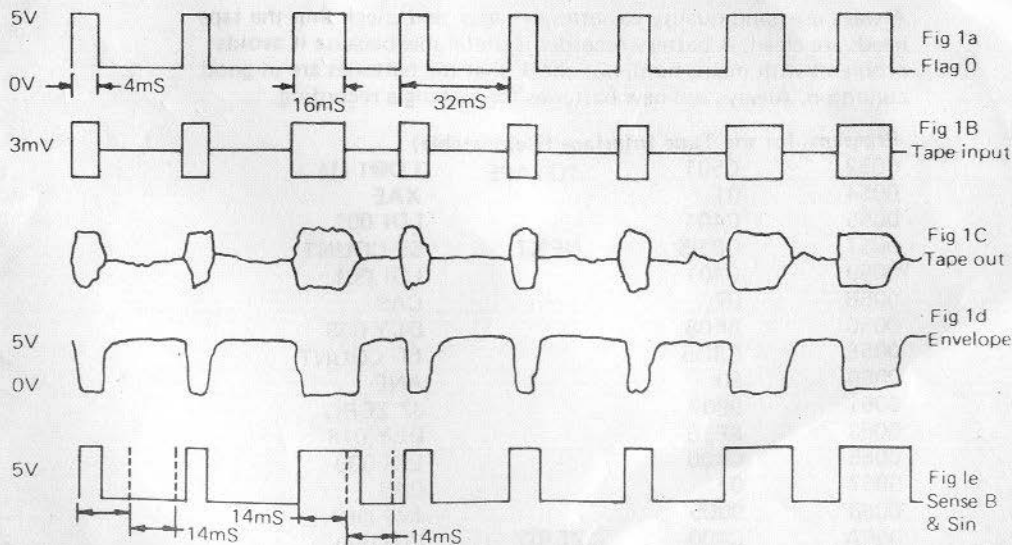


A Simple Tape Interface for the MK14

The hardware and software described below form a simple system for storing programs or data on a tape recorder and then reloading them anywhere in RAM memory. Programs can be relocated if they use suitable addressing modes.

Writing to tape The software reads the contents of the next address pointed to by the pointer register P1 and scans the bits from right to left pulsing flag 0 high for 4mS if the bit is a zero and for 16mS if it is a one. The leading edges of these pulses are separated by 32mS. If the byte was C4 (binary 11000100) and we connected an oscilloscope to flag 0, we would observe the waveform shown in Fig. 1a. The hardware contains a gated 1KHz oscillator which is controlled by flag 0. The e WRITE LED is also controlled by flag 0. The output of the oscillator is shown in Fig. 1b and this is connected to the input of the tape recorder. Notice how the flag 0 pulses are mixed with the output of the oscillator to give a zero-centred waveform. This reduces recording distortion and allows an automatic volume control recorder to adopt a higher input sensitivity. When all the bits of the byte have been scanned, the software increments P1 and repeats the process with the next byte. The system stores 4 bytes per second. When all the bytes have been scanned, control is returned to the monitor by the instruction XPPC3.

Reading from tape Typical output (C4) from the tape recorder is shown in Fig. 1c. This is amplified and demodulated by the hardware to give a waveform like than shown in Fig. 1d. This is then squared off by a CMOS gate to give the signal shown in Fig. 1e which is connected to SENSE B and SIN. The software cycles in a tight loop until SENSE B goes high, waits for 14mS, and then reads what is present on SIN into the extension register (from the right). The program waits a further 14mS before returning to the previous tight loop. When eight bits have been read into the extension register it will contain the original byte (C4). The software stores this at the next location pointed to by P1, increments P1, and returns to the tight loop to await the first bit of the next byte. Since the software has no way of knowing then the playback has finished, it is up to the user to press the RESET button, when the READ LED ceases to flash.



Operation of the tape interface

Writing to tape:

1. Put the number of bytes to be stored in location OFF5 (in OFF8 if you are using the new monitor). This will be a hex number not exceeding 256₁₀. If one wanted to store seventy bytes one would enter 46.
(NB: to store the full 256 bytes one should enter 00).
2. Put the starting address of the program to be stored in OFF9 and OFFA (P1H and P1L).
3. Enter the starting address of the TOTAPE routine (0052 in new monitor).
4. If desired make a short voice recording indicating the nature of the programme to be stored. Connect the tape interface to the recorder.
5. Start recording and after about five seconds press GO (GO-GO-TERM for old monitor).
6. When the WRITE LED has ceased flashing turn off the tape recorder.

Reloading from tape:

1. Put the starting address of where the program on tape is to be reloaded in OFF9 and OFFA (P1H and P1L).
2. Enter the starting address of the FRTAPE routine (007C in new monitor).
3. Start the recorder playing back. Wait until after the switch on click which follows the voice header before pressing GO. It is essential to wait until after this click as it might get read as a zero bit and cause an error.
4. When the READ LED has stopped flashing press RESET and turn off the tape recorder.

General Comments:

The system is intended for use with the high impedance (monitor) output of the tape recorder. If there is only a low impedance (loudspeaker) output, things should still work although the volume control setting may be critical.

Always use good quality cassettes or tapes, and check that the tape heads are clean. A battery recorder is preferable because it avoids problems with mains hum, but check that the batteries are in good condition. Always use new batteries for making a recording.

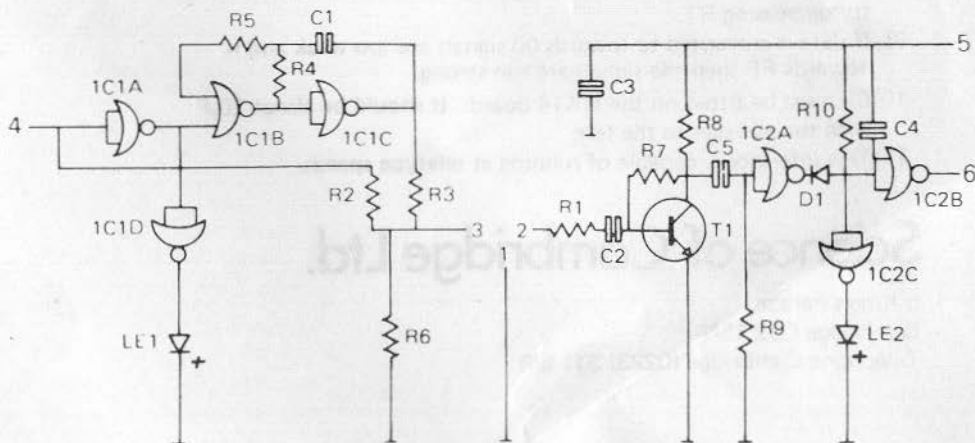
Programs for the Tape Interface (Relocatable)

0052	C501	TOTAPE:	LD@1 (1)
0054	01		XAE
0055	C401		LDI 001
0057	CBD5	NEXT:	ST COUNT
0059	C401		LDI 001
005B	07		CAS
005C	8F08		DLY 008
005E	C3D5		LD COUNT
0060	50		ANE
0061	9807		JZ ZERO
0063	8F18		DLY 018
0065	C400		LDI 000
0067	07		CAS
0068	9005		JMP DONE
006A	C400	ZERO:	LDI 000

006C	07	CAS
006D	8F18	DLY 018
006F	8F20	DONE:
0071	C3D5	DLY 020
0073	F3D5	LD COUNT
0075	9CE0	ADD COUNT
0077	BBD6	JNZ NEXT
0079	9CD7	DLD LEN
007B	3F	JNZ TOTAPE
007C	C408	XPPC 3
007E	CBD5	FRTAPE:
0080	06	LDI 008
0081	D420	ST COUNT
0083	98FB	LOOP:
0085	8F1C	CSA
0087	19	ANI 020
0088	8F1C	JZ LOOP
008A	BBD5	DLY 01C
008C	9CF2	DLD COUNT
008E	40	JNZ LOOP
008F	CD01	LDE
0091	90E9	ST@1 (1)
		JMP FRTAPE

OFF4	COUNT = D5 (3)	(OFF7 in new monitor)
OFF5	LEN=D6 (3)	(OFF8 in new monitor)
OFF9,OFFA	STARTING ADDRESS	

R1	27K	C1	10N
R2	1M	C2	10N
R3	470K	C3	100N (optional)
R4	27K	C4	10N
R5	150K	C5	2N2
R6	150	D1	
R7	4M7	LE1	NSL5057
R8	27K	LE2	NSL5057
R9	4M7	T1	2N2926G
R10	150K	1C1	4001
		1C2	4001



Edge connector details

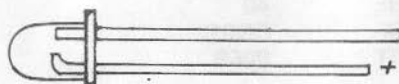
1. earth
2. tape output
3. tape input
4. flag zero (30 on MK14 edge connector)
5. + 5V
6. SENSE B and SIN (27 and 28 on MK14 edge connector)

Extra Notes on Construction

- 1) The white band on D1 is the positive end.
- 2) On some boards two positions are marked for C4. The position in the centre of the board is for C5.
- 3) The connections for the transistor are as shown below.
- 4) In some boards the +ve sign for the LEDS is the wrong way round. It should be on the left.
- 5) The polarity of the LEDS is as shown below.

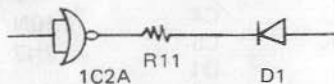


2N2926
Transistor



LED

- 6) On later boards there is an extra 27K resistor in series with D1. This improves the noise immunity.



- 7) Cheap foreign recorders may require an input of about 100mV. To get this larger signal increase R6 to 2K7.
- 8) If the output level from your tape recorder is less than 200mV try decreasing R1.
- 9) If data is corrupted to towards 00 signals are too weak and if towards FF then the signals are too strong.
- 10) C2 must be fitted on the MK14 board. It should be about 20 μ F with the +ve sign to the left.
- 11) This interface is capable of running at teletype speeds.

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