GC-IRL API Specification
Version 1.0

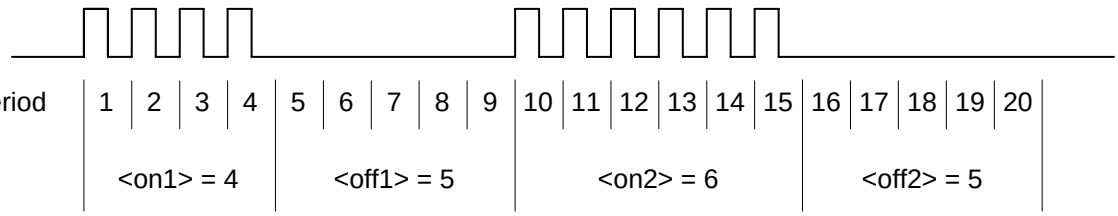
1. The GC-IRL

The Global Caché GC-IRL IR Learner plugs into the RS232 port of any PC and is used to learn the full spectrum, 30KHz to 500KHz, of IR codes that control infrared driven audio/video equipment. When used in conjunction with the free GC-IRL Utility software, learned codes are displayed, converted into other formats, and automatically copied into the Windows clipboard for easy IR database and spreadsheet creation. The stored codes can be used to control IR devices from any computer over the network. The GC-IRL provides all the information required to correctly recreate IR signals for playback. The GC-IRL power is supplied by the RTS line of the serial port and requires no external power supply.

2. IR Signal Encoding

The GC-IRL transmits IR signals in real time as comma delimited ASCII text strings terminated by a carriage return (↵). The ASCII structure is similar to the GC-100 IR output commands to simplify IR recording and playback.

An IR signal is a sequence of on and off states modulated with a carrier frequency during the on state (see figure below). Most IR remote control devices operate at frequencies near 40 KHz, with newer devices operating up to 500 KHz. *On* and *off* states are measured in periods of the carrier frequency ($\tau = 1/f$). For example, an on state of 24 represents 600µs for a carrier frequency of 40 KHz (600 µs = 24 / 40,000Hz).



The IR sequence begins with GC-IRL to identify the data. See below.

Sent from the GC-IRL:

GC-IRL,<frequency>,<on1>,<off1>,<on2>,<off2>,…,<onN>,<offN>↵

where;

<frequency> is	/32000/33000/…/500000/	(in hertz)
<on1> is	/4/5/…/65635/	(carrier frequency periods)
<off1> is	/4/5/…/65635/	(carrier frequency periods)
↵ is	0Dh	carriage return terminator

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The following is an ASCII text string representing a typical IR remote control signal:

GC-IRL,55000,22,340,24,156,23,92,23,157,23,157,23,92,23,156,23,156,23,157,23,157,23,156,
23,157,23,157,23,156,24,156,23,157,23,157,23,1375↵

The string above is interpreted as a signal with a 55 KHz carrier frequency. The first *on* state is 22 periods at the carrier frequency or 400µsec. The following *off* state is 340 periods or 6.182 ms in duration. The final 1375 *off* state may actually be longer, but is cut off by the GC-IRL after the "IR end timeout" period. This period needs to be long enough to distinguish between two separate signals rather than possibly misinterpreting them as one long signal that would fail to perform their intended functions during playback. Most remote controllers repeatedly send IR commands when the button is held down. A pause is usually inserted between each IR command sequence. Sometimes repeated commands differ from the first command. The GC-IRL encodes repeated commands as separate commands if the pause between the commands is longer than the "IR end timeout" period. Otherwise, repeated commands are sent as one long command.

3. IR Signal Compression

Some IR remote controllers send continuous signals without pausing between commands, for example when holding down the volume control. This may create a condition where the GC-IRL is unable to transmit serial data fast enough to keep the IR commands from overflowing the internal serial buffer. To avoid this, the GC-IRL employs a compression mode to reduce the serial data to as much as one third of its original size. If a serial overflow does occur, an ASCII X is appended to the end of the IR text string to indicate the error.

In this compressed format, repeated on and off pairs are represented in the serial data stream as single uppercase letters, A, B, C, or D. Up to four different pair combinations are condensed from several ASCII characters to only one. The compression process assigns A to represent the first *on*/*off* pair in a new IR signal, B to the next different pair, and so on. Using compression, the first occurrence of an *on*/*off* pair is transmitted as before, with all subsequent pair repeats represented by its assigned single letter. To aid compression, *on*/*off* values are consider equivalent if they are within 3 counts of each other reducing undesirable effects of noise and round-off error. The following example highlights alternating pairs to ease reading.

GC-IRL,55000,**22,340**,24,156,**23,92**,23,157,**23,157**,23,92,**23,156**,23,156,**23,157**,23,157,**23,156**,
A B C
23,310**,23,311**,23,156,**24,156**,23,157,**23,157**,23,1375↵
D

where A through D are assigned as follows, A = 22,340 B = 24,156 C = 23,92 D = 23,310

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In this example, the IR command will compress to the following:

GC-IRL,55000,22,340,24,156,23,92BBCBBBBB,23,310DBBBB,23,1375␍

Since the first pair 22,340 never repeats, the letter "A" is not used. Additionally, if the last pair 23,1375 had repeated, it would be sent uncompressed because all four letters are assigned to other pair values. Lastly, the letters are sent without comma delimiters, reducing the original signal from 138 to just 58 characters.

4. Filtering & Noise Measurement

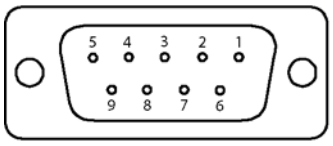
The GC-IRL contains filtering algorithms to improve performance by removing unwanted IR signals occurring from direct sunlight or fluorescent lighting. Another source of unwanted signals is caused by remote controllers operated from too great a distance, partially blocked by an obstruction, pointed poorly, or in need of fresh batteries. The GC-IRL filtering is not intended to correct a corrupted signal, but to prevent it from being transmitted as serial data. However, when an IR signal is corrupted during transmission, the GC-IRL immediately ends the current IR data output with the letter "Z."

A number of techniques are employed to identify incorrect IR signals, including the minimum acceptable <on> and <off> value of 12. Any time an <on>/<off> value is less than the minimum value the transmission is not sent, or if it is in progress, it is stopped by ending the serial data stream with the letter Z.

5. Serial Interface and Power

GC-IRL utilizes a female DB9 connector to mate directly to the GC-100 and most PCs. From the factory, the GC-IRL is set to 9600 baud, 8 bits, 1 stop, no parity, & no flow control.

The serial interface is also the power source for the GC-IRL, which operates off the RTS output voltage located on pin 7. The RTS voltage must be between 8 and 25 volts and capable of sourcing 5mA for proper operation. Typical RS232 serial drivers will meet this requirement. Also, hardware handshaking (or flow control) must be disabled to avoid RTS voltage interruption.



Female Connector

PIN
2. Receive
3. Transmit
5. Ground
7. RTS power

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6. Commands

The GC-IRL recognizes and responds to commands via the serial connection. Incorrect character sequences followed by a carriage return (↵) will result in an *unknowncommand* response. Commands are case sensitive and listed below.

Commands	Definition	Response	Non-Volatile	Action
gv↵	get version	ver,x.x.x ↵	-	-
id↵	identity of device	device,GC-IRL↵	-	-
e1↵	change IR end	IRend,20msec↵	Yes	sets IR end to 20msec
e2↵	change IR end	IRend,35msec↵	Yes	sets IR end to 35msec
e3↵	change IR end	IRend,50msec↵	Yes	sets IR end to 50msec
e4↵	change IR end	IRend,100msec↵	Yes	sets IR end to 100msec

Other	Definition	Response	Non-Volatile	Action
-	-	unknowncommand↵	-	received invalid command
-	-	X↵	-	buffer overflow
-	-	Z↵	-	abort signal

Note: The symbol ↵ represents the termination character used by the ASCII text string response. The termination character is a carriage return with a value (Hex 0d).

Serial commands sent to the GC-IRL are always terminated by a carriage return ↵ (Enter Key) for proper operation.

8. Specifications

Serial Interface

Connector	Female DB9
Baud rate	9600
Other	No parity, one stop bit
Flow Control	None
Power	Supplied by RTS (pin 7) — must be 8 to 25 volts @ 5mA
Data rate	32 to 500 KHz
Power	Not supplied

Encoding Comma delimited ASCII text string with termination character.

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