ELECTRONICS & DEFENSE

STARLPRO-1500

High Precision & Performance Rubidium Source

Main Features

- Very low temperature sensitivity
- Excellent short term stability
- Low power consumption
- Pin compatible with industry std.
- Small volume / low profile
- Rb lamp extended life expectancy (20 years)
- Industry standard pin out
- RS 232 interface for center frequency adjustment and monitoring of the working parameters

Applications

Telecom

Navigation

Broadcast

Defense

Instrument

Safran Electronics & Defense is with you every step of the way, building in the intelligence that gives you a critical advantage in observation, decision-making and guidance.

SAFRAN

Product Characteristics

- Ultra low aging : < 2E-12/ day
- Freq. offset over temp. range : < 2 E-10 over 0°C to 60°C
- Short-term stability : 1E-12 @ 100s
- Small volume : 28 in3 (5x3.74x1.5" / 128x95x38.1mm)
- Single power supply voltage : 12V or 24V
- RS232 standard interface : Control & monitoring commands, 9600 b/s

Main Applications

- Synchronization telecommunications (SDH, SONET, SS7, GSM, TETRA)
- Digital Audio Broadcast
- TV transmissions (analog & digital)
- Military communications
- Navigation
- Instrumentation
- Tracking and guidance control

Technical Specifications

ELECTRICAL

Spec	StarLPRO-1500			
Type	Standard	Options		
RFOUT Frequency	10 MHz	Not applicable		
Frequency Change Operating temperature range (Thermal chamber with air flow)	< $2E^{-10}$ -0°C to +60°C	+- $1E^{-10}$ (order code: 60)		
Frequency Accuracy @ Shipment	< $5E^{-11}$ (+25°C), typical			
Aging (After 3 months of continuous operation)	< $5E^{-11}$ / month (typical: $3E^{-11}$ / month)	< $3E^{-11}$ / month < $2E^{-10}$ / year < $1E^{-9}$ / 10 years (order code: A) (typical: ±$1E^{-11}$ / month)		
Short Term Stability		Improved Short term stability (order code: S)		
1s	2E-11	$1E^{-11}$		
10s	$8E^{-12}$	$3E^{-12}$		
100s	$3E^{-12}$	$1E^{-12}$		
Phase Noise (dBc/Hz) (RFOUT 10 MHz)				
1 Hz	-75			
10 Hz	-95			
100 Hz	-125			
1k Hz	-145			
10K Hz	-150			
Frequency Retrace Off/On (In stable temperature, gravity, pressure & magnetic field conditions)	< $5E^{-11}$ 24 hr / 1 hr			
Warm-up Time @ +25°C Frequency stability	12 min $5E^{-10}$	Lock < 7min (order code: F)	Lock < 5min (order code: FE)	25 min 5E-10 (order code: LP)
Analog Frequency Adjustment Range Tolerance [An external voltage (0-5 VDC) can be applied to pin 7 (V adjust). And internal mechanical adjustment by screwdriver	5×10^{-9} ±20%			
Digital Frequency Adjustment Range Resolution (Through RS-232 commands)	±$1.67E^{-8}$ $5.12E^{-13}$			
RFOUT Output level Output impedance Harmonics Spurious f_0 ± 100kHz	Sine wave 0.5 Vrms (± 10% / 50Ω) 50 Ω ±20% < -40dBc < -80dBc			
Communication Interface Protocol speed	RS-232 control & monitoring (see commands below) 9600, n, 8, 1			

Spec	StarLPRO-1500			
Type	Standard	Options		
Supply Voltage (DC)	24V (20 to 32 V)	12V (11.2 to 16 V) (order code: 12V)		
Max Power Supply Ripple	< 50 mV peak to peak (from 1Hz to 1 MHz frequency band)			
Supply Voltage Sensitivity	< $2E^{-11}$ for 10% voltage change			
Input Power		with the following options:		
		(F/E)	(FE)	(LP)
Warm up @+25°C (typical)	<30W @12V or <38W @ 24V	<40 W	<50 W	<24W
0°C	<14 W	(24V only)	(24V only)	
+25°C	< 11 W	Option GPS : +2W		
+60°C	< 7 W			
Lock Monitor : 5V CMOS LOAD (output impedance ~ 1KΩ)	Lock: < 0.5V	Unlock: > 4.2V		
Conformal coating	None	Included (order code: CC)		
Reverse Voltage Protection	< -40V (up to -40V on power input / no damage)			
Electrical Protection				
power +24V (12V)	An internal diode protects against reverse polarity connection			
RF output	ESD and short-cut protected			
TxD output	ESD and short-cut protected			
RxD input	ESD protected			
Frequency adjust input	ESD protected			
Lock indicator	Over current protected			

ENVIRONMENTAL

Spec	StarLPRO-1500
Type	Standard
Magnetic Field Sensitivity	< $2E^{-11}$ / Gauss (< $1E^{-10}$ / Gauss in longitudinal axis)
Storage Temperature	- 55°C to + 85°C
Humidity	GR-CORE-63, Section 5.1.2
Operating Vibration	GR-CORE-63, Section 5.4.2 Random and Sinusoidal MIL-PRF-28800F, Class 3, 4
Shock	Survival: 40g / 11ms
Helium concentration sensitivity	< $1E^{-10}$ per ppm of Helium concentration change
G-Tip-Over Test	< $2E^{-10}$ / g in worst axis

PHYSICAL

Spec	StarLPRO-1500	
Type	Standard	Options
Size (L x W x H)	5x3.74x1.5" / 128x95x38.1mm	
Weight	234g (8.25oz)	
Mounting & Mechanical Layout Screw fixture type (6 pieces)	see drawings below UNC-4-40	Not applicable M3 (order code: M3)
Connector	10 pins male TE-Connectivity 87456-6 Contacts AWG20 TE-Connectivity 86016-5	

MODEL ORDERING INSTRUCTIONS

StarLPRO-1500 / 10M / 12V / xx

Type Frequency Supply voltage Options (A/S/etc)

STANDARD RS-232 CONTROL & MONITORING COMMANDS

The operating and monitoring parameters of the StarLPRO-1500 are accessible for read and write operations through the serial RS-232 port (9600 bits/sec., no parity, 1 start bit, 8 data bits, 1 stop bit).

There are 2 basics commands, which are M, Cxxxx

M<CR><LF>: monitors the basic internal signals of the atomic clock.

The returned answer looks like

HH GG FF EE DD CC BB AA <CR> <LF>

Where each returned byte is an ASCII coded hexadecimal value, separated by a <Space> character.

All parameters are coded at full scale.

HH: Read-back of the user provided frequency adjustment voltage on pin 2 (0 to 5V)

GG: reserved

FF: peak voltage of Rb-signal (0 to 5V)

EE: DC-Voltage of the photocell (5V to 0V)

DD: varactor control voltage (0 to 5V)

CC: Rb-lamp heating current (Imax to 0)

BB: Rb-cell heating current (Imax to 0)

AA: reserved

Cxxxx<CR><LF>:output frequency adjustment through the synthesizer, by steps of 5.12 x 10^{-13}, where xxxx is a signed 16 bits word in hexa coded ASCII. This value is automatically stored in a EEPROM as last frequency which is applied after RESET or power-ON operation.

In Track mode this correction is not in use. The function FCsddddd do the same.

Set frequency adjustment	**FC**sddddd<CR><LF>	s=+/- signe ddddd = limited within range : +32767/-32768 FC+99999 : interrogation	sddddd<CR><LF>	s: +/- signe ddddd : frequ. Adj. in 5.12 x 10^{-13} step

PIN FUNCTION LAYOUT

Interface Circuits connector : (10 pin contact two rows)

LPFRS-01/LPRO TEMEX Parameter	Requirements
Pin 1(output)	10 Mhz RF
Pin 2(output)	RF return
Pin 3(RF return)	RF return Dc insulated
Pin 4(output)	GND
Pin 5(RxD)	RXD (TTL) RS232 input (0-5V)
Pin 6(output) (with CMOS load)	Lock monitor * See Option Spec.
Pin 7(input) V adjust	>1.5x10^{-6} to 5V <-1.5x10^{-6} to 0V
Pin 8(GND)	GND
Pin 9(TxD)	TxD (TTL) RS232 output (0-5V)
Pin10(input) 24V/12V	24V (12V)

Interface Circuits connector : (10 pin contact two rows)

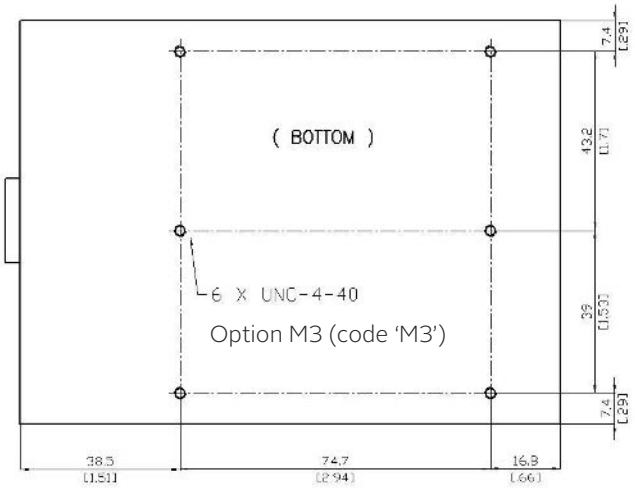
LPRO DATUM Parameter	requirements	
Pin 1(output)	10 Mhz RF	Chassis ground
Pin 2(output)	RF return	
Pin 3(NA....)	Reserved Requires open in use	RF return-DC isolated
Pin 4(output)	Chassis ground	
Pin 5(optional output)	Lamp voltage monitor (Acceptable level :3V to 13V after warm up)	
Pin 6(output) (with CMOS load)	Lock monitor (Z=2K Ohm±10%) 0V to 0.05V locked, 4.2V to 5.4V unlocked	
Pin 7(input)	>1.5x10^{-6} to 5V <-1.5x10^{-6} to 0V	
Pin 8(output)	Vin return	
Pin 9(optional output)	Xtal monitor Z=20K Ohm ±10%	
Pin10(input)	Vin power	

HEAT SINK MOUNTING

Below are some heat sink options depending on your environmental system configuration:

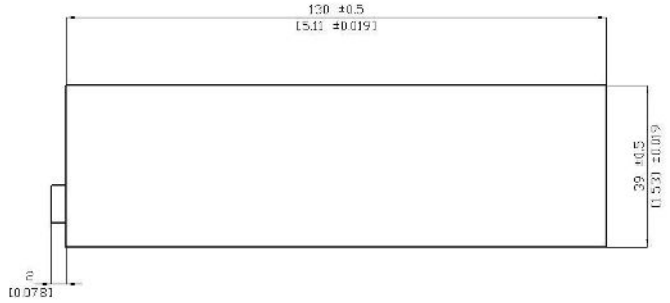
1. Mount the StarLPRO-1500 on a copper ground PCB. This mounting configuration is not recommended for >50°C ambient operational temperature.
2. Mount the StarLPRO-1500 against a system chassis using the UNC 4-40, Option M3 (code 'M3') screws with the provided thermal pad or thermal paste in between and wire bridge the connector. This mounting configuration is recommended.
3. Mount a radiator on top of the StarLPRO-1500 with the provided thermal pad or thermal paste in between, if no base plate or system chassis is available. This mounting configuration is recommended.

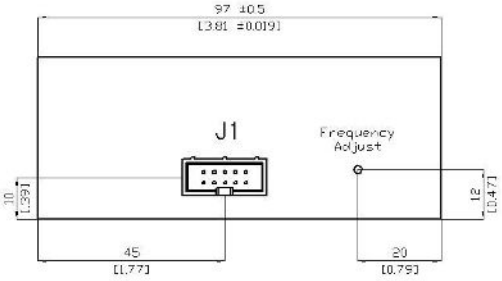
MECHANICAL DRAWINGS



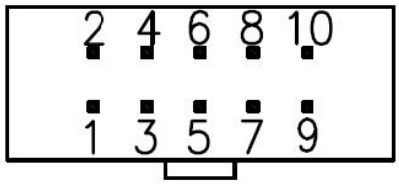
Maximum lenght of the fastening screws :
For UNC-4-40 : 0.1968"
For M3 : 5 mm

00 Dimension are in mm
[0.00] Dimension are in inche





Connector front view:



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