

Introduction

REF TEK Strong Motion and Earthquake Engineering Products combine the Third Generation Broadband Seismic Recorder (REF TEK 130-01) and an advanced low-noise force-balance accelerometer (REF TEK 131A-3), with a flat frequency response from DC to 500 Hz. It is housed in an anodized aluminum instrument case with single point mounting and 3-point leveling.

The 130-SM and 130-SMA Strong Motion Accelerographs provide accurate and timely data and information for seismic events, including their effects on buildings and structures by employing modern monitoring methods and technologies. The 130-SM and 130-SMA are made for continuous monitoring of earthquakes and other seismic events, and the recording of strong earthquake shaking at ground sites, in buildings and critical structures. The 130-SM and 130-SMA advanced communications features include TCP/IP over Ethernet and Asynchronous Serial. An LCD continuously displays State-Of-Health and status information.

The 130-SM and 130-SMA have three channels connected to an internal triaxial accelerometer. When ordered as a six-channel unit, the three additional channels can be connected to an external sensor. Both units have provision for an optional internal V.90 modem for communication over standard telephone lines. Both units also include a battery charger for maintaining a lead-acid battery. The size of the case allows the installation of an internal battery to provide backup power for more than 48 hours. An external battery can also be used.

The low cost 130-SMA uses 'command line' firmware, which was specifically designed for structural monitoring applications. Setup and control is accomplished using the strong motion GUI (Graphic User Interface), that runs on multiple platforms. This firmware allows control of three relay closure contacts for external alarm activation and can automatically dial the optional modem for remote notification of events and alarms.

The 130-SM full featured Accelerograph can also run the command line firmware, but typically runs the standard REF TEK 130 firmware. The standard firmware provides more options for sampling rate and triggering than the command line firmware, but does not include relay control. Setup and control of the unit is accomplished with either a Palm-OS device running PFC_130 or a desktop computer running RTI. These command/control interfaces allow the user to program and examine the instrument's operating parameters and perform important diagnostic functions.

The performance of the 130-SM and 130-SMA hardware is similar, with two notable differences. The 130-SM has a higher-precision oscillator for more precise timekeeping. The accelerometer in the 130-SM has a full-scale range of greater than +/- 3g with a dynamic range of 120 dB (at 1 Hz) while the accelerometer in the 130-SMA has a full-scale range of greater than +/- 4g with a dynamic range of 112 dB (at 1 Hz)

Ordering Information

Part No.	Description
130-SM	Strong Motion Accelerograph
130-SM/6	Strong Motion Accelerograph, 6 channel
130-SMA	Strong Motion Accelerograph
130-SMA/6	Strong Motion Accelerograph, 6 channel
130-GPS	GPS Receiver
130-FLASH/1G	Disk, Flash, 1GB CF Type II
130-FLASH/2G	Disk, Flash, 2GB CF Type II
130-FLASH/4G	Disk, Flash, 4GB CF Type II
130-FLASH/8G	Disk, Flash, 8GB CF Type II
130-FLASH/16G	Disk, Flash, 16GB CF Type II
130-8004	Cable, 130 Recorder to Serial & Ethernet RJ45
130-8015-33	Cable, GPS to 130 Recorder, 33ft (10m) (other lengths available)
130-8019	Cable, NET, 130 to Ethernet RJ45 Hub
130-8023	Cable, NET, 130 to Ethernet RJ45 Crossover
130-8039A	Power Supply, for 130-SM / 130-SMA
130-8018	Assembly, Cable, PC Command & Control
130-Reader-USB	Reader, CF I/II, External, USB (readers with other interfaces available upon request)
130-Modem/Int	Internal Modem, for RT530 Card
130-BATKIT/12	Kit, Internal Battery, w/12V 12 Amp, for 130-SM/SMA
130-PDA-KIT	Kit, PDA, Ruggedized, w/cables
SW-DATAUTILS	Software, Data Utilities
SW-SSDP	Software, Seismic Signal Data Processing, Interactive
SW-130SM-GUI	Software, Command Line GUI, 130SM

24-Bit Strong Motion Accelerographs

MODELS 130-SM 130-SMA



Applications:

- Free Field Recording
- Structural Monitoring
- Dam Monitoring
- Building Arrays
- Telemetry Networks
- Aftershock Studies

Features:

- State-of-the-Art 24-bit ADC
- Wide Dynamic Range
- Low Noise Force-Balance Accelerometer
- Linear response from DC to 500 Hz
- Simultaneous Telemetry and Self-Recording
- IP Communications over Ethernet and Asynchronous Serial
- Embedded / Removable Mass Storage
- Anodized Aluminum Case, Watertight to IP67
- Low Power



Specifications	Full Featured Accelerograph, Model 130-SM	Low Cost Accelerograph, Model 130-SMA
Mechanical		
Size:	• 9.25" high x 8.0" wide x 13.25" long (235mm x 203mm x 336mm)	• 9.25" high x 8.0" wide x 13.25" long (235mm x 203mm x 336mm)
Weight:	• 10.5 lbs (4.8 kg), without internal battery	• 10.5 lbs (4.8 kg), without internal battery
Watertight Integrity:	• IP 67	• IP 67
Shock:	• Survives a 1 meter drop on any axis	• Survives a 1 meter drop on any axis
Operating Temperature:	• -20°C to +60°C	• -20°C to +60°C
Connectors		
Power:	• PT07A12-4S	• PT07A12-4S
NET:	• PT07A14-19P	• PT07A14-19P
Serial:	• PT07A12-10P	• PT07A12-10P
GPS:	• PT07A12-8S	• PT07A12-8S
Channel (4-6):	• PT07A14-19S	• PT07A14-19S
Modem:	• PT07A12-3P	• PT07A12-3P
Relay:	• PT07A14-15P	• PT07A14-15P
Power		
Input Voltage:	• 10 to 16 VDC	• 10 to 16 VDC
Operating Power:	• 2 W (3-ch. @ 125 sps)	• 2 W (3-ch. @ 125 sps)
Peak Power:	• 3 W (DAS & GPS active, writing to CF)	• 3 W (DAS & GPS active, writing to CF)
Battery Charger:	• 15 V, 800 mAmp (internal or external)	• 15 V, 800 mAmp (internal or external)
Battery:	• 12 VDC, sealed lead-acid, 12 AmpH (optional, internal)	• 12 VDC, sealed lead-acid, 12 AmpH (optional, internal)
A/D Converter		
Type:	• Δ - Σ modulation, 24-bit resolution	• Δ - Σ modulation, 24-bit resolution
Channels:	• 3 or 6 channels	• 3 or 6 channels
Input Impedance:	• Matched to accelerometer	• Matched to accelerometer
Input Full Scale:	• Matched to accelerometer	• Matched to accelerometer
Bit Weight:	• 1.589 μ V	• 1.589 μ V
Self Noise Level:	• 2 counts RMS @ 200 sps	• 2 counts RMS @ 200 sps
Sample Rates:	• 500 - 50 sps (user selectable)	• 200, 100, 50 sps (user selectable)
Dynamic Range:	• >130 dB	• > 130 dB
Time Base		
Type:	• GPS Receiver/Clock plus a disciplined oscillator	• GPS Receiver/Clock plus a disciplined oscillator
Accuracy:	• \pm 10 μ sec with GPS locked and a validated 3-D fix	• \pm 100 μ sec with GPS locked and a validated 3-D fix
Accuracy without GPS:	• 0.1 ppm from 0° to 60°C, 0.2 ppm from -20° to 0°C	• 2.5 ppm from -20°C to 60°C
Auxiliary Channels		
Inputs:	• Battery, Temperature, Backup Battery	• Battery, Temperature, Backup Battery
Calibration		
Enable:	• User Command	• User Command
Type:	• Step applied to feedback	• Step applied to feedback
Communication		
NET:		
Ethernet:	• 10-BaseT: TCP/IP, UDP/IP, FTP, RTP	• 10-BaseT: TCP/IP, UDP/IP, FTP, RTP
Serial:	• Asynchronous RS-232: 1K XMODEM, YMODEM	• Asynchronous RS-232: 1K XMODEM, YMODEM
Modem (optional):	• V.90	• V.90
Recording Mode		
Trigger Type:	• Continuous, External, Level and Vote Trigger (0.0001 to 4g); Alarm	• Continuous, External, Level and Vote Trigger (0.0001 to 4g); Alarm
Media:	• Compact Flash, Ethernet	• Compact Flash, Ethernet
Format:	• PASSCAL Recording Format	• PASSCAL Recording Format
Recording Capacity		
Battery Backed SRAM:	• 8 MB	• 8 MB
Flash Disk:	• 1GB - 16GB (customer specific)	• 1GB - 16GB (customer specific)
Compliance		
	• CE	• CE
Internal Accelerometer		
Type:	• Force-balance (internal)	• Force-balance (internal)
Full Scale Range:	• > \pm 3g	• > \pm 4g
Dynamic Range:	• 120 dB @1 Hz	• 112 dB @1 Hz
Sensitivity:	• 2.4 V/g nominal (exact value in EEPROM)	• 1.6 V/g nominal (exact value in EEPROM)
Linearity:	• < 0.02% of full scale	• < 0.02% of full scale
Cross-axis Sensitivity:	• < 0.005 g/g	• < 0.005 g/g
Frequency Response:	• Flat DC - 500 Hz	• Flat DC - 500 Hz

Power Spectral Density (PSD), 130-ANSS/02 and 130-SM

Avg. 0.5 to 5 Hz = -153.4 dB dn
Dynamic Range (RMS) = 137 dB

dB rel V²/Hz

Frequency

Strong Motion Processing Software

Strong Motion Command-and-Control Software