



## D5000M SERIES FOUR CHANNEL SENSOR TO COMPUTER INTERFACE MODULES



### D5000M FEATURES

- Four analog input channels.
- Complete sensor to RS-485 or RS-232 interface.
- Modbus RTU or DGH ASCII communications protocol.
- 500V rms analog input isolation.
- 15 bit measurement resolution.
- Continuous self-calibration; no adjustments of any kind.
- Programmable digital filter.
- Requires +10V to +30Vdc unregulated supply.
- Transient suppression on RS-485 communications lines.
- Screw terminal plug connectors supplied.
- CE marked.

### APPLICATIONS

- Process monitoring and control
- Remote data logging to any host computer
- Product testing
- Direct connection to modems
- Direct connection to PLC.

### GENERAL DESCRIPTION

The D5000M series are similar to the D5000 series but use the Modbus RTU protocol for communication. The modules convert four analog input signals to engineering units and transmit in ASCII format to any host with standard RS-485 or RS-232 ports. These modules can measure temperature, voltage and current. The modules provide direct connection to a wide variety of sensors and perform all signal conditioning, scaling, linearization and conversion to engineering units.

The modules contain no pots or switches to be set. Features such as address, baud rate, parity, echo, and scaling are selectable using simple commands over the communications port—without requiring access to the module. The selections are stored in nonvolatile EEPROM which maintains data even after power is removed.

## D5000M SPECIFICATIONS (typical at +25°C and nominal power supply unless otherwise noted)

### Analog

- Four channel analog input.
- Maximum CMV, input to output at 60Hz: 500V rms.
- Leakage I, input to output at 115Vrms, 60Hz: <math>2\mu\text{A}</math> rms.
- 15 bit measurement resolution.
- 8 conversions per second.
- Common mode rejection: 100dB at 50/60Hz.
- Autozero & autocalibration—no adjustment pots.

### Digital

- 8-bit CMOS microcomputer.
- Digital scaling, linearization and calibration.
- Nonvolatile memory eliminates pots and switches.
- Small and large signal digital filtering with user selectable time constants.

### Communications

- Communications in ASCII via RS-232C, RS-485 ports.
- Selectable baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200.
- NRZ asynchronous data format; 1 start bit, 7 data bits, 1 parity bit and 1 stop bit.
- Parity: odd, even, none.
- User selectable channel address.
- Modbus RTU or DGH ASCII communications protocol.
- 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.
- Communications error checking via checksum.
- All communications setups stored in EEPROM.

### Power

Requirements: Unregulated +10V to +30Vdc, 0.75W 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.

### Warranty

12 months on workmanship and material.

Specifications are subject to change without notice.

### D5100M Voltage Inputs

- Voltages:  $\pm 100\text{mV}$ ,  $\pm 1\text{V}$ ,  $\pm 5\text{V}$ ,  $\pm 10\text{V}$ ,  $\pm 100\text{Vdc}$ .
- Resolution: 0.01% of FS (4 digits).
- Accuracy:  $\pm 0.02\%$  of FS max.
- Zero drift:  $\pm 1$  count max (autozero).
- Span tempco:  $\pm 50\text{ppm}/^\circ\text{C}$  max.
- Input burnout protection to 250Vac.
- Input impedance:  $\leq \pm 1\text{V}$  input = 100M $\Omega$  min.  
 $\geq \pm 5\text{V}$  input = 1M $\Omega$  min.

### D5200M Current Input

- Current: 4-20mAdc.
- Resolution: 0.04% of FS.
- Accuracy: 0.04% of FS.
- Zero drift:  $\pm 1$  count max (autozero).
- Span tempco:  $\pm 50\text{ppm}/^\circ\text{C}$  max.
- Voltage drop: 1.0V max.

### D5300M Thermocouple Inputs

- Thermocouple types: J, K, T, E (factory set).
- Ranges: J = -200°C to +760°C    T = -200°C to +400°C  
K = -150°C to +1250°C    E = -100°C to +1000°C
- Resolution:  $\pm 1^\circ$ .
- Overall Accuracy (error from all sources) from 0 to +40°C ambient:  $\pm 1.0^\circ\text{C}$ .
- Input impedance: 100M $\Omega$  min.
- Lead resistance effect: <math>20\mu\text{V}</math> per 350 $\Omega$ .
- Open thermocouple and overrange indication.
- Input burnout protection to 250Vac.
- Automatic cold junction compensation and linearization.

### D5450M Thermistor Inputs

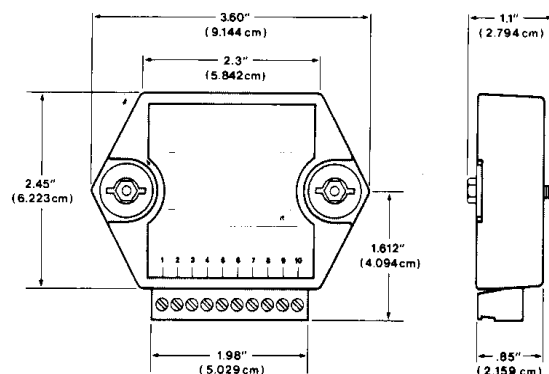
- Thermistor types: 2252 $\Omega$  at 25°C.
- Range: -0°C to +100°C.
- Resolution: 0.01°C or F.
- Accuracy:  $\pm 0.1^\circ\text{C}$ .
- Input protection to 30Vdc.

### D5000M Mechanicals and Dimensions

Case: ABS with captive hardware.

Connectors: Screw terminal barrier plug (supplied).

Replace with Phoenix MSTB 1.5/10 ST 5.08 or equivalent.



**NOTE:** Spacing for mounting screws = 2.700" (6.858 cm).  
Screw threads are 6 X 32.

## General Description (Continued)

The key to the DGH product concept is that the modules are easy to use. You do not need engineering experience in complicated data acquisition hardware. With the DGH modules, anyone familiar with a personal computer can construct a data acquisition system. This modular approach to data acquisition is very flexible, easy to use and cost effective. The modules can be mixed and matched to fit your application. They can be placed remote from the host and from each other.

The D5000M series is completely hardware and software-compatible with the DGH D1000, D2000, D3000 and D4000 series and may be mixed in any combination.

All modules are supplied with removeable screw-terminal connectors and captive mounting hardware. The connectors allow system expansion, reconfiguration or repair without disturbing field wiring.

## THEORY OF OPERATION

D5000M modules are complete four-channel data acquisition systems. Each unit contains analog signal conditioning circuits optimized for a specific input type. The amplified 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 D5000M converts the digital signal data into engineering units using look-up tables. The resultant data is stored in ASCII format 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 processors may request data by sending a query to the module. The D5000M 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 or one module to a RS-232C port. Each module on a serial line is identified by a unique user-programmable address. This addressing technique allows modules to be interrogated in any order.

## DIGITAL FILTER

The D5000M options include a unique programmable single pole digital filter. The filter is used to smooth analog data in noisy environments. Separate time constants 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.

## COMMUNICATIONS

The D5000M are designed to be easy to interface to all popular computers and terminals. All communications to and from the module are performed with printable ASCII characters. This allows the information to be processed

with string functions common to most high-level languages such as BASIC. For computers that support standard ports such as RS-232, no special machine language software drivers are necessary for operation. The modules can also be connected to auto-answer modems for long-distance operation without the need for a remote supervisory computer. The ASCII format makes system debugging easy with a dumb terminal.

Because the Modbus protocol does not support echoing D5000M RS-232 modules may not be daisy-chained. This limits you to one four-channel module per RS-232 port.

RS-485 was developed for multidropped systems that can communicate at high data rates over long distances. RS-485 receivers can handle common mode voltages from -7 to +12V without loss of data, making them ideal for transmission over great distances. Since an RS-485 system cannot transmit and receive at the same time it is a half-duplex system. For systems requiring many modules, high speed or long distances RS-485 is recommended.

## COMMAND SET

The D5000M series uses the Modbus RTU or the DGH 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 Functions and Descriptions

- 04 Read Input Register (Analog Inputs)
- 06 Preset Single Register (DGH/RTU Protocol)

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

## D5000M Series ASCII Command Set.

Command and Definition	Typical Command Message (\$ prompt)	Typical Response Message
MBD Modbus Disable	\$1MBD	*
RD Read Data	\$1RD	*+00072.00
RMA Read Module Address	\$1RMA	*0102
RS Read Setup	\$1RS	*31070142
RZ Read Zero	\$1RZ	*+00000.00
WE Write Enable	\$1WE	*

## Write Protected Commands.

CZ Clear Zero	\$1CZ	*
RR Remote Reset	\$1RR	*
SU Setup Module	\$1SU31070142	*
TS Trim Span	\$1TS+00600.00	*
TZ Trim Zero	\$1TZ+00000.00	*
MBR Write Slave Address	\$MBR01	*

## SETUP

The D5000M series are initiated at the factory using the DGH ASCII protocol. This allows setup and configuration, including the Modbus device address, to be easily performed using the DGH setup software or a dumb terminal. Each D5000M module must be properly configured before installation into a Modbus system.

## UTILITY SOFTWARE

Complimentary Utility Software is included with each purchase order. The software is compatible with Windows 95, 98, NT 4.0+, 2000 operating systems and distributed on CD-ROM. The Utility Software simplifies configuration of all user-selectable options such as device address, baud rate and filtering constants. The latest version of our software is always downloadable from our web site at [www.dghcorp.com](http://www.dghcorp.com).

## PROCESS CONTROL SOFTWARE

Modbus RTU protocol is supported by virtually all commercial process control software programs available today. These programs operate on IBM and compatible personal computers in the Windows 95, 98, NT and IBM OS/2 environments.

## ORDERING GUIDE

MODEL INPUT/OUTPUT

### Voltage Inputs

D5111M 100mV Input/RS-232 Output  
D5112M 100mV Input/RS-485 Output  
D5121M 1V Input/RS-232 Output  
D5122M 1V Input/RS-485 Output  
D5131M 5V Input/RS-232 Output  
D5132M 5V Input/RS-485 Output  
D5141M 10V Input/RS-232 Output  
D5142M 10V Input/RS-485 Output  
D5151M 100V Input/RS-232 Output  
D5152M 100V Input/RS-485 Output

### Current Input

D5251M 4-20mA Input/RS-232 Output  
D5252M 4-20mA Input/RS-485 Output

MODEL INPUT/OUTPUT

### Thermocouple Inputs

D5311M J Thermocouple Input/RS-232 Output  
D5312M J Thermocouple Input/RS-485 Output  
D5321M K Thermocouple Input/RS-232 Output  
D5322M K Thermocouple Input/RS-485 Output  
D5331M T Thermocouple Input/RS-232 Output  
D5332M T Thermocouple Input/RS-485 Output  
D5341M E Thermocouple Input/RS-232 Output  
D5342M E Thermocouple Input/RS-485 Output

### Thermistor Inputs

D5451M 2252 $\Omega$  Thermistor Input/RS-232 Output  
D5452M 2252 $\Omega$  Thermistor Input/RS-485 Output

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