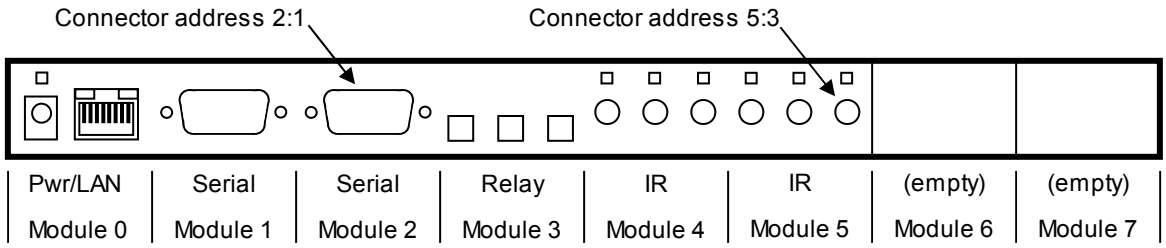
GC-100 API Specification
Version 1.0d

1. The GC-100 Modular Concept

The GC-100 Network Adapter's modular design concept provides a variety of capabilities that are combined within a single enclosure. Each module provides a particular function, such as infrared (IR), digital input, or relay closures. A module may support one or more connectors of the same type. For example, an IR module has three independent IR outputs; whereas, a serial module has only one DB9 connector for serial data. This is because the number of connectors a module can support is dictated by its 1.5 inch physical width.

It is important to understand that a module's address is determined solely by its physical position within the GC-100 enclosure. The concept is that each module occupies 1.5 inches of front panel space, even if it's part of a larger printed circuit board containing other module types. At power on, module addresses are assigned starting with 0 for the left-most modules and increasing sequentially to the right until all module addresses are assigned (see figure 1a). This presents a consistent programming interface as additional modules are added in the empty locations.

A connector's address is its position within a module, starting at 1 on the left and increasing to the right. A complete connector address includes the module address and the connector location within the module separated by a colon. See figure 1a for examples of connector addresses. Note: a connector's address does not necessarily have to agree with the front panel label. Below, the IR connector at address 5:3 is labeled as 6 on the front panel of the GC-100-12.



GC-100-12

Figure 1a

2. How to Configure the IP address*

The GC-100 is set by default to use DHCP to automatically obtain an IP address. To determine the IP address of a GC-100 using DHCP, run the iHelp Discovery Utility. Within three seconds of power up, the GC-100 will announce its IP address and display it in the list. The GC-100 will also periodically announce its IP address at intervals between 10 and 60 seconds while powered up. If the GC-100 is connected directly to a PC by way of a crossover cable, or if there isn't a DHCP server present, the GC-100 will use 192.168.1.70 as the default IP address. The IP address and DHCP settings can be changed on the GC-100 internal setup web pages by entering the GC-100's IP address into a web browser's address bar. Follow the link to Network Setup and select either DHCP or static and, if using a static IP, enter the new

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IP address and select “Apply.” The GC-100 will restart with the newly assigned IP address.

In most network environments, the GC-100 can also be accessed by name. The network name of a GC-100 is “GC-100_XXXXXXXXXXX_GlobalCache” where X is the 12 character MAC address printed on the bottom of the GC-100. For example, if the MAC address is 000C1E012345 the GC-100 network name would be GC100_ 000C1E012345_GlobalCache.

3. GC-100 Discovery Beacon

The GC-100 Network Adapter features a beacon message that can assist in locating GC-100s on the network. The beacon is a UDP packet sent to the multicast IP address 239.255.250.250 on UDP port number 9131. Any system listening to this address and port will receive the periodic beacon message. The message is sent 3 seconds after power on and then at random intervals of 10 to 60 seconds thereafter.

The beacon message has the following format (Note: The symbols “<” and “>” are actually included in the code.):

AMXB<-UUID=GC100_000C1E0AF4E1_GlobalCache><-SDKClass=Utility><-Make=GlobalCache><-Model=GC-100-12><-Revision=1.0.0><Config-Name=GC-100><Config-URL=http://192.168.1.70>

The UUID value contains the unique MAC address of the GC-100 and is also the name registered with the DHCP server. The “Model” value can either be GC-100-12 or GC-100-06. A GC-100-18 will report back as model GC-100-12.

4. Command and Data Structure

Communication with the GC-100 is accomplished by opening a TCP socket on Port 4998. All commands and data, with the exception of serial (RS232) data, are communicated through Port 4998. Port 4998 is used for such things as GC-100 status, IR data, toggling relays, and reading digital input states. All information, with the exception of serial data, is communicated by comma delimited ACSII text string terminated by a carriage return (↵).

Serial data is communicated over Ports 4999 and higher. Serial connections with the lowest module number will communicate over Port 4999; serial connections with the next higher module number will communicate over Port 5000, and so on.

Only one IR command can be executed at a time, so special consideration must be given when sending back-to-back IR commands. In addition, IR commands may be set up to repeat their IR timing pattern multiple times, for increasing volume or fast forwarding a tape drive. This characteristic can be used to create some very desirable results. See “Back-to-Back IR Commands” in section 5.2.3.

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5. Command Set

Commands are always initiated by short ASCII string representing the command type. Typically, address and data information will follow. The structures of GC-100 commands are described in the following sections. Text enclosed in brackets (<text>) must be substituted by its ASCII definition. Multiple ASCII choices are divided by separator (|) characters. Note: commands **are** case sensitive.

For example, a relay state is set to ON by the following command:

setstate,<connectoraddress>,<state>↵

where;
<connectoraddress> is 3:2 (3rd module, 2nd relay in module)
<state> is 1 (close contacts on a "normally open" relay)

For this example the command ASCII string is,

setstate,3:2,1↵

5.1 General Commands

getdevices

The GC-100 command is used to determine installed modules and capabilities. Each module responds with its address and type. This process is completed after receiving an endlistdevices response.

Sent to GC-100:

getdevices↵ (query for modules and capabilities)

device

Sent from GC-100 in response to getdevices:

device,<moduleaddress>,<moduletype>↵ (one string sent for each module)

where;
<moduleaddress> is |1|2|3|4|….|n|
<moduletype> is |3 RELAY|3 IR|1 SERIAL|

endlistdevices

endlistdevices↵ (end of query response)

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The following is the GC-100-12 (figure 1a) response to a getdevices command:

device,1,1 SERIAL↵device,2,1 SERIAL↵device,3,3 RELAY↵device,4,3 IR↵
device,5,3 IR↵endlistdevices↵

getversion,<moduleaddress>

The module version number may be obtained from any or all modules in a GC-100. Modules combined on the same printed circuit board will have the same version number.

Sent to GC-100:

getversion,<moduleaddress>↵
where;
<moduleaddress> is |1|2|3|4|….|n|

version

Sent from GC-100 in response to getversion:

version,<moduleaddress>,<textversionstring>↵

where;
<moduleaddress> is |1|2|3|4|….|n|
<textversionstring> can be any ACSII string

blink

The blink command is used to blink the power LED on the GC-100. This is especially helpful in a rack mount situation where the installer may need to positively identify a particular GC-100.

Sent to GC-100:

blink,<onoff>↵

where:
<onoff> is |0|1|. A value of 1 starts the power LED blinking, and a value of 0 stops it.

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set_NET

The set_NET command allows the developer to configure the network settings of a GC-100 via the TCP connection without having to access the web configuration pages.

Sent to GC-100:

set_NET,0:1,<configlock>,<IP settings>↵

where:
<configlock> is |LOCKED|UNLOCKED|
<IP settings> is |DHCP|STATIC,IP address,Subnet,Gateway|

Example :
set_NET,0:1,DHCP↵
This will select DHCP IP address assignment

set_NET,0:1,STATIC,192.168.1.70,255.255.255.0,192.168.1.1↵
This will select static IP address assignment and will assign the IP address values supplied.

get_NET

This command will retrieve the current network settings and return a comma delimited string with the settings.

Sent to GC-100:

get_NET,0:1↵

set_IR

This command allows the developer to configure each of the individual IR ports as either IR output or sensor input. The possible modes are IR out, Sensor in, Sensor in with Auto-notify, and IR out no carrier.*

Sent to GC-100:

set_IR,<connectoraddress>,<mode>↵

where:
<connectoraddress> as defined in section 1
<mode> is |IR|SENSOR|SENSOR_NOTIFY|IR_NOCARRIER|

Example:
set_IR,5:2,SENSOR_NOTIFY↵
This will setup IR port # 5 as sensor input with auto-notify.

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get_IR

This command will retrieve the current mode setting for a particular port.

get_IR,<connectoraddress>↵

where:
<connectoraddress> is as defined in section 1

set_SERIAL

This command allows the developer to configure the serial ports on a GC-100.

Sent to GC-100:

set_SERIAL,<connectoraddress>,<baudrate>,<flowcontrol>,<parity>↵

where:
<connectoraddress> is as defined in section 1
<baudrate> is |57600|38400|19200|9600|4800|2400|1200|
<flowcontrol> is |FLOW_HARDWARE|FLOW_NONE|
<parity> is |PARITY_NO|PARITY_ODD|PARITY_EVEN|

Example:
set_SERIAL,1:1,38400,FLOW_HARDWARE,PARITY_NO↵
This will setup serial port #1 on the GC-100 to operate at 38400 baud, use hardware flow control, and no parity.

get_SERIAL

This command will retrieve the current serial settings for a particular serial port.

get_SERIAL,<connectoraddress>↵

where:
<connectoraddress> is as defined in section 1

unknowncommand

An unknowncommand response will be sent by the GC-100 if a command is not understood. This can happen if, for example, a connector is set up as a digital input and the command sent is sendir.

Sent from GC-100 is response to unknown commands:

unknowncommand [error code]↵

See Error Codes below for more information.

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5.2 IR Commands

5.2.1 IR Structure

An IR, or infrared, transmission is created by sending an IR timing pattern to the GC-100. This pattern is a collection of <on> and <off> states modulated with a carrier frequency (f) which is present during the <on> state. A carrier frequency is typically between 35 to 45 KHz with some equipment manufacturers using 200 KHz and above. The length of time for an <on> or <off> state is calculated in units of the carrier frequency period. For example, an <on> value of 24 modulated with a 40 KHz carrier frequency produces an <on> state of 600µS, as calculated below.

600µS = <on> * P = 24 / f = 24 / 40,000 where P = 1 / f

Figure 5.2a illustrates an IR timing pattern that would be created for the value shown below. IR timing patterns typically have a long finally <off> value to ensure the next IR command is not interpreted as part of the current IR transmission.

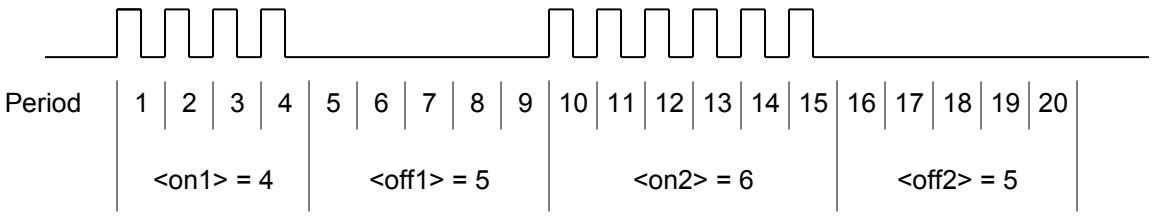

Figure 5.2a

5.2.2 Sending IR

sendir

Control of IR devices is accomplished through the sendir command. Since IR commands may take several hundred milliseconds to complete, the GC-100 provides an acknowledgment to indicate when it is ready to accept the next command.

Sent to GC-100:

sendir,<connectoraddress>,<ID>,<frequency>,<count>,<offset>,<on1>,
<off1>,<on2>,<off2>,….,onN,offN↵ (where N is less than 128 or a total of 256 numbers)

where;
<connectoraddress> is as defined in section 1.

<ID> is	|0|1|2|…|65535| (1)	(for the completeir command, see below)
<frequency> is	|20000|20001|….|500000|	(in hertz)
<count> is	|0|1|2|….|31| (2)	(the IR command is sent <count> times)
<offset> is	|1|3|5|….|255| (3)	(used if <count> is greater than 1, see below)
<on1> is	|1|2|…|65635| (4)	(measured in periods of the carrier frequency)
<off1> is	|1|2|…|65635| (4)	(measured in periods of the carrier frequency)

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(1) The <ID> is an ASCII number generated by the sender of the sendir command, which is included later in the completeir command to indicate completion of the respective sendir transmission.

(2) The <count> is the number of times an IR transmission is sent, if it is not halted early via a *stopir* or another IR command (see section 4.2.3). In all cases, the preamble is only sent once, see <offset> below. A <count> of "0" is a special case where the IR timing pattern is continually repeated until halted. However, IR transmission will halt on its own after the IR timing pattern repeats 65535 times.

(3) An <offset> applies when the <count> is greater than one. For IR commands that have preambles, an <offset> is employed to avoid repeating the preamble during repeated IR timing patterns. The <offset> value indicates the location within the timing pattern to start repeating the IR command as indicated below. The <offset> will always be an odd value since a timing pattern begins with an <on> state.

<offset> odd value	repeat start location	<offset> even value	should not point here	
1	<on1>	2	<off1>	no preamble
3	<on2>	4	<off2>	
….	….	….	….	
n-1	<on((n/2) -1)>	n	<off(n/2)>	where n is an even number

(4) Since an IR transmission ends in an <off> condition, there must be an equal number of <on> and <off> states. Also, every <on> and <off> state must meet an 80µS minimum time requirement for the GC-100 to work properly. For example, with a carrier frequency of 48 KHz the minimum value for <on> and <off> states is calculated below.

$$<off>_{min} = <on>_{min} \geq 80\mu S * f = 80\mu S * 48KHz = 3.84$$

For proper GC-100 operation, all <on> and <off> values in the timing pattern must be 4 or higher.
All of the conditions above must be met for valid sendir commands. When a variable is missing or outside the accepted range an unknowncommand will be sent by the GC-100. As an exercise, the sendir commands below will trigger a GC-100-12 unknowncommand response.

sendir,2:3,3456,23400,1,1,24,48,24,960↵	invalid GC-100-12 address, module 2 is serial
sendir,5:2,23333,40000,2,3,24,48,24,48,960↵	not an equal number of <on> and <off> pulses
sendir,5:3,0,40000,2,2,24,48,24,960↵	<offset> is an even number

completeir

All sendir commands are acknowledged with a completeir response from the GC-100 after completion of the IR transmission. The completeir response is associated with the sendir command through an <ID>. When utilized, the <ID>s can provide a unique identifier to determine which IR transmission has completed.

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Sent from GC-100 in response to sendir:

completeir,<connectoraddress>,<ID>↵

where;
<connectoraddress> is as defined in section 1.
<ID> is |0|1|2|…|65535|

A few example IR commands are shown below:

The following will send the IR timing sequence illustrated in figure 4.2a to the 5th IR connector on the GC-100-12 shown in figure 1a.

sendir,5:2,2445,40000,1,1,4,5,6,5↵

completeir,5:2,2445↵ (GC-100 response after completion)

In the next example, the following two IR commands will send the same IR timing pattern. Note: the carrier frequency is 34.5 KHz and <ID>s are different so as to provide unique completeir acknowledgments. The following is a simple IR timing pattern of 24,12,24,960 which is sent four times with a preamble of 34,48:

sendir,5:2,4444,34500,1,1,34,48,24,12,24,960,24,12,24,960,24,12,24,960,24,12,24,960↵

sendir,5:2,45234,34500,4,3,34,48,24,12,24,960↵

Acknowledgments for above IR commands are,

completeir,5:2,4444↵

completeir,5:2,45234↵

The second IR command structure is the recommended method, avoiding long commands and allowing repeats of the command to be halted if requested. See (**5.2.3**) below.

5.2.3 Back-to-Back IR Commands

A general discussion is necessary to better understand how IR commands are executed in the GC-100. IR commands are executed one at a time which, with large <count> values, may take several seconds to complete transmission. If a new IR command is received during execution of an earlier IR command, the IR command in progress will terminate; no further repeat timing patterns, due to a remaining <count> value, are transmitted. Therefore, IR commands with a <count> of 1 will always finish before the next IR command is started. Only the remaining portion of an IR command that may arise from restarting a repeating timing pattern is discarded.

For example, the above IR command

sendir,5:2,45234,34500,4,3,34,48,24,12,24,960↵

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will generate the following IR pattern if allowed to complete:

34,48,24,12,24,960,24,12,24,960,24,12,24,960,24,12,24,960
⇑
assume the next IR command is sent during the 24 state.

However, if the next IR command is received at the location shown above, the repeating timing pattern 24,12,24,960 is halted after completion of the current <count>; creating the timing pattern below.

34,48,24,12,24,960,24,12,24,960

This characteristic may be exploited to create desirable effects, such as increasing audio volume, fast-forwarding a DVD player, or any control requiring continuous IR transmissions. By using an appropriately high <count>, an IR command repeats until the desired volume or DVD scene is reached, whereupon it is then halted by sending the next sendir or stopir command. In either case, when a sendir or stopir is used to halt a previous IR command a completeir acknowledgment is not sent from the GC-100.

Other non-IR commands are not affected by IR transmissions and execute when received. However, if a sendir command is sent before an earlier IR transmission is finished, the new IR command will remain in the GC-100 input queue along with all other non-IR subsequent commands until the present IR transmission has halted, as explained above. This may take several hundred milliseconds.

stopir

A stopir command is used to halt repeating IR transmissions. After receipt of stopir the present IR transmission will halt at the end of the current timing pattern. Any remaining <count> will be discarded.

Sent to GC-100:

stopir,<connectoraddress>↵

where;
<connectoraddress> is as defined in section 1.

5.3 Discrete Input and Output

5.3.1 Digital Inputs

The GC-100 sends out notifications for digital input state changes as well as allowing the inputs to be polled for their current state at any time.

Digital input connectors are the same connectors used for IR output. The connector configuration is determined by the GC-100 configuration on an individual connector basis. For the following commands to operate correctly the connector being addressed must be configured for digital input. If a command requests information from an improperly configured connector, an unknowncommand response will be sent from the GC-100.

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getstate

Sent to GC-100:

getstate,<connectoraddress>↵
where;
<connectoraddress> is define in section 1.

state

Sent from GC-100 in response to getstate:

state,<connectoraddress>,<inputstate>↵

where;
<connectoraddress> is defined in section 1.
<inputstate> is |0|1|

Note: A "1" represents a high digital voltage level input or absence of an input (no connection) and a "0" is a low input.

statechange

If the sensor port has been configured as “Sensor In with Auto-Notify”, the GC-100 automatically sends a notification message upon a state change of that digital input connector as follows:

statechange,<connectoraddress>,<inputstate>↵

where;
<connectoraddress> is defined in section 1.
<inputstate> is |0|1|

5.3.2 Relay Closures

GC-100 relays are activated by sending a "1" state and deactivated with a "0." Activation of a normally open contact will close (or connect) the relay output pins, while a normally closed contact will open (or disconnect) the relay output pins. Note: relay states are not preserved through a power cycle and all relays will return to their inactive state until a 1 state is re-sent.

setstate

Relay state is set as follows:

setstate,<connectoraddress>,<outputstate>↵

where;
<connectoraddress> is defined in section 1.
<outputstate> is |0|1| (where 0 is inactive, 1 is active)

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Response:

state,<connectoraddress>,<0|1>↵

5.4 Serial Communication

GC-100 serial is bi-directional, RS232 communication. All communication is 8 data bits and one stop bit. Baud rate is set through a GC-100 internal web page, or configuration command, up to 57.6 Kbaud. Parity and hardware flow control can also be set. Each serial input buffer is 255 bytes with no flow control. All serial data is passed through without interpretation via an assigned IP port. Each serial connector is assigned a unique port number. The serial connector with the lowest module number is assigned to IP Port 4999. The serial connector with next highest module number is assigned to IP Port 5000, and so on.

If a serial buffer overflows, data will be lost. Parity errors and serial overflow are indicated on the web page for serial port configuration. Overflow will not occur unless the network connection is blocked where the GC-100 is unable to communicate.

* Applies to GC-100 Network Adapters versions 3.0 and higher.

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6. Error Codes

The chart below provides a list of error messages returned by the GC-100 from port 4998 and the explanation of each message.

Error Message	Explanation
unknowncommand 1	Time out occurred because carriage return <CR> not received. The request was not processed.
unknowncommand 2	Invalid module address (module does not exist) received when attempting to ascertain the version number (getversion).
unknowncommand 3	Invalid module address (module does not exist).
unknowncommand 4	Invalid connector address.
unknowncommand 5	Connector address 1 is set up as “sensor in” when attempting to send an IR command.
unknowncommand 6	Connector address 2 is set up as “sensor in” when attempting to send an IR command.
unknowncommand 7	Connector address 3 is set up as “sensor in” when attempting to send an IR command.
unknowncommand 8	Offset is set to an even transition number, but should be set to an odd transition number in the IR command.
unknowncommand 9	Maximum number of transitions exceeded (256 total on/off transitions allowed).
unknowncommand 10	Number of transitions in the IR command is not even (the same number of on and off transitions is required).
unknowncommand 11	Contact closure command sent to a module that is not a relay..
unknowncommand 12	Missing carriage return. All commands must end with a carriage return.
unknowncommand 13	State was requested of an invalid connector address, or the connector is programmed as IR out and not sensor in.
unknowncommand 14	Command sent to the unit is not supported by the GC-100.
unknowncommand 15	Maximum number of IR transitions exceeded. (SM_IR_INPROCESS)
unknowncommand 16	Invalid number of IR transitions (must be an even number).
unknowncommand 21	Attempted to send an IR command to a non-IR module.
unknowncommand 23	Command sent is not supported by this type of module.

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