Model 8000 – Data Acquisition System

FEATURES

- Eight software-selectable input channels
- Up to 16 scanners can be used concurrently
- Supported inputs include:
  - o Strain gage (quarter, half, and full bridges)
  - o Strain-gage-based transducer
  - o High-level voltage signal
  - o Thermocouples
- RJ45 input connectors for each input channel
- Scanning rates are 1000, 500, 200, 100, and 10 samples/second
- Compact size and ruggedized enclosure
- Ethernet network architecture
- Optional self-calibration functionality available

DESCRIPTION

System 8000 from Micro-Measurements is a versatile, precision data acquisition instrument system intended for static and dynamic test and measurement applications.

The system includes a scanner with 8 channels of data acquisition. A 10-ft crossover Ethernet cable is also included. The scanners may be used separately or up to 16 scanners can be used concurrently for a maximum of 128 channels.

Each channel can be configured, via software, to accept signals from strain gages or strain-gage-based transducers, thermocouples, or high level voltage sensors. Strain gage channels accept quarter, half, or full bridge configurations and have the required bridge completion components for 120, 350, and 1000 Ω bridges. Each scanner operates independently; multiple scanners are not synchronized.

The data is processed in a modern 24-bit digital signal processor and filtering is performed using Finite Impulse Response (FIR), multi-stage filters. This provides excellent noise rejection and stability and unsurpassed measurement accuracy.

The Model 8000-8-SM Scanner communicates with a host personal computer (PC) via an Ethernet connection. Micro-Measurements StrainSmart® software is optimal for configuring, controlling, and acquiring data from the System 8000. A Programmer's Reference Kit provides documentation, programming examples, and instrument drivers to assist with custom software development.

SUPPORTED SENSORS

Each channel can be defined, via software, to be one of the following sensor types:

- Strain gage (quarter, half, and full bridges)
- Strain-gage-based transducer
- High-level voltage signal
- Thermocouples

SAMPLING

All channels in each scanner are sampled simultaneously. Each channel's 24-bit analog-to-digital converter over-samples data at a rate of 128k samples/second, and provides high quality, low noise data (without the need for signal averaging) at rates up to 1000 samples/second/channel.

SCANNING RATES

The system provides numerous scan rates and Finite Impulse Response (FIR) filters are automatically selected to provide suitable filtering at each rate to avoid aliasing. Sampling rates for the Model 8000-8-SM are 1000, 500, 200, 100, and 10 samples/second.

COMPACT, RUGGEDIZED ENCLOSURE

The Model 8000-8-SM has 8 channels in a 1U (1.72 inch) height aluminium-alloy enclosure for durability. A rack mount kit is also available.

RJ45 INPUT CONNECTORS

Each channel input connector is RJ45.

RELAY OUTPUT

A relay output is provided to control external hardware.

ETHERNET NETWORK ARCHITECTURE

The system communicates over an IEEE-802.3u 100Base-TX or an IEEE-802.3 10Base-T Ethernet Network. The firmware uses separate command and data ports and employs a reliable TCP-based protocol to prevent data loss.

DC OPERATION

Model 8000 operates on 11-32 VDC power. This can be from the included power supply or by using a separate AC-to-DC converter or DC supply such as a battery.

MODEL 8000-8-SM POWER SOURCE

The Model 8000 is a DC-powered instrument. The system accommodates DC input voltages from 11 to 32 volts. The included power supply provides the required AC-to-DC conversion and up to 26 watts of power to the system. An alternate DC power source can be used provided that it

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supplies enough power to meet the system and excitation power requirements. The total system power requirements are highly dependent upon the power requirements of the bridge excitation circuitry. At a minimum, the instrument requires approximately 17 watts of power. A fully loaded instrument employing the maximum excitation current requires up to 26 watts of power.

ENCLOSURE

The Model 8000-8-SM enclosure is constructed of aluminum alloy. The enclosure is designed to provide strength, durability, and to minimize RF emissions and susceptibility.

A123 SYSTEM VOLTAGE CALIBRATION CARD (OPTIONAL)

The Micro-Measurements A123 System Voltage Calibration (VCAL) Card is available as an accessory and provides the ability to perform a system-level calibration of the entire measurement circuit without the need to return the system to the manufacturer or metrology lab. The gain and offset of each channel can be calibrated. The A123 is calibrated at the factory to NIST-traceable standards and does not need to be present in the system during normal operation. A benefit of on-board system calibration is the ability to calibrate the system under the actual operating conditions, thereby minimizing errors due to environmental conditions.

SPECIFICATIONS

All specifications are nominal or typical at +23°C unless noted.

MODEL 8000-8-SM – SCANNER

For CE compliance, Micro-Measurements recommends that all cables be limited to 30 meters in length.

PARAMETER	SPECIFICATION
GENERAL	
ENVIRONMENTAL	
Temperature:	0° to +50°C
Humidity:	Up to 90%, non-condensing
ENCLOSURE	
Material:	A356-T6 aluminum casting
CONFIGURATIONS:	Bench-top, stackable, rack-mountable
POWER	
Input:	10-32 VDC, 5A max.
Power Switch:	Rocker switch with green LED to indicate power on
RELAY	
Configuration	One NO and NC, 500 mA relay contact
COMMUNICATION	IEEE 802.3 10Base-T, 802.3u 100Base-TX, half- and full-duplex, auto-detect.
SIZE	1.72 H (1.96 with feet) x 11.0 W x 10.18 D (10.55 including power connector) inches (43.68 (49.78 with feet) x 279.4 x 258.66 mm)
WEIGHT	3.85 lbs (1.75 kg)

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PARAMETER	SPECIFICATION
ANALOG CHANNELS	Eight, differential inputs
A/D CONVERTER	Eight (one per channel)
Architecture:	Delta-Sigma (ΔΣ)
Resolution:	24 bits
Oversampling Rate:	128k samples/second/channel (max)
DATA RATES	1000, 500, 200, 100, or 10 samples/second/channel
ANALOG ANTI-ALIAS FILTER	
Type:	Low-pass
Cutoff Frequency:	500 Hz @ –3 dB
Number of Poles:	One
Topology:	Low pass RC
DIGITAL FILTERS	
Type	Two-stage Finite Impulse Response (FIR)

*f*user (Hz)	*F*pass (Hz)	Passband Peak-Peak Ripple (dB)	Stopband Attenuation (dB)
1000	360	0.01	-70
500	200	0.01	-80
200	80	0.01	-80
100	35	0.01	-70
10	3.5	0.01	-66

PROCESSOR	
Type	32-bit floating point Digital Signal Processor, 300 MHz
RAM	
Type:	SDRAM
Capacity:	32 MB
FLASH Memory	
Type:	Serial NOR
Capacity:	1MB (user)
SYSTEM CALIBRATION	Firmware-controlled. Calibration Voltage Supplied by Model A123 voltage calibration card.
Type:	Multi-point, ≥100 samples per point
STRAIN GAGE INPUTS	Up to 8 per scanner
INPUTS	Software selectable for S+/S-, Vcal+/Vcal-, or excitation
Strain Gage:	120, 350, 1000 Ω quarter-bridges; 60 to 5000 Ω half and full bridges
Input Impedance:	220 MΩ nominal each input
Source Current:	±5 nA per volt excitation
MEASUREMENT RANGE AND RESOLUTION	
Resolution:	0.5 με @ GF=2 (0.25 μV/V)
Range:	Depends upon excitation setting

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PARAMETER	SPECIFICATION		
	Excitation (V)	Typical Measuring Range includes Imbalance	
		±με @ GF=2	±mV/V
	0	77500*	19*
	0.25	310000	155
	0.5	155000	77
	0.75	103000	51
	1	77000	38
	2	3800	19
	3	25000	12
	4	77000	38
	5	62000	31
	6	51000	25
	7	44000	22
	8	38000	19
	9	34000	17
	10	31000	15
	*NOTE: Range calculations at zero volts excitation are based upon 1 volt excitation, and are typically used for the quantification of self-generating noise		
INPUT CONNECTOR	RJ45		
AMPLIFIER			
Zero Temperature Stability:	±1 µV/°C RTI, after 60-minute warm-up		
DC Gain Accuracy and Stability:	±0.05%; ±50 ppm/°C (1 year without periodic VCAL)		
Analog Input (including Full-Scale balance):			
Low Range:	±38 mV		
High Range:	±155 mV		
Linearity:	±0.02% of full scale		
Common-Mode Rejection:	>90 dB (DC to 60 Hz)		
Common-Mode Voltage Range:	±12 V typical		
BALANCE			
Type:	Software (mathematical)		
Range:	Full ADC range (actual balance level shifts dynamic measurement range 1:1)		
EXCITATION			
Selection:	Software controlled		
Unipolar:	0 to +10 VDC		
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 loads with remote sense		

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PARAMETER	SPECIFICATION
Temperature Stability:	±10 ppm/°C
QUARTER-BRIDGE COMPLETION	
Selection:	Firmware-controlled
Accuracy and drift:	120 Ω and 350 Ω: ±0.01%, 2.8 ppm/°C max. 1 kΩ: ±0.01%, 1.6 ppm/°C max. (Socketed)
SHUNT CALIBRATION	
Selection:	Firmware-controlled
Configuration:	Shunt calibration across each dummy resistor to simulate 10000 με (±0.1%).
Sockets:	Tin-plated
Levels:	Simulates 10000 με @ GF = 2.0
Values:	P- to D120: 59400 ±0.1% P- to D350: 173250 ±0.1% P- to D1000: 495000 ±0.1%
THERMOCOUPLE INPUTS	Up to 8 per scanner
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	RJ45
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:	±12 V typical
MEASUREMENT RANGE AND RESOLUTION	
Range:	±77.5 mV
Resolution:	1°C minimum
ACCURACY	±2°C (nominal)
HIGH-LEVEL INPUTS	Up to 8 per scanner
INPUTS	Differential
Input Impedance:	220 MΩ nominal each input
Input Bias Current:	±0.5 nA typical (±2 nA max.)
INPUT CONNECTOR	RJ45
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:	±12 V typical

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PARAMETER	SPECIFICATION
MEASUREMENT RANGE AND RESOLUTION	
Range:	±10 V
Resolution:	100 µV effective
EXCITATION	
Selection:	Software controlled
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/°C
Bipolar Mode:	
Range:	±12 VDC (24 VDC total)
Accuracy:	±5% of full scale
ACCURACY	±100 ppm repeatability, typical ±250 ppm repeatability, maximum
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

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