What IR codes look like

There is an initial burst of one or more pulses.

If the burst contains a single pulse, this is known as Flash Mode or Pulse Mode, and generally all remaining data consists of single pulses.

If the burst contains more than one pulse, CORE keeps track of the number of pulses in the burst and the duration of the burst, and is thereby able to compute the carrier frequency. (The value used in the frequency editing procedure refers to the period in microseconds: the time between consecutive pulses.)

Next there is a space, followed by some number of further bursts, or bits, of the same carrier frequency. CORE keeps track of the length of each space and the length of each burst.

Then there is an inter-word gap: i.e. a space which is usually longer than any of the inter-bit gaps. (The minimum length of an inter-word gap is decided upon empirically based on the number of pulses in the initial burst).

In the case of a "one-shot", that's all. In most cases, there is another word, which may be the same as the first word or may be different. Usually, when the key is held down, the controller continues to send the second word. (In rare cases it may repeat both the first and second word.) There are also "two-shots", which send two words and then stop.

During the Compression routine, all of the above information is stored in a compressed format. The compression of bit durations is done as follows:

The durations (both on and off) are grouped into "bins". Generally speaking, most IR signals contain only a few possible times. A typical code might contain a long space after the initial burst (bin 3), short bursts (bin 1) and medium-size spaces thereafter (bin 2). CORE allows for a maximum of 8 bins.

For cases where there are 1-4 bins, each bin can be represented by 2 bits. For 5-8 bins, 4 bits are used. See below for further details.

Documentation on CORE infrared code data structures

In the key definitions, a $21 or $23 indicates that an IR code definition follows. $21 refers to a standard repeating code (or two-shot); $23 refers to a one-shot.

The IR code definitions are structured as follows:

The first six bytes of "header" information are present in all codes:

BYTE 0: Length (L) in bytes of first word of the code (including the length byte). Most codes have two words (the second being referred to as a "keepalive" code). One-shots have only a single word.

BYTE 1:

Bit 7: repeater bit. If this bit is on, it means that the signal should repeat if held down. This bit will be on if two conditions are true:

1. The IR itself is a repeater.
2. This is the only IR in the key definition. In other words, if there is more than one IR in this definition, this bit is never set.

Bits 4-6: number of sends. Values of 0-7 correspond to 1-8 sends. The default is 001, meaning 2 sends. This value changes when the user edits the number of sends.

Bits 2-3: The "tag" for the carrier frequency (T). Can be 00, 01 or 10. See discussion under Byte 3.

Bit 1: keepalive bit. If this bit is set, the second word exists. If it's clear, there is no second word.

Bit 0: not used in Versions 4.0+.

BYTE 2:

Bits 1-7: not used.

Bit 0: set in rare case where the word consists of only a single burst, with no trailing data.

BYTE 3:

Bits 5-7: period value (P). Period is equal to 3*P + 18 - T (see above). For example if P is 000 and T is 10, the period is 16. This is the minimum value possible. The maximum is 39 (P=7, T= 0).

Bit 4: if this bit is set, the code is a one-shot.

Bit 3: if set, there is an odd number of bits in the word.

Bits 0-2: number of bins (B) for the compressed bit data. (A value of 000 means there are 8 bins.)

BYTES 4-5: Number of pulses in starting burst. A value of 1 means Pulse Mode or Flash Mode (corresponding to P:F in *frequency editing procedure*).

BYTES 6 to (5+2*B): the times corresponding to each bin. (These times are in multiples of 4 microseconds). For example, if there are 3 bins, there would be six bytes of data here.

BYTES (5+2*B + 1) to L-3: the compressed bit data.

If there are 1-4 bins, the data is represented in 2 bits, so there are 4 bits per byte. If there are 5-8 bins, the data is represented in 4 bits, so there are 2 bits per byte. For example, suppose there are 4 bins, & the data looks like this:

11000100 10000100

This translates to bins 3-0-1-0-2-0-1-0. The first bit corresponds to the "off time" after the initial burst, and the length of the bit is determined by the value of Bin 3. The 2nd byte is the next "on time" (from Bin 0), then off, on, etc...

BYTES L-2, L-1: inter-word gap between the 1st & second words (multiples of 4 microseconds).

BYTE L: if the second word is present, this is its length byte, and the remaining bytes have the same structure as above. If it's not present, this byte represents the next character in the key definitions.

Notes

When transmitting an IR code, the CORE code uses the above data structures to re-create the IR signal. Since the routines to expand and transmit the IR take time, there are adjustment factors built into the time data to take this into account. For example, the value given for the inter-word gap between the first and 2nd words is shorter than the actual time, to take account of the time needed to run the expansion routine on the second word.