SCM9B-D13x

CE

DIN-rail Mount Sensor-to-computer Thermocouple-input Module

DESCRIPTION

The SCM9B-D100 sensor-to-computer modules are a family of data acquisition modules that convert analog input signals to digital data and transmit via RS-485 to a controller which may be a computer or other processor-based equipment. The modules can measure temperature, pressure, voltage, current, digital input or digital output signals. The modules provide direct connection to a wide variety of sensors and perform all signal conditioning, scaling, linearization and conversion to either linearized ASCII data values or Modbus RTU data values.

Features such as address, data rate, parity, echo, etc., are selectable using simple commands over the RS-485 port. The selections are stored in nonvolatile EEPROM which maintains data even after power is removed.

Data is acquired on a per channel basis so you only buy as many channels as you need. The modules can be mixed and matched to fit your application. They can be placed remote from the host and from each other. You can string up to 247 modules on a twisted pair of wires by using RS-485 with repeaters.

All modules are supplied with screw terminal plug connectors. The connectors allow system expansion, reconfiguration or repair without disturbing field wiring.

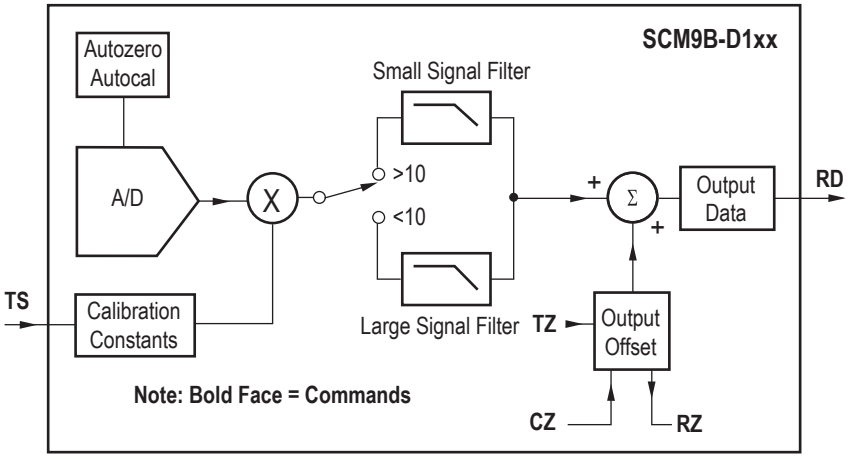
Utility software is available from Dataforth to make the D100 easier to learn and use. The software is provided at no charge on request with a purchase order and is not copy protected.

FEATURES

- Complete Sensor to RS-485 Interface
- 500Vrms Analog Input Isolation
- 15-bit Measurement Resolution
- Continuous Self-calibration; No Adjustments of Any Kind
- Programmable Digital Filter
- Requires +5VDC Supply
- Transient Suppression on RS-485 Communications Lines
- Screw Terminal Plug Connectors Supplied
- CE Compliant

Specifications

Module	SCM9B-D134
Thermocouple Type	E
Output Range	RS-485
Input Temperature Range	–100 to 1000°C
Mechanical Format	DIN-rail
Isolation Voltage	500Vrms
Isolation Type	Transformer/Optical 2-way
Accuracy	±1°C (max)
Supply Voltage	+5VDC ±5%
Input Voltage Withstand	250VAC
Gain/Offset Adjust	Autozero, Autocal
Module Bandwidth	N/A
NMR (60 Hz) Rejection	N/A
External I-to-V Resistor	N/A
Output Control	RS-485
Output Resistance	N/A
Dimensions	3.40 x 3.30 x 1.00 Inches
Interface	10 Pos Term Block
Customization	No
Weight	103 Grams (3.63 ounces)



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SCM9B-D134 Block Diagram - For Module Dimensions and Pinouts, See Page 5-26

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Theory of Operation

Each Dataforth module is a complete single-channel data acquisition system. Each unit contains an analog signal conditioning circuit optimized for a specific input type. Sensor signals are converted to digital data with a microprocessor-controlled integrating A/D converter. Offset and gain errors in the analog circuitry are continuously monitored and corrected using microprocessor techniques. The D100 converts the digital signal data and stores the resultant data in a memory buffer. The modules continuously convert data at the rate of 8 conversions per second and store the latest result in the buffer.

Host procesors may request data by sending a query to the module. The D100 will instantly respond by communicating the memory buffer data back to the host processor. Up to 247 modules may be linked to a single RS-485 port. Each module on a serial line is identified by a unique user-programmable address. This addressing technique allow modules to be interrogated in any order.

Digital Inputs/Outputs

D170 digital input/output modules contain open-collector transistor switches that may be controlled by the host processors. These switches may be used to control solid-state relays which in turn may control heaters, pumps, and other power equipment. The digital input may be read by the host processor and used to sense the state of remote digital signals. They are ideal for sensing the state of limit or safety switches.

Digital Filter

The D100 analog input modules include two unique programmable, single-pole digital filters. The filter is used to smooth analog data in noisy environments. Separate time constraints may be specified for small and large signal changes. Typically, a large time constant is specified for small signal changes to filter out noise and provide stable output readings. A smaller time constant may be chosen for large signal changes to provide fast response to such changes.

Command Set

The D100 series uses the Modbus RTU or the Dataforth ASCII protocol for communication.

The Modbus RTU binary protocol uses a master-slave technique, in which only the master device can initiate transactions. The slave devices respond by supplying the requested data to the master or by taking the action requested in the query. The master can address any slave device. The returned messages are considered response messages. The supported master codes are:

Modbus RTU Function and Descriptions

01	Read Coil Status (Digital Inputs)
04	Read Input Register (Analog Inputs)
05	Force Single Coil (One Digital Input)
06	Preset Single Register (Dataforth/RTU Protocol)
15	Force Multiple Coils (Multiple Digital Output)

The Dataforth ASCII protocol is a comment and response protocol using ASCII characters for easy troubleshooting and interpretation of data values.

D100 Series ASCII Command Set

Command and Definition		Typical Command Message ($ prompt)	Typical Response Message
DI	Digital input	$1DI	*0003
DO	Digital Output	$1DOFF	*
RD	Read Data	$1RD	*+00072.00
RS	Read Setup	$1RS	*31070142
RSU	Read Setup	$1RSU	*31070142
RZ	Read Zero	$1RZ	*+00000.00
WE	Write Enable	$1WE	*
Write Protect Commands			
CZ	Clear Zero	$1CZ	*
RR	Remote Reset	$1RR	*
SU	Setup Module	$1SU31070142	*
TS	Trim Span	$1TS+00600.00	*
TZ	Reim Zero	$1TZ+00000.00	*

Setup

The D100 series are initiated at the factory using the Dataforth ASCII protocol. This allows setup and configuration, including the Modbus device address, to be easily performed using the Dataforth setup software or a dumb terminal. Each D100 module must be properly configured before installation into a Modbus system.

Utility Software

Complimentary Utility Software is included with each purchase order. The software simplifies configuration of all user-selectable options such as device address, data range, and filtering constraints.

Process Control Software

Modbus RTU protocol is supported by virtually all commercial process control software.

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Specifications

Typical at T_A =+25°C and nominal power supply unless otherwise noted.

Analog
- Single channel analog input
- Maximum CMV, input to output at 60Hz: 500Vrms
- Leakage current, input to output at 115Vrms, 60Hz: <2µA rms
- 15-bit measurement resolution
- 8 conversions per second
- Autozero & autocalibration—no adjustment pots

Digital
- 8-bit CMOS microcomputer
- Digital scaling, linearization and calibration
- Nonvolatile memory eliminates pots and switches

Digital Filtering
- Small and large signal with user-selectable time constants from 0 to 16 seconds

Communications
- Communications in MODBUS-RTU via RS-485 ports
- Selectable data rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400bps
- NRZ asynchronous data format; 1 start bit, 8 data bits, 1 parity bit and 1 stop bit
- Parity: odd, even, none
- User selectable channel address
- Up to 247 multidrop modules per host serial port
- Communications distance up to 4,000 feet (RS-485)
- Transient suppression on RS-485 communications lines
- All communications setups stored in EEPROM

Power
- Requirements:Regulated +5VDC, 0.75W (max) (DIN-150, 2.0W (max))
- Protected against power supply reversals.

Environmental
- Temperature Range: Operating –25°C to +70°C
  Storage –25°C to +85°C
- Relative Humidity: 0 to 95% Noncondensing

D11x Voltage Inputs
- Voltages: ±10mV, ±100mV, ±1V, ±5V, ±10V, ±100VDC
- Resolution: 0.01% of FS (4 digits)
- Accuracy: ±0.02% of FS (max)
- Common mode rejection: 100dB at 50/60Hz
- Zero drift: ±1 count max (autozero)
- Span tempco: ±50ppm/°C (max)
- Input burnout protection to 250VAC
- Input impedance: ≤ ±1V input = 100MΩ (min)
  ≥±5V input = 1MΩ (min)

D125 Current Inputs
- Currents: 4-20mADC
- Resolution: 0.04% of FS
- Accuracy: 0.04% of FS
- Common mode rejection: 100dB at 50/60Hz
- Zero drift: ±1 count (max) (autozero)
- Span tempco: ±50ppm/°C (max)
- Voltage drop: ±0.1V (max)

D13x Thermocouple Inputs
- Thermocouple types: J, K, T, E, R, S, B, C (factory set)
- Ranges: J = –200°C to +760°CB = 0°C to +1820°C
  K = –150°C to +1250°CS = 0°C to +1750°C
  T = –200°C to +400°CR = 0°C to +1750°C
  E = –100°C to +1000°CC = 0°C to +2315°C
- Resolution: ±1°
- Overall Accuracy (error from all sources) from 0 to +40°C Ambient: ±1.0 °C (max) (J, K, T, E)
  ±2.5 °C (max) (R, S, B, C)(300°C to FS)
- Common-mode rejection: 100dB at 50/60Hz
- Input impedance: 100MΩ (min)
- Lead resistance effect: <20µV per 350Ω
- Open thermocouple indication
- Input burnout protection to 250VAC
- Overrange indication

D14x RTD Inputs
- RTD types:α = 0.00385, 0.00392,100Ω at 0°C,
  0.00388, 100Ω at 25°C
- Ranges: 0.00385 = –200°C to +850°C
  0.00392 = –200°C to +600°C
  0.00388 = –100°C to +125°C
- Accuracy: ±0.3°C
- Common-mode rejection: 100dB at 50/60Hz
- Input connections: 2-, 3-, or 4-wire
- Excitation current: 0.25mA
- Lead resistance effect: 3 wire - 2.5°C perΩ of imbalance
  4 wire - negligible
- Max lead resistance: 50Ω
- Input burnout protection to 120VAC
- Automatic linearization and lead compensation

D145 Thermistor Inputs
- Thermistor types: 2252Ω at 25°C, TD Series
- Ranges: 2252Ω = 0°C to +100°C
  TD = –40°C to +150°C
- Resolution: 2252Ω = 0.01°C or °F
  TD = 0.1°C or °F
- Accuracy: 2252Ω = ±0.1°C
  TD = ±0.2°C
- Common-mode rejection: 100dB at 50/60Hz
- Input burnout protection to 30VDC

D15x Bridge Inputs
- Voltage ranges:±30mV, ±100mV
- Resolution:10µV (mV Spans)
  0.02% of FS (V Span)
- Accuracy: ±0.05% of FS (max)
- Common-mode rejection: 100dB at 50/60Hz
- Input burnout protection to 30VDC
- Offset control: Full input range
- Excitation voltage: 5V, 10VDC, 50mA (max)
- Zero drift: ±1µV/°C (max)
- Span tempco: ±50ppm/°C (max)

D161 Frequency Inputs
- Range: 1Hz to 20kHz
- Resolution: 0.005% of reading +0.01Hz
- Accuracy: ±0.01% of reading ±0.01Hz
- Tempco: ±20ppm/°C
- Input impedance: 1MΩ
- Switching level: selectable 0V, +2.5V
- Hysteresis: adjustable 10mV-1.0V
- Input burnout protection: 250VAC

D17x Digital Inputs/Outputs
- 6 digital inputs or 6 digital outputs
- Input voltage levels: ±30V without damage
- Input switching levels: High, 3.5V (min), low,1.0V (max)
- Outputs: open collector to 30V, 100mA (max) load
- Vsat: 1.0V (max) at 100mA
- Inputs/Outputs are read/set in parallel
- Isolated from power supply ground

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Ordering Information – SCM9B-D13x

Part Number	Input Range	Output Range	Mechanical Format
Voltage Inputs			
SCM9B-D110	±10mV	RS-485	DIN-rail
SCM9B-D111	±100mV	RS-485	DIN-rail
SCM9B-D112	±1V	RS-485	DIN-rail
SCM9B-D113	±5V	RS-485	DIN-rail
SCM9B-D114	±10V	RS-485	DIN-rail
SCM9B-D115	±100V	RS-485	DIN-rail
Current Inputs			
SCM9B-D125	4-20mA	RS-485	DIN-rail
Thermocouple-inputs			
SCM9B-D131	J Thermocouple	RS-485	DIN-rail
SCM9B-D132	K Thermocouple	RS-485	DIN-rail
SCM9B-D133	T Thermocouple	RS-485	DIN-rail
SCM9B-D134	E Thermocouple	RS-485	DIN-rail
SCM9B-D135	R Thermocouple	RS-485	DIN-rail
SCM9B-D136	S Thermocouple	RS-485	DIN-rail
SCM9B-D137	B Thermocouple	RS-485	DIN-rail
SCM9B-D138	C Thermocouple	RS-485	DIN-rail
RTD/Thermistor Inputs			
SCM9B-D141	0.00385 RTD	RS-485	DIN-rail
SCM9B-D142	0.00392 RTD	RS-485	DIN-rail
SCM9B-D143	0.00388 RTD	RS-485	DIN-rail
SCM9B-D145	2252Ω Thermistor	RS-485	DIN-rail
SCM9B-D146	TD Thermistor	RS-485	DIN-rail
Timer/Frequency-inputs			
SCM9B-D161	Frequency	RS-485	DIN-rail

Part Number	Digital Input	Digital Output	RS Output	Mechanical Format
Digital Input/Outputs				
SCM9B-D171	6	0	RS-485	DIN-rail
SCM9B-D172	0	6	RS-485	DIN-rail

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