

## Patented SRO-5680 SynClock+<sup>®</sup>

Auto-Adaptive SmarTiming+<sup>®</sup> Disciplining  
& Filtering @ 1ns Resolution



### 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 <sup>-10</sup> -10°C to +60°C		<b>(Option code: E65)</b> -20°C à 65°C		
Frequency Accuracy @ Shipment		< 5E <sup>-11</sup> (+25°C), typical				
Aging (After 3 months of continuous operation)		< 5E <sup>-11</sup> / month (typical: 3E <sup>-11</sup> / month)				
Short Term Stability		<b>w/LN,ULN or EULN</b>		<b>STS1</b>		
	1s	2E <sup>-11</sup>	5E-12	3E-12		
	10s	8E <sup>-12</sup>	4E-12	3E-12		
	100s	2E <sup>-12</sup>	2E-12	3E-12		
Phase Noise (dBc/Hz) (RFOUT 10 MHz)		<b>(Option codes)</b>				
			<b>LGS</b>	<b>LN</b>	<b>ULN</b>	<b>EULN</b>
	1 Hz	-75	-85	-100	-103	-105
	10 Hz	-95	-130	-130*	-133*	-138*
	100 Hz	-125	-150*	-145	-153*	-150*
	1k Hz	-145	-160	-155	-158	-160
10K Hz	-145	-162	-155	-161	-166	
* Subject to export control (end user statement required)						
Frequency Retrace	Off/On (In stable temperature, gravity, pressure & magnetic field conditions)	< 5E <sup>-11</sup> 24 hr / 1 hr				
Warm-up Time @ +25°C	Frequency stability	12 min 5E <sup>-10</sup>				
Analog Frequency Adjustment	Tolerance	5 x 10 <sup>-9</sup> ±20%				
[An external voltage (0-5 VDC) can be applied to pin 6 (FA). The cursor pin of a 10 kΩ variable 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 <sup>-8</sup> 60MHz 5.12E <sup>-13</sup>				
RFOUT	Output level Output impedance	Sine wave 0.5 Vrms (±10% / 50Ω) 50 Ω±20%				
	Harmonics Spurious f <sub>o</sub> ±100kHz (DDSout off) 60MHz sub-harmonics	< -25dBc < -80dBc < -45dBc	<b>(Option code X)*</b> < -40dBc < -110dBc < -70dBc			
Supply Voltage (DC)		24V	<b>(with LN, ULN, EULN* or LGS option)</b> 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)	<28W @12V or <32W @24V	<b>(with LN, ULN, EULN* or LGS option)</b> < 32 W @12V			
	0°C +25°C +60°C	< 20 W < 13 W < 7 W	< 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 <b>(option code: CC)</b>			

\* '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 ( <b>ordering code: VIB</b> ) 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 For longer vibration periods, please contact Factory
Low g sensitivity	n/a	( <b>ordering code: LGS</b> ) 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 basic 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  $5.12 \times 10^{-13}$ , 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 `FCsdddd` 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.

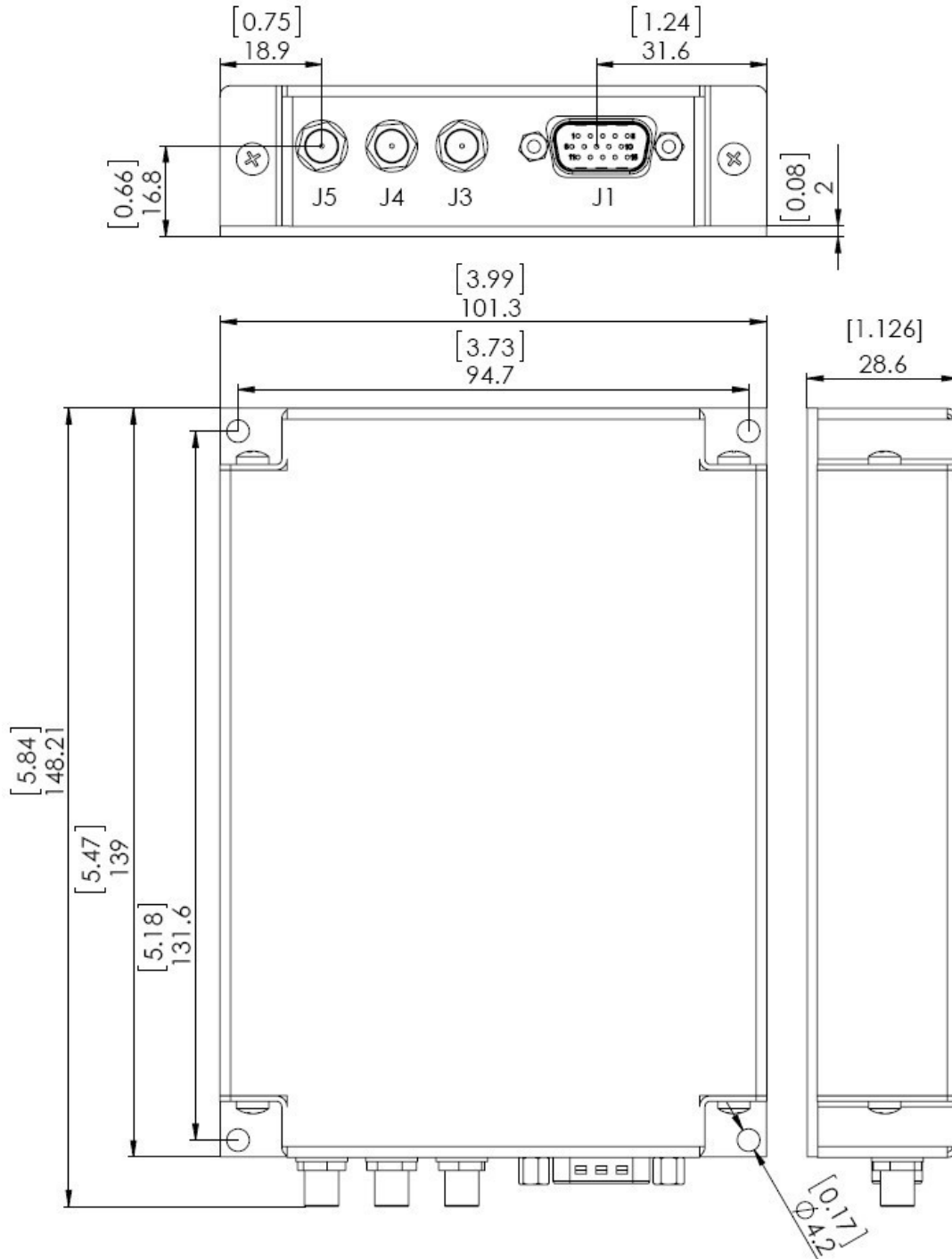
Command name	Syntax command	Data field (if any)	Response syntax	Response data (if any)
Identification	<b>ID</b> <CR><LF>	-	<b>TNTSRO</b> -aaa/rr/s.ss <CR><LF>	aaa: 100 rr: revision number s.ss: software version
Serial number	<b>SN</b> <CR><LF>	-	xxxxxx<CR><LF>	xxxxxx : 6 digits serial nbr
Status	<b>ST</b> <CR><LF>	-	<b>s</b> <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	<b>DE</b> ddddddd<CR><LF>	ddddddd=delay by 133ns step. Max 7499999 <b>DE</b> 0000000 :synch to PPSREF	ddddddd<CR><LF>	ddddddd=delay by 133ns step. Max 7499999
Set PPSOUT Pulse Width	<b>PW</b> ddddddd<CR><LF>	ddddddd=pulse Width by 133ns step. Max 7499999 <b>PW</b> 0000000: no pulse	ddddddd<CR><LF>	ddddddd=Pulse Width by 133ns step. Max 7499999 0000000: no pulse
Time of day	<b>TD</b> <CR><LF>	-	hh:mm:ss<CR><LF>	hh:hours mm:minutes ss:seconds
Set time of day	<b>TD</b> hh:mm:ss<CR><LF>	hh:Hours mm:Minutes ss:seconds	hh:mm:ss<CR><LF>	hh:hours mm:minutes ss:seconds
Date	<b>DT</b> <CR><LF>	-	yyyy-mm-dd	yyyy : year mm : month dd : day
Set date	<b>DT</b> 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.	<b>BT</b> 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 dddddddd 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	<b>FC</b> sdddd<CR><LF>	s=+/- signe dddd = limited within range : +32767/-32768 <b>FC</b> +99999 : interrogation	sdddd<CR><LF>	s: +/- signe dddd : frequ. Adj. in 5.12 x 10 <sup>-13</sup> step
Set frequency save. Integral part, when Status = 2, 3	<b>FS</b> 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	<b>MC</b> 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 = OO..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 string binary
Reset micro controller	<b>RESET</b> <CR><LF>	-	-	(Identification & welcome message, GPS binary)

### NMEA 0183 FORMAT (BTA, BTB)

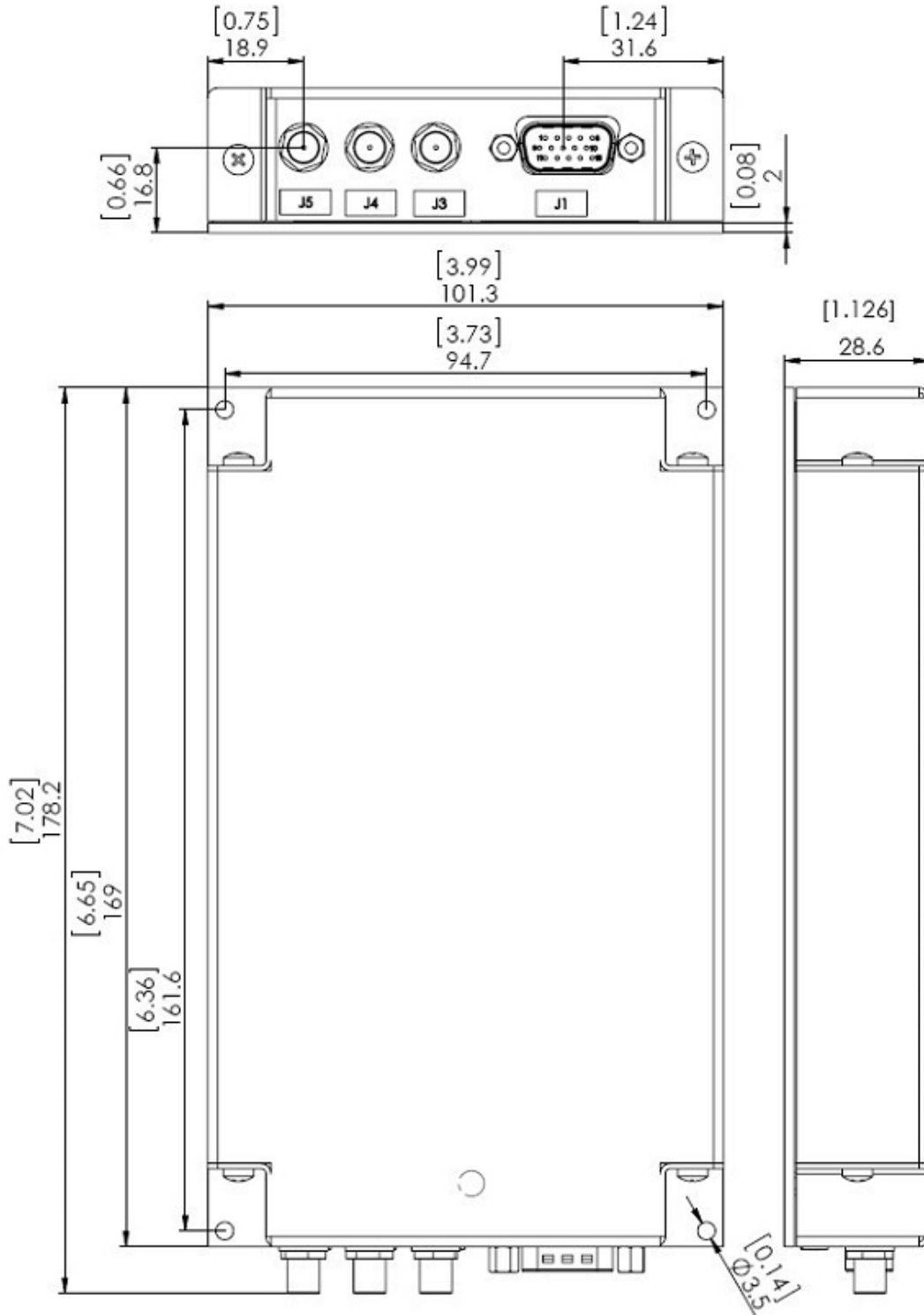
\$PTNTA,yyyymmddhhnnss,q,T3,rrrrrrr,sff,x,y\*CS<CR><LF>

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; rrrrrr: 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

