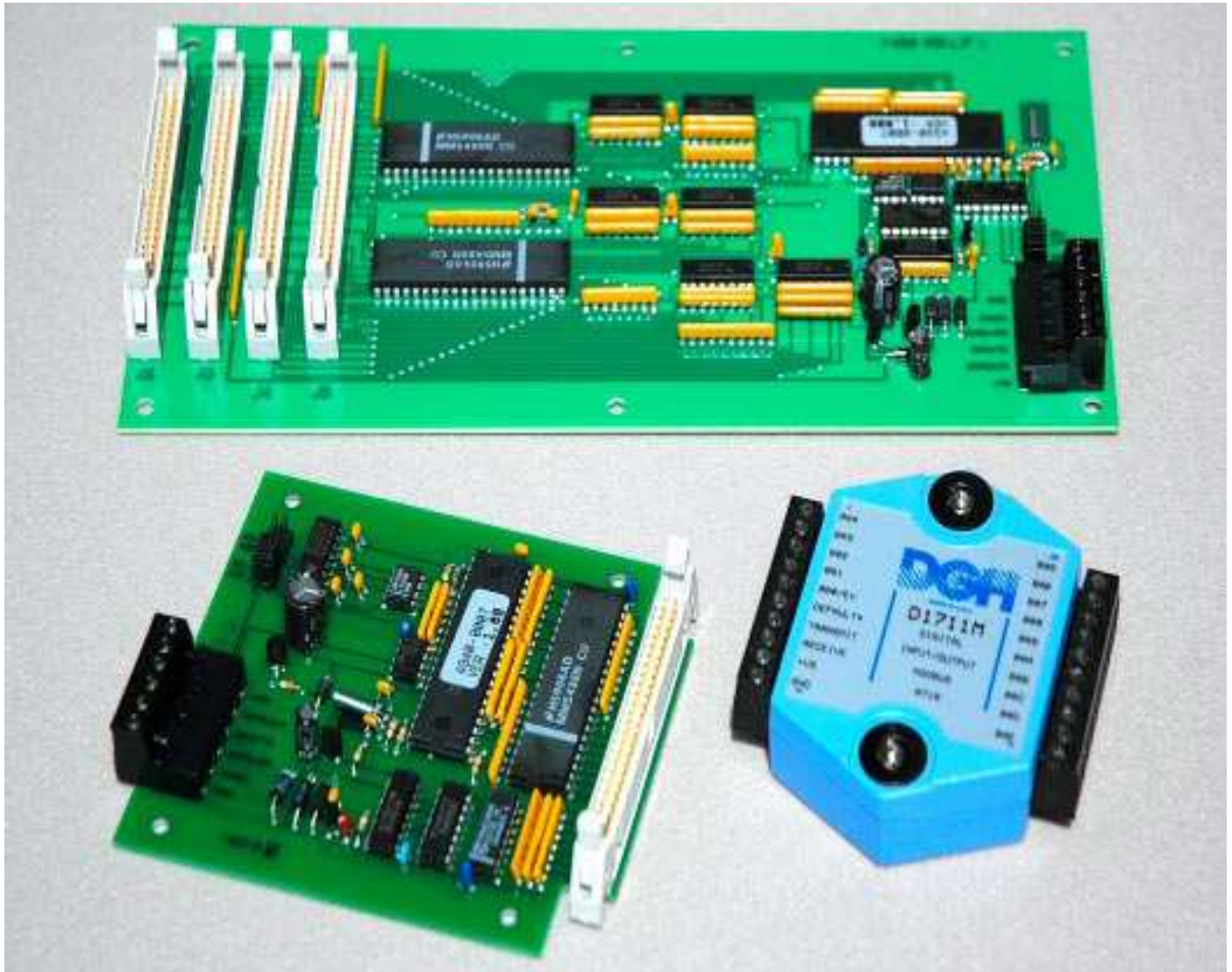




## 1700M SERIES DIGITAL I/O TO MODBUS COMPUTER INTERFACES



### FEATURES

- Digital inputs and outputs via RS-232 or RS-485.
- Connect to solid state relays to sense AC and DC voltages.
- User defines any bit as input or output.
- Controls digital I/O individually or all at once.
- No software initialization required—I/O startup stored in EEPROM.
- 15, 24, 64 bit versions.
- Host-free communications in continuous mode.
- Up to 15008 I/O points on a single twisted pair of wires.
- Compatible with Modbus RTU and all DGH products.
- Compatible with industry standard I/O modules and racks.

### APPLICATIONS

- Product Testing
- Energy Management
- Batch Processing
- Annunciators
- Interfaces with modems

## DPH 1700M SERIES SPECIFICATIONS (typical @ +25°C and nominal power supply unless otherwise noted)

### H1750M/H1770M Digital Input/Output Boards

H1750M: 24 digital input/output bits with jumper selectable RS-232 or RS-485 output.

H1770M: 64 digital input/output bits with jumper selectable RS-232 or RS-485 output.

- User can define any bit as an input or an output.
- Inputs/Outputs can be read/set individually or in parallel.
- Input voltage levels: 0-10V without damage.
- Input switching levels: High, 3.5V min., Low, 1.0V max.
- Outputs: 0-10V, 15mA max. load.
- Power requirements: +5Vdc  $\pm$ 0.25V @ 30mA max. (not including I/O modules requirements)
- User selectable RS-232/RS-485 Communications.

### D1700M Digital Input/Output Modules

D1711M: 15 digital input/output bits with RS-232 output.

D1712M: 15 digital input/output bits with RS-485 output.

- User can define any bit as an input or an output.
- Input voltage levels: 0-30V 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 @ 100mA.
- Events counter: Up to 16 million (Modbus RTU mode) or 10 million (DPH ASCII mode) positive transitions at bandwidths of 20Hz, 50Hz, 200Hz and 20KHz.
- Power requirements: Unregulated +10V to +30Vdc, 0.75W max.
- Internal switching regulator.
- Protected against power supply reversals.

### Communications

- Communications in ASCII via RS-232, RS-485 ports.
- Up to 124 multidrop boards per host communications port.
- User selectable channel address.
- NRZ asynchronous data format; 1 start bit, 7 data bits, 1 parity bit and 1 stop bit (DPH ASCII mode), 1 or 2 stop bits (Modbus RTU mode).
- Selectable baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 56700, 115200.
- ASCII format command/response protocol.
- Parity: odd, even, none.
- All communications setups (address, baud rate, parity) stored in nonvolatile memory using EEPROM.
- Transient suppression on RS-485 Communications lines.
- Communications error checking via checksum.
- Communications distance up to 4,000 feet.

### Digital

- 8-bit CMOS microcomputer.
- Nonvolatile memory storage for start up values eliminates software initialization.

### Environmental

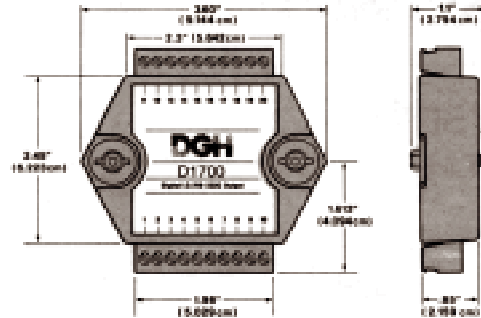
Temperature Range: Operating -25°C to +70°C.

Storage -25°C to +85°C.

Relative Humidity: 0 to 95% noncondensing.

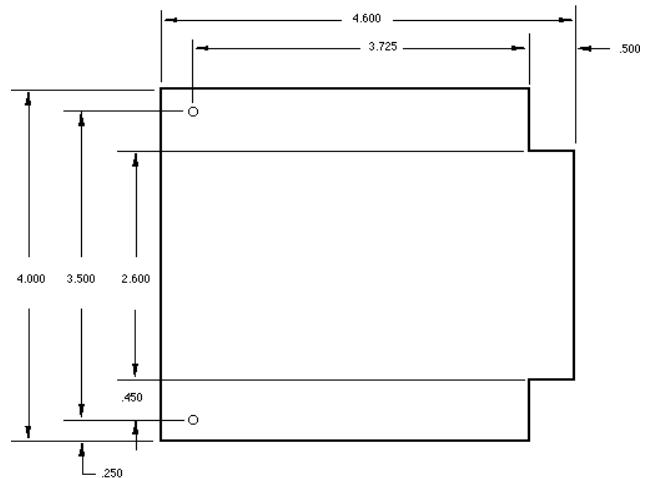
Specifications are subject to change without notice.

### D1700M Series



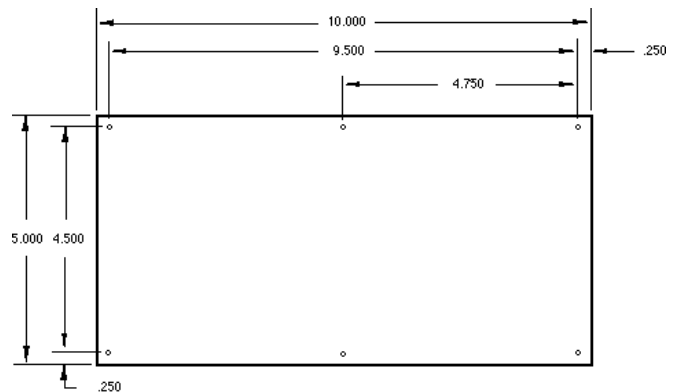
**NOTE:** Spacing for mounting screws = 2.700" (6.858 cm). Screw threads are 6 x 32.

### H1750M Series



**NOTE:** H1750M-1 contains a 50 pin ribbon cable female socket. H1750M-2 contains a 50 pin ribbon cable male header.

### H1770M Series



### Cable Assembly for H1770M

CA-1 Four 50 connector ribbon cables-13.5", 18.5", 24.0", 30.0" in length. Available from DGH.

Cables can be made from the following 3M part numbers or equivalent.

3425-6600 50 position socket.

3415-0001 50 position cardedge.

3365/50 50 position flat cable.

## GENERAL DESCRIPTION

The DGH 1700M series of digital I/O to computer interfaces provides computer monitoring and control of devices through solid state relays or TTL signals. The status of inputs and outputs is communicated to the host in either Modbus RTU or DGH ASCII format using RS-232 or RS-485 serial communications. The 1700M series includes:

D1711M	15 channel I/O module with RS-232 output.
D1712M	15 channel I/O module with RS-485 output.
H1750M	24 channel I/O board with RS-232/RS-485 output.
H1770M	64 channel I/O board with RS-232/RS-485 output.

You can string up to 247 boards/modules on one twisted pair of wires using RS-485 and repeaters in Modbus RTU format. When using RS-232 in Modbus format you are limited to one board/module. The 1700M series allows a single computer to monitor and control thousands of I/O points. The 1700M series is compatible with all industry standard I/O modules and I/O racks.

Each 1700M contains up to 64 bits of digital inputs and outputs. The input or output direction of each digital bit may be set by the user individually or all at once. The digital outputs are open-collector transistor switches that may be controlled by the host computer. These switches may be used to control solid-state relays which in turn may control heaters, pumps and other power equipment. The digital inputs may be read by the host computer and used to sense the state of remote digital signals. They are ideal for sensing the state of limit or safety switches. The host computer may configure and control the I/O lines by sending a wide variety simple ASCII commands to the 1700M. The 1700M instantly produces and transmits responses to each host command.

Many industrial applications require a 'safe' start-up condition to prevent accidents at critical points in the process. Each 1700M contains an initial start-up value which is used to configure the digital outputs on power up. The initial value is user selectable and stored in EEPROM. Since each digital output is automatically configured on start-up, no software initialization routines are required.

All user selectable options (address, baud rate, etc.) are done through the communications port and are stored in nonvolatile EEPROM memory.

The D1711M/1712M modules are supplied with screw terminal plugs and captive mounting screws. The H1750M/1770M boards are supplied with screw terminal plugs and thru-hole standoffs for mounting in 19" racks. The H1750M board has two versions: H1750M-1 makes a right angle connection to a 24 channel I/O module rack, H1750M-2 connects to I/O module racks via a 50-pin ribbon cable connector. The H1770M connects to I/O module racks via four 50-pin ribbon cable connector.

## USER OPTIONS

The 1700M series offers a variety of user selectable options including choice of address, baud rate, parity, echo, input/output bit assignment, initial values, continuous mode etc. These options are selectable using simple commands over the communications port. The selections are stored in a nonvolatile EEPROM which maintains data even after power is removed. The options may be changed remotely without requiring access to the 1700M.

The H1750M/H1770M contain jumpers so that the user can choose either RS-232 or RS-485.

## USER PROGRAMMABLE INPUTS & OUTPUTS

The 1700M series allows the user to specify the direction of each I/O line as either an input or an output bit. Bit addresses may be specified in two different formats, using either hexadecimal or decimal numbers. The I/O assignments are saved in EEPROM so that all pin directions are automatically configured when the device is powered up. Assigning the data direction of each I/O lines may be specified individually or all at once using simple commands from the 1700M command set.

## DIGITAL INPUTS/OUTPUTS EXPANSION

The 1700M series digital I/O may be expanded by linking up to 124 modules or boards to a single RS-232 or RS-485 host port. The modules and boards may be mixed and matched in any combination to meet the required amount of I/O. A system using 124 of the 64 bit boards would contain 7936 bits of digital I/O. All 15008 input and output bits can be scanned in less than 1 second.

## WATCHDOG TIMER

The 1700M series contains a user-programmable software timer to provide an orderly shutdown of the output signal in the event of host computer or communications failure. The timer is continually incremented in software. Each time the 1700M receives a valid command, the timer is cleared to zero and restarted. If the timer count reaches the preset value, the outputs will automatically be forced to the user-defined initial value. The initial value should be programmed to provide a 'safe' output value to minimize damage and disruption to the system under control.

## EVENT COUNTER

The D1711M and D1712M contain an onboard events counter that counts Up to 16 million (Modbus RTU mode) or 10 million (DGH ASCII mode) positive transitions that occur on the digital input. The event counter may be read and cleared by the host computer at any time.

## UTILITY SOFTWARE

The DGH Utility Software makes it easy to configure one or multiple D1700M series modules. The menu-driven software simplifies configuration of all user-selectable options such as Modbus slave Address, baud rate, parity, watchdog timer, and input/output selection. The Utility Software runs on MS-Windows based computers and is provided at no charge on CD-ROM with a purchase order or downloaded from [www.dghcorp.com](http://www.dghcorp.com).

## COMMUNICATIONS

The 1700M series is easy to interface with all popular computers and terminals. All communications to and from the 1700M series 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. The ASCII format also makes system debugging easy with a dumb terminal. For computers that support standard RS-232 interfaces, no special machine language software drivers are required for operation. The 1700M series can also be connected to auto-answer modems for long-distance operation without the need for a remote supervisory computer.

Up to 32 RS-485 units may be strung together on a single twisted pair of wires; 124 with repeaters. A practical limit for RS-232 units is about ten, although a string of 124 units is possible.

RS-485 is similar to RS-422 in that it uses a balanced differential pair of wires switching from 0 to 5V to communicate data. RS-485 receivers can handle common mode voltages from -7 to +12V without loss of data, making them ideal for transmission over great distances. RS-485 differs from RS-422 by using one balanced pair of wires for both transmitting and receiving. Since an RS-485 system cannot transmit and receive at the same time it is a half-duplex system. For systems that require more than a few boards, long wiring distances, or high speed, we recommend the RS-485 standard.

## COMMAND SET

The 1700M series uses the Modbus RTU protocol for communication. The Modbus 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. The returned messages are considered response messages.

The Modbus protocol format used by a master consists of a device address, a command function code which defines the operation to be performed, data required with the command, and an error checking value. The slave response message contains any required data and error checking value. If an error occurs, an exception code will be generated. The supported master codes are:

Code	Description
01	Read Coil Status
04	Read Input Register
05	Force Single Coil
06	Preset Single Register
15	Force Multiple Coils
01	Read Coil Status is a digital input such as contact status or contact closure.
04	Read Input Register is the analog input to the module.

- 05 Force Single Coil is used to set or clear a digital output.
- 06 Preset Single Register is used to temporarily suspend Modbus RTU mode and return to DGH ASCII protocol mode.
- 15 Force Multiple Coils is used to set or clear digital outputs.

## Typical Command/Response sequence

A typical Modbus RTU command to a module may look like this:

```
01 05 00 01 FF 00 DD FA
```

This example is a Modbus Force Single Coil command.

The 01 is the address of the slave DGH module being commanded. Each slave device must have its own unique address. The 05 character specifies the Modbus Force Single Coil command. The next two characters 00 01 specify the address of the coil to be modified. The FF 00 directs to turn the coil "on". The final two characters of the command (DD FA) make up the Cyclical Redundancy Check (CRC), used to check for errors in the message.

The typical response message for this command is to echo the command back to the host computer. Therefore, the response message would look like this:

```
01 05 00 01 FF 00 DD FA
```

Any other response message, other than the echoed command, would indicate that a Modbus exception error code was returned or communications time out occurred.

There are no prompt or terminating characters in the messages. All messages must be transmitted as continuous strings. Messages are terminated by a silent period of at least 3.5 character times.

## SETUP

The 17000M series are initiated at the factory using the DGH ASCII protocol. This allows easy setup and configuration, including the Modbus slave address value. Setup and configuration can be performed using a Terminal program or using the DGH Utility Software on a Windows based computer. Each 17000M module must be properly configured before installation into a Modbus system.

## SOFTWARE COMPATABILITY

The Modbus RTU protocol is supported by all major process control software programs on the market today. Including OPC server programs. Using these software programs and the DGH Modbus compatible modules, a data acquisition system can be created with ease.