

System 7100 – Data Acquisition System

FEATURES

- Stable, accurate, low-noise signal conditioning
- 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
- Scalable synchronized system (using multiple scanners)
- Maximum scan rate of 2000 samples per second (Radix-10).
- 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 with DHCP addressing

DESCRIPTION

Micro-Measurements System 7100 builds upon the years of experience gained since the introduction of Systems 4000, 5000, 6000 and 7000 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 7100 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 5U height, 19-inch rack mountable scanner (7100-128-SM). A 32-channel scanner is also available (7100-32-SM). The Ethernet interface with DHCP addressing allows flexible positioning of scanners, and multiple scanners can easily be synchronized using a single sync cable (maximum length 100 feet).


System 7100 is a high performance data acquisition system. Each sensor channel employs a 24-bit analog-to-digital converter. Scan rates up to 2000 updates 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 scanner module has high-capacity non-volatile 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 7100 is capable of self-calibration with a removable calibration reference (7100-SM-VC). Calibration can be performed anywhere and there is no need to return the entire system to the factory for calibration. Downtime while waiting for calibration is essentially eliminated. Input connectors are RJ45 type (except for the TC card) and assembly time is fast using simple cable crimping tools. Individual scanners can be separated and located near sensors to reduce sensor signal loss and cabling costs. Micro-Measurements StrainSmart® software is optimal for configuring, controlling, and acquiring data from the System 7100. It allows quick and intuitive channels and sensors setup, operation modes, displays and views.

System 7100 – Data Acquisition System

128-CHANNELS SCANNER SPECIFICATIONS	
	<p>Model 7100-128-SM Scanner houses and retains up to 16 input cards, regulates power to the cards, establishes and maintains communication between the Ethernet interface and the input cards, synchronizes the analog-to-digital converters in the system, and provides visual status information to the operator.</p>
Parameter	Value
Capacity	Up to 16 input cards, 8 channels each, maximum 128 channels per scanner
Installation	Rack-mount (19-inch) or bench-top
Front panel	Incorporates power switch and four status LEDs
Input Power	11-32 VDC, 40 A max.
Power Indication	Green LED (illuminated when power is on)
Ethernet Interface	802.3z Gigabit Ethernet
Processor	Cortex-A8, 32 bit, RISC
Memory	512 MB DDR3
System Synchronization	
Connections	Sync In, Sync Out
Topology	Daisy-chain
Cable Connection	RJ45, Category 5
Max. Distance	100 ft
System Calibration Reference	
Drift	1.9 ppm/°C ±0.6 μV/°C typical, 9.4 ppm/°C ±2.1 μV/°C maximum
Resolution	150 μV nominal
Voltage Range	±5 V
Dimensions	9.25 H x 17.3 W x 13.8 D inches (235 x 440 x 351 mm)
Weight	18.2 lb (8.25 kg)

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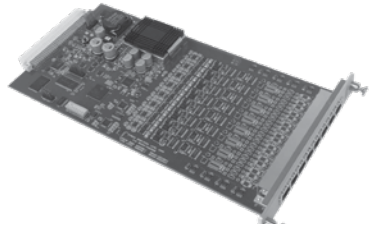
32-CHANNELS SCANNER SPECIFICATIONS



Model 7100-32-SM Scanner houses and retains up to 4 input cards, regulates power to the cards, establishes and maintains communication between the Ethernet interface and the input cards, synchronizes the analog-to-digital converters in the system, and provides visual status information to the operator.

Parameter	Value
Capacity	Up to 4 input cards, 8 channels each, maximum 32 channels per scanner
Installation	Bench-top
Front panel	Incorporates power switch and four status LEDs
Input Power	11–32 VDC, 12 A max.
Power Indication	Green LED (illuminated when power is on)
Ethernet Interface	802.3z Gigabit Ethernet
Processor	Cortex-A8, 32 bit, RISC
Memory	512 MB DDR3
System Synchronization	
Connections	Sync In, Sync Out
Topology	Daisy-chain
Cable Connection	RJ45, Category 5
Max. Distance	100 ft
System Calibration Reference	
Drift	1.9 ppm/°C ±0.6 µV/°C typical, 9.4 ppm/°C ±2.1 µV/°C maximum
Resolution	150 µV nominal
Voltage Range	±5 V
Dimensions	9.1 H x 5.9 W x 13.9 D inches (231 x 150 x 352 mm)
Weight	10.1 lb (4.6 kg)

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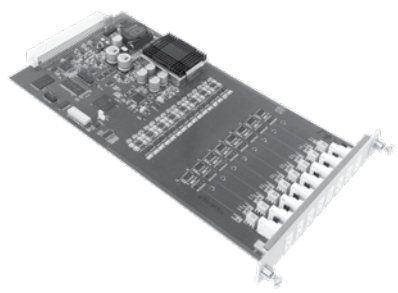
STRAIN GAGE INPUT CARDS			
			<p>Strain Gage Input Cards accomplish bridge excitation, bridge completion, shunt calibration, and signal conditioning for eight quarter-, half- and full-bridges.</p>
Parameter	Value		
Channels	Eight per card		
Inputs	Software selectable for S+/S-, VCAL+/VCAL-, or excitation		
Strain Gage	120 Ω , 350 Ω , 1000 Ω quarter-bridges; 60 Ω to 5000 Ω half- and full-bridges		
Sample rate	2000, 1000, 500, 200, 100, and 10 samples/second		
Input Impedance	220 M Ω nominal each input		
Source Current	± 5 nA per volt excitation		
Measurement Range and Resolution			
Resolution	0.5 $\mu\epsilon$ (GF=2)		
Range	Total range depends on excitation setting (see table below):		
	Excitation (Volts)	Measuring Range	
		$\mu\epsilon$ @ GF=2	mV/V
	0	77,500*	19*
	0.25	310,000	155
	0.5	155,000	77
	0.75	103,000	51
	1	77,000	38
	2	38,000	19
	3	25,000	12
	4	77,000	38
	5	62,000	31
	6	51,000	25
7	44,000	22	
8	38,000	19	
9	34,000	17	
10	31,000	15	
Input Connector	Eight-pin RJ45 (Amp type 554739 or equivalent)		
Amplifier			
Zero Temperature Stability	± 1 $\mu\text{V}/^\circ\text{C}$ RTI, after 60-minute warm-up		
DC Gain Accuracy and Stability	$\pm 0.1\%$; ± 50 ppm/ $^\circ\text{C}$ (1 year without periodic VCAL)		
Analog Input (Including Full-Scale Balance)			
Low Range	± 38 mV		
High Range	± 155 mV		
Linearity	$\pm 0.02\%$ of Full Scale		
Common-Mode Rejection	> 90 dB (DC to 60 Hz)		
Common-Mode Voltage Range	± 12 V typical		

*Based on 1 volt excitation

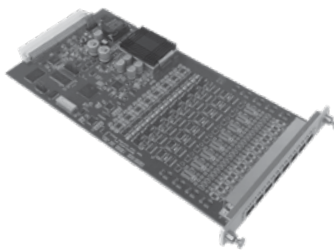
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STRAIN GAGE INPUT CARDS (cont.)	
Parameter	Value
Balance	
Type	Software (mathematical)
Range	Full ADC range
Excitation	
Selection	Firmware controlled per channel
Resolution	3 mV
Accuracy	±10 mV typical (Firmware measures excitation variations during arming process)
Current	50 mA 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	±10 ppm/°C
Quarter-Bridge Completion	
Selection	Firmware controlled
Accuracy and Drift	120 Ω and 350 Ω: ±0.01%, 5 ppm/°C max.; 1 kΩ: ±0.01%, 4.5 ppm/°C max. (socketed)
Shunt Calibration	
Selection	Firmware controlled
Configuration	Internal QB: P- to D120, P- to D350, P- to D1000 External: Switched shunt at Input Connector (Ra, Rb)
Standard Factory Installed resistors values (Simulates 10,000 µε @ GF=2.0)	5,940 Ω ± 0.1%: shunts P- to D120 17,325 Ω ± 0.1%: shunts P- to D350 49,500 Ω ± 0.1%: shunts P- to D1000 17,325 Ω ± 0.1%: external shunt Ra to Rb
Sockets	Tin-plated
System Calibration	Firmware controlled
Calibration voltage	Supplied by Model 7100-SM-VC voltage calibration card
Type	Ten point calibration, 100 samples per point
Dimensions	6.5 H x 1.0 W x 12.5 D in (165 x 25.4 x 318 mm)
Weight	0.9 lb (0.4 kg)

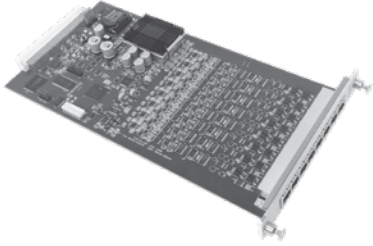
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THERMOCOUPLE INPUT CARD	
	<p>Model 7100-8-TC Thermocouple Input Card is used to perform signal conditioning and cold-junction compensation.</p>
Parameter	Value
Channels	Eight per card
Inputs	
Supported Thermocouple Types	J, K, T, E, N, R, S, B
Cold-Junction Compensation, Software-Selectable – Open-Sensor Detection	
Input Impedance	22 MΩ nominal each input
Input Connectors	mini-TC
Sample rate	2000, 1000, 500, 200, 100, and 10 samples/second
Amplifier	
Zero Temperature Stability	±2 μV/°C RTI, ±10 μV/°C RTO, after 60-minute warm-up
DC Gain Accuracy and Stability	±0.1%; ±30 ppm /°C
Linearity	±0.02% of Full Scale
Common Mode Rejection (DC to 60 Hz)	>90 dB
Common Mode Voltage Range	±12V typical
Measurement Range and Resolution	Range: ±77.5 mV Resolution: 1°C minimum
Accuracy	±2°C
Dimensions	6.5 H x 1.0 W x 12.5 D in (165 x 25.4 x 318 mm)
Weight	0.9 lb (0.4 kg)

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HIGH LEVEL INPUT CARD	
	<p>Model 7100-8-HL High Level Input Card is used to perform signal conditioning and excitation for high level ($\pm 10V$) inputs.</p>
Parameter	Value
Channels	Eight per card
Inputs Differential	
Input Impedance	220 M Ω nominal each input
Input Bias Current	± 0.5 nA typical (± 2 nA max.)
Input Connector	Eight-pin RJ45
Sample rate	2000, 1000, 500, 200, 100, and 10 samples/second
Amplifier	
Zero Temperature Stability	± 2 $\mu V/^{\circ}C$ RTI, typical, ± 10 $\mu V/^{\circ}C$ RTO, after 60-minute warm-up
DC Gain Accuracy and Stability	$\pm 0.1\%$; ± 30 ppm / $^{\circ}C$
Linearity	$\pm 0.02\%$ of Full Scale
Common-Mode Rejection (DC to 60 Hz)	>90 dB
Common-Mode Voltage Range	± 12 V typical
Measurement Ranges and Resolution	Range: ± 10 V Resolution: 100 μV effective
Excitation	
Firmware controlled settable per channel	
Unipolar Mode	
Range	0 to +11.997 VDC
Accuracy	± 10 mV typical
Current	50 mA max. Over-current/over-temperature protected
Load Regulation	<0.05% of full scale (unipolar mode) for a load variation of 10% to 100% of full scale loads (with remote sense)
Temperature Stability	Better than ± 30 ppm/ $^{\circ}C$
Bipolar Mode	
Range	± 12 VDC (24 VDC total)
Accuracy	$\pm 5\%$ of full scale
Dimensions	6.5 H x 1.0 W x 12.5 D in (165 x 25.4 x 318 mm)
Weight:	0.9 lb (0.4 kg)

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LVDT CARD	
	<p>Model 7100-8-LVDT is used to perform signal conditioning, polarity demodulation and AC excitation for transformer-type transducers.</p>
Parameter	Value
Channels	Eight per card
Inputs – Six-, Five-, Four- and Three-Wire Transducers	
Input Impedance	220 MΩ nominal each input with 0.001 μF parallel to both inputs
Input Bias Current	±0.5 nA typical (±2 nA max.)
Input Connector	Eight-pin RJ45
Sample rate	2000, 1000, 500, 200, 100, and 10 samples/second
Amplifier	
Zero Temperature Stability	±2 μV/°C RTI, typical, ±10 μV/°C RTO, after 60-minute warm-up
DC Gain Accuracy and Stability	±0.25%, ±30 ppm/°C
Common-Mode Rejection (DC to 60 Hz)	>80 dB
Common-Mode Voltage Range	±12 V typical
Post Demodulator Filter	1.0 kHz @ -3 dB
Measurement Range and Resolution	Range: ±5 VRMS Resolution: 50 μVRMS effective
Excitation	Firmware Controlled Per Card
Frequency	2500, 5000, or 10000 Hz sine wave
Amplitude	3 VRMS
Accuracy	±0.5% of full scale typical @ 2500 Hz; ±1.0% @ 5000 or 10000 Hz
Current	50 mA 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
Dimensions	6.5 H x 1.0 W x 12.5 D in (165 x 25.4 x 318 mm)
Weight	0.9 lb (0.4 kg)

STRAINSMART® 7100 - DATA ACQUISITION SYSTEM SOFTWARE

It is strongly recommended that StrainSmart® 7100 Software be installed on a Windows-based personal computer for data acquisition, reduction, display, and storage.

MINIMUM PC REQUIREMENTS:

- Windows 7, 64-bit
- Quad (4) Core i5 processor
- 8 GB RAM



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