OSA GPS 4550 STAR+

Specifications

Article number : TBD

TABLE OF CONTENTS

Historic

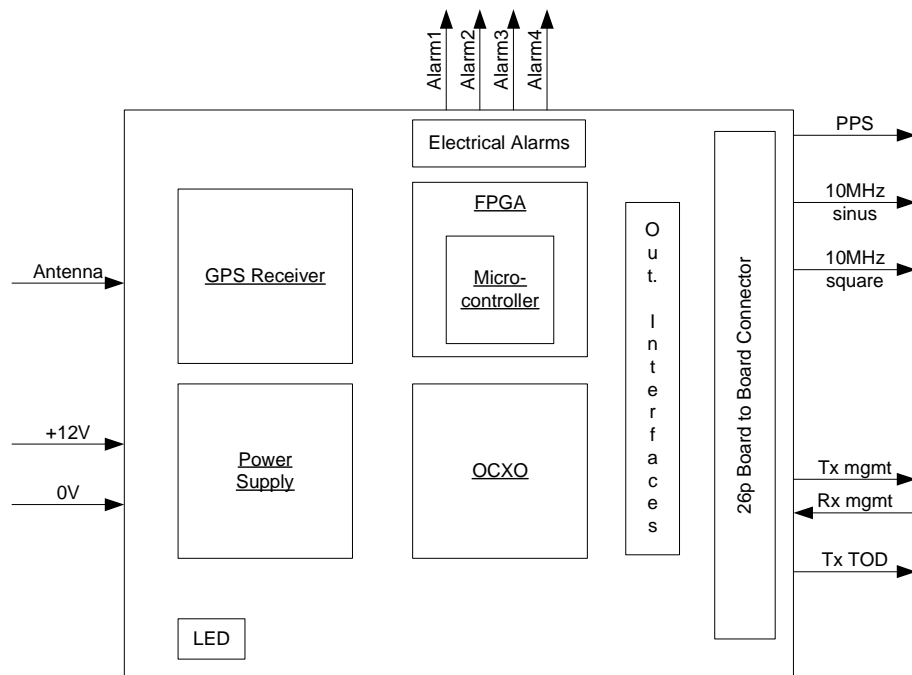| Revision	Description of change	By	Date
-	First edition	SUNA	02.03.2009

1   Overview

This document specifies the OSA STAR4 GPS Clock

1.1   Article number
This product is fully defined, including software specifications, by its article number: TBD

1.2   Block diagram
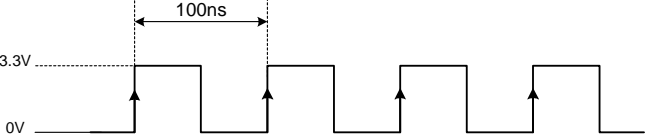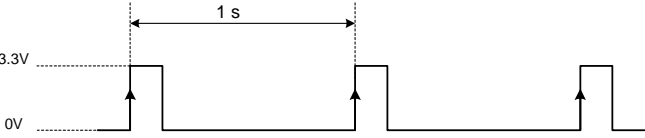
2   Inputs specifications

Antenna Input	
Connector	SMB, male, Right angle
Frequency	1575.42 MHz
Impedance	50 Ohms
Sensitivity	-144 dBm (cold start) -160 dBm (Fixed Position)
Absolute maximum rating [1]	+ 5dBm (Signal input power)
Power Input	
Connector	ERNI 063209
Connections:	+Vcc: Pins: a12,a13, b1 for 12V 0V: Pins: a2, a6, a7, a8, b11
Vcc	+12V +/-5%, Ripple and noise max: 150mV peak to peak
Consumption	Warm-up: Max 12W Steady-state: Max 6W (At 25℃)
Environmental	
Operating temperature range	-5°to +55°C
Storage temperature	-40°to +85°C
Humidity	5 to 95% non condensing.

[1]   Stressing the device beyond the "Absolute Maximum Ratings" may cause permanent damage

3 Outputs signals specifications

10MHz Sinus Frequency Output	
Number	2 (only one at a time)
Connectors	On the board to board connector, pin b2 SMB, male, Right angle
Signal wave form	Sinusoidal
Amplitude	1Vrms (+/-10%) => 0,8Vrms à 1,2Vrms
Impedance	50 Ohms
Harmonics	-45dBc
Spurious	-70dBc
Phase noise (8863 OCXO)	10 Hz -125dBc/Hz 100Hz -140dBc/Hz 1KHz -140dBc/Hz
Phase alignment	+/- 5ns at ambient temperature
PPS Output Timing reference	Rising edge
10MHz Square Frequency Output	
Number	1
Connectors	On the board to board connector, pin b7
Signal wave form	Square
Amplitude	3.3Vpp (ACMOS) (Amplitude is divided by two, when connected to a 50 Ohms load) [1]
Signal shape	 Duty cycle : Ton = 35% ; Toff = 65%
Phase alignment	+/- 5ns at ambient temperature
PPS Output Timing reference	Rising edge
PPS Outputs	
Number	1
Connectors	On the board to board connector, pin b9
Signal wave form	Square
Amplitude	3.3Vpp (ACMOS) (Amplitude is divided by two, when connected to a 50 Ohms load) [1]
Rising time	≤ 10ns (10% - 90%)
PPS Duration	20µs
Signal shape	
LED command outputs	
Number	2
Color	GREEN and RED

[1] **Absolute maximum ratings**
Loading PPS and 10MHz outputs with impedance lower than 30Ω may cause permanent damages to the device.

Output signal availability

Mode	10MHz sinus	10MHz square	PPS
INIT	available	available	Not available
WARM-UP	available	available	Not available
TRACK FAST	available	available	available
TRACKED	available	available	available
HOLDOVER	available	available	available

4 Alarms signals specifications

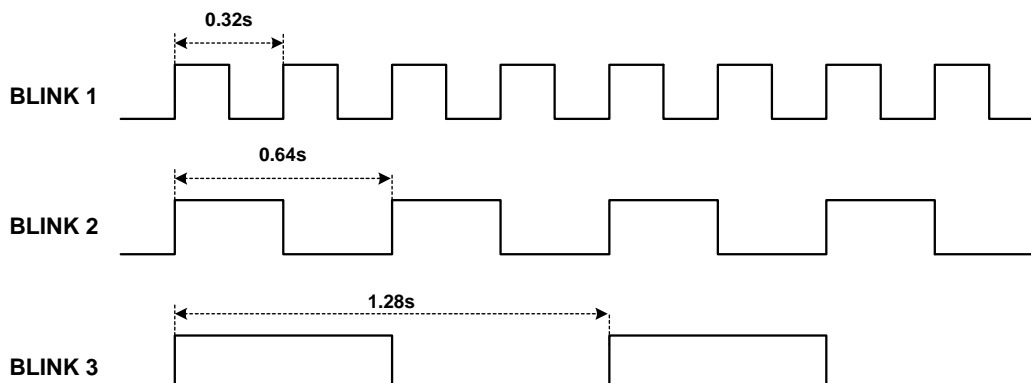| **Alarm status Output**	
Number	4
Connectors	ERNI 063209
Connections	Alarm 1: Pin b3 Alarm 2: Pin a3 Alarm 3: Pin b4 Alarm 4: Pin a4
Amplitude	3.3Vpp (ACMOS), 50 Ohms (Amplitude is divided by two, when connected to a 50 Ohms load).
Logical information	Logical "0" when alarm is information active (KO) Logical "1" when alarm is not active (OK)
Alarms signals: Truth table Note: It is not possible to show all alarms conditions with the electrical signals, as a binary code cannot represents all individuals conditions. To have a more detailed information, please use the management port and the appropriate command	<table><tr><th>Alarm 4</th><th>Alarm 3</th><th>Alarm 2</th><th>Alarm 1</th><th>Alarm condition</th></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>System OK</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Antenna failure</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>GPS Timing alarm</td></tr><tr><td>1</td><td>0</td><td>1</td><td>1</td><td>GPS OK, but Position averaging in progress</td></tr><tr><td>--</td><td>--</td><td>--</td><td>--</td><td>Reserved for future use</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>General system failure.</td></tr></table>

5   Operation mode :

5.1   Mode definition

- **Initialisation**
  After a power-up, the initialisation mode assures the configuration of the system. The typical time to perform the configuration of the system is up to 10 seconds.

- **Warm-up**
  In this mode, the system is waiting for the GPS initialisation (Satellites acquisition, tracking algorithms..) and for the OCXO stabilization.

- **Tracking Fast**
  After the warm-up phase, the OCXO is ready to be tracked, but with a short time constant to assure that the system is able to compensate the deviation of the phase during the retrace phase of the OCXO.

- **Normal Tracked**
  This is the normal mode of working. The system uses the time constant defined by the user

- **Holdover**
  If no input is available, the module enters in holdover mode. The tracking function is blocked and the OCXO delivers its own frequency for the outputs.

- **Squelch**
  After a while (See HBSQ value) of continuous holdover the outputs (PPS & 10MHz) are squelched.

5.2   LED's truth table

Mode	ALARM ANTENNA	ALARM PPS_GPS	LED GREEN	LED RED
INIT	X	X	BLINK 1	OFF
WARM-UP	1	1	BLINK 2	BLINK 2
	1	0	BLINK 3	BLINK 3
	0	1	BLINK 2	OFF
	0	0	BLINK 3	OFF
TRACK FAST	X	X	BLINK 3	OFF
TRACKED	X	X	ON	OFF
HOLDOVER & SQUELCH	1	X	OFF	BLINK 3
	0	X	OFF	ON

6 Management and TOD specifications

Management Port	
Number	1
Connectors	ERNI 063209
Connections	Rx (Input): Pin a5
	Tx (Output): Pin b5
Electrical levels	3V3 or RS232
Configuration	Baud-rate : 9600 Number of bits : 8 Stop bits : 2 Parity : None Flow control : None Characters : Tiny or Capital letters
Types of commands	1) Set command 2) Answer to a Set command 3) Request command 4) Answer to a Request command Note 1: All commands are not "case sensitive"
Format of Set Command	Set Command: `CMD=par1,par2,…,parN;<cr><lf>` CMD is the name of the command par1 to parN are the parameters of the command.
Format of an Answer to a Set Command	An answer to a set command is: `ANS;<cr><lf>` ANS is the answer, which can have the following values: • OK • SYNTAX_ERROR • UNKNOWN_CMD • PARAM_ERROR Note 1: Please not that the DOWNLOAD command is particular and has no response Note 2: Please note that during download process, the 4500 is not able to receive any answer
Format of a Request Command	Request Command: `CMD;<cr><lf>` CMD is the name of the command.

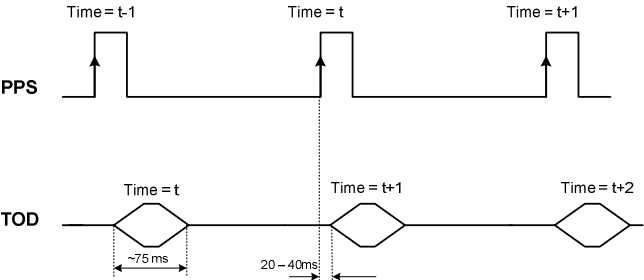| Format of an Answer to a Request Command	An answer to a request command is:
	
	`ANS=val1,val2,…,valN;<cr><lf>`
	
	ANS is the name of the answer.
	val1 to valN are the values of the answer.
	
	Some answers have to send many information. In this case, the answer is given on several lines:
	`ANS=<cr><lf>`
	`val11,val12,…,val1N,<cr><lf>`
	`val21,val22,…,val2N,<cr><lf>`
	`…`
	`valM1,valM2,…,valMN;<cr><lf>`

Time of Day Port	
Number	1
Connector on TOP side	ERNI 063209
Connections	Tx_tod_0 (Output): Pin b6
Configuration (NMEA compatible)	Baud-rate : 4800 Number of bits : 8 Stop bits : 1 Parity : None Flow control : None
Types of commands	NMEA spontaneous
Swap Tx (**Time of Day Port)** and Tx **(Management Port)**	When PCB_VER[0] input =0 (i.e.RS232 electrical level) The Tx (Time of Day Port) frame is available on the output pin TX_TOD_232 (pinb6 of J201). The Tx (Management Port) frame is available on the output pin TX_MGT_232 (pinb5 of J201). When PCB_VER[0] input =1 (i.e.3V3 electrical level) **and** when R501 to R503 **are** equipped and U501 **is** **not** equiped The Tx (Time of Day Port) frame is available on the output pin TX_TOD_232 (pinb6 of J201). The Tx (Management Port) frame is available on the output pin TX_MGT_232 (pinb5 of J201). **or** When PCB_VER[0] input =1 (i.e.3V3 electrical level) **and** when R501 to R503 **are not** equipped and U501 **is** equiped The Tx (Time of Day Port) frame is available on the output pin TX_TOD_232 (pinb6 of J201). The Tx (Management Port) frame is available on the output pin TX_MGT_232 (pinb5 of J201). This function implements a dynamical swap of the two Tx port in the FPGA according to PCB_VER[0] value.

Format	The NMEA spontaneous TOD information begin with a "$", followed by the command's name. Then, the parameters, each separated with a ",". The command is terminated by a " * " followed by the Checksum Finally, the string is terminated by "CR and LF" Example, for TOD:
	`$GPZDA,104534,11,07,2001,+00,00*CS<cr><lf>`
	Note: During warm-up and almanacs satellites acquisition phase, the system is not able to send correct TOD information. In this case, the following information is sent:
	`TOD_NOT_VALID;<cr><lf>`
	Note: A correct TOD can only be provided when the system has received the offset information between GPS Time and UTC Time. This information is contained in GPS almanacs
Timing specification	

List of Alarms	
Definition	Alarms are sent as a response to the specific command "Alarm" (No spontaneous messages).
Available alarms	1) Initialisation and Warm-up Start of the system and OCXO heating phase. 2) Holdover System in holdover (No GPS reference or user selection) 3) Tracked fast System is using a temporary tracked fast mode, in order to stabilize the system faster, after entering in tracked mode. 4) OCXO failure Signal failure detected at the OCXO's output 5) Outputs squelched (After specified time in holdover) The outputs have been squelched by the system, because the OCXO is in holdover mode since a longer time that specified with the HBSQ command. 6) GPS timing alarm The GPS system is not able to provide time reference. 7) GPS Failure (No internal communication) 8) Antenna failure The consumption of the antenna is out of the limits. It means, generally, that the cable is not correctly connected, or that a shorted condition is affecting the cable. 9) Tracked initial The system is tracked normally, but not in fixed position mode.

List of Commands	
Commands	***Answers***
Request the alarms status: `ALARM;<cr><lf>`	Returns the active alarms: Example: `ALARM=1,5,9;<cr><lf>` If alarms 1,5,9 are active `ALARM=N;<cr><lf>` If no alarm is active Means that the alarms 1, 5 and 9 are active. The meaning of the values "1 to 10" is given in the chapter " List of Alarms"
Request the alarms mask: `ALARM_MASK;<cr><lf>`	Returns the alarms mask: Example: `ALARM_MASK=2,5,6;<cr><lf>` If masks 2,5,6 are set `ALARM_MASK=N;<cr><lf>` If no masks is set For each parameter listed (1 to 10, Refer to List of Alarms, for description), the corresponding alarm condition is masked, others are implicitly not masked

Set the alarms mask:
 	
Example:
`ALARM_MASK=2,5,6;<cr><lf>`
To set mask for alarm 2,5,6 and clear mask of all others
`ALARM_MASK=N;<cr><lf>`
To clear all alarm masks
 	
For each parameter listed (1 to 10, Refer to List of Alarms, for description), the corresponding alarm mask is set, other are cleared
	Returns:
	
	`OK;<cr><lf>`
	or
	`PARAM_ERROR;<cr><lf>`

Request the configuration:
 	
`CONF;<cr><lf>`
	Returns the configuration:
	
	`CONF=ut,rt,um,g,c;<cr><lf>`
	
	ut : User PLL time constant ($0 \le ut \le 5000$)
	rt : Real PLL time constant ($0 \le rt \le 5000$)
	um : User mode (A: Automatic, H: Holdover)
	g : UTC offset (shh:mm) s:+ or -; 0<= hh<= 12;
	         0<= mm <=59;
	c : PPS Correction (-999999 <= c <= +999999)

Set the Download functionality:
 	
`DOWNLOAD(ON);<cr><lf>`
Or:
`DOWNLOAD(OFF);<cr><lf>`
	Returns:
	
	Note : Please not that the DOWNLOAD command is particular and has no response.

`FUNC;<CR><LF>`	Retourne la liste des fonctions disponibles séparées par des virgules.
	
	Exemples
	`FUNC=CMD_V2;<CR><LF>`
	`FUNC=DWNLD,CMD_V2;<CR><LF>`
	`FUNC=DWNLD,ATDC,CMD_V2;<CR><LF>`
	
	CMD_V2 : format des commandes en version 2 (CMSW.NET).
	DWNLD : fonction "firmware download" disponible.
	ATDC : fonction ATDC disponible.

Request the HBSQ configuration:
 	
`HBSQ;<cr><lf>`
 	
HBSQ is a functionality which squelches the output signals, after a configured delay in holdover mode.
	Returns the HBSQ configuration
	
	`HBSQ=h,a;<cr><lf>`
	
	h: User configured value, in minutes (0 <= h <= 7200)
	
	a: Current value of the HBSQ counter, in minutes.
	
	   If the system is not in holdover, "a" value is the same as "h" value.
	   If the system is in holdover, "a" value is the remaining time, in minutes, before that the outputs will be squelched.

Set the HBSQ configuration:
 	
`HBSQ=h;<cr><lf>`
 	
1 <= h <= 7200, in minutes. Delay before to squelch the outputs, in holdover mode.
0 : disable the HBSQ function
	Returns:
	
	`OK;<cr><lf>`
	
	Or:
	
	`PARAM_ERROR;<cr><lf>`

Request information about visible satellites:
 	
`INFO_VIS_SAT;<cr><lf>`
	Returns information about visible satellites:
	
	`INFO_VIS_SAT=n,<cr><lf>`
	`1,i,a,b,s,h,<cr><lf>`
	`…,<cr><lf>`
	`12,i,a,b,s,h;<cr><lf>`
	
	N : Number of visible satellites (0 <= n <= 12)
	
	I : Satellite Identifier (1 <= i <= 32)
	
	a : Elevation angle (5 <= a <= 90)
	
	b : Bearing angle (0 <= b <= 359)
	
	s : Signal/Noise Ration (0 <= s <= 99) (dBHz)
	
	h : Health (0:Almanach not collected, 1:Unhealthy, 2: Healthy)

Request information about tracked satellites:
 	
`INFO_TRACK_SAT;<cr><lf>`
	Returns information about tracked satellites:
	
	`INFO_TRACK_SAT=n,<cr><lf>`
	`1,i,<cr><lf>`
	`…,<cr><lf>`
	`12,i;<cr><lf>`
	
	i: Satellite Identifier (1 <= i <= 32)

Request information about GPS receiver position:
 	
`INFO_GPS_POS;<cr><lf>`
	Returns information about GPS receiver position:
	
	`INFO_GPS=lat,lon,h,da,tm;<cr><lf>`
	
	Lat : Latitude (dd:mm:ffff:di)
	    dd : Degree (00 <= dd <= 90)
	    mm : Minute (00 <= mm <= 59)
	    ffff : Fraction: (0000 <= ffff <= 9999)
	    di : Direction (N or S)
	
	lon : Longitude (ddd:mm:ffff:di)
	    dd : Degree (000 <= ddd <= 180
	    mm : Minute (00 <= mm <= 59)
	    ffff : Fraction: (0000 <= ffff <= 9999)
	    di : Direction: (E or W)
	
	h : Altitude (-999 <= h <= 17999)
	
	da : Date (dd.mm.yyyy)
	    If date is invalid: 99.99.9999
	
	tm: Time (hh:mm:ss)
	    If time is invalid: 99:99:99

Request the inventory information: `INV;<cr><lf>`	Returns the inventory information: `INV=a,b,c,d,e,f,g,h,i;<cr><lf>` a: Name of the module (Max. 12 characters) b: Article number (Max. 6 characters) c: Serial Number (Max: 6 characters) d: Hardware version (Max. 2 characters) e: Firmware article number (Max. 6 characters) f: Firmware version g: Date of test (ddmmyyyy) h: Version of test system (Max. 4 characters) i : Oscillator's type (Max. 10 characters) j: FPGA version
Request the mask angle: `MASK_ANGLE;<cr><lf>`	Returns the mask angle: `MASK_ANGLE=m;<cr><lf>` m : mask angle (5..90°)

Set the mask angle:
 	
`MASK_ANGLE=m;<cr><lf>`
 	
m : mask angle (5..90°)
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

Set the user mode configuration:
-Automatic or Holdover
 	
`MODE=m;<cr><lf>`
 	
m = A => Automatic Mode
m = H => Holdover Mode.
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

Request the outputs state
 	
`OUTPUT_STATE;<cr><lf>`
	Returns the output state of the system:
	
	`OUTPUT_STATE=3,<cr><lf>`
	`1,10M_S,output_state,<cr><lf>`
	`2,1PPS,outpus_state,<cr><lf>`
	`3,10M_L,output_state;<cr><lf>`
	
	output_state : OK : output is OK
	                      AL : output is squelched or in alarm

Set the PPS compensation:
 	
-Negative value to compensate delay in the antenna cable.
 	
`PPS_CABLE_DELAY=n;<cr><lf>`
 	
n: PPS Correction
(-999999 <= c <= +999999 , in ns)
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

Set the 1PPS width :
 	
`PPS_WIDTH=w;<cr><lf>`
 	
w : width in 0.1µs
(10 ≤ w ≤ 2000000, 1µs ≤ w ≤ 200ms)
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

Read ADC: `READ_ADC;<cr><lf>`	Returns: `PCB Ver=a,ADC=b,c;<cr><lf>` A = pcb version, B = C =

Request a Restart of the system:
 	
`RESTART(r);<cr><lf>`
 	
r = W: Ask for a Warm restart
      (Restart with current parameters)
 	
r= C: Ask for a Cold restart
      (Restart with factory parameters)
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

Request LED and GPS status
 	
`STATUS;<cr><lf>`
	Returns LED and GPS/AUX status :
	
	<u>GPS used only</u>
	`STATUS=l,g,rm;<cr><lf>`
	
	<u>AUX used only</u>
	`STATUS=l,a,T,rm;<cr><lf>`
	
	<u>GPS and AUX used</u>
	`STATUS=l,g,a,T,rm;<cr><lf>`

Set the PLL time constant
 	
`TAU=t;<cr><lf>`
 	
t= PLL time constant (0 ≤ t ≤ 5000)
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

Request Time Of Day `TOD;<cr><lf>`	Returns the Time Of Day : `$GPZDA,hhmmss,dd,MM,yyyy,shh,mm*CC<cr><lf>`
Request the type of the system `TYPE;<cr><lf>`	Returns the type of the system: `TYPE=family,variant;<cr><lf>` For this product: family = 4501 variant = std

Set the Time Zone (UTC Offset)
 	
`UTC_OFFSET=shh:mm;<cr><lf>`
 	
s :   Sign (+ or -)
hh :   Hours (0≤ hh ≤ 12)
mm: Minutes (0 ≤ mm ≤ 59)
	Returns:
	
	`OK;<cr><lf>`
	Or:
	`PARAM_ERROR;<cr><lf>`

7   Timing specifications

PPS Stability	
Tracked mode, during position averaging	150ns max, peak to peak
Tracked mode, fixed position mode	100ns max, peak to peak.
10MHz Stability	
Tracked mode, fixed position mode	ADEV <= 1×10^{-12} @ 20.000s
Stability in holdover mode, at constant temperature (after 30 days of continuous operation)	1×10^{-10} / Day after 30 days of continuous operation
Stability in holdover mode, over temperature range (after 48 hours of continuous operation)	1×10^{-9} peak to peak with 8863-XS OCXO
Fixed Position Mode	
Condition for transition to Fixed position mode	14.400 seconds (4 hours) after entering in tracked mode.
Condition for transition to Averaging position mode	Power-up.

8   Board to Board connector specification (connector on TOP side)

VIEW FROM CONNECTOR SIDE

+12VDC	13A	13B	*not connected* *
+12VDC	12A	12B	*not connected* *
do not connect *	11A	11B	GND
do not connect *	10A	10B	$\overline{\text{ATDC\_ACQ\_MODE}}$
$\overline{\text{RESET}}$	9A	9B	OUT_1PPS
GND	8A	8B	AUX_INPUT
GND	7A	7B	OUT_10MHZ_LVCMOS
GND	6A	6B	TX_TOD
RX_MANAGEMENT (INPUT)	5A	5B	TX_MANAGEMENT (OUTPUT)
ALARM_OUT_3	4A	4B	ALARM_OUT_2
ALARM_OUT_1	3A	3B	ALARM_OUT_0
GND	2A	2B	OUT_10MHZ_SINE
not connected	1A	1B	+12VDC

(*) reserved for factory testing or other use
IT IS VERY IMPORTANT NOT TO CONNECT ANYTHING

ERNI Dual Row Vertical Male Connector
SMC-Q, 26-pole
Part# 063209

9   Mechanical dimensions, mounting and positioning

-- End of document ---