Environmental Product Declaration

In accordance with ISO 14025 for:

Advanced Counter FAdC R2 Indoor Equipment

from

Frauscher Sensortechnik GmbH

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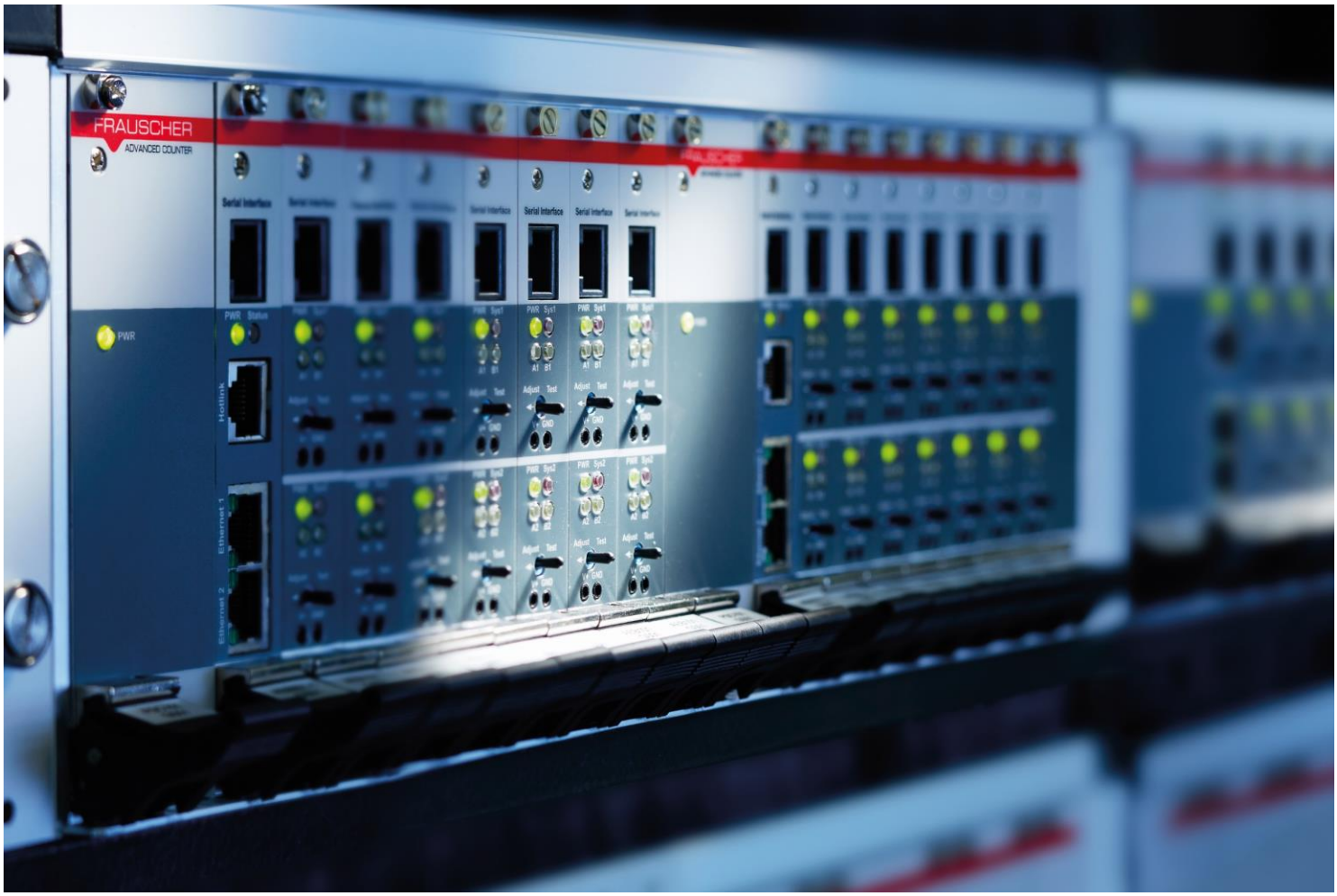

Programme information

Programme:	The International EPD® System EPD International AB Box 210 60 SE-100 31 Stockholm Sweden www.environdec.com info@environdec.com

Product category rules (PCR): Railways, 2013:19, Version 2.11, UN CPC 53212 (Railways)
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Independent third-party verification of the declaration and data, according to ISO 14025:2006: ☐ EPD process certification ☒ EPD verification
Third party verifier: Dr. Niels Jungbluth, ESU-services Ltd., Schaffhausen, Switzerland, www.esu-serivces.ch      Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: ☐ Yes ☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable.

Company information

Owner of the EPD:
Frauscher Sensortechnik GmbH
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Gewerbestraße 1 | 4774 St. Marienkirchen | Austria

Description of the organisation:
Frauscher Sensortechnik GmbH (Frauscher) is an Austrian company for sensor development based in St. Marienkirchen, Austria. Founded in 1987, the company has expanded to 15 locations worldwide, currently employing a staff of 450 people. Since 2019, Frauscher is part of the Delachaux Group. Frauscher develops and manufactures sensor technology for railways, including wheel sensors, wheel detection systems, axle counters as well as other equipment and solutions to ensure safe and reliable railway operations. Customers include global railway operators, both on a national, regional and local level.

Product-related or management system-related certifications: Since 2006 Frauscher holds an ISO 14001 certification, and the company has been awarded a gold medal in the EcoVadis sustainability rating in May 2021, recognizing its CSR and sustainability agenda. Frauscher follows a regional supply chain strategy, with main suppliers based around the head office in St. Marienkirchen.

Name and location of production site:
Frauscher Sensortechnik GmbH
Gewerbestraße 1 | 4774 St. Marienkirchen | Austria.

Product information

Product name: Frauscher Advanced Counter FAdC R2
Product identification: Frauscher Advanced Counter FAdC R2 Indoor equipment, in this EPD referred to as “Indoor equipment”.
Product description: The Indoor equipment, together with the Outdoor equipment[1], composes a **wheel detection system,** used to enable safe and reliable railway operations.
The Indoor equipment receives and processes the signals from the Outdoor equipment. The various electronic components of the Indoor equipment generate relevant information and transmit them to higher-level systems. The Indoor equipment consists of **7 electronic modules**, with different technical functions, written in **bold:**

Electrical modules for data recognition and processing, included are:
(1) **A**dvanced **E**valuation **B**oard (AEB101)
(2) **Com**munication Board (COM-AdC101)
(3) **P**ower **S**upply Board (PSC101)
(4) **I**nput/**O**utput **E**xtension **B**oard (IO-EXB101)

Backplanes for electric power supply of the indoor equipment, included are:
(5) **B**ack**p**lane for **E**xtension **B**oards (BP-EXB101-1)
(6) **B**ack**p**lane **P**o**we**r (BP-PWR101-8)

Protection of electronic modules in case of overvoltage, included is:
(7) Overvoltage Protection Board (BSI005)

The electronic modules are all mounted onto a **Casing (BGT07)** made of steel and aluminium,

[1] See section ”Additional information” for more information on the Outdoor equipment.

used to safely secure the Indoor equipment at its site of use and forming a complete Indoor installation. This casing is also considered in the LCA.

Figure 1: Overview of the 7 modules and the casing forming a complete Indoor installation.

UN CPC code: UN CPC 53212 (Railways)
Geographical scope: Europe

LCA information

Functional unit / declared unit: According to the PCR Railways (2019), the declared unit is defined as 1 km of railway. For each km of railway, the following modules are used:

Module	**Number of units per km railway, rounded**
Advanced **E**valuation **B**oard (AEB101)	2,30
Communication Board (COM-AdC101)	0,35
Power **S**upply Board (PSC101)	0,35
Input/**O**utput **E**xtension **B**oard (IO-EXB101)	1,13
Back**p**lane for **E**xtension **B**oards (BP-EXB101-1)	0,35
Back**p**lane **P**ow**e**r (BP-PWR101-8)	0,35
Overvoltage Protection Board (BSI005)	2,30
Casing (BGT07)	0,35

Table 1: Modules of the Indoor installation used for the declared unit (1 km of railway).

Reference service life: Not applicable.

Time representativeness: The data used in the LCA calculation cover the year 2020.

Database(s) and LCA software used: The data used for the LCA was sourced from the database **Ecoinvent v3.6**, system approach cut off by classification**.** The LCA was performed using the software **SimaPro v9.1.1.7**. The LCA followed an attributional approach.

System diagram: The performed LCA covers the upstream (1) and core (2) process in line with the PCR Railways (2019).

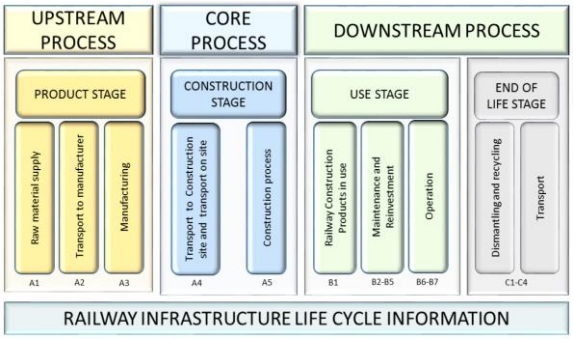

Figure 2: System diagram illustrating the processes included in the product system.

These processes translate to the following life cycle stages:

(1) Upstream process – product stage: includes the raw material supply (A1), transport to manufacturer (A2), and manufacturing (A3).
(2) Core process – construction stage: includes the transport to the construction site (railway operator location) (A4) and construction process (installation of the Indoor equipment at control centres along the railway line) (A5).

Description of system boundaries: Following the PCR Railways (2019), the LCA included all processes from **cradle-to-gate with options**, from the raw material supply over the manufacturing up to the installation of the indoor equipment.

Excluded lifecycle stages: This LCA does not consider the life cycle stages beyond the construction process, namely Downstream. Processes B1 to C4 are excluded for the Use stage and End of Life.

More information: For the LCA, a representative scenario from real life was considered, corresponding to the railway line Poznan - Stettin in Poland. This railway line covers 205 km of tracks

The LCA was performed by the ECODESIGN company engineering & management consultancy GmbH based in Vienna: https://www.ecodesign-company.com.
The contact person for this EPD is Dr. Adriana Díaz.

Content declaration

Product

In the LCA, the content declaration of the indoor equipment is calculated from the bill of materials using a cut-off by weight of over 99%, The total weight of the indoor equipment is 3,31 kg (rounded to 2 decimals).

Materials / chemical substances	Mass, g	%	Environmental / hazardous properties
Advanced Evaluation Board (AEB101)			
Steel	31,08	10,45	
Aluminium	12,19	4,10	
Brass	0,75	0,25	
Copper	0[2]	0	
Plastic	19,00	6,39	
Electronic	234,52	78,82	
Total Advanced Evaluation Board (AEB 101)	**297,53**	**100,00**	
Communication Board (COM-AdC101)			
Steel	31,08	14,78	
Aluminium	8,77	4,17	
Brass	0,75	0,36	
Copper	0	0	
Plastic	22,40	10,65	
Electronic	147,24	70,03	
Total Communication Board (COM-AdC 101)	**210,24**	**100,00**	
Power Supply Board (PSC101)			
Steel	31,08	10,48	
Aluminium	32,44	10,94	
Brass	0,75	0,25	
Copper	32,40	10,92	
Plastic	19,00	6,41	
Electronic	180,91	61,00	
Total Power Supply Board (PSC 101)	**296,58**	**100,00**	
Input/Output Extension Board (IO-EXB101)			
Steel	31,08	14,80	
Aluminium	21,42	10,20	

[2] The value zero indicates that the module has no component made exclusively of the respective material, e. g. copper. However, the material can be included in other material groups; e. g. copper presents a significant share of printed circuit boards, and is therefore considered in the material group ”electronic”.

Brass	0,75	0,36	
Copper	0	0	
Plastic	19,00	9,05	
Electronic	137,72	65,59	
Total Input/Output Extension Board (IO-EXB 10)	**209,97**	**100,00**	
Backplane for Extension Boards (BP-EXB101-1)			
Steel	2,70	2,16	
Aluminium	0	0	
Brass	0	0	
Copper	0	0	
Plastic	39,27	31,48	
Electronic	82,78	66,36	
Total Backplane for Extension Boards (BP-EXB 101-1)	**124,75**	**100,00**	
Backplane Power (BP-PWR101-8)			
Steel	11,10	2,38	
Aluminium	0	0	
Brass	0	0	
Copper	0	0	
Plastic	190,26	40,86	
Electronic	264,28	56,76	
Total Backplane Power (BP-PWR 101-8)	**465,64**	**100,00**	
Overvoltage Protection Board (BSI005)			
Steel	4,21	2,53	
Aluminium	0	0	
Brass	0	0	
Copper	13,00	7,81	
Plastic	71,80	43,14	
Electronic	77,43	46,52	
Total Overvoltage Protection Board (BSI 005)	**166,44**	**100,00**	
Casing (BGT07)			
Steel	170,40	11,08	
Aluminium	1 368,00	88,92	
Brass	0	0	
Copper	0	0	
Plastic	0	0	
Electronic	0	0	
Total Casing (BGT07)	**1 538,40**	**100,00**	

Packaging

The packaging information presented in this EPD follows the LCA considering a European scenario, in which the final product is packed at the manufacturing site in St. Marienkirchen, and further delivered to a reference installation location in Poland. The Indoor equipment is transported from Frauscher Sensortechnik GmbH (St. Marienkirchen, Austria) to Olomouc, Czech Republic (428 km); and from Olomouc to Poznan, Poland (396 km).
As Frauscher delivers their products to business partners (B2B), both the *distribution packaging* as well as the *consumer packaging* that are used in the core processes (transport to the construction site (A4) and construction process (A5)) arrive at the consumers site. Distribution packaging relates to the outer, robust packaging (secondary packaging) to enable a safe transport, whereas the consumer packaging relates to the primary packaging of the product.

Distribution packaging: For the core processes A4 and A5, the distribution packaging is a wooden box, enabling a safe and robust transport of the Indoor equipment to be delivered to Frauscher's customers. The weight of the wooden box is 2 660g.

Consumer packaging: To secure the product inside the wooden box, cardboard (690g) and foam material (120g) are used.
For the distribution of indoor equipment installation to a European (construction) railways site, in total 3,47kg packaging are used. The materials and weight of the packaging are presented as follows:

Packaging material	Mass, g
Wooden box	2 660
Cardboard	690
Foam material	120

Recycled material

Provenience of recycled materials (pre-consumer or post-consumer) in the product: There are no materials identified or certified as recycled for the declared unit, therefore, recycled materials were not considered in the LCA.

Environmental performance

Potential environmental impact

As indicated in the LCA information section, this EPD is based on an LCA conducted with a systems boundary **cradle to gate with options.**
Following the PCR Railways (2019), the life cycle stages upstream and core were considered, corresponding to the following processes:
Upstream: Raw material supply (A1), Transport the manufacture (A2), Manufacturing (A3);
Core: Transport to the construction site (A4), Construction/Installation process (A5).

The following table presents the results for the potential environment impact for the indoor equipment by Frauscher, consisting of seven electronic modules as well as a casing (as described in the section **Product information**), according to the considered life cycle stages and processes:

PARAMETER		UNIT	Total	Upstream			Core	
				A1	A2	A3	A4	A5
Global warming potential (GWP)	Fossil	kg CO_2 eq.	1,66E+02	1,66E+02	6,27E-02	2,08E-01	4,52E-01	4,78E-02
	Biogenic	kg CO_2 eq.	1,5E-00	-2,31E-01	3,34E-05	6,30E-01	2,41E-04	1,10E+00
	Land use and land trans-formation	kg CO_2 eq.	3,06E-01	3,05E-01	2,19E-05	3,62E-04	1,58E-04	1,58E-05
	TOTAL	kg CO_2 eq.	1,68E+02	1,66E+02	6,27E-02	8,38E-01	4,53E-01	1,15E+00
Acidification potential (AP)		kg SO_2 eq.	1,27E+00	1,27E+00	2,23E-04	1,90E-03	1,61E-03	2,99E-04
Eutrophication potential (EP)		kg PO_4^{3-} eq.	1,91E-01	1,90E-01	3,23E-05	3,93E-04	2,33E-04	3,96E-04
Formation potential of tropospheric ozone photochemical oxidants (POCP)		kg ethene-eq.	6,34E-02	6,29E-02	8,37E-06	1,97E-04	6,04E-05	1,56E-04
Abiotic depletion potential for non fossil resources (ADPE)		kg Sb eq.	6,72E-02	6,72E-02	1,70E-06	3,06E-06	1,22E-05	2,66E-07
Abiotic depletion potential for Fossil resources (ADPF)		MJ, net calorific value	1,78E+03	1,76E+03	9,26E-01	3,70E+00	6,68E+00	7,27E-01
Water scarcity potential		m^3 eq.	4,04E+01	4,03E+01	2,67E-03	1,03E-01	1,93E-02	8,74E-03

Use of resources

PARAMETER		UNIT	Total	Upstream			Core	
				A1	A2	A3	A4	A5
PERE - Primary energy resources - Renewable	Use as energy carrier	MJ, net calorific value	2,49E+02	2,33E+02	1,33E-02	1,55E+01	9,62E-02	3,16E-02
	Used as raw materials	MJ, net calorific value	0,00	0,00	0,00	0,00	0,00	0,00
	TOTAL	MJ, net calorific value	2,49E+02	2,33E+02	1,33E-02	1,55E+01	9,62E-02	3,16E-02
PENRE - Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	2,20E+03	2,19E+03	1,00E+00	4,41E+00	7,24E+00	8,13E-01
	Used as raw materials	MJ, net calorific value	0,00	0,00	0,00	0,00	0,00	0,00
	TOTAL	MJ, net calorific value	2,20E+03	2,19E+03	1,00E+00	4,41E+00	7,24E+00	8,13E-01
SM - Use of secondary materials		kg	0,00[3]	0,00	0,00	0,00	0,00	0,00
RSF - Use of renewable secondary fuels		MJ, net calorific value	0,00[4]	0,00	0,00	0,00	0,00	0,00
NRSF - Use of Non-renewable secondary fuels		MJ, net calorific value	0,00[5]	0,00	0,00	0,00	0,00	0,00
FW - Net use of fresh water		m^3	1,62E+00	1,62E+00	9,95E-05	3,13E-03	7,18E-04	9,11E-04

[3] No materials declared as secondary materials are used in the system investigated.

[4] No renewable secondary fuels are used in the system investigated.

[5] Non-renewable secondary fuels are not used in the system investigated.

Waste production and output flows

Waste production

PARAMETER	UNIT	TOTAL	Upstream			Core	
			A1	A2	A3	A4	A5
HWD - Hazardous waste disposed	kg	9,08E-03	9,05E-03	2,48E-06	3,40E-06	1,79E-05	9,38E-07
NHWD - Non-hazardous waste disposed	kg	2,18E+01	1,82E+01	4,52E-02	5,36E-02	3,26E-01	3,09E+00
RWD - Radioactive waste disposed	kg	6,04E-03	5,97E-03	6,44E-06	8,63E-06	4,65E-05	4,75E-06

Output flows

PARAMETER	UNIT	TOTAL	Upstream			Core	
			A1	A2	A3	A4	A5
Components for reuse	kg	0,00[6]	0,00	0,00	0,00	0,00	0,00
Material for recycling	kg	0,00[7]	0,00	0,00	0,00	0,00	0,00
Materials for energy recovery	kg	0,00[8]	0,00	0,00	0,00	0,00	0,00
Exported energy	MJ	0,00[9]	0,00	0,00	0,00	0,00	0,00

[6] There are no components certified as reused or refurbished in the declared unit.

[7] There are no material flows expressly identified/certified for material recycling for the declared unit.

[8] There are no material flows identified/certified for energy recovery in the declared unit. According to the PCR Railways: "…*the parameter "Materials for energy recovery"* ***does not include materials for waste incineration****. Waste incineration is a method of waste processing, when R1<60% (European Guideline on R1 energy interpretation), and is allocated within the system boundary"* [EPD® System, 2019].

[9] When there is no gross amount of "exported energy, electricity" leaving the system boundary, this indicator is set to zero according to the PCR Railways [EPD® System, 2019]. Moreover, there is no certified export of energy from the system investigated.

Additional information

The Frauscher Advanced Counter FAdC R2 Indoor equipment are used in **wheel detection systems** for failsafe monitoring of track sections. Tracksite (Outdoor) equipment, consisting of wheel sensors mounted onto the track by way of a rail claw which are connected to a track connection box, form the base of wheel detection systems. The complete wheel detection systems are able to detect the axles of rail vehicles driving on the track as well as their travel direction and speed (up to 450km/h), wheel diameter and diagnostic data. A separate LCA as well as an EPD for the Frauscher Outdoor equipment, consisting of the wheel sensor RSR123, the rail claw SK150, and a connection cable, does exist. The modular structure of the Frauscher wheel detection systems allows a scalable structure and easy to expand system.
The Frauscher Advanced Counter FAdC R2 has a use life over 30 years, enabled by a resiliency to high temperature fluctuations of -40°C to +70°C, corresponding to the ”in cabinet” climatic class T2 of EN 50125-3, as well as other environmental influences. The Frauscher Advanced Counter FAdC R2 conforms with the electromagnetic compatibility according to EN50121-4.

The electricity mix of the manufacturing plant of Frauscher in St. Marienkirchen, where the Indoor equipment is produced, is 100% hydropower. The processes carried out at this facility require energy (electricity and pellets/woodchips for heating) and auxiliary materials.
Thorough maintenance instructions are provided to the customer, who is responsible for the maintenance and performance of the system. Defective components must not be repaired, but must be replaced by components of the same type, which are checked and provided by Frauscher. After 30 years of use, the modules of the Indoor equipment must be subjected to a comprehensive functional check.
Concerning the disposal management of the Indoor equipment, defective components shall be returned to Frauscher, otherwise they must be disposed in accordance with national waste regulations. As with the planning of use and the performance, the disposal of the Frauscher Advanced Counter FAdC R2 and its components are in the customer’s responsibility, who must follow national regulations.

The impact that the installation and operation of the Frauscher Advanced Counter FAdC R2 & Indoor equipment has on biodiversity and water management has not been analysed in this LCA, as the modules covered are A1 to A5. The Indoor installation is placed and maintained by the railways line operators. It was not possible to assess these impacts for the individual railway infrastructure elements covered in this EPD.

References

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