System 6000

EMEME Micro-Measurements

StrainSmart® Data Acquisition System

FEATURES

- From 1 to 1200 input channels
- Individual input cards for strain gage and strain-gage-based transducers (Model 6010A), thermocouples (Model 6020), sensors with high-level voltage outputs (Model 6030A), LVDT's (Model 6040A), piezoelectric sensors (Model 6050), and digital tachometer (Model 6095)
- Built-in bridge completion for 120-, 350-, and 1000-ohm strain gages
- Maximum scan rate of 10 000 samples per second per channel; maximum throughput of 200 000 samples per second
- Simultaneous sampling with anti-aliasing filter and analog-to-digital conversion for each channel
- Stable, accurate, low-noise signal conditioning
- Selectable digital filtering of measurement signals
- High-speed PCI hardware interface (Model 6100) and Ethernet network interface (Model 6200A)
- Digital I/O for triggering external events

DESCRIPTION

System 6000 features data acquisition rates of up to 10,000 samples per second per channel. The hardware is designed to incorporate all the features required for precision strain measurement under a variety of loading conditions, while maintaining flexibility and ease of use. A system can be configured with 1 to 1200 sensors. Strain gages, strain-gage-based transducers, thermocouples, LVDT's, potentiometers, accelerometers, piezoelectric sensors and other transducers can be intermixed by choosing the appropriate sensor card. All System 6000 components can be easily configured for each test requirement. Both the Model 6100 Scanner (holding up to 20 input cards) and the Model 6200A Scanner (holding up to 16 input cards) function independently. Additionally, the smaller, lighter, portable Model 6200A can operate from a variety of dc power sources, and can be configured to remotely perform data acquisition and storage.

Utilizing the benefits of individual analog-to-digital conversion on each channel and simultaneous sampling data acquisition for all channels, System 6000's Model 6100 Scanners record test data at rates of up to 10,000 samples per second per channel of instrumentation hardware. The PCI hardware interface between the scanners and a PC running Strain-Smart software in the Windows NT/2000/XP environment enables a combined throughput of up to 200 000 samples per second for all channels (for example, 20 channels at 10 000 samples per second per channel or 40 channels at 5000 samples per second per channel).

Selectable, digital FIR low-pass filtering is incorporated into each instrumentation channel to meet a variety of testing requirements. Custom filters are also available.

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MODEL 6100 SCANNER SPECIFICATIONS

- AC powered
- 19-in rack-mountable, 3.5-in high package
- Accepts up to 20 plug-in input cards
- Support high-speed data transfer and setup of the plug-in cards
- Supports local diagnostics
- Supports software identification and setup of each type of plug-in card

OPERATION:
Direct software control.

INPUTS:
Accepts up to 20 cards (one channel per card and up to 20 channels per unit).

SYNC: Automatic

DATA STORAGE: None.

INTERFACE: Proprietary PCI.

SIZE:
3.5 H x 19 W x 16 D in (89 x 483 x 381mm)
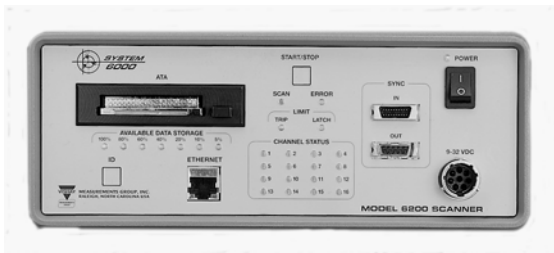
WEIGHT:
17lb (7.7kg) empty
19.5lb (8.8kg) loaded with 20 plug-in cards

POWER:
115 or 230Vac user-selectable; ±10% of setting; 50/60Hz; 200W max.

MODEL 6200A SCANNER SPECIFICATIONS

- DC powered (AC optional)
- Compact package
- Accepts up to 16 plug-in input cards
- Supports network communication via a 100BASE-T Ethernet connection
- Multiple units can be linked together to provide common control and synchronous sampling
- Offers user-selectable decimal-based (radix 10) and binary-based (radix 2) scanning rates
- On-board program and data storage
- Supports local diagnostics
- Supports software identification and setup of each type of plug-in card

OPERATION:
Stand-alone or direct software control.

INPUTS:
Accepts up to 16 cards (one channel per card and up to 16 channels per unit).

SYNC: Multiple scanners synchronized with synchronization cable links.

DATA STORAGE:
Can be configured:
Internal: 2GB solid state.
Removable: ATA form factor removable storage devices, solid state.

INTERFACE: Type : Ethernet
Topology : 100Base-T
Protocol : TCP/IP (HTTP)

OPERATING VIBRATION:
6G peak in all three axes. Sweep to 10Hz (solid state media).

OPERATING SHOCK:
20G peak in all three axes, 5 shocks in each axis (solid state media).

SIZE:
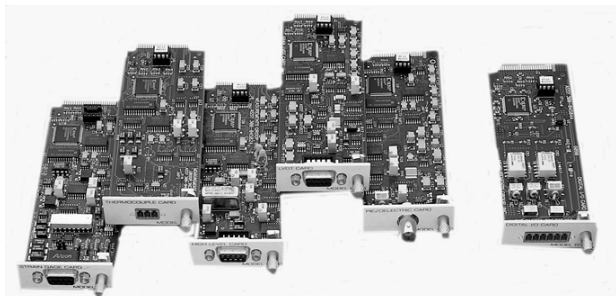4 H x 10 W x 12.3 D in (102 x 254 x 312mm)

WEIGHT:
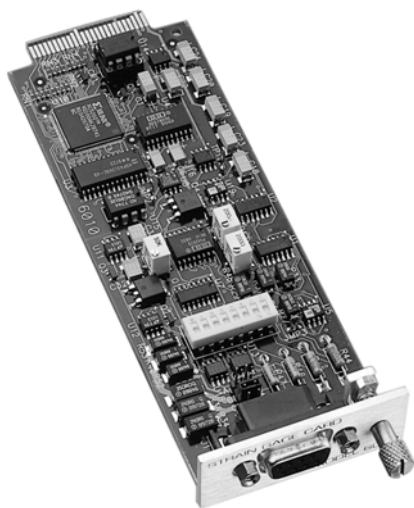9.1lb (4.1kg) empty, 11.1lb (5.0kg) loaded with 16 plug-in cards.

POWER:
Designed for use with dc power; 9-32Vdc, 100W max.
Optional power adapter (Model 6207); 120/240Vac.

SENSOR CARD SPECIFICATIONS

MODEL 6010A STRAIN GAGE CARD

- Supports software identification and setup of each type of plug-in card
- Complete strain gage signal conditioner with 16-bit analog-to-digital converter
- Programmable digital filter
- Programmable excitation supply per channel. The supply is settable to 0, 0.5, 1, 2, 5, and 10V. Up to 50mA of excitation current is available on each channel. Remote sense is provided for full-bridge transducers.
- Programmable gain to complement the excitation steps of 1, 2, 5, and 10V. Full-scale input range will be ±16 383µε. An excitation setting of 0.5V will use the 1V gain range, but with one-half the resolution. Gain settings are independent per channel.
- Internal bridge completion resistors: 120Ω, 350Ω, and 1000Ω dummy resistors (jumper selectable); 1000 internal half bridge
- Programmable coarse balance range of ±16 300µε (4096µε steps)

- Fixed low-pass anti-aliasing filter (six-pole)
- Two programmable shunt calibration circuits
- Input connections to user's strain gage via nine-pin D-sub connector

CHANNELS: One per card.

INPUTS:

Strain Gages:
120Ω, 350Ω,1000Ω quarter bridges; 60Ω to 5000Ω half and full bridges.
Jumper-selectable completion resistors (0.01% ± 2.5ppm/°C typical).

Measurement Range:
Normal range mode: ±16 380µε
High range mode: ±163 800µε
Low range mode: ±1638µε

Resolution:
Normal range mode: 0.5µε
High range mode: 5µε
Low range mode: 0.05µε

Strain Gage Based Transducers:
60Ω to 5000Ω impedance

Measurement Range:
Normal range mode: ±8mV/V
High range mode: ±80mV/V
Low range mode: ±0.8mV/V

Resolution:
Normal range mode: 0.25µV/V
High range mode: 2.5µV/V
Low range mode: 0.025µV/V

Input Impedance:
220MΩ each input.

Source Current: ±25nA max.

Input Connector: Nine-pin D-sub style.

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AMPLIFIER:

Zero Temperature Stability:
±1.5μV/°C RTI, ±100μV/°C RTO, after 30-minute warm-up.

DC Gain Accuracy & Stability:
(±0.1% at 23°C) ±50ppm/°C

Common-Mode Rejection (dc to 60Hz):
100dB typical

Common-Mode Voltage:
±6V typical

AC Accuracy: (typical):

Input Frequency/Bandwidth:	500/3000	50/200
Spurious Free Dynamic Range:	100dB	110dB
Signal to Noise:	90dB	95dB
Signal to Distortion:	100dB	110dB

Coarse Balance Range:
±99% of measurement range (typically ±16 300με)

CALIBRATION:
Two shunt calibration points are available on each channel. Switch-selectable.
Calibration switches, A and B, are software selectable.

EXCITATION:
0.0, 0.5, 1.0, 2.0, 5.0, and 10.0Vdc. Software-programmable.

Accuracy:
±3mV typical

Current:
50mA max. Over-current protected.

Load Regulation:
<0.05% of full scale for a load variation of 10% to 100% of full load

Temperature Stability:
Better than ±0.005%/°C

Remote Sense:
15Ω maximum lead resistance.

A/D CONVERTER :

Type:
16-bit successive approximation with integrated sample and hold.

Integral Linearity Error:
±2 LSB

FILTERS:
Linear phase, analog, 6-pole anti-aliasing filter, and 256-tap, programmable, FIR digital filter (lowpass)

Passband Frequency:
User-selectable 1Hz to 4kHz

ANALOG OUTPUT: (6010A version only)

Type:
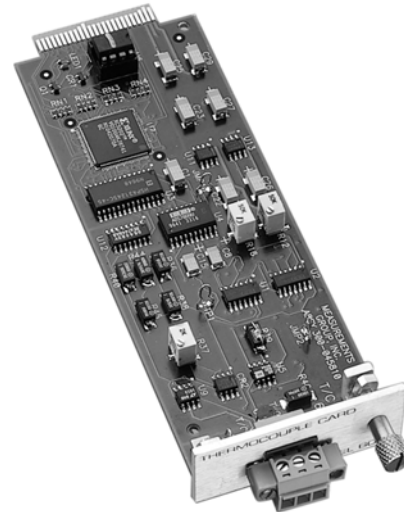±5.00V max for typical full-scale input of ±16 380με

Output Load:
2000Ω min

Bandwidth:
DC to 15kHz (-0.5dB typical)

MODEL 6020A THERMOCOUPLE CARD

- Complete thermocouple signal conditioner with 16-bit analog-to-digital converter
- Programmable digital filter
- Programmable common cold-junction reference
- Compensation is provided for J, K, T, N, E, R, S, and B thermocouple types
- Fixed low-pass anti-aliasing filter (six-pole)
- Connections to user's thermocouple circuit via a removable three-terminal screw connector

CHANNELS: One per card.

INPUTS:
Thermocouple types J, K, T, E, N, R, S, B. Built-in electronic cold-junction compensation. Software-selectable

Open sensor detection

Input Impedance: 10MΩ differential, 100KΩ common mode.
Source Current: ±0.5nA typical; ±5nA max.

INPUT CONNECTOR: Three-position screw terminal

AMPLIFIER:
Zero Temperature Stability:
±1.5μV/°C RTI, ±100μV/°C RTO, after 30-minute warm-up.

DC Gain Accuracy & Stability:
0.05% at 23°C ± 50ppm/°C

Common-Mode Rejection (dc to 60Hz):
100dB typical

Common-ModeVoltage:
±6V typical

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AC Accuracy: (typical):

Input Frequency/Bandwidth:	500/3000	50/200
Spurious Free Dynamic Range:	100dB	110dB
Signal to Noise:	90dB	95dB
Signal to Distortion:	100dB	110dB

MEASUREMENT RANGE: ±81.9mV

RESOLUTION: 2.5µV

A/D CONVERTER :

Type:
16-bit successive approximation with integrated sample and hold.
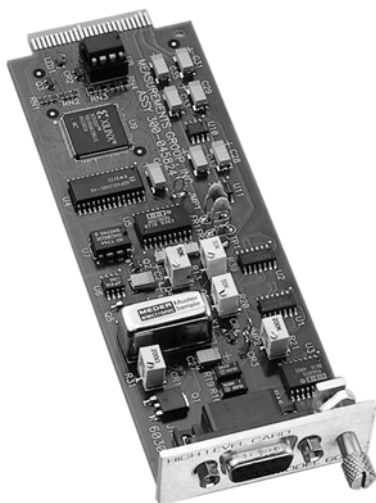
Integral Linearity Error:
±2 LSB

FILTERS:
Linear phase, analog, 6-pole anti-aliasing filter, and 256-tap, programmable, FIR digital filter (lowpass)

Passband Frequency:
User-selectable 1Hz to 4kHz

MODEL 6030A HIGH-LEVEL INPUT CARD

- Complete high-level signal conditioner with 16-bit analog-to-digital converter

- Programmable gain

- Programmable digital filter

- Programmable excitation supply. The supply is settable to 0, 0.5, 1, 2, 5, 10, 15, 20, 24, and 30V. Up to 50mA of current is available on each channel.

- Fixed low-pass anti-aliasing filter (six-pole)

- Input connections to user's voltage source via nine-pin D-sub connector

- Analog output

CHANNELS: One per card.

INPUTS: DC volts (differential)

Input Impedance: 22MΩ each input.
Source Current: ±2nA typical; ±100nA max

INPUT CONNECTOR: Nine-pin D-sub style

AMPLIFIER:

Zero Temperature Stability:
±2µV/°C RTI, typical. ±100µV/°C RTO, after 30-minute warm-up.

DC Gain Accuracy & Stability:
±0.05% at 23°C ± 20ppm/°C

Common-Mode Rejection (dc to 60Hz):
86dB typical at X1 gain
94dB typical at X10 gain

Common-Mode Voltage:
±12V typical

AC Accuracy: (typical):

Input Frequency/Bandwidth:	500/3000	50/200
Spurious Free Dynamic Range:	100dB	110dB
Signal to Noise:	90dB	95dB
Signal to Distortion:	100dB	110dB

MEASUREMENT RANGES: ±1, ±2, ±5, ±10Vdc

RESOLUTION: 30.5, 61, 152.5, 305µV

EXCITATION:
0, 0.5, 1.0, 2.0, 5.0, 10.0, 15.0, 20.0, 24.0, 30.0Vdc

Accuracy:
±10mV typical at 0 to 24Vdc; ±5% at 30Vdc

Current:
50mA max. Over-current protected

Over-current protected.

Load Regulation:
<±0.05% of full scale for a load variation of 10% to 100% of full load

Temperature Stability:
Better than ±0.005%/°C

A/D CONVERTER :

Type:
16-bit successive approximation with integrated sample and hold.

Integral Linearity Error:
±2 LSB

FILTERS:
Linear phase, analog, 6-pole anti-aliasing filter, and 256-tap, programmable, FIR digital filter (lowpass)

Passband Frequency:
User-selectable 1Hz to 4kHz

ANALOG OUTPUT: (6030A version only)

Type:
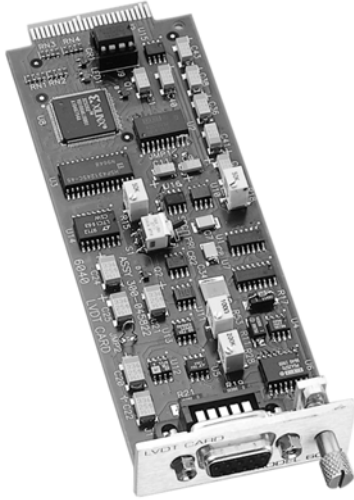±5.00V max for typical full-scale input of ±32767µε

Output Load:
2000Ω min

Bandwidth:
DC to 15kHz (-0.5dB typical)

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MODEL 6040A LVDT CARD

- Complete LVDT signal conditioner with 16-bit analog-to-digital converter
- Programmable digital filter
- Independent ac excitation supply
- Programmable gain steps of 1, 2, 5, and 10
- Supports six-, five-, four-, and three-wire transducers
- Fixed low-pass anti-aliasing filter (six-pole)
- Excitation reference provided for calibration
- Input connections to user's transducer via nine-pin D-sub connector

CHANNELS: One per card.

INPUTS: 3- to 6-wire transducers.

Input Impedance: 10MΩ each input.
Source Current: ±2nA typical; ±100nA max

INPUT CONNECTOR: Nine-pin D-sub style

AMPLIFIER:

Zero Temperature Stability:
±2μV/°C RTI, typical. ±100μV/°C RTO, after 30-minute warm-up.

Gain Accuracy & Stability:
±0.25% typical

Common-Mode Rejection (dc to 60Hz):
86dB typical at X1 gain
94dB typical at X10 gain

Common-Mode Voltage:
±12V typical

MEASUREMENT RANGES: ±0.5, ±1, ±2.5, ±5Vrms

RESOLUTION: 15.25, 30.5, 76.2, 152.5μVrms

CALIBRATION: Excitation sample

EXCITATION:
3.0Vrms at 2500, 5000, or 10000Hz sine wave.
Software-selectable

Accuracy:
±5mVrms typical

Current:
±50mA max.
Over-current protected.

Load Regulation:
<±0.1% of full scale for a load variation of 10% to 100% of full load

Temperature Stability:
Better than ±0.05%/°C

A/D CONVERTER :

Type:
16-bit successive approximation with integrated sample and hold

Integral Linearity Error:
±2 LSB

FILTERS:
Butterworth, six-pole anti-aliasing analog filter, and 256-tap, programmable, FIR digital filter (lowpass)
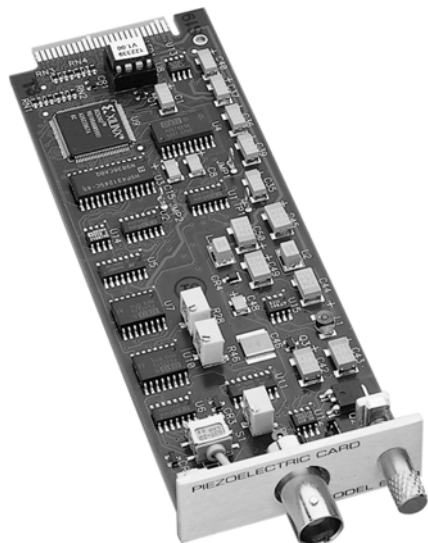
Passband Frequency:
User-selectable 1Hz to 4kHz

ANALOG OUTPUT: (6040A version only)

Linear Output: ± 5.00V for typical full-scale input

Output Load: 2000Ω min

Bandwidth: DC to 1kHz (-3dB typical)

System 6000

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MODEL 6050 PIEZOELECTRIC CARD

- Complete piezoelectric signal conditioner with 16-bit analog-to-digital converter

- Supports both VM (voltage mode, low impedance) and CM (charge mode, high impedance) type piezoelectric transducers

- Programmable constant current excitation supply for VM transducers is software settable to 1, 2, 4, 5, 10 and 20mA

- Programmable gain steps of 1, 2, 5, and 10 for VM transducers and steps of 1, 2, 5, 10, 20, 50 and 100 for CM transducers

- Programmable digital filter

- Fixed low-pass anti-aliasing filter (six-pole)

- Input connections to user's transducer via BNC connector

CHANNELS: One per card.

INPUTS: Voltage mode (VM) or charge mode (CM) piezoelectric type transducers (type is switch-selectable)

Coupling:
CM type - charge amplifier with software-selectable time constants of 0.5 and 5 seconds
VM type - ac coupling to remove dc bias voltage with high pass response of 0.1Hz (-3dB)

INPUT CONNECTOR: Female BNC

AMPLIFIER:
Zero Temperature Stability:
±10µV/°C RTI, typical, after 30-minute warm-up

Charge Amplifier Zero Stability:
±1.2pC/°C RTI typical at 0.5 second time constant

DC Gain Accuracy & Stability:
±0.1% at +23°C; ±25ppm/°C

AC Accuracy: (typical at X2 gain step)

Input Frequency/Bandwidth:	500/3000	50/200
Spurious Free Dynamic Range:	100dB	110dB
Signal to Noise:	90dB	95dB
Signal to Distortion:	100dB	110dB

MEASUREMENT RANGES:
VM type transducers: ±10.5V, ±5.25V, ±2.1V, and ±1.05V
CM type transducers: ±200 000pC, ±100 000pC, ±40 000pC, ±20 000pC, ±10 000pC, ±4000pC, and ±2000pC

RESOLUTION: 0.0015% of range

CALIBRATION: Excitation sample

EXCITATION:
0, 1, 2, 4, 5, 10 and 20mA selections for VM type transducers

Accuracy:
±1% + (±30µA) typical at 1 to 20mA

Voltage Compliance: 0 to 28V.

Temperature Stability:
±50ppm/°C

A/D CONVERTER :

Type:
16-bit successive approximation with integrated sample and hold

Integral Linearity Error:
±2 LSB

FILTERS:
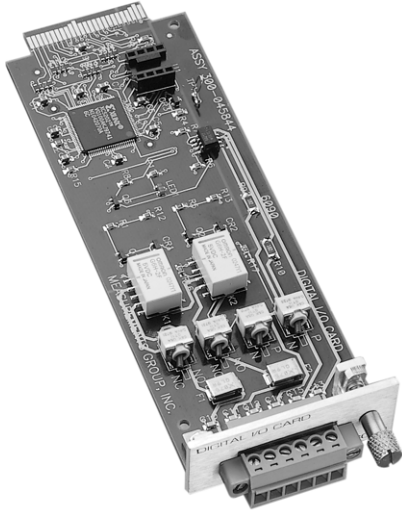Linear phase, analog, 6-pole anti-aliasing filter, and 256-tap, programmable, FIR digital filter (lowpass)

Passband Frequency:
User-selectable 1Hz to 4kHz

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MODEL 6095 DIGITAL/TACHOMETER CARD

- Multi-function digital input card
- Relay output for control functions
- Compatible with all System 6000 hardware
- Supported by StrainSmart software

When used in conjunction with Micro-Measurements StrainSmart® Software, the Model 6095 Digital/Tachometer Card enables the user to capture and reduce data in any one of five operating modes:

- Tachometer Mode
- Interval Mode
- Quadrature Mode
- Counter Mode
- Digital Input Mode

Depending upon the mode selected, data can be reduced as a digital input; counts; interval counts; pulses; rate; shaft angle; RPM; radians or degrees per second; elapsed time (milliseconds, seconds or minutes); or calculated values.

Multiple Model 6095 Cards can be used in each system, and each card in a system can be configured individually to any operating mode. However, the relay provides one distinct control function (on/off control for testing machines, etc.) per system when using a Model 6100 Scanner, or one per scanner when using multiple Model 6200 Scanners.

The Model 6095 is compatible with all Model 6100 and 6200 Scanners. It is supported by Version 3.0, and later, StrainSmart Software; no-charge upgrades are available upon request.

INPUT CONNECTOR: Nine-pin, D-sub style

RELAY OUTPUTS:
  Quantity: One
  Configuration: NO and NC, 500mA contact at 30Vac or 30Vdc into resistive load.

DIGITAL INPUTS:
  Quantity: Four

  Configuration: Optically isolated. TTL Schmitt-trigger input thresholds accept up to 28Vdc without damage. 2.23Ω pull-up resistors can be selected for each input.

  Impedance: 50kΩ

  Data Rate: DC to 200kHz

  Accessory Supply: 5 Volt ± 5%, 75mA

Disclaimer

All product specifications and data are subject to change without notice.

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