

TimeSource Enhanced PRTC

Enhanced Primary Reference Time Clock

TimeSource Enhanced PRTC (ANSI Form Factor)



TimeSource Enhanced PRTC (ETSI Form Factor)



Features

- Provides autonomous time scale for time, phase, and frequency that operates even without GNSS availability
- Exceeds requirements defined by ITU G.8272.1
- Operates with external cesium clock inputs
- Redundant power inputs
- Available in both ETSI and ANSI form factors
- End-to-end network management using Microsemi's TimePictra synchronization management system

Applications

- Wireline and wireless networks
- Utility networks
- Enterprise networks
- Government networks

Applications deployed in wireline and wireless, utility, enterprise, and government networks have become increasingly dependent upon global navigation satellite systems (GNSS). At the same time, the threat of GNSS vulnerabilities has increased. Events such as signal anomalies, regional disruptions, and even global outages have prompted governments across the globe to ask their primary network infrastructure providers for a plan to defend against this serious threat.

Anti-jamming and anti-spoofing products provide a level of protection; however, these solutions focus on defending against attacks, and can be difficult to deploy on a wide geographical basis, given that each site would need to be surveyed, and installation costs (such as accessing rooftops) can be expensive. A more permanent, scalable, and efficient solution is to reduce dependency on GNSS and to take back control of the timing source used for network synchronization.

The International Telecommunication Union Telecommunication Standardization Sector (ITU-T) has developed a new standard called the Enhanced Primary Reference Timing Clock (ePRTC). This new standard (G.8272.1) defines requirements for:

- Increasing performance for phase and time to meet the requirements of emerging mobile access network technologies
- Improving security for protection against GNSS outages through performance levels and reliability

The TimeSource Enhanced PRTC (ePRTC) delivers a unique solution to meet and exceed the requirements of G.8272.1, including accuracy better than 30 ns when verified against the applicable primary time standard (such as UTC) and taking into account all error factors. The TimeSource ePRTC provides a solution that goes far beyond mitigating the loss of GNSS, enabling an operator to deploy an autonomous time source that is impervious to GNSS anomalies and outages.

Microsemi unites the advantages of the TimeSource ePRTC with the world's most widely-adopted portfolio of frequency standards used for UTC generation: Microsemi's cesium clock portfolio. Microsemi cesium clocks account for 76% of all UTC clocks and contribute to 87% of UTC time. The TimeSource ePRTC can be purchased alone or combined with cesium clocks to deliver a complete solution stack. The TimeSource ePRTC portfolio is available today, along with services and support to help network operators with deployment and performance assurance.

TimeSource Enhanced PRTC

Enhanced Primary Reference Time Clock

System Overview

The Microsemi TimeSource ePRTC is designed to work in conjunction with cesium clock references to meet the ITU G.8272.1 standard for an enhanced primary reference time clock. The TimeSource ePRTC contains a single unit module that plugs into a rack-mounted shelf. There are two shelves available:

- ANSI standard with rear connectors
- ETSI standard with front-facing connector access

The TimeSource ePRTC incorporates a rubidium miniature atomic clock (MAC) for extended holdover, though the primary holdover reference sources come from the locally deployed cesium clocks.

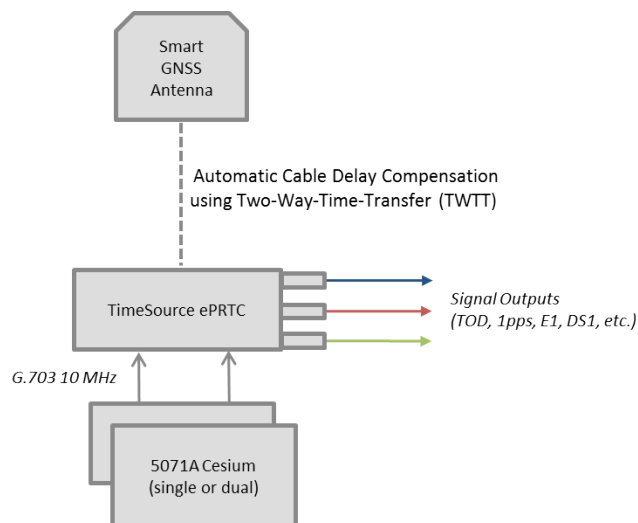
Low power consumption and full RoHS compliance make TimeSource ePRTC deployment a positive step towards more environmentally friendly data centers and central offices, which also helps in reducing overall operating costs.

Smart GNSS Antenna

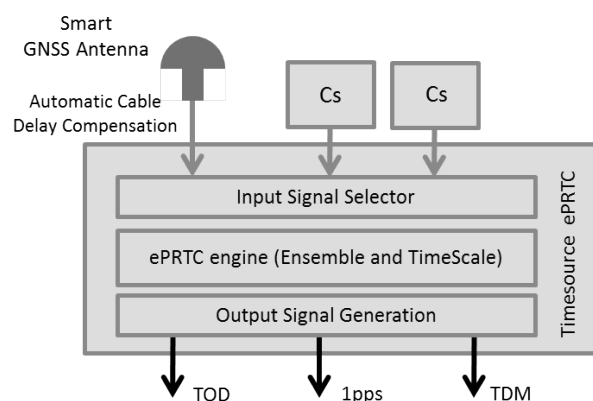
Conversion of the GNSS signal for digital consumption occurs in the antenna enclosure, which eliminates delays between the GNSS reception and conversion to digital format.

A unique two-way time transfer (TWTT) protocol transfers time as a digital signal to the TimeSource ePRTC plug-in card. A significant advantage of this approach is automatic cable delay compensation, which provides optimal performance without manually entering the parameters to measure the cable delay. The smart GNSS antenna uses inexpensive coax cable and can be installed within 1,000 feet of the office shelf, without the need for amplifiers. The antenna also has improved narrowband interference rejection, which protects the GNSS (the current system supports GPS) input against interference from adjacent spectrum.

Smart GNSS Antenna and Two-Way Time Transfer (TWTT)



ePRTC System Block Diagram



TimeSource ePRTC System Design

The TimeSource ePRTC system includes three primary elements:

- Input signal selector
- ePRTC engine
- Output signal generation

The input signal selector of the TimeSource ePRTC system includes interfaces for the smart GNSS antenna along with 10 MHz interfaces to external cesium clocks. For normal operation, a GNSS input and at least one cesium clock should be connected.

The ePRTC engine provides two primary functions:

- Ensemble

The Ensemble function is used when there are two cesium clocks connected to the system. The ensemble algorithm measures and compares the stability of the individual cesium clocks, and uses these measurements to produce a higher level of accuracy. Using two cesium clocks also provides operational advantages, as one of the cesium clocks can be removed from service while the system is in operation without any performance degradation.

- TimeScale

The TimeSource ePRTC solution generates time by producing its own independent autonomous TimeScale. The TimeScale provides time, phase, and frequency that are aligned and calibrated to the GNSS signal over time. Using patented measurement algorithms, the ePRTC engine evaluates and measures its own autonomous time scale relative to GNSS. It then adjusts its TimeScale as needed, rather than following the GNSS time regardless of its accuracy. The ePRTC system's approach is to make the TimeScale become the autonomous master source of time, while the cesium clocks and GNSS help maintain the accuracy of the ePRTC TimeScale.

The output signal generator of the TimeSource ePRTC system provides a number of formats, including time-of-day (TOD), 1PPS, and traditional timing formats such as E1 and DS1.

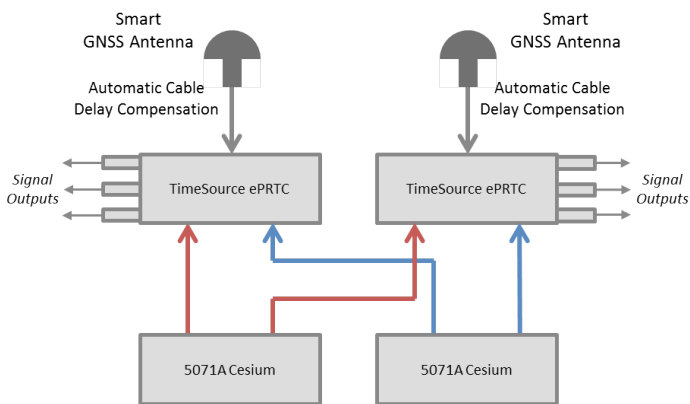
TimeSource Enhanced PRTC

Enhanced Primary Reference Time Clock

TimeSource ePRTC Deployment

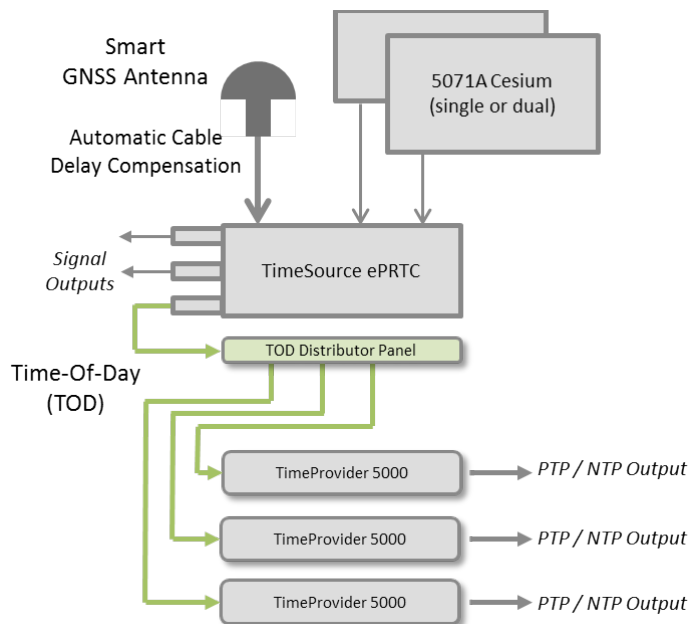
Deployment solutions using the TimeSource ePRTC can be done such that multiple levels of redundancy can be achieved. In addition to being able to use one or two cesium clocks, the TimeSource ePRTC system can also be deployed in a redundant pair. This deployment model creates additional redundancy with a small incremental investment, given that the dual TimeSource ePRTC systems can leverage the same cesium clocks.

Redundant TimeSource ePRTC Deployment



The TimeSource ePRTC is designed for integration with systems such as an SSU-2000 or TimeProvider 5000 to provide a larger number and broader range of output formats (including PTP and NTP timing). Using the TOD distributor panel, multiple TimeProvider 5000 systems can be connected directly to a TimeSource ePRTC for efficient scaling of packet time outputs.

TimeSource ePRTC and TimeProvider 5000 Integration



Network Operation of TimeSource ePRTC Using TimePictra

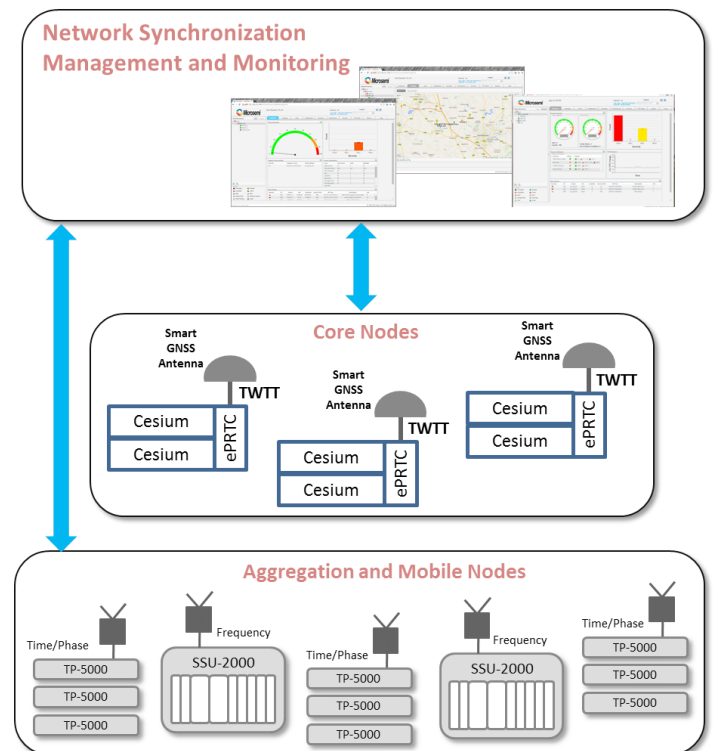
The major deployment goals of ePRTC systems are to:

- Improve the overall network synchronization performance for phase, time, and frequency
- Improve reliability with an emphasis on protecting the synchronization network from GNSS outages

To succeed with these objectives, it is important to be able to monitor and measure the results on a continuous basis.

To some extent, deployment of ePRTC systems is a return to pseudo-hierarchical network synchronization. The TimeSource ePRTC system is typically deployed at a tier above the subtending aggregation and mobile nodes. As network operators transition their overall network architectures towards a software-defined network (SDN), the strategy for network synchronization deployment needs to be mapped into this model as well. Using TimePictra, synchronization performance is viewed with end-to-end network visibility, driven by TimeSource ePRTC systems at key timing hub locations, and delivering time from the core to the edge of the network. This enables the network operator to measure how well nodes throughout the network are aligned in phase, time, and frequency.

Network Management Using TimePictra



Also available is Microsemi's TimeCraft software, which provides a local craft interface for on-site setup and configuration of the TimeSource ePRTC.

TimeSource Enhanced PRTC

Enhanced Primary Reference Time Clock

Services

Microsemi provides a wide range of services. With over 40 years of designing timing systems for mission-critical applications, Microsemi has comprehensive support resources available to ensure that customers are able to use all of the features of the TimeSource ePRTC system.

Available services for the TimeSource ePRTC include:

- Site survey and verification
- Customer-witnessed factory acceptance testing
- On-site installation
- Training
- 24/7 software maintenance and technical support
- Extended hardware warranty

Specifications

Overall Time Error	
Time error in locked mode	Accuracy to within 30 nS or better when verified against the applicable primary time standard (such as UTC)
Wander in locked mode	Better than MTIE and TDEV masks as defined by G.8272.1

System Output Ports	
Ports	2 (10 optional)
Type	T1, E1, composite clock outputs (software configurable)
T1 format	D4, ESF with or without SSM (software configurable)
E1 format	2.048 Mbps (CCS, CAS, CRC4, or non-CRC4) with or without SSM, analog 2.048 MHz (software configurable)
Connector	BNC and wire wrap (ETSI shelf), wire wrap (ANSI shelf)

1 PPS Output	
Ports	1
Signal type	TTL
Connector	BNC

1 TOD Output	
Ports	1
Signal type	RS-485
Connector	RJ-45

10 MHZ Output	
Ports	1
Signal type	TTL
Connector	BNC

Input Ports	
Ports	2
Signal type	T1, E1 (software configurable), with SSM
Connector	BNC and wire wrap (ETSI shelf), wire wrap (ANSI shelf)

Cesium Clock Input Ports	
Ports	2
Signal type	10 MHz
Connector	BNC

NTP Time Server (Optional)	
Type	SNTP
Interface	Ethernet TOD output
Ports	1
Type	Cisco ASCII or NTP type 4
Signal	RS-422
Connector	RJ45

Management	
Management interfaces	TL1, TimeCraft GUI, TimePictra management
Craft port	RS-232, female DB9
Alarm output	Wire wrap (critical, major, minor)
Alarm cutoff	Push button on front panel
Security	SSH/SSL

Antenna Specifications	
Type	Active antenna with integrated GPS receiver
Cable type	RG-59 with TNC connector
Cable delay compensation	Automatic compensation for up to 1000 feet without amplifier
Operating temperature	-30 °C to 80 °C

Mechanical, Power, and Environmental	
Dimensions, ANSI shelf	3.50" (H) × 19" (W) × 12" (D), 8.89 cm (H) × 48.26 cm (W) × 30.48 cm (D)
Dimensions, ETSI shelf	8.66" (H) × 17.72" (W) × 9.84" (D), 22 cm (H) × 45 cm (W) × 25 cm (D)
Power input	-48 VDC (-40 VDC to -72 VDC) dual, redundant
Power consumption	16 W (steady state)
Operating temperature	0 °C to 50 °C
Humidity	5% to 95% non-condensing convection cooling, no fans

TimeSource Enhanced PRTC

Enhanced Primary Reference Time Clock

Specifications

Standards Compliance

ITU-T G.8272.1
ITU-T G.703/9, ITU-T G.703/13, ITU-T G.704
IEEE 802.3u, 802.3ab, and 802.3z

Regulatory Compliance

ETSI EN 300 V1.6.1—Electromagnetic compatibility for telecom network equipment
EN 55022:2010/AC:2011; CISPR 22:2008—Emissions
EN 55024:2010; CISPR 24:2010—Immunity
NEBS GR-1089-CORE—Electromagnetic compatibility and electrical safety
NEBS GR-63-CORE—Network equipment-building system requirements: physical protection

Environmental Compliance

ETSI 300 019-2-1—Storage tests
ETSI 300 019-2-2—Transportation tests
ETSI 300 019-2-3—Operational tests
RoHS 6/6 compliance
CE



Microsemi Corporate Headquarters
 One Enterprise, Aliso Viejo, CA 92656 USA
 Within the USA: +1 (800) 713-4113
 Outside the USA: +1 (949) 380-6100
 Fax: +1 (949) 215-4996
 Email: sales.support@microsemi.com
www.microsemi.com

©2016–2017 Microsemi Corporation. All rights reserved. Microsemi and the Microsemi logo are registered trademarks of Microsemi Corporation. All other trademarks and service marks are the property

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, California and has approximately 4,800 employees globally. Learn more at www.microsemi.com.

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.