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Viper-002-PL Series

EN 50155 Ethernet Powerline Bridge

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1. General Information

1.1. Legal Information

The contents of this document are provided “as is”. Except as required by applicable law, no warranties of any kind are made in relation to the accuracy and reliability or contents of this document, either expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Westermo reserves the right to revise this document or withdraw it at any time without prior notice.

Under no circumstances shall Westermo be responsible for any loss of data or income or any special, incidental, and consequential or indirect damages howsoever caused.

More information about Westermo can be found at www.westermo.com.

1.2. About This Guide

This guide is intended for installation engineers and users of the Westermo products.

It includes information on safety and regulations, a product description, installation instructions and technical specifications.

2.1. Warning Levels

Warning signs are provided to prevent personal injuries and/or damages to the product. The following levels are used:

Level of warning	Description	Consequence personal injury	Consequence material damage
 WARNING	Indicates a potentially hazardous situation	Possible death or major injury	Major damage to the product
 CAUTION	Indicates a potentially hazardous situation	Minor or moderate injury	Moderate damage to the product
 NOTICE	Provides information in order to avoid misuse of the product, confusion or misunderstanding	No personal injury	Minor damage to the product
 NOTE	Used for highlighting general, but important information	No personal injury	Minor damage to the product

Table 1. Warning levels

2.2. Safety Information

Before installation:

Read this manual completely and gather all information available on the product. Make sure it is fully understood. Check that your application does not exceed the safe operating specifications for the product.

SAFETY DURING INSTALLATION

The product must be installed and operated by qualified service personnel and installed into an apparatus cabinet or similar, where access is restricted to service personnel only.

Refer to chapter Compliance Information to see the required level of qualified service personnel according to safety standards.

Before energising and connecting communication cables to the product, ensure a protective earthing conductor is first connected to the protective earthing terminal (only valid for metallic housings). Westermo recommends a cross-sectional area of at least 4 mm^2.

Upon removal of the product, disconnect the product from the power supply and all other communication ports before disconnecting the protective earthing conductor.

HAZARDOUS VOLTAGE

Do not open an energised product. Hazardous voltage may occur when connected to a power supply.

PROTECTIVE FUSE

The power supply wiring must be sufficiently fused.

It must be possible to disconnect manually from the power supply. Ensure compliance to national installation regulations.

Replacing the internal fuse must only be performed by Westermo qualified personnel.

REDUCE THE RISK OF FIRE

To reduce the risk of fire, use only telecommunication line cords with a cable diameter of AWG 26 or larger. Regarding power cable dimensions, see chapter Interface Specifications.

HOT SURFACE
Be aware that the surface of this product may become hot. When it is operated at high temperatures, the external surface may exceed Touch Temperature Limit according to the product's relevant electrical safety standard.

ELECTROSTATIC DISCHARGE (ESD)
Prevent electrostatic discharge damage to internal electronic parts by discharging your body to a grounding point (e.g. use a wrist strap).

2.3. Care Recommendations

Follow the care recommendations below to maintain full operation of the product and to fulfill the warranty obligations:

- Do not drop, knock or shake the product. Rough handling above the specification may cause damage to internal circuit boards.
- Use a dry or slightly water-damp cloth to clean the product. Do not use harsh chemicals, cleaning solvents or strong detergents.
- Do not paint the product. Paint can clog the product and prevent proper operation.

If the product is used in a manner not according to specification, the protection provided by the equipment may be impaired.

If the product is not working properly, contact the place of purchase, the nearest Westermo distributor office or Westermo technical support.

2.4. Product Disposal

This symbol means that the product shall not be treated as unsorted municipal waste when disposing of it. It needs to be handed over to an applicable collection point for recycling electrical and electronic equipment.

By ensuring the product is disposed of correctly, you will help to reduce hazardous substances and prevent potential negative consequences to both the environment and human health, which could be caused by inappropriate disposal.

Figure 1. WEEE symbol for treatment of product disposal

2.5. Compliance Information

2.5.1. Agency Approvals and Standards Compliance

Type	Approval/Compliance
Climate	• EN 50155 class OT4 / IEC 60571 class TX, Railway applications - Electronic equipment used on rolling stock • IEEE 1478 class 1, condition E4 (incl Salt Mist), Environmental conditions for transit rail car electronic equipment
EMC	• EN/IEC 61000-6-2, Immunity industrial environments • EN/IEC 61000-6-4, Emission industrial environments • EN 50121-4/IEC 62236-4, Railway signalling and telecommunications apparatus • EN 50121-3-2/IEC 62236-3-2, Railway applications – Rolling stock – apparatus • Tested and verified for Class S1, DB EMC Regulation 06, Commodity team Radio compatibility in VDB Rev 1.0 (Shunting Radio) • Tested and verified for FCC part 15b class A (CFR 47)
Mechanical (Shock and vibration)	• EN 61373 category 1, class A and B • EN 60068-2-27 20 g, 11 ms
Insulation (Coordination and test)	• EN 50124-1, Railway applications – Insulation coordination • EN 50155/IEC 60571, Railway applications - Electronic equipment used on rolling stock
Fire protection	• EN 45545-2, Fire protection on railway vehicles
Safety	• EN/IEC/UL 62368-1, Safety Requirements for audio/video, information and communication technology equipment

2.5.2. EN/IEC/UL 62368-1 Notice

This product has been tested and found compliant to EN/IEC/UL 62368-1, Safety for Communication Technology. In accordance with the definitions of the standard, this product shall be handled by skilled personnel. Energy source classifications are according to following:

Electrical energy source	Power port	ES3
	PL port	ES3
	Ethernet port	ES1, TNV-1
Power source	Power port	PS3
	PL port	PS3
Thermal energy source	Enclosure	TS1
Mechanical energy source	Enclosure	MS3
Radiation energy source	N/A	N/A

Table 2. EN/IEC/UL 62368-1 notice

2.5.3. FCC Part 15.105 Class A Notice

This product has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment.

This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the user manual, may cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the users own expense.

2.5.4. Simplified Declaration of Conformity

Hereby, Westermo declares that this product is in compliance with applicable EU directives and UK legislations. The full declaration of conformity and other detailed information is available at www.westermo.com/support/product-support.

Figure 2. The European Conformity and the UK Conformity Assessment markings

3. Product Description

3.1. Product Description

The Viper-002-PL series consists of Ethernet extenders and bridges for propagating Ethernet traffic over existing cabling. The series is based on power line communication (G.hn) and is capable of bridging high bandwidth Ethernet traffic over 2-wire cables, even when there are oxidized connectors.

By simply installing a Viper-002-PL product on each side of the coupler, a bridge connecting the Ethernet networks on each side is created. The power line technology allows using existing cables, which leads to significant financial savings when refurbishing trains. The fact that no configuration is needed further contributes to the ease of use.

The Viper-002-PL series has been thoroughly tested by certified labs to ensure its compliance with the standard for electronic equipment used on rolling stock, the EN 50155. For several characteristics, Westermo exceeds the requirements mandated by the standard, e.g. by providing 1.5 kVrms insulation on all ports.

Furthermore, the design is based on Westermo's long experience within the rolling stock market, which brings benefits such as vibration safe integrated connector threading, IP67 ingress protection with GORE-TEX® membrane to prevent condensation water build-up and ultimately a high MTBF and long service life under the harshest conditions.

The Viper-002-PL series is built in Westermo's Swedish factory which is renowned for its extremely high standard, as confirmed by a multitude of quality audits by demanding international customers. The factory is organized according to lean manufacturing principles and it is equipped with sophisticated state-of-the-art quality assurance equipment.

Meeting the requirements for rolling stock, makes the Viper-002-PL series also very well suited for deployment in other applications with severe operating conditions and extreme environments .

3.2. Available Models

Art. no.	Model	TX ports	Powerline	Rated voltage
3635-3000	Viper-002-T1-PL1	1	1	24-110 VDC
3635-3010	Viper-002-T1-PL1-DN2	1	1	24-110 VDC

3.2.1. Additional Model Information

In most cases, only the Viper-002-T1-PL1 model is used. In cases when two different Ethernet interfaces are used but only one transmission cable is present, different Viper-002-PL models can use same transmission cable without mixing Ethernet interfaces. The two models have different configurations which ensure that they will only connect to the same model and avoid crosstalk.

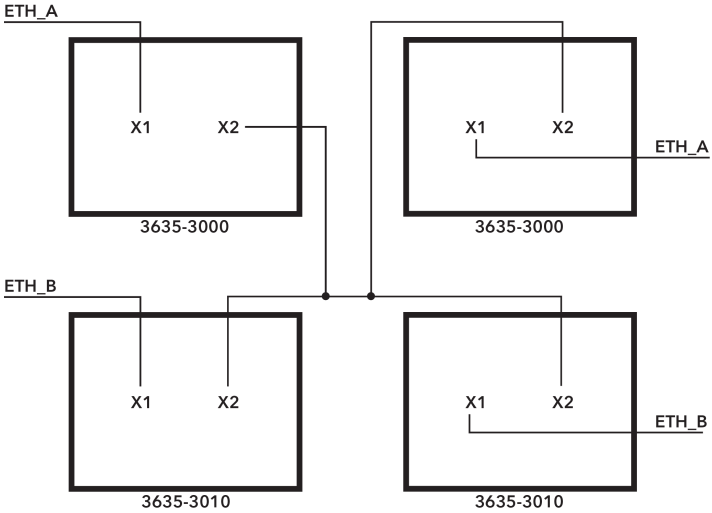
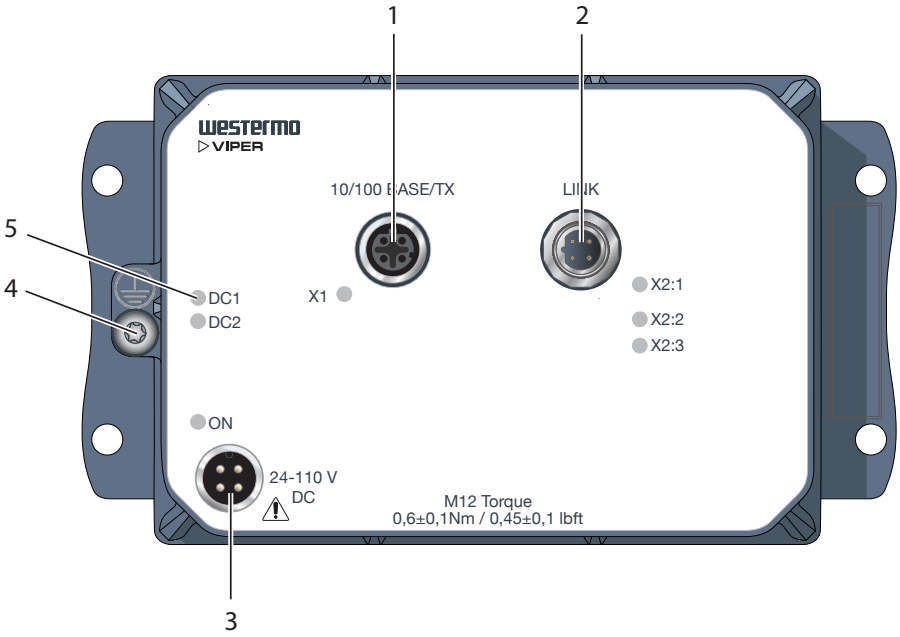


Figure 3. Explanatory overview

3.3. Hardware Overview



No.	Description	No.	Description
1	Ethernet port	2	Powerline connection
3	Power connection	4	Protective earth connection
5	LED indicators		

Figure 4. Location of interface ports and LED indicators

3.4. Connector Pinout

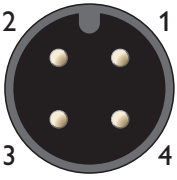
Pin no.	Signal	Illustration
1	+DC1	
2	+DC2	
3	-COM	
4	-COM	

Table 3. Power connector, A-coded

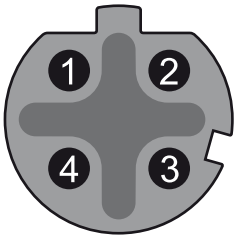
Pin no.	Signal	Illustration
1	TD+	
2	RD+	
3	TD-	
4	RD-	
Auto MDI/MDI-X is used. The table shows signals in MDI mode.		

Table 4. Ethernet connector, D-coded

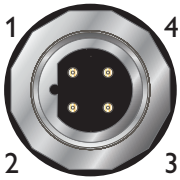
Pin no.	Signal	Illustration
1	PLC1	
2	NC	
3	PLC2	
4	NC	
PLC1 and PLC2 are polarity free		

Table 5. Powerline connector, B-coded

3.5. LED Indicators

LED	Status	Description
ON	OFF	Product has no power
	GREEN	All OK, no alarm condition
DC1	OFF	Product has no power
	GREEN	Power OK on DC1
	RED	Power failure on DC1
DC2	OFF	Product has no power
	GREEN	Voltage present on DC2
	RED	Power failure on DC2
X1	OFF	No link
	GREEN	Link established
	GREEN FLASH	Data traffic indication
X2:1	OFF	No PLC link established
	ON	PLC link established
X2:2	OFF	N/A
	GREEN	N/A
X2:3	OFF	N/A
	ON	N/A

Table 6. LED indicators

3.6. Dimensions

Dimensions are stated in mm and are regardless of model.

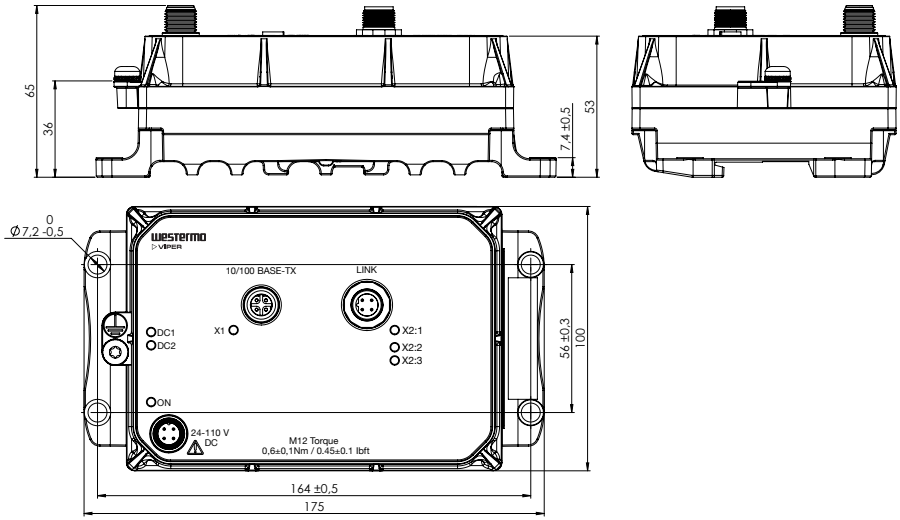


Figure 5. Dimensional drawing

4. Installation

4.1. Wall Mounting

The product can be wall mounted vertically or horizontally. There are four pieces of 7 mm bores for this. Use four M5, M6 or 1/4" screws with 12 mm washers on a flat and stable surface.

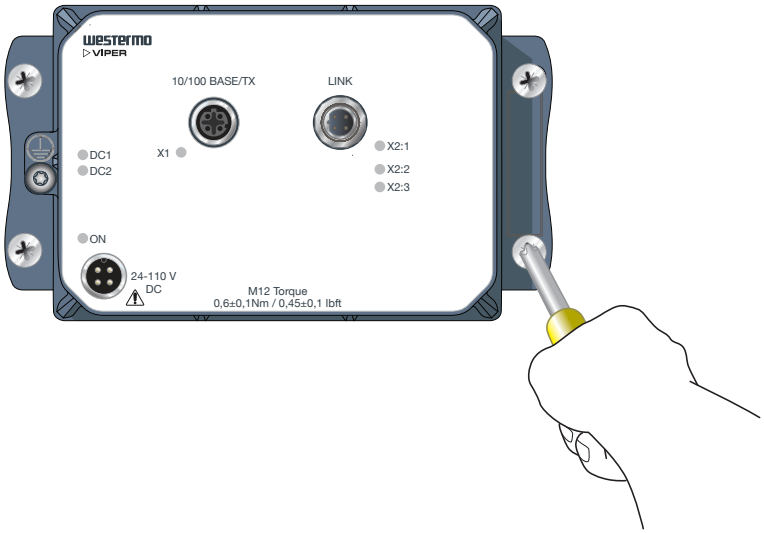


Figure 6. Wall mounting

4.2. Protective Earth Connection

For correct function, the earth connection needs to be properly connected to a designated PE rail. Torx: T25 and torque: 3.2 Nm.

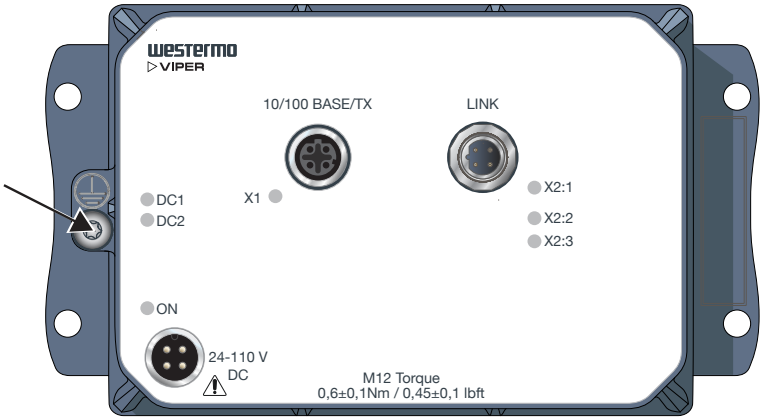


Figure 7. Earth connection

4.3. Connection of Cables

Recommended tightening torque for the M12 connectors is 0.6 Nm. When connecting the power cable, ensure that the pins are connected correctly before tightening the power cable to the unit.

PROTECTIVE FUSE

The power supply wiring must be sufficiently fused.

It must be possible to disconnect manually from the power supply. Ensure compliance to national installation regulations.

Replacing the internal fuse must only be performed by Westermo qualified personnel.

NOTE - UNUSED CONNECTORS

Unused connectors must be covered by a protective cap (delivered with the product), tightened to the specified torque in order to fulfill the specified ingress protection code.

4.4. Cooling

This product relies on convection cooling. Make sure that it is installed so that the ambient temperature is within the specified temperature range. Avoid obstruction of the airflow around the product.

4.5. Replacement of Product

Disconnect all cables and unscrew the product from the wall. MTTR (Mean Time To Repair), i.e. time for replacement of product is < 10 minutes.

4.6. EN 45545-2 Mounting Notes

Two product can be mounted together and as a single interior non-listed group in the sense of EN 45545-2 definitions. For multiple product, the spacing requirements for interior non-listed groups must be met.

4.7. Getting Started

The product is easy to use and install. The units work in a pair over existing cabling infrastructure and automatically connect to each other when the remote device is sensed over the interconnecting lines.

The installation procedure to get the application up and running is simple.

1. Connect the cable (twisted pair or parallell cable) to X2 pin 1 and 3 (polarity independent).
2. Connect Ethernet to the X1 port on the front of the product.
3. Connect power to the devices.

The following settings are valid for the Ethernet interface:

- Ethernet auto-negotiation enabled
- Auto MDI/MDI-X
- Auto-polarity enabled

The product will automatically detect the possible data rate to the remote device (over the X2 - PLC interface).

The link performance can easily be measured after the powerline link is established. Different types of methods and tools can be used.

One example of recommended software for throughput testing is Iperf. Please refer to Iperf user documentation for instructions of usage.

NOTE

If the PLC link is not established or the established data rate is not suffcient for the application, the distance might be too long between the products.

The product is an unmanaged unit. If performance is low or no connection established, check cabling between the product.

4.8. Configuration

All necessary configurations are preconfigured from factory and no other changes in the settings can be done.

5. Specifications

5.1. Interface Specifications

DC, Power port	
Rated voltage	24 to 110 VDC
Operating voltage	16.8 to 143 VDC (14.4 to VDC for 100 ms, 154 VDC for 1 s)
Rated current	200 mA at 24 VDC, 55 mA at 110 VDC
Rated frequency	DC
Inrush current	4 mA^2s at 24 VDC, 64 mA^2s at 110 VDC
Polarity	Reverse polarity protected
Redundant power input	Yes
Isolation	1500 VAC rms to all other ports
Connector	4-pin, male, M12, A-coded, recommended Westermo cables: 3146-1106 for 1.5 m 3146-1107 for 5 m
Cable size	M12, recommended power cable area 0.5 mm^2 (minimum 0.25 mm^2) Cable dimensions depend on choice of M12 connector

X1 Ethernet ports	
Electrical specification	IEEE std 802.3
Data rate	Auto-negotiation (10 Mbit/s or 100 Mbit/s)
Duplex	Auto-negotiation (full or half)
Circuit type	X1: TNV-1
Transmission range	Up to 150 m with CAT5e cable or better
Isolation	1500 VAC rms to all other ports
Connector	4-pin, female, M12, D-coded, auto MDI/MDI-X, recommended Westermo cables: 3146-1100 M12-M12 - 1 m 3146-1101 M12-M12 - 5 m 3146-1103 RJ45-M12 - 1 m 3146-1104 RJ45-M12 - 5 m
Cabling	Shielded cable is recommended in severe electromagnetic environments
Conductive chassis	Yes
Number of ports	1

X2 powerline interface	
Data rate	100 Mbit up to 400 m (depending on cable characteristics and temperature)
Connector	4-pin, M12, B-coded
Transmission range	Up to 400 m with full rate, up to 1000 m with reduced data rate (depending on cable characteristics and temperature)
Electrical specification	Supports communication over wires powered from 0 to 143 VDC

5.2. Type Tests and Environmental Conditions

Environmental phenomena	Basic standard	Description	Test levels
ESD	EN 61000-4-2	Enclosure	Contact: ±6 kV Air: ±8 kV
Fast transients	EN 61000-4-4	Power port	± 2 kV
		Signal ports	
		Earth port	
Surge	EN 61000-4-5	Power port	L-E: ± 2 kV, 42 Ω, 0.5 µF, 1.2/50 µs L-E: ± 1 kV, 12 Ω, 9 µF, 1.2/50 µs L-L: ± 2 kV, 42 Ω, 0.5 µF, 1.2/50 µs L-L: ± 0.5 kV, 2 Ω, 18 µF, 1.2/50 µs
		Ethernet port	L-E: ± 2 kV, 2 Ω
Power frequency magnetic field	EN 61000-4-8	Enclosure	300 A/m: 0 Hz (DC) 100 A/m: 16.7, 50, 60 Hz
Pulsed magnetic field	EN 61000-4-9	Enclosure	300 A/m
Radiated RF immunity	EN 61000-4-3	Enclosure	20 V/m at (80 MHz to 2.7 GHz) 10 V/m at (2.7 to 6 GHz) 1 kHz sine, 80% AM
Conducted RF immunity	EN 61000-4-6	Power port	10 V, 80% AM, 1 kHz; (0.15-80) MHz
		Ethernet ports	
		Earth port	
Radiated RF emission	CISPR 16-2-3	Enclosure	Class A (30 MHz to 6 GHz)
	ANSI C63,4 (FCC Part 15)		
Conducted RF emission	CISPR 16-2-1	Power port	Class A
		Ethernet ports	
Dielectric strength	EN 50155	Power port to all other ports	1.5 kVAC rms, 50 Hz, 1 min
		Fast Ethernet ports to all other ports	
		Link to all other ports	

Table 7. EMC and electrical conditions

Environmental phenomena	Basic standard	Description	Test levels
Temperatures	EN 60068-2-1 EN 60068-2-2	Operational	-40 to +70°C (-40 to +158°F)
		Storage and transport	-40 to +85°C (-40 to +185°F)
Humidity	EN 60068-2-30	Operational	5-95 % relative humidity
		Storage and transport	
Altitude		Operational	2000 m/80 kPa
Service life		Operational	15 years
MTBF	MIL-217F2, GB, 25°C (+77°F)		1,285,000 hours
Vibration	IEC 60068-2-64 (random)	Operational	2 m/s² rms 5-150 Hz
		Non-operational	11.44 m/s2 rms 5-150Hz
Shock	IEC 60068-2-27	Operational	10 g, 30 ms, 20 g, 11 ms
Enclosure	EN 62368-1	Zinc	Fire enclosure
Weight			1,2kg
Degree of protection	EN 60529	Enclosure	IP67
Cooling			Convection

Table 8. Environmental and mechanical conditions

6. Revision Notes

Revision	Date	Change description
Rev. A	2023-11	First version

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