HOLMES ENGINEERING SPRINTER 1L FOR MOD 1 TRS-80

ARCHBOLD ELECTRONICS

NOV 1 8 1981

SPEED-UP BOARD INSTALLATION

You have purchased the fastest speed-up unit on the market, regardless of price. It has been tested in a Model I TRS-80 operating at 5.3 mhz (three times faster than normal speed). A little care in its installation will insure years of trouble free operation. Please take a few minutes to review these instructions before beginning any work.

IMPORTANT! If you have an "early model" Radio Shack expansion interface (serial # less than 035000 for model 26-1140 or serial # less than 008000 for model 26-1141 or 26-1142), you should have the free Radio Shack DIN plug cable installed between the expansion interface and keyboard (commonly referred to as the 'pig tail' or 'twisted pair' modification). "Late model" Radio Shack expansion interfaces (serial # greater than 035000 for model 26-1140 or serial # greater than 008000 for models 26-1141 and 26-1142) do not require the DIN plug modification.

The DIN plug cable modification required for the early model expansion interface corrects design problems. Some Radio Shack stores may be reluctant to perform the work, however, unless you're having intermittent problems. This means that it's important you be insistant. HAVE THE MODIFICATION ADDED BEFORE INSTALLING THE SPEEDUP BOARD. Once you've installed the board, Radio Shack may not provide the upgrade. If your Radio Shack store is not aware of the DIN cable modification, refer them to Radio Shack service bulletin no. 1131-R.

CHECK OFF EACH STEP WHEN COMPLETED

1. Turn the computer upside-down on to a padded surface and remove the six screws securing the cover. Holding the case together, turn the computer right side up.

2. Carefully remove the top cover. If your computer has its red colored power-on light (LED) mounted to the cover, remove the LED as follows.

   a. Pull the plastic retaining ring off the underside of the LED (you may have to use needle-nose pliers).

   b. Push down on the top of the LED to pop it out of the case. Tape the LED to the keyboard to keep it out of the way for the remainder of the installation.

3. Refer to the photograph provided while performing the following steps. There may be slight differences between the traces shown in the photo and your board, but there is no need for concern. The locations to be soldered are the same for all versions of the Model I. When we use the term "keyboard" we are referring to the plastic or metal frame that holds the individual keys together. It is completely visible when the top computer cover is removed. "Keyboard unit" refers to the basic computer of which the keyboard is a part.

4. Lift up and fold back the keyboard on to the table. Be careful not to unnecessarily stress the short ribbon cable connecting the keyboard to the logic board (the logic board is the large board underneath the keyboard).

SOLDERING HINTS: Use the solder provided with the speed-up unit and a 15 to 25 watt soldering iron with a well tinned tip. Before making each connection, cut the wire to its proper length (leave a little slack as shown in the photo), strip back approximately 1/16" of insulation, pre-tin the wire (place solder on the wire), and then cut off the end to leave about 1/32" of wire exposed. Don't leave any bare wire exposed that can later short against a nearby connection or trace. Place a very small bead of solder on the point to be connected and let it cool. Hold the wire to the point to be connected with one hand and with the other hand place the iron to the connection until the solder flows smoothly together. It should not take more than two or three seconds to complete each connection. Leaving the soldering iron on longer could damage the computer. The completed connections should look like the rest of the TRS-80's connections - smooth and shiny. Use a damp sponge to clean off the soldering iron tip before making each connection. This will prevent solder from falling from the tip into the computer and it will make for better solder connections.

IC PIN NUMBERING: The following is an example of how integrated circuit (IC) pins are numbered. The same number pattern applies to all ICs, regardless of the total number of pins. Notice that the pins are counted counterclockwise when viewed from the component side of the board and clockwise when viewed from the solder side.

If you had our original speed-up board and cut the trace leading from Z69 pin 5, that trace must be restored and the wire jumper removed between Z69 pins 12 and 13. The easiest way to restore the trace cut is to connect a 1" wire between Z69 pins 5 and 12.

Use a single edge razor blade or X-Acto knife to make the trace cuts called for below. If there is ever a need to restore a trace cut, connect the points separated using a short piece of insulated wire. Do not try to restore a cut trace by bridging it with solder.

Find point "F" on the upper middle part of the photo. The letter following the number "1700069" designates the type of logic board being used.

5. FOR "G" LOGIC BOARDS ONLY -

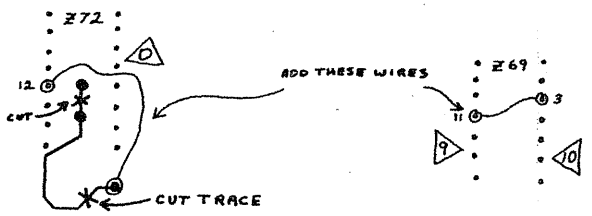
   a. Cut the trace leaving Z74 pin 1 (pin 1 is directly above point "C" in the photo). This trace goes to the right and up and connects Z74 pin 1 to Z40 pin 21.

   b. Connect a wire between point "B" (Z40 pin 19) and

the pin just above point "C" (Z74 pin 1).

6. FOR "D" AND "E" LOGIC BOARDS ONLY -

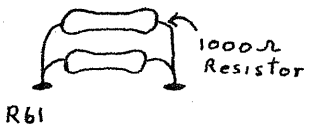
Cut the two traces and connect the two wires as shown below.



7. Connect a .1 uf capacitor (the blue capaci[illegible] the plastic packet with the number 104 st[illegible] en points "K" and "L" on the I[illegible] photos points "K" and "L" [illegible] ied so we drew in arrows to [illegible] points involved. Point "K" [illegible] oprocesor interrupt line and "L" [illegible] ground.

THIS STEP HAS BEEN DELETED

8. Remove the round white nylon spacers from the posts holding the logic board in place. Gently lift the logic board out of the case and fold it over onto the keyboard. The component side of the logic board should now be visible. Take a 1,000 ohm resistor from the plastic packet (it has colored bands brown-black-red-gold). Solder the resistor across (in parallel with) R61 on the logic board. R61 is near the edge of the board and just below Z69.



9. Look for a resistor labeled R68 just below and to the right of R61 on the logic board. If your keyboard has an R68, solder a 1,000 ohm resistor across it as was done with R61 above.

10. Fold the logic board back into the case, place the round white nylon spacers back on their posts, and then fold the keyboard back into place. Test the system to insure it is still working properly at the normal speed by running a few BASIC and machine language programs. If there are any problems, double check your wiring. When you are sure the system is functioning normally, disconnect power from the keyboard unit and fold the keyboard back on to the table.

11. Some keyboard units have a LEVEL II ROM board attached to the logic board with adhesive foam pads and covering points 14 through 20 shown in the photo. This board must be pulled out of the way to gain access to the points to be soldered. DO NOT UNPLUG THE RIBBON CABLE CONNECTED TO THE BOARD. There is enough slack in the cable to allow it to be pulled up and twisted out of the way. Pull up the pads from where they attach to the logic board. A little rubber cement can be used to secure the board when the installation is completed, although it is satisfactory to just let the board lay in place. If the pads get badly torn, they should be replaced with something similar and of approximately the same thickness. Double sided adhesive pads are available through most stationary, hardware,and Radio Shack stores. Stack the pads to obtain approximately 3/16" separation between boards to prevent anything from shorting out.

There may be a 1 1/4" X 1 1/2" board mounted on the logic board used to improve cassette loading. If it's going to interfere with the installation of the speed-up board, move it out of the way and re-secure it with rubber cement.

12. There is a rectangular piece of plastic with foam pads attached that is included with the speed-up board. Secure this plastic insulator squarely to the bottom of the speed-up board using masking or "Scotch" tape. Do not remove the paper backing from the adhesive pads on the insulator. That will be done later when the speed-up board is permanently mounted. Use tape to hold the speed-up unit in place on the logic board while performing the wiring steps below (refer to the photo for the mounting location).

NOTE: NEVER OPERATE THE TRS-80 WITHOUT THE PLASTIC INSULATOR SQUARELY ATTACHED TO THE SPEEDUP BOARD.

13. Cut the trace connecting point 15 to point 20.

14. Cut the trace connecting point 14 to 16.

15. Consider the wires coming from the speed-up board as being numbered from 1 to 20 counting left to right. Connect wire 1 to point 1, wire 2 to point 2, etc. Connect all wire as shown in the photo except wires 12, 13, 17, 18, and 19 which will be dealt with shortly. The location of wire 6 has been changed to Z52 pin 10. This new location has been marked on the photo with a black pen.

The wires easily separate from each other if you start a small cut on the end of the cable and then carefully pull them apart. If you have a problem identifying points in the photo, refer to the cross reference table on page 10. For a neat installation, fan out the cable as shown in the photo. Excessive wire length may cause problems, therefore, do not leave any more slack than is necessary for a neat installation. Recount the wires before soldering each connection to avoid an error that could make a real mess.

16. Connect wires 17 and 19 as described below.

a. Instead of connecting wire 19 to point 19 (Z56 pin 11) as shown in the photo, connect wire 19 to the pin directly below point 19 (to Z56 pin 10).

b. Wires 17 and 18 should not be connected together as shown in the photo. Instead, connect wire 17 to point 19.

c. Wire 18 is not used. Tape up the end of wire 18 to prevent it from shorting out in the keyboard unit.

NOTE: THE WIRE SHOWN IN THE PHOTO CONNECTING POINTS "D" AND 10 IS NO LONGER REQUIRED AND THE WIRE COMING FROM POINT "B" IS ONLY REQUIRED ON "G" LOGIC BOARDS.

17. FOR UNITS WITH THE RED POWER-ON LIGHT (LED) SOLDERED DIRECTLY TO THE KEYBOARD, DO THE FOLLOWING:

a. Unsolder and remove the LED.

b. Solder the replacement LED in its place. It does not matter which lead goes into which hole.

c. Cut the two traces that connect to the LED on the back side of the keyboard.

d. Connect wire 12 to one side of the new LED and connect wire 13 to the other side. Make the connections on the back side of the keyboard while going easy on the heat. It does not matter which wire goes to which lead of the LED.

18. FOR UNITS THAT HAVE THE RED POWER-ON LED FASTENED TO THE KEYBOARD UNIT TOP COVER, cut off or unsolder the LED and its attaching wires. Form the leads of the replacement LED to the same shape and length as the old LED. Solder wires 12 & 13 to the new LED while going easy on the heat. It does not matter which LED lead is connected to which wire.

NOTE: LEDS ARE SUSEPTIBLE TO HEAT DAMAGE ON INSTALLATION, THEREFORE, IF YOU NEED A REPLACEMENT, USE A RADIO SHACK LED, PART # 276-035, OR CONTACT US FOR A REPLACEMENT.

19. The TRS-80 is now wired for double speed (3.5 mhz). Please recheck your connections. Remove any wire shavings or pieces of solder that may have fallen into the TRS-80. Be sure the round white nylon spacers are still on their posts and then fold the keyboard back into place (be careful with the ribbon cable). If the LED has to be mounted to the cover with a retaining ring, just let it hang out of the computer for now. It will be mounted later when the keyboard unit is reassembled. If you have a LEVEL II ROM board (described in step 11), lay it back in place on the logic board.

Apply power to the keyboard unit (do not hook up the expansion interface for this test). The TRS-80 should power-up to the normal speed and the LED will be either red or green. Enter statement OUT254,1 and hit ENTER. The LED should change color. Run the following test:

```
10 FORX=1TO450:NEXT:PRINTY:Y=Y+1:GOTO10
```

This test loop should be counting off half seconds. If you experience any problems at this point, go to the troubleshooting section. BREAK from the program and enter OUT254,0 . Run the test again to see the difference between fast and normal operation. The test loop should now be counting off seconds. 'OUT254,' followed by 0 or any even number between 1 and 255 will change the TRS-80 to normal speed. 'OUT254,' followed by any odd number between 1 and 255 will change the TRS-80 to the high speed.

If the LED is green on power-up, reverse wires 12 & 13 to the LED to make it red on power-up.

CASSETTE OPERATION

The TRS-80 must be at the normal speed to load a cassette program that was saved at the normal speed. The following wiring will force the TRS-80 to return to normal speed during the period of a CLOAD (or CSAVE) when the high speed has been selected. The TRS-80 will then automatically resume high speed operation when the cassette motor shuts off. If you do not desire automatic slowdown with cassette, skip this section.

1. On the speed-up board, cut the wire jumper directly below holes "B" and "C".

2. Connect a wire between hole "C" on the speed-up board and point "J" (Z59 pin 10) on the logic board.

EXPANSION INTERFACE REWIRING

The Radio Shack expansion interface must be modified before it will work properly at the increased speed. If you are using an expansion interface manufactured by a company other than Radio Shack, skip this section. If you are using a Micro- Design expansion interface, notify us so we can send an important wiring change.

Remove the main circuit board from the expansion interface as follows:

a. Remove the RS-232 board from the top left hand compartment, if installed.

b. Remove the six bottom screws securing the expansion interface case and open it up.

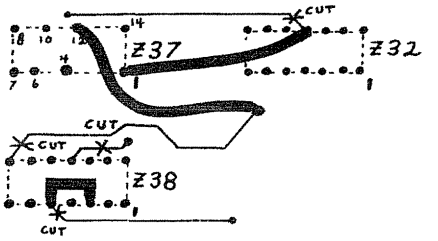
c. Remove the three screws holding the printed circuit board in the case.

FOR LATE MODEL RADIO SHACK EXPANSION INTERFACES ONLY-

The following rewiring is performed on the solder side (opposite the component side) of the late model Radio Shack expansion interface board.

BOLD LINES REPRESENT WIRES TO BE ADDED

(refer to steps 1-8 on next page)



1. Cut the trace leading from Z32 pin 11.

2. Cut the trace leading from Z38 pin 8.

3. Cut the trace leading from Z38 pin 5.

4. Cut the trace leading from Z38 pin 11.

5. Connect a 1 1/4" length of wire between Z37 pin 1 and Z32 pin 11. Be careful when counting pins on Z37 (pins 2, 3, 5, 9, 11, and 13 are missing).

6. Connect a 1" length of wire between Z38 pins 3 and 5.

7. Connect one end of a 1 1/4" length of wire to Z37 pin 12.

8. Locate Z38 pin 8. Follow the trace leading from that pin and go past the cut made in step 2 above. Stop at the end of the trace and connect the other end of the wire coming from Z37 pin 12.

9. Get the 74LS04 IC from the plastic packet and bend up all pins 90 degrees except pins 7 and 14. The bent pins will then be pointing straight out from the side of the IC.

10. Bend together and solder pins 2 & 3 on the 74LS04.

11. Bend together and solder pins 4 & 5 on the 74LS04.

12. Bend together and solder pins 9 & 10 on the 74LS04

13. Bend together and solder pins 11 & 12 on the 74LS04.

The following wiring is performed on the component side of the expansion interface board.

14. Mount the 74LS04 on top of Z43 in the expansion interface as follows. Place the 74LS04 on top of Z43 so pins 7 and 14 of the 74LS04 are directly over pins 7 and 14 respectively of Z43 (you will have to cut off the very tips of pins 7 and 14 on the 74LS04 to enable it to lay flat on top of Z43). Solder pin 7 to pin 7 and pin 14 to pin 14. Make sure the other pins on the 74LS04 are not touching the pins on the IC underneath.

15. Connect a short piece of wire between pins 6 and 13 on the 74LS04.

16. Connect a short piece of wire between pin 1 of the 74LS04 and Z38 pin 11.

17. Connect a short piece of wire between pin 8 of the 74LS04 and the circular pad directly beside Z38 pin 14 (the pad is connected to a trace that goes to Z37 pin 1).

18. Connect the brown ceramic disk capacitor with the number 221 stamped on it (provided in the plastic packet) between pins 7 and 13 of the 74LS04.

If disk drives are not being used, go to the REASSSEMBLY section. Disk users proceed to the DISK OPERATION section below.

FOR EARLY MODEL RADIO SHACK EXPANSION INTERFACES WITH THE DIN PLUG MODIFICATION-

The following must be performed on the solder side of the early model Radio Shack expansion interface board.

1. There are two traces leaving Z43 pin 1. One of those traces was cut when the DIN plug modification was performed. Cut the other trace leaving that pin.

2. Connect the brown ceramic disk capacitor with the number 221 stamped on it (enclosed in the plastic packet) between Z43 pins 1 and 8.

3. Connect a wire between pin Z43 pin 1 and Z22 pin 11.

If disk drives are not being used, go to the REASSEMBLY section. Disk users proceed to the following section.

DISK OPERATION

Hook up the system with the expansion interface board out of its case. Test the system thoroughly at the normal speed using single density diskettes only. If everything functions normally, proceed with the following wiring. This wiring will automatically return the system to normal speed when the disk drive motor is running.

Some DOS on the market support high speed operations. Such DOS can probably be used reliably if it slows down the TRS-80 by issuing an OUT254,0 statement before reading or writing to the disk controller. You can tell if this is occuring by watching the keyboard LED to see if it flashs red during disk operation. If it does, skip this section.

If the DOS has a high speed option but does not return the TRS-80 to normal speed during a disk read or write (that is, the LED stays green), then the following wiring should be accomplished and the DOS high speed option not used. This is because the DOS will not provide the proper read and write pulses to the disk controller making the system susceptible to erratic operation.

Please note: The photo does not accurately show the following connection to be made to the speed-up board. Also, the large capacitor shown on the speedup board is no longer used.

1. Remove the plastic insulator taped to the underside of the speed-up board.

2. Cut the wire jumper soldered across the blue capacitor to the immediate left of hole "B" on the speed-up board. The wire jumper is on the back side (solder side) of the speed-up board. It's the only wire jumper on the back side

of the board and it's next to Z3 pin 8.

3. Connect an 18" wire to hole "B" on the speed-up board.

4. Solder a connector terminal supplied in the packet to the free end of the wire and bend over the end tabs. Insert and lock the terminal into either of the white plastic connector housings.

5. Tie a stress loop in the wire and place it over the round plastic post nearest the rear edge connector on the logic board. Hang the connector out the rear connector port.

6. ON THE EARLY MODEL RADIO SHACK EXPANSION INTERFACE, connect a wire between Z47 pin 1 to Z24 pins 9 and 10. Also connect one end of a 12" piece of wire to Z24 pin 8.

ON THE LATE MODEL RADIO SHACK EXPANSION INTERFACE, connect a wire between Z41 pin 3 and Z39 pin 4. Also connect one end of a 12 " piece of wire to Z38 pin 10.

FOR EXPANSION INTERFACES MANUFACTURED BY A COMPANY OTHER THAN RADIO SHACK, connect a wire from the disk drive MOTOR ON line in the expansion interface to the input of any unused non-inverting gate in the expansion interface. This is to isolate the MOTOR ON line from the speed-up board. Connect one end of a 12" wire to the output of the non-inverting gate (for some expansion interfaces, the wire will have to be made slightly longer so it will reach the wire and connector coming from hole "B"" on the speedup board).

7. Solder the remaining connector to the free end of the 12" wire. Tie a stress loop in the wire and place the loop around one of the posts in the expansion interface. Plug the wire from the expansion interface into the wire from the speed-up board.

The system will now operate properly at the high speed when using single density diskettes (double density diskettes require the wiring change below). Whenever the disk drive motor starts running, the power-on light on the keyboard unit will change to red and the TRS-80 will go to normal speed. When the motor turns off, the TRS-80 will go back to the high speed. Check it out before proceeding.

NOTE: Unplugging the wire between the keyboard unit and the expansion interface will force the TRS-80 to the normal speed and can be used for that purpose in place of a switch. If you ever want to operate the keyboard at the high speed with the expansion interface turned off or disconnected, the wire leaving the keyboard will have to be grounded in the keyboard unit. WITHOUT A GROUND CONNECTION ON THIS WIRE, THE SPEEDUP BOARD WILL NEVER BE ABLE TO GO TO THE HIGH SPEED, EVEN IF A SWITCH HAS BEEN INSTALLED.

8. The following wiring change is essential for proper double density operation and may be performed to all systems.

a. Move wire 8 on the logic board down one pin (from Z73 pin 2 to Z73 pin 3).

b. Cut the short trace leading from Z73 pin 1 (Z73 pin 1 is the pin directly above point 8).

c. Connect a wire between Z73 pin 1 on the logic board and Z5 pin 8 on the speed-up board.

REASSEMBLY

Permanently mount the speed-up board by removing the paper backing from the adhesive foam pads on the plastic insulator. If you have the type of keyboard that is supported by a metal frame, be sure the speed-up board is mounted just far enough back on the logic board to prevent the metal frame from resting on top of the blue ribbon cable connector attached to the speed-up board. Don't mount the board any further back than necessary, otherwise the top cover will not fit properly. Gently press the board in place after thoroughly cleaning the mounting area and after cutting off all wire leads protruding through the logic board that could prevent the adhesive pads from making good contact.

Reassemble the TRS-80.

IMPORTANT! Test the system continuously for a few weeks using a wide variety of software. Resolve all problems and irregularities before proceeding with the optional wiring beginning on page 8. This could save you a lot of trouble later.

THE SPEED-UP BOARD HAS A 90 DAY WARRANTY. SHOULD IT FAIL DURING THAT PERIOD, IT WILL BE REPAIRED OR REPLACED, AT OUR OPTION.

If you plan to purchase memory before going to the triple speed, we recommend NEC brand 4116 chips rated at 150 nanoseconds. They're available through several mail order firms for less than $20 for 16k. Z80A microprocessors are going for under $8 and Z80Bs for under $20.

Keybounce may be a problem when operating at the high speed with the older style keyboard. For disk systems, changing the DOS keyboard scan rate will cure the problem. You will have to contact the company that produced the DOS to obtain information on what changes to make.

For a limited time, we will repair keyboard units having problems at the double speed for $30 labor if the keyboard unit works properly at the normal speed; otherwise the labor charge is $50. Triple speed repairs are slightly more. Call before sending units for repair. We also do speed-up board installations, Thoroughly testing all systems while operating them over a wide voltage and temperature range.

ARCHBOLD ELECTRONICS

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T R O U B L E S H O O T I N G C H A R T

TROUBLE	POSSIBLE CAUSE
Video screen blank and power-on LED not lit	(1) Line Cord unplugged, (2) keyboard unit power cord improperly connected, (3) 5 volt line shorted to ground in the keyboard unit.
Flashing "MEM SIZE" or scrolling video display on power-up. Some or all of the keys on the keyboard do not function correctly.	One or more lines broken in the ribbon cable connecting the keyboard to the logic board (bypass the breaks using insulated stranded wire).
"Garbage" on video screen when powering up at normal speed with interface disconnected.	Speedup board miswired or defective. By-pass the speedup board by disconnecting wires 14, 15, 16, and 20. Tape up the ends of the wires to prevent them from shorting out in the keyboard unit. Restore the trace cuts between points 14 & 16 and between points 15 & 20. If the TRS-80 still powers up with garbage on the screen, the fault lies on the logic board.
Erratic operation at the normal speed.	(1) bad solder connection. (2) speed-up board faulty (by-pass speed-up board as described in the section above for "garabage" on the screen. (3) Z56 (a 74LS92) on the logic board has been heat damaged. If Z56 is replaced, install the new IC using a low profile socket.
Video display slightly off center.	Variable resistors R20 or R21 out of adjustment. These resistors are visible under the right edge of the logic board when the top cover is removed. Adjust for a properly centered display.
TRS-80 will not switch to the high speed.	Holes "B" or "C" on the speed-up board are not at zero volts (approximately). There must be 0 volts on both of these holes before the TRS-80 will go to the high speed. Possible problem on disk system - wire to the interface not connected or the interface not turned on
Not showing interface memory when entering "PRINT MEM" while in LEVEL I/II BASIC	Interface wired incorrectly if the problem occurs at the normal speed.
Unable to load or run programs from disk. (also see below)	(1) Diskette has been electrically altered. (2) If the system works properly at the normal speed when the wire from the speed-up board is disconnected from the interface, the problem is a bad connection between hole "B" on the speed-up board and the interface.
Disk diognostic programs show drives are running faster than normal.	The speed-up board is causing the TRS-80 to run 3% slower than normal. Perform the wiring change called for in step 8 on page 5 to put the TRS-80 to precisely normal speed.
Power-on LED does not turn red when the disk drive motor turns on.	(1) Interface wired incorrectly (check over the steps in the DISK OPERATION section). (2) A bad conection, usually at hole "B" on the speed-up board.
TRS-80 inoperative or intermittent at the high speed.	See the high speed troubleshooting section on the next page.
Video display jumps vertically.	A very small percentage of users have reported this symptom while running at the high speed. We have been unable to get our hands on one of those systems to determine what is occuring, however, the following is worth a try. Find Z66 on the logic board. If it has a capacitor between pins 7 and 8, remove it. Please let us know if this helps or if you still have the problem.

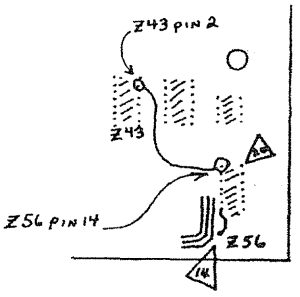
KEYBOARD UNIT ----------

Review the troubleshooting chart on the preceding page. If everything is OK at the normal speed, but the keyboard locks up immediately after the high speed is selected (expansion interface disconnected), then enter and run the following test program at the normal speed.

```
10 FOR I=28672 TO 28722
20 READ X
30 POKE I,X
40 NEXT I
50 POKE 16526,0
60 POKE 16527,112
70 X=USR(0)
80 DATA 33,26,112,229,17,192,63,1,12,0,237,176
90 DATA 16,254,13,32,251,225,62,61,173,111,211,254
100 DATA 24,233,78,79,82,77,65,76,32,83,80,69,69,68
110 DATA 0,32,72,73,71,72,32,32,83,80,69,69,68
```

The keyboard LED should continually switch between red and green and the words "HIGH"/"LOW" should alternately flash on the screen. If the program runs properly, your problems at the high speed could be caused by a slow Level I/II ROM. Please contact us for a possible cure other than replacing the ROM. If the program above crashed, do the following.

1. On the logic board, connect a wire between Z43 pin 2 and Z56 pin 14.



2. Move wire 17 from point 19 (Z56 pin 11) to Z56 pin 12 (the pin directly above point 19).

The TRS-80 is now wired for a 50% speed increase (2.66 mhz). If the keyboard unit operates correctly at this speed, the speed-up board is working properly. Return to the 100% increase by moving wire 17 back to point 19. The wire added between Z43 pin 2 and Z56 pin 14 may be left in place.

If the keyboard unit did not work at the 50% increase, recheck the installation. It may help to have someone else look over the work. If no mistakes are found, restore the TRS-80 to normal operation by doing the following.

1. Disconnect each of the wires coming from the speed-up board from where they attach to the logic board.

2. Restore the two trace cuts on the lower right-hand side of the logic board.

There is no need to remove the other wiring changes made to the logic board and to the interface. Return the speed-up board for testing.

If the keyboard unit works at the 50% increase, but not at the 100% increase, the problem is probably caused by one or more of the RAM memory chips (Z13 through Z20). If you have an expansion interface with memory, interchange interface memory with the keyboard memory and try again. On rare occasions, the Z80 microprocessor (location Z40 on the logic board) will not handle the speed. The only way to eliminate the Z80 as a possible cause is to replace it with another Z80. A Z80 is rated to 2 mhz when operated over a wide temperature range, but seldom fails to perform to 3.5 mhz at room temperature. A Z80A is rated to 4 mhz and a Z80B is rated to 6 mhz (a Z80A or Z80B will work in an unmodified TRS-80).

This is a good time to mention that all of the integrated circuits that plug into sockets on the TRS-80 are of a type that are subject to damage from relatively low voltages of electrostatic discharge. This means the following precautions must be observed when unplugging those components. Ensure that you are statically discharged immediately before touching the device by rubbing your hands on a conductive material. Avoid touching the pins of the chip. Stay away from carpets and other objects likely to hold a static charge. Don't transport a chip from your work area without first wraping it in tin foil.

Review the GENERAL troubleshooting section below.

EXPANSION INTERFACE----------

BEFORE TROUBLESHOOTING PROBLEMS THAT OCCUR WHEN THE INTERFACE IS CONNECTED, REMOVE THE RS-232 BOARD, IF INSTALLED, AND UNPLUG ALL ACCESSORY EQUIPMENT FROM THE SYSTEM OTHER THAN DISK DRIVES OR CASSETTE RECORDER.

Some systems will not run at the high speed when the buffered cable (a cable with a plastic box midway down its length) is used with the early model Radio Shack expansion interface. Try using the unbuffered ribbon cable of the type supplied by Radio Shack with their late model interface. Do not replace the buffered cable unless the DIN plug cable modification has been installed. CAUTION! The wire jumper (+5 volt line) Radio Shack added between Z42 pin 14 to the edge connector J2 in the interface must be removed before using the unbuffered cable.

If you have a late model Radio Shack expansion interface, but are not using a standard Radio Shack ribbon cable between keyboard and interface, consider the following. The cable should be shielded and no longer than approximately 10" (the same applies to the cable used to connect peripherals to the bus extension edge connector on the interface). Long or unshielded cables introduce noise into the system. A shielded ribbon cable will appear ribbed on one side and smooth on the other.

GENERAL ----------

Intermittent problems at the high speed may be caused by a slow memory chip that memory diognostic programs can't locate. The following test, however, will often isolate the bad chip.

> Use a word processing program (Electic Pencil, Scriptsit, etc) to fill up memory with an expression such as "Now is the time for all good men to come to the aid of their country." Scroll through the text and then use a search command to find any words that may have changed. If there are any changes, record what each letter or character should have been and what it changed to. Give us the results and we will be able to help you find the chip at fault. If errors do not show up immediately, let the TRS-80 sit for 12 to 24 hours and then check the text again.

Edge connectors are a constant source of problems. They should be cleaned as often as necessary using a TV tuner cleaner. If you are skilled at soldering, coating them with silver solder is an excellent cure. Never use ordinary solder.

The RS-232 connector in the expansion interface can cause fits at any operating speed if an RS-232 board is used. Several people reported being unable to run at double speed with the RS-232 board until they soldered it to the interface. This procedure is a bit drastic and not recommended. What usually occurs is the RS-232 board bows when the mounting screws are tightened, causing a poor connection in the middle area of the connector. EBG & Associates has a simple and effective solution to that problem. They call it the RS-232 BRACE FIX, catalog # 36-130, and it sells for 9.95 + $2 P&H. It's two pieces of plastic with holes drilled in them. All you do to install it is remove the mounting screws from the RS-232 board and connector and bolt in the braces using the existing mounting holes. There is no cutting, soldering, or drilling. Their address is: EBG & Associates, 203 N. Wabash Ave, Chicago, IL 60601, or call 312-782-9750.

In some keyboard units it's possible to accidently knock power supply resistors R5 and R10 out of adjustment. These resistors are on the rear of the logic board. To check the power supply adjustment, use the procedure outlined in the Radio Shack TRS-80 Microcomputing Technical Reference Handbook. Also, these resisors have been known to deteriorate with age and cause intermittent problems. It's important to note that reducing the 5 volt supply voltage on the logic board to 4.5 volts will often correct intermittent system problems experienced at the high speed. Conversely, increasing the 5 volt supply to 5.5 volts will often cause intermittent problems to occur with greater regularity, making it easier to track down the cause. When we modify systems, we test them for reliability over the entire 4.5 to 5.5 voltage range. When the testing is completed, the voltage is set to 5 volts.

If you have trouble obtaining a stable video display at the high speed, refer to the last item in the troubleshooting chart on page 6.

IF YOU NEED HELP, ITS BEST TO CALL. BILL ARCHBOLD IS AVAILABLE TO GIVE TECHNICAL ASSISTANCE WEEKDAYS BETWEEN 6:30 AND 10 PM AND MOST WEEKENDS BETWEEN 1 TO 10 PM, CALIFORNIA TIME.

THE FOLLOWING WIRING CHANGES ARE OPTIONAL.

HIGH SPEED POWER-UP

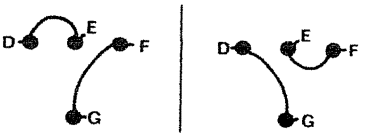
After getting used to the higher speeds, you may wish to power-up in the high speed mode by doing the following to the speed-up board.

1. Cut the jumper wire going between holes "F" and "G". Make the cut at the point where the wire connects at hole "F".

2. Cut the jumper wire going between holes "D" and "E". Make the cut at the point where the wire connects at hole "D".

3. Connect the wire coming from hole "G" to hole "D".

4. Connect the wire coming foroм hole "E" to hole "F".

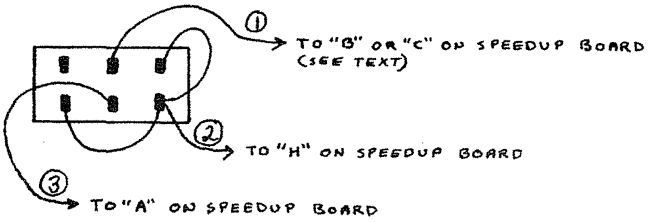


NORMAL SPEED POWER-UP | HIGH SPEED POWER-UP

MANUAL SPEED CONTROL

Installing a switch will allow speed changes while a program is running. The switch also enables selection of 50% slower than normal operation which may be helpful when listing or debugging programs and in other applications.

1. Purchase a double pole double throw (DPDT) switch with a neutral center or center off position. Wire the switch as shown in the diagram below.



2. Connect wire #3 from the switch to hole "A" on the speed-up board.

3. Connect wire #2 from the switch to hole "H" on the speed-up board.

4. Connect wire #1 as follows.

a. If automatic slowdown is not being used or is being used with disk only, connect wire #1 to hole "C" on the speedup board and cut the wire jumper below holes "B" and "C".

b. If automatic slowdown is used with cassette only, connect wire #1 to hole "B" on the speedup board and cut the wire jumper across the underside of the blue capacitor to the left of hole "B" (see the DISK OPERATION section, step 2).

c. If automatic slowdown is being used with disk and cassette, remove the wire connecting hole "C" on the speedup board to point "J" on the logic board. Connect wire #1 to hole "C" (the TRS-80 will no longer slowdown automatically during cassette operation.

5. Cut the wire jumper just below the letter "A" on the speed-up board.

6. Hang the switch out the back of the computer for testing. For the switch to work, the OUT254,1 statement must be entered when the computer is first powered up or the speedup board must be wired for high speed power-up (see the HIGH SPEED POWER-UP section). After determining that the switch is functioning properly, drill a hole and mount the switch at some convenient location on the cover. Make sure the switch will not short against anything when the case is reassembled.

When the switch is in the middle position, the TRS-80 will operate 50% slower than normal and the power-on LED will turn yellow. Flipping the switch one way will give high speed operation, the other way will give normal operation.

DO NOT RUN AT THE 50% REDUCED SPEED WHEN READING/WRITING TO DISK OR CASSETTE (ERRORS WILL RESULT). Also, if a wire has been run to the expansion interface, that wire must be connected to the interface or grounded in the keyboard before the high speed can be selected.

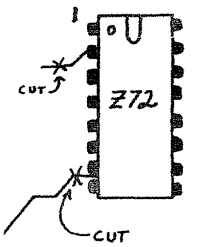
FASTER DISK OPERATION

On 1 February 1982, we will have available a newly design Fast Disk Board for the expansion interface that eliminates the need to remain at the normal speed during the entire period the disk drives are running. The board works with all Disk Operating Systems and can significantly speed-up disk operation. The cost of the unit is $24.95. It returns the TRS-80 to the normal speed for 1 second after the disk drives first come on to insure the motors reach proper speed before a read or write operation. After one second, it returns the system to the normal speed for .0001 seconds each time a read or write pulse is sent to the disk controller. If you have a switch installed, the Fast Disk Board also enables the disk system to work properly when the 50% reduced speed has been selected.

TRIPLE SPEED (5 MHZ)

The following shows how the TRS-80 can be wired for speeds up to three times faster than normal. The requirements are at least 200 nanosecond memory and a Z80B microprocessor.

1. Cut the trace that runs between pins 7 & 8 of Z72 (this trace is on the component side of the logic board and connects Z72 pin 10 to Z70 pin 6).

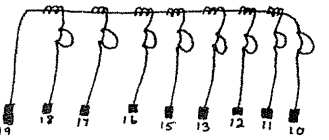


2. Cut the trace that leads from Z72 pin 2 (this trace is on the component side of the logic board and connects Z72 pin 2 to Z70 pin 2).

3. Connect a wire from Z72 pin 10 to Z69 pin 8.

4. Connect a wire from Z72 pin 2 to Z69 pin 5.

5. Add 220 picofarad ceramic RF by-pass capacitors between ground and each of the 8 data lines in the logic board. Do this by soldering one end of each of the capacitors to tab 19 on the edge connector that is directly below and to the right of Z76. Connect the other end of the capacitors to tabs 10, 11, 12, 13, 15, 16, 17, and 18 (be sure to skip tab 14). When we make up the capacitor network, we bond the capacitors together into a single unit by covering it with epoxy. This makes for a sturdy assembly and you don't have to worry about the capacitors bending, breaking, or shorting out on something. For $5.00 we will send a preassembled and encapsulated capacitor network.



6. Place the logic board in the case, install the nylon spacers, and fold the keyboard back into place. Run the computer to be sure it works properly at the normal and high speed (the TRS-80 is still wired for 3.5 mhz operation; the changes thus far are only to improve memory timing). If all is well, perform the following to the logic board.

(a). Move the wire at point "20" (Z56 pin 1) to the pin directly to its left (Z56 pin 14). If a wire had previously been connected between Z43 pin 2 and Z56 pin 14 for running at the 50% increase, that wire must be removed.

(b). Connect a wire between point 15 and point 20 (Z56

pin 1). There should now be two wires connected to point 15.

(c). Move wire 17 from point 19 (Z56 pin 11) to the pin directly above it (to Z56 pin 12).

7. The keyboard unit is now wired for 5.3 mhz operation. If you are using a late model Radio Shack expansion interface, remove the brown ceramic disk capacitor that was added earlier across the 74LS04 in the interface (paragraph 18 on page 4). If any problems are experienced, make the following changes which will compensate for exceptionally slow ROM or video memory.

a. Connect a wire between Z52 pin 13 and Z73 pin 2.

b. Cut the trace leaving Z73 pin 2 on the component side of the logic board (this trace runs between pins 13 and 14 of Z73 and connects Z73 pin 2 to Z40 pin 27).

CROSS REFERENCE TABLE - Photo location verses schematic designation

Point/Location		Point/Location	
1	Z10 pin 16 (+5 volts)	18	------
2	Z11 pin 1 (ground)	19	Z56 pin 11 (3.5 mhz)
3	Z13 pin 8 (+12 volts)	20	Z56 pin 1 (10 mhz)
4	Trace goes to Z25 pin 9 (OUT)	A	------
5	Z34 pin 8 (A0)	B	Z40 pin 19
6	Z52 pin 10 (power-on reset)	C	Z74 pin 2
7	Z54 pin 8 (FE)	D	Z72 pin 4
8	Z73 pin 2 (M1)	E	------
9	Z69 pin 9	F	------
10	Z69 pin 6	G	------
11	Z68 pin 9 (D0)	H	Z70 pin 5
12	------	J	Z59 pin 10
13	------	K	------
14	to Z80 clock input	L	------
15	10 mhz master clock output		
16	Z56 pin 8 (1.77 mhz clock output)		
17	wire 17 (high speed clock input to speed-up board)		

THEORY OF OPERATION

The speedup board is basically an electronic switch that provides different clock rates to the Z80 microprocessor. The following discussion deals with double speed operation.

A 10.6445 mhz clock signal goes into the speedup board on wire 15. The 10 mhz signal is reshaped by the speedup board and then sent out wire 20 (reshaping does not take place at the normal speed when the wiring required for double density disk operation has been performed). The reshaped signal at point 20 will appear to be constantly shifting when viewed on an oscilloscope.

Z56 on the logic board takes the 10 mhz signal in on pin 1 (point 20) and divides it by 3 to give 3.5 mhz at Z56 pin 11 (point 19). Z56 also divides the 10 mhz signal by 6 to give 1.77 mhz at Z56 pin 8 (point 16). The 1.77 mhz and 3.5 mhz signals are sent to the speedup board through wires 16 and 17 respectively. One of the two signal is selected by the speedup board and sent to point 14 on the logic board. Point 14 goes to a gate which connects to the Z80 microprocessor clock input.

Wire 1 provides +5 volts to power the speedup unit. Wire 2 provides a ground to the speedup board. Wire 3 provides +12 volts and is used in conjunction with the +5 volts supply to power the LED.

Wires 4, 5, 7, and 11 provide software control of the speedup board.

Wire 19 is grounded to Z56 pin 10.

Wires 8, 9, and 10 are used to control the reshaping of the 10 mhz signal before it leaves the speedup board through wire 15. These wires have no affect on the TRS-80 when running at the normal speed if the wiring required for double density disk operation has been performed.

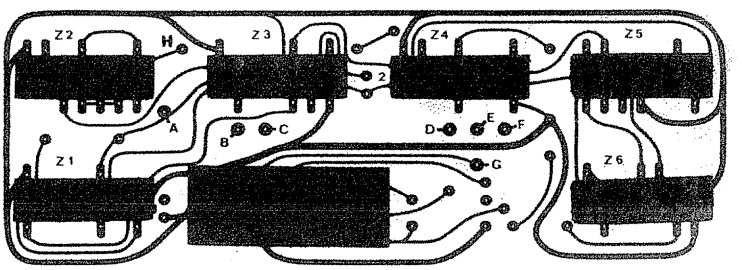
Wire 6 resets the speedup board on power-up. It is low for a brief instant after power is applied then goes to 5 volts and stays there.

The wiring changes made to the logic board and the expansion interface improve memory timing and reduce the affects of noise on the system.

For triple speed operation, the 10 mhz output from the speedup board is connected to Z56 pin 14. Z56 divides the 10 mhz signal by 2 to give 5.3 at Z56 pin 12.

An oscilloscope or logic probe should indicate the following signals at the points shown in the photo.

Point 1 - +5 volts.
Point 2 - ground.
Point 3 - +12 volts.
Point 4 - +5 volts.
Points 5, 7, 8, 9, 10, 11, 14, 15, 16, 17, and 20 should have a pulse train or square wave present.
Point 6 - +5 volts



CORRECTIONS to instructions dated November 18, 1981.

Mark the affected paragraphs so you will know when to refer back to this sheet.

Page 1, Add to the paragraph beginning with "If you had our original speed-up board ....." ; The original speed-up board had 4 IC chips mounted on it and was sold prior to October 1980.

Page 2. The following statement should immediately precede step 8, "The following steps apply to all keyboard units."

Page 2, step 11, add the following, "The Radio Shack part number for adhesive foam pads is 64-2344".

Page 4. As a point of clarification, steps 1 through 18 apply only to "late" model Radio Shack expansion interfaces.

Page 4, step 18. As a matter of information, the number 221 stamped on the capacitor stands for 220 pf (Radio Shack part number 272-124).

Page 4, section entitled "FOR EARLY MODEL RADIO SHACK EXPANSION INTERFACES WITH THE DIN PLUG MODIFICATION". Most early model interfaces do not require any modification to run reliably at the double (or triple) speed. DO NOT PERFORM THESE STEPS UNLESS PROBLEMS ARE EXPERIENCED AT THE HIGHER SPEED.

Page 4, top right-hand column, step 2. As a matter of information, the number 221 stamped on the capacitor stands for 220 pf (Radio Shack part # 272-124).

Page 9, step 5 under the TRIPLE SPEED (5 MHZ) section. Most keyboard units do not require this step to run reliably at the triple speed. DO NOT PERFORM THIS STEP UNLESS STEPS 7A AND 7B ON PAGE 10 HAVE BEEN PERFORMED AND PROBLEMS ARE STILL BEING EXPERIENCED AT THE TRIPLE SPEED.

Page 10. Add the following after step 7. "If you have a "early" model expansion interface and experience problems with interface memory at the triple speed, perform the early model expansion interface wiring described on page 4 if it has not already been accomplished.

SUPPLEMENTAL INFORMATION

The Z80B microprocessor and memory chips required for the triple speed are available from the following company at good prices. If you order memory chips, be sure to specify NEC brand only with a speed of at least 200 ns.

JDR Microdevices, Inc.
1224 Bascom Ave
San Jose, CA 95128
1-800-538-5000
1-800-662-6279 (California)
1-408-995-5430

IMPORTANT: If you plan to adapt your system for 8" disk drives, consider the following. When the double speed installation procedure is performed, the TRS-80 will actually run 4% below true double speed. This will not be fast enough to run 8" drives at double density. Making the following changes to the installation procedure will place the system to precisely double speed. (1) Remove wire 9 from point 9 and connect it to one end of a 1/4 watt 1,000 ohm resistor (Radio Shack part # 271-1321). (2) Connect the other end of the resistor to Z69 pin 14 (point 9 in the photo identifies Z69 pin 9, therefore, Z69 pin 14 will be up 5 pins). (3) Perform steps 1 through 4 on page 9 under the TRIPLE SPEED section. The system is now wired for true double speed and 8" drives should work properly at double density.

If you later decide to wire for triple speed operation, be sure to remove the resistor added above and connect wire 9 back to point 9.