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The Global Leader in
Resilient **PNT**

Patented SRO-5680 SynClock+®

Auto-Adaptive SmarTiming+® Disciplining & Filtering @ 1ns Resolution

INSIDE SMARTIMING® TECHNOLOGY

Applications

Telecom | Navigation | Broadcast | Defense | Battery Powered Instruments

KEY FEATURES

Smart Low Noise, Low g Sensitivity & Rugged SRO-5680 Rubidium Oscillator

- Single power supply voltage : 11 – 16V or 18 – 32V (standard model only)
  12V±5% (with low noise LN and ULN options)
- Frequency offset over temp. range : ±5E-11
- Short-term stability : 1E-12 / 100 sec.
- 1PPS output : CMOS 0-5V
- Low warm-up current : < 1.2A
- Ultralow aging : < 5E-11/ month
- Low noise (LN) option : -130dBc @ 10 Hz (12V±5% supply option only)
- Extreme ultralow low noise (EULN) option : -138dBc @ 10 Hz (12V±5% supply option only)
- Low g sensitivity : 2E-10/g per axis
- Slim profile : 1.12" height
- RS232 standard interface : Control & monitoring commands, 9600 b/s

SPECIFICATIONS

Version 1.095

ELECTRICAL

Spec	Smart SRO-5680			
Type	Standard			
RFOUT Frequency	10 MHz			
Frequency Change Operating temperature range (Thermal chamber with air flow)	< $2E^{-10}$ -10°C to +60°C	**(Option code: E65)** -20°C à 65°C		
Frequency Accuracy @ Shipment	< $5E^{-11}$ (+25°C), typical			
Aging (After 3 months of continuous operation)	< $5E^{-11}$ / month (typical: $3E^{-11}$ / month)			
Short Term Stability		**w/LN,ULN or EULN**	**STS1**	
1s	$2E^{-11}$	5E-12	3E-12	
10s	$8E^{-12}$	4E-12	3E-12	
100s	$2E^{-12}$	2E-12	3E-12	
Phase Noise (dBc/Hz) (RFOUT 10 MHz)		**(Option codes)**		
		LGS	**LN**	**ULN**	**EULN**
1 Hz	-75	-85	-100	-103	-110
10 Hz	-95	-130	-130*	-133*	-138*
100 Hz	-125	-155*	-145	-153*	-150*
1k Hz	-145	-162	-155	-158	-160
10K Hz	-145	-164	-155	-161	-170
		* Subject to export control (end user statement required)			
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 $5E^{-10}$			
Analog Frequency Adjustment Tolerance	5 x 10^{-9} ±20%			
[An external voltage (0-5 VDC) can be applied to pin 6 (FA). The cursor pin of a 10 kΩvariable resistor placed between pin 7 and GND can provide this voltage. If not used, pin 7 must be floating]				
Digital Frequency Adjustment Internal crystal oscillator freq. Resolution (Through RS-232 commands)	±1.67E^{-8} 60MHz 5.12E^{-13}			
RFOUT Output level Output impedance	Sine wave 0.5 Vrms (±10% / 50Ω) 50 Ω±20%			
Harmonics Spurious f_o ±100kHz (DDSout off) 60MHz sub-harmonics	< -25dBc < -80dBc < -45dBc	**(Option code X)*** < -40dBc < -110dBc < -70dBc		
Supply Voltage (DC)	24V	**(with LN, ULN, EULN* or LGS option)** 12V (12V ±5%)		
Max Power Supply Ripple	< 50 mV peak to peak (from 1Hz to 1 MHz frequency band)			
Input Power Warm up @+25°C (typical) 0°C +25°C +60°C	<28W @12V or <32W @24V < 20 W < 13 W < 7 W	**(with LN, ULN, EULN* or LGS option)** < 32 W @12V < 23 W < 15 W < 9 W		
Communication Interface Protocol speed Compatible with	RS-232 commands for control & monitoring (see commands below) Timing and locking control functions VMGA messages 9600, n, 8, 1 SRO model			
Conformal coating (CC)	None	CC **(option code: CC)**		

* 'EULN' & 'X' options cannot be selected together

Spec	Smart SRO-5680		
Reverse Voltage Protection	< -40V (up to –40V on power input / no damage)		
PPSOUT Output Current	1PPS, CMOS 0-5V +20 mA sink/source		
PPSOUT Pulse Width (PW)	1PPS, 0 to 1s in 133 ns/step		
PPSOUT Holdover Time Stability Temperature window (After careful user frequency & 1PPS phase adjustment)	< 1µs / 24 hr < 7µs / 1 week Within ± 2°C	< 3µs / 24 hr Within 20°C	< 7µs / 24 hr Within 40°C

ENVIRONMENTAL

Spec	Smart SRO-5680	
Magnetic Field Sensitivity	< 2E-10 / Gauss in worst 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	Ruggedized **(ordering code: VIB)** Profile: MIL-STD-810F, Method 514.5, Category 24 Average acceleration: 7.7g rms Duration: 1 hour/axis Axis: on each X/Y/Z axis
Low g sensitivity	n/a	**(ordering code: LGS)** 2E-10/g per axis
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	Smart SRO-5680
Size (L x W x H)	140 x 101.3 x 28.5 mm
Weight	720gr
Mounting & Mechanical Layout	See drawings below
Connector	Male D-sub 15 pins (see drawing below)

MODEL PN ORDERING INSTRUCTIONS

(Example: SRO-5680/10M/LP/ULN/CC)

SRO-5680 / 10M / x

Type Frequency Option(s)

STANDARD RS-232 CONTROL & MONITORING COMMANDS

Frequency Adjustment & Monitoring Functions

The operating and monitoring parameters of the SRO-5680 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 5.12×10^{-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. But the data format is different.

Timing & Locking Control Functions

Using the same data interface, the smart USRO models can accept the following basic ASCII commands: Data is in decimal ASCII code.

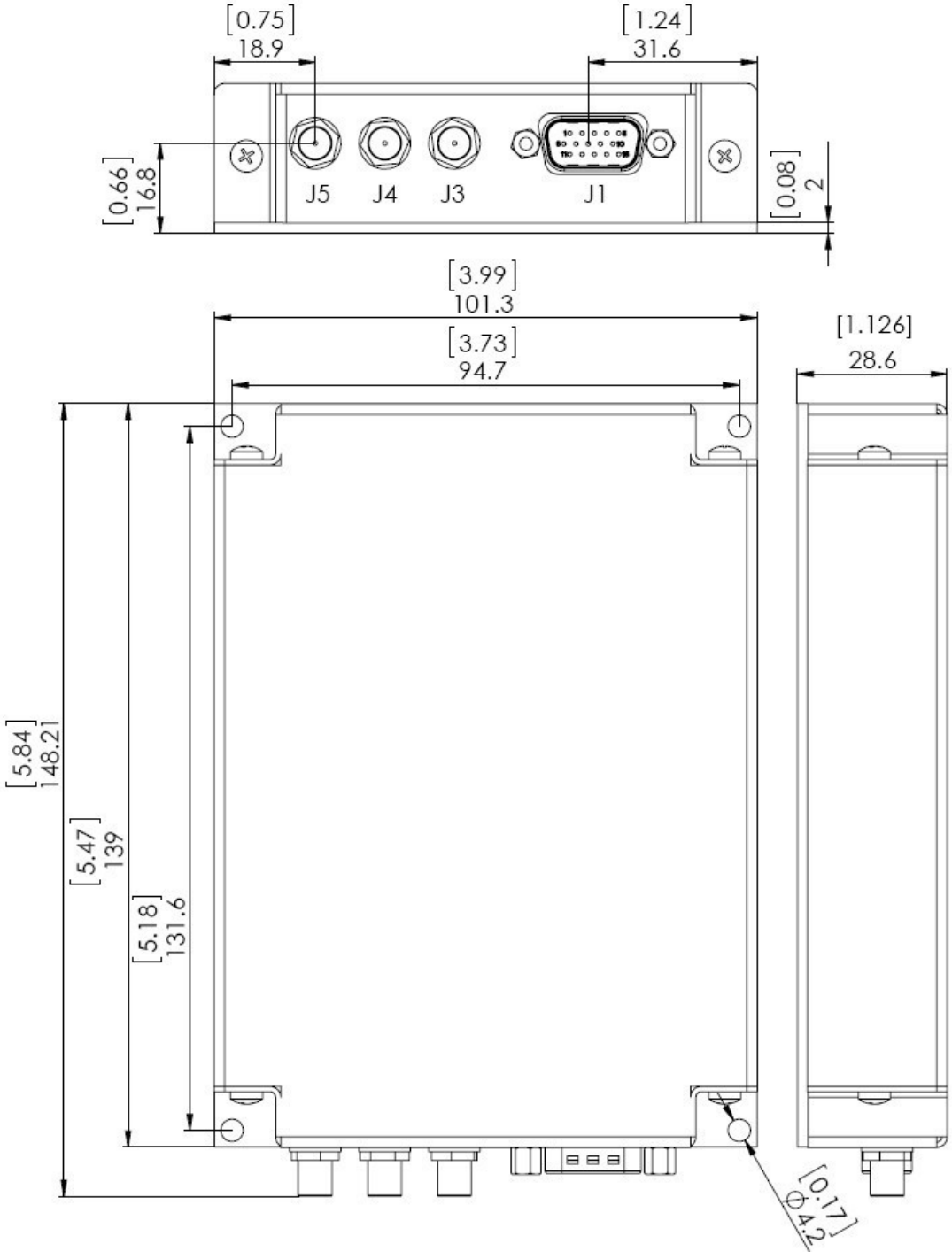
Command name	Syntax command	Data field (if any)	Response syntax	Response data (if any)
Identification	**ID**<CR><LF>	-	**TNTSRO**-aaa/rr/s.ss <CR><LF>	aaa: 100 rr: revision number s.ss: software version
Serial number	**SN**<CR><LF>	-	xxxxxx<CR><LF>	xxxxxx : 6 digits serial nbr
Status	**ST**<CR><LF>	-	**s**<CR><LF>	s:Status s=0 :warming up s=1 :tracking set-up s=2 :track to PPSREF s=3 :synch to PPSREF s=4 :Free Run. Track OFF s=5 :FR. PPSREF unstable s=6 :FR. No PPSREF s=7 :factory used s=8 :factory used s=9 :fault or Rb OOL
Set PPSOUT delay	**DE**ddddddd<CR><LF>	ddddddd=delay by 133ns step. Max 7499999 **DE**0000000 :synch to PPSREF	ddddddd<CR><LF>	ddddddd=delay by 133ns step. Max 7499999
Set PPSOUT Pulse Width	**PW**ddddddd<CR><LF>	ddddddd=pulse Width by 133ns step. Max 7499999 **PW**0000000: no pulse	ddddddd<CR><LF>	ddddddd=Pulse Width by 133ns step. Max 7499999 0000000: no pulse
Time of day	**TD**<CR><LF>	-	hh:mm:ss<CR><LF>	hh:hours mm:minutes ss:seconds
Set time of day	**TD**hh:mm:ss<CR><LF>	hh:Hours mm:Minutes ss:seconds	hh:mm:ss<CR><LF>	hh:hours mm:minutes ss:seconds
Date	**DT** <CR><LF>		yyyy-mm-dd	yyyy : year mm : month dd : day
Set date	**DT** yyyy-mm-dd <CR><LF>	yyyy : year mm : month dd : day	yyyy-mm-dd	yyyy : year mm : month dd : day
Beat every second on serial port.	**BT**x<CR><LF>	x=0 : Stop beat x=1 : Effective Time interval PPSOUT vs PPSREF x=2 : Phase comparator x=3 : Both x=1 & x=2 x=4 : Beat Time of day x=5 : Beat status x=6 : Beat <CR><LF> x=7 : Beat Date, Time, Status x=A : Beat NMEA $PTNTA, x=B : Beat NMEA $PTNTS,B,	ddddddd<CR><LF> or sppp<CR><LF> or ddddddd sppp <CR><LF> or hh:mm:ss<CR><LF> s<CR><LF> <CR><LF> yyyy-mm-dd hh:mm:ss s	ddddddd : delay in 133ns step sppp:phase error in ns s: +/- signe hh:hours mm:minutes ss:secondes s: status yyyy:year, mm:month,dd:day
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 5.12×10^{-13} step
Set frequency save. Integral part, when Status = 2, 3	**FS**x<CR><LF>	x=0 : never save x=1 : save every 24 hours x=2 : save right now x=3 : save actual freq. now x=9 : interrogation	x<CR><LF>	x=0 : never save x=1 : save every 24 hours
Set module customization	**MC**sxx [cc...c] <CR><LF>	s = L : Load parameter s = S : Store parameter ccc..c s = B : Load start behaviour s = A : Activate msg at start s = C : Cancel msg at start s = H : Load Help s = T : Load Data Type xx = 00..FF: msg number, ccc...c : new welcome message, up to 24 characters	cc..c<CR><LF> or d<CR><LF> or xy<CR><LF>	ccc..c : response to MCLxx or to MCHxx. d : 0, 1 response to MCBdd or xy : Data Type, response to MCTxx, x=0 RAM, x=1 eeprom, x=2 Flash, y=0 Byte, y=1 sByte, y=2 Word, y=3 sWoord, ... y=8 string ASCII, y=9 strng binary
Reset micro controller	**RESET**<CR><LF>			(Identification & welcome message, GPS binary)

NMEA 0183 FORMAT (BTA, BTB)

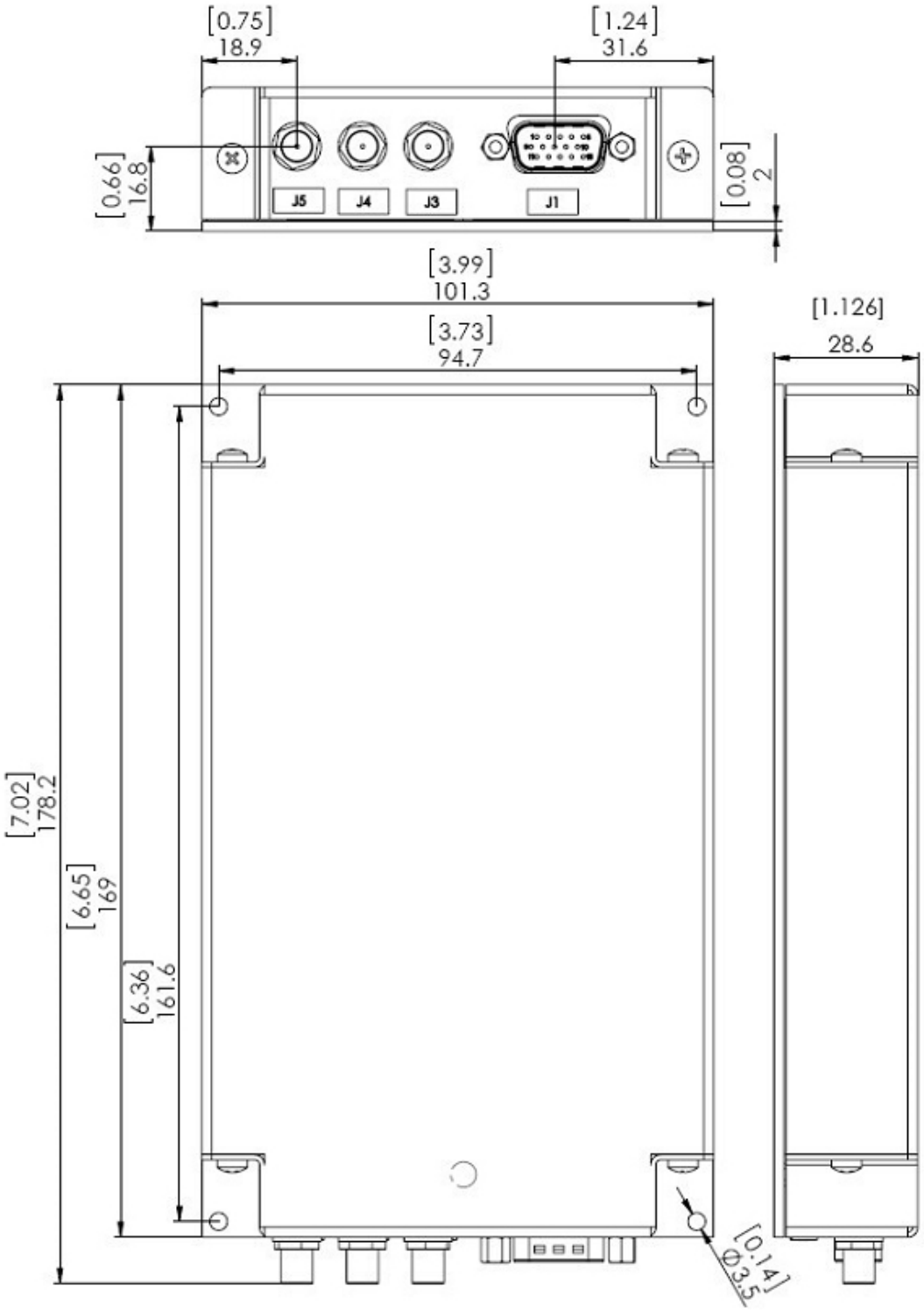
`$PTNTA,yyyymmddhhnnss,q,T3,rrrrrrr,sfff,x,y*CS<CR><LF>`

yyyy: year; mm:month; dd: day; hh: hour; nn: minute; ss: second; q: quality, 0: Rb line not locked, 1: Free Run, 2: Disciplined; T3: format descriptor; rrrrrrr: effective time interval PPSOUT vs PPSREF; sff: phase comparator; x,y: reserved; CS: checksum.

MOUNTING & MECHANICAL LAYOUT (STANDARD MODEL)



MOUNTING & MECHANICAL LAYOUT (WITH LN, ULN , LGS OR EULN OPTION)



PIN FUNCTIONS LAYOUT (All options)

Connector: 15 pins in 3 rows:

Pin	Function
1	Power +24V (+12V)
2	GND
3	Freq. Adj
4	GND
5	Vrefout
6	Power +24V (+12V)
7	GND
8	/Sync
9	/Track
10	PPSREF IN
11	PPS OUT
12	BITE (lock monitor)
13	Track/Sync alarm
14	RxD
15	TxD

Connector	Function
J3	PPSREF IN
J4	PPS OUT
J5	RF OUT