

# CANTERBURY SEISMIC

INSTRUMENTS

## CUSP-M Multichannel Structural Monitoring System

### Applications

- Structural monitoring
- Dense free-field arrays
- Construction monitoring

### Features

- Intuitive yet powerful user interface
- Up to 32 triaxial sensors up to 500m apart
- Option for wind and displacement sensors
- High performance triggering and recording
- Large storage capacity
- Flexible communications
- Highly Internet integrated
- Low operation and deployment costs



# CUSP-M Specifications

Standard Acceleration Sensors	
Type	Triaxial MEMs silicon accelerometers
Range	± 3g
Noise level	< 65 ug RMS noise floor (80Hz bandwidth)
Offset error	< 1 % over operating temperature range
Linearity	< ±0.1% (±1g) < 1% (full range)
Gain error	< 1 % over operating temperature range
Hysteresis	< 0.5 % over operating temperature range
Mounting	Bolt-down, optional precision leveling mounts available Software real-time coordinate transform system allows any mounting orientation to be used
Sampling	Zero skew autonomous sampling 1ppm internal time-base (0-60°C)
Anti-Alias	1-pole RC filter (fc = 10kHz) 78-tap linear-phase FIR filter in hardware within A/D
Sensor data output rate	400Hz (post $\Sigma$ - $\Delta$ decimation)
Conversion	24-bit $\Sigma$ - $\Delta$ A/D

Data Signal Processing	
Filtering	FIR digital anti-alias filter/decimator Linear phase
Measurement Bandwidth	40 or 80Hz
Recorded dynamic range	108dB (80 Hz BW) 108dB (50 Hz BW)

Processor	
Type	Low power x86
OS	Multi-tasking real-time Linux based

Timing	
Type	High precision over-determined GPS disciplined timebase, synced to UTC Backup real-time clock
Accuracy	Better than 10us of UTC with GPS lock 50ppm with backup real-time clock (emergency use only) (NB this is not the sampling time-base)

Communications	
Type	SSL-HTTP web server, FTP, Telnet, SSH, SFTP, RSYNC Email/FTP/SFTP transfer-on-event LAN, Dial-up server and client, Serial link, Cellular modem, WiFi
Protocol	TCP-IP, PPP
Data integrity	Password control to access instrument configuration and data areas with multiple data and administrator accounts SSL/SSH encryption
Features	Remote configuration of all parameters including IP number, Instrument setting, Power management etc Data retrieval Diagnostics

Triggering	
Type	STA/LTA <AND> or <OR> absolute level detection, each channel individually configured Remote manual trigger from web interface Remote trigger transmission/reception to/from multiple array management systems (e.g. CUSP-HUB systems) Remote trigger transmission/reception to/from one other CUSP-3X or CUSP-M instrument for, e.g., structural monitoring

Pre-trigger filter options	0.1 Hz high-pass 1 Hz high-pass 5 Hz low-pass 10 Hz low-pass	0.1 – 5 Hz band-pass 0.1 – 10 Hz band-pass 1 – 5 Hz band-pass 1 – 10 Hz band-pass
STA/LTA	Independent trigger and dettrigger thresholds on each channel Selectable <AND> or <OR> triggering on each channel Thresholds adjustable from 1.1:1 to 200:1 LTA lock-on-trigger for 5 - 60 seconds 0.3 to 500 s term lengths	
Absolute level	Independent thresholds on each channel Selectable <AND> or <OR> triggering on each channel Level from 0.1 mg to 3 g in 0.1mg steps	
Pre-event length	10 to 120 seconds in 1-second steps	
Post even length	10 to 120 seconds in 1-second steps	

Storage	
Type	Wear-leveling FLASH disk Unique record file names indicating time and instrument
Storage time	> 8 hours @ 200 samples/s, 16 channels (8GB card) Hard disk option allows > 1 week of continuous recording No upper limit – depends of disk size

Power	
Supply voltage	110-240V AC, UPS backup 3 days, other capacities on request
Power consumption	15 W typical
Supply monitoring	User adjustable low voltage shut-down and auto re-power on resumption of power

User Interface	
Type	Web browser based Fully interactive Platform independent Linux/Windows/Mac Can be configured / interrogated remotely from any Internet connected PC Secure SSL-encrypted Apache web server

Sensor Options	
Sensors	Acceleration, wind or displacement options

Environmental / Casing	
Protection	Hardened steel frame or 19" rack options, other to order, please contact factory
Temperature range	-10 – +50°C standard
Humidity	0 to 100% (non condensing)
Mounting	Various options, bolted to wall, floor or into 19" rack, please contact factory

Contact Details	
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*Due to continuous product development, CSI reserves the right to change these and any specifications at any time without notice.*