Preliminary

RHG9528 Series

IEC61850-3 Certified Rack-Mount High-Availability Managed Modular Gigabit Switch - PTP Boundary Clock

FEATURED HIGHLIGHTS

- Supports HSR (IEC 62439-3), PRP (IEC 62439-4) for high-availability
- IEC 61850-3 and IEEE 1613 DNV.GL certification (pending)
- Integrated IEEE 1588v2 hardware-based BC and TC (-SB version)
- Maximum 128Gbps switching capacity, 95.24Mpps throughput
- Rugged industrial design for harsh environments between -40~85°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 (client) redundancy
- Advanced management features such as QoS and VLAN
- Supports Synchronous Ethernet for Telecom Applications (-SB version)

PRODUCT DESCRIPTION

Flexibility: ATOP's high-density RHG9528 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: RHG9528 supports up to **24 Gigabit ports in any 8-port multiple configuration**. Specifically designed for IEC61850 substation backbone use, it is fully certified to meet all IEC61850-3 hardware requirements – such as EMC Level 3, 4 and 5 requirements, Wide temperature range and High availability. ATOP is proud to be applying for DNV.GL (KEMA) certification, the most prestigious one in Power Utilities.

Award-winning Performance: RHG9528's IEEE1588v2 Hardware-PTP version received recognition for nanosecond-level accuracy, high-performance and an astonishing holdover performance of less than 1 Microsecond/hour. This makes RHG9528 one of the most reliable GMC backups. And being embedded with Synchronous Ethernet and with full support for PTP profiles, RHG9528 is also ideal for Telecom applications.

High-availability, versatility and power: When equipped with ***High-Availability HSR/PRP modules***, RHG9528 complies with the most stringent redundancy requirements, ensuring no packet loss and guaranteeing GOOSE packets arrive at their respective destinations. RHG9528'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. RHG9528 supports ITU-T G.8032 ERPS Ring, IEEE802.1D-2004 RSTP, STP, MSTP, MRP (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 24~48VDC input) and one for the more popular High-Voltage applications in the distribution grid (redundant 90~264VAC, 24~120VDC or 120~370VDC input). Additional 4 x 10 Gigabit uplink SFP slots allow RHG9528 to be the backbone of the substation.

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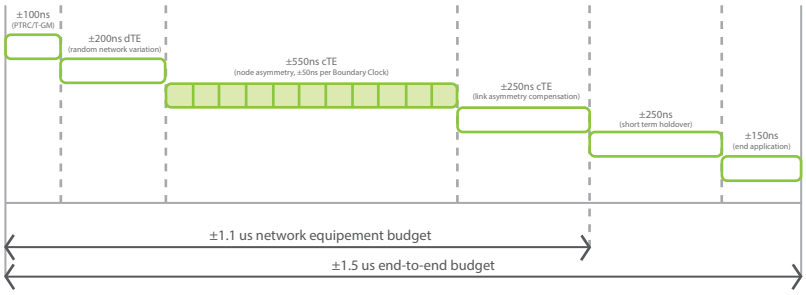
BOUNDARY CLOCK APPLICATION

High accuracy delivered, even in holdover mode

A boundary clock, mainly used in Telecom applications, 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 RHG9528 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 per from 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.

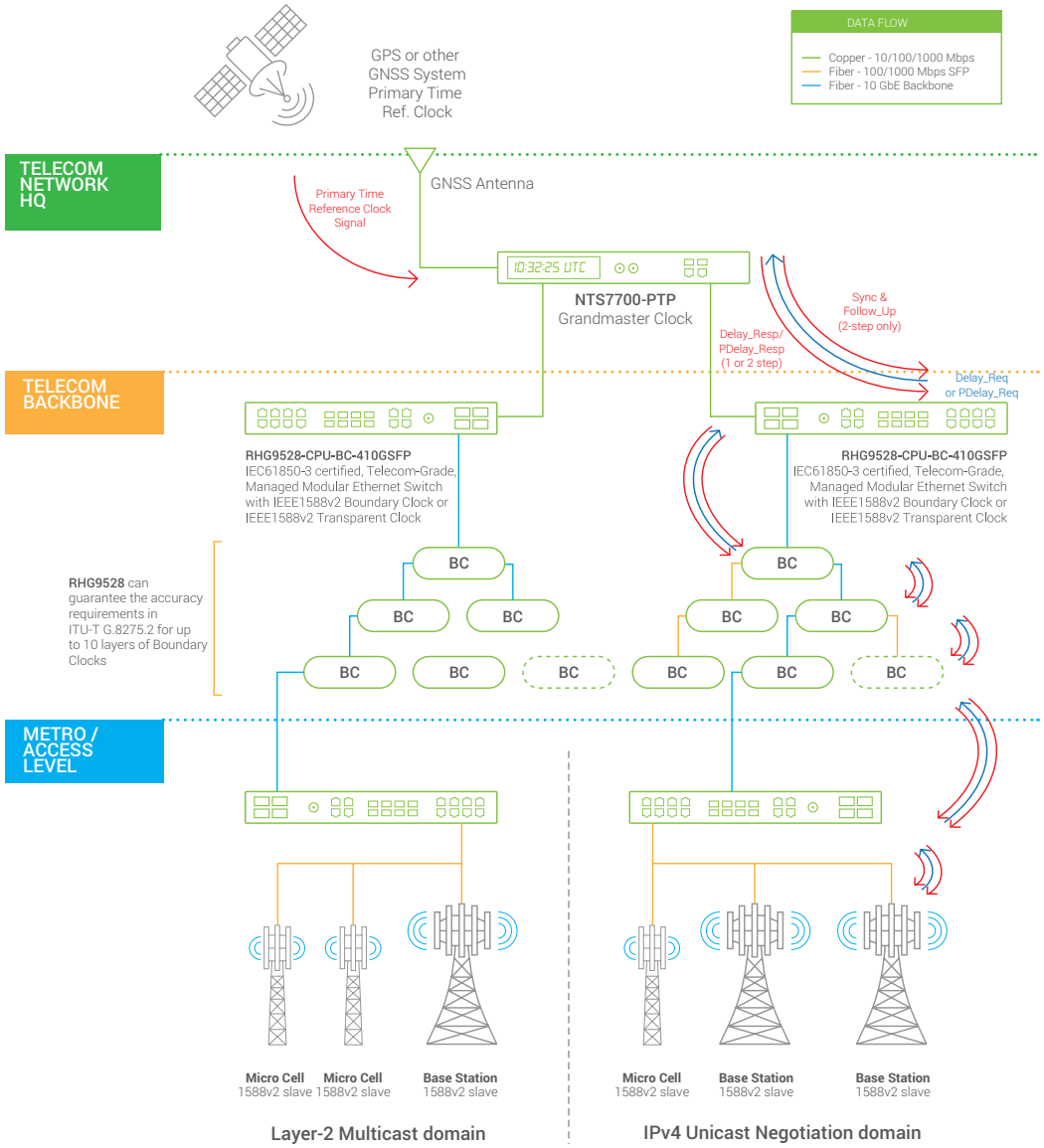


Application Example

The network diagram shows the use of ATOP's NTS7700 Grandmaster Clock and RHG9528 Boundary clock in a telecommunication application.

RHG9528 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. For example, the switches shown on the left hand-side will work on an L2 ITU-T G.8275.1 multicast End-to-End configuration, while the Boundary Clocks shown on the right hand-side work on IPv4 Unicast Negotiation End-to-End configuration that is fully compatible with ITU-T G.8275.2 Telecom Profile.

A wide variety of settings are allowed within profiles – such as the Power, Telecoms, and Enterprise profiles. RHG 9528-BS supports Synchronous Ethernet, allowing the transport of time and frequency, which is important for legacy networks such as SDH-SONET.



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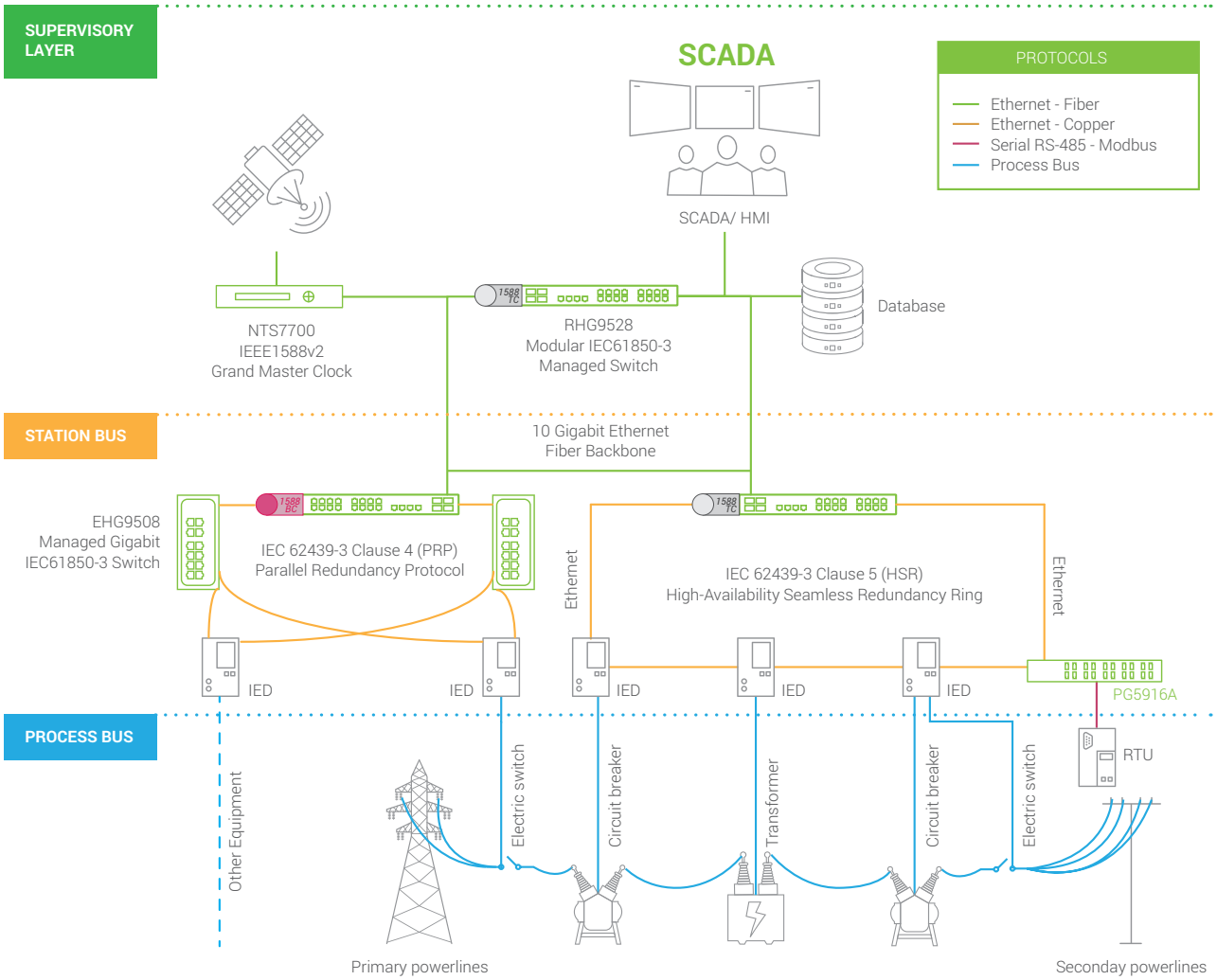
HIGH AVAILABILITY APPLICATION

Zero packet loss, on multiple ports

Install a 4-port Gigabit RJ45 or SFP High-Availability module in any of the module slots in RHG9528 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, You'll have a powerful quadbox at Your disposal: you can use 4 ports in HSR mode, in PRP mode or have 2 Ports working in an HSR Ring while other 2 working in PRP. This will provide you flexibility when integrating the switch in a complex topology.
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 RHG9528 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

RHG9528 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.

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CONFIGURATION EXAMPLE

RHG9528-CPU-410GSFP-SB-HV Main unit, with 4x 10 Gigabit SFP uplink slots,1PPS BNC, 120~370VDC, 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.

IEC61850-3 certified Layer-2 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.

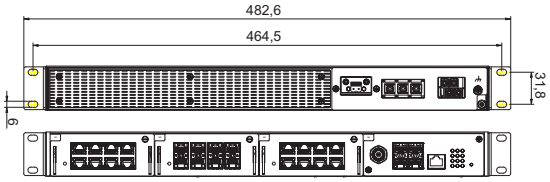
RHG9X28-M2
8-port Gigabit SFP module supporting IEEE1588v2 Hardware BC/TC.

DIMENSIONS & LAYOUT

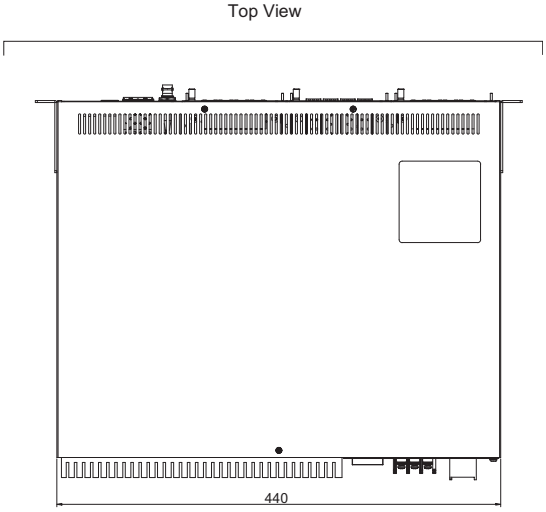
Switch Core

Side View

Front View



Top View



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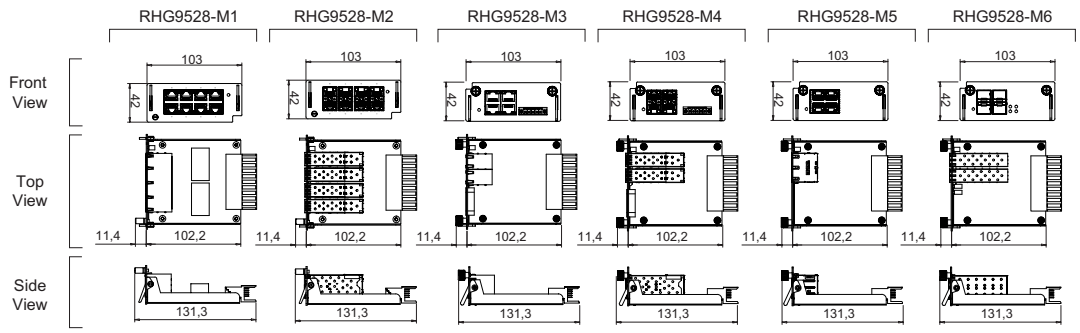
RHG9X28-M1
RHG9X28-M2
RHG9X28-M3
RHG9X28-M4
RHG9X28-M5
RHG9X28-M6



SPECIFICATIONS

Switch core	
Model Name	RHG9528
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 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, ERPS, LLDP, IEEE 1588 PTP V2(Hw-based), 802.1x, RADIUS, TACACS+, SyncE, HSR, PRP

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Redundancy	IEC62439-3 High-Avail-Seamless-Redundancy(HSR) only RHG9X28-M5/6 IEC62439-4 Parallel-Redundancy-Protocol (PRP) - only with RHG9X28-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		
Precision timing			
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, one or two- 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) ITU-T G.8265.1 Telecom Profile (Frequency) ITU-T G.8275.1 Telecom Profile (Phase/Time) ITU-T G.8275.2 Telecom Profile (Phase/Time)	
	Maximum Slaves	RHG9528-CPU-SB can handle maximum 150 PTP packets per seconds	
	Additional Interfaces	RHG9528-CPU-SB support hardware-assisted BC/TC also on 4x1G or 4x10G SFP uplink slots. 1PPS square pulse issued from a 1PPS output BNC(F)	
Power			
Input Voltage	DC version: redundant 24~120 VDC AC version: redundant 90~264 VAC HV version: redundant 120~370 VDC		
Input Current (Max)	TBD		
Power	TBD		
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		

Physical Characteristics	
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 Storage Temperature Ambient Relative Humidity	-40°C~85°C (-40°F~185°F) -40°C~85°C (-40°F~185°F) 5%~95%, 55°C (Non-condensing)

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Switch Modules

Technical Specifications

Description	8-Port RJ45 module	8-Port SFP module	4-Port RJ45 HSR/PRP module	4-Port SFP HSR/PRP module
Model Name	RHG9X28-M1	RHG9X28-M2	RHG9X28-M5	RHG9X28-M6
Properties				
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 -BC core)	TC/BC (with -BC core) SyncE (with -BC core)	TC (E2E, P2P) BC (with -BC core)	TC/BC (E2E, P2P) BC (with -BC core)
HSR/PRP	No	No	2 Groups	2 Groups
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 with IRIG-B module	4-port SFP with IRIG-B module
Model Name	RHG9X28-M3	RHG9X28-M4
Properties		
Port speed	10/100/1000 Mbps	100/1000 Mbps
Interface	RJ45	SFP Slot
HW PTP IEEE1588v2	TC/BC (with -BC core) SyncE (with -BC core)	TC/BC (with -BC core) SyncE (with -BC core)
IRIG-B	Yes, Terminal Block	Yes, Terminal Block
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)

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REGULATORY APPROVALS

Regulatory Approvals				
Safety	UL/EN/IEC(CB) 60950/62368			
EMC	FCC Part 15, Subpart B, Class A, EN 55032, EN 55024, 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 (DNV.GL KEMA - Pending)			
Test	**Item**		**Value**	**Level**
IEC 61000-4-2	ESD	Contact Discharge Air Discharge	±8KV ±15KV	4 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 DC Power Port Signal Port	±4.0kV @2.5kHz ±4.0kV @2.5kHz ±2.0KV @2.5kHz	4 4 4
IEC 61000-4-5	Surge	AC Power Port AC Power Port DC Power Port DC Power Port Signal Port	Line-to Line±2.0kV Line-to Earth±4.0kV Line-to Line±1.0kV Line-to Earth±2.0kV Line-to Earth±4.0kV	4 4 3 3 4
IEC 61000-4-6	CS	AC Power Port DC Power Port Signal Port	10V rms 0.15-80MHz, 80% AM 10V rms 0.15-80MHz, 80% AM 10V rms 0.15-80MHz, 80% AM	3 3 3
IEC 61000-4-8	PFMF	(Enclosure)	100A/m continuous, 1000A/m (3s)	5
IEC 61000-4-10	Damped Osc. Magnetic Field	(Enclosure)	100A/m, 100kHz, 1MHz	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 61000-4-12	Damped Oscillatory	AC Power Port Signal Port	2.5kV common,1kV diff.mode 2.5kV common,1kV diff.mode	3 3
Shock Drop Vibration	MIL-STD-810G Method 516.5 MIL-STD-810F Method 516.5 MIL-STD-810F Method 514.5 C-1 & C-2			
RoHS2	Yes			
MTBF	TBD			
Warranty	5 years			

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ORDERING INFORMATION

Main core switch ordering information

Model Name	Part Number	Slots	Uplink ports	HW PTP	SyncE	Power supply
RHG9528-CPU-410GSFP-DC	1P1RHG9528CPU4G	3	4x 10G SFP			Dual 24~120VDC
RHG9528-CPU-410GSFP-AC	1P1RHG9528CPU6G	3	4x 10G SFP			Dual 90~264VAC
RHG9528-CPU-410GSFP-HV	1P1RHG9528CPU5G	3	4x 10G SFP			Dual 120~370VDC
RHG9528-CPU-410GSFP-SB-DC		3	4x 10G SFP	•	•	Dual 24~120VDC
RHG9528-CPU-410GSFP-SB-AC		3	4x 10G SFP	•	•	Dual 90~264VAC
RHG9528-CPU-410GSFP-SB-HV		3	4x 10G SFP	•	•	Dual 120~370VDC

Modules ordering information

Model Name	Part Number	10/100/1000 RJ45 ports	100/1000 SFP slots	IEEE1588v2 (HW)	High-Availability
RHG9X28-M1	1P1RHG9X28M101G	8	-	TC/BC	-
RHG9X28-M2	1P1RHG9X28M201G	-	8	TC/BC	-
RHG9X28-M3	1P1RHG9X28M301G	4	-	TC/BC	IRIG-B (TB)
RHG9X28-M4	1P1RHG9X28M401G	‘	4	TC/BC	IRIG-B (TB)
RHG9X28-M5	1P1RHG9X28M501G	4	-	TC/BC	HSR/PRP
RHG9X28-M6	1P1RHG9X28M601G	-	4	TC/BC	HSR/PRP

Optional Accessories

Model name	Part Number	Description
SDR-75-24	505007522400l1G	DIN RAIL POWER SUPPLY / T;AC 88~264V to 24VDC 3.2A;75W
LM38-A3S-TI-N	50708051G	SFP Transceiver, 155Mbps, 1310nmFP, Multi-mode, 2km, 3.3V, -40~85°C
LS38-A3S-TI-N	50709431G	SFP Transceiver, 155Mbps, 1310nmFP, Single-mode, 30km, 3.3V, -40~85°C
LM28-C3S-TI-N	50708031G	SFP Transceiver, 1250Mbps, 850nmVCSEL, Multi-mode, 550m, 3.3V, -20~85°C
LM38-C3S-TI-N	50709411G	SFP Transceiver, 1250Mbps, 1310nmFP, Multi-mode, 2km, 3.3V, -40~85°C
LS38-C3S-TI-N	50709391G	SFP Transceiver, 1250Mbps, 1310nmFP, Single-mode, 10km, 3.3V, -40~85°C
LS38-C3L-TI-N	50709441G	SFP Transceiver, 1250Mbps, 1310nmDFB, Single-mode, 30km, 3.3V, -40~85°C
LM28-H3S-TI-N	50710061G	SFP Transceiver, 10.3Gbps, 850nmFP, Multi-mode, 10km, 3.3V, -10~85°C
LS38-H3S-TI-N	50710071G	SFP Transceiver, 10.3Gbps, 1310nmFP, Single-mode, 10km, 3.3V, -40~85°C
LS48-H3L-TI-N	50710081G	SFP Transceiver, 10.3Gbps, 1550nmFP, Single-mode, 40km, 3.3V, -40~85°C
LS48-H3U-TI	50710091G	SFP Transceiver, 10.3Gbps, 1550nmFP, Single-mode, 80km, 3.3V, -40~85°C

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