iTest+™ PFRS Spec

June 17, 2002

iPrecision Timing Solutions™

Low Cost Portable Frequency Rubidium Standard (PFRS)

High Precision & Performance Test Set

Easy-to-Use, Light weight & Low Profile

Calibration | Oscillator/Clock Characterization | TIE Measurements | Lab Instrument

Applications

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Product Characteristics:

••	Small volume	: 117 in^3.
••	Frequency offset over temp. range	: $\pm 1 \cdot 10^{-10}$
••	Stability	: $1 \cdot 10^{-12}$ / 100 sec.
••	Long term stability	: < $3 \cdot 10^{-11}$ / month
••	Power supply	: DC 12V and 100-240V with external AC converter
••	1 Pulse per second	: TTL output level

Main Features :

- Very low temperature sensitivity
- Excellent short term stability
- Fast warm-up
- Small volume / low profile
- Rb lamp extended life expectancy (20 years)
- RS 232 interface for center frequency adjustment and monitoring of the working parameters
- Precision manual frequency adjust
- Lock / Unlock indicators

Main Applications :

- Laboratory and field reference
- Instrumentation
- Tracking and guidance control
- Timing systems reference
- Test and diagnostics equipment

Parameters accessible through RS232:

The working and monitoring parameters of the PFRS are accessible for read and write operations through the serial RS-232 port (1200 bits/sec., no parity, 1 start bit, 8 data bits, 1 stop bit).
There are three different commands, which are:
M, *Cxx* and *Fxx* followed by a carriage return.

M: monitors the basic factory adjustments of the atomic clock.
The returned answer looks like

HH GG FF EE DD CC BB AA <CR>

Where each returned byte is an ASCII coded hexadecimal value, separated by a <Space> character. All parameters are coded at full scale.

HH: DC-Voltage of the photocell (5V to 0V)
GG: peak voltage of Rb-signal (0 to 5V)
FF: not used
EE: varactor control voltage (0 to 5V)
DD: Read-back of the user provided frequency adjustment voltage on pin 2 (0 to 5V)
CC: Rb-lamp heating current (500mA to 0mA)
BB: Rb-cell heating current (500mA to 0mA)
AA: 90MHz power control signal (0 to 5V)

Cxx: output frequency correction through the synthesizer, by steps of 1 x 10^{-9} , where xx is a signed 8 bits word. This value is automatically stored in a EEPROM.

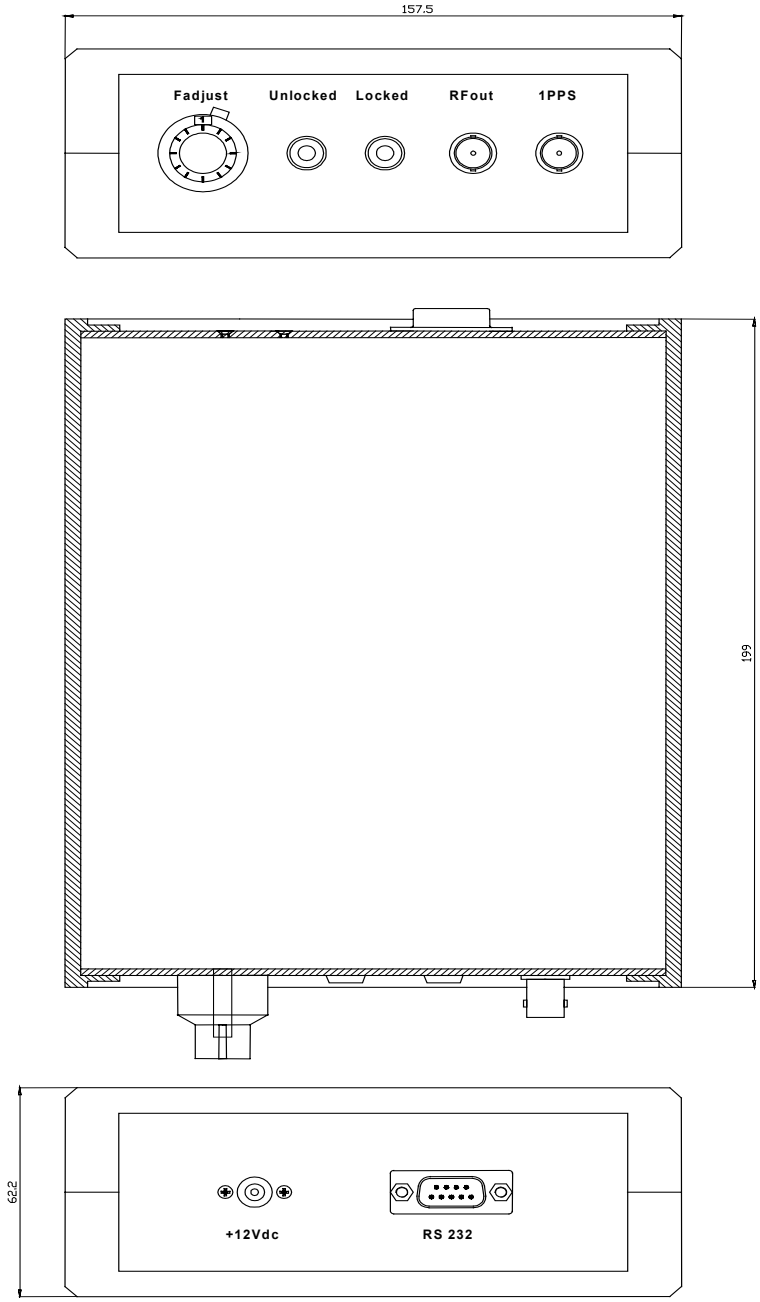
Fxx: output frequency correction through C-field, by steps of 1 x 10^{-11} , where xx is a signed 8 bits word.

Manual Frequency adjustment:

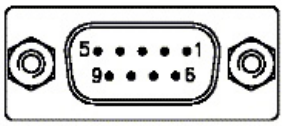
In addition to coarse and fine adjustment through RS232 interface :

A front panel precision trimmer is available for manual frequency adjustment within +- 1.2 E –9 +-20% relative frequency range. (+- 12 mHz @ 10MHz)

Package: (all dimensions in mm)



D-Sub 9 pins female



PIN FUNCTION

2 RxD (RS232 receive,TTL)
3 TxD (RS232 transmit,TTL)
5 GND

SPECIFICATIONS

ELECTRICAL:

Type	PFRS-01	
	Standard version	**Options**
1 PPS	TTL output level, 50Ω Duty cycle 50% t_{PLH} , t_{PHL} < 10ns	
Frequency	10 MHz	Optional 20 MHz, 5 MHz
Frequency change within operating temperature range (Thermal chamber with air flow)	<= ± 1 x 10^{-10} over -5°C to +55°C	
Long term stability (Measured after 3 months of continuous operation)	< 5x10^{-11} / month (typical: 3x10^{-11} / month)	< 3x10^{-11} / month (**option code A**) (typical: ±1x10^{-11} / month)
Short term stability	3 x 10^{-11} / 1 s 1 x 10^{-11} / 10 s 3 x 10^{-12} / 100 s	Improved short term stability (**option code S**) 1 x 10^{-11} / 1 s 3 x 10^{-12} / 10 s 1 x 10^{-12} / 100 s
Phase noise (10 MHz)	-70 dBc/Hz at 1 Hz -80 dBc/Hz at 10 Hz -115 dBc/Hz at 100 Hz -135 dBc/Hz at 1kHz -140 dBc/Hz at 10 kHz	-80 dBc/Hz at 1 Hz -100 dBc/Hz at 10Hz -130 dBc/Hz at 100 Hz -145 dBc/Hz at 1kHz -153 dBc/Hz at 10 kHz (**option code Q3**)
Frequency retrace (in stable temperature, gravity, pressure and magnetic field conditions)	< 5 x 10^{-11} within 1 h after 24 h off	
Warm-up time [minutes]	standard version 5 x 10^{-10} after 15' at +25°C	
Analog frequency adjustment By precision trimmer	2.5 x 10^{-9} ±20%	Large analog frequency tuning (**option code O**) 5 x 10^{-9} ±20%
Digital frequency adjustment through serial RS-232 port.	±1.2 x 10^{-7} (resolution: 1 x 10^{-9}) 2.5 x 10^{-9} (resolution: 1 x 10^{-11}) ±20%	
Output level	sinewave 0.5 Vrms ±10%, 50 Ω	
Return loss	-20 dB	
Harmonics	< -25dBc	< -40 dBc (**option code X**)
Spurious f_0 ± 100kHz	< -80dBc	< -110 dBc (**option code X**)
Subharmonics	< -60dBc	< -100 dBc (**option code X**)
Supply voltage	**100V to 240V 50/60 Hz with external AC converter** **12V- input (batt. Operations)** : 11.2 to 17 V	
Supply voltage sensitivity	< 2 x 10^{-11} for 10% voltage change on 12V	
Input power	warm up: typical <20 W at 12 V -5°C: <13 W +25°C: <10 W +50°C: <7 W	
Electrical Protection power (12V) RF output TxD output RxD input	An internal diode protects against reverse polarity connection ESD and short-cut protected ESD and short-cut protected ESD protected	

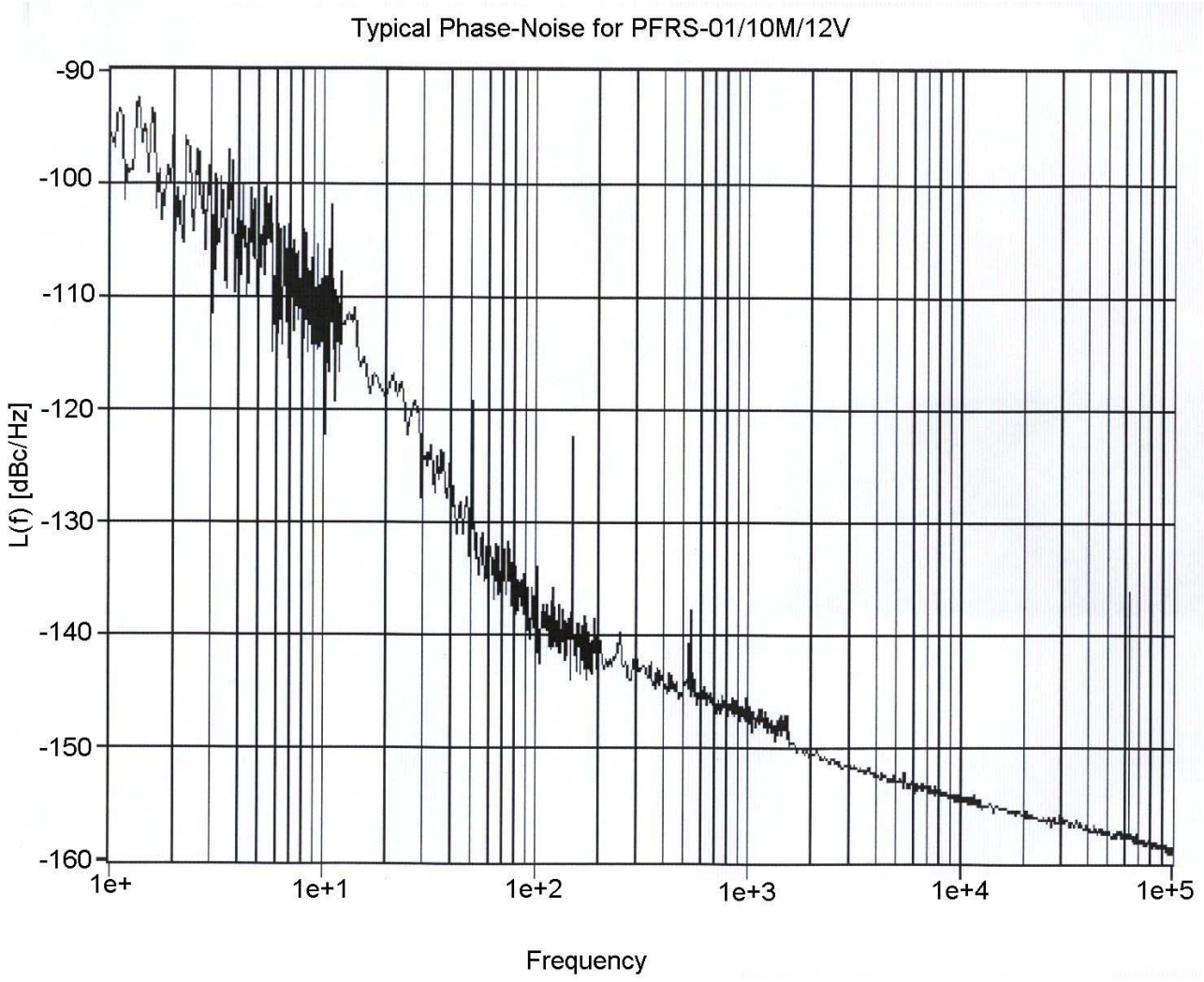
ENVIRONMENTAL

Magnetic field sensitivity	< 2 x 10^{-11} / Gauss in X and Y axis < 1 x 10^{-10} / Gauss in Z axis
Storage Temperature	- 40°C to + 85°C
Operating Temperature	-25°C to +55°C (55°C is the maximal temperature of the thermal chamber with air flow around the unit)
Overall Environment Effects * (Altitude,Vibration,Shocks)	Meets or exceeds MIL-T-28800B for Type III, class 5 equipment + MIL Std 810 + 516.2 /160g, 4ms, half sinus
Humidity	RTCA/DO-160C hot humidity, 35°C, 95% relative humidity
Helium concentration sensitivity	< 1 x 10^{-10} per ppm of Helium concentration change
g-tip-over test	2 x 10^{-10} / g on worst sensitive axis

PHYSICAL

Size	199 x 62.2 x 157.5 mm. (7.68 × 2.45 × 6.2 inches)
Weight	900 g max. (2 Lbs. max)
Volume	1.95 liter (117 cubic inches)
Connector	9 male contacts Mate with ITT Cannon Series DB9 + BNC coaxial

TYPICAL PHASE NOISE



Safety !

- Use proper ESD precautions

- Ensure that all cables are properly connected

- Ensure PFRS connected to earth through COM interface.

Unpacking

Unpack and carefully inspect the unit. Check for physical damage. If physical damage is observed, then immediately contact Temex Neuchâtel Time SA.

Unit supply

- 1 PFRS-01/10M
- 1 External AC converter 100-240 V~ 50/60 Hz to 12V- 2,92A with operating manual
- 1 Cable DB-9 male/female
- 1 LPFRS users manual
- 1 Euro cable
- 1 US cable

Cables required

- 1 coaxial cables terminated at one end with male BNC connectors. The other end should have the appropriate connector as determined by your application.
- 1 cable for earth connection if COM interface not used.

Calibration

The PFRS requires to be re-calibrated periodically, due to aging of the Rubidium Oscillator

Operation

Refer to LPFRS user manual for operations.

Ordering Information

PFRS -01 / XX/ 10 M / A

Type Option Frequency Low aging rate