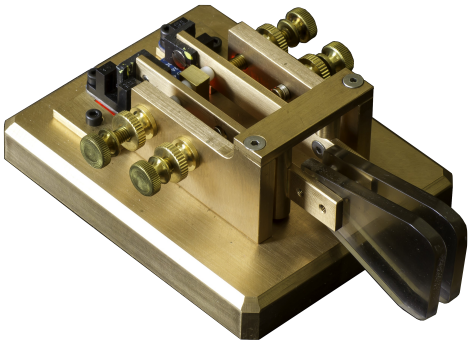
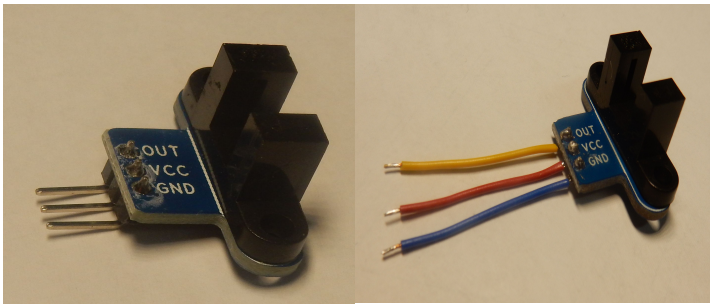
NV1Q Opto-Keyer Design



The design goal was to build an iambic keyer that utilizes no mechanical contacts. A search on the Internet revealed that the only one out there was the touch-keyer. I have a touch-keyer, but it does not give me a nice key-press feeling.
I focused on using easily available slotted optical switches in my design.
After doing some testing, I was satisfied that a displacement distance of 0.3mm would reliably change the state of the opto switch. This was also confirmed with data from an optical switch datasheet. Adding 0.2mm as a safety factor, I came up with a design goal of 0.5mm for travel into the slot i.e., a comfortable paddle squeeze during operation should at least present 0.5mm stroke at the end of the lever arm.
An outline on my CAD system provided me with the required length of the lever and the location of the pivot point which determined the size of the base plate. That's when I started on the layout and design of the keyer, creating detailed drawings of all parts, and the assembly drawings.
The pivot point is the most critical design area of any iambic keyer. I decided on a ball-pivot mechanism. Two steel balls rest in holes which are slightly smaller than the diameter of the balls and held captive between the pivot pin and base plate and the top support plate. The bottom ball can be tightened by a setscrew to allow for adjustments to compensate for machining tolerances. This pivot assembly aligns the lever during its movement. To design the pivot mechanism I created an equation [*Equation 1*] and entered it into a spreadsheet. This made it easy to find the right dimensions for the steel ball and pivot hole.
Left and right lever force is supplied by a compression spring and can be adjusted by a knurled screw and locked in place by a knurled nut to keep its adjustment. The same type of screws and nuts are used for setting contact spacing.
All parts are machined from a piece of bronze. The knurled screws and nuts are commercially available.



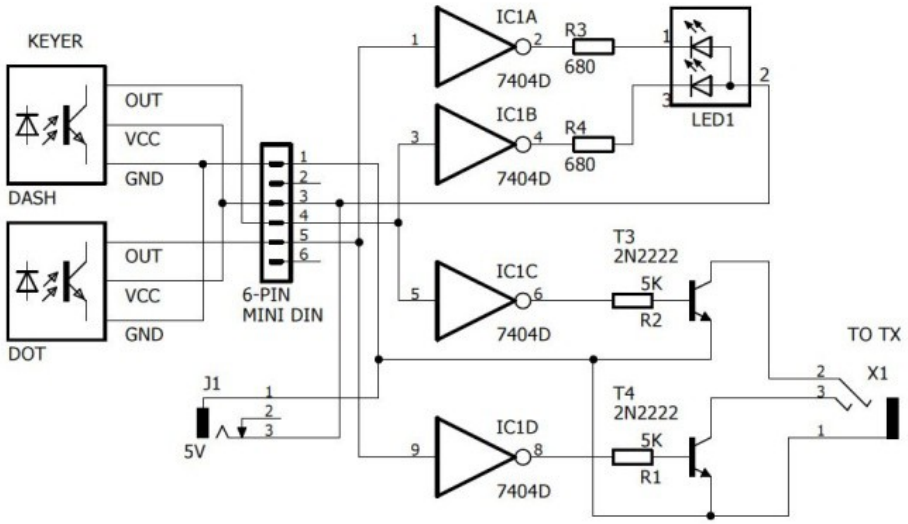
The two optical switches are mounted on separate sliding plates that have a slotted hole for the initial alignment.

Before mounting the optical switches to the sliding plates, they have to be modified. The pins have to be unsoldered or cut off and replaced with three approximately 3cm long wires.

<u>Pivot Design:</u>
P_L = Length of the Pivot Pin
P_H = Pivot height (Distance between Base and top Plate)
d_{PB} = Diameter of the Steel Ball
d_{PH} = Diameter of the Pivot Hole

$$P_L = P_H - 2 * \sqrt{d_{PB}^2 - d_{PH}^2}$$

Electronic Circuit:



The optical switches require a 5V power supply. When the paddle is at rest, the output of the optical switch is at 5V (logic 1). Hence, it cannot be used directly to control the switching transistor for keying the transmitter. The signal has to be negated, which is done by a 7404 Hex Inverter. The LED1 will change colors when pressing the left or the right paddle.

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