



## FEATURED HIGHLIGHTS

- Supports HSR (IEC 62439-3 Clause 5) and PRP (IEC 62439-3 Clause 4)
- IEC 61850-3 and IEEE 1613 certification
- Integrated IEEE 1588v2 hardware-based BC and TC (-BC/SB version)
- Maximum 128Gbps switching capacity, 95.24Mpps throughput
- Rugged industrial design for harsh environments between -40°C to +85°C
- Flexible modular configuration, 3 Module-dedicated slots
- Up to 24 Gigabit ports, and 4x10 Gigabit SFP Uplink slots, 1PPS BNC
- ITU-T G.8032 ERPS Ring, RSTP, or MRP (Manager/ Client) redundancy
- Advanced management features such as QoS and VLAN

## PRODUCT DESCRIPTION

**Flexibility:** ATOP's high-density RHG9628 Rack-mounted managed switch provides the flexibility needed for your application demands. You can choose from among six different Core versions: based on power supply, uplink port configurations and embedded Hardware-Assisted Boundary Clock feature. And you can choose from six different 4- or 8-Port modules to customize your device in a very simple way.

**Designed for Substations:** Layer-3 routing support BGPv4, IPv4 static routing, RIP v1/v2 and OSPFv2.

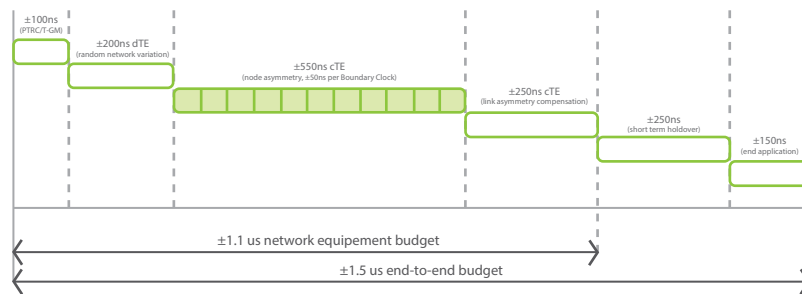
**Award-winning Performance:** RHG9628's IEEE1588v2 Hardware-PTP version received recognition for nanosecond-level accuracy. This makes RHG9628 one of the most reliable GMC backups. And being embedded with Synchronous Ethernet and with full support for PTP profiles.

**High-availability, versatility and power:** When equipped with *High-Availability HSR/PRP modules*, RHG9628 complies with the most stringent redundancy requirements, ensuring no packet loss and guaranteeing GOOSE packets arrive at their respective destinations. RHG9628's high performance provides a network redundant self-recovery mechanism of under 20ms on full load. This enables you to build a reliable network through almost any redundant ring topology. RHG9628 supports ITU-T G.8032 ERPS Ring, IEEE802.1D-2004 RSTP, STP, MSTP, MRP (Manager/ Client), iA-Ring, iA-Chain and many other compatible ring protocols for network redundancy. With a Multifunctional web dashboard, its offers intelligent features such as Quality of service (QoS), IGMP, port mirroring, and security. It is available in two power input variants: one for low-DC voltage (redundant 24~120VDC input) and one for the more popular High-Voltage applications in the distribution grid (redundant 110~240VAC, 24~120VDC or 120~380VDC input). Additional 4 x 10 Gigabit uplink SFP slots allow RHG9628 to be the backbone of the substation.

# BOUNDARY CLOCK APPLICATION

## High accuracy delivered, even in holdover mode

A boundary clock, is normally a switch that doesn't act transparently to the slaves in the network. Directly connected to the Grandmaster, large networks with thousands of slaves would overload the Grandmaster. So the need for a device that acts as a slave towards the master and as a master towards slaves is achieved with a boundary clock. ATOP's RHG9628 Boundary clock, once synchronized, achieves the 50ns precision set forth in the ITU-T G.8271.1 recommendation. And it is equipped with a high-precision OCXO to guarantee that precision in the event of a link or device failure, with a maximum time-drift of 250ns from GNSS time. All this can guarantee a maximum 1.5us end-to-end time deviation budget from the GNSS to the end-application, up to 10 BC hierarchies.

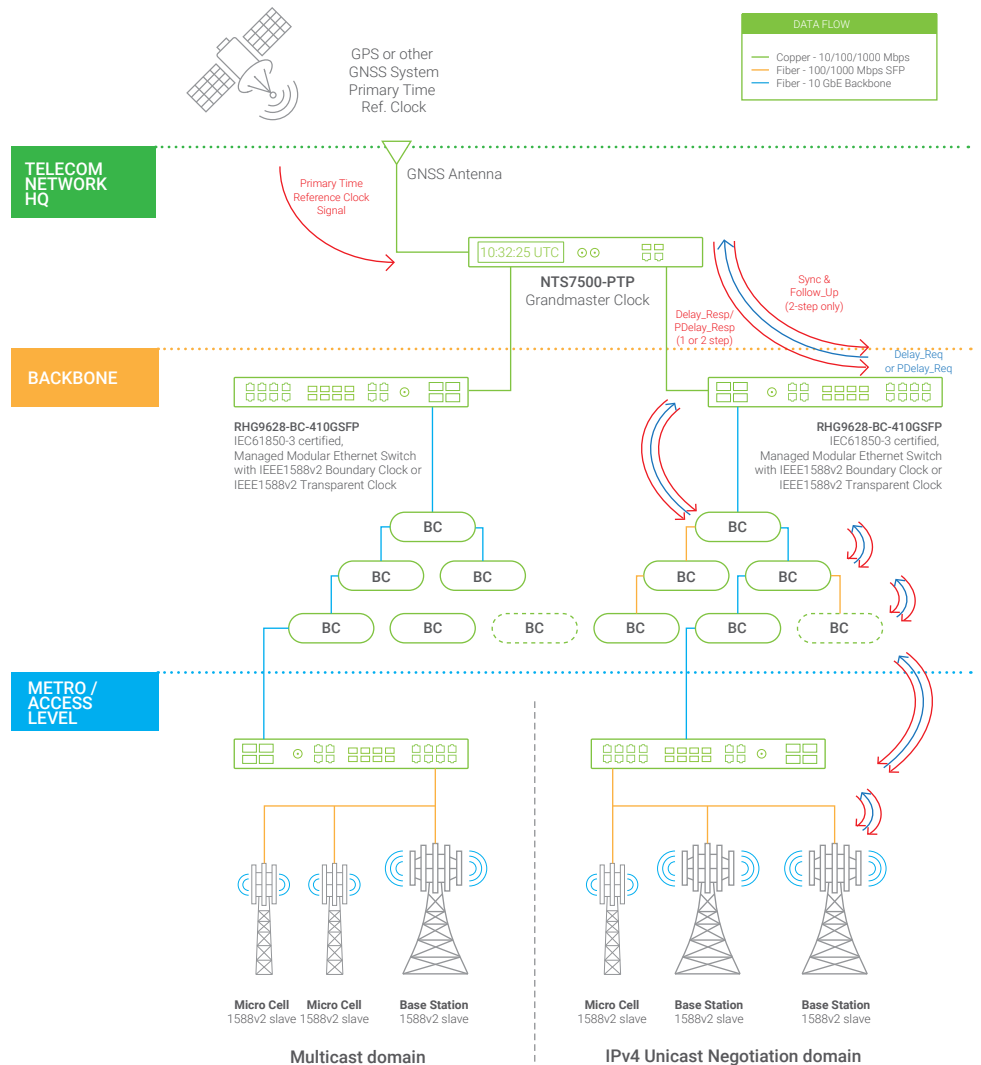


## Application Example

The network diagram shows the use of ATOP's NTS7500 Grandmaster Clock and RHG9628 Boundary clock application.

RHG9628 can easily function as a both Access/Aggregation switch with up to 4x1/10Gbps SFP slots and as a PTP boundary clock. Up to 28 ports can be individually configured to run different instances of IEEE1588v2.

A wide variety of settings are allowed within profiles – such as the Power, and Enterprise profiles. RHG 9628-BS supports Synchronous Ethernet, allowing the transport of time and frequency, which is important for legacy networks such as SDH-SONET.

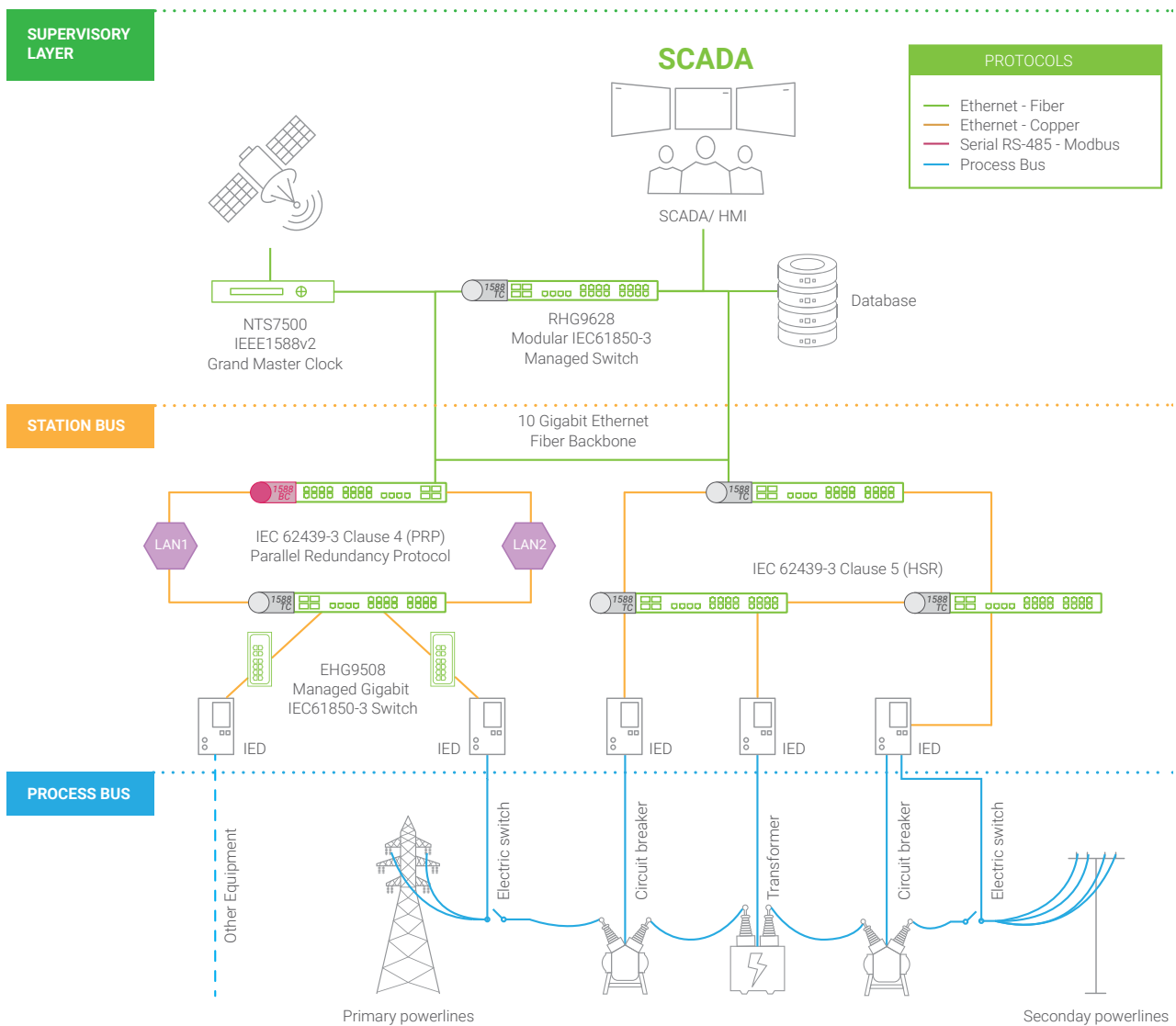


# HIGH AVAILABILITY APPLICATION

## Zero packet loss, on multiple ports

Install a 4-port Gigabit RJ45 or SFP High-Availability module in any of the module slots in RHG9628 CPU board, and you're good to go. Congratulations: your network is now fully compliant with IEC62439-3 Clause 4- 2016 (PRP) and IEC62439-3 Clause 5-2016 (HSR). Simultaneously. Though this 4-port module.

Through HSR/PRP technology, ATOP's device will replicate the packet through 2 redundant paths and the end-application will have the risks to lose a packet almost zeroed. This is an example of a mixed HSR/PRP network, where RHG9628 is used flexibly as a Transparent or a Boundary Clock and as an HSR/PRP manager.



## IEEE1588v2 PTP, IEC61850-9-3 Power Profile and HSR/PRP

RHG9628 is an advanced and flexible platform. It embeds high-bandwidth Switching fabric, Accurate hardware-based Boundary Clock or Transparent Clock, IEC61850-3 compliant hardware, and fully supports IEC/IEEE61850-9-3 - 2016 Power Profile. Also on HSR/PRP ports. When properly configured, our Switch can seamlessly provide Peer-to-Peer transparent clock and Boundary Clock on all ports, HSR/PRP ports included.

## CONFIGURATION EXAMPLE



**RHG9628-410GSFP-SB-HV** Main unit, with 4x 10 Gigabit SFP uplink slots, 1PPS BNC, 120-380VDC, HW PTP BC/TC and SyncE



**RHG9X28-M1**  
8-port Gigabit RJ45 module supporting IEEE1588v2 Hardware BC/TC.



**RHG9X28-M5**  
4-port 10/100/1000Mbps RJ45 High-Avail. module, supporting HSR/PRP.

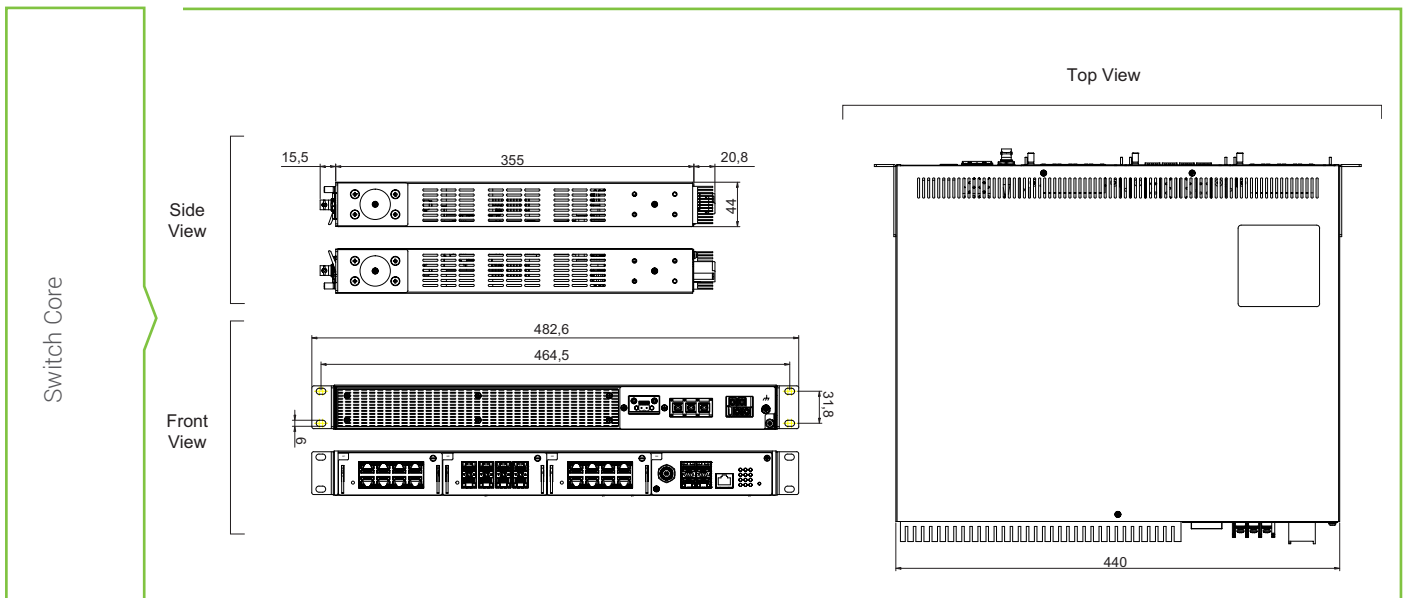


**RHG9X28-M2**  
8-port Gigabit SFP module supporting IEEE1588v2 Hardware BC/TC.

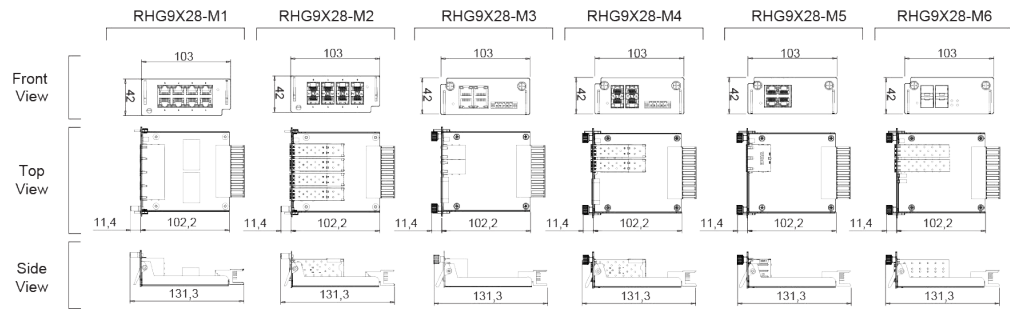


IEC61850-3 certified Layer-3 Managed Switch, with 8 Gigabit ports, 4 10/100/1000 High-Availability HSR/PRP ports, 8 Gigabit SFP slots, one PPS output BNC (F) plug, and 4 x 10 Gigabit SFP uplinks, supporting IEEE1588v2 HW BC and Synchronous Ethernet.

## DIMENSIONS & LAYOUT



RHG9X28-M1  
 RHG9X28-M2  
 RHG9X28-M3  
 RHG9X28-M4  
 RHG9X28-M5  
 RHG9X28-M6



## SPECIFICATIONS

### Switch core

Model Name RHG9628

### Switch Properties

Priority Queues	8
VLAN Table	512
MAC-Based VLAN	512
VLAN ID Range	VID 1 to 4094
Trunk Group	8
Static IGMP Groups	128
Dynamic IGMP Groups	256
MAC Table Size	16k
Packet Buffer Size	1.5 MB
Jumbo Frame	9216 Byte
Switching Fabric Capacity	128 Gbps
Maximum throughput	95.24 Mpps

### Ethernet

Standards

- IEEE 802.3 for 10BASE-T
- IEEE 802.3u for 100BASE-T(X)
- IEEE 802.3u for 100BASE-FX
- IEEE 802.3ab for 1000BASE-T(X)
- IEEE 802.3z for 1000BASE-X
- IEEE 802.3ae For 10 Gigabit Ethernet Fiber
- IEEE 802.3x for Flow Control, backpressure control
- IEEE 802.1D-2004 for Rapid Spanning Tree Protocol
- IEEE 802.1s for Multiple Spanning Tree Protocol
- IEEE 802.1Q for VLAN Tagging
- IEEE 802.1p for Class of Service
- IEEE 8021X for Authentication
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- IEEE 802.1Q VLAN.
- IEEE 802.3ad for Port Trunk with LACP
- IEC-62439-3 Clause 4 PRP (Parallel Redundancy Protocol)
- IEEE1588v2 PTP (Hardware-based) - (-SB version only)
- ITU-T G.8261 Synchronous Ethernet

Protocols	IPv4, IPv6, IGMPv1/v2/v3, GMRP, GVRP, SNMPv1/v2c/v3, SNMP Inform, ICMP, Telnet, SSH, DHCP Server/Relay/Client, DHCP Option 66/67/82, Bootp, TFTP, NTP Server/Client, SNTP, SMTP, RMON, HTTP, HTTPS, Telnet, Syslog, MRP(Manager/Client), ERPS, LLDP, IEEE 1588 PTP V2(Hw-based), 802.1x, RADIUS, TACACS+, SyncE, HSR, PRP, ACL, DHCP Snooping, ARP Spoof Prevention, Dynamic ARP Inspection, MLD, UDLD, IP Source Guard, sFlow		
Layer-3 Switching Protocols	Routing: static routing, RIP v1/v2, OSPFv2, BGPv4 Multicast: IGMPv1/v2/v3, DVMRP, PIM-DM, PIM-SM, PIM-SSM Routing Redundancy: VRRP (Virtual Router Redundancy Protocol)		
Redundancy	IEC62439-3 Clause 5 High-Avail-Seamless-Redundancy(HSR) only RH-G9X28-M5/6 IEC62439-3 Clause 4 Parallel-Redundancy-Protocol (PRP) - only with RH-G9X28-M5/6 ITU-T G.8032 ERPS, STP, RSTP, MSTP, MRP, Compatible Ring/Chain, U-Ring		
Automation Profiles	Modbus TCP		
MIB	MIB II, IF-MIB, SNMPv2 MIB, BRIDGE-MIB, RMON MIB Group 1,2,3,9		
<b>Precision timing</b>			
Time Synchronization	Network Time	NTP Server/Client, SNTP	
	Precision Time Protocol	Std Version	IEEE1588v1 BC (SW) IEEE1588v2 BC (SW) IEEE1588v2 TC (HW)-ns accuracy
		PTP (-SB) Version	IEEE1588v2 BC (HW)-ns accuracy IEEE1588v2 TC (HW)-ns accuracy Synchronous Ethernet
	Holdover Accuracy	Boundary Clock/SyncE (-SB)	<30 ns/s (IEEE61850-9-3 compliant)
	PTP Mode (all versions)	Layer-2: Multicast, E2E/P2P, two-steps Layer-3 (IPv4):Multicast,Unicast,Unicast Neg. (E2E/P2P)	
	Supported Profiles (-SB version)	C37.238 -2017 Power Profile IEC/ IEEE61850-9-3 Power Profile(2016)	
	Additional Interfaces	RHG9528-410GSFP-BC/SB-XX support hardware-assisted BC/TC also on 4x1G or 4x10G SFP uplink slots. 1PPS square pulse issued from a 1PPS output BNC(F)	
<b>Power</b>			
Input Voltage	DC version: redundant 24~120 VDC AC version: redundant 110~240 VAC HV version: redundant 120~380 VDC		
Input Current (Max)	2.66A Max, 64W Max (For DC version models) 0.7A Max, 50/60Hz (For AC version models) 0.52A Max, 62W Max (For HVDC version models)		
Power	< 70W (85°C).		
Reverse polarity Protection	Yes		
Relay Output	1 Relay Output (24V/1A)		
Connectors	AC: Barrier Terminal Block 4pin 9.52mm DC: Barrier Terminal Block 3Pin 13mm		
<b>Physical Characteristics</b>			
Housing Dimension (W x H x D) Weight Installation	IP30 SPCC metal housing 440 x 44x 355 mm (not including screws, terminal blocks and rack-mount kit) 5Kg (not including module but module cover only) 1U Rack-mount, Rack-mount kit included		

### Environmental Limits

Operating Temperature	-40°C to +75°C (-40°F to +158°F)
Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Ambient Relative Humidity	5% to 95%, 55°C (Non-condensing)

### Switch Modules



### Technical Specifications

Description	8-Port RJ45 module	8-Port SFP module	4-Port RJ45 with IRIG-B module	4-port SFP with IRIG-B module
Model Name	RHG9X28-M1	RHG9X28-M2	RHG9X28-M3	RHG9X28-M4
<b>Properties</b>				
Port speed	10/100/1000 Mbps	100/1000 Mbps	10/100/1000 Mbps	100/1000 Mbps
Interface	RJ45	SFP Slot	RJ45	SFP Slot
HW PTP IEEE1588v2	TC/BC (with -BC core) SyncE (with -SB core)	TC/BC (with -BC core) SyncE (with -SB core)	TC/BC (with -BC core) SyncE (with -SB core)	TC/BC (with -BC core) SyncE (with -SB core)
HSR/PRP	No	No	Yes, Terminal Block	Yes, Terminal Block
Dimensions	102 x 120 x 42 mm	102 x 120 x 42 mm	102 x 120 x 42 mm	102 x 120 x 42 mm
Weight	550 g	500 g	550 g	500 g
Fixing	2 x quick-release screws (included)	2 x quick-release screws (included)	2 x quick-release screws (included)	2 x quick-release screws (included)



### Technical Specifications

Description	4-Port RJ45 HSR/PRP module	4-Port SFP HSR/PRP module
Model Name	RHG9X28-M5	RHG9X28-M6
<b>Properties</b>		
Port speed	10/100/1000 Mbps	100/1000 Mbps
Interface	RJ45	SFP Slot
HW PTP IEEE1588v2	TC/BC (with -BC core)	TC/BC (with -BC core)
IRIG-B	2 Groups	2 Groups
Dimensions	102 x 120 x 42 mm	102 x 120 x 42 mm
Weight	550 g	500 g
Fixing	2 x quick-release screws (included)	2 x quick-release screws (included)

## REGULATORY APPROVALS

Regulatory Approvals				
Safety	UL/EN/IEC(CB) 62368-1			
EMC	FCC Part 15, Subpart B, Class A, EN 55032, EN55035, EN 61000-6-4:2007+A1 2011, EN 61000-3-2, EN 61000-3-3, EN 61000-6-2:2005			
Power Automation	IEC61850-3, IEEE 1613			
Test	Item		Value	Level
IEC 61000-4-2	ESD	Contact Discharge	±8KV	4
		Air Discharge	±15KV	4
IEC 61000-4-3	RS	Enclosure Port	10(V/m), 80-1000MHZ, 80% AM, 1~3GHz	3
IEC 61000-4-4	EFT	AC Power Port	±4.0kV @5.0kHz	4
		DC Power Port	±4.0kV @5.0kHz	4
		Signal Port	±4.0kV @5.0kHz	4
IEC 61000-4-5	Surge	AC Power Port	Line-to Line±2.0kV	4
		AC Power Port	Line-to Earth±4.0kV	4
		DC Power Port	Line-to Line±1.0kV	3
		DC Power Port	Line-to Earth±2.0kV	3
		Signal Port	Line-to Earth±4.0kV	4
IEC 61000-4-6	CS	AC Power Port	10V rms 0.15-80MHZ, 80% AM	3
		DC Power Port	10V rms 0.15-80MHZ, 80% AM	3
		Signal Port	10V rms 0.15-80MHZ, 80% AM	3
IEC 61000-4-8	PFMF	(Enclosure)	100A/m continuous, 1000A/m (1s)	5
IEC 61000-4-11	DIP	AC Power Port	Drop 70% 3 times/s (1period) Drop 40% 3 times/1ms (50 period) Drop 100% 3 times/50m(5-50per.)	-
IEC 61000-4-16	Main	DC Input / Output	30V continuous, / 300V 1S	4
	Frequency	Signal Port	30V continuous, / 300V 1S	4
IEC 61000-4-17	Ripple	DC Input / Output	10% of unit (10% Level3)	3
IEC 61000-4-18	Damped	AC Power Port	Line-to-Line ±1.0KV	3
			Line-to-Earth ±2.5KV	3
	Oscillatory	DC Power Port	Line-to-Line ±1.0KV	3
			Line-to-Earth ±2.5KV	3
			Signal Port	Line-to-Earth ±2.5KV
IEC 61000-4-29	DC Input Port	Dips and Interruptions	30% Reduction: 0.1 sec	N/A
			60% Reduction: 0.1 sec	N/A
			100% Reduction: 0.05 sec	N/A
Shock Drop Vibration	MIL-STD-810G Method 516.7 (2014) MIL-STD-810F Method 516.7 (2014) MIL-STD-810F Method 514.7 C-1 & C-III Category 4(2014)			
RoHS2	Yes			
MTBF	20 years			
Warranty	5 years			



## ORDERING INFORMATION

### Main core switch ordering information

Model name	Part Number	Description
RHG9628-410GSFP-DC	1P1RHG96280004G	4*10G, SFP, 2DC
RHG9628-410GSFP-AC	1P1RHG96280006G	4*10G, SFP, 2AC
RHG9628-410GSFP-HV	1P1RHG96280005G	4*10G, SFP, 2HV
RHG9628-410GSFP-SB-DC	1P1RHG9628000GG	4*10G, SFP, 2DC, Support HW-Boundary Clock/ SyncE
RHG9628-410GSFP-SB-AC	1P1RHG9628000KG	4*10G, SFP, 2AC, Support HW-Boundary Clock/ SyncE
RHG9628-410GSFP-SB-HV	1P1RHG9628000IG	4*10G, SFP, 2HV, Support HW-Boundary Clock/ SyncE

### Modules ordering information

Model name	Part Number	Description
RHG9X28-M1	1P1RHG9X28M101G	8P*1000TX RJ45 Module
RHG9X28-M2	1P1RHG9X28M201G	8P*1000FX SFP Module
RHG9X28-M3	1P1RHG9X28M301G	4P, RJ45 Module and IRIG-B(TB)
RHG9X28-M4	1P1RHG9X28M401G	4P, SFP Module and IRIG-B(TB)
RHG9X28-M5	1P1RHG9X28M501G	4P, RJ45 Module with HSR/PRP
RHG9X28-M6	1P1RHG9X28M601G	4P, SFP Module with HSR/PRP

### Optional Accessories

Model name	Part Number	Description
AC POWER CORD(US)	50892531G	RHG9X28 US AC Power CORD, 183cm
AC POWER CORD(EU)	50891751G	RHG9X28 EU AC Power CORD, 180cm
SDR-240-48	50502401480001G	DIN RAIL POWER SUPPLY / T, AC 100~240V to 48V to 55V DC 5A, 240W
SDR-480-48	50504801480001G	DIN RAIL POWER SUPPLY / T, AC 100~240V to 48V to 55V DC 10A, 480W
AXFD-1314-0523	522AXFD1314001G	SFP Transceiver, 155Mbps, Multi-mode, 1310nm, 2km, -40°C to +85°C, DDMI
AXFD-1314-0553	522AXFD1314011G	SFP Transceiver, 155Mbps, Single-mode, 1310nm, 30km, -40°C to +85°C, DDMI
AXGD-5854-0513	522AXGD5854001G	SFP Transceiver, 1250Mbps, 850nm, Multi-mode, 550m, 3.3V, -40°C to +85°C, DDMI
AXGD-1354-0523	522AXGD1354001G	SFP Transceiver, 1250Mbps, 1310nm, Multi-mode, 2km, 3.3V, -40°C to +85°C, DDMI
AXGD-1354-0533	522AXGD1354011G	SFP Transceiver, 1250Mbps, 1310nm, Single-mode, 10km, 3.3V, -40°C to +85°C, DDMI
AXGD-3354-0593	522AXGD3354001G	SFP Transceiver, 1250Mbps, 1310nm, Single-mode, 40km, 3.3V, -40°C to +85°C, DDMI
AXXE-5886-05B3	522AXXE5886001G	SFP Transceiver, 10Gbps Multi, 850nm, 300m, -40°C to +85°C