SSU-32

Synchronisation Supply Unit for PDH & SDH networks

With the ever increasing stringent requirements of new broadband technologies and new multimedia high demanding applications, synchronisation matter has become the warranty to Quality of Service provided to the customer.

Pendulum Instruments AB offers global turnkey solutions to different types of network synchronisation needs, offering both Synchronisation Supply Units and Wandermeters.

The SSU-32 is a modular synchronisation supply unit (SSU or SASE), full redundant and convenient for PDH and SDH networks synchronisation (see figure 1).

SSU-32 Main Features

Synchronisation inputs
6 synchronisation inputs, GPS PRR support, Caesium PRS support, management of synchronisation reference priorities, alarms, configurations and performance.

Full redundant architecture

Hot swapping
Modules and cards are dynamically exchangeable.

Quality parameters monitoring
MTIE, TDEV, false frequency on synchronisation inputs.

Oscillators
High-performance Quartz , Quartz OCXO or Rubidium Oscillator.

Performances
Exceed major ITU-T recommendations and ETSI standards : ITU- G.812 / G.813, ETSI 300 462-3/4/5

Number of outputs easily increasable
Direct interface with the GNCD allowing to increase easily the maximal number of available outputs with the SSU-32.

Phase jumps
No perturbation on outputs (phase jump < 1/64 U.I.) during oscillators, reference inputs and outputs reconfiguration.

SSM Management
Full SSM and quality level management.
Field configuration supported.

Frequency monitoring of the synchronization equipments
Capability to check the effectiveness of the synchronization through frequency measurement (« feed back » interface).

Software download
Firmware software in FLASH memory. Software remote download through local and remote control interfaces.

Remote control standardised protocols
Use of wide spread standard protocols (IP-UDP, V25 bis, X25 or 10 Base-T, SNMP) to manage the NE SSU-32 in the synchronization network.

LYNX RSNM integrated equipment
Integrated into the remote synchronisation network management system, the LYNX-RSNM allows a dynamic and graphic management of the network : detection of timing loops, interaction with the SSU-32s, management of the quality etc. The LYNX-RSNM also supports FCAPS functionalities.

SSU-32 Specifications

SSU-32 Product Portions

The SSU-32 unit provides two different configurations :

1. SSU-32 / SSU : the SSU-32 will be used as a standard SSU unit
2. SSU-32 / NCD : the SSU-32 will be used as a clock distributor (without embedded oscillators, those ones being bypassed).

The SSU-32 can be upgraded during life time on field from the NCD release up to the SSU release, by simply adding two oscillator cards. The modular structure of the SSU-32 unit allows to integrate different cards and modules:

Product portion	Ref.	Min. Qty	Max. Qty	Basic/ Option
Subracks				
SSU-32 Main subrack ETSI compliant or SSU-32 Main subrack 19" compliant	Z8-99247G00-10 Z8-99247G00-11	1	1	X
SSU-32 Main subrack panel connection type xx	Z6-99247G30-xx	1	1	x
SSU-32 Extension 1 subrack ETSI compliant or SSU-32 Extension 1 subrack 19" compliant	Z8-99247G00-20 Z8-99247G00-21	0	1	Opt.
SSU-32 Extension 1 subrack panel connection type xx	Z6-99247G31-xx	0	1	Opt.
Oscillators				
Quartz OCXO oscillator & synthesis card	Z8-99247G25-00	1	2	x
High precision Quartz OCXO oscillator & synthesis card	Z8-99247G25-10	0	2	Opt.
Rubidium atomic oscillator & Synthesis card	Z8-99247G26-00	0	2	Opt.
Power supply				
Power Supply –48/-72 VDC-DC converter	Z8-99247G08-00	1	2	x
Power Supply 220 Vac	Z8-99247G34-00	0	2	Opt.
Local Management				
CPU management card 2Mbytes	Z3-99247G10-10	1	1	x
Frequency feedback card	Z3-99247G17-00	1	2^1	x
Visual synoptic interface card	Z3-99247G07-00	1	1	x
Inputs				
Input multiplexer card	Z3-99247G13-00	0	2	Opt.
2048 kHz-kbit/s Input card (2 input ports)	Z8-99247G14-00	1	3	x
1-5-10 MHz input card	Z8-99247G16-00	0	3	Opt.
Outputs				
2048 kHz Output card (4 output ports, 1+1 redundancy)	Z3-99247G21-00	2	32^1	x
2048 kHz Output card (2 output ports, 2 frequency feed-back)	Z3-99247G18-00	1	32^1	Opt.
2048 kbit/s Output card (2 output ports, 1+1 redundancy, + SSM)	Z3-99247G33-00	2	32^1	Opt.
2048 kbit/s Output card (2 output ports, 2 frequency feed-back + extended SSM)	Z3-99247G20-00	1	32^1	Opt.
1 or 5 or 10 MHz Output card (2 outputs)	Z3-99247G22-XX	1	32^1	Opt.
2048 kbit/s Output retiming card (2 retimed output ports, 2 inputs ports)	Z3-99247G19-00	1	32^1	Opt.
Remote management				
X25/PSTN Remote control card	Z3-99247G11-00	0	1^2	Opt.
10B-T Remote control card	Z3-99247G12-00	0	1^2	Opt.
PRS				
GPS FE-5019A	Z8-99247G38-00	0	2	Opt.

[1] With SSU-32 Extension 1 subrack ETSI compliant or SSU-32 Extension 1 subrack 19" compliant

[2] Option X25/PSTN Remote control card and 10B-T Remote control card cannot be installed simultaneously.

Typical SSU-32 equipment configuration

The SSU-32 Main unit can be equipped with:

- 2 x input multiplex cards (option)
- 3 x input cards with two input references per card
- 2 x oscillator & synthesis cards (Rubidium, Quartz or mixed)
- 2 x power supply cards – 48 Vdc / 72 Vdc
- 1 x CPU management card
- 2 x power supply cards 220 Vac (option)
- 1 x remote control communication card (X25/PSTN or 10 BaseT)
- 1 x visual interface card

And for the 16 output slots the following optional max. configurations :

- 16 x 1+1 redundant 2048 kHz output cards with 4 outputs per card (64 1+1 redundant outputs)
- 16 x 2048 kHz output cards with 2 outputs per card and 2 frequency feedback (32 outputs + 32 frequency feedback)
- 16 x 2048 kbit/s output cards with 2 outputs per card and 2 frequency feedback (32 outputs + 32 frequency feedback)
- 16 x 2048 kbit/s retiming cards with 2 retimed outputs per card
- 2 input ports (32 retiming outputs + 32 input ports)

The SSU-32 Extension unit 1 (16 output slots) can be equipped with either:

- 16 x 1+1 redundant 2048 kHz output cards with 4 outputs per card (64 1+1 redundant outputs)
- 16 x 2048 kHz output cards with 2 outputs per card and 2 frequency feedback (32 outputs + 32 frequency feedback)
- 16 x 2048 kbit/s output cards with 2 outputs per card and 2 frequency feedback (32 outputs + 32 frequency feedback)
- 16 x 2048 kbit/s retiming cards with 2 retimed outputs per card
- 2 input ports (32 retiming outputs + 32 input ports)

SSU-32 Block Diagram

SSU-32 Block diagram is given in figure 2, last page.

Input Card (Main)

Maximum number of inputs:	6, 2 allowing to connect to a GPS receiver
Impedance:	75 Ohms, 120 Ohms or high Z
Compatible signals:	2048 kHz ITU-T G.703 § 13
	2048 kbit/s ITU-T G.703 § 9
	1-5-10 MHz: 50 Ohms 0 dBm (special card)
Jitter and wander tolerance:	ITU-T G.823
G.703 § 13 signal monitoring:	MRTIE, TDEV, LOS
G.703 § 9 signal monitoring:	MRTIE, TDEV, LOS, AIS
G.704 signal monitoring:	MRTIE, TDEV, LOS, AIS, OOF, CRC-4 (with or without) CAS-16, SSM

This card ensures the interface and monitoring functions of the synchronisation inputs. The SSU-32 can integrate three cards of this type; each card manages two inputs.

The card can be configured for operation in following 3 modes:
G703 § 9, G703 § 13,
G704 multiframe CRC-4

Each input can be configured separately. It is also possible to configure the inputs to interface with an external GPS receiver. The input card function can be proposed with a redundant Input multiplexer function in order to reach full 1+1 redundancy (option). The 1-5-10 MHz special input card is designed in order to accept two different input types :

1 x 1-5-10 MHz input signal

1 x 2048 kHz or 2048 kbit/s input signal.

Oscillator and Synthesis Card (Main)

Quartz oscillator

Stability in Holdover mode:	$<\pm2\times10^{-10}$/day
Preheating period:	30 min
Acquisition range:	$\pm0.4\times10^{-6}$
Frequency drift (temperature variation between 5 and 40 °C, gradient of 0.5 °C / min):	$<\pm1\ 10^{-9}$

Quartz oscillator high quality OCXO

Stability in Holdover mode:	$<\pm1\times10^{-10}$/day
Preheating period:	30 min
Acquisition range:	$\pm 0.4\times10^{-6}$
Frequency drift (temperature variation between 5 and 40 °C, gradient of 0.5 °C / min):	$<\pm1\times10^{-9}$

FE-5650A Rubidium oscillator

Stability in Holdover mode:	$< 2\times10^{-11}$/day
Preheating period:	<4 min to lock at 25° C
Acquisition range:	$\pm1.6\times10^{-8}$

Other

Frequency resolution:	2×10^{-13}
Jitter and wander filter:	0.01 - 0.0001 Hz (programmable)
Typically :	0.0007 Hz
Fifo for frequency measurement:	10 – 1000 s (programmable)
Typically :	75 s

This is an autonomous synchronisation module ensuring functions like:

- jitter and wander filtering
- locking of the oscillator (DPLL)
- distribution towards output cards

Two different technology-based configurations are available:
- Quartz technology
- Rubidium technology

Output Card (Main)

2048 kHz output cards (Main, Extension 1)

Max. number of signal outputs:	64 (128 with extension unit 1)
Impedance:	75 Ohms, 120 Ohm
Compatible signals:	-2048 kHz ITU-T G.703 §13

Two types of cards are available:

- 4 output ports: This card provides a 1+1 redundancy but does not allow for the use of the frequency feedback function. To provide a 1 + 1 output card redundancy, it is always necessary to equip the SSU with an even number of cards.

- 2 output ports: This card can be combined with the useful frequency feedback card, and provides a 2+1 amplifier redundancy on card.

Those cards amplify and distribute the synchronisation signal. In the main subrack, up to 16 cards can be placed. In the extension 1 subrack, up to 16 cards can also be placed.

2048 kbit/s output cards (Main, Extension 1)

Maximal number of signal outputs:	32 (64 with extension unit 1)
Impedance:	75 Ohms, 120 Ohms
Compatible signals:	- 2048 kbit/s ITU-T G.703 § 9
Configuration signal:	ITU-T G-704 ; AIS, CRC-4, CAS-16, system

Two types of cards are available:

2 output ports with redundancy and SSM: This card is designed to be mounted in the SSU-32 Main/Extension unit 1. A 1 + 1 hardware redundancy is then provided. To provide a 1 + 1 out put card redundancy, it is always necessary to equip the SSU with an even number of cards.

2 independent output ports with SSM: This card is designed to be mounted in the SSU-32 Main/Extension unit 1.
No redundancy is available but the card provides SSM delivery on two independent channels. It also allows extended system features such as "DO NOT USE" management, AIS signalling in extension of the "DO NOT USE" message, and frequency feedback monitoring.

1-5-10 MHz output card (Main, Extension 1)

Maximal number of signal outputs:	64 (128 with extent. unit 1)
Impedance:	75 Ohms
Signals:	1 MHz sine wave – 10dBm 50 Ohms;
	5 MHz, sine wave – 10dBm 50 Ohms;
	10 MHz, sine wave – 10dBm 50 Ohms
4 output ports:	This card is designed to be mounted in the SSU-32 Main/Extension unit.

Retiming card (Main, Extension 1)

Maximal number of signal outputs:	32 (64 with extension unit 1)
Impedance:	75 Ohms, 120 Ohms
Compatible signals:	2048 kbit/s ITU-T G703 § 9
Configuration signals:	ITU-T G704, AIS, CRC-4, CAS-16
FIFO maximum depth:	± 512 bits

The Data stream on the output port comes from the FIFO at the 2048 kbit/s synchronized speed. This FIFO is filled with the data stream coming from the input port at the 2048 kbit/s external speed. Two output ports per card. Two input ports per card.

Frequency feedback monitoring card

(Main, Extension 1)

Supervision of 32 frequency feedback signals

Phase comparator resolution: $0,48 \times 10^{-9}$ s

Alarms:

LOS Frequency programmed threshold:

$$df/f > 10^{-8}$$
$$df/f > 10^{-9}$$
$$df/f > 10^{-10}$$
$$df/f > 10^{-11}$$

This card allows to check that the synchronisation provided to NE by the SSU-32 is correctly used by the NE. One card supervises 32 frequency feedback signals. One card is necessary in the main unit and in the extension subrack. This card is always necessary for the operation of the SSU-32, even when there is no wired frequency feedback. It also controls the output card status multiplexing.

Power Supply Module (Main)

Input voltage:	48 Vdc nom., 35 Vdc 72 Vdc
Output voltage:	5 Vdc, 10A
	12 Vdc, 7A
	-12 Vdc, 2,5 A

Load distribution system of each voltage when putting in parallel both power supplies.

Protection:	polarity inversion, current limitation
Test points:	3 x
Signal power fail	

In the SSU-32, two identical power supply cards are available. Each card allows supplying power for the whole equipment by its own (redundant configuration). An additional optional 220 Vac power module is available.

CPU Management Card (Main)

Serial interface:	For self-powered local terminal (TPE) or 9600 bit/s VT100 terminal, compatible or PC. Automatic recognition of the physical interface.
Craft terminal:	V24/V28 (RS-232C)
User interface menus:	Accessible through tree-sorted menus: list of alarms, configuration, dynamic supervision, events logbook,
User interface passwords:	Accessible through menus protected by password: configuration of temporising, management of oscillators, supervision of reference inputs frequency.
Management automatons:	Frequency feedback monitoring
	Oscillators
	Synchronization references
Files buffering for:	Logbook
	Monitoring of oscillators
	MTIE + TDEV
Other:	SNMP agent interface
	Extended alarms management

This card is connected to the different modules of the equipment and concentrates every status, alarms and configuration information. The card enables the remote control function (in communication with the remote control interface card) and the local management function: data base, visual synoptic interface management, configuration, alarms management (relays interface).

Remote control communication cards (Main)

Interface:	Interface towards the LYNX-RSNM remote synchronisation network management.
Control&Conf:	Remote control and configuration of each SSU-32 equipment functions.
Local User Interface:	Directly accessible on the LYNX Manager.
SNMP agent:	(partial MIB-II+proprietary MIB)
Option 1:	10 Base-T LAN Local interface
Option 2:	X25 / V25bis interface: V24 DTE /DCE, Clock DTE/DCE
Internet protocols:	IP / UDP / TFTP

Those cards ensure the management of the communication protocols necessary to the connection to the remote control network (through Data Communication Network: DCN). This card is in communication with the CPU management card. The X25/PSTN and the 10 Base-T remote control cards cannot be installed simultaneously in the equipment.

Visual Interface Card (Main)

Test points:

120 Ohms symmetrical / galvanic isolation accessible for:

Selected reference
Selected oscillator
Oscillator 1
Oscillator 2
Output signal (64 x)

Led status:	6 inputs, 2 oscillators, power supplies, CPU
Led selection:	inputs / oscillators
Alarm LED:	Major/Minor
Other:	Serial interface for local remote control terminal
	Acknowledgement button
Visual interface:	Synoptic panel with LEDs. Representation of the functional modules and their status with colour coded Led (off/red/green /yellow, blinking).

In addition, test points allowing non-intrusive measurements on the reference signal and oscillators are to be found.

Mechanics

The mechanical Main subrack is ETSI 300 119-2 compliant:

Height:	750 mm
Width:	449 mm
Depth:	285 mm
Matter:	stainless steel
Option:	fixation for Rack 19"

The Extension 1 mechanical subrack is ETSI 300 119-2 compliant:

Height:	425 mm
Width:	449 mm
Depth:	285 mm
Matter:	stainless steel
Option:	fixation for Rack 19"

Weight

SSU-32 Main unit	$\leq$50 kg
SSU-32 Extension 1	$\leq$25 kg

Environment & typical power consumption

The SSU-32 is compliant with the ETSI 300 019 recommendations, part 1-3, class 3.1 (5° < Temp < 40°). The maximum consumption of the SSU-32 on the different voltage is:

+ 12V 10A, 120W
+ 5V 10A, 50W
- 12V 4A, 48W
TOTAL: 218 W

To this total, we have to add the power supply efficiencies (80 %).

The maximal consumption on the 48V is therefore 270 Watts. Remark: This consumption, if it would be the case, is met only on the start when the oscillators are in preheating (count 30 watts in less in normal use). A more precise indication of power consumption can be calculated on request. This one will be based on the precise definition of the SSU-32 configuration.
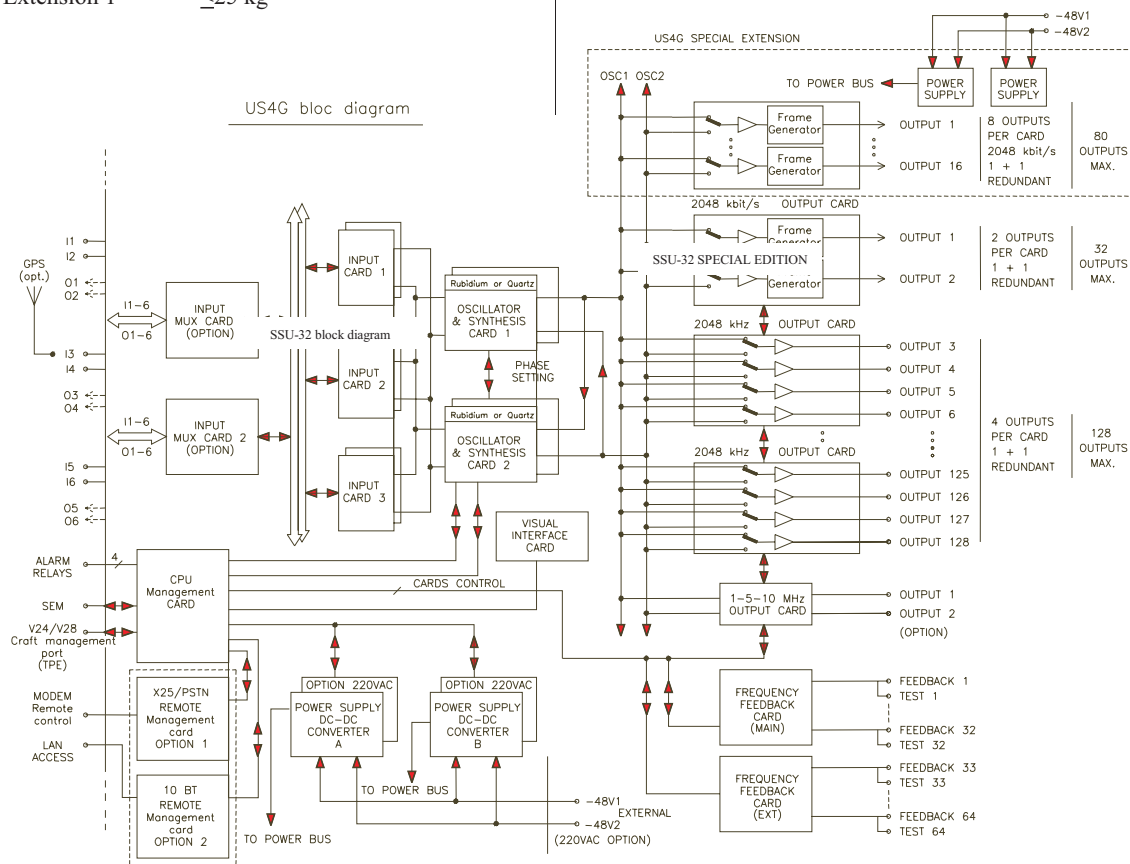
For further details please contact us.

Figure 2: SSU-32 Block diagram.

Specifications subject to change without notice.

pendulum

Incorporating XL Microwave