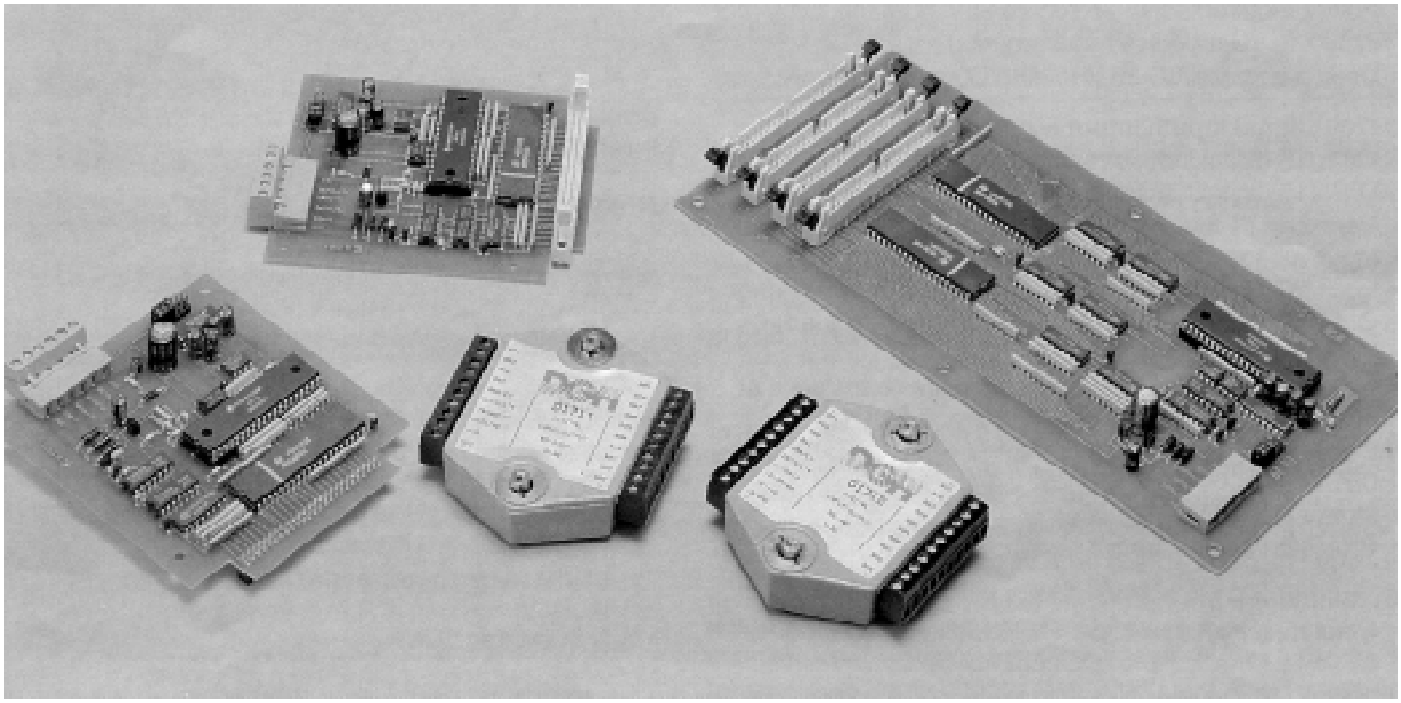
1700 SERIES
DIGITAL I/O TO COMPUTER INTERFACES



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 7936 I/O points on a single twisted pair of wires.
- Compatible with all DGH products.

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

GENERAL DESCRIPTION

The DGH 1700 series of digital I/O to computer Interfaces provide 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 ASCII format using RS-232 or RS-485 serial communications. You can string up to 124 boards/modules on one twisted pair of wires using RS-485 and repeaters. The 1700 series allows a single computer to monitor and control thousands of I/O points. The 1700 series is compatible with all industry standard I/O modules and I/O racks.

Each 1700 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 1700. The 1700 instantly produces and transmits responses to each host command.

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

H1750/H1770 Digital Input/Output Boards

H1750: 24 digital input/output bits with RS-232 or RS-485 output.
H1770: 64 digital input/output bits with 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 ±0.25V @ 30mA max. (not including I/O modules requirements)
- User selectable RS-232/RS-485 Communications.

D1700 Digital Input/Output Modules

D1711: 15 digital input/output bits with RS-232 output.
D1712: 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 10 million 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.
- Selectable baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400.
- ASCII format command/response protocol.
- Can be used with a “dumb” terminal.
- 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.

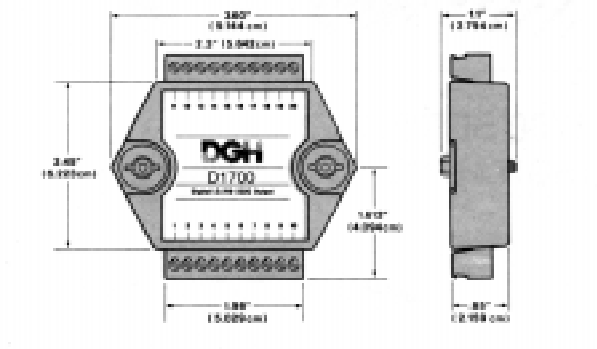
Environmental

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.

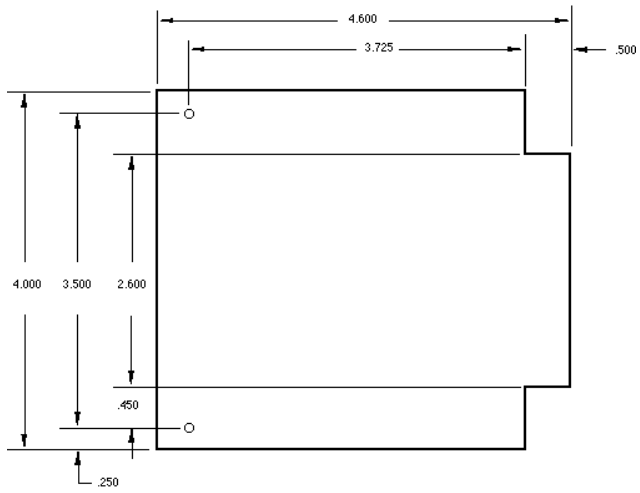
Dimensions

D1700 Series



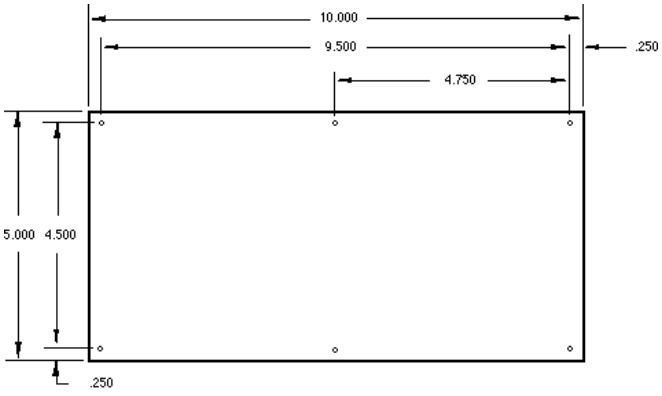
NOTE: Spacing for mounting screws = 2.700" (6.858 cm). Screw threads are 6 x 32.

H1750 Series



NOTE: H1750-1 contains a 50 pin ribbon cable female socket. H1750-2 contains a 50 pin ribbon cable male header.

H1770 Series



Cable Assembly for H1770

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 (continued)
Many industrial applications require a 'safe' start-up condition to prevent accidents at critical points in the process. Each 1700 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 D1711/1712 modules are supplied with screw terminal plugs and captive mounting screws. The H1750/ 1770 boards are supplied with screw terminal plugs and thru-hole standoffs for mounting in 19" racks. The H1750 board has two versions: H1750-1 makes a right angle connection to a 24 channel I/O module rack, H1750-2 connects to I/O module racks via a 50-pin ribbon cable connector. The H1770 board contains four 50-pin ribbon cable connectors for connecting to I/O module racks.

Although software is not required, utility software (S1000) is available on IBM-compatible diskette from DGH to make the 1700 series easier to learn and use. S1000 software is provided at no charge on request with a purchase order and is not copy protected.

USER OPTIONS
To provide maximum flexibility, the 1700 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 1700.

The H1750/H1770 contain jumpers so that the user can choose the output format as either RS-232 or RS-485.

USER PROGRAMMABLE INPUTS & OUTPUTS
The 1700 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 1700 command set.

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

CONTINUOUS INPUT/OUTPUT MODE
The Continuous Input/Output Mode allows the 1700 to communicate without being polled by a host computer. In many applications the burden on the host may be greatly simplified and in some cases the host may be eliminated.

The continuous mode is a master-slave configuration where a 1700 is the master and the slave may be either a host computer or another 1700 unit. In this mode, the master 1700 reports digital input status without being polled. The digital input status may be interpreted by either a host or a slave 1700. The slave 1700 can use the master's input status information to set its own digital outputs. This allows data to be monitored at one 1700 and reproduced at the outputs of another 1700 without a host computer. Continuous mode may be operated in three ways:

Timer Mode: A software timer is activated in the 1700. It specifies a time period that repeats indefinitely. After each timeout, the 1700 will output the status of the I/O lines. It is not necessary for the host to poll the 1700 to obtain data.

Edge-Trigger Mode: The edge trigger mode will produce an output data string in response to an external trigger signal. It also provides a means of daisy-chaining several 1700 continuous output units together.

Change Mode: The 1700 continuously monitors the status of the I/O lines. If a change is detected in status, an output data message is initiated. The 1700 will output the data string reporting the new state of the inputs. The change mode is ideal in applications where the state of the digital inputs change infrequently; such as security switches, fire detectors or alarm switches.

WATCHDOG TIMER
The 1700 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 1700 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 D1711 and D1712 contain an onboard events counter. The event counter will count up to 10 million transitions that occur on the digital input. The event counter may be read and cleared by the host computer at any time.

COMMUNICATIONS

The 1700 series is easy to interface with all popular computers and terminals. All communications to and from the 1700 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 1700 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 1700 series use a simple command/response protocol for communication. Each 1700 must be interrogated by the host to obtain data. A 1700 can never initiate a command sequence. A typical command/response sequence could look like this:

Command: $1DI
Response: *F1A5

A command/response sequence 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. The address is followed by two or three-character ASCII command such as DI to read Digital Input data. Every command is terminated with a carriage return. Each 1700 on a communications bus must be setup with a unique address. The command is directed in this case to board address ‘1’.

After board address ‘1’ receives the command it will respond with the digital input data. The response begins with a response prompt, which is an asterisk (*), followed by four characters that represent the hexadecimal equivalent of 16 bits of digital input data.

Table 1 contains a sample command and response for all 1700 commands. Notice that some commands only respond with an * acknowledgment.

Table 1. DGH 1700 Command Set

Command and Definition		Typical Command Message	Typical Response Message
ACK	Acknowledge	$1ACK	*
CB	Clear Bit	$1CB0C	*
CP	Clear Position	$1CP12	*
DI	Digital Input	$1DI	*0007
DO	Digital Output	$1DO1234	*
RA	Read Assignments	$1RA	*0F0F
RAB	Read Assignment Bit	$1RAB0E	*O
RAP	Read Assignment Position	$1RAP14	*I
RB	Read Bit	$1RB0E	*1
RD	Read Data	$1RD	*+99999.99
RE	Read Event Counter	$1RE	*0001107
RID	Read Identification	$1RID	*BOILER
RIV	Read Initial Value	$1RIV	*0F0F
RP	Read Position	$1RP14	*0
RS	Read Setup	$1RS	*31070002
RSU	Read Setup	$1RSU	*31070002
RWT	Read Watchdog Timer	$1RWT	*+00010.00
SB	Set Bit	$1SB0C	*
SP	Set Position	$1SP12	*
WE	Write Enable	$1WE	*
Write Protected Commands			
AIB	Assign Input Bit	$1AIB0E	*
AIO	Assign Input/Output	$1AIO0F0F	*
AIP	Assign Input Position	$1AIP14	*
AOB	Assign Output Bit	$1AOB0E	*
AOP	Assign Output Position	$1AOP14	*
CE	Clear Events	$1CE	*
EC	Events Clear	$1EC	*0000100
ID	Identification	$1IDBOILER	*
IV	Initial Value	$1IV0F0F	*
RR	Remote Reset	$1RR	*
SU	Setup	$1SU310701C2	*
WT	Watchdog Timer	$1WT+00010.00	*
Continuous Input/Output Mode Commands			
CIA	Set Input Address	$1CIA31	*
CMC	Continuous Mode Change	$1CMC	*
CMD	Continuous Mode Disable	$1CMD	*
CME	Continuous Mode Edge Triggered	$1CME	*
CMT	Continuous Mode Timer	$1CMT	*
CT	Continuous Time (Set Time)	$1CT+00010.00	*
RCM	Read Continuous Mode	$1RCM	*D, T, E, C
RCT	Read Continuous Time Variable	$1RCT	*+00010.00
RIA	Read Input Address	$1RIA	*31

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 board 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. All DGH products automatically calculate a checksum for every command received with either a # prompt or a checksum.

The 1700 series performs extensive error checking on commands and will respond with an error message if necessary:

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 1700 series did not recognize ‘AB’ as a valid command.