

**Radio Shack®**

# **Service Manual**

**TRS-80®**

## **MODEL 16 UPGRADE INSTALLATION GUIDE**

**Model 16 Enhancement Option**

**Catalog Number 26-6010**  
(Model II only)

**Memory Board Upgrade**

**Catalog Number 26-6011**  
(Model 16 only)

**Memory Kit Upgrade**

**Catalog Number 26-6012**  
(enhanced Model II and Model 16)

**Model 16 Disk Drive Upgrade**

**Catalog Number 26-4167**  
(Model 16 only)

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Service Manual

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Model 16

## MODEL 16 UPGRADE INSTALLATION GUIDE

Model 16 Upgrade  
Catalog Number 16-5017  
(Note: 1 only)

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Model 16 Installation Guide  
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## INTRODUCTION

This Installation Guide combines installation and testing information for the TRS-80 Model 16 computer upgrades and the TRS-80 Model II computer enhancement option and the memory upgrade.

Please note that the Model 16 Enhancement Option, Catalog Number 26-6010, can be used on the Model II computer only. The Memory Board upgrade, Catalog Number 26-6011, can be used on Model 16 computer only; however, the Memory Kit, Catalog Number 26-6012, can be used on a Model 16 or an enhanced Model II. The Disk Drive Upgrade, Catalog Number 26-4167, is for the Model 16 only.

The Upgrades, with exception of the memory upgrades, are divided into separate sections. Each section contains a parts list, installation, and testing for that particular upgrade. The memory upgrades, Memory Board and Memory Kit, are combined in one section.



**MODEL 16 ENHANCEMENT OPTION**

The Model II computer can be modified to use the same 16-bit CPU and Memory boards that the Model 16 uses simply by replacing the power supply with a modified version of the present supply and by replacing the +5 volt feed for the motherboard with heavier gauge wire. The enhanced Model II will be equal to the Model 16 except for the floppy drive characteristics and the maximum memory configuration supported. The table below outlines the main differences between the Model 16 and the Model II/16 upgrade.

	Model 16	Model II/16
Stepping Rate	3 ms	10 ms
Double Sided Media Supported	yes	no
Max. 16-bit Memory Supported	512K	256K

The upgrade kit (Cat. No. 26-6010) contains everything required to accomplish this modification except the replacement power supply which must be purchased as a separate item from Radio Shack National Parts (Part Number AX6008). Check the parts list shown below to be sure that you have received everything that comes with this modification kit.

**Parts List**

Quantity	Description	Manufacturer's Part Number
1	16-bit CPU PC Board Assembly	8898003
1	16-bit Memory PC Board Assembly	8898002
1	Cable, 34-position	8709278
1	Cable, 50-position	8709279
1	Wire, 16 gauge	8898045
1	Manual, TRSDOS 16 (includes systems diskette)	8898009
1	Manual, Editor/Assembler 16	8898031
1	Manual, Model 16 Operator's	8749330
1	Supplement, Model II	8749345



## Modification Instructions

1. Before opening the Model II's case, run all available Model II diagnostics to verify proper operation of the Model II. If the unit is not operating correctly, it should be repaired before attempting the upgrade.
2. Remove the top cover of the Model II by removing the two machine screws from the back and carefully lifting up the case and angling it off toward the front panel.
3. Before installing the 16-bit memory board, verify that position 2 of switch S1 is ON and that all other positions are OFF. Remove the card guide support and install the 16-bit CPU board in the seventh slot from the right and the 16-bit memory board in the eighth slot from the right. Also install the two provided connecting cables between these two boards. The memory board should be to the left of the CPU board (when facing the rear of the Model II). Replace the card guide support.
4. Remove the video harness from the video board. Unplug the +120V video power supply harness from the power supply. Next, remove the three screws that fasten the power supply bracket to the chassis.

Take care not to put pressure on the neck of the CRT during the following operations. Carefully pull up the power supply chassis and disconnect the AC power plug, the DC power plug, and the ground wire. Next, remove the four screws that hold the video driver board to the power supply bracket. Clear all cables and carefully remove the power supply from the unit then remove the DC harness that plugs into the motherboard.

5. Use a pin extractor tool (Radio Shack National Parts Number AXX9077) to remove the +5 volt feed wire from the power supply to the motherboard. Replace it with the #16 gauge wire provided. Connect the wire so that the contact with the shoulders on the side goes into the motherboard plug and the other end of the wire goes into the power supply plug.
6. Place the modified power supply in the enclosure close to it's mounting location, but do not install the mounting hardware at this time. Install all of the power supply harness connectors previously removed then continue on to Power Supply Adjustments.



### Power Supply Adjustments

The output voltages of the power supply must be adjusted to support the loads present with this particular system configuration. The necessary adjustments are described below. If more boards are installed or others removed, this procedure should be repeated for the new configuration.

\* \* \* W A R N I N G \* \* \*

A potential shock hazard exists while adjusting the modified Model II power supply. The heat sink for Q1 has a potential of 160 volts and should not be touched or grounded to the metal chassis when power is on. To greatly reduce the potential for a shock hazard, follow the adjustment procedures carefully and in the order given.

1. Do not move the power supply unless the power is off.
2. Place a 6-inch strip of electrical tape over the edge of the CRT support nearest the power supply. The bottom edge of the tape should be approximately two inches above the bottom of the support.
3. Place a wooden block or other non-conductive material under the power supply in order to elevate it so that trim potentiometer R39 is accessible to a small flat-bladed screwdriver. A block that is 2 inches wide, 6 inches long and 2 inches high should be sufficient.
4. Before applying power, verify that the heat sink for Q1 is not touching any metal and that the supply is in a stable position. Grounding Q1 to the chassis will result in catastrophic power supply failure.
5. Verify that all cables to the power supply and the motherboard are attached and check that the unit is plugged into a proper AC power source. Ensure that the video monitor board does not short to the sheet metal parts of the enclosure.
6. Turn on the power and insert a diskette and close the drive door. Wait until Drive Zero is de-selected in the boot-up process.
7. Measure the +5-volt supply by attaching a voltmeter to the positive side (+) and the negative side (-) of C56 on

7. Measure the +5-volt supply by attaching a voltmeter to the positive side (+) and the negative side (-) of C56 on the 8-bit memory board. Adjust the power supply, via R39 on the supply, to an output of 5 volts +/- 0.05 volts.
8. Measure the +12-volt supply by attaching a voltmeter to the positive side (+) and the negative side (-) of C38 on the 8-bit memory board. The voltage should measure above 11.4 volts but below 12.6 volts. If necessary, adjust R39 on the power supply until the voltage is within these limits.
9. If an adjustment was required in step 8, verify that the +5 volt-supply is still between 4.85 and 5.15 volts. If this voltage does not measure correctly then the power supply is defective.
10. Check the +24-volt supply at pin one of the power connector for the floppy drive PCB. This voltage should measure between 21.6 volts and 26.4 volts; but, if it does not, the power supply is defective.
11. Calibration of the power supply is now complete. Properly mount the power supply in the chassis by replacing the mounting hardware removed during disassembly.

### Functional Testing

Verify proper operation of the upgraded Model II with the Model II to Model 16 Upgrade Diagnostics. If the Model II/16 passes all tests, replace the top cover of the case and fasten it in the back with the two machine screws. Attach the upgrade label to the rear of the unit to identify it as an upgraded Model II.

After reassembly, rerun the Model II to Model 16 Upgrade Diagnostics.







**MEMORY UPGRADES**

These instructions apply to the 128K Memory Kit (Catalog Number 26-6012) as well as the 128K Memory Board (Catalog Number 26-6011). Please be aware that the Memory Board can be used with a Model 16 computer only, while the Memory Kit can be used on Model 16 or an enhanced Model II computer. Check the parts lists below to be sure you have received all parts required for the particular upgrade you are installing.

**Memory Kit Parts List**  
**Catalog Number 26-6012**

Quantity	Description	Manufacturer's Part Number
16	Dynamic RAM chips (200NS)	8040665
1	Label, Upgrade	8789669

**Memory Board Parts List**  
**Catalog Number 26-6011**

Quantity	Description	Manufacturer's Part Number
1	16-bit, 128K Memory Board	8898002
1	Cable, 3-connector, 34-position	8709292
1	Cable, 3-connector, 50-position	8709293
1	Label, Upgrade	8789667

### Installation Instructions

1. Remove the power cord and all cables connected to the Model 16. Remove the two machine screws from the rear of case and carefully lift off the case top.
2. Remove the Card Guide Retainer. Instructions for installing the Memory Kit are located in step 3 and instructions for installing the Memory Board are in step 4. If both a Memory Kit and a Memory Board are being installed (Model 16 only), it is recommended that the Memory Kit (chips) be installed first.
3. Remove the two cables from the Memory Board then remove the Memory Board itself. Locate the sockets U30 through U37 and U40 through U47. Install the 16 Dynamic RAMS in these locations. Be sure that pin 1 of the chip matches up with pin 1 of the socket. After the chips are in place, refer to Table 1 and set switch S1 accordingly. Reinstall the Memory board and replace the two card edge connectors. Go to step 5.
4. Before installing the new Memory Board, refer to Table 1 and set switch S1 accordingly. Next install the new Memory Board in the slot to the left of the old Memory Board (looking from the rear of the computer). Do not leave any open slots between the two boards. Remove the two cables presently between the CPU board and the old Memory board and install the two new cables. One end of each cable connects to the CPU board, the middle connector goes to the old Memory board and the other end connector goes to the new Memory board. Go to step 5.

TABLE 1.

Model 16 Configuration	Memory Installed	Number of Memory Boards	Switch S1 Configuration
As shipped	128K	one	pos. 2 ON
128K kit	256K	one	pos. 2 ON
128K board	384K	two	pos. 2, 3 ON
128K kit	512K	two	pos. 2, 3 ON

5. Check to see that all cables have been reconnected and that all boards are securely seated in the Motherboard. Before reassembly of the case, connect the power cord to the rear of the computer and apply power. Boot up the computer and run the appropriate diagnostics. If the machine checks out correctly, continue on to the next step. If the machine does not pass the test, go back over your work and try to correct the problem.
6. Reinstall the Card Guide Retainer. Replace the case top and fasten it with two machine screws in the rear of the unit. Attach the appropriate label to the rear of the unit to identify it as an upgraded computer.
7. Rerun the diagnostics program for a final check after the computer is completely reassembled.







**MODEL 16 DISK DRIVE UPGRADE**

Please be aware that this Disk Drive Upgrade can be used with Model 16 computers only. Check the parts list below to be sure you have received everything that comes with this modification kit.

**Parts List**

Quantity	Description	Manufacturer's Part Number
1	Disk Drive, 8-inch Slim Line	8898200
5	Screw, #8, flat head	8569141
1	Strap, sheet metal, top rear	8729103

Next check the new 8-inch disk drive for correct configuration as described below.

- The 150 ohm DIP resistor, RP1, should be removed from its socket.  
NOTE: The DIP resistor, RP1, should be on either Drive 0 or Drive 1, but not both. The DIP resistor should have pins 1, 2, 4, 6, 7, and 8 cut off. All other pins should be present.
- The Drive Select jumper plug should be in the DS2 position.
- The M2 jumper plug should be removed.

## Installation Instructions

1. Remove the power cord and all cables from the rear of the unit and unplug the keyboard. Remove the two machine screws from the rear of the case and carefully lift off the case top.
2. Disconnect the Reset harness from the 8-bit CPU board.
3. Remove the four screws holding the front bezel in place. Pull out the front bezel and remove the Power and Reset cables from the harness clips so that the bezel will lay flat on the work table.
4. Turn the tinnerman clips on the bezel insert to the vertical position and push out the insert.

Refer to Figure 1 throughout the remainder of the text.

5. You will have to remove the existing internal drive before installing the new drive. To do this, remove the #8-32 machine screw that passes through the bezel mounting bracket and fastens to the top front disk drive strap. Next, remove the two #8-32 sheet metal screws that fasten the lower front disk drive bracket to the disk drive mounting platform.
6. Remove the Disk Drive Signal cable located at the rear of the drive. It is a 50-wire flat ribbon cable with two connectors on one end. Then remove the DC Power harness from its socket which is located just above the Signal cable connector. Note that there are two connectors on this end of the harness.

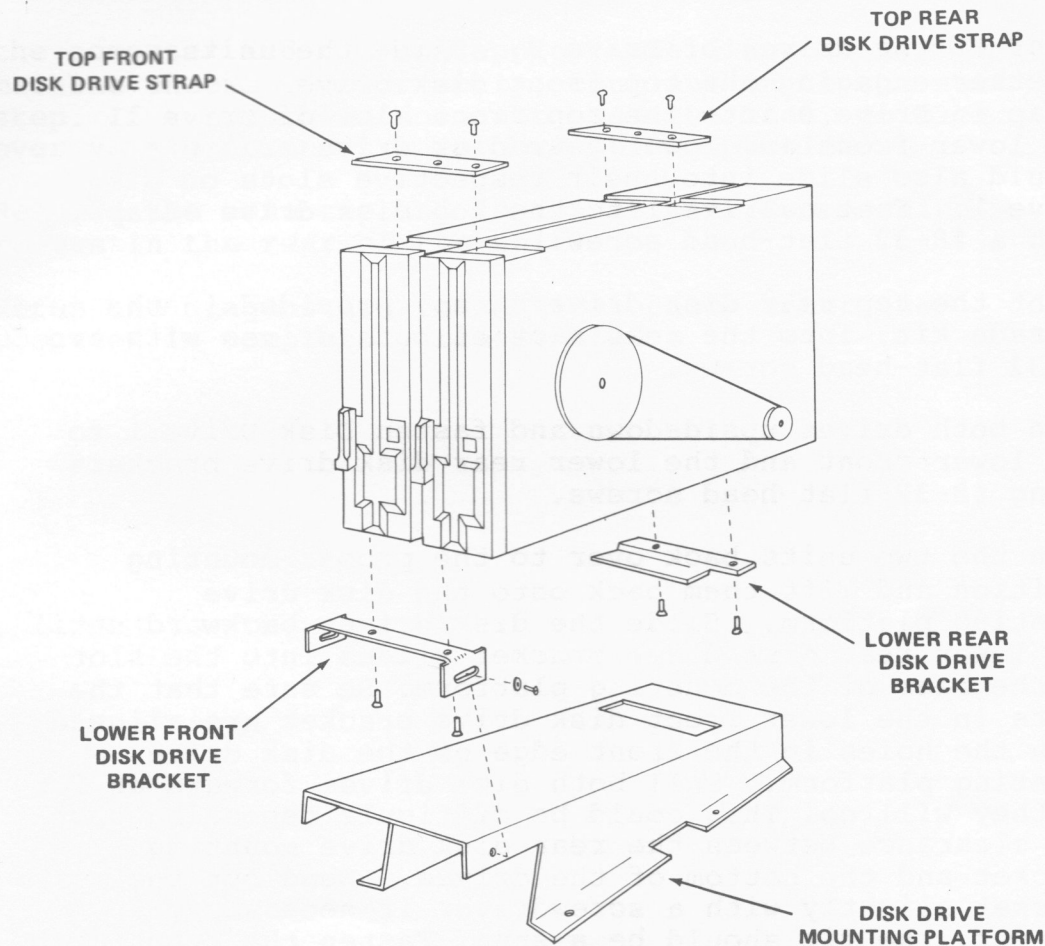


Figure 1. Disk Drives and Mounting Hardware

7. Carefully push the Disk Drive toward the rear of the computer until the lower rear disk drive bracket is disengaged from the disk drive mounting platform. Firm pressure may be required. Lift up the rear of the Drive slightly so that the bracket will clear the slot then move the unit forward and off the disk drive mounting platform.
8. Set Drive 0 on a flat surface with the unit oriented the same way it was mounted in the Model 16. Note that the top front disk drive strap and the lower front and lower rear disk drive brackets are still mounted to this drive.
9. Take Disk Drive 1, oriented in same manner as Drive 0, and set it on the table to the right (looking from the



front of the drive) of Drive 0. Slide the units together engaging the top front disk drive strap on Drive 0 into the top front slot of Drive 1. The lower front and lower rear disk drive brackets should also slide into their respective slots on Disk Drive 1. Fasten Drive 1 to the top disk drive strap with a #8-32 flat-head screw.

10. Mount the top rear disk drive strap, provided in the upgrade kit, into the rear slot of both drives with two #8-32 flat-head screws.
11. Turn both drives upsidedown and fasten Disk Drive 1 to the lower front and the lower rear disk drive brackets using #8-32 flat-head screws.
12. Turn the two units back over to the proper mounting position and lift them back onto the disk drive mounting platform. Slide the disk drives backward until the lower rear disk drive bracket slides into the slot at the rear of the mounting platform. Be sure that the slots in the lower front disk drive bracket are aligned with the holes in the front edge of the disk drive mounting platform. Pull both disk drives forward as far as they will go. This could be difficult depending upon the clearance between the rear disk drive mounting bracket and the bottom of the drives. Bend out the bracket slightly with a screwdriver if necessary; however, the fit should be a snug. Fasten the front disk drive bracket to the disk drive mounting platform with two #8-32 sheet metal screws.
13. Reinstall the #8-32 machine screw that fastens the top front disk drive strap to the bezel mounting bracket.
14. Plug in the Disk Drive Signal cable. The connector on the end of the cable plugs into Drive 1 and the other connector plugs into Drive 0. Connect the DC Power harness to both drives in sockets just above and to the left of the signal connector.
15. Replace the front bezel and fasten it with the four screws removed earlier. Replace the Power and Reset cables in the harness clips and reconnect the Reset harness to the 8-bit CPU board.
16. Check carefully to be sure that all cables have been reconnected. Before reassembly of the case top, connect the power cord and the keyboard and apply power. Boot up



the computer and run the appropriate diagnostics. If the machine checks out correctly, continue on to the next step. If the machine does not pass the test, go back over your work and try to correct the problem.

17. Replace the case top and fasten it with two machine screws in the rear of the unit.
18. Rerun the diagnostics for a final check after the computer is completely reassembled.



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