

# NEC Infrared Transmission Protocol

Modified by on 6-Nov-2013

The NEC IR transmission protocol uses pulse distance encoding of the message bits. Each pulse burst (mark – RC transmitter ON) is  $562.5\mu\text{s}$  in length, at a carrier frequency of 38kHz ( $26.3\mu\text{s}$ ). Logical bits are transmitted as follows:

- Logical '0' – a  $562.5\mu\text{s}$  pulse burst followed by a  $562.5\mu\text{s}$  space, with a total transmit time of  $1.125\text{ms}$
- Logical '1' – a  $562.5\mu\text{s}$  pulse burst followed by a  $1.6875\text{ms}$  space, with a total transmit time of  $2.25\text{ms}$

When transmitting or receiving remote control codes using the NEC IR transmission protocol, the WB\_IRRC performs optimally when the carrier frequency (used for modulation/demodulation) is set to 38.222kHz.

When a key is pressed on the remote controller, the message transmitted consists of the following, in order:

- a 9ms leading pulse burst (16 times the pulse burst length used for a logical data bit)
- a 4.5ms space
- the 8-bit address for the receiving device
- the 8-bit logical inverse of the address
- the 8-bit command
- the 8-bit logical inverse of the command
- a final  $562.5\mu\text{s}$  pulse burst to signify the end of message transmission.

The four bytes of data bits are each sent least significant bit first. Figure 1 illustrates the format of an NEC IR transmission frame, for an address of 00h (00000000b) and a command of ADh (10101101b).

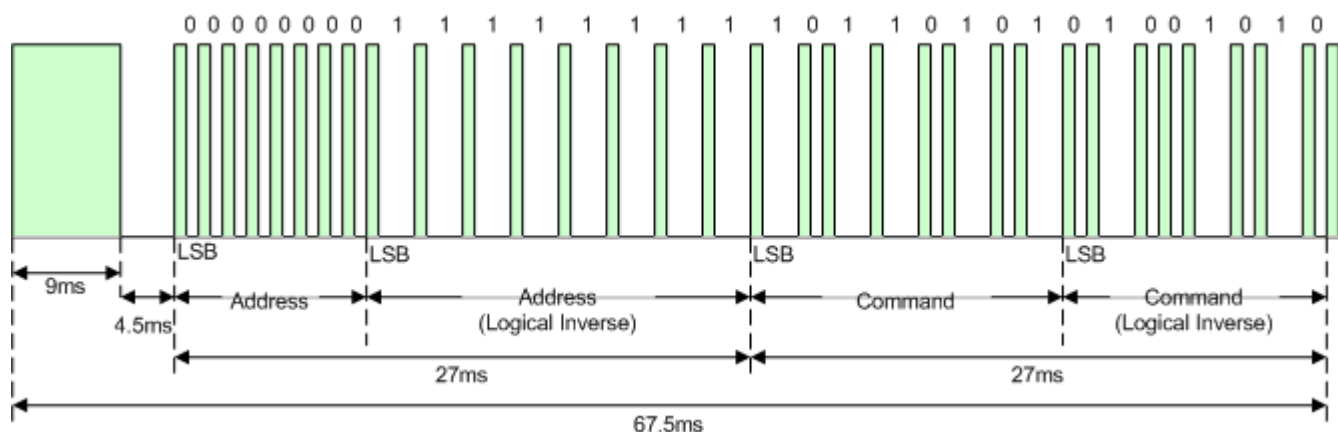


Figure 1. Example message frame using the NEC IR transmission protocol.

Notice from Figure 1 that it takes:

- 27ms to transmit both the 16 bits for the address (address + inverse) and the 16 bits for the command (command + inverse). This comes from each of the 16 bit blocks ultimately containing eight '0's and eight '1's - giving  $(8 * 1.125\text{ms}) + (8 * 2.25\text{ms})$ .
- 67.5ms to fully transmit the message frame (discounting the final 562.5 $\mu\text{s}$  pulse burst that signifies the end of message).

## Repeat Codes

If the key on the remote controller is kept depressed, a repeat code will be issued, typically around 40ms after the pulse burst that signified the end of the message. A repeat code will continue to be sent out at 108ms intervals, until the key is finally released. The repeat code consists of the following, in order:

- a 9ms leading pulse burst
- a 2.25ms space
- a 562.5 $\mu\text{s}$  pulse burst to mark the end of the space (and hence end of the transmitted repeat code).

Figure 2 illustrates the transmission of two repeat codes after an initial message frame is sent.

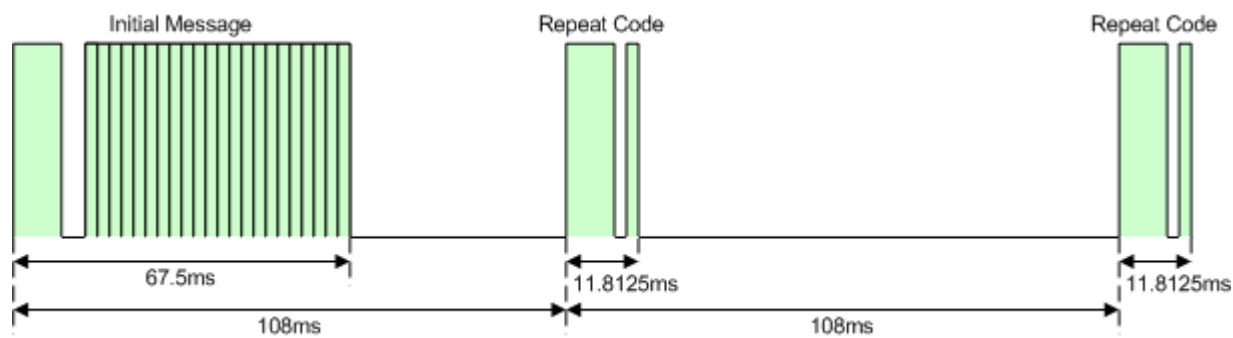


Figure 2. Example repeat codes sent for a key held down on the transmitting remote controller.