REF TEK
SYSTEMS INC.

SMHR²

INTEGRATED SEISMIC RECORDER & ACCELEROMETER



The SMHR2 combines Reftek's latest generation of universal broadband seismic recorder, with the advanced high resolution, force-balance accelerometer, model 147. Designed to facilitate installation, security and maintenance in a single, secure enclosure optimized for early warning system installations.

The SMHR2 features a high-performance 32-bit A/D and boasts a large dynamic range. The enhanced dynamic range enables the SMHR2 to record very small vibrations from its integrated seismic sensor, providing detailed data for seismic analysis.

The internal triaxial accelerometer is a force-balance accelerometer which converts acceleration signals into voltage signals to measure low frequency and ultra-low frequency motion. It features high sensitivity, large linear range, high resolution and high dynamic range making it perfectly suited to Earthquake Early Warning systems. The force balance feedback technique mitigates for mechanical characteristic limitations of conventional accelerometers and overcomes shortcomings in nonlinear distortion and threshold of sensitivity of elastic measuring parts.

Communications

Using the Seedlink server, your system can be configured to automatically import the MiniSeed data straight into the analysis software. The SMHR2 has a large non-volatile internal memory providing a substantial data buffer for when the connection is not available or when you require historical data from the recorder.

With smart setup options, the SMHR2 gives you the choice between automatic data transfer of Seedlink data or the option to transmit ultra low latency data for Earthquake Early Warning applications (EEW). For EEW applications, simply set up your SMHR2 to send data via REF TEK's RTPD software in near real time to your EEW software – resulting in answers for quick decision making when it counts.

BENEFITS

- ~140 dB dynamic range for detailed event data & high quality scientific analysis
- Ultra low latency for Earthquake Early Warning Systems
- Built-in Seedlink server for robust data transmission
- Precise & accurate timing
- Low-noise, force balance accelerometer
- Sensitivity & offset stable

RELIABLE PERFORMANCE FOR:

- Earthquake Early Warning
- Local and regional broadband seismic networks
- Structural health monitoring

COMPLIANCE

The SMHR² is compliant with regulations as described in various structural monitoring codes including but not limited to:

- California Building Code Appendix L
- Section 1613.10 of Los Angeles Building Code
- Section 105.2 National Structural Code of the Philippines

SMHR2

A/D CONVERTER	
Type	32-bit SAR A/D converters
Dynamic Range	~140 dB @100 sps
Input Channels	3
Gain Options	Available with x1 or x2 gain
Input Full Scale	Matched @ x1 gain
Input Impendance	26 Kohms, 0.002 uFd, differential @ x1 2 Mohms, 0.002 uFd, differential @ x64
Common Mode Rejection	>90 dB
Sample Rates	1000, 500, 250, 200, 125, 100, 50, 40, 20, 10, 5, 1 sps
Multiple Sample Rates	Supported for rates in the group 1000, 200, 100, 50, 40, 20, 10, 5, 1
Sampling	Simultaneous on all channels
FIR Filter	~140 dB down in the stopband

TIME BASE	
Type	GNSS Receiver with Internal Disciplined Oscillator
Accuracy with GNSS	<+/- 5 µsec after validated 3-D Fix and Locked
Free-Running Accuracy	0.1 ppm over the temp. range of 0°C to 50°C 0.2 ppm from -20°C to 0°C
Alternate Time Sources	PTP or NTP

POWER	
Input Voltage	9–24 VDC
Average Power (3 channels, accelerometer, no communication, GNSS duty cycle)	2.4 Watts
Average Power (3 channels, accelerometer, with communication, GNSS duty cycle)	2.7 Watts
Internal Battery	1.2 Ah, Lead Acid
Low Voltage Disconnect	User-programmable. Additional hardware cut-off fixed at 9.0 Volts

RECORDING	
Format	Miniseed, MRF
Transmission	SeedLink Server, RTP
Data Products	On-board Calculation of: PGA, PGV, PGD, MMI, PEIS, JMA (email notifications available)
Trigger Types	Continuous, STA/LTA, Level, Vote, Time, External and Cross
Internal Capacity	8 GB internal Flash memory data buffer, 32 GB USB drive

COMMS	
Ethernet	10/100 Base-T, TCP/IP, UDP/IP, FTP, RTP DHCP, Static, Link-Local
WiFi	Access-point mode for local command & control
WebUI	Accessible via WiFi or Ethernet

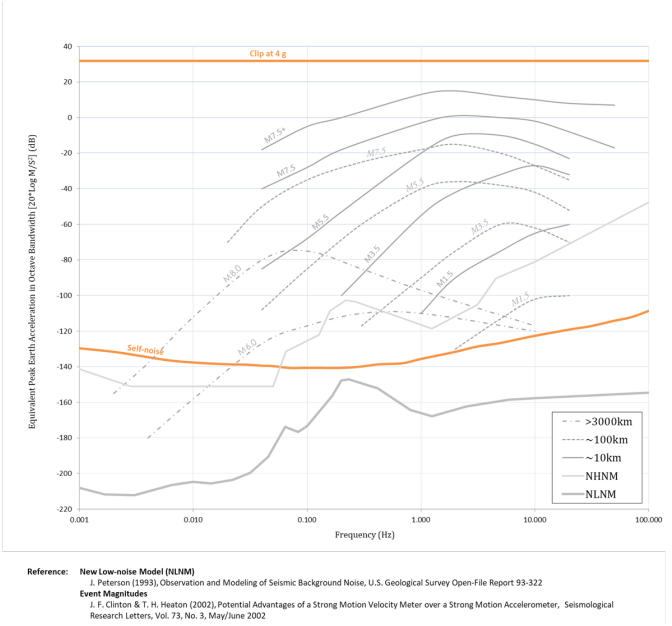
UI	
Screen	2.8" TFT Color Display with Backlight 240 x 320 pixels



ACCELEROMETER

ELECTRICAL	
Full-scale Range	+/- 4 g, +/-2 g user selectable

PERFORMANCE	
Self-Noise	<1 µm/s/s
Dynamic Range	~155 dB (DC to 10 Hz)
Linearity	<0.1 %
Frequency Response	DC – 250 Hz (+/-3 dB)
Damping	0.7
Self-test Response	Logic level input will produce consistent g level output
Lightning Protection	Built-in surge protection
Cross Axis Sensitivity	<1%
Hysteresis	<0.1% of full-scale
Thermal Drift	≤600 µg/°C



Reference: **New Low-noise Model (NLNM)**
J. Peterson (1993), Observation and Modeling of Seismic Background Noise, U.S. Geological Survey Open-File Report 93-322
Event Magnitudes
J. F. Clinton & T. H. Heaton (2002), Potential Advantages of a Strong Motion Velocity Meter over a Strong Motion Accelerometer, Seismological Research Letters, Vol. 73, No. 3, May/June 2002

MECHANICAL	
Dimensions	7.3"L x 6"W x 5.3"H
Weight	3.5 Kg (3kg without optional internal battery)
LCD	✓
Magnetic Switch	✓
Watertight Integrity	IP 68
Humidity Range	0-100% (non-condensing)
Operating Temp	-20 °C to 75 °C
Storage Temperature	-40 °C to 85 °C
Mounting	Single Point
Levelling	3 Adjustable Feet

CERTIFICATIONS	
Compliance	CE, FCC, RoHS