Managed Industrial 1/10Gbit/s Ethernet Switch

- Industrial Ethernet Switch with 19" 1U chassis,
- Up to 30 x 10/100/1000 Mbps or 26x1Gbit/s and 4x1/10Gbit/s optional Ethernet ports with UTP RJ-45, fiber SFP removable transceivers or non removable fiber transceivers, fiber with LC, SC, connectors, SFP slots,
- DDMI monitoring functions,
- **Ethernet protection support: ITU-T G.8032 v2 ring** topology protection with multi ring and dual homing support, up to 20ms protection and recovery switching with support, up to 64 rings at the same time
- Spanning Tree, Rapid Spanning Tree and Multiple Spanning Tree protocol support,
- **HSR** and **PRP** (**IEC 62439-3 Clause 5 & 4**) protection support on dedicated ports
- **Optionally**[1] **IEEE 1588-2008v.2 (PTPv2)**: precise time protocol synchronization, hardware timestamping; precise time synchronization for real-time applications with support of **IEEE C37.238-2011, IEC61850-9-3 - Power Profile**,
- Hardware ready for **IEEE 1588v.3 (PTPv3)**,
- Optional hardware and software support for Synchronous Ethernet,
- Authentication **IEEE802.1x, Radius, Tacacs+** - AAA
- Secure modules with **IEEE 802.1ae MACsec** - data encryption and integrity 128-bit AES keys on each UTP or 256-bit AES optional on dedicated UTP ports,
- Optional L3 routing hardware support – static routing.
- Optional **EoMPLS LER (PWE)**
- Optional SAT: **RFC 2544**
- Optional Advanced Service Activation Measurements **(SAM) Y.1564**
- Reflectometer (VCT) test for of used pairs in the UTP cable
- **IEC61850–3, IEEE1613** design compliance for power substation,
- **PROFINET** Conformance Class A,
- Management IP, IPv6, Web browser, telnet, SSH and local CLI console, SNMP v1/v2c/v3,
- **PoE÷PoE++** on all ports up to 90W power, with PoE watchdog and 500W total power on device – for DC power supply option only. PoE is optional for UTP ports
- **-40 to +70°C** operating temperature,
- Hot swap redundant power supply 80 – 350 V DC, 70 – 250 V AC and 48 V DC.
- Load balance mechanism between two redundant power supplies.

[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

Description of the device

Transmission

HYPERION-402 is the advanced 10G/1G/100M modular Ethernet switch with up 80Gbps matrix capacity dedicated to provide the transmission of applications, supervision and operation of power stations, CCTV and other applications for the industry.

Network redundancy

HYPERION-402 switch supports Ethernet Ring Protection Switching according to the ITU-T G.8032 standard, providing up to 20ms protection and recovery switching for Ethernet traffic in ring topologies with support, up to 64 rings at the same time. Standard resiliency spanning tree protocols like STP, RSTP, MSTP are also supported to ensure system reliability. In dedicated version PRP/HSR REDBOX functionality compliant with IEC 62439-3 Clause 5 & 4 is implemented.

Environmental limits

Switch was designed to operate in temperature range from -40 to 70° C. Solid **IP-30** metal enclosures ensure stable operation in heavy environment. **HYPERION-402** can be mounted in standard 19" rack or on a standard DIN rail. Redundant power supply provides stable and continuous operation in case of one power supply failure.
HYPERION-402 device supports Energy Efficient Ethernet functionality (IEEE 802.3az) allowing for less power consumption by putting Ethernet ports into "sleep" mode during periods of low data activity and adjusting the power according to Ethernet cable length.

Network Performance and synchronization

HYPERION-402 supports ***IEEE 1588v.2*** Precision Time Protocol (function optional[1]) with support for **IEEE C37.238-2011, IEC 61850-9-3** power profile to provide precise time synchronization for applications with restrictive real-time requirements. The servo mechanism and filtering is implemented. As an option synchronous Ethernet is supported with clock reference to PTP blocks. Built-in NTP server could also provide time reference taken from PTP or SyncE sources.

VLAN, Q-in-Q

Ethernet transmission channels may be set as transparent or divided into independent transmission channels through the virtual VLAN mechanism. Device supports advanced Ethernet interface features like ***VLAN*** stacking (***QinQ***, ***IEEE802.1ad***), private VLANs, ***LACP*** links aggregation, jumbo frame size, programmable rate limiting and port priority setting. Device supports Ethernet OAM features (Link OAM and Service OAM), providing effective fault management and performance monitoring (remote loopbacks, continuity checks using CFM messages, performance monitoring measurements such as frame loss ratio, frame delay.

Network security

The **HYPERION-402** switches can be equipped with the MACSec IEEE 802.1ae security protocol, which in addition to data encryption also has a data integrity function that enables detection of events involving entering false data into the network during attempted hacker attacks of the "man in the middle" type. MACsec also enables the data integrity function itself to be ensured without encryption. For transmission encryption we can use 128 or 256-bit AES keys on dedicated Ethernet ports or 128-bit AES keys for each UTP ports.

Management

Embedded ***HTTPs*** server, ***SSH*** server and ***SNMPv3*** agent allow free configuration of the device performance by standard Web browser and continuous monitoring from any management platforms equipped with SNMP client. In addition SSH and SNMPv3 provide secure communication with remote devices using encrypted messages. Remote software update is supported to allow further functionality improvement.

Applications

HYPERION-402 switch can be used to provide reliable connections between ***SCADA*** system and network controllers, to create ***IP CCTV*** monitoring systems, to provide communication for wind farms, to monitor environmental parameters in harsh environment, to realize smart grid applications and in many others industrial applications

[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

Example of such application is presented on the drawing below.

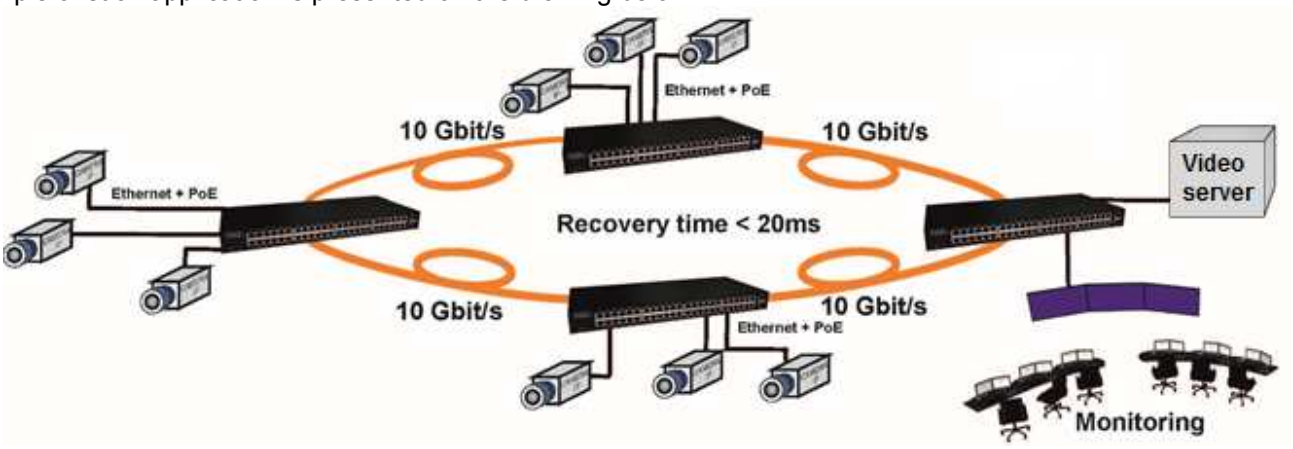


Fig. 1. The sample application, illustrating the connection of peripheral systems to measure the detectors or measuring environmental parameters in power stations unattended

Technical specifications

Ethernet switch global specifications

- **Ethernet:** Store and forward switching packet, up to 36x 10/100/1000 Mbps ports, Jumbo frame: 9600 B, Packet buffer size: 4 MB, Forwarding rate: 80 Gbps,
- **Mac Table size**: 32k,
- **VLAN:** 4094 IDs, 802.1Q, 802.1QinQ, VLAN translation, private VLAN,
- **QoS:** Weighted Round Robin, Strict Priority, 8 priority queues per port, queue egress shaper, PCP 802.1p, DSCP/ToS, Port Rate Limit ingress policing and egress shaping,
- **Storm Protection**: Broadcast, Multicast, Unknown DA,
- **IGMP snooping** V1/V2/V3, IGMP Filtering/ Throttling, IGMP query, IGMP proxy reporting, MLD snooping V1/V2,
- **Port Mirroring:** copy network traffic to specified port, ingress or egress direction or both,
- **Port Aggregation:** Static 5 groups**,** dynamic LACP,
- **Port Loop Protection,**
- **RMON, MIB II, DNS, NTP,**
- **IEEE802.1ab LLDP, LLDP-MED**
- **SFP DDMI:** Digital Diagnostic Monitoring for all SFP slots**,**
- Optional **Synchronous Ethernet G.8261:** SSM monit, clock source from all traffic ports,
- **Power over Ethernet++:** optional support up to 90W per port**.**
- Optional **L3 routing hardware support** – static routing.
- Optional **EoMPLS LER** (PWE)
- Optional SAT: **RFC 2544**
- Optional Advanced Service Activation Measurements **(SAM) Y.1564**
- **UTP module reflectometric test:** Each RJ45 port can perform a reflectometric test of all pairs (4 pairs for 1000Base-T and 2 pairs for 10 / 100Base-Tx) for twisted cable, i.e. line short circuit diagnostics or line interruption diagnostics, and total cable length for next active device

[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

Supported standards and protocols

General information

- IEEE 802.3 10Base-T Ethernet,
- IEEE 802.3u 100Base-TX, 100Base-FX Fast Ethernet,
- IEEE 802.3ab 1000Base-T,
- IEEE 802.3z Gigabit Fiber,
- IEEE 802.3x Flow Control and Back-pressure,
- IEEE 802.1p Class of Service (CoS),
- IEEE 802.1Q VLAN, up to 4095 active VLANs,
- IEEE 802.1ad QinQ,
- IEEE 802.3ad Link Aggregation Protocol (LACP),
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP),
- IEEE 802.1ak Multiple Registration Protocol (MRP, GARP, GVRP),
- IEEE 802.3az Energy Efficient Ethernet.

Network redundancy

- IEEE 802.1D Spanning Tree Protocol (STP),
- IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP),
- IEEE 802.1s Multiple Spanning Tree Protocol (MSTP),
- ITU-T G.8032 v2 Ethernet Ring Protection Switching, Major Ring, Sub Ring - DHP dual homing protection,
- ITU-T G.8031 Ethernet Linear Protection Switching 1+1, 1:1,
- Each redundancy protocol is available on all ports and on all modules without management port in CUS module.
- MPLS EVC: 1:1 E-Line protection - Optional
- MPLS-TP 1:1 LSP protection – Optional
- IEC 62439-3 Clause 4 support -optional
- IEC 62439-3 Clause 5 support- optional

Network security

- IEEE 802.1x Port Based Network Access Protocol, EAP, TACACS+, RADIUS - authentication, authorization and accounting functions - AAA
- IEEE 802.1AE MAC security (MACsec) - data encryption and integrity, support GCM-AES-128, 128 bit AES keys,
- IEEE 802.1AEbn-2011 MAC security (MACsec) - data encryption and integrity, support GCM-AES-256, 256 bit AES keys,

Network synchronization

- Optional function[1]: IEEE 1588-2008 Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems:
- BMC algorithm
- Transparent clock: peer to peer, end to end with one step, two step;
- Boundary clock;
- Ordinary clock;
- Absolute maximum time error 200 ns;
- Relative time error 50 ns per network hop;
- IEEE C37.238-2011 Standard Profile for Use of IEEE 1588 Precision Time Protocol in Power System Applications,
- IEC 61850-9-3 Communication networks and systems for power utility automation - Part 9-3: Precision time
- protocol profile for power utility automation,
- Synchronous Ethernet, G.8261: Timing and synchronization aspects in packet networks - optional
- Synchronization precision: ±50 ns;

[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

Power supply

- Power supply DC 36-72V, 80-350V
- Power supply AC 70-250V
- Two power supply inputs, redundant
- Screw connection for DC power supply
- IEC socket for AC power
- Total power consumption 50W without PoE

Power over Ethernet

- IEEE 802.3af Power over Ethernet (option),
- IEEE 802.3at Power over Ethernet Plus (option),
- Support for PoE++ from 15W to 90W per RJ45 port, but only with 40 to 60V DC power supply (for all ports max power up to 90W).

Management

- IPv4, IPv6, ARP, ICMP, TCP, UDP, DNS,
- DHCP Client, Server, Relay Option 82,
- Management CPU has up to 10 network interfaces with different IP address, separate by VLAN,
- Access permission: password, configurable range of source IP address,
- Privilege level for configuration/status - read/write, configuration independent for multi-user
- HTTP, HTTPS - the device has a self-signed certificate installed, but it is possible to install another certificate,
- Telnet, SSH, NTP, TFTP, Syslog - cooperation with the syslog server
- SNMP v1/v2c/v3, SNMP trap, inform,
- Local (Ethernet/RS-232) and Remote CLI,
- System Log of events and alarms,
- MIB II.

Environment

- Operating temperature: -40 to 70°C for 0,2m/s Air Flow
- Operating temperature: -40 to 60°C for 0m/s Air Flow
- Operating humidity (non condensing): 5%-95%.

Supported standards, recommendations and directives EMC Security* for all of Hyperion 402 elements*

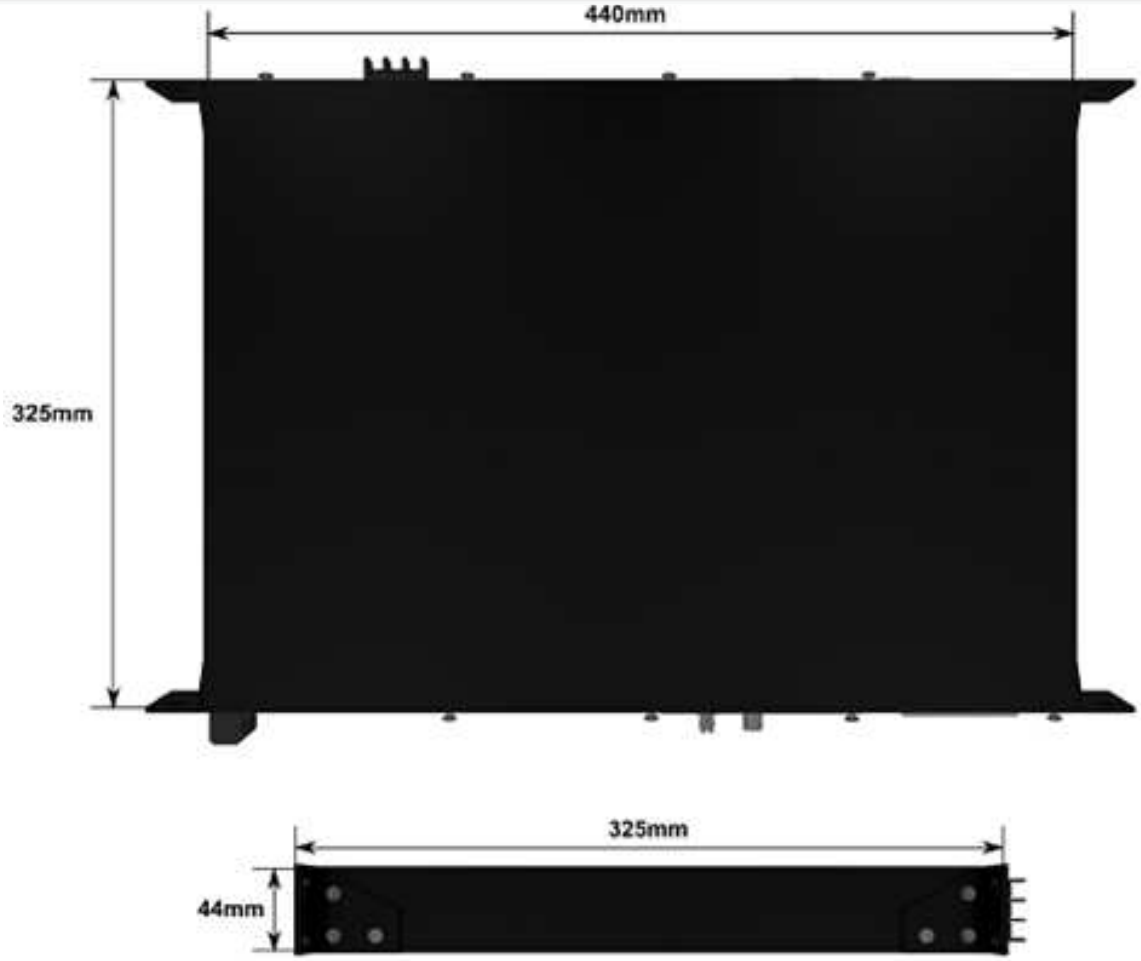
- EN 55011:2012
- EN 55024:2011/A1:2015-08
- EN 60950-1:2007/A2:2014-05
- EN 60825-1:2014-11
- IEC 61000-4-2 Electromagnetic compatibility (EMC)- Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
- IEC 61000-4-3 Electromagnetic compatibility (EMC)- Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
- IEC 61000-4-4 Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
- IEC 61000-4-5 Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
- IEC 61000-4-6 Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
- IEC 61000-4-8 Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test
- IEC 61000-4-11 Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests
- IEC 61000-4-12 Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test

[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

- IEC 61000-4-29 Electromagnetic compatibility (EMC) – Part 4-29: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests,
- IEC 61850-3 Communication networks and systems for power utility automation
- IEEE 1613-2009 - IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations

* - list of supported standards may vary with the development of the device

Mechanical drawing



[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

Code

HYPERION-402(.X)-Y-(L)-(Z)-(SE)-(R)-(U)

Production version:
Without symbol – standard
2 – version dedicated for power substations

Versions of HYPERION 402:
1 – 32x RJ45(10M/100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)
2 – 24x RJ45(10M/100M/1G) + 8x SFP(100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)
3 – 16x RJ45(10M/100M/1G) + 16x SFP(100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)
4 – 8x RJ45(10M/100M/1G) + 24x SFP(100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)
5* – 32x SFP(100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)
6 – 24x RJ45(10M/100M/1G) + 2x SFP/ SFP+ (1G/2.5G/10G)
7 – 8x RJ45(10M/100M/1G) + 16x SFP(100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)
8** – 16x RJ45(10M/100M/1G) + 2x SFP/ SFP+ (1G/2.5G/10G)
9** – 16x RJ45(10M/100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G)

* - Not applicable for PoE versions

** - Offer and availability upon agreement with the manufacturer

L3 routing, RFC tests:
L3 – static routing, RFC2544 and Y.1564 tests

Option SyncE:
SE – Synchronous Ethernet

Optional PoE:
S8P – 8x PoE+ PSE
S16P – 16x PoE+ PSE
S24P – 24x PoE+ PSE
S32P – 32x PoE+ PSE
S8P2 – 8x PoE++ PSE
S16P2* – 16x PoE++ PSE
S24P2* – 24x PoE++ PSE
S32P2* – 32x PoE++ PSE

* - the first 8 ports can work with power up to 90W and the remaining 60W

Optional modules:
R* – REDBOX PRP/HSR support on additional SFP ports (2x SFP 1G) present in the device.

* - If Redbox is present in H402 only version 6,7,8,9 are possible

Power supply:
7[1] - 36-72VDC, for PoE in the range 45-57VDC
C[3] - 120-260V DC/100-240V AC
77p[1] - 36-72VDC redundant, for PoE in the range 45-57VDC
CCp[3] - 120-260V DC/100-240V AC, - redundant

[1] – required voltages for PoE + (max 30W) 52-57VDC and for PoE ++ (max 90W) 55-57VDC
[2] – for this option, PoE power is available only from the 36-72V DC power supply
[3] – option available only for devices without PoE

Attention - on all ports at the moment max. 500W for 55VDC

[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2

Examples of code:

HYPERION-402.2-1-SE-77p	- Hyperion-402, in version dedicated for power substationswith interface 32x RJ45(10M/100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G), PTP and Synchronous Ethernet, redundant power supply 36-72VDC
HYPERION-402-2-S24P-77p	- Hyperion-402, in version standard with interface 24x RJ45 (10M/100M/1G) + 8x SFP(100M/1G) + 4x SFP/ SFP+ (1G/2.5G/10G), redundant power supply 36-72VDC; 24x ports PoE+

ORDERING:

- **BTPP-85192-SRC** 10G, 850nm, MM, 300m, SFP, LC, 0~70OC, SFP+
- **BTPP-31192-LRC** 10G, 1310nm, SM, 10km, SFP, LC, 0~70OC, SFP+
- **BTPP-31192-L2C** 10G, 1310nm, SM, 20km, SFP, LC, 0~70OC, SFP+
- **BTPP-55192-ERC** 10G, 1550nm, SM, 40km, SFP, LC, 0~70OC, SFP+
- **BTPP-55192-ZRC** 10G, 1550nm, SM, 80m, SFP, LC, 0~70OC, SFP+

- **BTPB-8524-S5TD** 1.25G, 850nm, MM, 550m, SFP, LC, -40~85°C, (support 100M)
- **BTPB-3124-L2TD** 1.25G, 1310nm, MM/SM, 2/20km, SFP, LC, -40~85°C, (support 100M)
- **BTPB-3124-L4TD** 1.25G, 1310nm, SM, 40km, SFP, LC, -40~85°C, (support 100M)
- **BTPB-5524-L4TD** 1.25G, 1550nm, SM, 40km, SFP, LC, -40~85°C, (support 100M)
- **BTPB-5524-L8TD** 1.25G, 1550nm, SM, 80km, SFP, LC, -40~85°C, (support 100M)
- **BTPB-5524-12TD** 1.25G, 1550nm, SM, 120km, SFP, LC, -40~85°C, (support 100M)

- **BTP-3131-L2TD** 1.25G-3.125G, 1310nm, SM, 20km, SFP, LC, -40~85°C
- **BTP-3131-L4TD** 1.25G-3.125G, 1550nm, SM, 40km, SFP, LC, -40~85°C
- **BTP-3131-L8TD** 1.25G-3.125G, 1550nm, SM, 80km, SFP, LC, -40~85°C
- **BTP-3131-L12TD** 1.25G-3.125G, 1550nm, SM, 120km, SFP, LC, -40~85°C

List of proposed power supplies for BITSTREAM devices

Model	Output voltage range	Rated power	Number of ports for PoE support (15W)	Number of ports for PoE+ support (30W)	Number of ports for PoE++ support (60W)	Number of ports for PoE++ support (90W)	Working temperature C-Standard T-Industrial	COMMENTS
	DC	W						
ZAS-48V56-60-R-T	48 - 56 V	60	3	1	0	0	-20°C ~ +70°C	PoE support
ZAS-48V55-120-R-T	48 - 55 V	120	6	3	1	1	-20°C ~ +70°C	PoE support
ZAS-48V56-240-R-T	47 - 56 V	240	13	6	3	2	-20°C ~ +70°C	PoE support
ZAS-48V56-480-R-T	47 - 56 V	480	30	14	7	4	-20°C ~ +70°C	PoE support
ZAS-48V55-960-R-T	48 - 55 V	960	60	30	15	8	-20°C ~ +70°C	PoE support

Legend of symbols: W - plug-in; S - standalone; R - DIN rail mounting

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[1] - The IEEE 1588: 2008 PTP function is standard only in version 402.2