MTX Tape Cont

The Memotech computers are one of the more better micros for expansion, however, they do lack a cassette tape control system — with this project your troubles are over.

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The Memotech MTX500 and MTX512 home computers have one of the better interfaces with an operating speed of 2400 baud and reliable results being possible with most cassette recorders. One facility that is lacking is an output to control the cassette motor via the "Remote" socket. This makes saving programs somewhat less convenient than it needs to be and is a more major drawback when dealing with data handling on cassette.

Although the hardware for a cassette remote control facility is not included, an input/output address is reserved for this function, and there seems to be some supporting software built into the machine.

This article describes a simple cassette remote control add-on for either of the MTX machines which makes use of the built-in software so that the controller is "transparent" in use. Only the normal SAVE and LOAD commands are required, with no additional OUT instructions to operate the controller.

The Circuit

The MTX500/512 manual states that hexadecimal input/output address 1F (31 in decimal) is reserved for cassette motor control. A few simple experiments with a suitable address decoder showed that four output pulses were generated when saving or loading programs — at the beginning and end of program identification, and at the beginning and end of the program itself.

Initial controller circuits used the obvious method of using the address decoder to latch data from one of the data lines using a flip/flop. However, regardless of what data was used, the desired action was never produced.

In the final cicuit an alternative approach has therefore been adopted, and the data bus is not used at all. Instead, the pulses from an address decoder circuit are fed to a flip/flop which is configured as a divide by two circuit. The output of this circuit is then used to operate the relay via a suitable driver cicuit.

The action this gives is for the relay to be switched on during the tone leader and program identification periods, and then again while the main program is saved or loaded. In practice a delay circuit is used to eliminate the short switch-off period between the program identification data and the main program data, just in case this gap would give any problems in use.

The full circuit diagram of the unit appears in **Figure 1.**

IC1 and IC2 are used in the address decoder, which also decodes some of the control lines. The MTX computers have a conventional Z80 input/output arrangement, with only the eight least significant address lines used to give 256 input/output addresses. The address decoder therefore only has to deal with eight address lines, plus the MI and IORQ control lines.

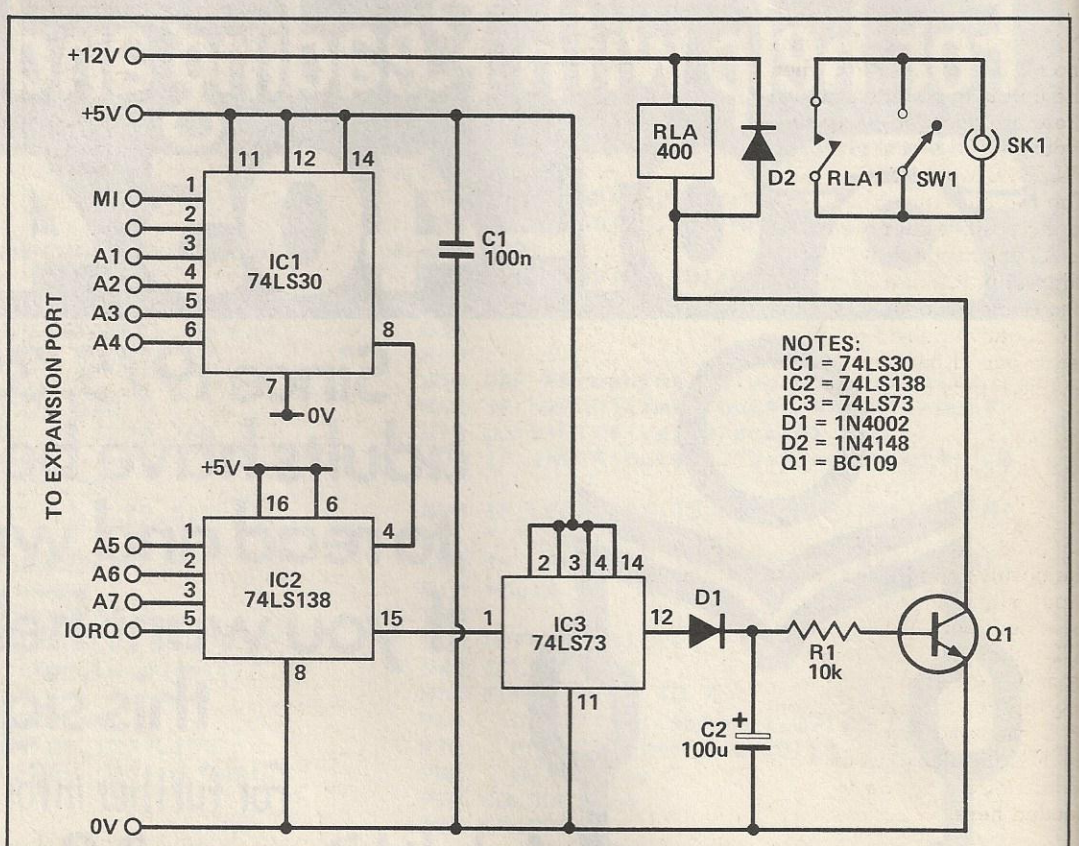

Figure 1. The full circuit diagram of the MTX Tape Controller.

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The IORQ line goes low when an input/output address is accessed, and the MEMRQ line goes low when a memory address is accessed. By decoding the IORQ line correctly the circuit can be made to respond to the right input/output address while ignoring the same address when the Z80 is accessing memory. The MI line goes low (together with IORQ) after an interrupt has occured to give a sort of interrupt acknowledge signal to interrupt-generating devices.

In this case the MI line is decoded so that the unit is only activated when it is high, and spurious operations of the motor controller are avoided. There is no need to decode the read and write lines, and they are ignored.

Address lines A0 to A4 plus the MI line are all high when the unit is to be activated, and these are decoded using six inputs of IC1 which is a 74LS30 8 input NAND gate. The two unused inputs are tied to the positive supply rail. A5 to A7 are decoded by the address inputs of a 74LS138 3-to-8 line decoder, IC2, and the negative pulse from IC1 is fed to one of the negative chip enable inputs of this device.

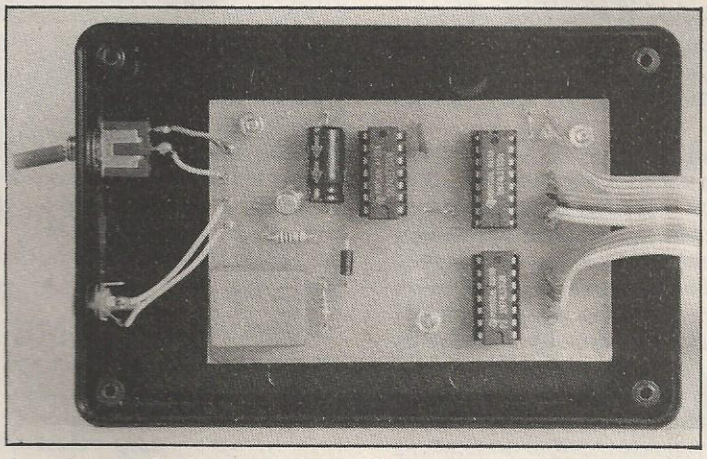
The other negative chip enable input is used to decode the IORQ line, but the positive chip enable input is not used and is connected to the positive supply rail. When input/output address 31 is accessed, output 0, pin 15 of IC2 pulses low. This pulse from IC2 is fed to a divide by two flip/flop circuit based on IC3. The latter is a 74LS73 dual JK flip/flop, but only one section of the device is needed here.

The output of IC3 drives common emitter switching transistor Q1 via current limiting resistor R1, plus the smoothing circuit formed by D1 and C2. This circuit gives a fast attack time as C2 can rapidly charge by way of D1 from the low output impedence of IC3, but the only discharge path is through the relatively high impedance of R1 and the base-emitter junction of Q1. This gives the required slow release time of about one second or so. Q1 drives the relay coil, and D2 is the usual protection diode. A set of normally open relay contacts are used to control the cassette motor, and SW1 is a bypass switch. This is useful when utilizing "fast-forward" or "rewind" to move the tape to the beginning of a program.

The main circuit requires a +5V supply, but the relay and driver need a +12V type. Both these are available from, and taken from the expansion port of the computer.

Construction

Details of the printed circuit board are provided in **Figure 2.** There are a few components to mount on the board, and in most respects construction is quite straightforward. However, be careful not to overlook either of the two link wires, and make quite sure that D2 is connected with the correct polarity.



Provided the relay specified in the components list is used it can be mounted direct onto the printed circuit board just like any of the other components. From the electrical point of view the only requirements are for a 12V coil having a resistance of around 200 ohms or more, and at least one set of normally open contacts capable of switching a few hundred milliamps at 12V DC.

The use of an alternative type is not recommended though as it would almost certainly have to be mounted off-board, and would unnecessarily complicate the construction of the unit.

The board is mounted in a plastic box which has outside dimensions of 120 by 80 by 35mm. SK1 and SW1 are mounted at one end of the box, and on the prototype SK1 is a 2.5mm jack socket. This is the most convenient type to use with most cassette recorders as the connection from the controller to the recorder can then be made via a twin lead terminated at each end with a 2.5mm jack plug.

Not all recorders have a 2.5mm "remote" socket though, and if a DIN connector is fitted to your recorder the instruction booklet should give connection details for this. Keep the connections to SK1 electrically isolated from the rest of the circuit.

A 13 way ribbon cable about half a metre long connects to the board and passes out of the case at the opposite end to

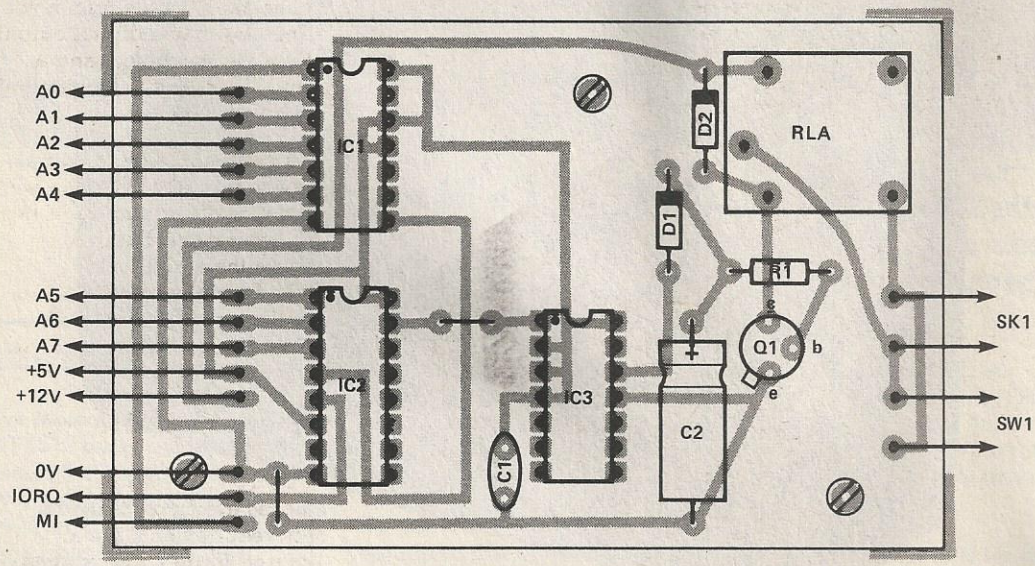


Figure 2. The printed circuit overlay.

SK1 and SW1. A small flat file is used to make a suitable slot in the main and lid sections of the case. The unit is connected to the external expansion port of the computer, and this requires a 2 by 30 way 0.1 inch edge connector. There is povision for a polarising key in the connector, but 2 by 30 way connectors fitted with this key do not seem to be available as yet. An ordinary 2 by 30 way type can be used provided due care is taken to always connect it properly.

A better alternative is to use a Spectrum type 2 by 28 way connector which does have the polarising key. The fact that no connections can be made to four terminals of the expansion port is not important in this case as no connections are made to these particular terminals anyway.

Figure 3 gives connection details for the connector.

In Use

After a thorough check of all the wiring, connect the unit to the computer, and then switch the computer on. The ready message and flashing cursor should appear in the usual way, and the computer should function normally. Switch off at once and recheck the unit if this does not happen. If all is well, as a quick check of the unit, the command OUT 31,0 should switch on the relay.

Repeating the command should switch it off again. The unit can then be tried out properly with SAVE and LOAD commands. If loading problems are ever experienced, the relay will not switch off when the computer is returned to the direct mode. However, once in the direct mode the command OUT 31,0 can be used to switch off the relay.

DME

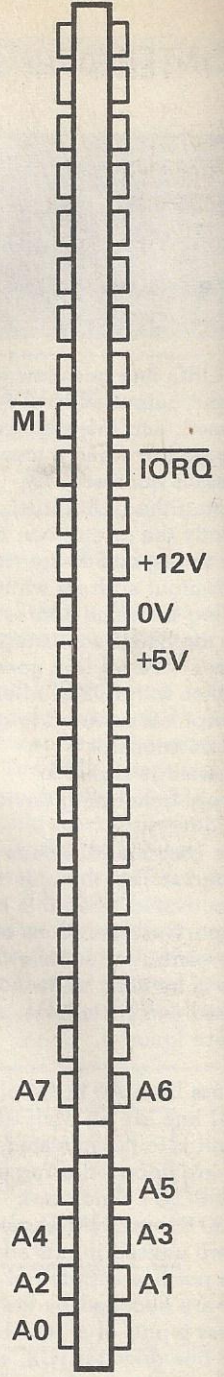


Figure 3. Connection details for the expansion port.

Parts List

RESISTOR
R1 ..... 10k ¼ watt 5%

CAPACITORS
C1 ..... 100n ceramic
C2 ..... 100u 10V axial electro

SEMICONDUCTORS
IC1 ..... 74LS30 8 input NAND
IC2 ..... 74LS138 3-to-8 line decoder
IC3 ..... 74LS73 D-type latch
Q1 ..... BC109 NPN silicon
D1 ..... 1N4002 rectifier
D2 ..... 1N4148 silicon diode

MISCELLANEOUS
SK1 ..... 2.5mm jack socket
SK2 ..... 2x28 way 0.1 inch (Spectrum) edge connector
RLA ..... 12V 400R coil, 3A SPDT contacts, miniature PCB mounting
SW1 ..... SPST miniature toggle switch

Plastic case 120 by 80 by 35mm; printed circuit board; two 14 pin DIL IC sockets; one 16 pin; Veropins, ribbon cable, wire, etc.