XPRO

High-Performance Rubidium Oscillator

Summary

Microchip's XPRO is a high-performance rubidium oscillator designed for a wide range of telecommunications and test and measurement applications. The XPRO is a drop-in replacement for the venerable LPRO, which has been widely installed in wireless base station applications, RF test equipment and other applications where an embedded high-performance oscillator is required.

The XPRO leverages over 35 years of proven rubidium atomic physics with advanced digital electronics architecture to provide an exceptionally stable oscillator that meets the most demanding performance requirements.

With its low profile and standard connector interface, the XPRO is designed for easy integration into time and frequency systems. Great care has been taken in the design to minimize EMI emissions and susceptibility, including the use of a filtered 9-pin D-connector, SMA for the RF output and a shielded outer cover.



The XPRO is designed for long operating periods without maintenance (long-life rubidium lamp and extended crystal control range). With a 5.0×10^{-11} per month aging, the oscillator will maintain 1.0×10^{-9} frequency accuracy for 10 years or longer without recalibration.

A low aging rate option is available for XPRO that will provide 1×10^{-11} per month aging, resulting in an even more robust reference source.

Standard outputs are 10 MHz, 1PPS and a rubidium lock status bit. All monitoring and control is done through the TTL level RS-232 style serial interface, allowing you access to comprehensive status and control parameters.

Standard Features

- 10 MHz output
- 1 PPS output
- $<5.0 \times 10^{-11}$ (optional $<1.0 \times 10^{-11}$) per month aging
- Digital monitor and control
- RoHS compliant
- Low EMI emission and susceptibility

Benefits

- Low profile with standard connector interface for easy integration
- Low maintenance
- Long lifecycle (>10 years) without recalibration operation



Specifications¹

Electrical

Frequency	RF Output		
Amplitude 7.8 ±0.8 dBm Load impedance 50 Ω Connector SMA Quantity 1 IPPS Output Rise time < 5 nS Pulse width < 20 μS Level 5V CMOS (Vh > 4.2V, 15 pF load) Jitter < 1 ns RMS Connector DB-9 Quantity 1 Built-in Test Equipment Output Format 5V CMOS (Vh > 4.2V, 15 pF load) Logic 0 = Normal Operation 1 = Alarm Serial Communications Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate 57,600 (8, N, 1) Power Input Max input (A) at 24V < 1.45 A (at −20°C) < 1.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC Voltage sensitivity (over input voltage range) Input power quiescent 24 VDC at 25°C < 14 W 19 VDC at 65°C < 9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Frequency	10 MHz	
Load impedance 50Ω Connector SMA Quantity 1 IPPS Output Rise time $<5 \text{ nS}$ Pulse width $<20 \mu\text{S}$ Level $5V \text{ CMOS (Vh} > 4.2V, 15 \text{ pF load)}$ Jitter $<1 \text{ ns RMS}$ Connector DB-9 Quantity 1 Ba-9 Quantity 1 Bromat $5V \text{ CMOS (Vh} > 4.2V, 15 \text{ pF load)}$ Logic 0 = Normal Operation Logic RS-232 Format Operation Serial Communications Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate $57,600 (8, N, 1)$ Power Input Max input (A) at 24V $<1.45 \text{ A (at } -20^{\circ}\text{C})$ $<1.43 \text{ A (at } 25^{\circ}\text{C})$ $<1.43 \text{ A (at } 25^{\circ}\text{C})$ Input voltage range $0.72 \times 10^{-11}\text{ /V}$ (over input voltage range) $<0.72 \times 10^{-11}\text{ /V}$ (over input voltage range) $<0.72 \times 10^{-11}\text{ /V}$ Voltage sensitivity	Format	Sinewave	
Connector SMA Quantity 1 IPPS Output Rise time <5 nS	Amplitude	7.8 ±0.8 dBm	
Pulse time	Load impedance	50 Ω	
Rise time	Connector	SMA	
Rise time <5 nS Pulse width <20 μS Level 5V CMOS (Vh > 4.2V, 15 pF load) Jitter <1 ns RMS Connector DB-9 Quantity 1 Built-in Test Equipment Output Format 5V CMOS (Vh > 4.2V, 15 pF load) Logic 0 = Normal Operation Logic RS-232 Format 3.3V CMOS (not true RS-232) Baud rate 57,600 (8, N, 1) Power Input Max input (A) at 24V <1.45 A (at -20°C) <1.43 A (at 25°C)	Quantity	1	
Pulse width $<20~\mu\text{S}$ Level 5V CMOS (Vh > 4.2V, 15 pF load) Jitter $<1~\text{ns RMS}$ Connector $DB-9$ Quantity 1 Built-in Test Equipment Output Format 5V CMOS (Vh > 4.2V, 15 pF load) Logic $0=\text{Normal Operation}$ $1=\text{Alarm}$ Serial Communications Protocol $RS-232$ Format 3.3V CMOS (not true RS-232) Baud rate $57,600~(8, N, 1)$ Power Input Max input (A) at 24V $<1.45~\text{A}$ (at -20°C) $<1.43~\text{A}$ (at 25°C) Input voltage range $19~\text{VDC}$ to $32~\text{VDC}$ Voltage sensitivity $0.72~\text{x}~10^{-11}/\text{W}$ (over input voltage range) Input power quiescent $24~\text{VDC}$ at $25^{\circ}\text{C} < 14~\text{W}$ $19~\text{VDC}$ at $65^{\circ}\text{C} < 9.5~\text{W}$ Physical Input connector $(1)~\text{DB-9}$ (all input power, monitoring, 1PPS) RF connector $(1)~\text{SMA}$		1PPS Output	
Level 5V CMOS (Vh > 4.2V, 15 pF load)	Rise time	<5 nS	
Jitter <1 ns RMS Connector DB-9 Quantity 1 Built-in Test Equipment Output Format 5V CMOS (Vh > 4.2V, 15 pF load) Logic 0 = Normal Operation 1 = Alarm Serial Communications Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate 57,600 (8, N, 1) Power Input Max input (A) at 24V < 1.45 A (at -20°C) < 1.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC Voltage sensitivity 0.72 × 10⁻¹¹/V (over input voltage range) Voltage range 24 VDC at 25°C < 14 W 19 VDC at 65°C < 9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Pulse width	<20 µS	
Connector DB-9 Quantity 1 Built-in Test Equipment Output Format 5V CMOS (Vh > 4.2V, 15 pF load) Logic 0 = Normal Operation 1 = Alarm Serial Communications Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate 57,600 (8, N, 1) Power Input Max input (A) at 24V < 1.45 A (at -20°C) < 1.43 A (at 25°C)	Level	5V CMOS (Vh > 4.2V, 15 pF load)	
QuantityBuilt-in Test Equipment OutputFormat $5V \text{ CMOS}$ ($Vh > 4.2V$, 15 pF load)Logic $0 = \text{Normal Operation}$ $1 = \text{Alarm}$ Serial CommunicationsProtocolRS-232Format $3.3V \text{ CMOS}$ (not true RS-232)Baud rate $57,600 (8, N, 1)$ Power InputMax input (A) at 24V $<1.45 \text{ A}$ (at -20°C) $<1.43 \text{ A}$ (at 25°C)Input voltage range 19 VDC to 32 VDC Voltage sensitivity $0.72 \times 10^{-11}/V$ (over input voltage range)Input power quiescent 24 VDC at $25^{\circ}\text{C} < 14 \text{ W}$ 19 VDC at $65^{\circ}\text{C} < 9.5 \text{ W}$ PhysicalInput connector(1) DB-9 (all input power, monitoring, 1PPS) (1) SMA	Jitter	<1 ns RMS	
Built-in Test Equipment Output	Connector	DB-9	
Format 5V CMOS (Vh > 4.2V, 15 pF load) Logic $0 = \text{Normal Operation}$ $1 = \text{Alarm}$ Serial Communications Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate $57,600 (8, N, 1)$ Power Input Max input (A) at 24V $<1.45 \text{ A (at } -20^{\circ}\text{C)}$ $<1.43 \text{ A (at } 25^{\circ}\text{C)}$ Input voltage range $19 \text{ VDC to } 32 \text{ VDC}$ Voltage sensitivity $0.72 \times 10^{-11}\text{/V}$ (over input voltage range) Input power quiescent $24 \text{ VDC at } 25^{\circ}\text{C} < 14 \text{ W}$ $19 \text{ VDC at } 65^{\circ}\text{C} < 9.5 \text{ W}$ Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Quantity	1	
Logic 0 = Normal Operation 1 = Alarm Serial Communications Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate 57,600 (8, N, 1) Power Input Max input (A) at 24V <1.45 A (at -20°C) <1.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC 0.72 × 10 ⁻¹¹ /V (over input voltage range) Input power quiescent 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Built-in Test Equipment Output		
Serial Communications	Format	5V CMOS (Vh > 4.2V, 15 pF load)	
Protocol RS-232 Format 3.3V CMOS (not true RS-232) Baud rate 57,600 (8, N, 1) Power Input Max input (A) at 24V <1.45 A (at −20°C) <1.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC Voltage sensitivity 0.72 × 10⁻¹¹¼V (over input voltage range) Input power quiescent 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Logic		
Solution Solution	Serial Communications		
Baud rate 57,600 (8, N, 1) Power Input 41.45 A (at -20°C) 41.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC 0.72 × 10 ⁻¹¹ /V (over input voltage range) Input power quiescent 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Protocol	RS-232	
Power Input (1.45 A (at -20°C) (1.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC 0.72 × 10 ⁻¹¹ /V (over input voltage range) Input power quiescent 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector	Format	3.3V CMOS (not true RS-232)	
Max input (A) at 24V <1.45 A (at -20°C) <1.43 A (at 25°C) Input voltage range 19 VDC to 32 VDC 0.72 × 10 ⁻¹¹ /V (over input voltage range) Input power quiescent 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Baud rate	57,600 (8, N, 1)	
Input voltage range 19 VDC to 32 VDC		Power Input	
Voltage sensitivity 0.72 × 10 ⁻¹¹ /V (over input voltage range) 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Max input (A) at 24V	· · · · · · · · · · · · · · · · · · ·	
Voltage sensitivity (over input voltage range) 24 VDC at 25°C <14 W 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Input voltage range	19 VDC to 32 VDC	
Input power quiescent 19 VDC at 65°C <9.5 W Physical Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Voltage sensitivity		
Input connector (1) DB-9 (all input power, monitoring, 1PPS) RF connector (1) SMA	Input power quiescent		
RF connector (1) SMA		Physical	
(1) 21111	Input connector	(1) DB-9 (all input power, monitoring, 1PPS)	
1.5" (3.81 cm) (H) ×	RF connector	(1) SMA	
Dimensions 3.7" (9.4 cm) (W) × 5.0" (12.7 cm) (D)	Dimensions	3.7" (9.4 cm) (W) ×	
Weight <1.1 lbs (<500 g)	Weight	<1.1 lbs (<500 g)	

'All specifications at 25C and 24 Vdc, u	ınless noted otherwise.
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	Environmental	
Operating temperature	−25°C to 70°C baseplate	
Altitude	-200' to 40,000'	
Magnetic sensitivity	DC (≤2 Gauss), <±1.0 × 10 ⁻¹¹ /Gauss	
Humidity	GR-63-CORE, issue 4, April 2012, section 4.1.2: 5–85% RH, operating	
Vibration (operating)	Telcordia GR-63-CORE, Issue 4, April 2012, section 4.4.4 and 5.4.2 Opt2: Random Vibration 0.15 grms, unit remains locked	
ЕМІ	Compliant to FCC Part 15 Class B (conducted and radiated emissions) and complies with EN55022B emissions (radiated and conducted) and EN50082-1 (immunity)	
Storage and Transport (Non-operating)		
Temperature	−55°C to 85°C	
Altitude	-200' to 70,000'	
Vibration	Telcordia GR-63-CORE, Issue 4, April 2012; section 4.4.5 and 5.4.3: Random Vibration 0.78 grms	
Shock	Telcordia GR-63-CORE, Issue 4, April 2012; section 4.3.1 and 5.3.1.1: Packaged Drop from 1000 mm	
Performance Parameters		
Aging (after 1 month continuous operation)	Monthly: $<\pm 5.0 \times 10^{-11}$; $<1.0 \times 10^{-11}$ (option) 10 years: $<\pm 1.0 \times 10^{-9}$	
Frequency accuracy at shipment	<±5.0 × 10 ⁻¹¹	
Frequency retrace	$<\pm 2.5 \times 10^{-11}$ (24 hours on, 48 hours off, 24 hours on)	
Analog tuning	$\pm 1.5 \times 10^{-9} (0V-5V)$	
Digital tuning	$\pm 1.0 \times 10^{-6}$ (with 1.5 × 10 ⁻¹² resolution)	
Tempco	$<6.0 \times 10^{-10}$ (-25°C to 70°C), $<3.0 \times 10^{-10}$ (0°C to 50°C)	



RF Output Phase Noise (SSB)

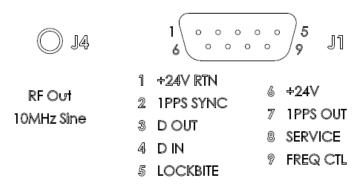
Frequency	Phase Noise
1 Hz	≤-80 dBc/Hz
10 Hz	≤-90 dBc/Hz
100 Hz	≤-128 dBc/Hz
1 kHz	≤-143 dBc/Hz
10 kHz	≤-148 dBc/Hz

Spectral purity: <-60 dBc (harmonics), <-80 dBc (non-harmonics)

Frequency Stability (Allan Deviation)

Time	Allan Deviation
TAU = 1 second	<1.0 × 10 ⁻¹¹
TAU = 10 seconds	<3.2 × 10 ⁻¹²
TAU = 100 seconds	$<1.0 \times 10^{-12}$

XPRO Connection Diagram



Warm-Up Time

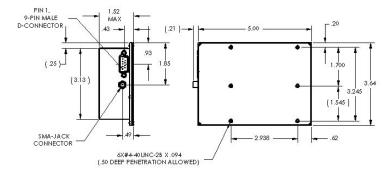
Parameter	-20°C	25°C
To lock	<8.7 minutes	<6 minutes
To $<1 \times 10^{-9}$	<10.2 minutes	<8 minutes
To $<4 \times 10^{-10}$	<12.7 minutes	<10.6 minutes

Ordering Information²

Part Number	Description
16192-003	1×10^{-11} /month aging, AT disabled, RoHS 6/6
16192-004	1×10^{-11} /month aging, AT enabled, RoHS 6/6
16192-103	5×10^{-11} /month aging, AT disabled, RoHS 6/6
16192-104	5×10^{-11} /month aging, AT enabled, RoHS 6/6

 $^{^{2}}AT = analog tuning.$

XPRO Outline Diagram



For More Information

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