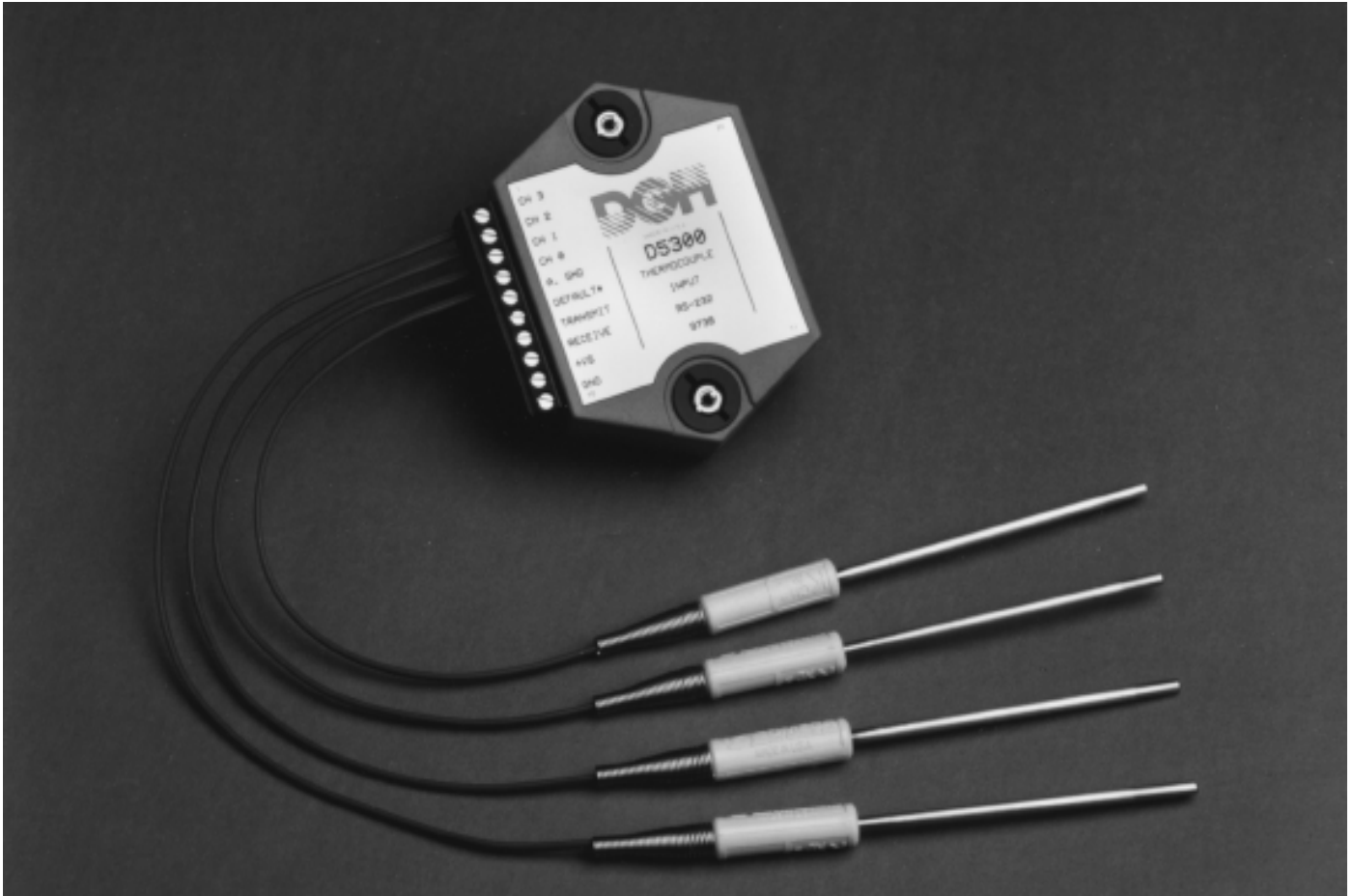


D5000 SERIES FOUR CHANNEL SENSOR TO COMPUTER INTERFACE MODULES



D5000 FEATURES

- Four analog input channels.
- Complete sensor to RS-485 or RS-232 interface.
- ASCII format command/response 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.
- Y2K compliant.
- CE marked.

APPLICATIONS

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

GENERAL DESCRIPTION

The D5000 Four Channel Sensor to Computer Modules are a family of complete solutions designed for data acquisition systems based on personal computers and other processor-based equipment with standard serial I/O ports. 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 D5000 series can be programmed by the user to scale linear input signals such as millivolts and milliamps to desired engineering units such as pounds or percent of full scale. The scaling constants are stored in nonvolatile EEPROM which maintains data even after power is removed.

D5000 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: <2 μ A 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.
- ASCII format command/response protocol.
- Up to 3721 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.
- Scan up to 250 channels per second.
- 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.

ORDERING GUIDE

MODEL INPUT/OUTPUT

Voltage Inputs

D5111	100mV Input/RS-232 Output
D5112	100mV Input/RS-485 Output
D5121	1V Input/RS-232 Output
D5122	1V Input/RS-485 Output
D5131	5V Input/RS-232 Output
D5132	5V Input/RS-485 Output
D5141	10V Input/RS-232 Output
D5142	10V Input/RS-485 Output
D5151	100V Input/RS-232 Output
D5152	100V Input/RS-485 Output

Current Input

D5251	4-20mA Input/RS-232 Output
D5252	4-20mA Input/RS-485 Output

D5100 Voltage Inputs

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

D5200 Current Input

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

D5300 Thermocouple Inputs

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

D5450 Thermistor Inputs

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

Specifications are subject to change without notice.

MODEL INPUT/OUTPUT

Thermocouple Inputs

D5311	J Thermocouple Input/RS-232 Output
D5312	J Thermocouple Input/RS-485 Output
D5321	K Thermocouple Input/RS-232 Output
D5322	K Thermocouple Input/RS-485 Output
D5331	T Thermocouple Input/RS-232 Output
D5332	T Thermocouple Input/RS-485 Output
D5341	E Thermocouple Input/RS-232 Output
D5342	E Thermocouple Input/RS-485 Output

Thermistor Inputs

D5451	2252 Ω Thermistor Input/RS-232 Output
D5452	2252 Ω Thermistor Input/RS-485 Output

General Description (Continued)

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.

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 D5000 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.

Although software is not required, utility software (S1000) is available on IBM-compatible diskette from DGH to make the D5000 easier to learn and use.

THEORY OF OPERATION

D5000 modules are complete four-channel data acquisition system. 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 D5000 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. The host computer may request data by sending simple ASCII commands to the module. The D5000 will instantly respond by communicating the ASCII buffer data back to the host. You can string up to 3721 modules on one set of wires by using RS-485 with repeaters.

DIGITAL FILTER

The D5000 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 D5000 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.

RS-232 is not designed to be used as a multiparty system; however the modules can be daisy-chained to allow many modules to be connected to a single communications port. In this network, any characters transmitted by the host are received by each module in the chain and passed on to the next module until the information is echoed back to the host. If a module is correctly addressed and receives a valid command, it transmits a response on the daisy chain network. The response will be rippled through any other modules in the chain until it reaches the host.

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

All DGH products use a simple command/response protocol for communication. A module must be interrogated by the host to obtain data. A module can never initiate a command sequence. A typical command/response sequence could look like this:

Command: \$1RD
Response: *+00075.00

A command is initiated with a command prompt, which may be a dollar sign (\$) or a pound sign (#). Following the prompt a single address character must be transmitted. Each module on a communications bus must be setup with a unique address. The command is directed in this case to module address '1'. The address is followed by a two-character command which in this case is RD for Read Data. The command is terminated with a carriage return.

After module address '1' receives the command it will respond with the analog input data. The response begins with a response prompt, which is an asterisk (*). The data is read back in a standardized format of sign, 5 digits, decimal point, and 2 more digits. All DGH modules represent data in the same standard format.

Table 1 shows the D5000 commands. For each case, a sample command and response is shown. Notice that some commands only respond with an * acknowledgment.

Table 1. D5000 Series Command Set.

Command and Definition	Typical Command Message (\$ prompt)	Typical Response Message
RB Read Block of data	\$1RB	*+00070.00 *+00112.00 *+00555.00 *+00900.00 *+00072.00
RD Read Data	\$1RD	*3031
REA Read Extended Address	\$1REA	*BOILER
RID Read IDentification	\$1RID	*+00025.00
RMN Read displayed MiNimum	\$1RMN	*+00100.00
RMN Read displayed MaXimum	\$1RMX	*31070142
RS Read Setup	\$1RS	*31070142
RSU Read Setup	\$1RSU	*+00000.00
RZ Read Zero	\$1RZ	*
WE Write Enable	\$1WE	

Write Protected Commands.

CZ Clear Zero	\$1CZ	*
ID IDentification	\$1IDBOILER	*
RR Remote Reset	\$1RR	*
SU Setup Module	\$1SU31070142	*
TS Trim Span	\$1TS+00600.00	*
TZ Trim Zero	\$1TZ+00000.00	*
WEA Write Extended Address	\$1WEA3031	*
WMN Write displayed MiNimum	\$1WMN+00000.00	*
WMX Write displayed MaXimum	\$1WMX+00025.00	*

For greater data security, options are available to echo transmitted commands and to send and receive checksums. The # command prompt requests a response message from the module that begins with an *, followed by the channel address, command, data (if necessary) and checksum. This response echoes the channel address and command for verification and adds checksum for error checking. Checksum is a two character hexadecimal value that can be added to the end of any command message, regardless of prompt, at your option. Checksum verifies that the message received is exactly the same as the message sent.

The DGH modules perform extensive error checking on commands and will respond with an error message if necessary. For example:

Command: \$1AB

Response: ?1 COMMAND ERROR

All error messages start with an error prompt (?) followed by the channel address and error description. In this case, the module did not recognize 'AB' as a valid command.

S1000 UTILITY SOFTWARE

The S1000 utility software diskette contains executable programs that make the D5000 series easier to learn and use.

The programs can be run on IBM PC and compatible computers. A menu-driven setup program with context sensitive help is provided to simplify configuration of all user-selectable options.

The S1000 also contains programming examples written in high level languages such as Visual Basic, Turbo Pascal and C. The examples are easily configured for COM1: or COM2:

ports and are provided in ASCII text format. The S1000 is provided at no charge on request with a purchase order.

D5000 SCALING

Each D5000 can output data in easy-to-understand engineering units that may be instantly read and interpreted, without software conversion, by a host computer. Using simple ASCII commands the voltage or current input range of a D5000 module can be rescaled to represent desired engineering units such as degree or psi.

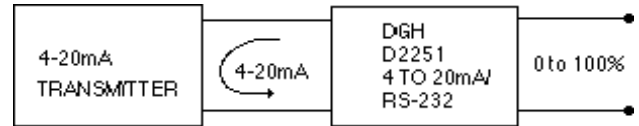


Figure 1. Scaling to desired engineering units.

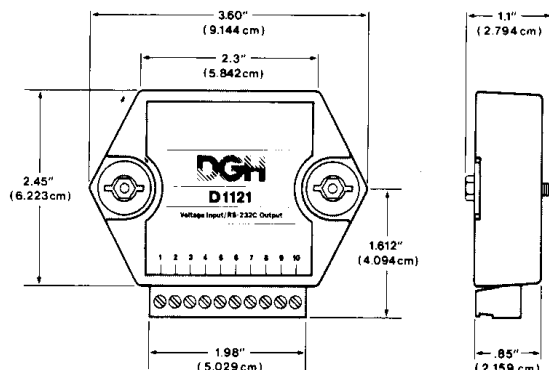
For example, an application requires the displayed output values from a D5251 4-20mA current input module be rescaled to 0 to 100%. The D5251 module has an actual input range of 0-25mA to make it easier to adjust for zero and span and to allow for drift in the end points of the input. Since the input range is 0 to 25 mA and you want to use a portion of that range you must determine the new minimum and maximum values. The two desired values: 4mA, 0% and 20mA, 100% determine the desired transfer function. Extrapolate this function to the full-scale range of the module, which is 0-25mA. This results in end-points at 0mA, -25% and 25mA, 131.25%.

Input the new minimum and maximum values to the module by using the Write MiNnum Value and Write Maximum Value commands. In this case assume a channel address of 1. Send a Write MiNnum Value command of \$1WMN-00025.00 and a Write Maximum Value command of \$1MX+00131.25. The entire range of the D5251 is rescaled and all values between 4-20mA are read as 0-100%.

D5000 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.