westermo

www.westermo.com

RedFox 5528 Series

Industrial routing switches

WeOS

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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.

1.3. Software Tools

Related software tools are available at https://www.westermo.com/support/product-support.

1.4. License and Copyright for Included FLOSS

This product includes software developed by third parties, including Free/Libre Open Source Software (FLOSS). The specific license terms and copyright associated with the software are included in each software package respectively. Please visit the product web page for more information.

Upon request, the applicable source code will be provided. A nominal fee may be charged to cover shipping and media. Please direct any source code request to your normal sales or support channel.

1.5. WeOS

This product runs WeOS 5 (Westermo Operating System). Instructions for quick start, configuration and factory reset are found in the WeOS user documentation at www.westermo.com.

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.

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.

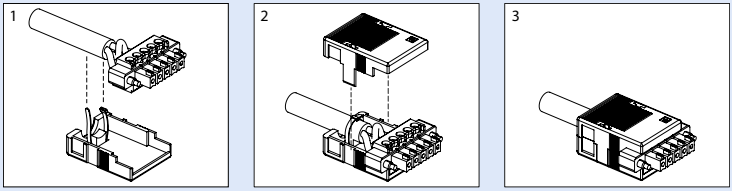
HAZARDOUS VOLTAGE

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

WARNING - PREVENT ACCESS TO HAZARDOUS VOLTAGE CABLE
Apply the protective cap (if delivered with the product) on the power cable, according to the illustrated steps below. The number of pins on the connector plug may vary depending on product.

To prevent accidentally pulling out wires, make sure the power cable and the wires are firmly attached to the protective cap.

For screw connectors, make sure the screws are properly tightened, as well as routing the wires separately from other wires. For connectors with straps, fasten the cable as strain relief, as well as routing the wires separately.



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

POWER SUPPLY CONNECTION

REDUCE THE RISK OF FIRE

CLASS 1 LASER PRODUCT
Do not look directly into a fibre optical port or any connected fibre.

HANDLING OF SFP TRANSCEIVERS
SFP transceivers are supplied with plugs to avoid contamination inside the optical port. They are very sensitive to dust and dirt. If the fibre optic cable is disconnected from the product, a protective plug must be used on the transmitter/receiver. The protective plug must be kept on during transportation. The fibre optic cable must be handled the same way.

CORROSIVE GASES
If the product is placed in a corrosive environment, it is important that all unused connector sockets are protected with a suitable plug, in order to avoid corrosion attacks on the gold plated connector pins.

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.

Proper disposal of the product helps minimize hazardous substances and prevents potential negative impacts on both the environment and human health.

Figure 1. WEEE symbol for treatment of product disposal

2.5. Compliance Information

2.5.1. Agency Approvals and Standards Compliance

Type	Approval/Compliance
EMC	• EN 50121-4/IEC 62236-4, Railway signalling and telecommunications apparatus • EN/IEC 61000-6-1, Immunity residential environments[a.] • EN/IEC 61000-6-2, Immunity industrial environments • EN/IEC 61000-6-3, Emission residential environments[a.] • EN/IEC 61000-6-4, Emission industrial environments
Safety	• EN/IEC/UL 62368-1, Safety Requirements for audio/video, information and communication technology equipment[b.] • EN/IEC/UL 61010-1, Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements[c.] • EN/IEC/UL 61010-2-201, Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-201: Particular requirements[c.]
Marine[d.]	DNV GL rules for classification - Ships and offshore units

[a.] Valid for all RedFox-5528(-E)-LV models, except RedFox-5528(-E)-F24G-T4G-LV

[b.] Valid for all RedFox-5528(-E)-LV models

[c.] Valid for all RedFox-5528(-E)-HV models

[d.] Pending for RedFox-5528(-E)-F24G-LV models. Valid for all other RedFox-5528(-E)-LV models.

Table 2. Agency approvals and standards compliance

2.5.2. EN/IEC 61010-2-201 Notice

This product has been tested and found compliant to EN/IEC 61010-2-201, Safety requirements for electrical equipment for measurement, control, and laboratory use. In accordance with the definitions of the standard, this product shall be handled by skilled service personnel.

2.5.3. 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 personnel. Energy source classifications are according to following:

2.5.4. UL 62368-1 DC Mains Notice

In accordance with UL 62368-1, Annex DVD and DVH then Westermo does not recommend using the mechanical enclosure/chassis (PE) as a conductive part of the sourced earthed DC power system in a DC mains distribution networks. If so, the transient protective barriers are compromised, and the product will not be compliant to evaluated standards and immunity performance according to type test table in the user guide.

The earthing electrodes shall be located at the source in the DC distribution system and separate earth and protective earth conductors shall be provided throughout the system.

The field wiring shall be sufficient fixated and the protective cap for the power connector, if supplied with the product, shall be used on DC voltages higher than 60 VDC.

2.5.5. 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.

2.5.6. FCC Part 15.105 Class B Notice

This product has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This product generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this product does cause harmful interference to radio or television reception, which can be determined by turning the product off and on, the user

is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the unit and receiver
- Connect the product into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

2.5.7. Corrosive Environment

This product has been successfully tested in a corrosion test according to IEC 60068-2-60, method 3. This means that the product meets the requirements to be placed in an environment classified as ISA-S71.04 class G3.

CORROSIVE GASES
If the product is placed in a corrosive environment, it is important that all unused connector sockets are protected with a suitable plug, in order to avoid corrosion attacks on the gold plated connector pins.

2.5.8. 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 RedFox 5528 series is designed for the core of large high-performance industrial networks and has been developed to cater to the needs of current and future industrial data networks, combining outstanding performance, durability and reliability. These switches are ideal for handling the big data and high bandwidth requirements typically found within transportation, manufacturing, energy, smart cities and other applications.

Integrating hardware, software and network design support tools, this next generation switch platform offers advanced capabilities, the lowest total cost of ownership and will create the most reliable and resilient networks on the market.

The switch is engineered to maintain uninterrupted data communication, even in exceptionally harsh environments. The RedFox 5528 series is tested and certified to withstand extreme temperatures, vibrations and shocks. The switches only use industrial grade components which contributes towards a market leading mean time between failure (MTBF), maximized service life, and reduced operational and life cycle costs.

Various port configurations are available, all with full gigabit speed, that can be further customized with SFP transceivers. The RedFox 5528 series is available in either a DC or AC power supply as well as a configurable I/O fault contact making the switch ideal for monitoring in industrial applications.

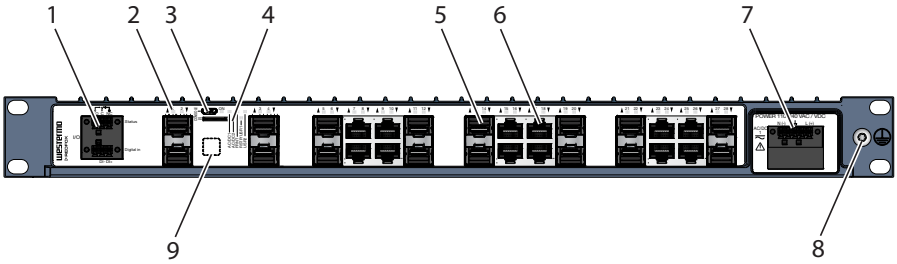
The RedFox 5528 series is powered by the next generation WeOS operating system, which ensures robust operation and support for an expanding range of protocols and features. In addition, recognizing the growing sophistication of cyberattacks, an extensive suite of cyber security tools is available.

The switches are also prepared for routing acceleration, extended cybersecurity and time synchronization IEEE 1588v2 applications, making them an ideal solution to meet future security and bandwidth requirements.

3.2. Available Models

Art. no.	Model	No. of copper ports	No. of SFP ports	LV	HV
3641-4500 3641-4400	RedFox-5528-T28G-LV RedFox-5528-E-T28G-LV	28	-	24-48 VDC	
3641-4508 3641-4408	RedFox-5528-T28G-HV RedFox-5528-E-T28G-HV	28	-		110-240 V AC/DC
3641-4510 3641-4410	RedFox-5528-F4G-T24G-LV RedFox-5528-E-F4G-T24G-LV	24	4	24-48 VDC	
3641-4518 3641-4418	RedFox-5528-F4G-T24G-HV RedFox-5528-E-F4G-T24G-HV	24	4		110-240 V AC/DC
3641-4520 3641-4420	RedFox-5528-F16G-T12G-LV RedFox-5528-E-F16G-T12G-LV	12	16	24-48 VDC	
3641-4528 3641-4428	RedFox-5528-F16G-T12G-HV RedFox-5528-E-F16G-T12G-HV	12	16		110-240 V AC/DC
3641-4600 3641-4700	RedFox-5528-F24G-T4G-LV RedFox-5528-E-F24G-T4G-LV	4	24	24-48 VDC	

3.3. Hardware Overview



No.	Description	No.	Description
1	I/O connection	2	Console port
3	Micro SD	4	LED indicators
5	100/1000 Mbit/s SFP ports (number depending on model)	6	10/100/1000 Mbit/s TX ports (number depending on model)
7	Power Input	8	Protective earth
9	Label with data matrix[a.]		

[a.] The base MAC address and production date of the product is included in the front label data matrix.

Figure 3. Location of interface ports and LED indicators, illustrated by a RedFox-5528-F16G-T12G-HV

3.4. Connector Information

3.4.1. Power Input

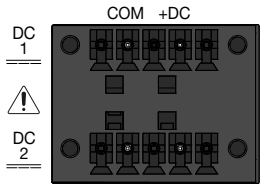
Illustration	Product marking	Direction	Description
	+DC1	Input	Supply voltage
	+DC2	Input	Supply voltage
	-COM	Input	Common
	-COM	Input	Common

Table 3. Power input LV models

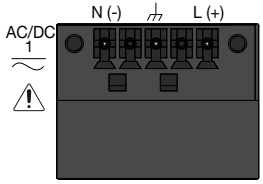
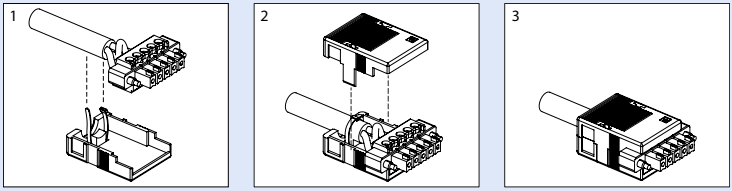
Illustration	Position	Product marking	Direction	Description
	AC/DC1	L(+)	Input	Line/Phase (AC), positive (DC)
		N(-)	Input	Neutral (AC), negative/return (DC)
		⏚	Input	Functional earth

Table 4. Power input HV models

WARNING - PREVENT ACCESS TO HAZARDOUS VOLTAGE CABLE
Apply the protective cap (if delivered with the product) on the power cable, according to the illustrated steps below. The number of pins on the connector plug may vary depending on product.

To prevent accidentally pulling out wires, make sure the power cable and the wires are firmly attached to the protective cap.

For screw connectors, make sure the screws are properly tightened, as well as routing the wires separately from other wires. For connectors with straps, fasten the cable as strain relief, as well as routing the wires separately.



3.4.2. I/O Connection

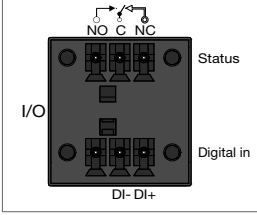
Illustration	Position	Product marking	Direction	Description
	Digital in	DI+	Input	Digital in+
		DI-		Digital in-
	Status	Status NO	Output	Alarm (status) relay contact NO - Normally Open C - Common NC - Normally Closed
		Status C		
		Status NC		

Table 5. I/O connection

The Digital in is an opto-isolated digital input, which can be used to monitor external events.

The Status output is a potential free, opto-isolated, alternation (Form-C) solid-state relay. This can be configured to monitor various alarm events within the product, see WeOS user documentation at www.westermo.com. An external load in series with an external DC voltage source is required for proper functionality.

Unit condition	Status NO- C	Status NC-C
Unpowered / pre-operational or Alarm active	OPEN	CLOSED
Operational and Alarm inactive	CLOSED	OPEN

Table 6. Status output

3.4.3. Console Port

The console port can be used to connect to the CLI (Command Line Interface). The console connector is a USB cable that connects to a FTDI FT232R USB to serial converter internally. For drivers, refer to www.ftdichip.com and download the appropriate VCP driver.

3.4.4. Micro SD

3.4.5. SFP Transceivers

Each SFP slot can hold one SFP transceiver. See *"Transceiver User Guide 6100-0000"* for transceiver handling instructions, which also can be downloaded from the product support pages at www.westermo.com/support/product-support.

In the event of contamination, the optical connectors in the SFP transceivers should only be cleaned by the use of forced nitrogen and some kind of cleaning stick. Recommended cleaning fluids are methyl-, ethyl-, isopropyl- or isobutyl alcohol, hexane or naphtha.

HANDLING OF SFP TRANSCEIVERS

SFP transceivers are supplied with plugs to avoid contamination inside the optical port. They are very sensitive to dust and dirt. If the fibre optic cable is disconnected from the product, a protective plug must be used on the transmitter/receiver. The protective plug must be kept on during transportation. The fibre optic cable must be handled the same way.

3.5. LED Indicators

LED	Status	Description
ON	OFF	Product has no power
	GREEN	All OK, no alarm condition
	RED	Alarm condition, or until product has started up. (Alarm conditions are configurable, see *WeOS5 User Guide*)
RSTP/ USR1	OFF	RSTP disabled
	GREEN	RSTP enabled
	BLINK	Product selected as RSTP/STP root switch
	USR1	Configurable, see *WeOS5 User Guide*
FRNT	OFF	FRNT disabled
	GREEN	FRNT OK
	RED	FRNT error
	FLASH	Product configured as FRNT focal point
DC1	OFF	Product has no power
	GREEN	Power OK on DC1
	RED	Input voltage is below operating voltage limit
DC2	OFF	Product has no power
	GREEN	Power OK on DC2
	RED	Input voltage is below operating voltage limit
USR2	Configurable, see *WeOS5 User Guide*	
TX/FX ports	OFF	No link
	GREEN	Link established
	GREEN FLASH	Data traffic indication
	YELLOW	Port alarm, or port is set in blocking state by link redundancy protocol

Table 7. LED indicators

3.6. Dimensions

Dimensions are stated in mm.

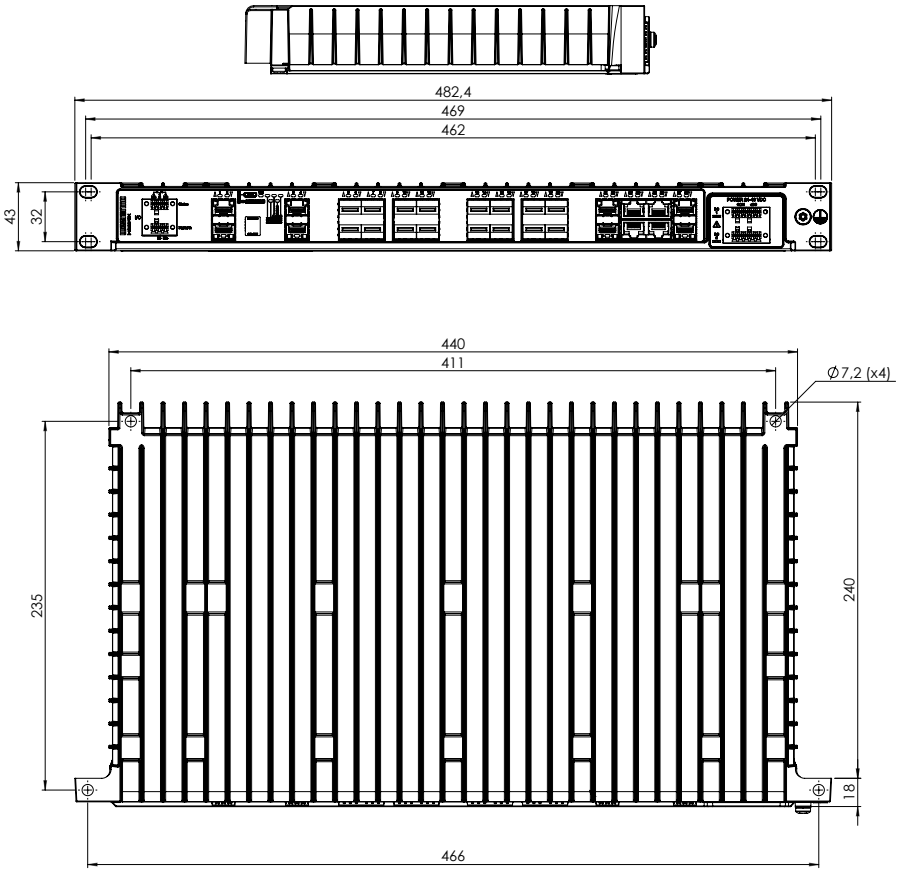


Figure 4. Dimensional drawing

4. Installation

4.1. Mounting

RedFox is designed for installation in 19" rack solutions according to ETSI standard, with a shallow depth of 240 millimetres. It can also be wall mounted as an installation option.

4.1.1. Rack Mounting

The product can be mounted in all directions inside a 19" apparatus cabinet. Use supplied M6x25 (Philips no. 3) or 1/4x1" screws.

4.1.2. Wall Mounting

The product can be wall mounted in all directions. Use maximum 6.4 mm or 1/4" screws.

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.

4.3. Cooling

This product relies on convection cooling. To avoid obstruction of the airflow around the product, follow the spacing recommendations.

For mounting in 19" apparatus cabinet without forced ventilation, a minimum spacing of 1U according to IEC 60297 or 45 mm (1.75") above and below is recommended.

4.3.1. SFP Placement

Ambient temperature influences the lifelength of electronic components and prolonged exposure to high temperatures can reduce the overall lifelength. To maximize the lifelength of SFPs used in the product, it is recommended to consider the following for optimized placement of the SFPs in the RedFox-F24G products in terms of thermal characteristics and heat dissipation capabilities.

Figure 5. SFP placement

Generally, singlemode (SM) and bi-directional (BiDi) SFPs have higher current consumption than multimode (MM) SFPs. Copper (Cu) SFPs can have a power consumption of up to 1.2 W with an active 1000BASE-T link. For applications requiring more than 4 pcs of SM/BiDi or Cu SFPs, it is recommended to place these SFPs in non-adjacent ports to minimize the local self-heating from neighboring SFPs. This to ensure that the maximum SFP lifelength is achieved.

Generally, singlemode (SM) and bi-directional (BiDi) SFPs have higher current consumption than multimode (MM) SFPs. Copper (Cu) SFPs can have a power consumption of up to 1.2 W with an active 1000BASE-T link. For applications requiring multiple SM/BiDi or Cu SFPs, it is recommended to place these SFPs in non-adjacent ports to minimize the local self-heating from neighbouring SFPs. This to ensure that the maximum SFP lifelength is achieved.

See table below for the maximum number of SFPs that can be used considering the different SFP types and the capabilities of the RedFox-F24G products.

SFP type	Max. number of SFPs			Total
	MM	SM/BiDi	Cu	
All MM:	24	-	-	24
4 x SM/BiDi:	20	4	-	24
8 x SM/BiDi:	12	8	-	20
4 x Cu:	16	-	4	20
	8	4	4	16

Table 8. Guidelines on recommended SFP population schemes for some typical use cases

5.1. Interface Specifications

Power port		
Rated voltage	For LV models: 24-48 VDC For HV models: 110-240 V AC/DC	
Operating voltage	For LV models: 18-60 VDC For HV models: 85-264 VAC 47-63 Hz, 85-264 VDC	
Rated current	RedFox-5528-(E-)T28G-LV:	0.95 A at 24 VDC 0.49 A at 48 VDC
	RedFox-5528-(E-)T28G-HV:	0.12 A at 240 V AC/DC 0.24 A at 110 V AC/DC
	RedFox-5528-(E-)F4G-T24G-LV:	1.02 A at 24 VDC 0.51 A at 48 VDC
	RedFox-5528-(E-)F4G-T24G-HV:	0.13 A at 240 V AC/DC 0.26 A at 110 V AC/DC
	RedFox-5528-(E-)F16G-T12G-LV:	1.17 A at 24 VDC 0.59 A at 48 VDC
	RedFox-5528-(E-)F16G-T12G-HV:	0.15 A at 240 V AC/DC 0.30 A at 110 V AC/DC
	RedFox-5528-(E)-F24G-T4G-LV:	1.29 A at 24 VDC 0.64 A at 48 VDC
Fuse rating Component: U2 (LV), U43 (HV)	LV models: 4A(T), 125 VDC, breaking capacity 100 A, UL248-14 HV models: 4A(T), 350 VAC/VDC, breaking capacity 100 A, UL248-14	
Rated frequency	DC (LV models), DC, 50-60 Hz (HV models)	
Inrush current, I^2t[a.]	For all LV-models:	125 mA^2s at 24 VDC 82 mA^2s at 48 VDC
	For all HV-models:	4 mA^2s at 240 VAC, 50 Hz 0.4 mA^2s at 110 VAC, 60 Hz 2 mA^2s at 240 VDC 0.1 mA^2s at 110 VDC
Startup current[b.]	2x nominal current	
Polarity	Reverse polarity protected (LV models, not applicable for HV models)	
Redundant power input	Yes (LV models)	
Isolation	All other ports	
Connector	Detachable screw terminal	
Conductor cross section	0.5-1.5 mm² (AWG 20-16) Use copper conductors only.	
Stripping length cable	7 mm	

Power port	
Cable temperature rating	Minimum temperature rating of the cable to be connected to the field wiring terminals is +77 °C
Tightening torque, terminal screw	0.34 Nm
Tightening torque, screw flange	0.34 Nm
Shielded cable	Not required

[a.] Measured for 1 second at startup

[b.] Recommended external supply current capability for proper startup

I/O connection, Digital input	
Isolation to	All other ports
Connector	Detachable screw terminal
Conductor cross section	0.08 - 1.5 mm² (AWG 28-16). Use copper conductors only.
Stripping length cable	7 mm
Cable temperature rating	Minimum temperature rating of the cable to be connected to the field wiring terminals is +77 °C
Tightening torque, terminal screw	0.22 - 0.25 Nm
Terminal torque, screw flange	0.3 Nm
Circuit type	SELV
Maximum voltage/ current	60 VDC, $I_{IN} \leq 2.9$ mA at 60 VDC
Voltage levels	Logic one: >8 VDC Logic zero: <5 VDC

I/O connection, Relay output	
Contact resistance	Maximum 30 Ω
Isolation to	All other ports
Connector	Detachable screw terminal
Conductor cross section	0.08 - 1.5 mm² (AWG 28-16). Use copper conductors only.
Stripping length cable	7 mm
Cable temperature rating	Minimum temperature rating of the cable to be connected to the field wiring terminals is +77 °C
Tightening torque, terminal screw	0.22 - 0.25 Nm
Terminal torque, screw flange	0.3 Nm
Circuit type	SELV
Type of switch	Solid state, DC general use, DC Pilot duty
Maximum withstand across open contacts	60 VDC (continous)
Permissible current	80 mA (continous), 120 mA (short term 1 s.)

Ethernet TX[a.]	
Electrical specification	IEEE std 802.3
Data rate	10 Mbit/s, 100 Mbit/s, 1000 Mbit/s, manual or auto
Duplex	Full or half, manual or auto
Circuit type	TNV-1
Transmission range	Up to 100 m with CAT5e cable or better
Isolation	All other ports
Cabling	Shielded cable CAT5e or better is recommended
Conductive chassis	Yes

[a.] 10/100/1000 Mbit/s ports are:
RedFox-5528-(E-)T28G-LV/HV: 1-28
RedFox-5528-(E-)F4G-T24G-LV/HV: 5-28
RedFox-5528-(E-)F16G-T12G-LV/HV: 7-10, 15-18, 23-26
RedFox-5528-(E-)F24G-T4G-LV: 23-26

SFP ports[a.]	
Optical/Electrical specification	IEEE std 802.3
Data rate	100 Mbit/s, 1000 Mbit/s[b.]
Duplex	Full or half, manual or auto
Transmission range	Depending on transceiver
Connector	SFP slot holding fibre transceiver

[a.] SFP ports are:
RedFox-5528-(E-)F4G-T24G-LV/HV: 1-4
RedFox-5528-(E-)F16G-T12G-LV/HV: 1-6, 11-14, 19-22, 27-28
RedFox-5528-(E-)F24G-T4G-LV: 1-22, 27-28

[b.] 100 Mbit/s or 1000 Mbit/s tranceiver supported

Console port	
Electrical specification	USB 2.0 device interface
Data rate	Up to 480 Mbps (high-speed mode)
Circuit type	SELV
Maximum supply current	100 mA
Connector	USB Micro B connector in device mode

Micro SD	
Electrical specification	Secure Digital 2.0
Circuit type	SELV
Maximum supply current	100 mA
Connector	Micro SD connector

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
		I/O ports	
		Earth port	
Surge 1.2/50 µs	EN 61000-4-5	Power port	LV models: L-E: ± 1 kV, 12 Ω, 9 µF L-E: ± 2 kV, 42 Ω, 0,5 µF L-L: ± 0,5 kV, 2 Ω, 18 µF L-L: ± 1 kV, 42 Ω, 0,5 µF HV models: L-E: ± 2 kV, 12 Ω, 9 µF L-L: ± 1 kV, 2 Ω, 18 µF
		I/O ports	L-E, L-L: ± 2 kV, 42 Ω, 0.5 µF
		Ethernet ports	L-E: ± 2 kV, 2 Ω direct on shield
Power frequency magnetic field	EN 61000-4-8	Enclosure	HV models: 100 A/m, cont. 1000 A/m, 3 s
Voltage dips and interruptions	EN 61000-4-11	AC power port	HV models: 0% U_T, 1 cycle 0%,U_T, 250/300 cycles at 50/60 Hz 40% U_T,10/12 cycles at 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 GHz) 10 V/m at (2-6 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	
		I/O ports	
		Earth port	
Radiated RF emission	CISPR 16-2-3	Enclosure	LV models: Class B[a.] HV models: Class A (30-6000 MHz)
	ANSI C63.4		LV models: Class B[a.] HV models: Class A (FCC Part 15 B, 30 MHz -25.5 GHz)
Conducted RF emission	CISPR 16-2-1	Power port	LV models: Class B[a.] HV models: Class A
	ANSI C63.4		LV models: Class B[a.] HV models: Class A (FCC Part 15 B)

Environmental phenomena	Basic standard	Description	Test levels
	CISPR 22	Ethernet ports	LV models: Class B[a.] HV models: Class A
Dielectric strength	EN/IEC/UL 62368-1	Power port to all other ports	LV models: 1500 VAC rms, 60 s
		I/O port to all other ports	
		Ethernet ports to all other ports	
	IEC 60255-27	Power port (AC, DC) to all other ports	HV models: 2000 VAC rms, 60 s
		I/O port to all other ports	
	IEEE 802.3	Ethernet ports to all other ports	1500 VAC rms, 60 s

[a.]Except RedFox-5528(-E)-F24G-T4G-LV which is Class A

Table 9. EMC and electrical conditions

Environmental phenomena	Basic standard	Description	Test levels
Temperatures	EN 60068-2-1 EN 60068-2-2	Operational	For LV models: -40 to +74°C (-40 to +165°F) For HV and (E-)F24G-T4G-LV models: -40 to +70°C (-40 to +158°F)
		Storage and transport	-50 to +85°C (-58 to +185°F)
Humidity	EN 60068-2-30	Operational	5-95 % relative humidity
		Storage and transport	
Corrosive gases[a.]	IEC 60068-2-60	Operating	Method 3, 21 days[b.]
Altitude		Operational	2000 m/80 kPa
MTBF hours	MIL-HDBK 217F		RedFox-5528-(E-)F4G-T24G-LV: 371,000 RedFox-5528-(E-)F4G-T24G-HV: 316,000 RedFox-5528-(E-)F16G-T12G-LV: 386,000 RedFox-5528-(E-)F16G-T12G-HV: 353,000 RedFox-5528-(E-)F24G-T4G-LV: 370,000 RedFox-5528-(E-)T28G-LV: 356,000 RedFox-5528-(E-)T28G-HV: 303,000
	Telcordia		RedFox-5528-(E-)F4G-T24G-LV: 643,000 RedFox-5528-(E-)F4G-T24G-HV: 678,000 RedFox-5528-(E-)F16G-T12G-LV: 706,000 RedFox-5528-(E-)F16G-T12G-HV: 710,000 RedFox-5528-(E-)F24G-T4G-LV: 860,000 RedFox-5528-(E-)T28G-LV: 620,000 RedFox-5528-(E-)T28G-HV: 653,000
Vibration	IEC 60068-2-6 (sine)	Operational	2 g rms 5-500 Hz, 5 sweeps
	IEC 60068-2-64 (random)	Operational, endurance test	12 dB/octave, 2-13.2 Hz, 0.011 g^2/Hz, 13.2-100 Hz, 1.0 grms, 150 minutes per axis
			5-2000 Hz, rms 2.3 m/s^2 ,1.5h
Shock	IEC 60068-2-27	Operational	30 g, 11 ms
Enclosure	EN/IEC/UL 62368-1	Aluminium	Fire enclosure
Weight			3.8 kg

Environmental phenomena	Basic standard	Description	Test levels
Degree of protection	EN 60529	Enclosure	IP40
Cooling			Convection
Pollution degree	EN/IEC/UL 61010-1, EN 50124-1, EN/IEC/UL 62368-1		HV models: PD2 Macro and Micro Environment
Overvoltage category	EN/IEC/UL 61010-1, EN/IEC/UL 62368-1		HV models: OVC II
Insulation class	EN/IEC/UL 61010-1		HV models: Class I equipment
Location			Indoor use

[a.] For LV models only

[b.] Method 3, 21 days corresponds to Harsh Industrial Environment G3 which is defined in ANSI/ISA 17.04: 2015

Table 10. Environmental and mechanical conditions

6. Revision Notes

Revision	Date	Change description
Rev. M	Feb 2025	Illustrations of the products are updated
Rev. N	Dec 2024	2.2. Safety Information; Warning - Prevent access to hazardous voltage cable updated, 2.4 Product Disposal updated, 2.5.1 Agency Approvals and Standards Compliance updated, 2.5.2 EN/IEC/UL 61010-2-201 Notice updated, 3.2 Available Models updated, 4.3 Cooling; text updated, 4.3.1 SFP Placement; new chapter, 5.1 Interface Specifications updated with references to new RedFox-5528-(E-)F24G-T4G-LV models, 5.2 Type Tests and Environmental Conditions updated with references to new RedFox-5528-(E-)F24G-T4G-LV models
Rev. M	Oct. 2023	3.2 Footnote "Selective sales approval" deleted
Rev. L	April 2023	3.5 LED Indicators updated (ON; Blink deleted)
Rev. K	Oct. 2022	All MV model references in the user guide are deleted. 5.1 Interface Specifications updated (rated current updated
Rev. J	Jan. 2022	2.5.1 Agency Approvals and Standards Compliance updated (UL added to EN/IEC 61010-1, EN/IEC added to UL 61010-2-201), 2.5.2 EN/IEC/UL 61010-2-210 Notice added, 2.5.4 UL 62368-1 DC Mains Notice added, 5.2 Type Tests and Environmental Conditions (added UL to EN/IEC 61010-1, added EN/IEC/UL 62368-1)
Rev. I	June 2021	2.5.1 Agency Approvals and Standards Compliance updated (EN/IEC/UL 60950-1 > 62368-1), 2.5.4 EN/IEC/UL 62368-1 Notice new chapter, 5.2 Type Test and Environmental Conditions table updated
Rev. H	Nov. 2020	2.2 Safety Information updated, 2.5.1 Agency Approvals and Standards Compliance, 3.4.1 Power input updated, 3.4.3 I/O Connection updated, 4.1.1 Rack Mounting, illustration updated, 4.1.2 Wall Mounting, illustration updated, 5.1 Interface Specifications updated (Power)
Rev. G	Oct. 2020	Westermo logo updated, illustrations throughout user guide updated with blue colour, 2.2 Safety information; warnings updated, 2.3 Care Recommendations; text updated, 2.5.1 Agency Approvals and Standards Compliance; table updated, 2.5.2 new chapter, 2.5.3 FCC Part 15.105 Class B Notice; footnote added, 2.5.4 Corrosive Environment; footnote added, 3.1 Product Description; text updated, 3.2 Available Models; table updated, 3.4.1 Power Input; table added, 3.4.2 I/O Connection; table added, note deleted, 3.4.4 new chapter, 3.4.5 SFP Transceivers; text updated, 3.5 LED Indicators; table updated, 4.1.1 Rack Mounting; text updated, 4.2 Earth Connection; text updated, 5.1 Interface Specifications; tables updated, 5.2 Type Tests and Environmental Conditions; tables updated
Rev. F	Nov. 2019	2.2 Safety Information and 2.3 Care Recommendations texts are updated to match the new revision of "General and Safety Information" (100-5001). old 2.4 Maintenance deleted, old 2.5 Fibre Optics Handling deleted, old 2.6 Cleaning Optical Connectors

Revision	Date	Change description
		deleted (replaced with 3.4.4.1), 3.2 Available Models, table updated (name change HV to MV), 3.4.4 Warning added, 3.4.4.1 new chapter, 5.1 Interface Specifications table updated (name change HV to MV)
Rev. E	Oct. 2019	1.5 WeOS text updated, 3.2 Available Models table updated (name change HV to MV), 3.3 Hardware Overview Figure 3 text updated (name change HV to MV), 3.6 Dimensions text updated (name change HV to MV), 4.1 Mounting text updated, 5.1 Interface Specifications table updated (name change HV to MV), 5.2 Type Test and Environmental Conditions table updated (name change HV to MV)
Rev. D	June 2019	Product name change throughout the user guide. USB port removed in illustrations and information. "Unit" changed to "product". 1.3 Software tools updated, 2.1 Warning levels updated (Caution), 2.2 Safety information updated, 2.3 Care recommendations updated, 2.5 Fibre optic handling updated, 2.7 Product disposal updated, 2.8.1 Agency approvals and standard compliance updated, 2.8.4 Simplified declaration of conformity updated, 3.1 Product description updated, 3.2 Available models updated, 3.3 Hardware overview updated, 3.4.1 Power input and I/O updated, 3.5 LED indicators updated, 3.6 Dimensions updated, 5.1 Interface specifications updated, 5.2 Type test and environmental conditions updated
Rev. C	Oct. 2018	2.2 New warning added, 2.7 Environmental protection updated to Product disposal, 2.8.1 Agency approvals updated, 2.8.3 Corrosive gases upgraded to Caution instead of Notice, 2.8.4 DoC updated, 3.1 Text updated, 3.4.1 Warning updated with illustrations, 3.4.4 Figure 3 deleted (old), 5.1 Fuse rating updated
Rev. B	Nov. 2017	2.2 Safety information; Caution - Class 1 laser product updated, 2.3 Care Recommendations updated, 2.8.3 new chapter added, 3.3 text added, 5.1 Interface Specifications updated - inrush current, SFP ports, 5.2 Type Tests and Environmental Conditions updated - Surge updated, Corrosive gased added, Vibration updated, Radiated RF emission and Conducted RF emission updated
Rev. A	July 2017	First issue of the user guide

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