SYNCHRONIZATION SUPPLY UNIT

Cost-optimized Network Synchronization Solution – Stratum 1/2/3E

## Modular – Flexible – Fully Redundant – Fully Manageable

Integrated Rubidium / OCXO / GPS reference / SNMP protocol

The EPSILON SSU is a fully modular and flexible equipment which can be customized to provide the most cost-effective solution to all network synchronization requirements, from Primary Reference Clock to Central/Transit/Local nodes.

Based on ITU-T G.811 / G.812 and ETSI EN 300 462-4/6 recommendations, with distributed power supplies and redundant hot swappable modules, including 1 or 2 integrated GPS references, the EPSILON SSU provides the highest level of reliability and service availability.

The EPSILON SSU, with embedded SNMP protocol, is designed to be fully manageable at network level by the EPSYNC MANAGER which ensures full central supervision and control of all synchronization links and devices through a high performance Graphic User Interface.

The package EPSILON SSUs + EPSYNC MANAGER, as a turnkey solution tailored by TEKELEC, allows the operators to reach the highest standard in term of Quality of Service for their telecom networks.
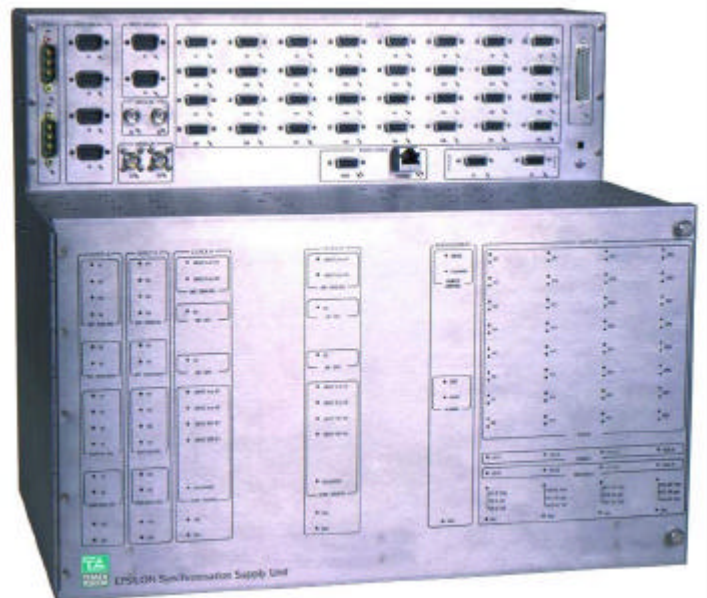
Optimized configurations vs. Application requirements

Whether the purpose of the SSU is to build a Primary Reference Clock (PRC - Stratum 1), or a Synchronization Transit Node (STN - Stratum 2), or a Synchronization Local Node (SLN - Stratum 2/3E) or a Time/Frequency equipment, the SSU configuration can be optimized to match exactly the application requirements with no extra costs for useless functions.

For instance, as shown in the block diagram overleaf, the simplest configuration can be built with only 3 modules :
- 1 x Clock Module with quartz oscillator,
- 1 x Distribution Module
- the Management Module.
This offers a very cost effective solution for simple Local Nodes with supervision capability.

At the other hand, the full configuration with :
- 2 x redundant Input Modules
- 2 x redundant Clock Modules both equipped with High Quality Rubidium or OCXO oscillators and GPS receivers
- 4 x Distribution Modules providing up to 32 outputs
- the Management Module,
performs a very high performance and robust solution for the most stringent requirements.

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System specification

- Number of reference inputs : up to 6, fully protected with monitoring, selection, filtering, tracking and holdover process achieve on redundant modules

- Input jitter & wander tolerances compliant with G811 / G.812 and ETSI EN 300 462-4/6 recommendations

- Number of outputs in main rack : up to 32, 1+1 protected

- Optional extension unit for an another set of outputs

- Output frequency stability : G.811 when locked

- Holdover stability (at 25°C) :
    - PRC / Stratum1 / with Rubidium
    - Transit Node /Stratum2E with OCXO
    - Transit Node /Stratum2 with OCXO
    - Local Node /Stratum3 with OCXO

- No phase hits when source switching

- Embedded Sync Status Messaging (SSM) on 2.048 Mbit/s outputs for self-healing networks

- Built-in test and continuous monitoring of modules, signals and performances : SSU status along with reference and module selections displayed through front panel LEDs

- Alarm interface through relay closures, with Urgent and Non Urgent severity

- Local and remote management over IP with standard SNMP protocol through high data rate Ethernet port.

- RS232 interface with Telnet (ASCII) protocol for maintenance and installation purposes

- Automatic IP address configuration with DHCP protocol

- HTTP option provides dialogue with SSU (web server function with HTML pages)

- Supply voltage : Dual -36 Vdc to - 72 Vdc

- Power requirements : < 150 W

- Rack module : ETSI ETS 300-119 / ANSI standard

- Dimensions (W x H x D) : 441 x 275 x 365 mm3

- Weight (full configuration) < 15 kg

Block Diagram
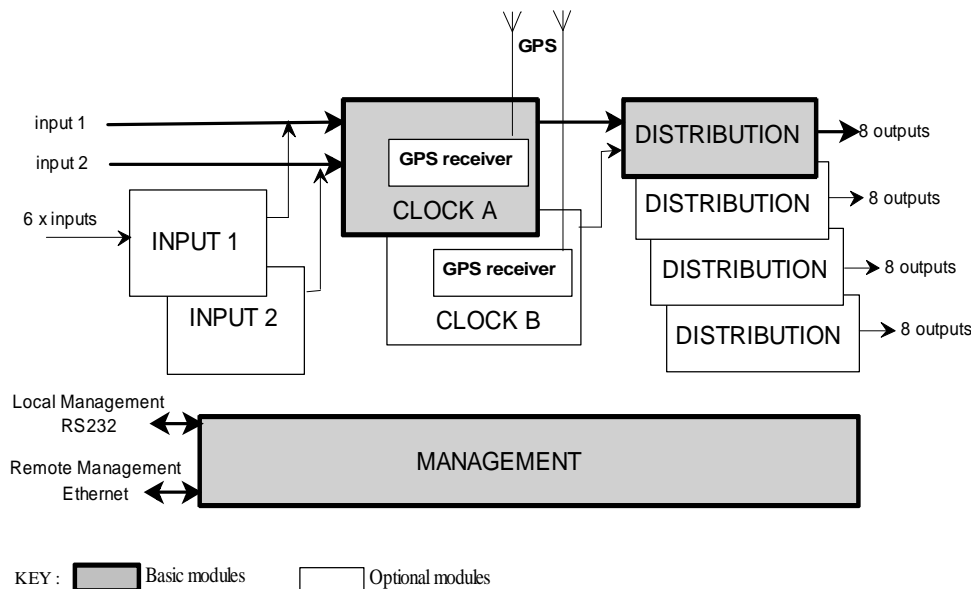
Architecture

- Four types of SSU modules :
    - Input   (Qty = 0, 1 or 2)
    - Clock   (Qty = 1 or 2)
    - Distribution   (Qty = 1, 2, 3 or 4)
    - Management   (Qty = 1)

- Hot-swapping of every module

- Distributed –48 Vdc power supplies with DC/DC converters fitted on each module in order to increase reliability and modularity

- No phase hits while switching signal reference or redundant module

- Optional GPS receiver integrated into each Clock Module

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Main Features

- ◼ **INPUT REFERENCES**

  - ▪ 6 x input references on each Input Module :
    - - 4 x 2.048 MHz
    - - 2 x 2.048 Mbit/s
  - ▪ 2 direct inputs to Clock Module optimizing cost for PRC application (no Input Module required) :
    - - Input 1 :   2.048 MHz
    - - Input 2 :   10 MHz or 2.048 MHz
  - ▪ 2 x GPS inputs from active antennas (L1 – 1 575 MHz) to feed 2 x integrated GPS receivers

- ◼ **INPUT MODULE**

  - ▪ Single or redundant Input Module
  - ▪ Input Module achieves input protection, individual source monitoring, pre-filtering and selection
  - ▪ Automatic selection of the best reference source by continuous monitoring of MTIE and TDEV characteristics of the input lines
  - ▪ Sync Status Message (SSM) taken in account if required on 2.048 Mbit/s sources

- ◼ **CLOCK MODULE**

  - ▪ Single or redundant Clock Modules
  - ▪ Each Clock Module accepts one GPS receiver optimized for synchronization applications with :
    - - Time Receiver Autonomous Integrity Monitoring (T-RAIM), meaning that faulty GPS satellites are detected and excluded
    - - Position hold, meaning that Time Solution is given by a single GPS satellite
    - - Antenna cable compensation
  - ▪ The Clock Module removes the jitter of input references and provides stable frequencies even in case of input loss
  - ▪ Automatic switching to holdover mode in case of loss of GPS and input references : both frequency and Time of Day information are delivered autonomously (GPS option required for ToD)
  - ▪ Reference tracking based on a smart predictive Kalman algorithm, that learns the oscillator behavior and so optimize reaction time to correct frequency drifts due to temperature changes or oscillator aging.

- ▪ High resolution on both phase error measurements and voltage tuning of the oscillator yields an excellent frequency accuracy
- ▪ Internal oscillators of different technologies to meet specific holdover requirements : Rubidium, Oven Control Quartz Oscillator (OCXO)

- ◼ **DISTRIBUTION MODULE**

  - ▪ The SSU accepts up to 4 Distribution Modules providing up to 32 outputs
  - ▪ Three kinds of Distribution Modules are available to meet different format requirements :
    - - 2 MHz Module : 8 x 2.048 MHz outputs for telecom
    - - 2 Mbit Module : 8 x 2.048 Mbit/s outputs for telecom
    - - T&F Module : 2 x 10 MHz and 2 x pps and 2 x ToD for Time stamping or DVB-T or Base Stations of mobile networks
  - ▪ Sync Status Message management on 2.048 Mbit/s outputs if required
  - ▪ Output buffer secured by 4 x paralleled amplifiers for maximum output reliability (1 + 1 protection)
  - ▪ Balanced or unbalanced impedance

- ◼ **MANAGEMENT MODULE**

  - ▪ This module achieves full supervision of SSU modules :
    - - SSU configuration
    - - Module configuration
    - - Alarm and fault configuration
    - - Alarm and fault history
    - - Performance monitoring, including TDEV and MTIE characteristics
  - ▪ Remote management capacity is available through high data rate RJ45/10 BaseT Ethernet interface
  - ▪ SSU remote management can be achieved by the EPSYNC MANAGER with optimized Graphic User Interface. If required, the widely used SNMP Protocol associated with the SSU Management Information Base (MIB), ensures seamless integration into customer management application.
  - ▪ Software and firmware upload through TFTP protocol from the remote Manager, without service disruption
  - ▪ Failure of this non redundant Management Module causes only supervision loss without service disruption : all synchronization functions are maintained with nominal performances

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Specifications

Synchronizing Source	G703 - § 10	E1 – G703 - § 6 – G704	Sine wave	GPS
Rate	2.048 MHz	2.048 Mbit/s	10 MHz	1 pps
Impedance	75 Ω unbal or 120 Ω balanced	75 Ω unbal or 120 Ω balanced	50 Ω unbal	
Number	4	2	2	2

Distribution Module	2 MHz Module	2 Mbit Module	T&F Module		
OutPut Type	G703 - § 10	E1 G703 - § 6 – G704	Time / Frequency		
Rate	2.048 MHz	2.048 Mbit/s	10 MHz	1 pps	ToD
Impedance	75 Ω unbal or 120 Ω balanced	75 Ω unbal or 120 Ω balanced	50 Ω unbal	50 Ω unbal	Asynchronous RS232
Nb of outputs / module	8	8	2	2	2
Nb of modules in SSU rack	up to 4	up to 4	up to 4		
Nb of modules in extension rack	up to 4 (more on request)	up to 4 (more on request)	up to 4 (more on request)		

Application	PRC – Stratum1 G.811	Transit and local node (Stratum1 when locked)
Oscillator type	Rubidium	High performance OCXO
Stability "Hold Over" (@ 25°C)	$< \pm 1\text{x}10^{-10}$/month	$< \pm 1\text{x}10^{-9}$/day(*)
Short term stability	$< \pm 1\text{x}10^{-11}$/day	$< \pm 1\text{x}10^{-10}$/100 sec
Pulling range	$< \pm 2.5\text{x}10^{-9}$	$< \pm 1\text{x}10^{-6}$
Switching over	< 10 ns	< 10 ns
Line tracking mode	G.812	G.812
GPS tracking mode	$< \pm 2\text{x}10^{-12}$ aver.	$< \pm 5\text{x}10^{-12}$ aver.

(*) Other OCXO quality on request : $5\text{x}10^{-10}$ to $1\text{x}10^{-8}$

■ ENVIRONMENT

- Operating temperature : 0°C to +50°C
- Storage temperature : -20°C to +70°C
- Relative humidity : 95% RH @ +40°C, non condensing
- CE certified : EN 50081-1 / EN 50082-2 / EN 60950