



# User Guide - *FIRST* IR Learning Infrared Remote Control Decoder Board Version 1.0



## 1 General Description

The *FIRST* IR board is capable of recognizing infrared (IR) command sequences from standard consumer remote controls. It is trainable and compatible with remotes from many manufacturers. Once trained, the device provides four remotely controllable pulse outputs. Each output provides a 100 mSec high (5V) pulse when its command is recognized. In addition, the indicator light emitting diode (LED) that corresponds to each output will flash when its command is recognized. The board contains an IR sensor, a CMOS microcontroller, a 5V voltage regulator, five LEDs, resistors, capacitors, and a small pushbutton (learn) switch.

## 2 Acknowledgements

The *FIRST* IR board is a modified TinyIR2 board. The original TinyIR2 design and the customization for *FIRST* was done by Bob Grieb, founder and owner of TaunTek. Mr. Grieb also updated the PIC code for use on the *FIRST* IR board. The *FIRST* IR board layout and assembly was donated by Diversified Systems. The IR sensors used on the *FIRST* IR boards were donated by Vishay.

## 3 Making the Connections

Before you can begin to train and use your *FIRST* IR board, you must connect it appropriately. The connector pinout/signal descriptions are included in the table below.

Name	Pin #	Signal Description
+VIN	1, 2	Positive power supply voltage input. Voltage should be in the range 7-15 volts DC. Your power supply will have to be independent, for example, a 6 x AA battery pack, 9V battery, 12V battery, bench top supply, or other.
GND	3, 4	Negative power supply voltage input
OUT2	5	Output signal associated with third trained button
OUT1	6	Output signal associated with second trained button
OUT3	7	Output signal associated with fourth trained button
OUT0	8	Output signal associated with first trained button
NC	9, 10	Unused

## 4 Training the Chip

Before training the chip, pick the remote you intend to use. When using a universal remote, set it to the manufacturer that you want to use. Selecting a TV, VCR, or DVD code setting should be OK. **Do not use a cable box remote, or a cable box setting on a universal remote.**

1. Power the board down. Press and hold the small “learn” pushbutton switch while applying power to the board. The Error LED will light. Wait at least two seconds after applying power, then release the switch.
2. At this time, the Error LED will blink off for 1 second, then the CMD0 LED will light indicating that “learn” mode has been initiated for CMD0.
3. For best results while training, hold the remote approx 4-6” from the IR sensor and shade the sensor from bright light.
4. To train the first remote button, press the button and hold it down until the CMD0 LED turns off, releasing it quickly. The CMD0 LED will turn on again. Press the button on the remote again, hold it, and release it quickly when the LED turns off. At this point, the chip has learned and saved the first code.
5. The CMD1 LED will now turn on. Switch to the next button you wish to use, and repeat the procedure, pressing the button twice, as before, to learn it. After 4 buttons have been learned, the chip will automatically switch out of “learn” mode. The LED’s will go off and stay off.

Your device is now ready for use, and will retain its code information, even if power is lost. You can train the chip many times, if desired. Each time you enter “learn” mode, all previously learned commands are erased.

If, during training, the Error LED starts flashing continually, power down the board and start again. Check the position of the remote relative to the IR sensor, and try lowering the ambient light level. If it fails to learn again, it probably means that the remote is using an unusual protocol, which will not work properly. If this happens please switch to a different remote. If you are using a universal remote, simply switch to a different manufacturer setting.

There are two “Error” conditions that are detected when the chip is learning remote commands. These are indicated by flashing the Error LED. If pressing and holding the remote button causes the command to be sent just once, with nothing after that, then the Error LED will flash twice when learning that command. If pressing and holding the remote button causes the command to be sent once, followed by a special “key down” code to be sent over and over until the button is released, the Error LED will flash four times when learning that command. Both of these cases mean that the receiver has only one chance to detect the command when you first press the button, so it might miss it. Many remotes send the same command over and over if you hold the button down. These would probably be a better choice, and will not cause the Error LED to flash during learning.

If you have successfully trained the *FIRST* IR board, but find that it does not respond when the remote is positioned more than a few feet away, the remote is probably not using a 38KHz modulation frequency. To solve this, switch to a different remote (or setting on a universal remote) and re-train.

## 5 Operation

The IR receiver used on the board has an input acceptance angle of roughly +/- 30-40 degrees from the normal. The further you go (off-axis) from directly in front of the receiver, the weaker the signal will be.

Holding a learned button down on many remotes will cause the correct LED to flash on and off as long as the button is held down. If it only flashes once, this remote only sends the command once per button press.

## 6 Operating Voltage, Output Current

### 6.1 Operating voltage range

The onboard voltage regulator needs at least 7 volts DC, and can accept more than 15 volts. To avoid problems, a reasonably clean voltage source is recommended to power this board. Avoid having any noise glitches on this supply that go below 7 volts DC.

### 6.2 Typical power consumption

The typical idle current for the *FIRST* IR board alone is approximately 6.5 mA, which is partly the idle current of the 78L05 regulator. When a single LED is on, the current should increase to approximately 19 mA. Assuming a 12VDC supply, the power consumption of an idle *FIRST* IR board is approximately 78mW. With a single LED on, the power consumption will increase to approximately 228mW.

### 6.3 Output current capabilities

When +VIN is equal to 5.0 volts, each of the four outputs of the device is capable of sourcing (the current out of the pin) 3 mA when it is high, and sinking (the current into the pin) 8.5 mA when it is low. A 47 ohm resistor is in series with each pin. For more detailed information on the output capability, you can go to Microchip’s web site and download the data sheet for the PIC16LF87 device.