STANFORD RESEARCH SYSTEMS

FS725

The Stanford Research Systems FS725 is a high-performance Rubidium Frequency Standard designed for laboratory and precision calibration environments. It offers exceptionally low phase noise, high short-term stability, and integrates standard 10 MHz, 5 MHz, and 1 PPS outputs in a compact half-rack enclosure.

SPECIFICATIONS

General

Interfaces	RS-232 (standard), GPIB / IEEE-488 (optional)
Display	None (front-panel status LEDs for Lock, 1 PPS, and Output)

Physical

Power Supply	90 to 132 VAC or 175 to 264 VAC, 47 to 63 Hz, 100 W (warm-up), 30 W (steady-state)
Operating Temperature	0 to 50 °C °C
Dimensions (W×H×D)	216 × 89 × 330 mm mm
Weight	4.1 kg kg

Frequency and RF Outputs

Primary Output Frequencies	10 MHz, 5 MHz, 1 PPS
Number of Standard Outputs	2 × 10 MHz, 1 × 5 MHz, 1 × 1 PPS
Output Level (10 MHz & 5 MHz)	+7 dBm (+/-1 dB)
Output Impedance	50 Ω
Output Waveform Type	Sine wave (for 10 MHz and 5 MHz)
Harmonics	<-40 dBc
Spurious Outputs	<-100 dBc (within 100 kHz of carrier)
RF Connector Type	BNC (female, rear panel)
Isolation Between Outputs	>100 dB
1PPS Output Pulse Width	10 µs
1PPS Output Level	TTL (>2.0 V into 50 Ω, >4.0 V into high impedance)

Frequency Stability and Accuracy

Temperature Stability (0 to 50 °C)	<1 × 10^-10
Aging Rate (Monthly)	<5 × 10^-11
Aging Rate (Yearly)	<5 × 10^-10
Allan Deviation (1 s)	<2 × 10^-11
Allan Deviation (10 s)	<1 × 10^-11
Allan Deviation (100 s)	<2 × 10^-12
Retrace (after 24 hours off)	<5 × 10^-11
Warm-up Time to Lock	<6 minutes

Phase Noise and Jitter

Phase Noise @ 1 Hz offset (10 MHz)	<-80 dBc/Hz
Phase Noise @ 10 Hz offset (10 MHz)	<-130 dBc/Hz
Phase Noise @ 100 Hz offset (10 MHz)	<-140 dBc/Hz
Phase Noise @ 1 kHz offset (10 MHz)	<-150 dBc/Hz
Phase Noise @ 10 kHz offset (10 MHz)	<-155 dBc/Hz

Tuning, Disciplining and Synchronization

Frequency Tuning Range (via RS-232)	±2 × 10^-9
Tuning Resolution (via RS-232)	1 × 10^-12
Electrical Tuning Range (0 to 5 V)	±2 × 10^-9
Control Voltage Input Range	0 to 5 VDC
1PPS Input Signal Type	TTL / CMOS compatible
1PPS Input Minimum Pulse Width	100 ns
1PPS Lock Loop Time Constant Range	8 minutes to 22 hours

Interfaces, Monitoring and Control

Status Indicators (LEDs)	Lock (green), 1 PPS (green), Output (green)
Lock Status Relay Contacts	SPDT contact (closed when locked)
Lock Status Open-Collector Output	Active low (conducts when locked)
RS-232 Protocol Specifications	9600 baud, 8 data bits, no parity, 1 stop bit

Power Specifications

Power Consumption (Warm-up)	100 W
Power Consumption (Steady State)	30 W (at 25 °C ambient)
Internal Battery Backup Option	Internal 12 V, 4.5 Ah Gel-cell battery (Option 02)
Internal Battery Operating Lifetime	Up to 3.5 hours at 25 °C

Physical Characteristics

Form Factor	2U high, half-rack width
Weight with Battery Option	7.3 kg
Rackmount Compatibility	19-inch rack-mountable (with optional RM2U rack mount kit)

Standards and Certifications

Calibration Traceability Standard	Traceable to NIST

Environmental

Storage Temperature	-55 °C to +85 °C
Operating Humidity	95% R.H. non-condensing (max)

Performance

Magnetic Field Sensitivity	< 2 × 10^-10 for 1 Gauss field reversal
Voltage Sensitivity	< 2 × 10^-11 for a 10% change in line voltage
Warm-up Time to 1 × 10^-9 Accuracy	< 10 minutes

Inputs & Outputs

1PPS Input Impedance	1 MΩ
1PPS Output Rise Time	< 10 ns
Lock Status Relay Rating	0.5 A @ 120 VAC, 1 A @ 24 VDC
Lock Status Open-Collector Rating	40 VDC maximum voltage, 100 mA maximum sink current

Options

Option 01 Expansion Outputs	Adds 3 × 10 MHz, 1 × 5 MHz, and 1 × 1PPS outputs
Option 02 Battery Pack	Internal 12 VDC, 4.5 Ah battery (provides up to 3.5 hours of backup in steady state)
Option 01 Maximum Cards	3
Option 01 Outputs per Card	5

Reliability

Expected Rubidium Lamp Lifetime	> 20 years

1PPS Output

1PPS Output Jitter	< 1 ns (rms, relative to 10 MHz output)

1PPS Input

1PPS Input Threshold	1.0 V (nominal)

Frequency Tuning

Analog Tuning Resolution	Digital tuning resolution = 1 × 10^-12
Tuning Voltage Input Impedance	1 MΩ

Power

AC Input Voltage Range	90 to 264 VAC
AC Input Frequency Range	47 to 63 Hz
DC Input Voltage Range	22 to 30 VDC

Power Options

Option 02 Battery Capacity	4.5 Ah
Option 02 Battery Voltage	12 V
Option 02 Battery Type	Gel-cell

Interfaces

RS-232 Baud Rate	9600 bps
RS-232 Configuration	8 data bits, no parity, 1 stop bit (8N1)

TECHNOLOGY

Rubidium Vapor Frequency Standard

APPLICATIONS

Precision Frequency Reference and Timekeeping