

**ULTRALOW POWER
24-BIT STRONG MOTION
DATA RECORDER
Model SMR-4000-4A**

4 channel with internal accelerometers

The SMR-4000-4A is a *portable, rugged, ultra low power, high-performance, versatile 24-bit resolution strong motion recording system*. The standard 4-channel (optional 8-channel) unit contains an internal triaxial 2g EA-120 low noise force balance accelerometer package. An ultra low noise accelerometer package (Model EA-140) and/or a rotational seismometer (Model R-1) are available options. The hinged front panel allows for easy adjusting and leveling of the accelerometer package after the unit is installed. If required, an accelerometer adjustment board option can be included to further fine-tune the accelerometer's zero bias. A 512 Mb compact flash card for data storage is standard. A 30Gb removable hard disk is optional. Data is retrieved by removal of the PC compatible compact flash card, or through dial up telephone access (internal modem optional), or via LAN (Ethernet card optional). The SMR-4000-4A includes GPS receiver and antenna and "Smart Timing" software, allowing the user to select the timing accuracy, which will automatically control the GPS cycling. The integrated display and keyboard allows for easy setup in the field and real time viewing of up to 3 waveforms. For large permanent installations, the SMR line includes multi-channel systems up to 24 channels (Model SMR-4000X)

SMR-4000-4A SPECIFICATIONS:

INPUT CHANNELS

Type:	Single-Ended or Differential
Data Channels:	3 + 1 ¹ ; optional up to 8
State-of-Health 4 th Channel:	24-bit resolution
Gain:	Software programmable: 1,2,4,8,16,32,64
Differential Input Signal Range:	Software programmable: ?2.5, ?10 V
Overvoltage Protection	?40 V
Input Impedance	Data inputs: ?2.5V – 1M? ; ?10 V –26k? State-of-health input: 1M?
Analog Anti-Aliasing Filter:	>100 dB @ primary sampling rate
Dynamic Range: (rms noise to full scale)	>132 dB @ 100 sps

DIGITIZER

Type:	24-bit delta-sigma converter in each channel
Sampling Rates:	0.1, 1, 10, 20, 40, 80, 100, 200, 500, 1000, 2000 4000 sps
Digital Filter (@ output Nyquist):	>130 dB @ 200 sps (FIR or optional IIR)
Phase	Linear within the passband
Digital Signal Processor:	TMS320VC5409
Static RAM Buffer:	Standard: 4MB expandable to 16MB

TIMING SYSTEM

Type:	True Real Time? PLL controlled, GPS-referenced
Maximum Accuracy (Software Selectable):	<1?sec
Crystal Oscillator	Standard: 25ppm; Optional TCXO 1 ppm/year
Crystal Frequency Correction Resolution	0.016 ppm
GPS Duty Cycle (Software Selectable):	Once every 18 hrs to achieve <1msec accuracy
GPS Receiver (integral with antenna):	Miniature; external; connects via a cable up to 30m

EVENT DETECTORS

Type:	STA/LTA, Level, up to 6 independent detectors in frequency domain
Pre-filter	Up to 6 passbands for each channel
Pre-event data buffer	up to 90 seconds (@100 sps)
Post-event buffer	User configured – no limitations
Trigger channels	May be controlled by one, several or all 6 detectors associated with any physical or virtual acquisition channel
Calibration	5V square wave (others optional)
Calibration Duration	User selectable

¹ Fourth channel may be used as state-of-health channel or function as fully featured data channel

SMR-4000-4A SPECIFICATIONS (Con't):

POWER

Voltage:	6 – 16 Vdc
Overvoltage protection:	?60 V
Power consumption (12 channels, 100sps):	4 ch ~1W, (Display off, PC and GPS cycled)
Internal Battery	5Ahr Optional, or external power pack with charger

USER INTERFACE

Display Type:	Backlit 320x200 graphic LCD display, opt. TFT color 640x480 VGA
Keypad:	12 (numerical + function) keys
Full PC keyboard:	Optional
User Control:	Menu-driven; state-of-health messaging
Waveform Data display:	Up to 3 channels simultaneously in real time
Master Computer	Fully PC Compatible, single-board, PC/104 586 CPU
Remote PC:	RS232 com2 port

MASS STORAGE

Flash Disk	128Mb compact flash card
Disk Compatibility:	Any PC
Temperature Range:	-10 to +50°C (built-in automatic heater for optional disks)
Data Formats:	Mini-SEED w/Steim-2 compression up to x6 CSS 3.0: long integer; separate data description in ASCII, free stand- ing conversion programs to other formats available.

COMMUNICATION

Dial-up Telephone Line Access	RS232 com2 port; optional internal modem
Ethernet	Optional LAN card

ENVIRONMENTAL PARAMETERS

Housing	Painted Steel, optional stainless steel
Waterproofing	NEMA 6
Operating Temperature Range	-10 to +50°C
Humidity	100%
Storage Temperature Range	-40 to +60°C
Size (4 to 8 channels)	9.84" x 7.87" x 5.91"
Weight	8.5lb typ (4 ch w/ sensor)

EXTERNAL CONNECTORS

Power	MS Circular
LAN or Serial port	MS Circular or DB9
GPS	MS Circular

SMR-4000-4A SPECIFICATIONS (Con't):

CONNECTORS: MAIN PANEL

To PC Keyboard	PS/2 Mini-DIN
To external PC	RS232 (DB9)

ACCELEROMETER SPECIFICATIONS

EA-120

EA-140 (optional)

Full Scale Ranges:	± 2 g standard, ± 0.5 g and ± 5 g or adjustable optional	
Full Scale Output Voltage:	± 10 V for ± 12 V input standard, ± 2 V opt	
Natural Frequency:	50 Hz minimum	
Noise per Root Hz:	<1 μ V	0.4 μ V
Dynamic Range:	135 dB @ ± 10 V	148 dB @ ± 10 V
Resolution at ± 10 V Output:	0.4 μ g @ 1g 0.8 μ g @ 2g	0.1 μ g @ 1g 0.2 μ g @ 2g
Broadband RMS Noise:	25 μ V, DC to 50 Hz	5 μ V, DC to 50 Hz
Broadband Dynamic Range:	120 dB @ ± 10 V	145 dB @ ± 10 V
Zero G Bias:	+/- 0.01g (optional adjustable)	
Linearity	± 1 % over temperature range	
Cross Axis Sensitivity:	0.02 g/g (0.005 g/g optional)	
Frequency Response ± 3 dB:	DC to 50 Hz standard (25Hz, 100Hz, and 200Hz optional)	
Damping:	Nominally 70% critical	
Zero Output Temp Effect:	Less than 5 mg over range (others optional)	
Scale Factor Temp. Effect:	0.05% / $^{\circ}$ C	0.02% / $^{\circ}$ C
Self Test (excites mass):	Voltage applied on self test input produces predictable output	
Level Adjustment	Accelerometers mounted on an internal, easy to access plate for leveling after installation	
Zero Bias Adjustment	Optional electronic module for user adjustable zero bias	
Full Scale Adjustment	Optional electronic module for selecting full scale range (0.25g to 2g)	
External Accelerometer	Optional	