

IR remote-control systems

Chapter 1 of this volume briefly mentioned the fact that IR light-beam systems can be used for remote-control purposes. This final chapter of the book expands on this theme by explaining the basic operating principles of IR remote-control systems, and by giving hints on how to use modern IR remote-control ICs.

Remote-control systems

All modern remote-control systems take the basic form shown in *Figure 12.1*, and consist of a remote-control transmitter and a remote-control receiver that are linked by some type of transmission medium. At the transmitter end of the system, a 'control' instruction is selected via the keyboard, is converted into a multi-bit digital word by a digital encoder, and is then transmitted *in serial form* by the transmitter's Tx unit. At the receiver end of the system the transmission medium's coded signal is picked up by the Rx unit, is decoded by a digital decoder, and is then converted into some useful form by an 'output actions' unit.

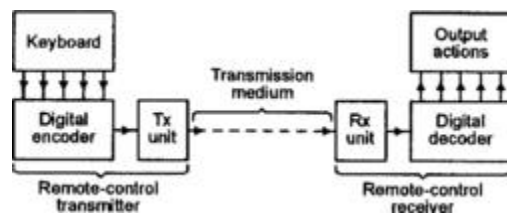


Figure 12.1 Basic form of a modern remote-control system

The 'transmission medium' mentioned in the above paragraph may take a variety of forms, including a direct wire or fibre optic cable link, a wireless link, or an IR light-beam link. Wireless links offer good effective operating ranges and are not obstructed by walls or various other physical structures, but (in 'security' applications) can easily be intercepted and duplicated by criminals equipped with scanner/recorder units. IR light-beam links work on a strict line-of-sight principle and have fairly short operating ranges (typically less than 12 metres), but have good immunity to interception/duplication by criminals. The rest of this chapter is concerned primarily with remote-control systems that use IR light-beam links.

Figure 12.2 illustrates some important basic principles of IR remote-control operation. Here, the hand-held control unit transmits a coded waveform via a broad IR light beam, and this signal is detected and decoded in the remotely placed receiver and thence used to activate external devices, etc., via the receiver outputs. Note that the transmitter can remote-control a receiver that is placed anywhere within the active area of the IR beam, and that the transmitter and receiver do not need to be pointed directly at each other to effect operation but *must* be in line-of-sight contact; also note that an object placed within the beam can create a blind area in which line-of-sight contact cannot exist.

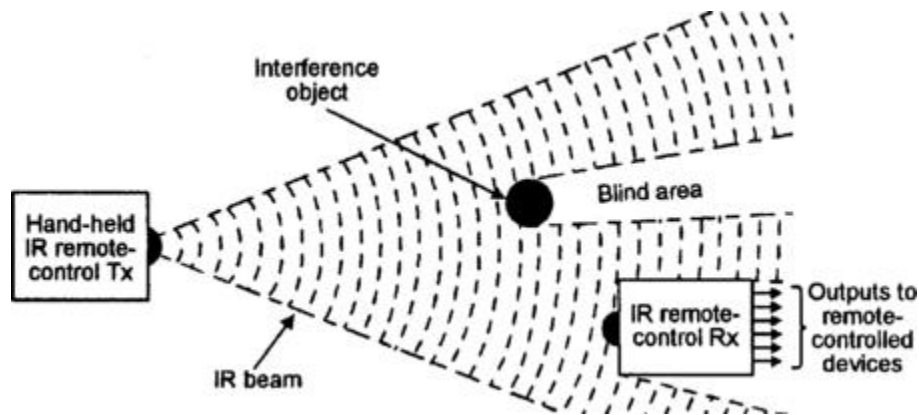


Figure 12.2 Diagram illustrating some important basic principles of IR remote-control operation

Code waveforms

TV/Hi-Fi controllers

Most modern IR remote-control systems give multichannel operation, with each channel giving digital control of an individual function. The transmitter waveforms usually take the general form shown in *Figure 12.3*, which depicts those of a basic 6-bit multichannel system. Here, the waveform comprises a 9ms repeating frame of seven bits of pulse-coded information, with each bit modulated at about 30kHz. The first bit has a fixed 1ms duration and provides frame synchronization for the decoder; the subsequent six data bits appear at 1ms intervals and each gives an on/off form of control, with a less-than-0.25ms pulse representing an OFF or logic-0 state and a greater-than-0.25ms pulse representing an ON or logic-1 state. In practice, this 6-bit code waveform can be used to give either six simultaneous channels or up to 64 non-simultaneous channels of remote-control, as shown in *Figures 12.4* and *12.5*.

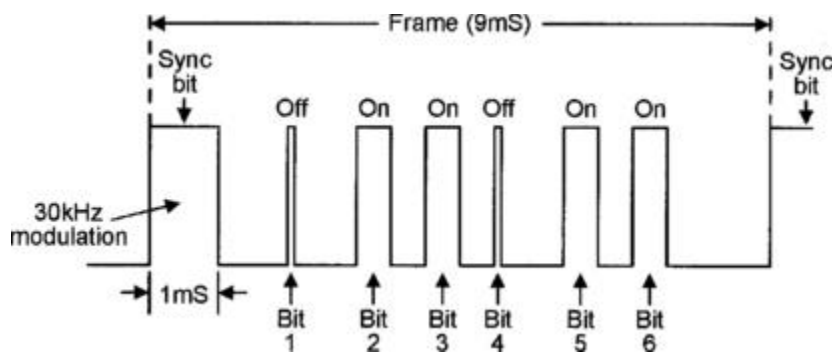


Figure 12.3 Typical transmitter code waveform of a 6-bit remote-control system

Channel number	Channel state	Decoded function
1	On Off	Switch A On Switch A Off
2	On Off	Switch B On Switch B Off
3	On Off	Volume increase
4	On Off	Volume decrease
5	On Off	Brilliance increase
6	On Off	Brilliance decrease

Figure 12.4 Typical functions of a 6-channel simultaneous remote-control system

Channel number	6-Bit code	Decoded function
1	000 000	Switch A On
2	000 001	Switch A Off
3	000 010	Switch B On
4	000 011	Switch B Off

61	111 100	Volume increase
62	111 101	Volume decrease
63	111 110	Brilliance increase
64	111 111	Brilliance decrease

Figure 12.5 Typical functions of a 64-channel non-simultaneous remote-control system

When the *Figure 12.3* waveforms are used to give simultaneous operation, each data bit controls a single channel, as shown in *Figure 12.4*. Channels 1 and 2 may thus each be used to give independent on/off switching functions, while channels 3 and 4 may be used to increase or decrease the output of a ramping volume control, and channels 5 and 6 may be used to similarly control the output of a ramping brilliance control, etc. Note that, within each transmitter frame, all six channels can be varied simultaneously.