

*EPSILON BOARD
MODEL EBO2
USER'S MANUAL*

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Table of Contents

1	INTRODUCTION	1-1
1.1	Inventory	1-2
1.2	Inspection	1-2
1.3	Basic Configuration	1-2
1.4	Mechanical Characteristics	1-3
1.5	Board View	1-4
1.6	Terminology	1-4
2	INSTALLATION	2-1
2.1	Preliminary Connections	2-1
2.2	Connector HE1302 Pin-Out (P2)	2-2
2.3	Connections Quality	2-3
2.4	Starting the Board	2-3
2.5	Switching Off the Board	2-4
3	SPECIFICATIONS	3-1
3.1	Frequency Output	3-1
3.2	1PPS Output	3-1
3.3	Remote Control Interface (TTL)	3-1
3.4	TOD Output	3-2
3.5	Status Outputs	3-3
3.6	Power Supply	3-3
3.7	GPS Antenna Input/Output	3-4
3.8	Operating Environment	3-4
4	REMOTE CONTROL INTERFACE	4-1
4.1	General	4-1
4.2	Protocol	4-1
4.3	Commands Description	4-2
4.3.1	TOD output setup	4-2
4.3.2	TOD output transmission period	4-2
4.3.3	Board reset	4-2
4.3.4	Date setup	4-2
4.3.5	GPS setup	4-2
4.3.6	GPS Position	4-3
4.3.7	Local hour	4-3
4.3.8	Antenna delay correction	4-3
4.3.9	Leap second	4-3
4.3.10	Display	4-4
4.3.11	Alarms	4-4
4.4	Time distribution on the remote control interface	4-5
4.5	Command or Query Lists	4-6

1 Introduction

The EPSILON BOARD MODEL EBO2 generates and distributes a highly accurate and stable frequency source disciplined using GPS input.

The board has autonomous control of GPS system integrity features (TRAIM) and rejects defective satellites.

The time reference thus obtained is processed by efficient algorithms that control the built-in oscillator, which generates inner frequency and time signals. The board continues to distribute time and frequency signals even if the GPS input signal is lost. Furthermore, “learning” from its behavior in different situations (effects attributed to aging and to temperature variations) while the GPS reference signal is present, the frequency driver improves on the accuracy of time and frequency distribution (when the GPS signal is lost).

The majority of the EPSILON BOARD MODEL EBO2’s functions are software controlled. At start-up, the board carries out a series of automatic tests including hardware tests and verification of the built-in oscillator’s stability before making an initial coarse adjustment to the distributed frequency. The board has a serial remote control interface for all the queries and commands in this manual.

THE EPSILON BOARD MODEL EBO2 IS FACTORY CONFIGURED TO ASSUME AUTOMATIC START-UP AND NORMAL OPERATION WITHOUT USING THE REMOTE CONTROL INTERFACE.

The EPSILON BOARD MODEL EBO2 is used to generate, maintain, and provide the following:

- A synchronized UTC(GPS) time reference. The board distributes a 1PPS signal, a Time Of Day message (TOD interface), and a time-coded message (remote control interface).
- A frequency reference (one sine-wave 10 MHz).

The board is powered by two DC power supplies: +5V and +12V.

A remote control interface provides board status and allows the user to send initialization and configuration commands.

The board has two TTL status outputs. One is dedicated to the GPS reception and the other is dedicated to hardware fault detection and performance control.

The EPSILON BOARD MODEL EBO2 is fully automatic. It requires no maintenance for a period of 10 years.

1.1 Inventory

Before installing your Spectracom product, please verify that all material ordered has been received. If there is a discrepancy, please contact Spectracom Customer Service. Customer service is available by telephone at +33 (0) 1.64.53.39.80 (France), or +1.585.321.5800 (United States). Updated contacts information are available on web site, see "Support" page.

CAUTION:

Electronic equipment is sensitive to Electrostatic Discharge (ESD). Observe all applicable ESD precautions and safeguards when handling the Spectracom equipment.

NOTE: If equipment is returned to Spectracom, it must be shipped in its original packing material. Save all packaging material for this purpose.

1.2 Inspection

Unpack the equipment and inspect it for damage. If any equipment has been damaged in transit, please contact Spectracom Customer Service. Customer service is available by telephone at +33 (0) 1.64.53.39.80 (France), or +1.585.321.5800 (United States). Updated contacts information are available on web site, see "Support" page.

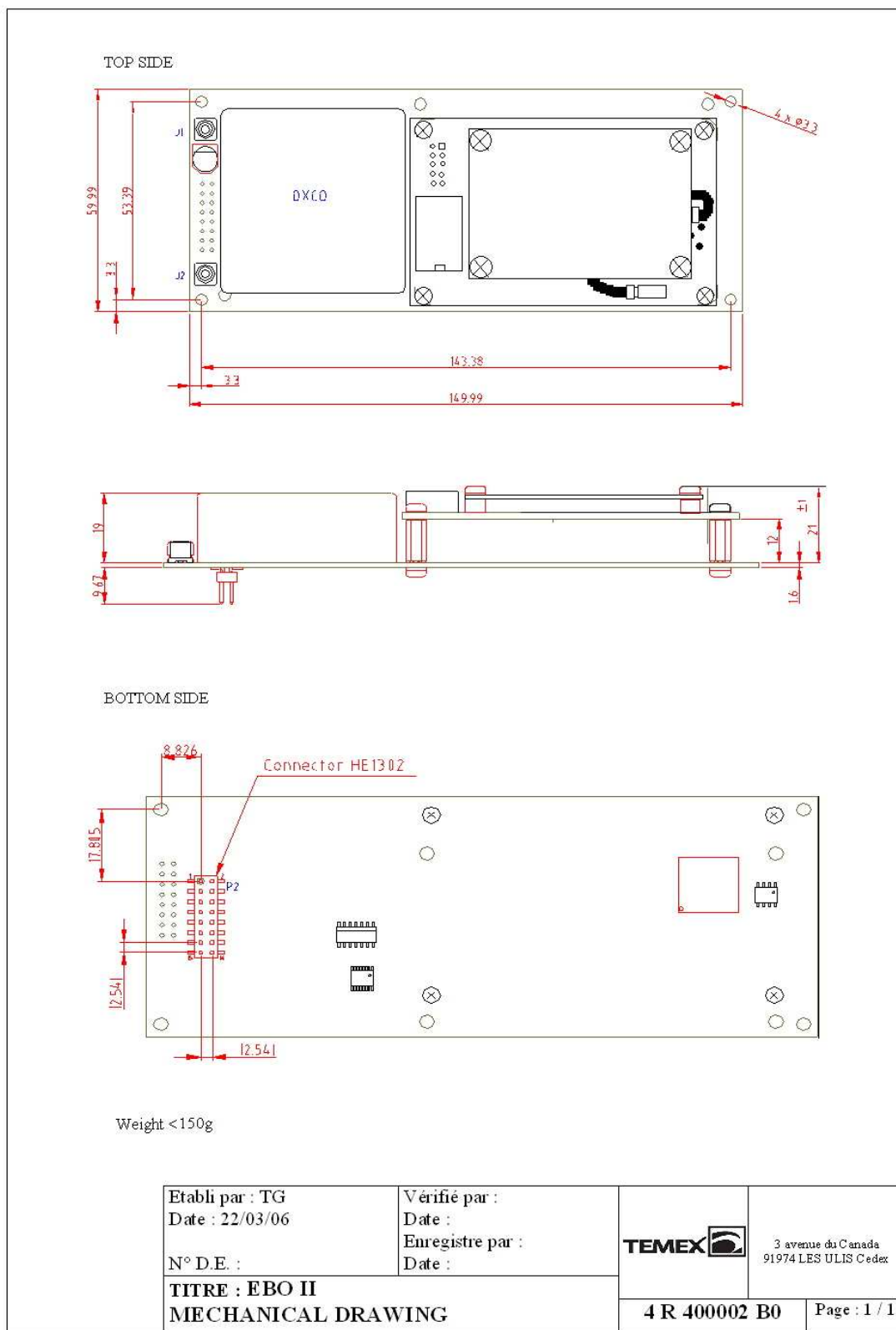
1.3 Basic Configuration

The EPSILON BOARD MODEL EBO2 is equipped with:

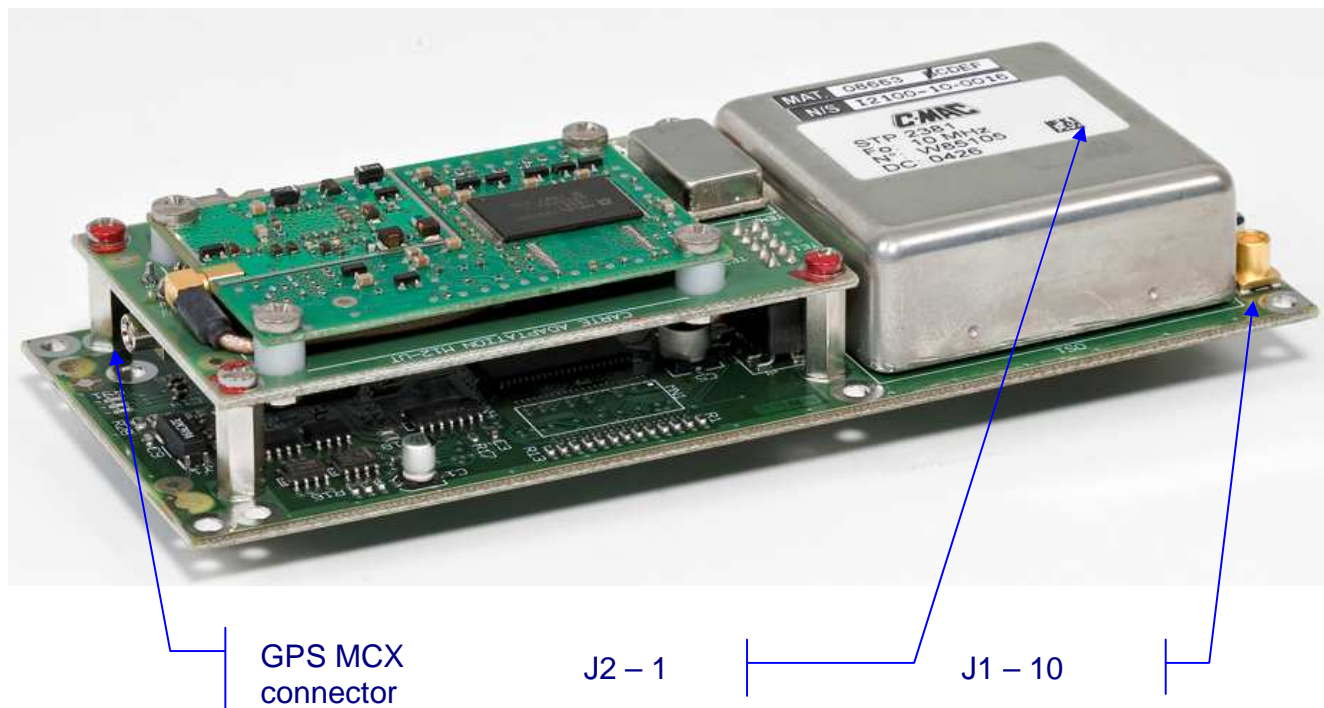
- 1 x GPS antenna input (MCX),
- 1 x DC power supply input +5V (HE1302),
- 1 x DC power supply input +12V (HE1302),
- 1 x 10 MHz sine-wave outputs (MCX),
- 1 x 1pps output (TTL / 50 Ω , MCX),
- 1 x Time Of Day interface (TTL, HE1302),
- 1 x remote control interface (TTL, HE1302).
- 2 x status outputs (TTL, HE1302),

The EPSILON BOARD MODEL EBO2 DO is identical to the EPSILON BOARD MODEL EBO2, but the oscillator is a double oven OCXO.

1.4 Mechanical Characteristics



1.5 Board View



1.6 Terminology

GPS	Global Positioning System
OCXO	Oven Controlled XTAL (Crystal) Oscillator
Rb	Rubidium oscillator
S/A	Selective Availability
TRAIM	Time Receiver Autonomous Integrity Monitoring
UTC	Universal Time Coordinated
1PPS	One Pulse Per Second
1 PPS driver	Pulse signal obtained through division of the frequency driver
Holdover	If the reference input signal is lost, the EPSILON CLOCK® maintains the generation of information and of time and frequency signals.
Reliability	Concerns the positioning mode of the antenna. In automatic mode, the EPSILON CLOCK® calculates the position of the antenna and, after testing the result, imposes the reliable position on the internal GPS receiver. The receiver therefore functions in GPS 0D reception mode. The EPSILON CLOCK® is synchronized by following at least one satellite.
Frequency driver	Frequency signal generated by the built-in oscillator.
Reference input	Time and frequency source used by the EPSILON CLOCK®.
IERS	International Earth Rotation Service.

2 Installation

2.1 Preliminary Connections

Before starting the EPSILON BOARD MODEL EBO2, perform the following tasks:

- Locate the board to obtain natural air cooling.
- Locate the GPS antenna outside in a place from which it is in direct view of the sky over 360 degrees (on top of a mast, for example).

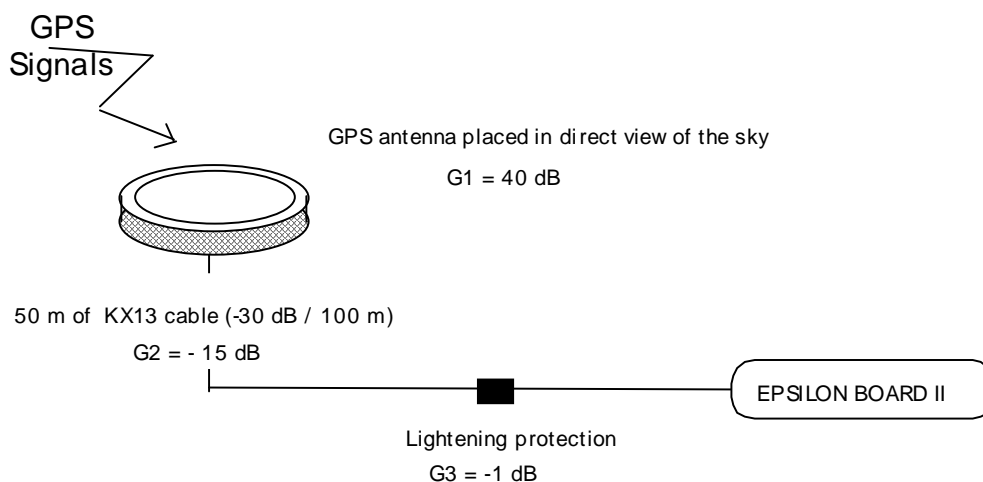
CAUTION:



The EPSILON BOARD MODEL EBO2 is designed to be used with the supplied GPS antenna ONLY. Using another antenna may cause significant damage to the unit and will void your Spectracom warranty.

- Connect the antenna cable to the MCX GPS connector of the GPS receiver. To ensure the correct reception of the GPS signal, the overall system of antenna/cable/protection requires accurate gain matching.

Example:



$$G1 + G2 + G3 = 40 \text{ dB} - 15 \text{ dB} - 1 \text{ dB} = 24 \text{ dB}$$

$$\text{Thus: } X_{\min} \text{ dB} < G1 + G2 + G3 = 24 \text{ dB} < X_{\max} \text{ dB}$$

X_{\min} and X_{\max} are defined in last updated revision of application note TF2.

2.2 Connector HE1302 Pin-Out (P2)

The main characteristics of the HE1302 connector of the EPSILON BOARD MODEL EBO2 are:

- 16 contacts (2 rows, eight pins per row).
- Vertical headers 2.54 x 2.54 mm (0.100 x 0.100 in.)
- Mating length 6.1 mm (0.240 in.)

The pin-out of the connector is described in the following table:

1	PWR_5VDC	2	PWR_5VDC
3	GND	4	GND
5	TC_RX	6	TC_TX
7	TOD_TX	8	Reserved
9	GPS_LOCK	10	EBO_OK
11	Reserved	12	RESET
13	GND	14	GND
15	PWR_12VDC	16	PWR_12VDC

The inputs/outputs of the HE1302 connector are defined in the following table:

GND	Ground
TC_TX	Transmit line output of the remote control interface. TTL compatible level
TC_RX	Receive line input of the remote control interface. TTL compatible level
PWR_12VDC	12V DC power input
GPS_LOCK	Binary status output relative to GPS reception: - "1" logical level indicates that the GPS reception is correct. - "0" logical level: - non permanent: <i>at start-up</i> , indicates that the minimum time to first fix sufficient GPS satellites is not reached. <i>in normal operation</i> , indicates a momentarily loss of GPS reception. - permanent: indicates a GPS reception failure. TTL compatible level.
EBO_OK	Binary status output relative to board working order. "1" logical level indicates the good working order of the board. "0" logical level indicates a board failure or a phase or a frequency alarm. TTL compatible level.
PWR_5VDC	5V DC power input
TOD_TX	Transmit line of the Time Of Day message interface. TTL compatible level.
RESET	External reset input of the board. External command must be provided by a switch (connected to the board ground) or an open collector transistor (powered on the board 5V DC supply).
Reserved	Use for factory test, don't connect

2.3 Connections Quality

Great care must be taken in setting up the GPS Antenna and its connections. Remember that your GPS antenna must have an unobstructed view of the sky.

The type of cable connecting the antenna to the clock and the length of the cable influence greatly the quality of the signal reception. Cable type and length must conform to the rules described herein.

Connections to the antenna, the accessories (surge protection, in-line amplifier) and the cable must be weatherproofed.

An improper installation could result in problems ranging from random, intermittent loss of signal to complete loss of GPS reference. The most common outcome is the inability to discipline the GPS reference correctly.

2.4 Starting the Board

Verify that the preliminary connections have been made.

CAUTION:

The "EBO_OK" control output is at the logic level "0" during the OCXO warm-up time (about 20 minutes).

For 10 seconds after board start-up, the TOD and the Remote Control cannot be used.

The two status outputs are used to report the status of the board. During start-up procedures, the output level of these two statuses are to be interpreted as follows:

	GPS_LOCK	EBO_OK	Notes
Standard hardware automatic test	"0"	"0"	Checks the basic features of the board
Daughter board hardware test	"1"	"0"	Checks GPS features
Period of synchronization	"0"	"1"	Searching for signal emitted by GPS satellite
Synchronization	"1"	"1"	The distributed time is synchronized to UTC(GPS)

In case of hardware failure (or software failure if the corresponding factory setting is active) the “EBO_OK” status output is not activated (“0” logical level).

The conditions for activating this output are as follows:

- Faulty GPS receiver,
- Faulty frequency driver,
- Faulty frequency divider loop,
- Faulty distribution of frequency or synchronization signals,
- Faulty frequency or synchronization performances*.

**This functionality is a parameter that can be selected via the remote control interface.*

If the failure occurs after the start-up sequence, both status outputs are set to “0” logic level. In this state, the Time Of Day message is not distributed and the board will not be synchronized to the GPS source. In this event you should contact Spectracom.

Under normal operating conditions, the EPSILON BOARD II is synchronized to UTC_(GPS) about 5 minutes after switching it on. When it is synchronized, both status outputs are set to the “1” logic level.

In this state the EPSILON BOARD II continuously provides, with UTC_(GPS) reference, the following outputs:

- The 1pps outputs (J2) and the associated Time Of Day message output (HE1302)
- The frequency output (J1)

2.5 Switching Off the Board

To switch off the EPSILON BOARD MODEL EBO2, remove the +5V and +12V power input.

3 Specifications

3.1 Frequency Output

Connectors: J1 MCX Female

Pin settings:

Core: Sine-wave signal
Ground: Electrical ground of the GND pins

Refer to data sheet for signal characteristics.

3.2 1PPS Output

Connector J2: MCX Female

Pin settings:

Core: Periodic pulse
Ground: Electrical ground of the GND pins

Refer to data sheet for signal characteristics.

3.3 Remote Control Interface (TTL)

CAUTION:



The remote control interface is TTL compatible ONLY. It should not be connected to an RS-232 interface.

Serial port parameters:	9600 bps, 8 bits, 1 stop bit, odd parity
Protocol / syntax / format of messages:	Refer to <i>Remote Control Interface</i>
Data:	Binary (two's complement)
Order of bytes emitted:	Most significant bytes first

Connector: HE1302 (P2)

Pin settings:

<u>Pin</u>	<u>Setting</u>
6	Transmit remote signal
5	Receive remote signal
3	Electrical and mechanical ground
4	Electrical and mechanical ground
13	Electrical and mechanical ground

14 Electrical and mechanical ground

3.4 TOD Output

CAUTION:



The TOD interface is TTL compatible ONLY. It should not be connected to an RS-232 interface.

Time Of Day message output:

Output: ASCII, 9600 bps, 8 bits, 1 stop bit, odd parity.

Protocol: <Message> CR LF

Format*: Day/Month/Year Hour: Minute: Second Source
e.g.: 20/03/1996_21:02:05U

Format*: Month/Day/Year Hour: Minute: Second Source
e.g.: 11/12/1996_18:14:38L

Format*: Day of Year/Year Hour: Minute: Second Source
e.g.: 317/1996_18:16:20 L

Format*: MJD** - Integer part Hour: Minute: Second Source
e.g.: _____50399.18:20:50_U

Format*: MJD** Source
e.g.: _____50399.762130_L

The "Source" byte holds one ASCII character which codes the reference of the time chosen

N No reference

U UTC reference

G GPS reference

L Local time

M Manual

- Maximum output period*: 1 message per second

- Output synchronization: Sent at 200 ms \pm 100 ms after the 1PPS signal.

* Programmable through the remote control interface.

** Modified Julian Day

Connectors: HE1302 (P2)

Pin settings:

<u>Pin</u>	<u>Setting</u>
7	TOD message output
3	Electrical and mechanical ground
4	Electrical and mechanical ground
13	Electrical and mechanical ground
14	Electrical and mechanical ground

3.5 Status Outputs

Connectors: HE1302 (P2)

Pin settings:

<u>Pin</u>	<u>Setting</u>
9	"GPS_LOCK" output
10	"EBO_OK" output
3	Electrical and mechanical ground
4	Electrical and mechanical ground
13	Electrical and mechanical ground
14	Electrical and mechanical ground

Signal Level: TTL compatible

3.6 Power Supply

+5V DC Power

Typical consumption: 500 mA.

Connectors: HE1302 (P2)

Pin Settings

- 1, 2: +5V \pm 10%.
- 3, 4, 13, 14: Electrical ground of the "GND" pins

+12V DC Power

Typical consumption: 300 mA (500 mA at warm-up) for EPSILON BORD II

350 mA (800 mA at warm-up) for EPSILON BORD II DO

Connectors: HE1302 (P2)

Pin Settings

- 15, 16: +12V \pm 1V for EPSILON BORD II
- +12V \pm 0.6V for EPSILON BORD II DO

- 3, 4, 13, 14: Electrical ground of the “GND” pins

3.7 GPS Antenna Input/Output

Connector: On the daughter board (MCX female)

Pin Settings:

Core: GPS Signal Input (L1)
output power supply of the active antenna

Voltage: 5V

Current: 50 mA max

Ground: Electrical ground of the “GND” pins

3.8 Operating Environment

Operating temperature:	-5 to +60°C
Storage temperature:	- 40°C to 85°C
Relative humidity:	95 % without condensation, at + 40°C

4 Remote Control Interface

4.1 General

The remote control interface allows remote configuration and remote status reporting of the board. The TTL connection operates at 9600 bps and is set to 8 bits, 1 stop bit, and odd parity.

4.2 Protocol

The protocol used is Master (Host) / Slave (EPSILON BOARD MODEL EBO2) with a systematic reply to all messages. The following exceptions apply (for which no reply is expected):

- The time code message sent periodically
- The reset board command

All messages start with the "STX" character and end with the "ETX" character.

e.g.: <STX> <Message> <ETX>

The characters "STX", "ETX" or "DLE" to be sent within a message should be escaped (prefixed) by the "DLE" character.

Each message contains four distinct sections:

- The message "ID" (this identifies the type of message being sent):
- The count of the number of data bytes in the message (CNT),
- The data bytes (DATA^(*)) of the message,
- The checksum: calculated by performing an exclusive OR on all the consecutive characters in the message (ID + CNT + DATA)

e.g.: <Message> = <ID> <CNT> <DATA^(*)> <CS>
 Number of bytes 1 1 N 1

(*): The encoding format of the DATA is based on "MOTOROLA big Endian" type (integer, long, float, and double data must be sent or received with the MSB first).

NOTE: The maximum length of the <DATA> section is 255 bytes.

Messages belong to one of three categories:

- Queries (requests for information from the EPSILON BOARD MODEL EBO2)
- Commands (functions that initialize or configure the EPSILON BOARD MODEL EBO2)
- Error Messages (returned by the board if errors are detected in the Queries or Commands sent by the user)

When a user sends a message to the EPSILON BOARD MODEL EBO2, it replies within the current second. This reply, or acknowledgement, is formatted as follows:

- The format of the message is identical to the message sent by the user
- The contents of sections <ID> and <CNT> are identical to those sent by the user

- The content of the <DATA > section:
 - Is identical to that sent by the user if the message was a Command
 - Contains the information supplied by the board, if the message was a Query

The acknowledgement to a Command is an exact copy of the message sent.

The reply to a Query is the copy of the Query message with the <DATA> section completed by the EPSILON BOARD MODEL EBO2. In a query, the <DATA> field is not taken into account by the EPSILON BOARD MODEL EBO2 command interpreter.

An Error message is generated by the board if one of the following errors occurs:

- The message contains an unknown ID
- The number of bytes in the <DATA> section does not correspond to the <CNT> value
- An overflow is detected in a parameter within the <DATA> section

NOTE: If the board detects a checksum error, it does not take into account the message and it does not transmit any error message.

4.3 Commands Description

4.3.1 TOD output setup

This command allows the user to modify the contents of the periodical messages transmitted by the board on the TOD output. In standard mode, the default message transmitted contains the current date and hour according to the codes provided herein. In diagnostic mode, the message transmitted contains information regarding the disciplining of the frequency driver to the GPS reference. This mode is used by the manufacturer during the “good” working verification phases.

4.3.2 TOD output transmission period

This command defines the transmission period to the TOD message on the corresponding special link. This period is quantified in seconds; the value 0 inhibits permanently the transmission of the message.

4.3.3 Board reset

This command generates the re-initialization of the board.

4.3.4 Date setup

This command initializes the date of the board's GPS receiver. This associated with the initialization of the position, when possible, accelerates the tracking procedure of the GPS satellites

4.3.5 GPS setup

This command defines the board functioning mode with regards to the GPS signals received. Three modes are available: Automatic, Manual, or Mobile.

The Automatic mode is the default mode during the board initialization. In this mode, the board averages during 1 hour the antenna position supplied by the receiver in order to make it reliable. After this period and providing that a minimum of 4 satellites were received at all times, the position is fixed and the board requires only one satellite for time transfer. This 1 hour reliability procedure of the position is initialized every time the board is switched on and is maintained as long as a minimum of 4 satellites are not received continuously.

The manual mode allows the user to instantaneously force the GPS receiver to function in one satellite mode. The user is required to enter the date and the geographic position of the antenna.

The Mobile mode is useful when the board is moved while functioning. This command prevents the GPS receiver from switching to the 1 satellite mode. It is therefore necessary in this case to receive a minimum of 4 satellites continuously to ensure a good disciplining of the frequency source.

4.3.6 GPS Position

This command allows the initialization of the antenna position. This is necessary in Manual mode. This command also allows the user to define which time reference is used. The two possibilities are as follows:

- The Universal Time Coordinated,
- The GPS Atomic Time.

The difference between these two time references is equal to a whole number of seconds, which changes with every leap second insertion in the UTC reference.

The GPS Atomic Time reference is recommended when the user's application requires a perfectly continuous time reference. In effect, the GPS Atomic Time is not subject to leap second insertion.

4.3.7 Local hour

Using this command, the user may shift the hour transmitted by the GPS clock. This shift corresponds to a whole number of hours and minutes (such as a correction for DST).

4.3.8 Antenna delay correction

The cable between the antenna and the board generates a propagation delay of the GPS signal. This delay corresponds to a time shift of the synchronizing signal. This time shift can be compensated for using this command. The correction is entered in nanoseconds, and the value corresponding to the delay is linked to the type of cable and its length. As a general rule of thumb, the value for the delay of a coaxial cable is 5 nanoseconds per meter.

4.3.9 Leap second

The UTC time reference, maintained by the GPS clock, is subject to leap second corrections, the purpose of which is to maintain the difference between the atomic time represented by UTC and the astronomic time. These corrections decided by the IERS are published in Bulletin C and D.

If the time reference used by the board is UTC, these corrections are automatically made in real time provided the GPS signal is received correctly. This command allows the board to maintain a reliable time reference by programming in advance the leap second correction, ensuring it will be applied even in the case of loss of GPS signal input.

This command does not apply to the other time references.

4.3.10 Display

This command defines the format of the hour transmitted by the TOD message and displayed on the front panel display screen if this option was chosen.

The five formats available are as follows:

- | | |
|----------------------|-----------------------|
| • Day / Month / Year | Hour: Minute: Second |
| • Month / Day / Year | Hour: Minute: Second |
| • Day of year / Year | Hour: Minute: Second |
| • MJD | (Modified Julian Day) |
| • MJD integer part | Hour: Minute: Second |

With this command, the user defines whether the output of the hour is issued from the UTC or GPS time reference, or from the local hour with the programmed shift.

4.3.11 Alarms

If the GPS input signal is lost, the board's internal oscillator is no longer disciplined. The frequency accuracy and the distributed synchronization start to degrade slowly according to the ageing of the oscillator.

Using the alarms limits commands, the user may define the accuracy limits outside of which the output signals are deemed invalid. These limit values are in the form of a time difference for the 1 pps and in the form of a relative frequency difference for the frequency outputs.

When these limit values are reached, a fault is generated and status output "EBO_OK" is fixed to a "0" logic level.

4.4 Time distribution on the remote control interface

The time message is transmitted to the remote control interface. The format and the output TOD are selected by the "display" function. The transmission is synchronous with the 1pps.

Format 1:	ID: 193 CNT: 8 DATA: day/month/year/hour/min/sec/source
Format 2:	ID: 194 CNT: 8 DATA: day/month/year/hour/min/sec/source
Format 3:	ID: 195 CNT: 8 DATA: Day of Year/year/hour/min/sec/source
Format 4:	ID: 196 CNT: 9 DATA: MJD/source
Format 5:	ID: 197 CNT: 8 DATA: MJD integer part/hour/min/sec/source

The "Source" byte holds an ASCII character, which codes the time reference:

N	No reference
U	UTC reference
G	GPS reference
L	Local time
M	Manual

Encoding Type:

Day	: char	
Month	: char	
Year	: integer	(2 bytes)
Min	: char	
Sec	: char	
Source	: char	
MJD integer part	: long	(4 bytes)
MJD	: double	(8 bytes)

4.5 Command or Query Lists

Designation	Command ID	query ID	Number of bytes	Command validity conditions
Serial Line Configuration	1	65	1	(1)
Status	---	80	37	(1)
Emission period of the time message on the TOD interface and on the remote control interface	2	66	4	
Reset	16	---	0	(1)
GPS Date init	4	68	7	(1)
Local Time	7	71	2	(1) et (3)
Phase Correction	8	72	4	(1) et (3)
Leap Second	9	73	6	(1) et (4)
GPS Positioning	10	74	19	(1) et (3)
Display	13	77	2	(1)
Alarm limits	14	78	10	(1)
Version	---	67	10	(1)
Forced holdover mode	15	79	1	(1)
Manual time setting	17	81	7	(1) et (5)
Manual correction $\pm 1s$	21	85	1	(1) et (5)
Remote control mode	18	82	1	(2)

- (1): Command authorized if the clock is in remote control mode.
 (2): Command always authorized.
 (3): Command authorized if the clock is not in forced holdover mode.
 (4): Command authorized if the current time reference is UTC.
 (5): Command authorized if the clock is in forced holdover mode.

The tables that follow contain the format of the commands and the requests.

Name	Identifier		Bytes	Byte No.	Encode Type	Settings	Description
	Query	Command					
Status	80	-	37	0 to 3	1 long	b ₀ = 1 b ₀ = 0	Board is synchronized to the reference input (GPS) Board is not synchronized (the board is in hold over mode after the loss of the reference input signal).
						b ₁ to b ₇	Reserved bits.
						b ₈ = 1 b ₈ = 0	GPS 1pps failure. GPS 1pps operational.
						b ₉ = 1 b ₉ = 0	Frequency driver failure. Frequency driver operational.
						b ₁₀ = 1 b ₁₀ = 0	1pps driver failure. 1pps driver operational.
						b ₁₁ 0	Reserved bit.
						b ₁₂ = 1 b ₁₂ = 0	1pps output failure. 1pps output operational.
						b ₁₃ = 1 b ₁₃ = 0	Phase limit alarm: loss of synchronization, programmed phase-limit exceeded. Phase limit not exceeded.
						b ₁₄ = 1 b ₁₄ = 0	Frequency or limit alarm: loss of synchronization (if the programmed limit is set to 0) or loss of synchronization and limit exceeded or synchronization period too short to provide the programmed frequency limit. Programmed frequency or limit not exceeded: the board is synchronized during a period of time sufficient enough to provide the frequency inside the programmed limit or the loss of synchronization is not sufficiently long to exceed the programmed limit.
						b ₁₅	Reserved bit
						b ₁₆ = 1 b ₁₆ = 0	EPSILON BOARD hardware failure. EPSILON BOARD hardware operational.
						b ₁₇	Reserved
						b ₁₈ = 1 b ₁₈ = 0	Antenna not connected. Antenna connected.
						b ₁₉ = 1 b ₁₉ = 0	Antenna short circuit alarm. No antenna short circuit.
						b ₂₀ to b ₃₁	Reserved

Name	Identifier		Bytes	Byte No.	Encode Type	Settings	Description
	Query	Command					
Serial line configuration	65	1	1	4	1 char	Char value: 1 or 5	GPS reception, mode 0D: The EPSILON BOARD is synchronized using a single satellite. Mode set to manual positioning of the GPS antenna or after reliability testing of the GPS antenna's coordinates in automatic positioning mode.
						Char value: 2 or 6	GPS reception mode 2D: The EPSILON BOARD is synchronized using 3 satellites. This mode can only operate if the antenna positioning mode is set to mobile, or automatic (before reliability testing and only if 3 satellites are tracked).
						Char value: 3 or 7	GPS reception mode 3D: The EPSILON BOARD is synchronized using 4 to 8 satellites and the antenna positioning mode is set to mobile, or automatic (before reliability testing).
				5 to 20	8 integers	Odd bytes (5 to 19)	For each byte, the number of the satellite being tracked is set on bits b0 to b6. The locking to satellite indicator is given by bit b7 (b7=0 ; locked).
						Even bytes (6 to 20)	SNR (0 to 255) of the followed satellites. The even byte Oi gives the SNR of the satellite indicated by the byte Oi-1 e.g.: O3 = 140 (80 HEX + 12 decimal) O4 = 120 Satellite 12 is locked and its SNR is 120.
				21 to 22	1 integer	---	Reserved
				23 to 26	1 long	-324,000,000 ... 324,000,000 (-90°S ... +90°N)	Latitude of the GPS antenna (ms).
				27 to 30	1 long	-648,000,000 ... 648,000,000 (-180°W .. +180°E)	Longitude of the GPS antenna (ms).
				31 to 34	1 long	-100,000 ... 1,800,000 (-1,000 m to 18,000 m)	Altitude of the GPS antenna (cm).
				35	1 char	1 0	GPS receiver failure GPS receiver operational.
				36	1 char	---	Reserved
				0	1 char	1 0	Board diagnostic output. TOD message output.
				0 to 3	1 long	0 ... 100,000 (0 ... 100,000 sec)	Period of the emission of the time message on the TOD interface and on the remote control interface.
Reset of the board	---	16	0		---	---	Stops and restarts the board (warm-reboot).

	Identifier		Bytes	Byte No.	Encode Type	Settings	Description
	Query	Command					
GPS date init	68	4	7	0	1 char	1 ... 31 (Days)	Sets the GPS receiver date and time.
				1	1 char	1 to 12 (Months)	
				2 to 3	1 integer	1992 ... 2016 (Years)	
				4	1 char	0 ... 23 (hours)	
				5	1 char	0 ... 59 (minutes)	
				6	1 char	0 ... 59 (seconds)	
Set GPS	74	10	19	0	1 char	1 2 3	Antenna positioning mode: Automatic Antenna positioning mode: Manual Antenna positioning mode: Mobile
				1 to 4	1 long	-324,000,000 ... 324,000,000 (-90°S ... +90°N)	Latitude (ms).
				5 to 8	1 long	-648,000,000 ... 648,000,000 (-180°W ... +180°E)	Longitude (ms).
				9 to 12	1 long	-100,000 ... 1,800,000 (-1,000 m to 18,000 m)	Altitude (cm).
				13 to 17	5 char	---	Reserved
				18	1 char	1 0	UTC time reference. GPS time reference.
Local time	71	7	2	0	1 char	-23 ... +23 (hours)	Difference, in hours and minutes, between local time and the board's reference time.
				1	1 char	-59 ... +59 (minutes)	
Phase correction	72	8	4	0 to 3	1 long	0 ... 1,000 ns	Programmed difference between the distributed 1pps signal and the built-in reference (to correct antenna cable delay).
Leap second	73	9	6	0	1 char	1 0	No leap second. Use leap second.
				1	1 char	1 2	Leap second addition. Leap second subtraction.
				2 to 3	1 integer	1 ... 366 Days	Day of the year to be used.
				4 to 5	1 integer	1992 ... 2127	Year to be used
Display	77	13	2	0	1 char	0	Day / Month / Year format
						1	Month / Day / Year format
						2	Day of year / Year format
						3	MJD format
						4	MJD format integer part /hh/mn/sec
				1	1 char	---	Reserved
Alarm limits	78	14	10	0 to 3	1 long	0 ... 1,000 μ s	Phase alarm limit 0 = no phase alarm.
				4 to 7	1 long	0 ... 1,000 10 ⁻⁹	Frequency alarm limit 0 = alarm immediate if synchronization is lost.
				8 to 9	1 integer	---	Reserved
Version	67		10	0 to 3	1 long	---	Reserved

Name	Identifier		Bytes	Byte No.	Encode Type	Settings	Description
	Query	Command					
				4	1 char	0 ... 255	Software version.
				5	1 char	0 ... 255	Update version number.
				6 to 9	1 integer	---	Reserved
				8	1 char		EPLD version number
				9	1 char	---	Reserved
Error (ID = 64)			2	0	1 char	X	Invalid message ID
				1	1 char	0	Incorrect number of useful bytes
						1	Unknown message ID
						2	Unauthorized parameter in <DATA> section.
						3	Command not valid
						4	Remote command not authorized
Forced holdover mode	79	15	1	0	1 char	1 0	Functioning mode: disciplining authorized Functioning mode: holdover forced
Manual time setting	81	17	7	0	1 char	1 ... 31 (days)	Manual setting of the board (authorized only in forced keeping mode).
				1	1 char	1 ... 12 (months)	
				2 to 3	1 integer	1992 ... 2127 (years)	
				4	1 char	0 ... 23 (hours)	
				5	1 char	0 ... 59 (minutes)	
				6	1 char	0 ... 59 (seconds)	
Manual correction ±1s	85	21	1	0	1 char	1: - 1 second 0: + 1 second	Manual second correction (authorized only in forced keeping mode).
Remote control mode	82	18	1	0	1 char	0: remote control mode authorized 1: remote control not authorized	Authorization or not of new remote control commands.

REVISION HISTORY

<i>Revision Level</i>	<i>ECN Number</i>	<i>Description</i>
A	21/08/01	Création / First draft
B	4/5/02	Mention of encoding format type
C	21/06/02	Temperature stability / Operating temperature
D	24/05/05	Features, mechanical drawing, antenna installation, power consumption
E	22/03/06	Drawing update
F0	29/08/08	First iteration of this Spectracom documentation, converted from previous documentation.

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