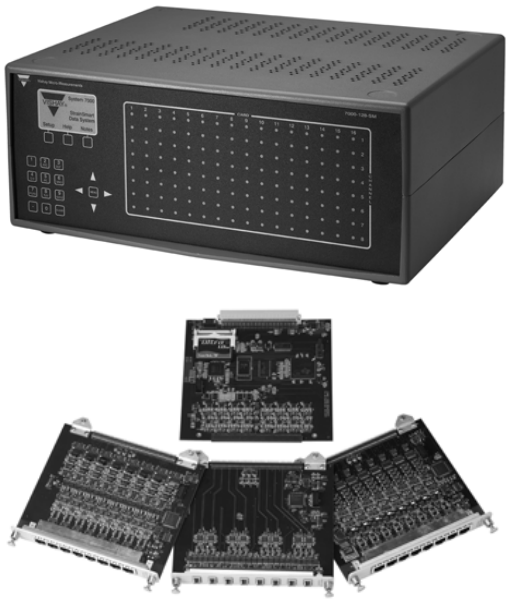
StrainSmart® Data Acquisition System



FEATURES

- Stable, accurate, low-noise signal conditioning
- Measurement accuracy ±0.05%
- Measurement resolution 0.5 microstrain
- Individual input cards for strain gage and strain-gage-based transducers, thermocouples, sensors with high-level voltage outputs, and LVDTs
- Electronically selectable, built-in bridge completion for 120-, 350-, and 1000-ohm strain gages
- Virtually unlimited number of channels in increments of 8 channels
- Maximum scan rate of 2048 samples per second
- Self calibration traceable to NIST standard
- Simultaneous sampling with anti-aliasing filter and analog-to-digital conversion for each channel
- Selectable digital filtering of measurement signals
- High-speed Ethernet network interface
- Remote Utility includes capability for acquiring data without connection to a computer (field upgradeable)

DESCRIPTION

Micro-Measurements System 7000 builds upon the years of experience gained since the introduction of Systems 4000, 5000, and 6000 by continuing to provide a complete hardware/software approach to data acquisition, reduction, and presentation for strain gages and related sensors for stress analysis testing.

System 7000 hardware is designed to incorporate all the features required for precision strain measurement in a high channel density enclosure. Strain gages, strain-gage-based transducers, thermocouples, LVDTs, and other sensors with high level voltage outputs can be intermixed in groups of eight (8) by choosing the appropriate sensor card for up to 128 channels in a 4U height, 19-inch rack-mountable scanner (7000-128-SM). A 32-channel scanner is also available (7000-32-SM). The Ethernet interface allows flexible positioning of scanners, and multiple scanners can easily be synchronized using a single sync cable (maximum length 100 meters). A system can be configured with virtually an unlimited number of sensors.

System 7000 is a high performance data acquisition instrument with measurement accuracy of ±0.05% of full scale. Each sensor card employs a 24-bit analog-to-digital converter enabling 0.5 microstrain resolution. Scan rates up to 2048 samples per second are available for simultaneous reading of all sensor inputs. A combination of analog and flexible Finite Impulse Response (FIR) filters are available to provide adequate anti-alias filtering at all scanning rates. Each sensor card has high-capacity nonvolatile data storage capability. Electronically selectable bridge completion resistors allow the user to choose between 120-, 350-, and 1000-ohm strain gages through software selection.

Several design features are provided to reduce total cost of ownership. System 7000 is capable of self-calibration with a removable calibration reference (7000-SM-VC). Calibration can be performed anywhere and there is no need to return the entire system to the factory for calibration. Down-time while waiting for calibration is essentially eliminated. Input connectors are RJ-45 type and assembly time is fast using simple cable crimping tools. Sensor input cards all use common Analog Input Cards (Model 7003-8-A-I), which thereby allow users to interchange sensor input cards with analog input cards. Individual scanners can be separated and located near sensors to reduce sensor cabling costs.

A feature for acquiring data without a connection to a computer has been added. This Remote Utility Feature is field upgradeable on units purchased prior to the introduction of this feature. With this feature, data can be collected then exported to other applications for analysis.

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SCANNER SPECIFICATIONS (128 CHANNEL VERSION)

The purpose of the Model 7000-128-SM Scanner is to house and retain the acquisition cards, regulate power to the cards, establish and maintain communication between the Ethernet interface and the input cards, synchronize the analog-to-digital converters in the system, and provide visual status information to the operator.

CAPACITY:
Up to 16 Input Cards. 128 channels maximum

CONFIGURATIONS:
Rack-mount (19-inch) or bench-top

LCD DISPLAY:
64 x 128 white LED-backlit display

LED PANEL:
128 individual red/green LEDs; one per channel

KEYPAD:
Membrane. 20-key; 12 key numeric keypad, 5 key navigation keypad, and three soft-keys

INPUT POWER:
11 - 32Vdc, 30A max

POWER INDICATION:
Green LED. Illuminated when power is on

ETHERNET INTERFACE:
IEEE 802.3, 802.3u 10Base-T, 100Base-TX, half- and full-duplex, auto-detect

COMPACT FLASH® CAPACITY:
1GB supplied. Removable

PROCESSOR:
250MHz floating point digital signal processor

MEMORY:
64MB SDRAM

INTERNAL COMMUNICATION:
Asynchronous command bus, synchronous data bus

SYSTEM SYNCHRONIZATION:
Connections: Sync In, Sync Out
Topology: Daisy-chain
Cable Connection: TIA/EIA RJ-45, Category 5
Max. Distance: 100m

SYSTEM CALIBRATION REFERENCE:
Firmware-controlled
Drift: 1.9ppm/°C ± 0.6µV/°C typical, 9.4ppm/°C ± 2.1µV/°C maximum
Resolution: 150µV nominal
Voltage Range: ±5V

DIMENSIONS:
7.5 H x 17.5 W x 13.5 D inches (190 x 445 x 343mm)

WEIGHT:
20lb (9.1kg)

SCANNER SPECIFICATIONS (32-CHANNEL VERSION)

The purpose of the Model 7000-32-SM Scanner is to house and retain the acquisition cards, regulate power to the cards, establish and maintain communication between the Ethernet interface and the input cards, synchronize the analog-to-digital converters in the system, and provide visual status information to the operator.

CAPACITY:
Up to 4 Input Cards. 32 channels maximum

CONFIGURATIONS:
Bench-top

LCD DISPLAY:
64 x 128 white LED-backlit display

LED PANEL:
32 individual red/green LEDs; one per channel

KEYPAD:
Membrane. 20-key; 12 key numeric keypad, 5 key navigation keypad, and three soft-keys

INPUT POWER:
11 - 32Vdc, 30A max

POWER INDICATION:
Green LED. Illuminated when power is on

ETHERNET INTERFACE:
IEEE 802.3, 802.3u 10Base-T, 100Base-TX, half- and full-duplex, auto-detect

COMPACT FLASH® CAPACITY:
1GB supplied. Removable

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PROCESSOR:
250MHz floating point digital signal processor
MEMORY:
64MB SDRAM
INTERNAL COMMUNICATION:
Asynchronous command bus, synchronous data bus
SYSTEM SYNCHRONIZATION:
Connections: Sync In, Sync Out
Topology: Daisy-chain
Cable Connection: TIA/EIA RJ-45, Category 5
Max. Distance: 100m

SYSTEM CALIBRATION REFERENCE:
Firmware-controlled
Drift: 1.9ppm/°C ± 0.6µV/°C typical, 9.4ppm/°C ± 2.1µV/°C maximum
Resolution: 150µV nominal
Voltage Range: ±5V
DIMENSIONS:
7.5 H x 7.1 W x 13.5 D inches (190 x 180 x 343mm)
WEIGHT:
10.1lb (4.6kg)

STRAIN GAGE INPUT CARDS

A choice of two Strain Gage Input Cards (7003-8-SG or 7003-8-SG-A) are used in conjunction with the Model 7003-8-A-I Analog Input Card to perform bridge excitation, bridge completion, shunt calibration, and signal conditioning for eight quarter, half, and full bridges. Note that the 7003-8-SG-A Strain Gage Input Card with Analog Output has an analog output which provides an amplified representation of the input source.

CHANNELS:
Eight per card

INPUTS:
Software selectable for S+/S-, Vcal+/Vcal-, or excitation
Strain Gage: 120Ω, 350Ω, 1000Ω quarter-bridges; 60Ω to 5000Ω half- and full-bridges
Input Impedance: 220MΩ nominal each input
Source Current: ±5nA per volt excitation

ANALOG OUTPUT (Model 7003-8-SG-A Only):
Fixed Gain: 50.3 V/V +/- 1%
Output Range: +/- 10V min
Output Load: 2000Ω min
Bandwidth: DC to 4.2Khz (-3db +/- 0.25db)

MEASUREMENT RANGE AND RESOLUTION:
Total range depends upon excitation setting (see table).
Resolution: 0.5µe (GF=2)

INPUT CONNECTOR:
Eight-pin TIA/EIA RJ-45 (Amp type 554739 or equivalent)

AMPLIFIER:
Zero Temperature Stability: ±1µV/°C RTI, after 60-minute warm-up
DC Gain Accuracy and Stability: ±0.05%; ±50ppm/°C (1 year without periodic VCAL)
Analog Input (including full-scale balance):
Low Range: ±50mV
High Range: ±220mV
Linearity: ±0.02% of Full Scale
Common-Mode Rejection: >90dB (dc to 60Hz)
Common-Mode Voltage Range: ±12V typical

BALANCE:
Type: Software (mathematical)
Range: Full ADC Range

Excitation Volts	Measuring Range Includes Full Scale Imbalance	
	µε@GF=2	mV/V
0	48 000	24*
0.25	100 000	50
0.5	96 000	48
0.75	70 000	35
1	48 000	24
2	24 000	12
3	16 000	8
4	50 000	25
5	40 000	20
6	35 000	17.5
7	30 000	15
8	25 000	12.5
9	20 000	10
10	20 000	10

* Based on 1 volt excitation

EXCITATION:
Selection: Software controlled
Resolution: 1mV
Accuracy: ±4mV typical (Firmware measures excitation variations during arming process)
Current: 50mA max. per channel
Over-current limited
Over-current indication
Load Regulation: <0.05% of full scale for 10% to 100% of full scale load with remote sense
Temperature Stability: ±10ppm/°C

QUARTER-BRIDGE COMPLETION:
Selection: Firmware-controlled
Accuracy and drift:
120Ω and 350Ω: ±0.01%, 2.8ppm/°C max.
1kΩ: ±0.01%, 1.6ppm/°C max. (socketed)

SHUNT CALIBRATION:
Selection: Firmware-controlled

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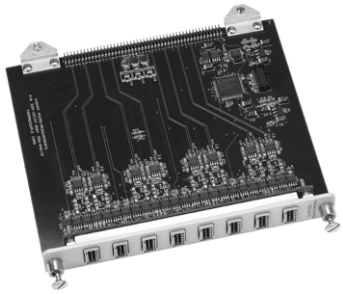
Configuration:
Internal: P- to D120, P- to D350, P- to D1000
Remote: RcalA to RcalB
Sockets: Tin-plated
Levels: Simulates 10000με @GF = 2.0
Values:
P- to D120: 5940Ω ±0.1%
P- to D350: 17325Ω ±0.1%
P- to D1000: 49500Ω ±0.1%

SYSTEM CALIBRATION:
Firmware-controlled
Calibration voltage: Supplied by Model 7000-SM-VC voltage calibration card
Type: Ten point calibration

SIZE:
6.5 L x 6.5 W x 0.9 H in (165 x 165 x 23mm)

WEIGHT:
0.45lb (0.2kg)

THERMOCOUPLE INPUT CARD



The Model 7003-8-TC Thermocouple Input Card is used in conjunction with the Model 7003-8-A-I Analog Input Card to perform signal conditioning and cold-junction compensation for thermocouple types J, K, T, E, N, R, S, and B.

CHANNELS:
Eight per card

INPUTS:
Supported thermocouple types: J, K, T, E, N, R, S, B
Cold-junction compensation, software-selectable
Open-sensor detection
Input Impedance: 220MΩ nominal each input
Input Connectors:
Five-position connector with screw terminals

AMPLIFIER:
Zero Temperature Stability: ±2μV/°C RTI, ±10μV/°C RTO, after 60-minute warm-up
DC Gain Accuracy and Stability: ±0.1%; ±30ppm /°C
Linearity: ±0.02% of Full Scale
Common Mode Rejection (dc to 60Hz): >90dB
Common Mode Voltage range: ±12V typical

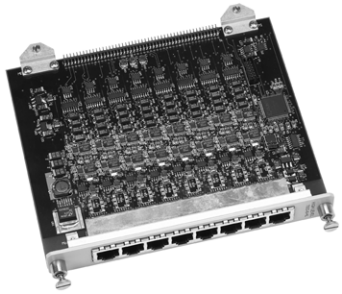
MEASUREMENT RANGE AND RESOLUTION:
Range: ±81.9mV
Resolution: 1°C minimum

ACCURACY:
±2°C

SIZE:
6.5 L x 6.5 W x 0.9 H in (165 x 165 x 23mm)

WEIGHT:
0.45lb (0.2kg)

HIGH LEVEL INPUT CARD



The Model 7003-8-HL High Level Input Card is used in conjunction with the Model 7003-8-A-I Analog Input Card to perform signal conditioning and excitation for high level (±10V) inputs.

CHANNELS:
Eight per card

INPUTS:
Differential
Input Impedance: 220MΩ nominal each input
Input Bias Current: ±0.5nA typical (±2nA max.)

INPUT CONNECTOR:
Eight-pin RJ-45

AMPLIFIER:
Zero Temperature Stability: ±2μV/°C RTI, typical, ±10μV/°C RTO, after 60-minute warm-up
DC Gain Accuracy and Stability: ±0.1%; ±30ppm /°C
Linearity: ±0.02% of Full Scale
Common-Mode Rejection (dc to 60 Hz): >90dB
Common-Mode Voltage Range: ±12V typical

MEASUREMENT RANGES AND RESOLUTION:
Range: ±10V
Resolution: 100μV effective

EXCITATION:
Selection: Software controlled
Bipolar range: 0 to ±12Vdc (24Vdc total)
Unipolar range: 0 to +12Vdc
Accuracy: ±0.1% of full scale using remote sense
Current: 50mA max. Over-current/over-temperature protected
Load Regulation: <0.05% of full scale (bipolar mode) for a load variation of 10% to 100% of full scale load (with remote sense)
Temperature Stability: Better than ±30ppm/°C

DIMENSIONS:
6.5 L x 6.5 W x 0.9 H in (165 x 165 x 23mm)

WEIGHT:
0.45lb (0.2kg)

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LVDT CARD

The Model 7003-8-LVDT is used in conjunction with the Model 7003-8-A-I Analog Input Card to perform signal conditioning, polarity demodulation and AC excitation for transformer type transducers.

CHANNELS: Eight per card

INPUTS:
Six-, five-, four- and three-wire transducers
Input Impedance: 220MΩ nominal each input with 0.001µF parallel to both inputs
Input Bias Current: ±0.5nA typical (±2nA max.)

INPUT CONNECTOR:
Eight-pin RJ-45

AMPLIFIER:
Zero Temperature Stability: ±2µV/°C RTI, typical, ±10µV/°C RTO, after 60-minute warm-up
DC Gain Accuracy and Stability: ±0.25%, ±30ppm /°C
Common-Mode Rejection (dc to 60 Hz): >90dB
Common-Mode Voltage Range: ±12V typical

POST DEMODULATOR FILTER:
Type: Low-Pass
Frequency: 1.0kHz @ -3dB
Number of Poles: Six
Topology: Butterworth

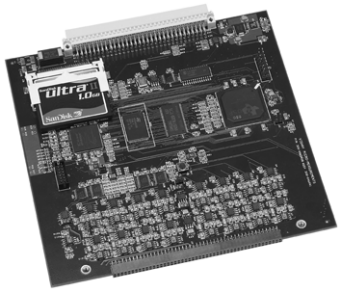
MEASUREMENT RANGE AND RESOLUTION:
Range: ±5Vrms
Resolution: 50µVrms effective

EXCITATION:
Selection: Software controlled
Frequency: 2500, 5000, or 10000Hz sine wave
Amplitude: 3Vrms
Accuracy: ±0.5% of full scale typical
Current: 50mA max. Over-current/over-temperature protected
Load Regulation: <0.1% of full scale for a load variation of 10% to 100% of full scale load
Temperature Stability: Better than ±0.05%/°C

SIZE:
6.5 L x 6.5 W x 0.9 H in (165 x 165 x 23mm)

WEIGHT:
0.45lb (0.2kg)

ANALOG INPUT CARD



The Model 7003-8-A-I Analog Input Card performs the analog anti-alias filtering, analog-to-digital conversion and data storage for the System. The Model 7003-8-A-I is used in conjunction with a Sensor Input Card, which performs the sensor-specific analog conditioning.

The Model 7003-8-A-I consists of eight dedicated 3-pole constant delay analog anti-alias filters, eight fully synchronized, 24 bit analog-to-digital converters operating at 40k samples/second/channel, a dedicated digital signal processor to perform scaling and digital filtering, a pretrigger buffer with a capacity of over one-half million samples per channel, and 1GB of CompactFlash® memory for data storage.

CHANNELS:
Eight per card

A/D CONVERTER:
Quantity: Eight (one per channel)
Architecture: Sigma-delta
Resolution: 24 bits
Conversion Rate:
Radix-10: 40k samples/second/channel
Radix-2: 40.96k samples/second/channel

DATA RECORDING RATES:
2048, 1024, 512, 256, 128, or 64 samples/second/channel (radix-2)
2000, 1000, 500, 200, 100, or 10 samples/second/channel (radix-10)

PRE-TRIGGER BUFFER:
Type: SDRAM, firmware-controlled
Depth: 645,276 samples/channel

ANALOG ANTI-ALIAS FILTER:
Type: Low-pass
Frequency: 3.5kHz @-3dB
Number of Poles: Three
Topology: GIC, constant delay

PROCESSOR:
Type: 32-bit floating point digital signal processor
250MHz operating frequency

RAM:
Type: SDRAM
Size: 64MB

PROGRAM AND CALIBRATION DATA STORAGE:
Type: Flash Memory
Size: 1MB

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DATA STORAGE:
Type: Sandisk Ultra-Series II® CompactFlash
Quantity: One per card
Capacity: 1GB supplied. Removable

SIZE:
6.8 L x 6.5 W x 0.7 H in (173 x 165 x 18mm)

WEIGHT: 0.35lb (0.16kg)

Disclaimer

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

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