OSCILLOQUARTZ
An ADVA Optical Networking Company

OSA 3235B Cesium Clock

USER MANUAL

Document number: 80000037997

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What's new in this revision

- Fix some commands errors
- Fix Led state
- Change for the startup sequence

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Table of Contents

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List of Figures

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List of Tables

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List of Procedures

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1. Introduction

- About this Manual
- Reading Guide
- Safety Instructions
- Warranty
- Certification

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1.1 About this Manual

The present manual contains information about Frequency Time Standard OSA 3235B CESIUM CLOCK, its composition, main applications, principle of operation, basic configuration, programming functions and technical maintenance.
It also gives the description of instrument specifications and information on adequate usage of the instrument according to its purpose

It is intended for the use of the following types of users:

Systems Engineers:	An overview of the equipment concept and theory of operation in Chapter 2.
Installation Engineers:	Detailed technical information and procedures for correct installation, operation, configuration and commissioning as well as equipment specifications and maintenance guidelines. Chapters 3 - 7.

1.1.1 Copyright Notice

1.2 Reading Guide

Special icons, attracting your attention, precede important and/or critical information in this document. Hereafter are explanations of each icon.

CAUTION

This symbol is extremely important and must not be neglected. It precedes information or procedures regarding installation, operation or maintenance. Follow all steps or procedures, as instructed, to avoid any damage to equipment or serious personal injury.

ELECTRICAL SHOCK HARZARD

This warning symbol is extremely important and must not be neglected. It indicates that there are dangerous high voltages present inside the enclosure of this product and precedes important warnings to avoid any risk of fire or electrical shock that could lead to serious personal injury or loss of life.

ESD CAUTION

Electrostatic Discharge (ESD) must be avoided so as not to damage or destroy static sensitive components.

Note:

A note symbol informs the reader that additional information on the related subject is provided in order to simplify a described task, suggest other references or even just simplify an explanation.

Recommendation:

Recommendations advise the user on manufacturer tested methods and procedures proven valuable for correct use and optimum equipment results.

1.3 Safety Instructions

IMPORTANT SAFETY INSTRUCTIONS.
DO NOT DISCARD, READ BEFORE OPERATING

GENERAL

Exercise extreme care when handling any electronics equipment as it contains precision parts that can be damaged by improper handling.

Avoid touching connector pin surfaces. Foreign matter deposited on contact surfaces can cause corrosion, and eventually lead to degradation of performance. In addition, do not use abrasives to clean contact/pin surfaces.

ESD CONSIDERATION

Each module contains semiconductor devices that can be damaged by electrostatic discharges. It is advisable to take anti-static precautions when handling electronic boards or static sensitive components. Use an approved anti-static bracelet in accordance with company practice.

WATER AND MOISTURE

Do not place containers with liquids such as coffee, water, sodas, etc. on this unit. Do not operate this equipment in a wet environment.

HEATING

Do not install this product near heat sources such as radiators, air ducts, areas subject to direct, intense sunlight, or other products that produce heat.

FIRE

Suitable for mounting on concrete or other non-combustible surface only.

VENTILATION

Slots and openings in the chassis are provided for ventilation and to ensure reliable operation of the product. To protect the unit from overheating, those openings must not be blocked or covered. When integrating this unit in a rack cabinet, at least 1 RU (4.3 cm) of clearance above and below the unit is necessary to assure sufficient cooling.

GROUNDING

No ground stud is provided on front panel unit but the shelf must be connected to protective earth (PE). This is done through the detachable cord set of the device

Ensure that all other devices connected to the unit, are also connected to protective earth (PE)

Any interruption of the protective earth (PE) conductor (inside the equipment) or disconnecting the protective earth terminal is likely to make this equipment dangerous. Intentional interruption is prohibited.

POWER

Make sure the power sources are compatible with the power inputs of the equipment.

Other equipment around the unit must be connected to protective earth (PE). The protective action must not be negated by the use of an extension cord (power cable) without a protective earth conductor.

Whenever it is likely that the protection offered by fuses has been impaired, the equipment must be made inoperative and be secured against any unintended operation.

To avoid dangerous situations, it is necessary to provide the possibility to disconnect the equipment from the power source and to implement a protection against overcurrent in the power supply circuit.

POWER CORD PROTECTION

The power supply cord for this product should be routed or installed in such a manner to protect it from being walked on or pinched. The unit should be powered down completely before connecting or disconnecting the power cable. The power cord should be removed before moving the unit. The power cord must be placed near an easily accessible unobstructed socket outlet.

CLEANING

Connected and running equipment can only be dusted using a soft dry cloth.

ONLY WITH**, AUTHORIZED PERMISSION,** OUT OF SERVICE & UNPLUGGED equipment can be cleaned with a soft cloth slightly moistened with a mild detergent solution. Do not use liquid cleaners, aerosols, abrasive pads, scouring powders or solvents, such as benzine or alcohol. Ensure the surface cleaned is fully dry before reconnecting power.

SERVICING AND MODIFICATIONS

To avoid dangerous electric shock, do not perform any servicing or modifications other than what is recommended in this User Manual. Do not attempt to gain access to areas of the unit where dangerous voltages are present. Refer servicing to qualified service personnel.

DAMAGE REQUIRING SERVICE

- Refer servicing to qualified service personnel under the following conditions:
- When the power supply cord is damaged.
- If liquid has been spilled into the enclosure of the unit.
- If the product does not function normally by following the instructions in the User's Manual. Adjust only those controls that are covered by the operating instructions. Improper adjustment of other controls may result in damage and will often require rework by a qualified technician to restore the product to its normal operation.
- If the product has been damaged in any way.

When the unit displays a negative, distinct change in performance.

RISK OF EXPLOSION

There is a risk of explosion in case the battery (optional) is replaced by an inappropriate model.

In case of battery replacement, the used battery must be recycled according to instruction

LOCATION FOR INSTALLATION

For safety reasons, OSA 3235B must be installed in a restricted access location.

Moreover, the shelf in which OSA3235B is installed must act as a fire and particles protection to prevent from any damages.

REPAIRING

The device shall be repaired only by Oscilloquartz authorized personnel. Oscilloquartz technical support shall wait at least 5 minutes in power off state before opening the unit to avoid touching high temperature surfaces.

1.4 Warranty

This Oscilloquartz product carries a warranty which commences from date of dispatch from factory as stipulated on the original acknowledgement of order.

It applies to demonstrably faulty material or poor workmanship, but excludes batteries.

Oscilloquartz shall bear only the cost of repair or replacement in its own premises. Should this not be possible for reasons beyond our control, all additional costs are at customer expense.

Damages resulting from natural wear, improper maintenance, failure to observe the operating instructions, excessive strain, unsuited consumption material as well as improper environmental and mounting conditions are excluded from this warranty.

The warranty expires if the customer or a third party modifies or repairs the product without Oscilloquartz prior written consent or if the customer does not take immediate steps to prevent the damage from becoming more serious; likewise, if insufficient time is provided for repair or replacement.

The customer will not be entitled to other warranty claims. Oscilloquartz is not liable for consequential damage.

1.5 Certification

EQUIPMENT CERTIFICATION:

Oscilloquartz equipment is tested according to well-defined procedures. Appropriate testing and inspection takes place at the component, board, equipment and system levels. The company maintains in-house cesium high performances that are continuously compared to UTC. Before any equipment is released, it must satisfy the relevant tests and inspection schedules. The equipment is then issued with a "Certificate of Conformity" that guarantees its conformance with the relevant performance criteria.

The OSA 3235B CESIUM CLOCK is compliant with CE and RoHS

A variety of Oscilloquartz products are certified world-wide. For details, please refer to our web site at www.oscilloquartz.com

COMPANY CERTIFICATION:

Certified ISO 9001, ISO 14001 and TL9000 by Quality Austria

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2. General Description

- Introduction
- System Architecture
- System Description

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2.1 Introduction

2.1.1 Short device description

The OSA 3235B Cesium Clocks is an atomic frequency standards based on a hyperfine transition in the ground state of the cesium 133 atom. It is specifically designed and produced with the latest technology in a very compact and reduced size.
Our OSA 3235B is a highly stable and accurate cesium clock that provides a frequency source with an accuracy better than ±1x10-12 (PRC variants). Together with very high frequency stability, it provides a variety of low noise frequency outputs as well as telecom output signal and several phase time outputs.
Typical applications include metrology, defense, time scales, space, and telecom industries.

2.1.2 Main Applications

Atomic clocks are used to generate standard frequencies. They are installed at sites of time signals like telecommunications networks centrums, navigations systems ground stations (LORAN C, GPS, GLONASS, GALILEO, etc…), Satellites (on board clocks) or long wave and medium wave broadcasting stations to deliver a very precise carrier frequency.
They are also used for specific internal navigation systems when external “time reference signals” are not available or insufficiently protected regarding transmission risks: war, attempts, EMC / ESD perturbations.
Regarding astrophysics’ applications, very high precision atomic clocks are used for long-baseline interferometry in radio astronomy.

2.1.3 General Principle

Atomic clocks do not use radioactivity but rather the precise microwave signal that electrons in atoms emit or absorb when they change energy levels.
Operation of the model “OSA 3235B CESIUM CLOCK” is based on a fundamental property of Cesium-133 atom.
Regarding quantum mechanics, the transition frequency between two magnetic hyperfine levels of the fundamental state of Cs atom (F3, mF=0 →F4, mF=0) amounts to F0 = 9.192 631 770 GHz.

That transition has some important properties:

- First, the “atomic quality factor” (ratio between F0 and the Ramsey “fringe width” measured at mid height) is very high (# 1.8 107).
- Second, according to fundamental properties of Cs atom, it is not subject to natural aging, in other words to a systematic variation versus time.
- Third, that clock transition can be considered as quite insensitive regarding magnetic field perturbations.

- Forth, it has a high degree of intrinsic reproducibility and therefore is used since 1967 to define the “Time Unit” (International System of Units: SI).

In these conditions, independently regulated, with normally available equipment, such frequency standard has a guaranteed accuracy of typically $\pm$ 1 10^{-12}.
The basic element of such frequency standard is the “Cesium beam tube” which has the effect of isolating the desired transition of the Cesium atom and minimizing the influence exerted on atoms by the environment. It thus exhibits the transition frequency (F3, mF=0 →F4, mF=0) while avoiding the errors due to external magnetic field, variations of temperature or other disturbing factors.

The diagram of a classical magnetic Cs beam tube thus that the basic principle of a traditional frequency standard is shown in the Figure 2-1.

A small reservoir of Cesium, heated about 100°C, forms a beam of atoms which passes into the gap of a selecting “A” magnet, so that only the atoms in the desired energy state are directed towards the cavity. This is possible because the atoms behave as tiny magnets whose orientation depends on their energy state. When they pass through the strong field of the selecting magnet, they follow trajectories which differ according to their magnetic state. Atoms in “wrong” energy state are deflected off the tube axis and absorbed by graphite getters.

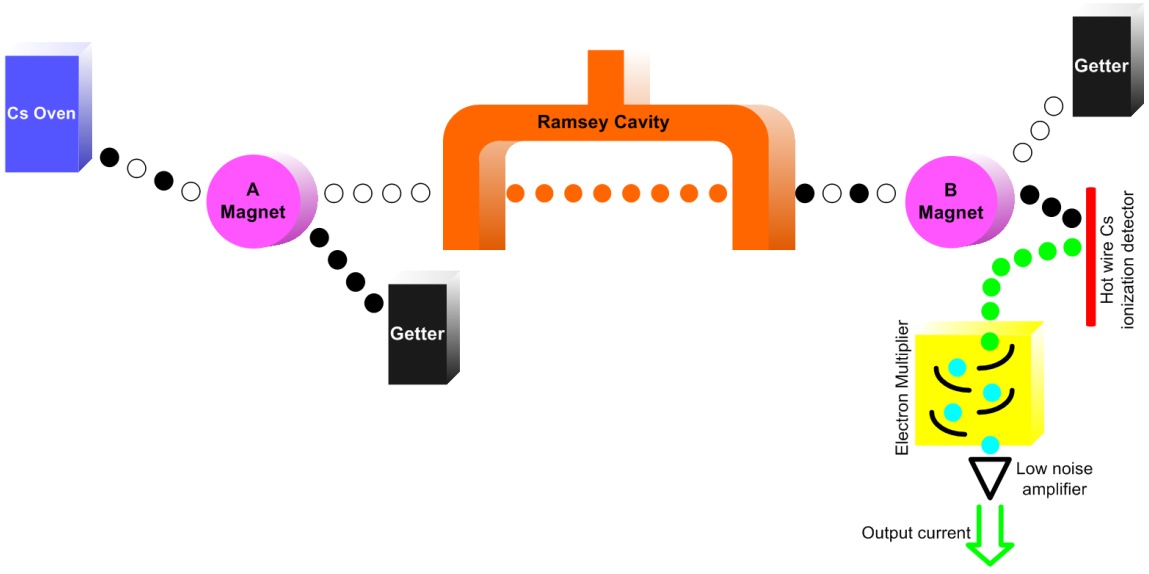

Figure 2-1 General Principle

The “good” atoms thus selected pass through a slit into the Ramsey cavity in which they are excited by an alternating microwave electromagnetic field. This high frequency field induces the desired state transition of the atoms at F0.

The number of atoms which undergo a change of state, or which are reoriented magnetically, during their passage through the cavity depends on the difference between the frequency of the applied electromagnetic field and the frequency of the atomic transition.

At the outlet of the cavity, there is a second “B” magnet, which deflects those atoms having undergone the change of state towards the hot wire Cs ionization detector. This detector supplies an output current which is proportional to the number of atoms detected. After in-situ current amplification by an electron multiplier, the output current is converted to voltage outside the Cs tube. This output signal is at its maximum value when the excitation frequency of the tube corresponds exactly to the desired transition of Cs atoms.

In order to separate the various transitions between the seven possible magnetic hyperfine levels (Zeeman effect), the cavity is placed in a uniform magnetic field (C-field), which is magnetically shielded from the influence of external fields, either terrestrial or parasitic. The Figure 2-2 shows the response of a Cesium beam tube around its central “clock transition” frequency (Zeeman sub-level m_F=0). The two first adjacent “Zeeman” patterns ($m_F = \pm 1$) are positioned symmetrically on each side of the central fringe at about ± 48 kHz. One of these Zeeman transitions is used to calibrate the induced magnetic C-field.

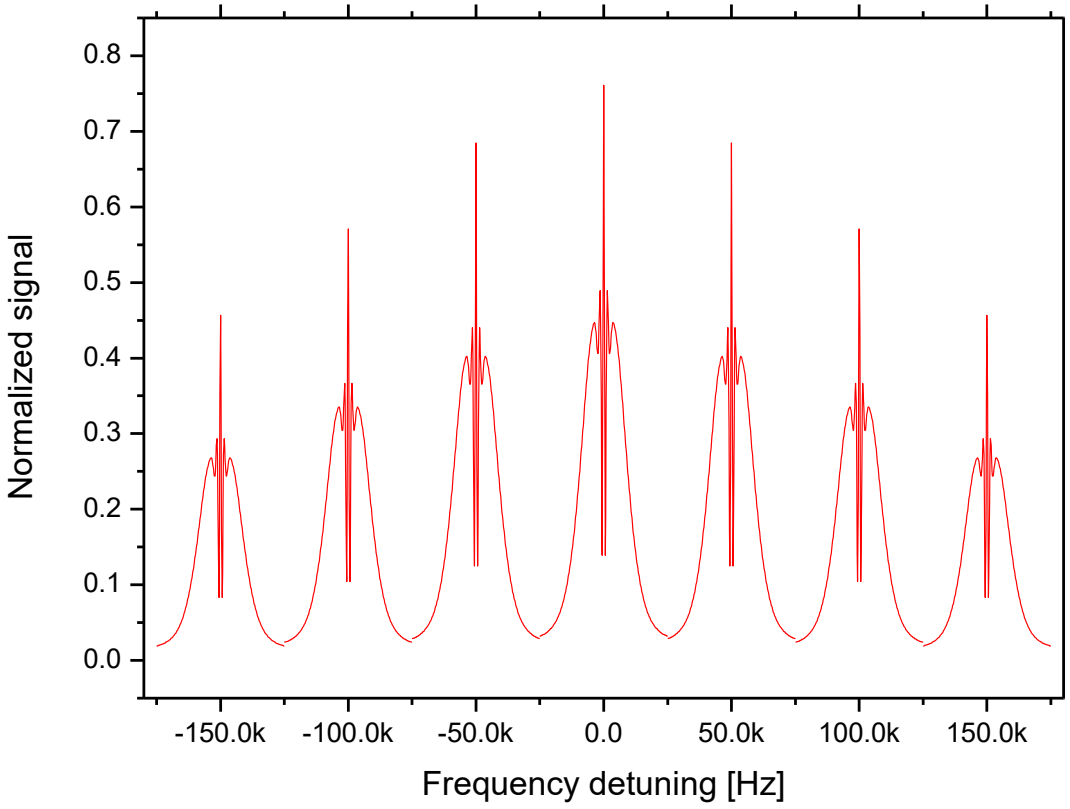

Figure 2-2 Response of a Cesium Beam Tube

To detect and use this transition frequency, which is both accurate and very stable in time, an electronic system is necessary. The excitation frequency of the tube is supplied by a microwave synthesized signal, which is issued from a high-performance quartz-crystal oscillator whose frequency is servo-controlled by the output DC signal produced by the tube (see Figure 2-3).

The output signal of the standard, which has a frequency of 10MHz, is supplied by the servo-controlled quartz-crystal oscillator. Stabilized this way, the quartz-crystal oscillator supplies the user a signal of very low phase noise thanks to its intrinsic properties, and a very high frequency stability and accuracy thanks to the control of its frequency by the Cs reference signal for long integration time.

2.1.4 Operation Principle

The following figure shows the operation principle of OSA 3235B CESIUM CLOCK. The Ramsey central fringe is alternatively scanned by a low square wave frequency modulation to generate an “Error Signal”.
Main objective of that operation is adjusting perfectly the OCXO’s frequency to reach the “zero” error signal.
“Zero” error signal is obtained when the “Left signal” is absolutely equal to the “Right signal”. In these conditions the frequency “detuning” compared to (F3, 4; mF=0) clock transition is # 0 (yellow dotted line). In case of an OXCO frequency detuning, the error signal is square wave modulated at the same frequency as the interrogation signal (typically 30 Hz), and its phase depends on the sign of the OCXO detuning with respect to the reference atomic transition frequency.

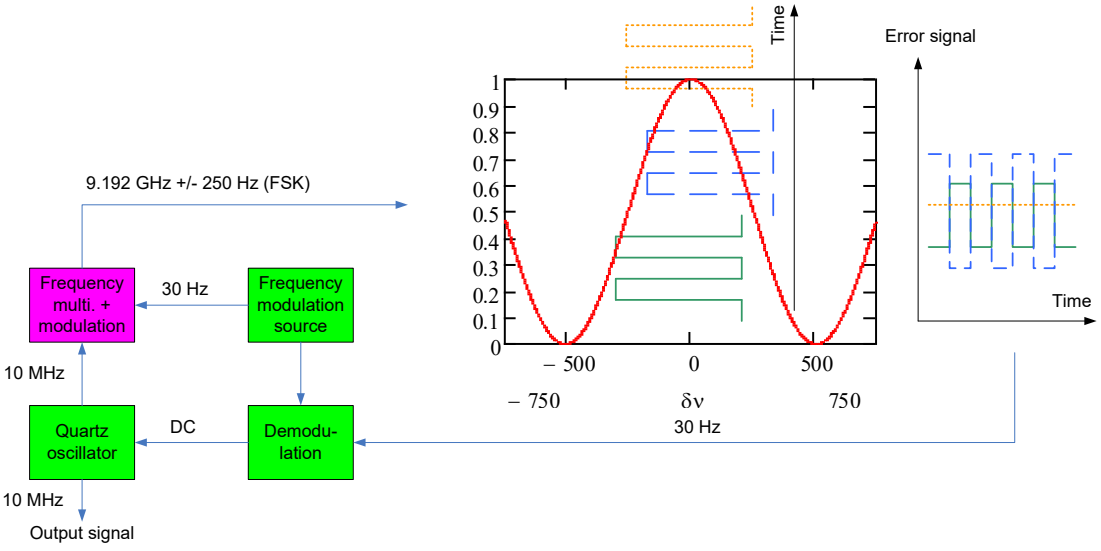

Figure 2-3 Operation Principle

Square wave frequency modulation is realized by the RF synthesis via the DDS (Direct Digital Synthesizer) and the control board. Synchronous demodulation is made on “control” board too after amplification in the trans-impedance amplifier.

2.2 System Architecture

The “OSA 3235B CESIUM CLOCK” general structure is as shown below:

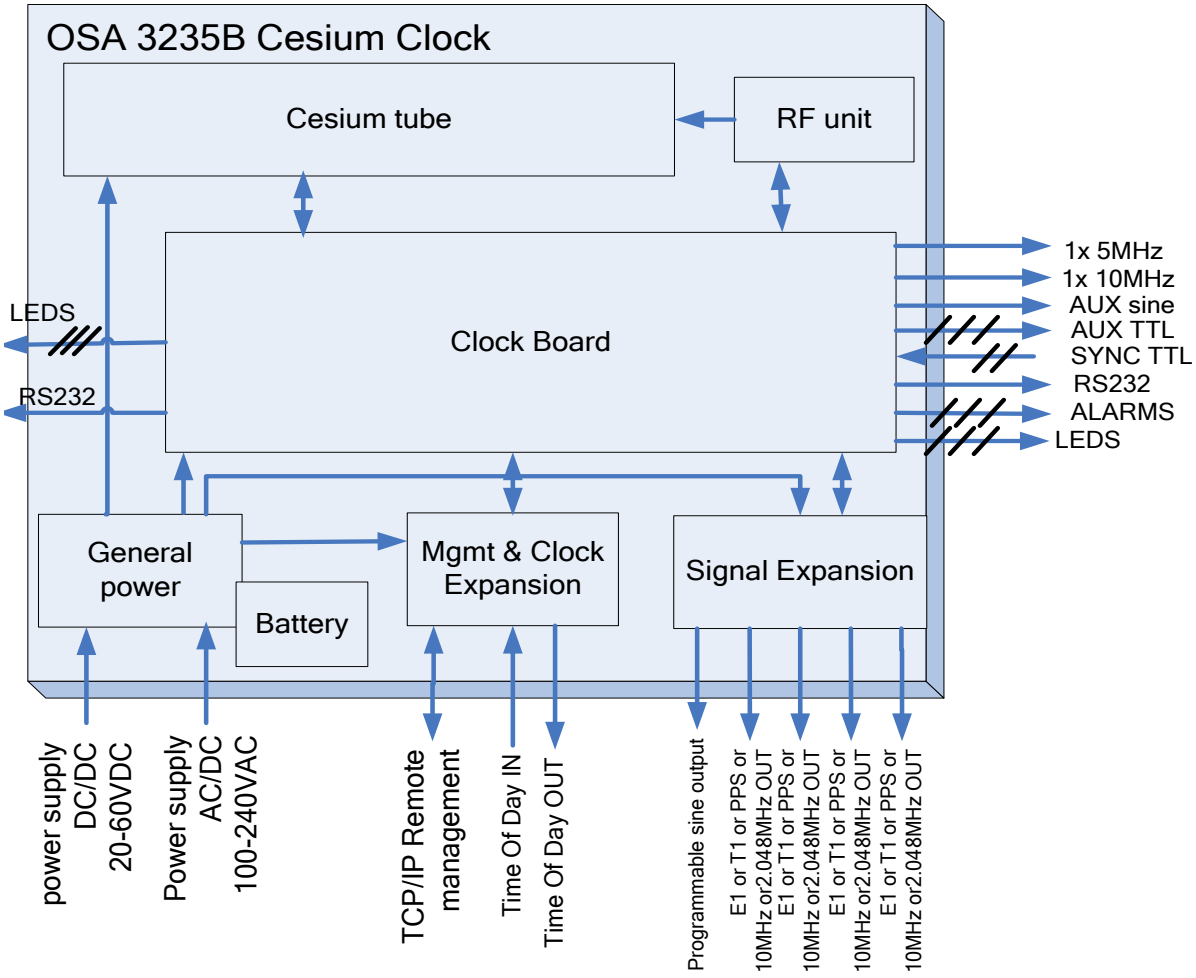

Figure 2-4 System Architecture

As shown above, regarding “Electronics”, only 5 main functional boards are used in OSA 3235B CESIUM CLOCK Units:

2.2.1 Power Supply Distribution Board

The OSA 3235B features two independent power inputs. The unit is equipped with two Power Supply Units, the first one is DC voltage and the second one is AC voltage. If the external power supply is switched off (AC and DC), internal batteries provide the instrument operation, with specifications preserved, for the time period not less than 45 minutes

- 1 redundant DC and AC power entries (3235B, 1 x AC, 1x DC)
- This board supports all the DC/DC converters able to generate DC voltages used by other boards.
- This board also supports 2 programmable “high voltage” power supplies: "Electron Multiplier” and “Vacuum Ionic Pump”.
- Fuse protection and EMC protection

2.2.2 RF Synthesizer and RF Chain Board

- This board synthesizes the alternating microwave electromagnetic field that is injected in Ramsey cavity (RF input). The RF frequency can be modulated via the DDS (placed on “clock board”) to scan the Cs beam tube spectrum.
- Some additional microwave elements are placed outside the board directly on the clock’s mechanic.

2.2.3 Clock Board Unit

- This board is the heart of the clock. It controls the main clock’s functions, so as:
- The RF synthesized frequency via the DDS (Direct Digital Synthesizer)
- The power supply distribution
- It also supports the “trans-impedance” amplifier (output signal of the tube) and the Oven Controlled Crystal Oscillator (OCXO)
- The management of the clock is made on this board too. It allows the commands and signals or power supplies monitoring and can generate the clock’s alarms.
- The frequency locked loop of the OCXO
- Generates the 10MHz, 5MHz, AUX outputs and SYNC input
- Provides the local management RS232
- Manages the Ethernet access through the management expansion board
- The Cesium source (Thermostat)
- The C field-magnet current (Low noise Source)
- The “Hot Wire” (Heating + polarization)

2.2.4 Management Expansion Board

- Provides Ethernet port management
- Provides Time of Day input and output

2.2.5 Signal Expansion Board

- Provides PPS TTL or 10MHz TTL or 2.048MHz or 2.048kbit/s (E1) or 1.544kbit/s (T1) outputs
- Verifies the output presence
- Squelches the output

2.3 System Description

The OSA 3235B delivers high stability signals. In addition to the standard main output panel, different optional Telecom output expansions are available. Two types of management panels are available for the 19".

2.3.1 19’’ Rear View

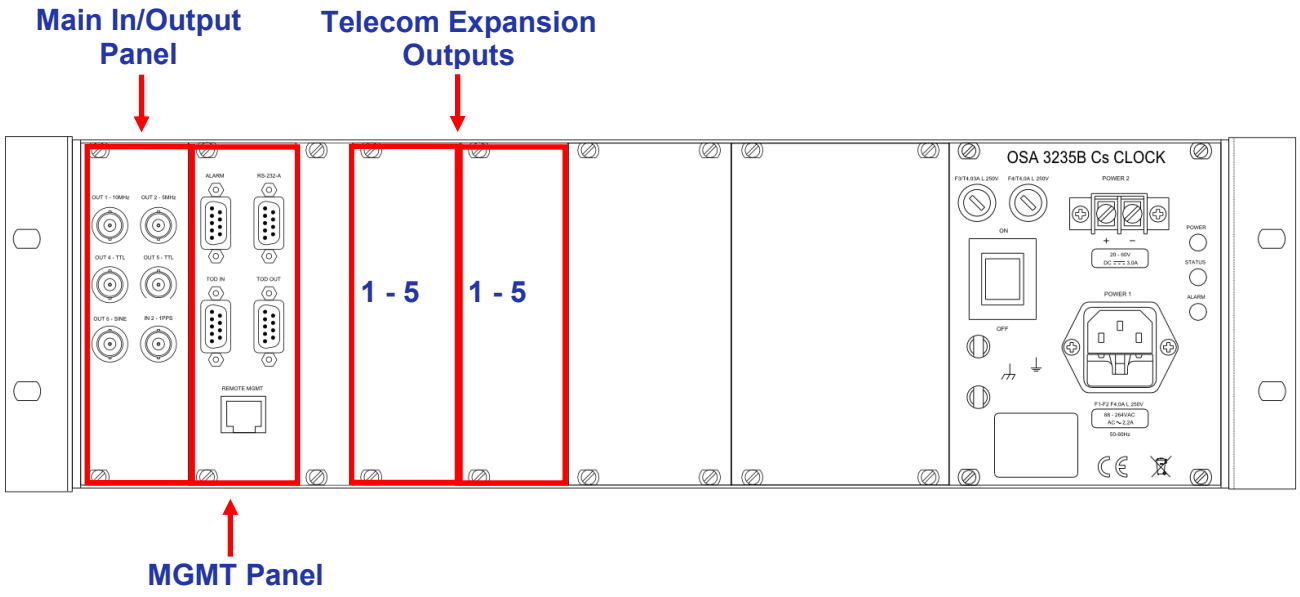

Figure 2-5 19" Rear View

2.3.2 19" Main In/Output Panels

The main In/Outputs are located on both rear and front panels

2.3.2.1 Rear Panel

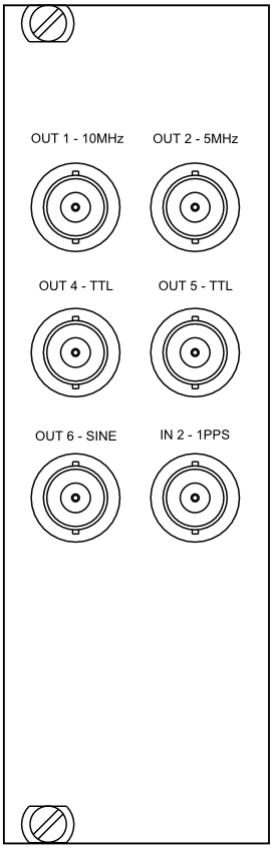

Figure 2-6 Main Rear In/Output Connectors

Description	Frequency	Connector
Out 1 - 10MHz	Low Noise 10MHz	BNC/F
Out 2 - 5MHz	Low Noise 5MHz	BNC/F
Out 4 - TTL	PPS /1MHz / 5MHz / 10MHz	BNC/F
Out 5 - TTL	PPS /1MHz / 5MHz / 10MHz	BNC/F
Out 6 - SINE	SINE wave analog output 100kHz to 50MHz	BNC/F
In 2 - 1PPS	Synchronization input, Used to synchronize all outputs	BNC/F

Table 2-1: Main Rear In/Output Connectors

2.3.2.2 Front Panel

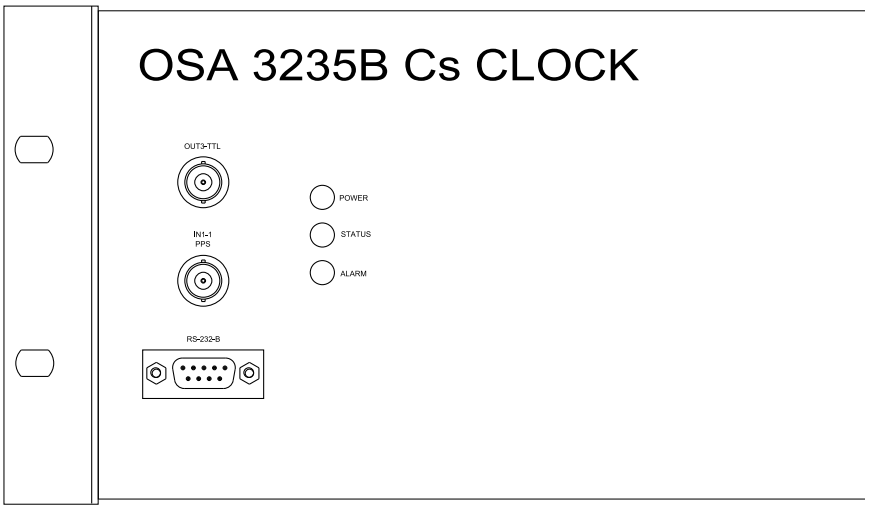

Figure 2-7 19" Main Front In/Output Connectors

Description	Frequency	Connector
Out 3 - TTL	PPS /1MHz / 5MHz / 10MHz	BNC/F
In 1 - 1PPS	Synchronization input, Used to synchronize outputs	BNC/F

Table 2-2: 19" Main Front In/Output Connectors

2.3.3 Telecom Expansion Outputs

2.3.3.1 Option: 4x Telecom outputs on BNC 75 Ω, 1x prog. analog output BNC 50 Ω

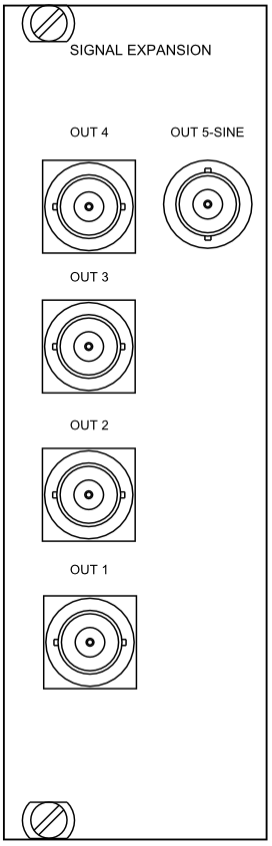

Figure 2-8 19" 4x Telecom Outputs BNC, 1x Prog. Analog Connectors

Description	Frequency	Connector
Out 1	PPS /10MHz / 2.048MHz / 2.048Mbit/s	BNC/F
Out 2	PPS /10MHz / 2.048MHz / 2.048Mbit/s	BNC/F
Out 3	PPS /10MHz / 2.048MHz / 2.048Mbit/s	BNC/F
Out 4	PPS /10MHz / 2.048MHz / 2.048Mbit/s	BNC/F
Out 5 - SINE	Programmable SINE wave analog output 100kHz to 50MHz	BNC/F

Table 2-3: 19" 4x Telecom Outputs BNC, 1x Prog. Analog Connectors

2.3.3.2 Option: 4x Telecom Outputs Sub-D9 120 Ω /BNC 75 Ω mix, 1x Prog. Analog BNC 50 Ω

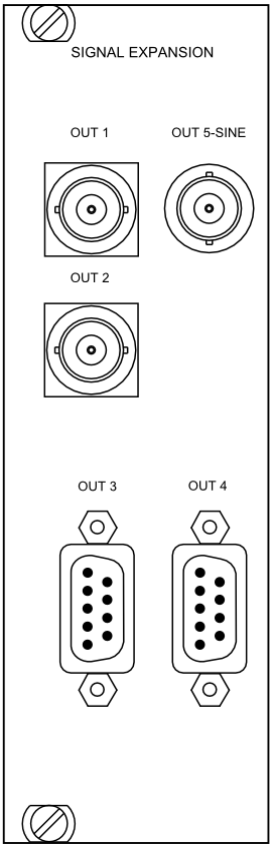

Figure 2-9 19" 4x Telecom Outputs mix, 1x Prog. Analog Connectors

Description	Frequency	Connector
Out 1	PPS /10MHz / 2.048MHz / 2.048Mbit/s / 1.544Mbit/s	BNC/F
Out 2	PPS /10MHz / 2.048MHz / 2.048Mbit/s / 1.544Mbit/s	BNC/F
Out 3	PPS /10MHz / 2.048MHz / 2.048Mbit/s	Sub-D9/F
Out 4	PPS /10MHz / 2.048MHz / 2.048Mbit/s	Sub-D9/F
Out 5 - SINE	SINE wave analog output 100kHz to 50MHz	BNC/F

Table 2-4: 19" 4x Telecom Outputs mix, 1x Prog. Analog Connectors

2.3.3.3 Option: 4x Telecom Outputs Sub-D9 120 Ω, 1x Prog. Analog on BNC 50 Ω

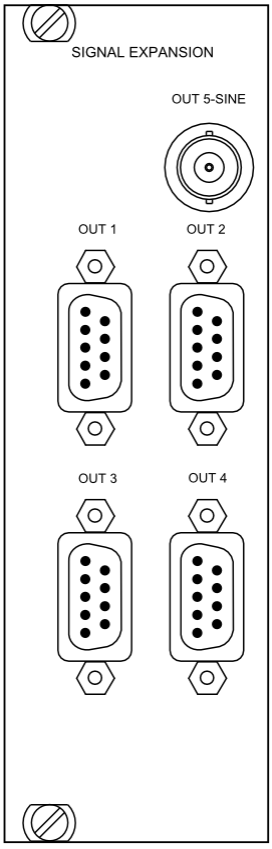

Figure 2-10 19" 4x Telecom Outputs Sub-D, 1x Prog. Analog Connectors

Description	Frequency	Connector
Out 1	PPS /10MHz / 2.048MHz / 2.048Mbit/s / 1.544Mbit/s	Sub-D9/F
Out 2	PPS /10MHz / 2.048MHz / 2.048Mbit/s / 1.544Mbit/s	Sub-D9/F
Out 3	PPS /10MHz / 2.048MHz / 2.048Mbit/s / 1.544Mbit/s	Sub-D9/F
Out 4	PPS /10MHz / 2.048MHz / 2.048Mbit/s / 1.544Mbit/s	Sub-D9/F
Out 5 - SINE	Programmable SINE wave analog output 100kHz to 50MHz	BNC/F

Table 2-5: 19" 4x Telecom Outputs Sub-D, 1x Prog. Analog Connectors

2.3.4 MGMT Panel Options

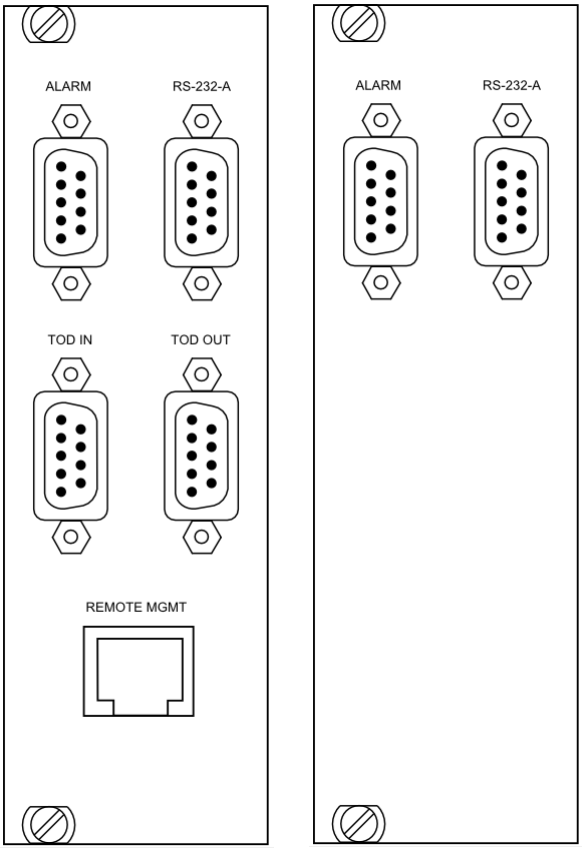

Figure 2-11 19" MGMT Panel Options

Description	Connector
ALARM	Sub-D9/F
RS-232-A	Sub-D9/M
TOD IN	Sub-D9/M
TOD OUT	Sub-D9/F
REMOTE MGMT	RJ 45

Table 2-6: 19" MGMT Panel Connectors

2.3.5 Dimensions

19’’ version with the main outputs in the front panel.

19’’ mounting 3U: H x W x D: 132 x 436 x 381 mm (5.1’’ x 17.1’’ x 15’’)

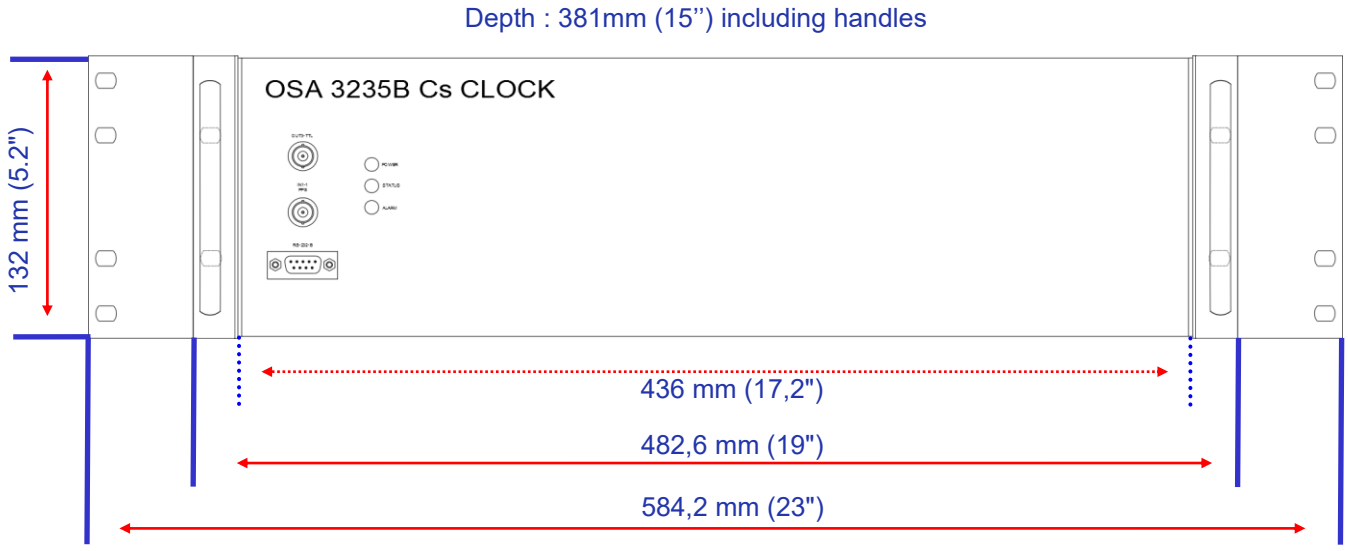

Figure 2-12 Dimensions - Front View 19’’/23"

2.3.6 Rack Mounting

The OSA 3235B Cs Clock could be mounted in a 19’’ and 23’’ rack for “19’’” version. For a detailed mounting procedure please refer to the Installation/Rack instructions chapter.

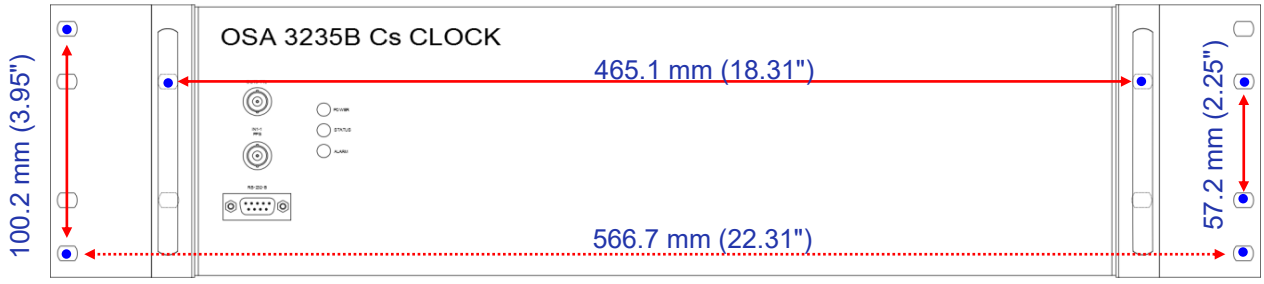

Figure 2-13 Dimensions – Mounting 19’’/23’’

2.3.7 Connector Panels 19”

Main connector panel is located either on the front or rear of the unit.

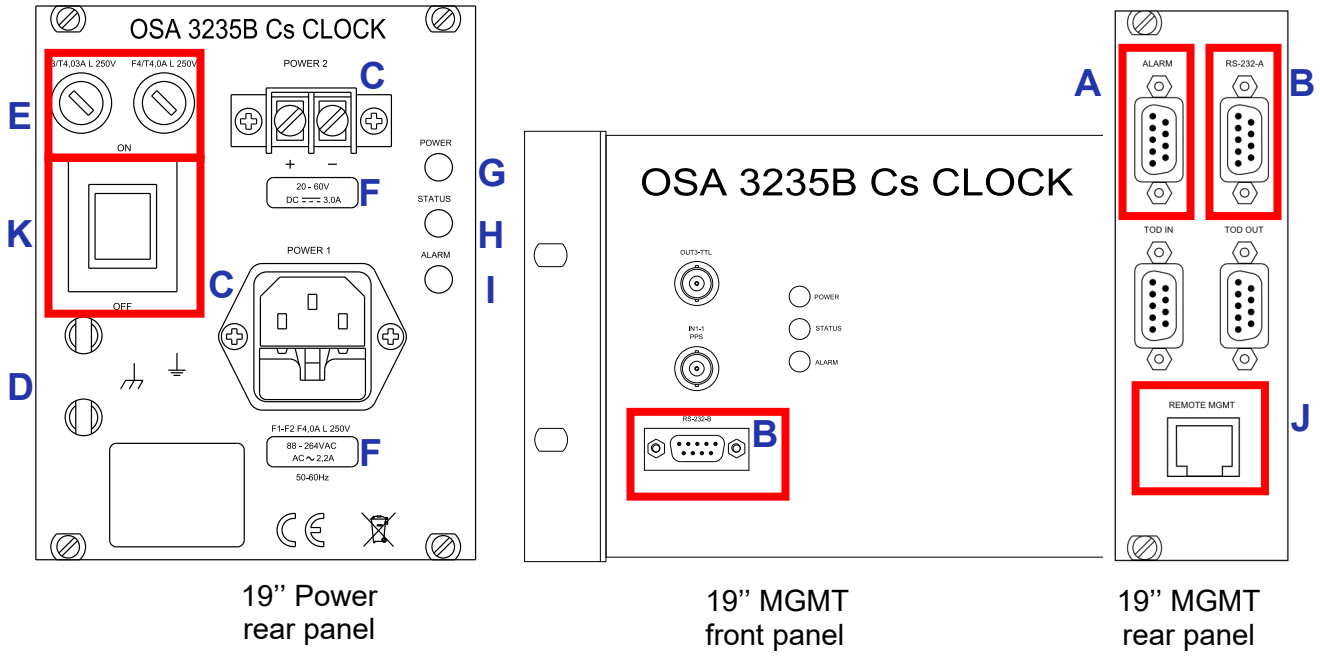

Figure 2-14: Connector Panels

A: SUB-D9 Female connector is available to control Alarms (User alarm via Front panel).

B: Command functions and parameters monitoring are available on a “RS-232” serial link on a SUB-D9 Male connector (PC user via front panel).

C: The DC power connector is screw terminal. DC Power supply is possible between 24V and 50V. The in-rush current may be 6A during typically 1ms.

The AC power supply is possible between 88-264 VAC.

D: Grounding studs, they must be connected to a reliable ground.

E: An external fuse is available; please refer to specification before to replace it.

F: Power supply indications

G: "LED" gives the status of the POWER:

- "Off" LED : Unit not powered
- "Red blinking" LED : Unit powered by battery (if present)
- "Green blinking" LED : Unit powered by 1x DC or 1x AC (no redundant)
- "Green fixed" LED : Unit powered by 2x DC or 1x DC and 1x AC

H: "LED" gives the state of STATUS:

- "Off" LED : Unit not powered
- "Red fixed" LED: Critical Alarm
- "Green blinking" LED : Warm Up
- "Green fixed" LED : Operational State
- "Orange blinking" LED : Download state
- "Orange fixed" LED : Standby mode

I: "LED" gives the status of ALARM:

- "Off" LED : Unit not powered
- "Red blinking" LED : Major Alarm
- "Red fixed" LED: Critical Alarm
- "Green blinking" LED : Minor Alarm
- "Green fixed" LED : No Alarm

J: Command functions and parameters monitoring are available on a LAN link on a RJ45 connector (PC user via front panel). ETSI shelf.

K: Switch to disable battery as POWER source. Put in on OFF position to completely switch off the unit (only available when battery option is present)

A **"Configuration & Monitoring Software"** is available in option to view the main parameters of the unit

Connector	Type	Description	Processed by	Comments
ALARMS	SUB-D9 Female	Alarms List	Relay status	refer to **ALARM**
RS-232	SUB-D9 Male	Commands & Monitoring	External PC	refer to **Remote Operations**
POWER (P) STATUS (S) ALARM (A)	LED	**Red blinking**	automatic	P: Unit powered by battery S: N/A A: Major alarm
		Green blinking	automatic	P: Unit powered by 1xDC or 1x AC S: Warm Up A: Minor alarm
		Green fixed	automatic	P: Unit powered by 2xDC or 1x AC & DC S: Operational State A: No alarm
		Orange fixed	automatic	S: Standby mode (only ion pump is powered)
		Red fixed	automatic	P: N/A S: Critical Alarm A: Critical Alarm
POWER		24V-50VDC¨ or 100-240VAC	N.A	refer to **Power**

Table 2-7 Front Panel Connectors

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3. Installation

- Pre-Installation Considerations
- Unpacking & Inspection
- Connections

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3.1 Pre-Installation Considerations

Before you start the installation, review the recommended environmental conditions, verify the site readiness, and ensure that you have the required tools.

CAUTION

The equipment is intended for installation in a restricted-access area. Install the shelf at locations where the presence of children is unlikely.
The product is safe under reasonably foreseeable conditions

3.1.1 Tools Required

For the installation and commissioning of the OSA 3235B CESIUM CLOCK the following tools are needed:

- Multimeter (DC and AC, frequency range up to at least 3 MHz)
- Oscilloscope (bandwidth of at least 30 MHz)

3.1.2 Environmental Conditions

To obtain the best results with this “Cesium Frequency Standard”, it is better to install/store the unit in a quiet place with the following conditions:

- Temperature relatively stable (e.g.: 23°C +/-2°C)
- No powerful electrical engines around
- DC power supply stable and relatively noiseless
- No powerful vibrations sources

3.1.3 Magnetic Field Precautions

CAUTION

Magnetic field influences the OSA 3235B CESIUM CLOCK

Vibration influences the OSA 3235B CESIUM CLOCK

Quick temperature variations influence the OSA 3235B CESIUM CLOCK

This instrument is sensible to external magnetic field.

***Stability performances can be definitively degraded if exposed to a strong magnetic field**.*

In order to not saturate the internal magnetic shielding of the Cesium tube, it is necessary to place the unit far from magnets.

Never exceed +/- 2 Gauss magnetic field around the Instrument.

Recommendation:

Please install the OSA 3235B CESIUM CLOCK in a very quiet environment to have best specifications.

3.1.4 Working Conditions

In order to work within specification, the OSA 3235B CESIUM CLOCK should be installed at a location which does not exceed the following working conditions:

- Operating temperature range: -5°C to +50°C (no battery option)
  0°C to +35°C (with battery option)
- Altitude : 0m to 3'000m (For DC only version)
  0m to 2'000m (For version with AC)
- Humidity: Up to 95% at 25^0C
- External magnetic field: +/- 1Gauss
- No vibrations

3.1.5 Normal & Utmost Operating Conditions

Operating conditions	Power Supply	Operation temperature	Humidity	Atmospheric pressure	External magnetic field
Nominal	40V +/- 10%	23°C +/- 2°C	50% (+/-10%)	101.3 kPa	5 to 6.10^{-9} Gauss (55000 nT)
Utmost	Min 24V to max 50V	-5°C to +50°C (no battery) 0°C to +35°C (with battery)	Up to 95%	81 kPa to 106 kPa	+/- 2 Gauss

Table 3-1: Normal & Utmost Operating Conditions

3.1.6 Rack instructions

When rack-mounting the shelf, consider these:

- Mount the shelf according to your installation plan.
- Mount the shelf immediately after you fit the adaptor brackets, if any.
- When rack-mounting multiple shelves avoid uneven mechanical loading.
- Avoid mounting shelves in an overly congested rack.
- To ensure adequate cooling of the modules in the shelf, verify fee space of approximately 5 cm (2.0 in) around the ventilation openings of each shelf.
- when mounting inside a cabinet, prefer mounting the deepest shelves at the bottom of the rack so that air flow in the cabinet is not restricted and to avoid uneven mechanical load
- If the earthing terminal on a shelf is not accessible after mounting into the rack, attach the earthing conductor prior to mounting.
- The shelf must be reliably and permanently connected to the rack earth point.

LOCATION FOR INSTALLATION

For safety reasons, OSA 3230B must be installed in a restricted access location.

Moreover, the shelf in which OSA3230B is installed must act as a fire and particles protection to prevent from any damages.

ESD CONSIDERATION

Ensure that you are grounded with a wrist strap or equivalent while mounting the brackets to a shelf that contains ESD-sensitive devices.
Ensure that you are grounded with a wrist strap or equivalent while mounting the brackets to a shelf that contains ESD-sensitive

3.1.6.1 Required Tools

- 4 x rack screws and washers for fixing the shelf to the rack rail (not provided).
- Use screws that fit the threaded holes in your rack.
- Appropriate screwdriver.

3.1.6.2 Mounting the Shelf

To mount the shelf:

1. Review the rack installation and cabling plans to get information about the:
   - rack that holds the shelf
   - position of the shelf within the rack.
2. Verify that there is enough working space behind or on either sides of the rack.
3. On the rack mounting rails, locate and mark the mounting holes to which you will fix the shelf.
4. Optional. Install two or four cage nuts in the corresponding holes on both sides of the rack.
5. Mount the shelf to the rack:
   We recommend to have a persons to hold the shelf in place, while another secures the shelf to the rack.
   a. With a person on each side, lift the shelf to the bay and position it with the attached brackets in the rack so that the bracket holes on each side are aligned with the rack mounting holes or the cage nuts.
   b. Insert the corresponding rack screws with the proper washers.
   c. Tighten the rack screws with a screwdriver.
6. Insert the pozidrive screw with washers when using a cage nut or use an appropriate screw for the preinstalled terminal connector on the rack.
7. Tighten the screw with a screwdriver.

3.2 Unpacking & Inspection

CAUTION

Check first that the packing does not have any signs of rough handling such as dents or scratches, which might have occurred during transportation. Also inspect the equipment carefully for possible damages (broken knobs, bent handles, etc.).

Should the equipment have suffered any damage, immediately notify the carrier and retain the packing material for inspection.

Recommendation:

We recommend saving the packing material for use in case of return shipment. Should you need to return the equipment, please do not hesitate to contact OSCILLOQUARTZ for help in obtaining appropriate packing material.

CAUTION

When handling the unit or spare cards, the operator must use grounded wrist straps.

CAUTION

Spare cards must be stored in anti-static packaging.

Note:

Compare the unit contents with the purchase order / order acknowledgement. In case of error, contact your local OSCILLOQUARTZ representative or OSCILLOQUARTZ offices.

3.3 Connections

3.3.1 Connectors & Indicators

The following table and figure provide descriptions of the connectors and indicators as well as their location on the instrument.

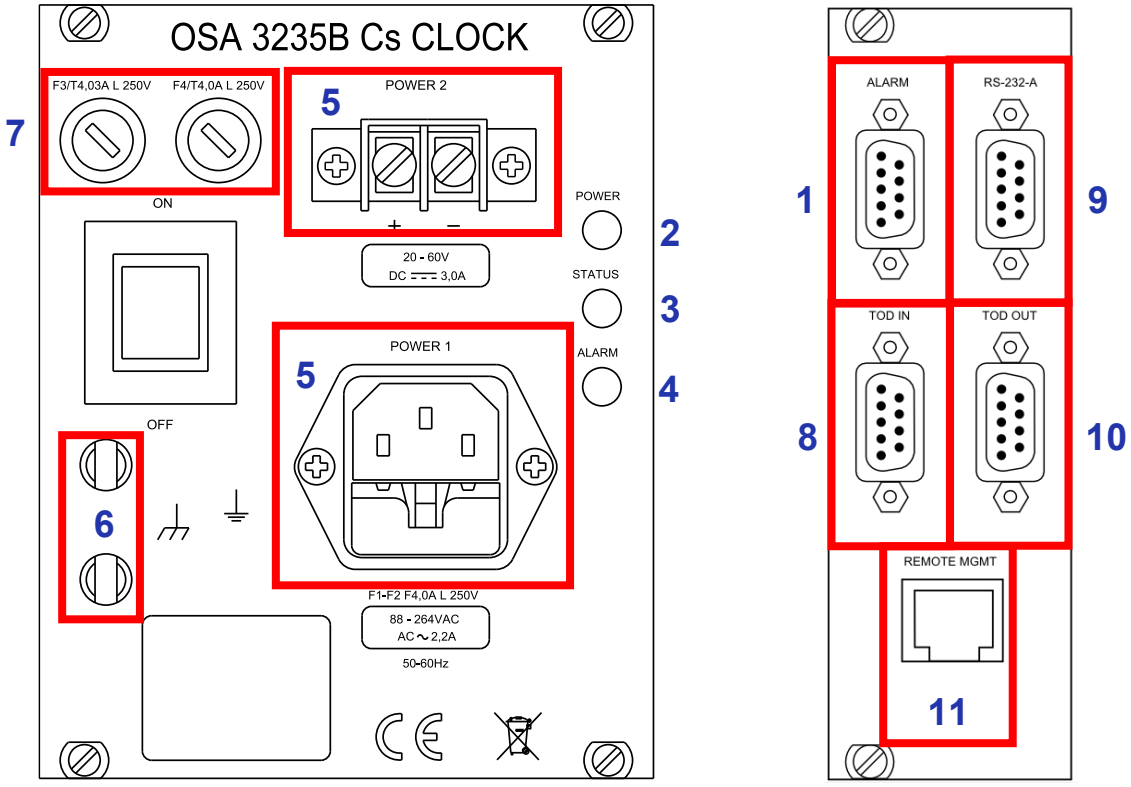

Figure 3-1: Main Connector Panel

Positions	Means of control or connectors designation	Description
1	ALARM	Sub-D9/F connector
2	LED POWER	--
3	LED OPERATING	--
4	LED ALARM	--
5	POWER 1/ 88-264 VAC	--
5	POWER 2/ 20V-60V	--
6	Grounding Studs	--
7	Fuses	--
8	RS-232	Sub-D9/M connector
9	TOD IN	Sub-D9/M connector
10	TOD OUT	Sub-D9/F connector
11	REMOTE MGMT	RJ 45

Table 3-2: Main Connectors & Indicators

3.3.2 Power Connection

Recommendation:

We recommend saving the packing material for use in case of return

Please refer section Power-Up & Commissioning for Turn-Up Procedure.

3.3.2.1 Power Supplies

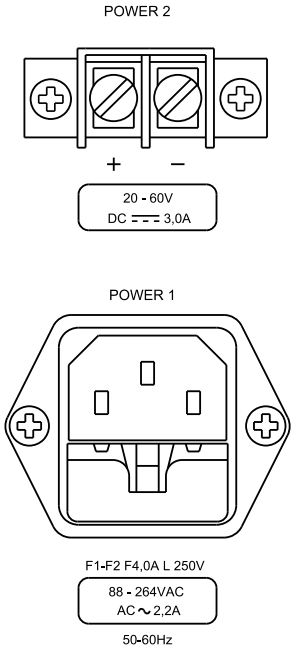

Figure 3-2 Power Connectors (w/o battery option)

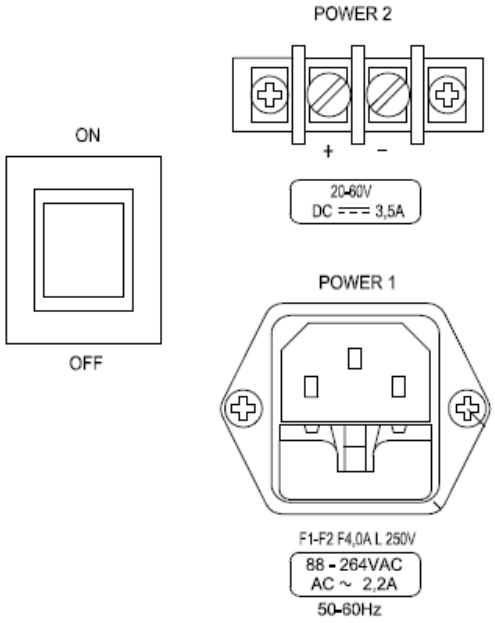

Figure 3-3 Power Connectors (with battery option)

CAUTION

OSA 3235B can be supplied with redundant POWER sources. Please carefully disconnect POWER source 1 and 2 before replacing the unit.

- For DC sources a breaker system should be used
- For AC sources just remove the detachable cord
- When battery option is present put the main switch on OFF position to DISABLE battery power source

Note:

Removing or changing fuses must be carried out by qualified service personnel.

3.3.3 Output Connectors

The same BNC female connectors are used available for both outputs:

3.3.3.1 BNC Output Connector (F)

The associated connector panel has two connectors with the following pin-out:

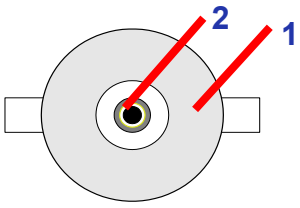

Figure 3-4 BNC/F Output Connector

Pin Nr.	Signal
1	Ground
2	Output

Table 3-3 BNC/F Output Connections

3.3.3.2 Sub-D9 Output Connector

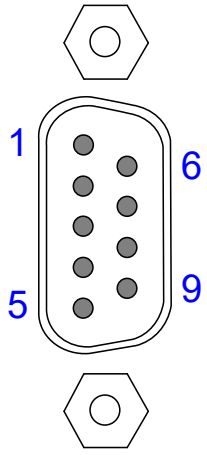

Figure 3-5 Output Sub-D9/F Connector

Pin Nr.	Signal
1	Out 1b
2	Out 1a
8	Out 2b
4	Out 2a
3,7	NC
5,6,7	Ground

Table 3-4 Sub-D9/F Output Connections

3.3.3.3 Connecting the Output Signals

Outputs signals are BNC female type or Sub-D9 male for Signal expansion

"OUT 1 10MHz" and "OUT 2 5MHz" are sine waves high performance signal (high frequency stability, low phase noise).
Out 6 and optional Out 5: is/are programmable sine wave (100kHz to 50MHz)
"OUT 6 to OUT 3" are programmable square wave ACMOS signal (PPS, 100kHz, 1MHz, 5MHz or 10MHz)
"IN1 PPS" and "IN2 PPS" are external reference synchronization input. These inputs accept any TTL signal between 3V and 5V.
OUT 1 to OUT 4 are telecom outputs (2.048MHz, E1, T1, PPS and 10MHz)

Signal Output	Frequency	Connector	Location
OUT 1	10MHz low noise	BNC/F	Rear
OUT 2	5MHz low noise	BNC/F	Rear
IN 1 PPS	1Hz	BNC/F	Front
IN 2 PPS	1Hz	BNC/F	Rear
OUT 3	1PPS, 100kHz, 1MHz, 5MHz, 10MHz	BNC/F	Front
OUT 4	1PPS, 100kHz, 1MHz, 5MHz, 10MHz	BNC/F	Rear
OUT 5	1PPS, 100kHz, 1MHz, 5MHz, 10MHz	BNC/F	Rear
OUT 6	Sine 100kHz to 50MHz	BNC/F	Rear
EXP OPTIONS			
OUT 1	2.048MHz, 2.048MBits/s, 1.544MBits/s, PPS, 10MHz	BNC/F or Sub-D9/F	Rear
OUT 2	2.048MHz, 2.048MBits/s, 1.544MBits/s, PPS, 10MHz	BNC/F or Sub-D9/F	Rear
OUT 3	2.048MHz, 2.048MBits/s, 1.544MBits/s, PPS, 10MHz	BNC/F or Sub-D9/F	Rear
OUT 4	2.048MHz, 2.048MBits/s, 1.544MBits/s, PPS, 10MHz	BNC/F or Sub-D9/F	Rear
OUT 5	Sine 100kHz to 50MHz	BNC/F	Rear

Table 3-5 Output Signal Connections

STEP	ACTION
1	Connect a male BNC cable on “OUT 1 10MHz” to use sine wave signal.
2	Connect a male BNC cable on “OUT 2 5MHz.” to use sine wave signal.
3	Connect a male BNC cable on “IN PPS.”
4	Connect a male BNC cable on “OUT 6” or optional “OUT 5” and/or “OUT 5” (seconds expansion signal) to use programmable sine wave.
5	Connect a male BNC cable on “OUT 3”, “OUT 4”, “OUT 5” to use PPS, 1MHz, 5MHz or 10MHz sine wave
6	Connect a male BNC cable on “OUT 1” to “OUT 4” to use telecom signals (2.048MHz, 2.048Mbits/s and/or 1.544MHz).

Procedure 3-1 Connecting the Output Connections

The “OSA 3235B CESIUM CLOCK” is now installed and ready to synchronize the equipment connected to its outputs.

3.3.4 ALARM Outputs

Three types of alarms are possible: Minor, Major and Critical.
Relay outputs are available to users to command “electronics”.

Relay output is on the front panel for ETSI and on the rear panel for 19’’.

When an Alarm is generated, the LED Status can be red or green blinking.
For more information’s about these alarms, it’s necessary to use the “Configuration and Monitoring Software” available on CD and via the RS-232 serial link.

3.3.4.1 ALARMS Connection

This electrical alarm is issued from relay isolated contacts and is available on the 'ALARM' connector.

Absolute maximum ratings

U = 50VDC I = 250mA

The alarm output works in "Normally Closed" or "Normally Opened" mode (depending of the wiring). In "Normally Closed" mode, the relay contacts are open when there is an alarm condition or when the OSA 3235B CESIUM CLOCK is switched-off while it is closed in "Normally opened" mode.

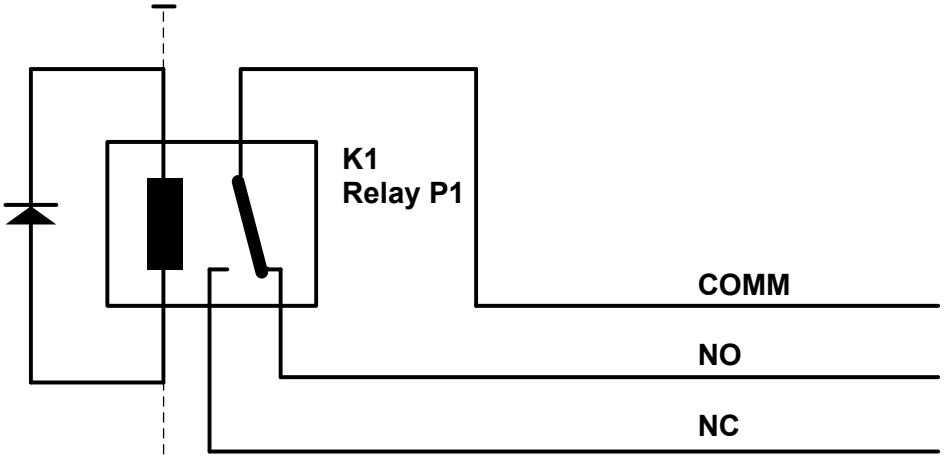

Figure 3-6 Alarm Connection

3.3.4.2 ALARMS Connector

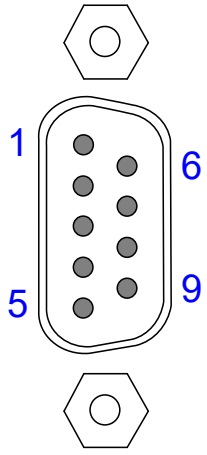

Figure 3-7 Output Alarm Pin-Out - SUB-D9/F

Pin No.	Functions
1	Minor Common
2	Minor Normally Open
3	Minor Normally Closed
4	Major Common
5	Major Normally Open
6	Major Normally Closed
7	Critical Common
8	Critical Normally Open
9	Critical Normally Closed

Table 3-6 SUB-D9/F Alarm functions

3.3.5 "RS-232" Serial Link

A **"Configuration & Monitoring Software"** is available in option to command and monitor the OSA 3235B CESIUM CLOCK unit.

3.3.5.1 Connector

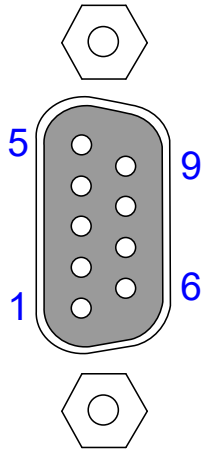

Figure 3-8 RS-232 Pin-Out - SUB-D/M

Pin No.	Function
2	Rx
3	Tx
5	Ground
1,4,6,7,8,9	NC

Table 3-7 SUB-D9/M RS-232 Pin-Out

3.3.5.2 Port Configuration

- Baud-rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: None
- Handshake: None

On the Rx line, the signal could be either

- standard RS-232: logical “zero” level [-15V,-3V] and logical “one” level [+3V,+15V], or
- ACMOS/TTL signal: logical “zero” level (0V) and logical “one” level (+5V)

On the Tx line, the signal is always standard RS-232: logical “zero” level [-15V,-3V] and logical “one” level [+3V,+15V].

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4. Remote Operations

- Commands Format
- Command Details

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4.1 Commands Format

Commands may be of several types:

write commands ;

answer to write command ;

request commands;

answer to request commands ;

For all commands, the line may include one or more blanks that will be ignored. Upper and lower case characters may be indifferently used.

All commands lines end with a Carriage Return – Line Feed sequence.

Principally, a command may be sent only **after** the reception of the previous command's answer. In case of sending grouped commands, the integrity of their answers is not guaranteed.

Write Commands

These commands are used to configure the equipment's parameters. They have the following structure:

CMD=val1,val2,…,valN;<cr><lf>

CMD is the command name or identifier. It is followed by the equality sign '=' and by one or more comma separated parameters. Commands end with a ';' and the line with Carriage Return – Line Feed.

If a command needs one parameter (for example to choose between different possibilities), then the syntax is:

CMD(par1,…,parN)=val1,val2,…,valN;<cr><lf>

Answers to Write Commands

The answer to the write command has the following format:

ANS;<cr><lf>

ANS is the actual answer. It ends with a semi-colon ';'. The line ends with a Carriage Return – Line Feed sequence.

ANS may have one of the following values:

OK;	Command executed
NOT_OK;	Command not executed
PARAMETER_MISSING;	Missing command parameter
PARAMETER_ERROR;	Parameters errors
SYNTAX_ERROR	Command syntax error
UNKNOWN_CMD	Unknown command
TIMEOUT;	No carriage return – line feed
PARITY_ERROR;	Parity error on the RS port
DWNLD_IN_PROGRESS;	Download in progress

Request Commands

The request command format is:

CMD;<cr><lf>

If a request command must accept one or more parameters, then the format is:

CMD(par1,par2,…,parN);<cr><lf>

Answer to the Request Commands

The answer to the request command is the following:

ANS=val1,val2,…,valN;<cr><lf>

ANS is the name or identifier of the request. It's followed by the equality sign '=' and by the comma separated values. The answer ends with a semi-colon ';' and the line ends with Carriage Return – Line Feed.
Some commands may return a large amount of data. Data is then transmitted over several lines as in the following example:

ANS=<cr><lf>
val11,val12,…,val1N,<cr><lf>
val21,val22,…,val2N,<cr><lf>
…
valM1,valM2,…,valMN;<cr><lf>

The Carriage Return - Line Feed sequence at the end of each line is optional.

4.2 Command Details

4.2.1 ACCURACY

Returns the accuracy user

Command

ACCURACY;<cr><lf>

Answer

ACCURACY=accuracy;<cr><lf>

accuracy: -1000000 to +1000000 (delta f/f 10^{-15})

4.2.2 ACCURACY=accuracy;

Set the accuracy user

Command

ACCURACY=accuracy;<cr><lf>

accuracy: -1000000 to +1000000 (delta f/f 10^{-15})

Answer

OK;<cr><lf>

4.2.3 ADM_STATE(input)

Return the state of input PPS

ADM_STATE(input);<cr><lf>

input: 1 or 2

Answer

ADM_STATE(input)=admstate;<cr><lf>

admstate: 0 (Disabled) or 1 (Enabled)

Note:

If no PPS signal is connected and not used. Input should be deactivated to avoid PPS input alarm.

4.2.4 ADM_STATE(input)

Enable or disable the PPS input

ADM_STATE(input)=admstate;<cr><lf>

input: **1 or 2**
admstate: **0 (Disabled) or 1 (Enabled)**

Answer

OK;<cr><lf>

4.2.5 ALARM

Returns the list of active alarms

Command

ALARM;<cr><lf>

Answer

ALARM=N;<cr><lf>

or

ALARM=a,b,…;<cr><lf>

With

N: No Alarms

or

a : 1st alarm id
b : 2nd alarm id

Each alarm is separated by a comma ‘,’, the list is ended by a semi-colon ‘;’, and the answer ends with a Carriage Return – Line Feed.

The following table gives the list of available alarms.

ID	Name	Alarm raised condition	Severity
0	CLOCK_IN_WARMUP	Raised at clock power-up during the complete start-up sequence (typically 35 minutes)	Minor
1	OCXO_FAILURE	Raised when OCXO current is out of specification	Critical
3	OVEN_FAILURE	Raised when OVEN current is out of specification	Critical
5	DIGITAL_POT_FAILURE	Raised when digital potentiometer can't be accessed	Critical
6	POWER_ON_BATTERY	Raised when power is supply by battery	Major
7	BATTERY_FAILED	Raised when battery is out of order	Minor
8	BATTERY_IN_CHARGE	Raised when battery is charging	Minor
9	LOSS_OF_PPS_INPUT_1	Raised when PPS IN 1 is missing or to low level.	Minor
10	LOSS_OF_PPS_INPUT_2	Raised when PPS IN 2 is missing or to low level.	Minor
11	EXP_1_OUT_1_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
12	EXP_1_OUT_2_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
13	EXP_1_OUT_3_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
14	EXP_1_OUT_4_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
15	EXP_2_OUT_1_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
16	EXP_2_OUT_2_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
17	EXP_2_OUT_3_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
18	EXP_2_OUT_4_SHORT_CIRCUIT	Raised when expansion outputs are shorted	Major
19	LOSS_OF_ATOMIC_SIGNAL	Loss of atomic signal	Critical
20	OCXO_DELOCK	OCXO not locked	Critical
21	CFIELD_DELOCK	C field not locked	Critical
22	RF_POWER_DELOCK	RF power not locked	Critical
23	PI_OCXO_OVERFLOW	Raised when PI loop is out of expected values	Critical
24	PI_CFIELD_OVERFLOW	Raised when PI loop is out of expected values	Critical
25	PI_RFPOWER_OVERFLOW	Raised when PI loop is out of expected values	Critical
26	PI_GAIN_OVERFLOW	Raised when PI loop is out of expected values	Critical
28	OVEN_TEMPERATURE_FAILURE	Raised when oven temperature is under expected value	Critical
29	CLOCK_IN_STANDBY	Cesium clock is in standby (only Ion-pump is enabled)	Minor
36	FLASH_ERROR	Flash is corrupted (wrong checksum)	Critical
37	SINGLE_POWER_SUPPLY	Only one power supply is powered	Minor
38	ACCURACY_CHANGED	User accuracy has been changed and shall be acknowledged	Warning
39	ATOMIC_SIGNAL_SATURATION	Critical degradation of vacuum level	Critical

Table 4-1 Alarm List

4.2.6 ALARM MASK

Returns the list of active mask alarms

Command

ALARM_MASK;<cr><lf>

Answer

ALARM_MASK=N;<cr><lf>

or

ALARM_MASK=a,b,…;<cr><lf>

With

N: No Alarm mask

or

a : 1st alarm id
b : 2nd alarm id

4.2.7 ALARM MASK=id

Set the list of active mask alarms

Command

ALARM_MASK=id1,id2,id3,…;<cr><lf>

id: list of alarm id to hide

or

ALARM_MASK=N;<cr><lf>

No Alarm Mask

Answer

OK;<cr><lf>

4.2.8 BATTERY_STATE

Read the battery state

Command

BATTERY_STATE;<cr><lf>

Answer

BATTERY_STATE=state,source;<cr><lf>

State:	NO_BATT:	No battery available
	CHARGED:	Battery full
	CHARGING:	Battery is charging
	DISCHARGED:	Battery is discharged
	FAILED:	Charging failed, battery is out of order
Source:	DC:	DC power supply
	BATT:	Battery power supply

4.2.9 BUZZER

Read the buzzer state

Command

BUZZER;<cr><lf>

Answer

BUZZER=buzzer;<cr><lf>

buzzer: ON_BATTERY or OFF

Note:

The buzzer is activated when unit is supplied on battery and the buzzer is configured ON_BATTERY.

4.2.10 BUZZER=buzzer

Set the buzzer

Command

BUZZER=buzzer;<cr><lf>

buzzer: ON_BATTERY or OFF

Answer

OK;<cr><lf>

4.2.11 EXP_FREQ(card)

Returns the AUX sine out (Output panel option ETSI : OUT5)
(Output panel option 19'' : OUT5 and OUT10)

Command

EXP_FREQ(card);<cr><lf>

Card: 1 or 2 for 19''
Card: 1 for ETSI

Answer

EXP_FREQ(card)=000000000000;<cr><lf>

Hexadecimal value on 48bits.
(nb[decimal]=2^{48} *(frequency[Hz]/320000000[Hz])

Example: fout : 10MHz
Nb_decimal: 8796093022208 -> Hexa: 080000000000

4.2.12 EXP_FREQ(card)=n

Set the AUX sine out (Output panel option ETSI : OUT5)
(Output panel option 19'' : OUT5 and OUT10)

Command

EXP_FREQ(card)=n;<cr><lf>

Card: 1 or 2 for 19''
Card: 1 for ETSI

Answer

OK;<cr><lf>

Hexadecimal value on 48bits.
(nb[decimal]=2^{48} *(frequency[Hz]/320000000[Hz])

Example: fout : 10MHz
Nb_decimal: 8796093022208 -> Hexa: 080000000000

FREQUENCY RANGE:

Minimum value acceptable: 00147AE147AE (100kHz)
Maximum value acceptable: 280000000000 (50MHz)

4.2.13 EXP_STATUS

Returns the general state of expansion card

Command

EXP_STATUS;<cr><lf>

Answer

EXP_STATUS=card1,card2;<cr><lf>

Card can be:

NO: No expansion card detected
AL: Expansion card in alarm
OK: No alarm

4.2.14 INV

Returns the CESIUM CLOCK unit inventory.

Command

INV;<cr><lf>

Answer

INV=a,b,c,d,e,f,g,h,i,j,k,l,m,n;<cr><lf>

Each inventory's ID is separated by a comma ',', the list is ended by a semi-colon ';', and the answer ends with a Carriage Return – Line Feed.

ID	Parameter	Example
a	Name	OSA3235B
b	Article number	A015835
c	Serial number	100
d	HW version	1
e	Firmware article number	A015152
f	Firmware version	1.12
g	Test date (ddmmyyyy)	31122011
h	Oscillator type	8788-AS
i	FPGA version	3.02
j	Cs tube type	A015356
k	Cs tube serial number	1295
l	Expansion board FPGA version	1.03
m	PSU HW revision	4
n	PSU Firmware version	1.02

4.2.15 OUTPUT_E1

Returns the E1 output configuration of the expansion card

Command

OUTPUT_E1(card,output);<cr><lf>

card: 1 or 2
output: 1, 2, 3, 4

Answer

OUTPUT_E1(card,output)=code,crc4,frame,ais,sa4,sa5,sa6,sa7,sa8, idlecode;<cr><lf>

card: 1 or 2
output: 1, 2, 3 or 4
code: AMI or HDB3
crc4: CRC_ON or CRC_OFF
frame: CCS or CAS
ais: AIS_ON or AIS_OFF
sa4-8: SSM, SA_ON or SA_OFF
idlecode: 0 to 255

4.2.16 OUTPUT_E1(card,output)

Set the E1 output configuration of the expansion card

Command

OUTPUT_E1(card,output)=code,crc4,frame,ais,sa4,sa5,sa6,sa7,sa8, idlecode;<cr><lf>

card: 1 or 2
output: 1, 2, 3 or 4
code: AMI or HDB3
crc4: CRC_ON or CRC_OFF
frame: CCS or CAS
ais: AIS_ON or AIS_OFF
sa4-8: SSM, SA_ON or SA_OFF
idlecode: 0 to 255

Answer

OK;<cr><lf>

4.2.17 OUTPUT_T1

Returns the T1 output configuration of the expansion card

Command

OUTPUT_T1(card,output);<cr><lf>

card: 1 or 2
output: 1, 2, 3 or 4

Answer

OUTPUT_T1(card,output)=code,frame,idlecode;<cr><lf>

card: 1 or 2
output: 1, 2, 3 or 4
code: AMI or B8ZS
frame: D4 or ESF
idlecode: 0 to 255

4.2.18 OUTPUT_T1(card,output)

Set the T1 output configuration of the expansion card

Command

OUTPUT_T1(card,output)=code,frame,idlecode;<cr><lf>

card: 1 or 2
output: 1, 2, 3 or 4
code: AMI or B8ZS
frame: D4 or ESF
idlecode: 0 to 255

Answer

OK;<cr><lf>

4.2.19 OUTPUT_FREQ

Returns the AUX out (Main in/output panel: OUT1)

Command

OUTPUT_FREQ;<cr><lf>

Answer

OUTPUT_FREQ=000000000000;<cr><lf>

Hexadecimal value on 48bits.
(nb[decimal]=2^{48} *(frequency[Hz]/320000000[Hz])

Example: fout : 10MHz
Nb_decimal: 8796093022208 -> Hexa: 080000000000

4.2.20 OUTPUT_FREQ=n

Set the AUX out (Main in/output panel: OUT1)

Command

OUTPUT_FREQ=n;<cr><lf>

Answer

OK;<cr><lf>

Hexadecimal value on 48bits.
(nb[decimal]=2^{48} *(frequency[Hz]/320000000[Hz])

Example: fout : 10MHz
Nb_decimal: 8796093022208 -> Hexa: 080000000000

FREQUENCY RANGE:

Minimum value acceptable: 00147AE147AE (100kHz)
Maximum value acceptable: 280000000000 (50MHz)

4.2.21 OUTPUT_TYPE(card,output)

Returns the output configuration of unit or expansion card

Command

OUTPUT_TYPE(card,output);<cr><lf>

Card: 0 (unit), 1 or 2 (expansion card)

If card 0 (unit) **output: 1, 2, 3, 4, 5**

If card 1 or 2 (exp card) **output: 1, 2, 3, 4**

Answer

OUTPUT_TYPE(card,output)=type;

Type	Description
1PPS	1 PPS (unit)
100K_T	100 kHz TTL (unit)
1M_T	1 MHz TTL (unit)
5M_T	5 MHz TTL (unit)
10M_T	10 MHz TTL (unit)
E1	E1 (exp card)
T1	T1 (exp card)
PPS	PPS (exp card)
10MHZ	10 MHz Sinus (exp card)
2048KHZ	2.048 MHz Sinus (exp card)

Note:

The output 6 of unit is the DDS output. The DDS output is frequency configurable. A command specific is available.

Note:

The output 5 of expansion card is the DDS output. The DDS output is frequency configurable. A command specific is available.

4.2.22 OUTPUT_TYPE(card,output)

Set the output configuration of unit or expansion card

Command

OUTPUT_TYPE(card,output)=type;<cr><lf>

Card: 0 (unit), 1 or 2 (expansion card)

If card = 0 (unit)	**output: 3,4,5** **type: 1PPS, 100K_T, 1M_T, 5M_T, 10M_T**
If card = 1 or 2 (exp card)	**output: 1,2,3,4** **type: E1, T1, PPS, 10MHZ, 2048KHZ**

4.2.23 OUTPUT_SQ(card,output)

Returns the output squelch of unit or expansion card

Command

OUTPUT_SQ(card,output);<cr><lf>

Card: 0 (unit), 1 or 2 (expansion card)

If card = 0 (unit)	**output: 1, 2, 3, 4, 5, 6**
If card = 1 or 2 (exp card)	**output: 1, 2, 3, 4, 5**

Answer

OUTPUT_SQ(card,output)=sq;

sq can be:
ON: Active squelch, no signal
OFF: User squelch deactivated

4.2.24 OUTPUT_SQ(card,output)=sq;

Set the output squelch of unit or expansion card

Command

OUTPUT_SQ(card,output)=sq;<cr><lf>

Card: 0 (unit), 1 or 2 (expansion card)

If card = 0 (unit) **output: 1, 2, 3, 4, 5, 6**
If card = 1 or 2 (exp card) **output: 1, 2, 3, 4, 5**

sq: ON or OFF

Answer

OK;<cr><lf>

4.2.25 OUTPUT_STATE

Returns the Main IN/OUT outputs state and type

Command

OUTPUT_STATE;<cr><lf>

Answer

OUTPUT_STATE=6,<CR><LF>
1,10M_S,OK,<CR><LF>
2,5M_S,OK,<CR><LF>
3,100K_T,OK,<CR><LF>
4,1M_T,OK,<CR><LF>
5,5M_T,OK,<CR><LF>
6,DDS,OK;<CR><LF>

Signal type :
5M_S -> Output 5MHz sinus
10M_S -> Output 10MHz sinus
1PPS -> Output 1 PPS
100K_T -> 100 kHz TTL
1M_T -> 1 MHz TTL
5M_T -> 5 MHz TTL
10M_T -> 10 MHz TTL
DDS -> DDS frequency configurable

Signal state :
OK -> Output valid
AL -> Output fail

DIS -> Output disabled

4.2.26 PORT(port)

Returns the RS port configuration

Command

PORT(port);<cr><lf>

port: A, B or -1 (means port used)

Answer

PORT(port)=baud,data,parity,stop;<cr><lf>

Port:	A, B or -1
Baud rate:	9600, 19200, 57600 or 115200
Data bit:	8 or 7
Parity:	N = NONE, O = ODD, E = EVEN
Stop Bit:	1 or 2

4.2.27 PORT(port)=baud,data,parity,stop,save

Returns the RS port configuration

Command

PORT(port)=baud,data,parity,stop,save;<cr><lf>

Port:	A, B or -1 (means port used)
Baud rate:	9600, 19200, 57600 or 115200
Data bit:	8 or 7
Parity:	N = NONE, O = ODD, E = EVEN
Stop Bit:	1 or 2
Save:	YES or NO (save parameters)

Answer

OK;<cr><lf>

4.2.28 PPS_OUTPUT(card,output)

Returns the PPS configuration

Command

PPS_OUTPUT(card,output);<cr><lf>

card: 0
output: 3, 4, 5

Answer

PPS_OUTPUT(card,output)=width,delay,polarity;<cr><lf>

width: 1 to 250000 us (1us to 250000us (250ms))
delay: 0 to 999999990 ns (0ns to 1s , step: 10ns)
polarity: POS or NEG

4.2.29 PPS_OUTPUT(card,output)=width,delay,polarity

Set the PPS configuration

Command

PPS_OUTPUT(card,output)=width,delay,polarity;<cr><lf>

card: 0
output: 3, 4, 5
width: 1 to 250000 us (1us to 250000us (250ms))
delay: 0 to 999999990 ns (0ns to 1s , step: 10ns)
polarity: POS or NEG

Answer

OK;<cr><lf>

4.2.30 PPS_INPUT

Returns the PPS configuration

Command

PPS_INPUT;<cr><lf>

Answer

PPS_INPUT=polarity;<cr><lf>

polarity: POS or NEG

4.2.31 PPS_INPUT=polarity

Set the PPS configuration

Command

PPS_INPUT=polarity;<cr><lf>

polarity: POS or NEG

Answer

OK;<cr><lf>

4.2.32 RESTART(W)

Restart the Cs clock via its embedded software. Such command is equivalent to an external power switch OFF – ON, which repeats the complete start-up sequence.

Command

RESTART(W);<cr><lf>

Answer

OK;<cr><lf>

4.2.33 STANDBY

Only used for maintenance.
Restarts the Cs clock after the standby command is sent. The ion pump remains power/active.
Use the restart command to resume normal operation. This will initiate a complete start-up sequence.

Command

STANDBY;<cr><lf>

Answer

OK;<cr><lf>

4.2.34 STATUS

Returns the equipment LED and operational status.

Command

STATUS;<cr><lf>

Answer

STATUS=led1,led2,led3,pps1opstate, pps2opstate,state;<cr><lf>

where

ID	Value	Description	Remark
Led 1, 2 & 3			
	0	OFF	
	1	Red, fixed	
	2	Red, blinking	
	3	Green, fixed	
	4	Green, blinking	
	6	Orange, fixed	
	7	Orange, blinking	
pps1opstate			
	OK	Entry valid with PPS detected	
	AL	No PPS signal	
	DIS	Entry deactivated	
	NA	No PPS entry available	
pps2opstate			
	OK	Entry valid with PPS detected	
	AL	No PPS signal	
	DIS	Entry deactivated	
	NA	No PPS entry available	
state			
	LOCKED	Unit locked	
	WARMUP	Unit power up	
	STANDBY	Maintenance, only ion pump on	

4.2.35 SSM_MODE

Returns the SSM configuration

Command

SSM_MODE;<cr><lf>

Answer

SSM_MODE=state,quality;<cr><lf>

If SSM ON
SSM_MODE=ON,PRC;

or

SSM_MODE=ON,DNU;

If SSM OFF
SSM_MODE=OFF;

state: ON or OFF
quality: PRC or DNU (optional parameters, only available if SSM ON)

4.2.36 SSM_MODE=enable

Set the SSM configuration

Command

SSM_MODE=enable;<cr><lf>

Enable: ON or OFF

Answer

OK;<cr><lf>

4.2.37 SYNC_PPS(input)

Synchronization on PPS input

Command

SYNC_PPS(input);<cr><lf>

input: 1 or 2

Answer

OK;<cr><lf>
NOT_OK;<cr><lf>

Note:

The command is accepted and executed only if PPS entry is active and a valid PPS signal is detected.

5. Power-Up & Commissioning

- Overview
- Power-Up & Verification
- Turn - Off Procedure

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5.1 Overview

Instrument operation and its monitoring are exercised in an automatic mode. However a direct control possibility is available but only in “maintenance mode”.
“Maintenance Mode” is not available to customers.

5.2 Power-Up & Verification

First, be sure that the DC power supply used to power the Unit is able to deliver 24V / 4A.
Second, if the unit is powered at the bottom limit (24V), the external power supply must be able to withstand an “in-rush” current of 6 A during typically 1 millisecond.

CAUTION

To avoid damage to the OSA 3235B CESIUM CLOCK, access cover must not be removed except by OSA technical assistance (Customer Support & Services).

CAUTION

For continued protection against risk of fire, an internal fuse is operating inside the unit. That fuse is not accessible to users.
Be sure that “maximum current” is not higher than 6A during “Warm-Up”.

ESD CONSIDERATION

Electrostatic Discharge (ESD) must be avoided so as not to damage or destroy static sensitive components in the OSA 3235B CESIUM CLOCK. Please observe proper ESD handling procedures.

CAUTION

Connection must be made with a suitable connector. Measure voltages and polarities of the external power sources before connecting them to the OSA 3235B CESIUM CLOCK. The voltages must be within the ranges specified.

Note:

When the unit is powered from a -48V power source and power wires fail or become disconnected, no power alarm is raised. All of the LEDs on the unit remain green, which is incorrect. For more information please refer to Customer Service Bulletin CSB-200903 Magnetic Cesium no power alarm raised.

5.2.1 Start-up Sequence

In order to startup the clock follow the procedure below.

STEP	ACTION
1	Adjust the DC power supply @ # 24V. Current limit must be fixed at 4A.
2	Turn-off the DC power supply
3	Verify the “power cord” wiring and its compatibility with screw terminal power connector (Refer to Power Connection characteristics section.)
4	Connect the 2 wires of “power cord” to DC power supply (+ 24V)
5	Turn-On the DC power supply
6	The LED status must be “Green blinking” for about 35 minutes (Warm-up sequence)
7	When the LED status became “Green fixed”, the OSA 3235B CESIUM CLOCK is ready.
8	Wait about 45 minutes before using the unit (All performances compliant versus specification).

Procedure 5-1 Start-up Sequence

5.3 Turn - Off Procedure

No particular “Turn-Off” procedure is necessary for OSA 3235B CESIUM CLOCK.
It is just necessary to “Turn-Off” the Power supply.

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6. Maintenance & Troubleshooting

- Preventive Maintenance
- Calibration
- Storage
- Troubleshooting
- Transportation
- Oscilloquartz Contact Information

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6.1 Preventive Maintenance

A critical part of OSA 3235B CESIUM CLOCK is the “ion pump” that is mandatory to maintain a good vacuum inside the Cesium tube. A dedicated operational mode (Standby) allows only powering it, but without consuming the limited quantity of Cesium alkali in the tube.

CAUTION

If the unit has been stored at a temperature **below 35°C**, it must be turned ON during **at least four hours every two months** (Standby mode).

If the unit has been stored at a temperature between 35°C and 45°C, it must be turned ON during **at least four hours every month** (Standby mode).

If the unit is stored at a temperature above 50°C, the expected operating life of the Cesium beam tube is reduced (typ. 4 months per each year of storage at 70°C), and the internal tube vacuum affected by such “natural” cesium emission. Unit must be turned ON continuously (Standby mode) to maintain tube vacuum.

For turning the unit in the Standby mode, apply the following procedure:

STEP	ACTION
1	Adjust the DC power supply @ # 24V. Current limit must be fixed at 4A.
2	Turn-off the DC power supply.
3	Verify the “power cord” wiring and its compatibility with screw terminal power connector (Refer to Power Connection characteristics section.)
4	Connect the 2 wires of “power cord” to DC power supply (+ 24V).
5	Turn-On the DC power supply.
6	Connect the unit to an RS-232 compatible computer.
7	Send either the STANDBY command (Refer to Command Details) or by using the corresponding command in the Control and Management Software.
8	When the LED status becomes “Orange fixed”, the OSA 3235B CESIUM CLOCK is in Standby mode.
9	Leave the unit running so for four hours.
10	Then the power supply can be turned off and the power cord disconnected.

Procedure 6-1 Preventive maintenance (Standby mode)

For exiting the Standby mode, either switch OFF-ON the power supply, or simply send the RESTART command (Refer to Command Details) or by using the corresponding command in the Control and Management Software.

6.2 Calibration

Calibration is not necessary for OSA 3235B CESIUM CLOCK .A fine frequency adjustment has been made before delivery after one month continuous “measurements” where the phase and all other parameters have been controlled.
In stable conditions, initial frequency offset is always smaller than $\pm 1 \times 10^{-12}$.

6.3 Storage

In general, storage temperature above 35°C must be avoided for preventing a degradation of the vacuum level in the Cs tube and for limiting the Cesium alkali consumption. In any case, refer to the Preventive Maintenance for regular switch ON of the unit in Standby mode.

6.4 Troubleshooting

OSA 3235B CESIUM CLOCK encloses some critical elements like the “Cs Tube module” and two “high voltage” power supplies. In case of failure, only the “Oscilloquartz Customer Support & Services” is qualified to repair the Unit.
Main parameters of the clock are internally monitored and alarms can be automatically generated in case of limits overstepping. When an alarm is generated, the LED status became red.

Three types of alarms can be generated:

- **Minor alarms**: Generally, one or several “Cs tube” parameters (e.g.: Cs Tube power supplies) can be slightly “out of specification” but performances of clock signal remain compliant (locked on atomic signal). Troubles can be analyzed by monitoring these main parameters.
- **Major alarms**: Generally, a major alarm can involve performances failures (e.g.: 10MHz signal not locked on atomic signal).
  Troubles can be analyzed by monitoring “Cs tube” main parameters.
  Ionic pump current must be controlled and a new “unit start” can be proposed to shoot troubles.
- **Critical alarms**: In that case, the “Unit” is automatically stopped to avoid the “Cs tube module” destruction. Unit will be returned to “Oscilloquartz S.A” for repair.

6.5 Transportation

OSA 3235B CESIUM CLOCK must be warily transported in a special protection package delivered by Oscilloquartz S.A.
Transport conditions must be compliant with Norm ETS 300 019-1-2 Class 2.2
Vibrations will not exceed $0.01g^2/Hz$ from 5Hz to 500Hz (Slope: -3dB/Octave).
Chocks will not exceed 25g peak (6ms max).

6.6 Oscilloquartz Contact Information

6.6.1 Technical Assistance

For technical assistance, contact the following:

6.6.1.1 International

Customer portal : www.advaoptical.com/en/customer-portal.aspx
Customer : support@advaoptical.com
Phone : +1(866)442-ADVA (2382)

Local phone numbers are available for the following countries:

COUNTRY/CC	NRN	ASIT	Actual Number
Australia	11	800-4422-3821	0011-800-4422-3821
India	0	800-100-1546	000-800-100-1546
Japan	10	800-4422-3821	010-800-4422-3821
Hong Kong(HK)	1	800-4422-3821	001-800-4422-3821
New Zealand(NZ)		800-4422-3821	00-800-4422-3821
Singapore(S1)	1	800-4422-3821	001-800-4422-3821

6.6.2 Sales

For sales assistance, contact the following:

6.6.2.1 International

Oscilloquartz SA
Sales & Marketing
Avenue des Pâquiers 1
2072 St-Blaise
SWITZERLAND

Tel: +41-32-722-5555
Fax: +41-32-722-5556
e-mail: osa@oscilloquartz.com

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7. Specifications

- General Specifications
- Technical Specifications

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7.1 General Specifications

POWER SUPPLY	
Input Voltage 1xDC & 1xAC	DC : min 24V to max 50V Max 3A (no battery) Max 3.5A (with battery) AC : min 88VAC to max 264VAC 50-60Hz Max 2.2A
Power Consumption	Warm-Up @25°C : ≤ 60W Steady state @25°C: ≤ 60W typical without battery option ≤ 70W typical with battery option
Warm-Up time @ 25°C (Cold-Start)	45 minutes typical
Warm-Up time to ± 10^{-11}	20 minutes typical
Fuse type	COOPER BUSSMANN LLC type S505H with ratings T 4 A H 250V
ENVIRONMENTAL	In progress
Operating mode	EN 300-019-1-3 class 3.2 -5°C to 50°C (no battery) 0°C to 35°C (with battery)
Storage	EN 300-019-1-1 class 1.1 -40°C to 70°C
Transportation	EN 300-019-1-2 class 2.2
Altitude (operating)	0 to 2'000 m
In-use Humidity	Up to 95%
DC magnetic field	± 2 Gauss
MECHANICAL	
Size: H x W x D without connectors, including handles	132 x 436 x 381 mm (5.1'' x 17.1'' x 15'')
Weight	< 15kg

BATTERY (optional)	As a relay back-up power
Power time	45 minutes min (60 minutes typical)
Battery charge	AC or DC
Capacity	≥ 60Wh
Life span	1000 charge/discharge cycles or max. 5 years

Table 7-1: General Specifications

7.2 Technical Specifications

7.2.1 Main Outputs Signal Specification

10MHz SINE	
Number	1
Connector	BNC female
Frequency	10 MHz
Level value	1 Vrms +-20% @ 50Ω
Harmonics	≤ -35dB
Spurious	≤ -80dB
5MHz SINE	
Number	1
Connector	BNC female
Frequency	5 MHz
Level value	1 Vrms -10%/+30% @ 50Ω
Harmonics	≤ -25dB
Spurious	≤ -80dB
AUX SINE Out 1	
Number	1
Level value	Min: 100kHz (>280mVrms/50Ω) (>350mVrms/50W) Max: 50MHz typ: 500mVrms/50Ω)
Connector	BNC female
Wave / Frequency	Sine Configurable 100kHz to 50MHz
AUX TTL Out 2 to Out 4	
Number	3
Connector	BNC female
Wave / Frequency	Square Configurable 1PPS, 0.1 to 10MHz
Level value	0-5 V high Z 0-3V @ 50Ω
Duty cycle	50%
PPS width	20µs setting: 1µs to 100µs step:1µs
AUX TTL synchronization by SYNC IN	range: -0.5s to 0.5s step: 50ns

Note:

Aux sine configuration is available in section 4.2.12

7.2.2 Input Signal Specification

SYNC IN /SYNC IN1 /SYNC IN2	
Connector	BNC female
Frequency	Configurable 1PPS, 10MHz sine
Synchronization	Positive edge
PPS level	0-5 V typical 0-3V acceptable
10MHz level	≤ 7dBm

7.2.3 Frequency Source Characteristics

Frequency Source Characteristics	
ADEV	Long life
τ =1s	≤ $1{,}2\times10^{-11}$
τ =10s	≤ $8{,}5\times10^{-12}$
τ =100s	≤ $2{,}7\times10^{-12}$
τ =1'000s	≤ $8{,}5\times10^{-13}$
τ =10'000s	≤ $2{,}7\times10^{-13}$
τ =100''000s	≤ $8{,}5\times10^{-14}$
Floor	≤ 5×10^{-14}
Accuracy	
Specification	± 1×10^{-12}
Settability	
Resolution	< 1×10^{-15}
Range	>± 1×10^{-9}
Resolution	< 1×10^{-15}
5 MHz SINE SSB phase noise spectral density	Long life
1 Hz	-95 dBc/Hz
10 Hz	-125 dBc/Hz
100 Hz	-140 dBc/Hz
1 kHz	-150 dBc/Hz
10 MHz SINE SSB phase noise spectral density	Long life
1 Hz	-90 dBc/Hz
10 Hz	-120 dBc/Hz
100 Hz	-135 dBc/Hz
1 kHz	-145 dBc/Hz

Table 7-2: Technical specifications

7.2.4 Signal Expansion Specification

Up to 2 Signal expansion cards. This option is providing 5 additional outputs.

AUX SINE Out 5	
Number	1
Level value	0.5Vrms +-20% @50Ω
Connector	BNC female
Wave / Frequency	Sine Configurable 100kHz to 50MHz

Telecom outputs Out 1 to Out 4	
Number	4
Connector	BNC female or sub-d
Wave / Frequency	Configurable: E1 (G703-9), 2.048MHz (G703-13), T1 (G703-5), 1PPS, or 10MHz

Note:

PPS configuration is available on chapter 4.2.29

Aux sine configuration is available in section 4.2.12

Recommendation:

Allow the unit an 8 hour operational warm-up period to ensure the unit performs within specification time

The instrument/unit performs within specifications when it is provided with the recommended/optimal operating conditions.

Specifications will be met after the unit has been at optimum operating conditions for eight hours.

The instrument/unit will perform within specification in continuous non-stop operation if all optimum operating conditions are met.

Ordering Information

The following tables contain the articles and drawing numbers for supplementary accessories and kits.

Please include Article and Drawing numbers in purchase orders.

Units

Items	Article number
OSA 3235B/19"/AC+DC/BNC	*1047020063-01*
OSA 3235B/19"/AC+DC/DB9	*1047020064-01*
OSA 3235B/19"/AC+DC/BNC-DB9	*1047020065-01*
OSA 3235B/19"/AC+DC	*1047020066-01*
OSA 3235B/19"/AC+DC-BAT/BNC	*1047020067-01*
OSA 3235B/19"/AC+DC-BAT/DB9	*1047020068-01*
OSA 3235B/19"/AC+DC-BAT/BNC-DB9	*1047020069-01*
OSA 3235B/19"/AC+DC-BAT	*1047020070-01*

Table 7-3 Ordering Units

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Document History

Project N° : OSA 3235B CESIUM CLOCK 19”
Document Type : User Manual
Version : English
Author : OSA
Revision : D
Last Up-date : 19.03.2021
Creation : 08.06.2016

REVISION	DATE	CORRECTIONS
A	08.06.2016	- Document creation based on 3235B Rev G
B	01.12.2016	- Fix some commands errors and Led status
C	12.01.2021	- Add initial device description - 10 MHz and 5 MHz tolerances updated - Added reference to CSB-200903 Magnetic Cesium no power alarm raised.
D	17.02.2021	- Maximum operating temperature changed to 50°C - Added safety restriction notes - Added mounting instructions - Alarm list updated - Inventory command updated for expansion board