Symmetricom

SyncSwitch TC100

IEEE-1588 Transparent Clock/Managed Ethernet Switch

KEY FEATURES

- IEEE-1588 Transparent Clock
- PTP Enabled 10/100BASE-T/TX Switch
- PTP v1 and v2 Support
- End-to-End and Peer-to-Peer Transparency
- Plug-and-Play PTP Ready
- Copper and Fiber Port Combinations
- Single Mode or Multimode Fiber Support
- Less than 10 Nanoseconds Error Contribution
- Windows GUI Based Remote User Interface
- SNMP, IGMP, RSTP, Custom MIB
- VLAN Support
- Multicast Filtering
- Network Redundancy
- QoS Priority Optimization
- 1U Chassis, AC Powered
- CE(RoHS) Compliant

KEY BENEFITS

- Improve IEEE-1588 PTP master/slave synchronization accuracy
- Rack-and-stack chassis and AC power compatibility
- Managed switch optimized for IEEE-1588 performance
- Easy integration into existing network infrastructure
- Network redundancy for critical systems

The SyncSwitch TC100 Transparent Clock is a Precise Time Protocol (PTP) enabled Ethernet switch that mitigates time-transfer errors due to packet-queuing delays common in Ethernet switches. PTP packets traversing the network between a PTP Grandmaster and the PTP slaves often coexist on the same network as data traffic. Even minor traffic congestion in a switch randomly delays PTP packets and drastically degrades the time accuracy achievable by the PTP slave. The SyncSwitch is an Ethernet switch that solves this problem.

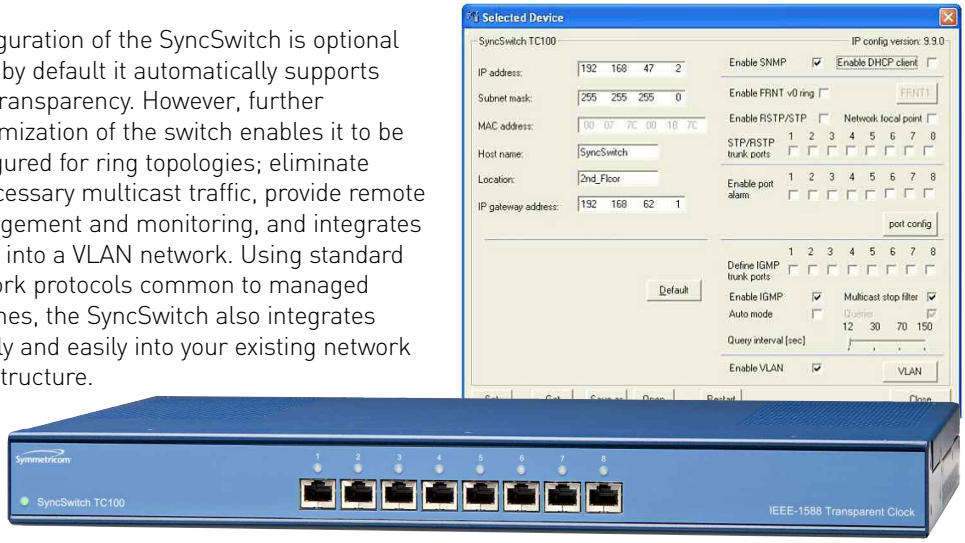
The SyncSwitch employs IEEE-1588 transparency technology for switches. This technology removes errors related to PTP packet delays inside the SyncSwitch and facilitates extremely accurate time synchronization between the PTP Grandmaster and the PTP slaves. These corrections are performed in real time while the TC100 switches all traffic at line speed. The TC100 automatically and simultaneously supports both End-to-End (E2E) and Peer-to-Peer (P2P) transparency as defined in the 2008 version of the IEEE-1588 standard. In other words, it supports IEEE-1588 v1 and v2 protocol for multicast PTP packets.

Configuration of the SyncSwitch is optional since by default it automatically supports PTP transparency. However, further customization of the switch enables it to be configured for ring topologies; eliminate unnecessary multicast traffic, provide remote management and monitoring, and integrates easily into a VLAN network. Using standard network protocols common to managed switches, the SyncSwitch also integrates quickly and easily into your existing network infrastructure.

Remote configuration changes to the SyncSwitch are easily accomplished via the intuitive Windows based GUI. All parameters are clearly presented and in most cases only need to be enabled or disabled via point and click operations. For more detailed configuration and monitoring, the SyncSwitch includes a custom SNMP MIB.

Physical port connections include copper and fiber combinations to accommodate various network topologies and distances. The 10/100BASE-T/TX ports can be enabled for auto-negotiation or individually configured for port speed, duplex, mirroring or sniffing. Ports 7 and 8 can optionally be 10/100BASE-T/TX copper or 100BASE-FX fiber with multimode or single mode fiber transceivers with LC connectors.

The SyncSwitch TC100 Transparent Clock is an essential network element in the deployment of IEEE-1588 enabled devices in real-world networks, particularly on LANs using multicast PTP traffic. The unique PTP transparency technology in the TC100 enables PTP slaves to accurately synchronize to PTP masters while minimizing any detrimental effects caused by traffic on the network.



TC100 NETWORK OPTIMIZED FOR IEEE-1588

Network Integration of PTP Pathways

The SyncSwitch is best suited to be deployed in the network between the PTP Grandmaster and the PTP slaves. This provides for optimized time transfer accuracy as well as integration into an existing network, thereby maintaining the flow of network traffic and timing packets in as efficient a manner as possible.

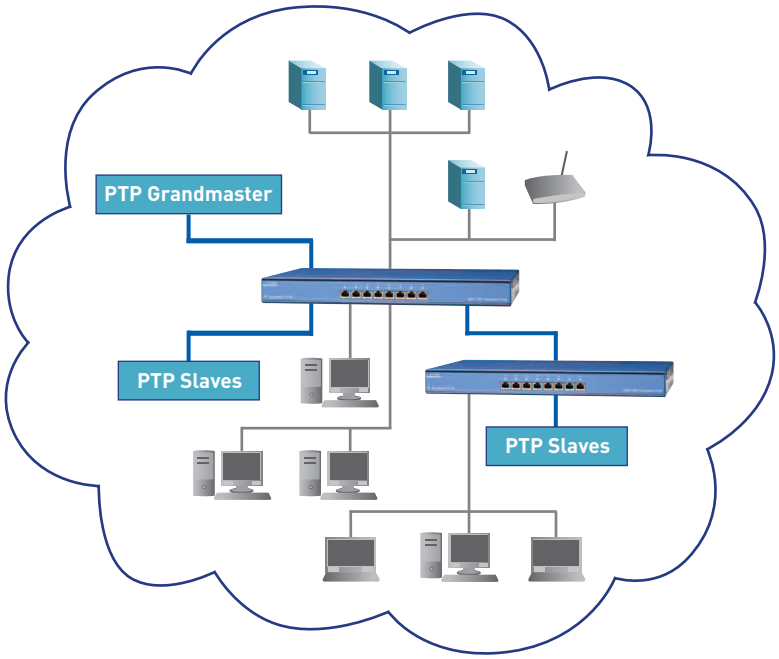
Network Redundancy for High Switching Availability

The TC100 supports network redundancy via rings and port trunking. Rapid Spanning Tree Protocol (RSTP) or the SyncSwitch-to-SyncSwitch Fast Re-configuration of Networks Topology (FRNT) protocol are used to ensure fast reconfiguration of the network if a link goes down. FRNT offers particularly robust and ultra fast re-configuration of the network topology and eliminates failures caused by network links and/or switches. FRNT recovery time is as fast as 30 milliseconds compared to the typical 1-2 seconds of RSTP. A redundant ring topology using SyncSwitches is an excellent choice when high availability and fast re-configuring of the network topology is required between the PTP Grandmaster and PTP slaves.

Multicast Filtering to Reduce Network Load

IEEE-1588 uses multicasting of packets between the PTP Grandmaster and the PTP slaves. Common switches treat multicast traffic like broadcast traffic and repeat it out of all ports, needlessly increasing network traffic. Multicast packet load is minimized by the IGMP snooping feature of the SyncSwitch, which will direct multicast traffic only to interested hosts on the LAN, thereby improving the efficiency of the multicast distribution of PTP packets. Up to 500 multicast groups can be handled by the SyncSwitch.

Choose between all copper ports or a combination of copper and single mode or multimode fiber ports.



Deploy TC100 SyncSwitches in the network between PTP Grandmasters and PTP slaves to substantially improve time synchronization accuracy.

Switch Management Made Easy

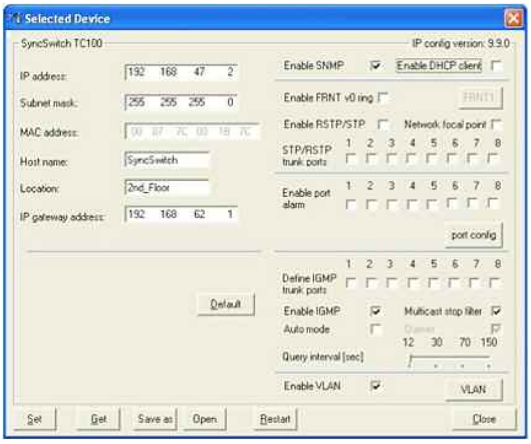
The TC100 SyncSwitch is by default optimized for plug-and-play PTP operations. Further customization of the SyncSwitch is easily accomplished via the Windows based IP Configuration tool or via SNMP. The IP configuration tool operates remotely over the network. Thus, no special craft port is required for configuring the SyncSwitch. Configuration parameters include VLAN, RSTP, FRNT, IGMP, SNMP, DHCP, mirroring, sniffing, port alarms and more.

Optimized Quality of Service

Excellent real time properties are offered through both Layer 2 and Layer 3 priority support, where high priority packets are served based on strict priority scheduling. Layer 2 priority is based on the principles defined in IEEE802.1p using tag insertion performed by the SyncSwitch according to user-defined VLAN settings (port-based VLAN) or on tagged packets generated by the Ethernet end nodes. Layer 3 priority is based on pre-defined IP Type-of-Service (ToS) settings. Head-of-Line blocking prevention assures critical data is delivered to destination nodes as quickly as possible.

Adaptability to LANs and WANs

The 8-port SyncSwitch is available in a combination of copper and fiber ports. Two of the copper ports can be replaced with either two single mode fiber ports or two multimode fiber ports, both using LC connectors. The adaptability to fiber infrastructure enables the distribution of precise time to PTP slaves at remote locations where alternative sources of time, such as GPS, may not be possible or economically feasible.



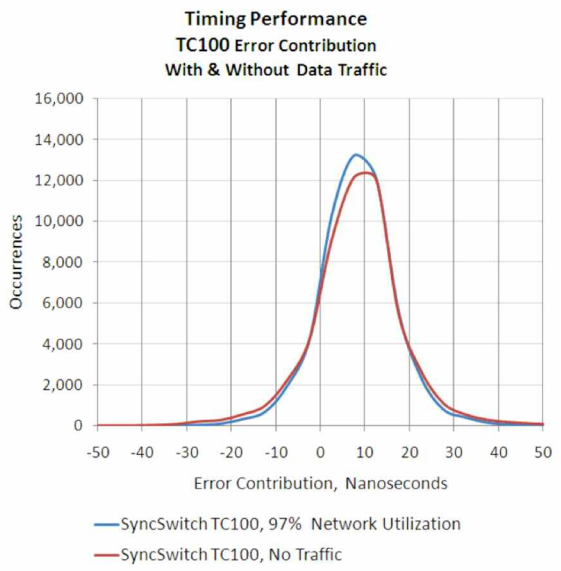
Remotely configure the SyncSwitch using the intuitive Windows interface

SyncSwitch TC100 SPECIFICATIONS

TIMING FUNCTIONS

- IEEE Std 1588™-2008 — End-to-End (E2E) Transparent Clock; Peer-to-Peer (P2P) Transparent Clock; 2-Step Clock; Multicast support only
- IEEE Std 1588™-2002 — End-to-End Transparency; 2-Step Clock; Multicast support only
- Hybrid Operation — Simultaneous support of 1588-2008 E2E, 1588-2008 P2P and 1588-2002 multicast packet types

TIMING PERFORMANCE



Timing performance of the SyncSwitch TC100 is first determined by base lining master to slave accuracy with a crossover cable and comparison measurement of the 1PPS outputs of each clock. Then replacing the crossover cable with TC100s and measuring the slave offset from the master. Two TC100s are used to assure bidirectional queuing delays. Operational accuracy is determined by increasing the bidirectional traffic through the TC100s to near full network capacity and measuring slave timing offset relative to the master. The Symmetricom whitepaper titled "Improving Real World Synchronization Accuracy with IEEE-1588 Transparent Clocks" details this entire test process.

- Accuracy — <10 nanoseconds mean error contribution, Standard Deviation 10 ns. Error contribution the same with or without simultaneous bidirectional data traffic.

SWITCHING PERFORMANCE

- Switching Capacity — 1.6 Gbps when operating at full wire speed handling the maximum data rate in both directions on all eight ports.
- Forwarding Capacity — 800 Mbps wire-speed performance
- MAC Addresses — ≤ 8000
- VLANs — ≤ 11 with support for 802.1q trunking
- RSTP/STP — Rapid Spanning Tree Protocol
- FRNT Protocol — SyncSwitch-to-SyncSwitch Fast Re-configuration of Networks Topology
- Queuing — Head-of-line blocking prevention is set to ON for low priority packets to improve real-time performance.(Flow control is OFF by default).
  Layer 3 DSCP (Differentiated Services Code Point) ToS values recognized and prioritized.

STANDARDS

- IEEE 1588 2008 (v2)
- IEEE 1588 2002 (v1)
- IEEE 802.1p CoS Classification
- IEEE 802.1q VLAN
- IEEE 802.1w Rapid Spanning Tree Protocol
- IEEE 802.1d Spanning Tree Protocol
- IEEE 802.3 10BASE-T
- IEEE 802.3u 100BASE-T/TX
- IEEE 802.3u 100BASE-FX
- IEEE 802.3x Flow Control
- IGMP v1, v2 Snooping
- DHCP (RFC 2131)
- SNMP v2c
- MIB-II (RFC 1213)
- BRIDGE-MIB (RFC 1493)
- IF-MIB (RFC 2863)
- Custom Symmetricom MIB

NETWORK CONNECTORS

- RJ-45 Ports — 10/100BASE-T/TX; Auto negotiation for: Speed, duplex, MDI/MDIX; Manual for: Speed, full and half duplex
- Fiber Ports — LC Multimode (see Options); LC Single Mode (see Options)

MECHANICAL/ENVIRONMENTAL

- Size — 1.75" x 17" x 11.25" (4.5 cm x 43.2 cm x 28.6 cm) 1U rack mount
- Power — 100-240 VAC, 50-60 Hz, 15 watts
- Operating Temperature — 0°C to +50°C (+32 to +122°F)
- Storage Temperature — -20°C to +85°C (-4 to +185°F)
- Humidity — To 95%, noncondensing
- Certifications — FCC, CE (RoHS), UL
- Server weight — 4.5 lbs (2 kgs), Shipping package: 9.5 lbs (4.3 kgs)

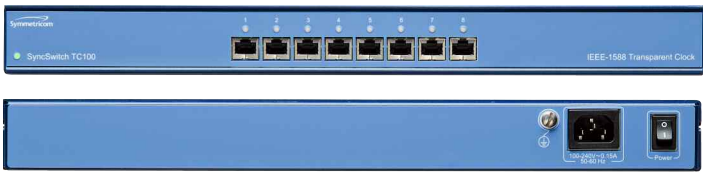
PRODUCT INCLUDES

SyncSwitch TC100, Windows GUI interface software on CD, rack-mount ears, manual and MIB on CD, power cord, QuickStart Guide, 1 Year Warranty.

OPTIONS

Three configurations:

Part Number	Description
1550R-100	8-Port 10/100BASET/TX
1550R-101	6-Port 10/100BASET/TX, 2-Port 100BASE-FX Multimode Fiber
1550R-102	6-Port 10/100BASET/TX, 2-Port 100BASE-FX Single Mode Fiber



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