# Touch Sensitive Keyers

*by Geoffrey Walsh, GM4FH**


**Iambic touch keyer. Alternative touch sensors may be plugged into the front panel DIN sockets.**

MARK TWAIN described the report as 'highly exaggerated' on hearing of his own demise; the end of Morse, often predicted, seems a long way off. To me the durability of Morse, one way or another, is comparable to those twin certainties, death and taxes.

I am a medical physiologist interested in the control of muscles, a subject on which I have written a book [1]. I am a member of the Museum of Communication and have written several articles for the newsletter *Transmitting*. One article dealt with 'Telegraphists' Cramp' [2], another on an attempt to use the sense of taste to pick up Morse signals in early, noisy aircraft [3], another [4] deals with 'Telegraphists' Cramp in 1922'. One has dealt with the physiological uses of Morse keys [5].

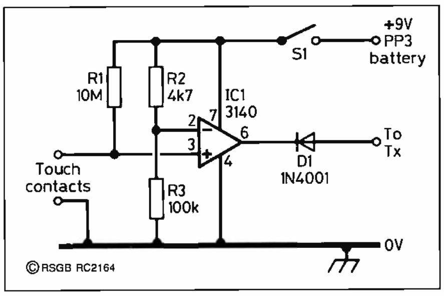



**Fig 1: The simplest form of touch contact sender. The IC (a CA3140) has only 8 pins, so the unit can be very compact and construction is extremely simple. The current drain of the one I constructed is only about 2.3mA.**

I have now started to investigate finger control when playing the recorder [6]. There are many degrees of freedom, many alternative ways of fingering the instrument! Other measurements [7] have been on highly skilled players of the bagpipes, a study appropriate for attention in Scotland!

## A STRAIGHT TOUCH SENSITIVE SENDER

AS A RATHER inactive CW enthusiast, it occurred to me that the system I had developed for my experiments could form the basis of methods of sending Morse without a mechanical key. This journal has already had an article by G3BIK on a touch keyer [8] but my system is different. The component count of the basic circuit is lower and there has been development of the most suitable ways of interfacing with finger movements.

*64 Liberton Drive, Edinburgh EH16 6NW. E-mail Geoffrey.Walsh@ed.ac.uk

The first two projects were for 'straight' sending. The simplest uses just one operational amplifier, three resistors and a diode (**Fig 1**). The procedure is made possible because the operational amplifier selected has very high input impedance, and the very small currents employed can thus be detected. Earth for the hand is provided by the metal box. QRP enthusiasts who not only use low power but may also want their equipment to be physically small may, by drawing power from the Tx supply, get away with something smaller. The small space needed for the electronics could be in the transmitter case and the contacts on the panel. This version uses a CMOS operational amplifier type CA3140 as IC1. The manufacturers' figures show that when running at ±15V the current drain is typically 4mA, but in this example a single ended supply of 9V is used so it will be less.

The conductor is a plain brass button 5/8in in diameter, obtained from a haberdashery counter at a large departmental store, insulated from the box by a tap washer, and glued in place with Evostik® (see photo above). It was easy to solder a wire to the ring at the back of the button.

I found this arrangement keyed my FT-290 without any difficulty and an 'on air' test proved satisfactory. In this transceiver the key up voltage is 7V and the key down current is only 0.3mA, so the circuitry has no difficulty in sinking this quite tiny current. D1 may not be necessary; I put it in to ensure that too high a positive voltage did not reach the keying circuitry of the Tx.

The inverting input, marked with a negative sign, is held by the resistance divider R2 and R3 at a little below the positive rail. When the finger is not in contact with the disc the non inverting input, marked with a positive sign, is held above this by R1, so the output of the amplifier is positive and no transmission takes place. When the finger makes contact, the voltage on the non inverting input falls below that on the inverting input, the output voltage drops and the transmitter is activated, current passing from the key socket into the operational amplifier through D1. The action depends on skin conductivity; exceptionally dry skin may need to be slightly moistened, although this problem is quite exceptional.

## SECOND STRAIGHT TOUCH SENSITIVE SENDER

I THOUGHT IT would be an interesting project to build a second straight version with its own sound generator, for practice when not on the air. The circuitry is shown in **Fig 2**. The first stage is similar to the previous version, but it is followed by another operational amplifier in the same chip which inverts the signal and drives a buzzer. Here I used a twin version of the same amplifier, the CA3240. When running at ±15V the drain is typically 8mA. I also incorporated a transistor which would be capable of dealing with heavier currents than merely the output of an operational amplifier.

As they stand, these systems are not suitable for use with valve transmitters, where a negative rather than a positive voltage may have to be taken down to earth. They could, however, be adapted by the use of a reed relay. In any event, the keying requirements should

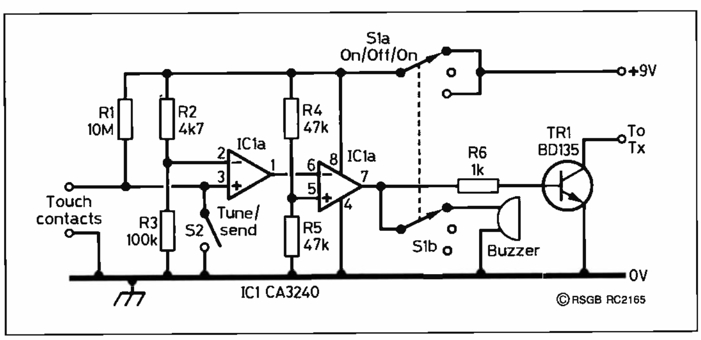



**Fig 2: Straight sender with option to use a piezo buzzer (a Maplin CR34M). The power is off when S1 is in the central position, to one side power is on and buzzer is on, to the other side power is on and buzzer is off. When practising without being connected to the transmitter it is appropriate to use the buzzer. When transmitting, if the transmitter generates a side tone, it may be more pleasing to have the buzzer off. S2 enables the unit to be on continuously. This facility my be of use in checking power levels of the transmitter, VSWR, etc. The quiescent current drain is about 3mA and about 9mA when activated and the buzzer on.**

be checked first to see if the specification is being appropriately met.

## IAMBIC SENDERS

THE NEXT PROJECT was an iambic keyer. I had no ambition to devise the appropriate logic circuitry; this has already been done by others. I bought a small ICOM board (IC-EX243) for a modest sum.

Doubling up the electrical side was straight forward. The circuits were based on copies of that in Fig 1, but the two amplifiers were provided by one 8 pin chip, type CA3240. A 6 volt supply from four AA batteries in a holder provided power. I dispensed with the diodes. If a higher supply voltage had been used they might have been essential for safety.

The ICOM module is designed to work from a mechanical key which shorts the inputs to earth. This can easily be driven, being almost no electrical load. A piezo buzzer can be switched in between the positive supply and the output of the ICOM module to provide a tone when practising off the air. The quiescent drain was about 7.5mA and about 12mA when activated with the buzzer on. A two-pole two-way switch could reverse the inputs, so that dots or dashes could be generated by touching either disc.

The main question about iambic keying was the arrangement of the contacts. Should one use thumb and index finger, as is customary with the usual twin horizontal paddles? The only design I could come up with along these lines was somewhat clumsy; I cut a piece of double sided circuit board and fixed it with a small bracket, using insulation and plastic screws, to the end of an aluminium box. This is not the only interface which can be satisfactory. The QRP Company can supply twin vertically operated keys, manufactured by DK1WE, for use with iambic keyers. These are very attractive products.

I decided to try a similar arrangement for the touch contacts. This proved good, but other possibilities can be considered. To use contacts not on the box but on a board a foot or two away may be convenient; but for this it is essential to use twin individually screened leads or there may be interaction between the wires, the currents being minute.

Using this arrangement I made up, for experimental purposes, a number of alternatives which could be connected in parallel to the inputs, using DIN connector plugs, so that the various arrangements could be easily tried and compared. I liked, in particular, an arrangement with three buttons. The centre button is earthed and the outer ones connected to the circuit inputs. In operation the middle finger remains down on the middle contact and the first and third fingers touch the other ones as required for sending. The tendons of adjacent fingers link the movements to some extent, it is surely easier to move the first and third fingers independently rather than the first and second. This is probably the preferable method. The touch keyers work well with such a module and it is possible easily to experiment with different geometrical arrangements for the brass discs, or whatever else is used to pick up the finger contacts. Thus finger control may be optimised, ie modifications of the ergonomics of iambic sending can be tested which would be much more difficult to do with mechanical keys.

## TOUCH SENDERS FOR THE DISABLED?

MORSE WAS FIRST used for land based telegraph circuits, and only much later for radio communication. But there is another use too. Some severely disabled people, suffering from motor neurone disease and other conditions are unable to speak or write, but have good intellects. With the muscle action of which they remain capable they may be able to operate a switch. I am in touch by e-mail with a group, mainly based in the USA, who are active in using Morse - which these people know or learn - to control computers. The group is known as MORSE2000. More information may be obtained from a page on the World Wide Web at http://www.uwec.edu/Academic/Outreach/Morse2000/morse2000.html

One e-mail message I recently read says of a person "a user of EZKEYS-Morse, who has set up his own home page, who runs a small business, who corresponds with numerous individuals via e-mail, all with the one single movement under his control, a thumb that moves 1/8in".

There are systems for operating a word processor programme by a Morse input and it is likely that touch contacts of the type described, with suitable modifications, may be easier for the disabled to operate than mechanical keys.

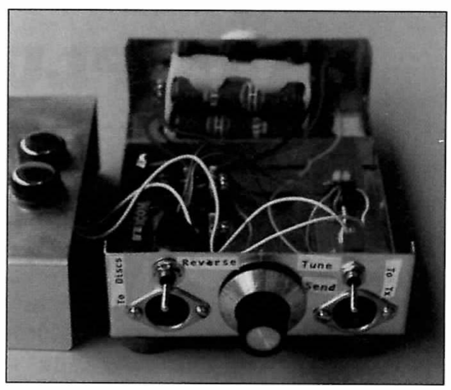
## CONCLUSIONS

TOUCH SENDERS may have significant uses; their simplicity renders construction suitable as an educational exercise for beginners in electronics; they can be compact and extremely inexpensive alternatives to mechanical keys; and are of particular potential use in low power work. They allow the exploration of an almost indefinite number of options for alternative fingering methods for iambic working, and may prove to be the most suitable way in which disabled people can control word processors.

## REFERENCES

[1] EG Walsh. *Muscles, Masses and Motion. The Physiology of Normality, Hypotonicity, Spasticity and Rigidity.* ISBN 0 521 43229 4 MacKeith/Cambridge University Press (1992).
[2] EG Walsh. (1997 b). 'Telegraphists' Cramp, Some Early Physiological Observations of Hand Movements of Telegraphists' *Transmitting* (Journal of the Museum of Communication) No 21, 8-10.
[3] EG Walsh. (1998) 'Sensitivity of the Tongue to Electrical Currents and an Investigation into the use of the Sense of Taste for receiving Morse Signals'. *Transmitting* (Journal of the Museum of Communication) No 22, 4-6.
[4] EG Walsh. (1998 b). 'Telegraphists' Cramp in 1922'. *Transmitting* (Journal of the Museum of Communication) No 23, 13.
[5] EG Walsh. (1997a) Physiological Uses of Morse Keys, Studies of Finger Movements. *Transmitting* No 19, 8-9.
[6] EG Walsh. 'Cross-Finger Timings In Sixteen Naive Recorder Players'. *Journal of Physiology*, 1997, 501P, 45P.
[7] M Paterson. (1998) 'Top Pipers' Fingers Put To The Test'. *Piping Notes* 3, 5.
[8] E Chicken. 'Simple Touch-Key For The BIK Keyer'. *RadCom*, September 1996, 37-38. ♦


**Selection of touch keyers. Left: Vertical blade iambic keyer. Centre: Iambic keyer with built-in electronics. Right: Touch pads. The operator rests the wrist on the rectangular pad and keys by touching the buttons.**




**Inside the iambic keyer. The ICOM module can be seen on the left. The small piece of Veroboard on the right carries the circuit shown in Fig 2.**