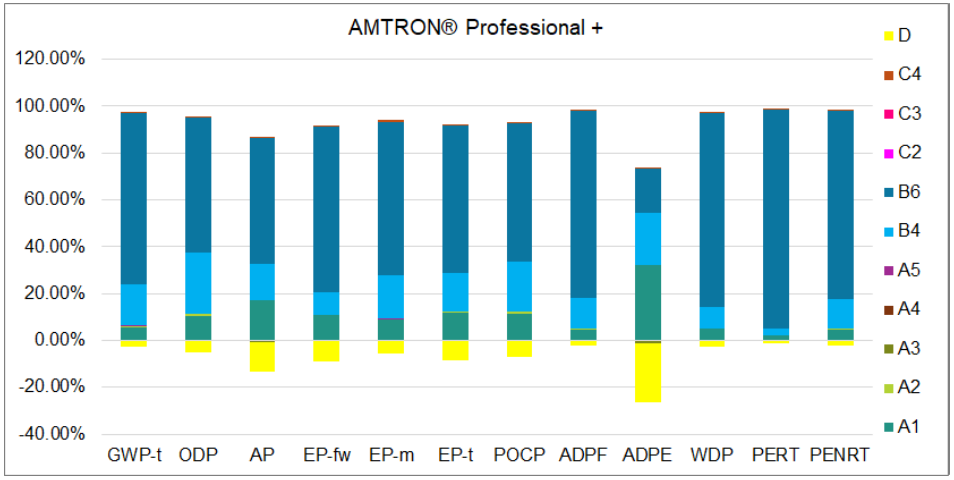



Figure 2 Percentage shares of the modules for selected environmental impact indicators over the whole life cycle (use stage: 50 years)

The core environmental impact indicators (without subcategories of GWP) and PERT/PENRT are shown in the diagrams. Please note that the diagrams are dominated by B4 and B6 over the entire life cycle, as the results of the impacts in the use stage are extrapolated to a building service life of 50 years. Therefore, another diagram is shown without use stage (B4 and B6 set to zero). For a better overview all modules which were not declared (B1) or zero (B2, B3, B5, B7, C1) are not shown in the legend. The greatest environmental impacts result from raw material extraction (A1). Benefits due to recycling processes at the end-of-life (D of C, yellow) may offset remarkable shares of impacts of the manufacturing stage (A1-A3).

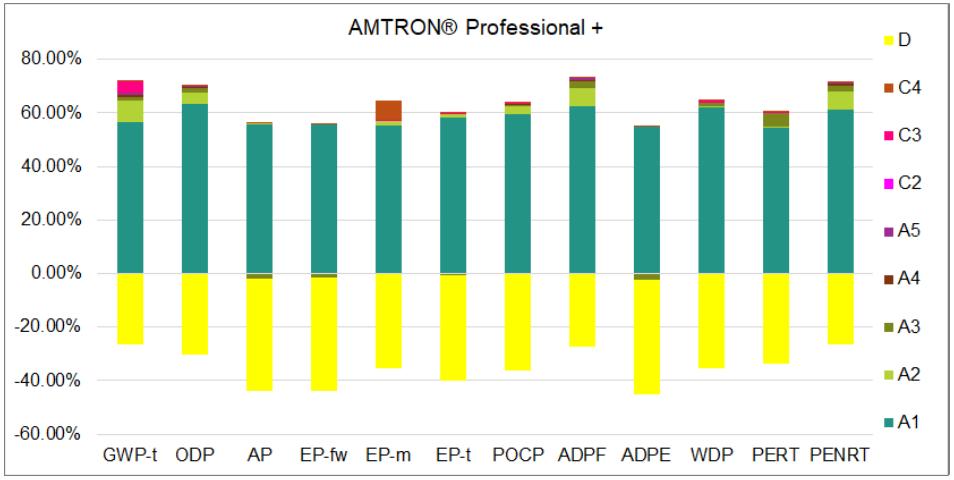



Figure 3 Percentage shares of the modules for selected environmental impact indicators over the life cycle without use stage

# 7 Annex

**Indicators considered in this LCA (list out of openLCA software documentation)**

EN15804 (EF 3.1) | Global Warming Potential - biogenic (GWP-biogenic)

EN15804 (EF 3.1) | Global Warming Potential - fossil fuels (GWP-fossil)

EN15804 (EF 3.1) | Global Warming Potential - land use and land use change (GWP-luluc)

EN15804 (EF 3.1) | Global Warming Potential - total (GWP-total)

EN15804 (EF 3.1) | Global warming potential except emissions and uptake of biogenic carbon (GWP-IOBC/GHG); additionally required by the PCR, see documentation

EN15804 (EF 3.1) | Potential Comparative Toxic Unit for ecosystems (ETP-fw)

EN15804 (EF 3.1) | Potential Comparative Toxic Unit for humans - non-cancer effects (HTP-nc)

EN15804 (EF3.0 & 3.1) | Abiotic depletion potential - fossil resources (ADPF)

EN15804 (EF3.0 & 3.1) | Abiotic depletion potential - non-fossil resources (ADPE)

EN15804 (EF3.0 & 3.1) | Acidification potential, Accumulated Exceedance (AP)

EN15804 (EF3.0 & 3.1) | Depletion potential of the stratospheric ozone layer (ODP)

EN15804 (EF3.0 & 3.1) | Eutrophication potential - freshwater (EP-freshwater)

EN15804 (EF3.0 & 3.1) | Eutrophication potential - marine (EP-marine)

EN15804 (EF3.0 & 3.1) | Eutrophication potential - terrestrial (EP-terrestrial)

EN15804 (EF3.0 & 3.1) | Photochemical Ozone Creation Potential (POCP)

EN15804 (EF3.0 & 3.1) | Potential Comparative Toxic Unit for humans - cancer effects (HTP-c)

EN15804 (EF3.0 & 3.1) | Potential Human exposure efficiency relative to U235 (IRP)

EN15804 (EF3.0 & 3.1) | Potential incidence of disease due to PM emissions (PM)

EN15804 (EF3.0 & 3.1) | Potential Soil quality index (SQP)

EN15804 (EF3.0 & 3.1) | Water (user) deprivation potential (WDP)

Output | Components for re-use (CRU)

Output | Exported electrical energy (EEE)

Output | Exported thermal energy (EET)

Output | Materials for energy recovery (MER)

Output | Materials for recycling (MFR)

Resource | Total use of non renewable primary energy resources (PENRT)

Resource | Total use of renewable primary energy resources (PERT)

Resource | Use of net fresh water (FW)

Resource | Use of non renewable primary energy resources used as energy carrier (PENRE)

Resource | Use of non renewable primary energy resources used as raw materials (PENRM)

Resource | Use of non renewable secondary fuels (NRSF)

Resource | Use of renewable primary energy resources used as energy carrier (PERE)

Resource | Use of renewable primary energy resources used as raw materials (PERM)

Resource | Use of renewable secondary fuels (RSF)

Resource | Use of secondary materials (SM)

Waste | Hazardous waste disposed (HWD)

Waste | Non hazardous waste disposed (NHWD)

Waste | Radioactive waste disposed (RWD)

# 8 References

**ISO 14040**

ISO 14040:2006-10, Environmental management - Life cycle assessment - Principles and framework; EN ISO 14040:2006

**ISO 14044**

ISO 14044:2006-10, Environmental management - Life cycle assessment - Requirements and guidelines; EN ISO 14044:2006

**ISO 14025**

ISO 14025:2011-10: Environmental labels and declarations — Type III environmental declarations — Principles and procedures

**EN 15804+A2**

EN 15804+A2: 2019: Sustainability of construction works — Environmental Product Declarations — Core rules for the product category of construction products

**Kiwa-Ecobility Experts (Kiwa-EE)**

General Product Category Rules - Version 2.1, 2022-02-14

**Background database**

ecoinvent version 3.10

**NMD Determination Method V1.1 (March 2022)**

**EN 50693:2019**

Product category rules for life cycle assessments of electronic and electrical products and systems

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Kiwa-Ecobility Experts is an established member of the ECO PLATFORM