



Automatic Passenger Counting

IRMA MATRIX

Product Data Sheet

Sensors and Connectors for Ethernet



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1 Product

1.1 Brief description

IRMA MATRIX is an automatic passenger counting sensor working with 500-pixel Time-of-Flight (ToF) technology. It is designed for vehicle and railway applications, and is mounted above doors.

IRMA MATRIX generates real-time counting data, which is forwarded to the on-board computer via Ethernet for further processing.

1.2 Product variants

This document covers IRMA MATRIX sensors release 2 (IRMA MATRIX R2).

The IRMA MATRIX sensors and connectors with Ethernet interface are available in the following variants:

Product type	Description
IRMA MATRIX R2 sensors	
DIST500-A	Sensor, surface mount version
DIST500-F	Sensor, flush mount version
IRMA MATRIX Connectors	
sCON-S-ETH-...	Connector (standard) with an Ethernet interface for IRMA MATRIX sensors
sCON-F-12-CC-E	Connector with Ethernet and two CAN interfaces for IRMA MATRIX sensors of type <i>DIST500-F</i> (flush mount version)
sCON-F-12-PoE	Connector with PoE Ethernet interface for <i>DIST500-F</i>

IRMA MATRIX sCON-S connectors are available with different cable lengths and in different cable qualities for use in different applications, e.g., automotive and railroad.

An illustration of the sensor and connector combinations can be found in section [2](#) starting on page [6](#).

1.3 Components

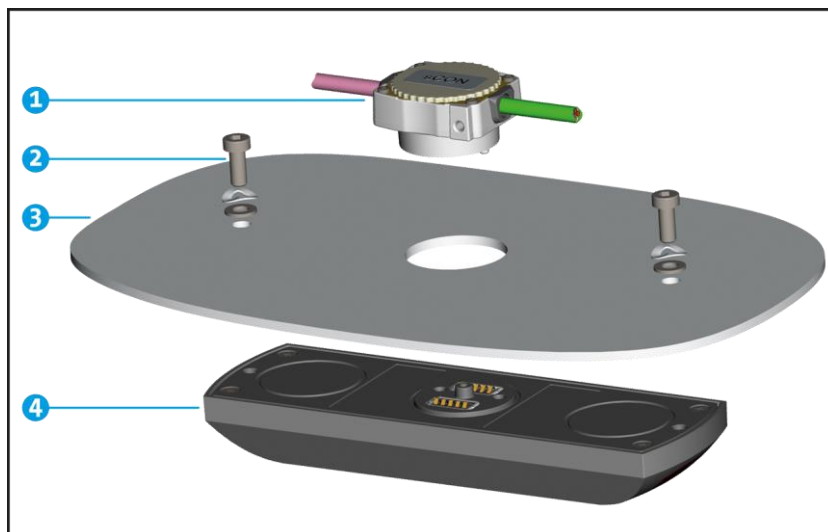
Product	Product designation	Item No.	Description
IRMA MATRIX R2 DIST500-A	DIST500.7-A07.OC	5002_01	Sensor DIST500-A, surface mount version
IRMA MATRIX R2 DIST500-F	DIST500.7-F07.OC	5002_07	Sensor DIST500-F, flush mount version
sCON-S-ETH	sCON-S-ETH-32-K2-1-2m	0250_47	Connector with Ethernet cable (M12 socket, 1 m) and power supply cable (open ends, 2 m) ECE R118, for automotive applications
	sCON-S-ETH-32-K3-1-2m	0250_50	Connector with Ethernet cable (M12, 1 m) and power supply cable (open ends, 2 m) ECE-R 118, EN 45545-2, for automotive and railroad applications
sCON-F-12	sCON-F-12-CC-E	5250_42	Connector with M12 connections for Ethernet, CAN bus, power supply
	sCON-F-12-PoE	5250_41	Connector with M12 connections for PoE (Power over Ethernet)
Door contact magnet (set)	S-D500-068	0198_30	Door contact magnet option for DIST500-A
	S-D500-081	0198_31	Door contact magnet option for DIST500-F with sCON-F-12
Mounting kit D500F Standard	Set_D500F-01	0006_91	Mounting kit for DIST500-F with sCON-S
Mounting kit with door contact magnet	Set_D500F-DC-01-2m	0006_93	Mounting kit D500F Standard with door contact magnet, for DIST500-F
Power supply cable for sCON-F-CC-E	K-M12POW-B-oE-04-2m	0215_36	with M12 coupling, straight (not suitable for CAN)
	K-M12.POW-B9-oE-G-05-2m	0215_68	with M12 coupling, 90° (not suitable for CAN)
Ethernet cable	K-M12CAT5-...	On request	with M12 plugs, straight or 90°
Others on request			

2 Sensor and connector combinations

2.1 IRMA MATRIX DIST500-A with sCON-S



The surface mount version of the IRMA MATRIX is mounted on the panel above the vehicle door.



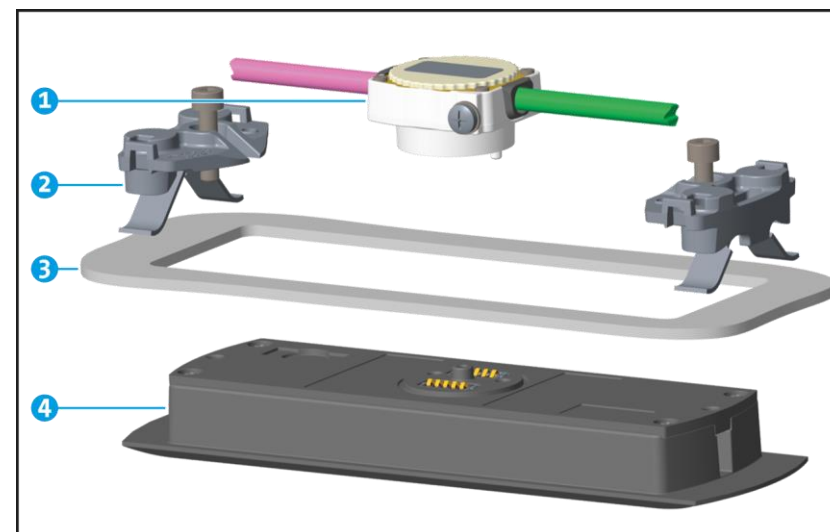
- 1 Connector sCON-S-ETH-...
- 2 Fixing screws M5
- 3 Panel above the door
- 4 Sensor IRMA MATRIX DIST500-A

2.2 IRMA MATRIX DIST500-F



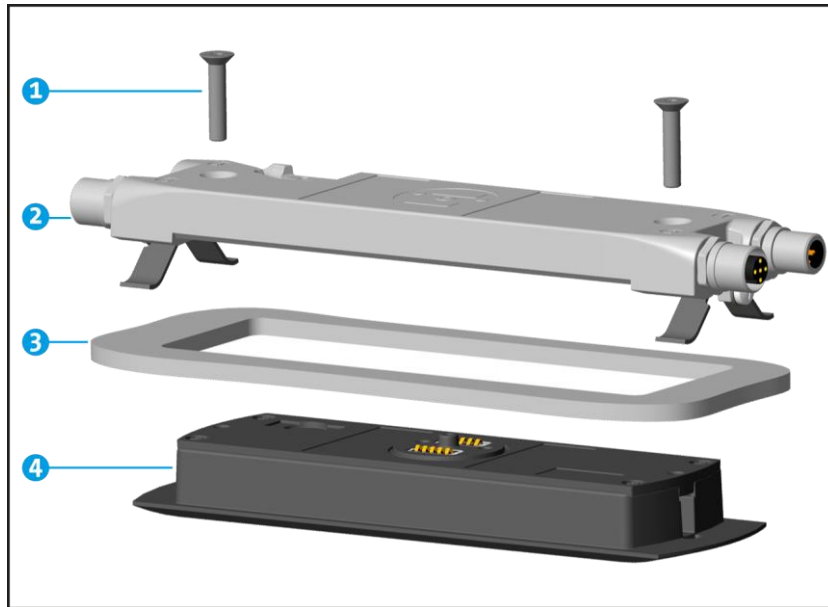
The flush mount version of the IRMA MATRIX is inserted into the panel above the vehicle door.

2.2.1 IRMA MATRIX DIST500-F with sCON-S



- 1 Connector sCON-S-ETH-...
- 2 Mounting kit
- 3 Panel above the door
- 4 Sensor IRMA MATRIX DIST500-F

2.2.2 IRMA MATRIX DIST500-F with sCON-F



- 1 Fixing screws M5
- 2 Connector sCON-F-12-...
- 3 Panel above the door
- 4 Sensor IRMA MATRIX DIST500-F

3 Door contact magnet option

If the sensor is equipped with a door contact magnet, person counting can be activated directly via a door contact on the vehicle door or an electrical signal.

Without a door contact magnet, counting must be activated or deactivated by an on-board computer via Ethernet.

Mounting of the door contact magnet

For DIST500-A: Mounting by means of an additional hole in the panel.

For DIST500-F with sCON-S: Mounting with the mounting kit with door contact magnet instead of the standard mounting kit.

For DIST500-F with sCON-F: Mounting on the sCON-F.

Door contact magnet connection

Signal	Wire color and labeling	Connection
VP+	white, with red marking, "1"	24 V _{DC} switched
VP-	white, "2"	Masse

If 24 V_{DC} is switched, the door contact magnet is activated.

At 0 V the door contact magnet is deactivated.

Do not reverse the polarity of the connection. The door contact logic (24 V = "door open" or 24 V = "door closed") can be set using the IRMA MATRIX configuration software.

Technical data of the door contact magnet

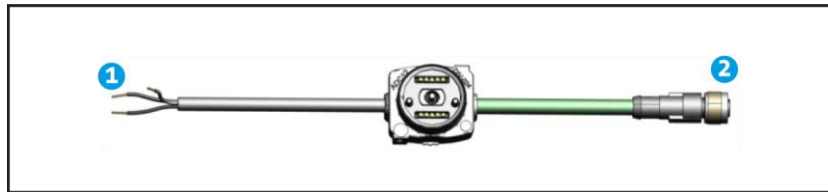
Power supply: 16.8 - 30 V_{DC}

Current consumption at 24 V: 40 ± 10 mA

4 Interfaces at sCON

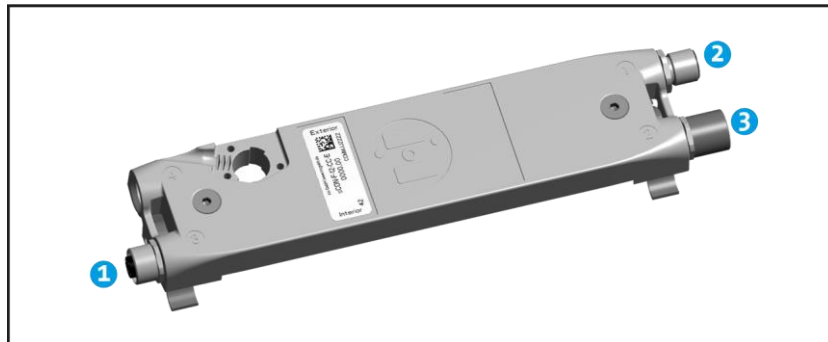
4.1 Position of connections

sCON-S



- 1 Power supply
- 2 Ethernet M12

sCON-F



- 1 Ethernet M12 socket
- For sCON-F12-CC-E only:
- 2 Power supply
(for CAN bus installations also CAN-IN)
 - 3 Sealing plug (for CAN bus installations CAN-OUT)

4.2 Ethernet

Ethernet connection with M12 connectors, D-coded, 4-pole.

For POE: Power-over-Ethernet according to IEEE 802.3af: Type 1, Class 0 (12.95 W), Mode A (power via data cable).

		Pin assignment	Signal
M12 connector (contact pins)		Housing	Shielding
		Pin 1	TD+
		Pin 2	RD+
M12 socket/coupling (contact sleeves)		Pin 3	TD-
		Pin 4	RD-
	View:		

Cables for Ethernet connection


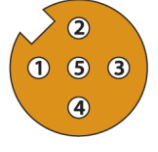

Ethernet cables are designed for use in automotive applications (cable quality 03) or automotive and railroad applications (cable quality 04).

Ethernet cables with angled or straight M12 connectors are available in lengths from 1 m to 30 m.

Further data on request

4.3 Power supply sCON-F-12-CC-E

Connection of the power supply with M12 connectors, A-coded, 5-pole

		Pin assignment	Signal
M12 connector (contact pins)		Housing	Shielding
		Pin 1	Not used
		Pin 2	VP+
		Pin 3	VP-
		Pin 4	Not used (CAN-H)
M12 socket/coupling (contact sleeves)		Pin 5	Not used (CAN-L)
		View: 	

For CAN bus installations, pin 4 and pin 5 are used.
 For pure power supply cables for Ethernet installations, pin 4 and pin 5 are not used.

Cables for power supply

Power supply cables are designed for use in automotive and railroad applications, see [4.5 Cable qualities](#), page 10.

The cables have an open end (single wires) for connection to the on-board voltage 24 V_{DC}.

Further data on request

4.4 Power supply sCON-S

Connection of the power supply with single wires.

No.	Signal	Wire color and labeling	
		sCON-S-ETH-32-K2-	sCON-S-ETH-32-K3-
1	VP-	black "1"	white "1"
2	VP+	black "2"	white "2"
3	Shield	black	black

4.5 Cable qualities

Indicator	Requirement	Brief description
K02 K1	UN/ECE-R 118	These cables comply with the general technical requirements. They are certified according to UN/ECE-R 118.
K03 K2	Halogen-free UN/ECE-R 118	These cables comply with the general technical requirements. They are certified according to UN/ECE-R 118. They meet at least one of the following halogen-free requirements: <ul style="list-style-type: none"> - VDE0472-815 - EN50267-2-1 (hydrogen halide content ≤ 0.5%). - IEC60754-1 (hydrogen halide content ≤ 0.5%)
K04 K3	Cables suitable for railroad use according to EN45545 R15 HL3 (includes halogen-free) UN/ECE-R 118	These cables comply with the general technical requirements. They are certified according to UN/ECE-R 118. They comply with at least one of the following standards regarding fire protection: <ul style="list-style-type: none"> - EN 45545-2:2013 R15 HL3 - EN 50306
K05 K4	Railroad cable according to EN 50306 (includes halogen-free)	These cables fully comply with the requirements of EN 50306.

5 Communication architecture

Communication with the IRMA MATRIX sensor takes place via the UIP 2.0 communication protocol (UIP = Universal IRMA Protocol).

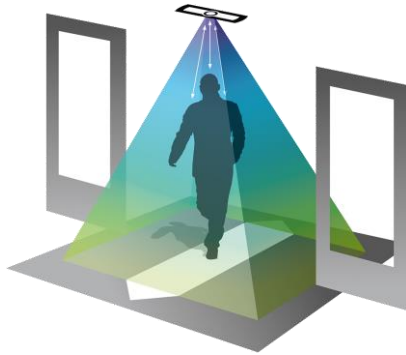
To simplify the integration of the sensor, an API (Application Programming Interface) is provided.

The API enables high-level access to the sensor, its data and configuration. This keeps the programming effort to a minimum.

iris-GmbH provides ready-compiled libraries for all common operating system derivatives (Linux, Windows [also embedded variants], Mac OS X).

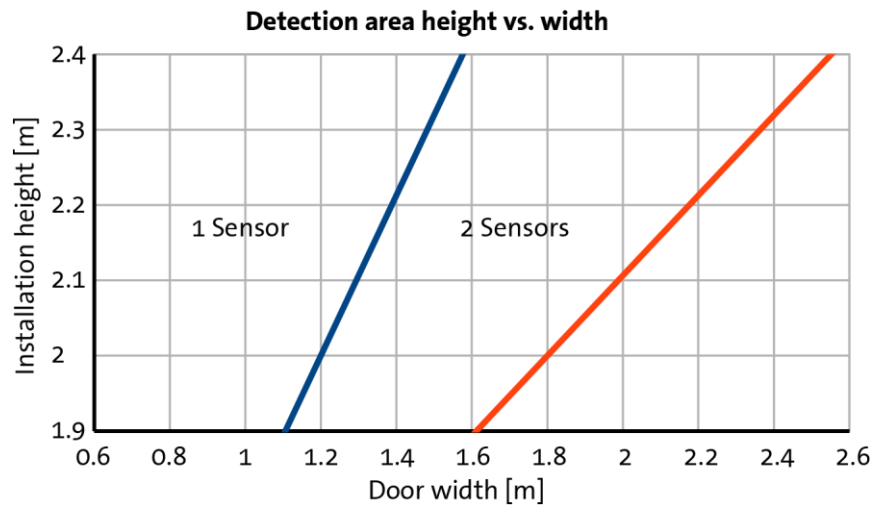
6 Technical Data

6.1 Field of View



The field of view is determined by the aperture angles of the time-of-flight sensor.

Thus, the maximum covered door width results from the mounting height of the sensor, as shown in the following graphic.



The blue line indicates the maximum door width depending on the installation height when using one IRMA MATRIX per door, the red line when using two IRMA MATRIX per door.

Example:

At an installation height of 2 m above the vehicle floor, a door width of up to 1.2 m can be covered with one sensor, and up to 1.8 m with 2 sensors.

At a height of 2.3 m, the maximum door width with one sensor is 1.48 m, with 2 sensors 2.36 m.

6.2 Weights

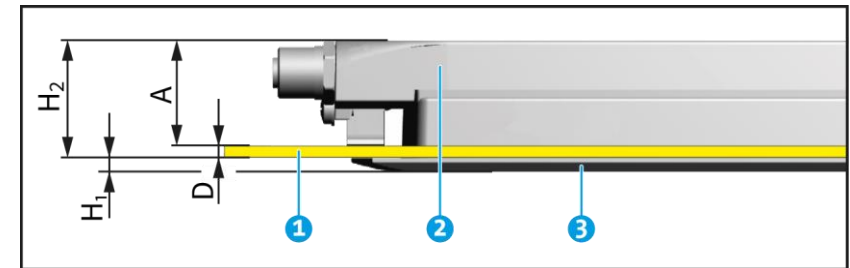
Part	Weight (ca.)	Comment
DIST500-A	260 g	without sCON connector
DIST500-F	340 g	without sCON connector
sCON-S	280 g	
sCON-F-12-CC-E	220 g	
sCON-F-12-POE	200 g	
Mounting kit	55 g	for DIST500-F with sCON-S

6.3 Dimensions

	Length x width x height L x W x H in mm	Height over surface ¹ H ₁ in mm	Depth behind surface ² H ₂ in mm
DIST500-A	165.5 x 53 x 22	22	-
DIST500 F	188 x 58 x 22	max. 4	18
DIST500-A with sCON-S	165.5 x 53 x 43	22	21
DIST500 F with sCON-S	188 x 58 x 42	max. 4	39
DIST500 F with sCON- F-12-CC-E ³	222 ⁺⁸ x 58 x 35	max. 4	31
DIST500 F with sCON- F-12-POE ³	214 ⁺⁴ x 58 x 35	max. 4	31

- 1 *Height over surface* measured from the surface of the panel to which the sensor is attached.
- 2 *Depth behind surface* measured from the surface of the panel to which the sensor is attached. The space required behind the panel is calculated from the *depth behind surface* minus the thickness of the panel, see example opposite.
- 3 The length of the sCON-F may differ due to the M12 connections and sealing plugs used. Housing dimension L = 197 mm

Example: DIST500-F with sCON-F



- 1 Panel to which the sensor is attached.
- 2 sCON-F-12-...
- 3 Sensor DIST500-F

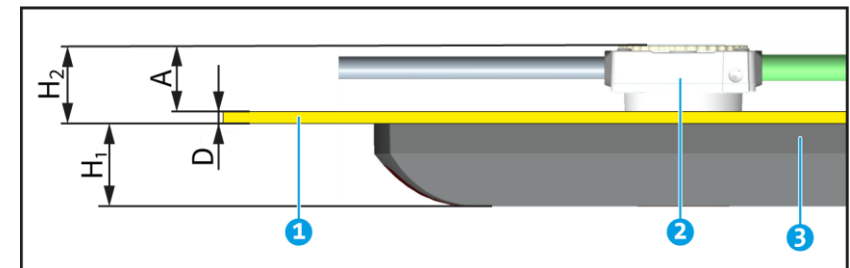
Height over surface H₁ = 4 mm max.

Depth behind surface H₂ = 31 mm

D = Thickness of panel 1

Space requirement above the panel: A = H₂ - D = 31 mm - D

Example: DIST500-A with sCON-S



- 1 Panel to which the sensor is attached.
- 2 sCON-S-...
- 3 Sensor DIST500-F

Height over surface H₁ = 22 mm

Depth behind surface H₂ = 21 mm

D = Thickness of panel 1

Space requirement above the panel: A = H₂ - D = 21 mm - D

6.4 Power supply

Connector used	sCON-F-12-CC-E, sCON-S-,	sCON-F-12-POE ¹
Voltage U _{min.}	16.8 V _{DC}	–
Voltage U _{typical}	24 V _{DC}	48 V
Voltage U _{max.}	33.6 V _{DC}	57 V
Power consumption ² P _N	typical	6 W
	max.	9 W

- 1 Power-over-Ethernet according to IEEE 802.3af: Type 1, Class 0 (12.95 W), Mode A (power via data cable)
- 2 Rated power consumption with vehicle door open and +24 V_{DC}, ambient temperature +25°C (+77°F)

6.5 Operating and ambient conditions

	min.	max.
Operating temperature range according to EN 50155	–25 °C (–13 °F)	+70 °C (+158 °F)
Operating temperature T _B	–25 °C (–13 °F)	+70 °C (+158 °F)
Temperature range T _L for storage and transport (according to EN 50155)	–40 °C (–40 °F)	+85 °C (+185 °F)

6.6 General Data

Parameter	Value
MTBF ¹ at +25°C (+77°F)	1,24 x 10 ⁶ h
Max. Ethernet transmission rate	100 MBit/s
Housing material	Die Cast Aluminum
Optical openings material	Makrolon 2405 Color shade 450601
Degree of protection of the housing (according to IEC 60529) in connected state	IP65; (IP67 on request)

- 1 MTBF = Mean Time Between Failures

6.7 Test program for compliance with standards

6.7.1 EMC

Compliance with standards, device tests

Field	Product/testing standard	Remark
Noise radiation, immunity to interference	EN 50121-3-2:2016	Electromagnetic compatibility in rail vehicles
	EN 50155:2017 (regarding the EMC requirement)	Immunity to voltage fluctuations/interruptions (Railway applications)
	2014/30/EU	EMC directive, basis for CE marking
	AK EMV Regulation No. EMV 06 from 09.05.2019	Technical Rules for Electromagnetic Compatibility. Proof of radio compatibility of rail vehicles with railway radio services
Road vehicles	ECE-R 10 Revision 05	E1 type approval No.: 10R-046535

6.7.2 Climatic and mechanical tests

Compliance with standards, device tests

Field	Product standard/testing standard	Remark
Climatic standards	EN 50155: 2017 (railway applications) IEC 60068-2-1, -2-2: 2007 IEC 61373: 2010 (railway applications) IEC 60068-2-6: 2007 IEC 60068-2-64, -2-27: 2008 IEC 60721-3-5: 1997	
	IEC 60068-2-1	Cold
	EN 50155 item 13.4.4 Cl. OT3	Test Ad (function)
	EN 50155 item 13.4.6	Test Ab (storage)
	IEC 60068-2-2	Dry heat
	EN 50155 item 13.4.5 Cl. OT3	Test Be (function), Test Bb (storage +85 °C)
	EN 50155 item 13.4.13/ IEC 61373 item 9 Cl. B, Cat. 1/ IEC 60068-2-64	Vibration, broadband random, life test - Test Fh
	EN 50155 item 13.4.13/ IEC 61373 item 10 Cl. B Cat.1/ IEC 60068-2-27	Shock load - Test Ea
	EN 50155 item 13.4.13/ IEC 61373 item 8 Cl. B, Cat. 1/ IEC 60068-2-64	Vibration, broadband random, function test - Test Fh
	IEC 60721-3-5 Tab. 6, Cl. 5M3/ IEC 60068-2-64	Vibration, noise-type - Test Fh
Mechanical standards	IEC 60721-3-5 Tab. 6, Cl. 5M3/ IEC 60068-2-6	Vibration, sinusoidal - Test Fc
	IEC 60721-3-5 Tab. 6, Cl. 5M3/ IEC 60068-2-27	Shock load - Test Ea (spectrum), (spectrum) - without external shock loading -

6.7.3 Insulation test

Compliance with standards, device tests

Field	Product standard/ testing standard	Remarks
Insulation test	EN 50155 item 13.4.9: 2017	Railway applications

6.7.4 Check of protection class

Compliance with standards, device tests

Field	Product standard/ testing standard <small>(IEC 60529: 1989 + A1: 1999)</small>	Remarks
Degree of protection of housing	IEC 60529 §13.4	Test for protection against contact
	IEC 60529 §14.2.5	IP65 test

6.7.5 Eye safety

Compliance with standards, device tests

Field	Product standard/ testing standard	Remarks
Eye safety	EN 62471: 2008	Photobiological safety of lamps and lamp systems

6.7.6 Fire protection behavior

Compliance with standards, device tests

Field	Product standard/testing standard
Fire protection in rail vehicles Conformity evaluation	EN 45545-2: 2020 (railway applications)