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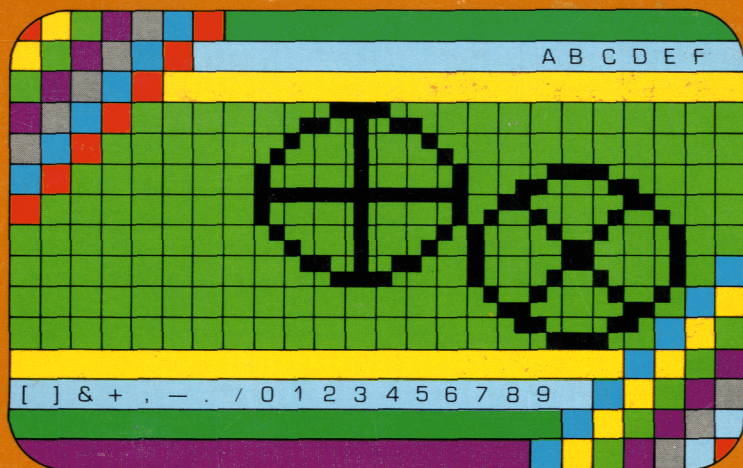
Colin Hinson

In the village of Blunham, Bedfordshire.



Diagnostic

Comprehensive tests for checking proper operation of the Texas Instruments Home Computer.



As this manual was designed for the U.S. market, warranty conditions described herein are not applicable. The only valid command module warranty conditions are those set forth in the "user's ref. guide" accompanying the home computer.

CAUTION:

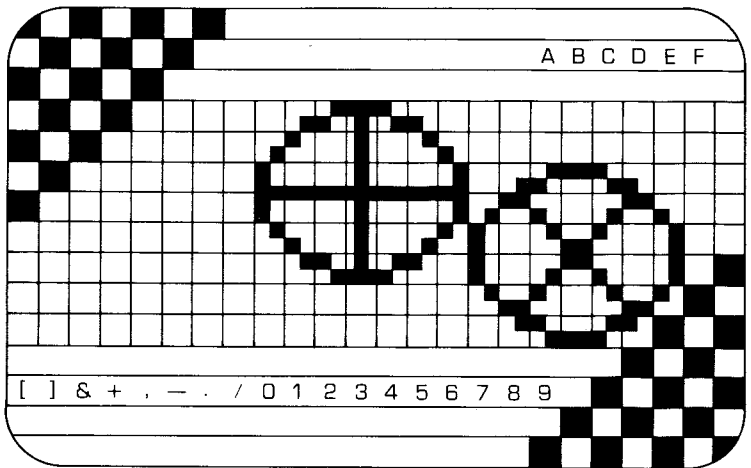
The contents of a module can be damaged by static electricity discharges.

Be sure the module is free of static electricity before plugging it into the computer (see page 19 for details).



TEXAS INSTRUMENTS
HOME COMPUTER

Diagnostic



This *Solid State Software*™ Command Module is designed to be used with the Texas Instruments Home Computer. Its preprogrammed solid-state memory expands the power, versatility, and capability of your Home Computer.

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Command Module program and data base contents
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See important warranty information at back of book.

TEXAS INSTRUMENTS HOME COMPUTER

The Diagnostic *Solid State Software*[™] Command Module is designed to test the operation of the Texas Instruments Home Computer. Service technicians, sales-clerks, and computer owners alike can use the module to check the computer and identify problem areas quickly, automatically, and reliably.

You've probably encountered this well-known situation: you take in a piece of equipment for repair and describe the problem to the serviceman, only to find that the equipment doesn't malfunction at the shop as it did at home. The Diagnostic Command Module can help you avoid this frustrating situation.

The programs included in the Diagnostic Command Module test these operations:

- Keyboard function
- Random Access Memory (RAM)
- Video Display (VDP)
- Sound – Tones and Noise
- Calculations

In addition, there are test sequences to check the operation of two accessories: audio cassette recorders and the Wired Remote Controllers. Also, a special test mode for repair technicians is included.

HOW TO USE THIS MANUAL

Note: This manual does not provide repair techniques or procedures. Instead, the information included here describes the various displays seen when the Diagnostic Command Module is in use and the computer is functioning properly.

Any errors detected by the module are indicated in one of three ways:

- You view an error listing on a separate display.



- You observe incorrect results from the checking procedure.
- You hear inappropriate sounds from the computer's speakers.

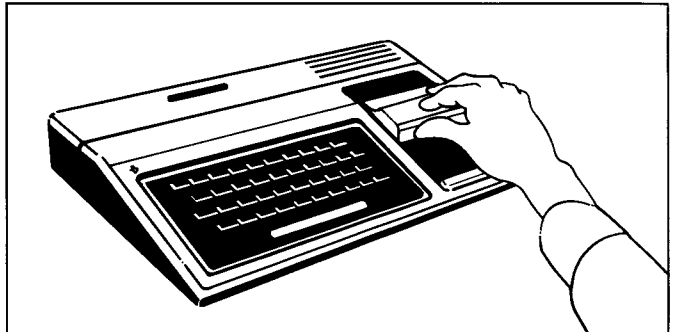
If a diagnostic test indicates that the computer is not working properly, repairs should be made by a qualified service technician. See page 20 for in-warranty and out-of-warranty service information.

AUTOMATIC RESET FEATURE

An automatic reset feature is built into the computer. Anytime a module is inserted into the console, the computer should return to the master title screen. (*Note:* All data or program material you have entered will be erased.) In rare instances if the module is accidentally removed from the slot while the module contents are being used, the computer may behave erratically. To restore the computer to normal operation, turn the computer console off, wait a few seconds, reinsert the module, and turn it on again.

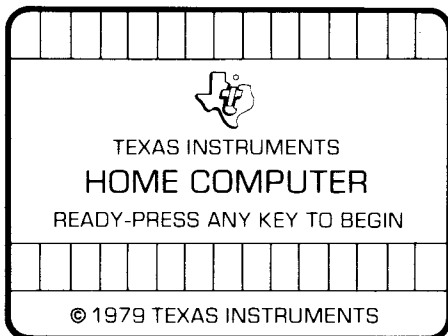
USING THE *SOLID STATE SOFTWARE™* COMMAND MODULE

Note: Be sure the module is free of static electricity before inserting it into the computer.



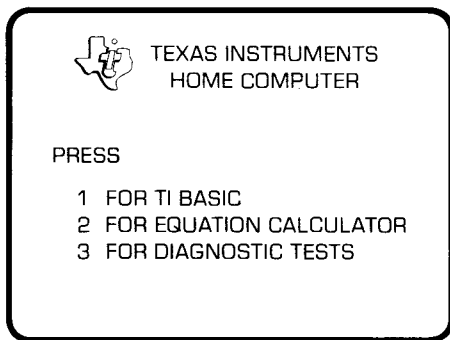
TEXAS INSTRUMENTS HOME COMPUTER

1. *If the computer is OFF*, slide the module into the slot on the console, and turn the computer on. The master title screen should then appear.



If the computer is ON, hold down the **SHIFT** key and press **Q** to make the master title screen appear. *Then* slide the module into the slot on the console.

2. Press any key to make the master selection list appear. The title of the module will be third on the list.

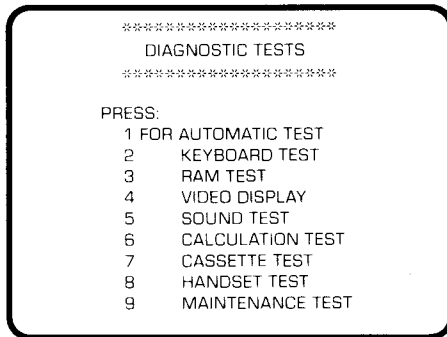




3. Press the **3** key to select the module.

(*Note:* To remove the module, *first* return the computer to the master title screen by pressing **SHIFT Q**. *Then* remove the module from the slot. If you have any problem inserting the module, or if it is accidentally removed from the slot while in use, please see "In Case of Difficulty" on page 20.)

When you press **3**, the title screen for Diagnostic appears. You can press any key at this time to go immediately to the Diagnostic Selection List. (If you wait a few moments, the Diagnostic Selection List automatically appears.)



Select the option which will best help you diagnose any problem you may have observed. The following chart summarizes some of these problems and refers to the pages where the appropriate test is described in this manual.

TEXAS INSTRUMENTS HOME COMPUTER

<i>Problem</i>	<i>Option Number</i>	<i>Option Title</i>	<i>See Page</i>
<i>Need to check operation of new computer.</i>	<i>1</i>	<i>Automatic Test</i>	<i>7</i>
<i>Characters on display screen differ from characters entered from keyboard, or no characters appear on the screen.</i>	<i>2</i>	<i>Keyboard Test</i>	<i>8</i>
<i>Incorrect display of program results, or random appearance of unusual characters.</i>	<i>3</i>	<i>RAM Test</i>	<i>8</i>
<i>Incorrect display of colors and characters.</i>	<i>4</i>	<i>Video Display Test</i>	<i>11</i>
<i>Tones or noise are missing or impaired.</i>	<i>5</i>	<i>Sound Test</i>	<i>13</i>
<i>Incorrect solutions to problems involving mathematical operations.</i>	<i>6</i>	<i>Calculation Test</i>	<i>15</i>
<i>Cassette recorder doesn't seem to be working properly.</i>	<i>7</i>	<i>Cassette Test</i>	<i>15</i>
<i>Wired Remote Controllers produce results which don't agree with input.</i>	<i>8</i>	<i>Handset Test</i>	<i>17</i>
<i>Information for repair technician.</i>	<i>9</i>	<i>Maintenance Test</i>	<i>19</i>



AUTOMATIC TEST

The Automatic Test provides a general overview of the computer's operation. If you receive an error message in any of these tests, check that area more thoroughly by selecting the corresponding option from the Diagnostic Selection List.

The options programmed into the Automatic Test are the Random-Access-Memory (RAM) Test, the Video Display Processor (VDP) Test, the Sound Test, and the Calculation Test. After you press **1** for the Automatic Test, the computer asks you to choose one of the RAM tests: (1) Checker Board, (2) Address, or (3) Input Pattern. The computer tests the selected option and then continues through the routine by automatically checking the other tests in a preprogrammed order. The order of the tests is:

- (1) one of three RAM tests (see page 8)
- (2) the VDP Pattern Mode Test (see page 12)
- (3) the VDP Multicolor Mode Test (see page 12)
- (4) the VDP Text Mode Test (see page 13)
- (5) the Sound Test (see page 13)
- (6) the Calculation Test (see page 15)

Note: When you press the **SPACE BAR** during the RAM test or the Calculation Test, an error report appears. Pressing the **SPACE BAR** during any of the three VDP Tests or the Sound Test freezes the action. In either case, pressing the **SPACE BAR** a second time continues the testing routine.

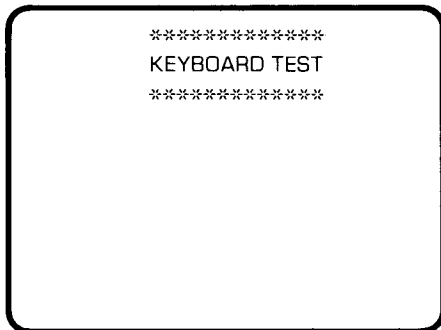
After completing the Calculation Test, the program automatically returns to the beginning of the routine and starts the tests again. When you're ready to return to the Diagnostic Selection List, press the **ENTER** key.

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HOME COMPUTER

KEYBOARD TEST

Option 2 on the Diagnostic Selection List is the Keyboard Test. After you press **2**, the screen displays the words **KEYBOARD TEST** at the top.



Enter several characters from the keyboard and ensure that what you enter corresponds with the display. If you use the **SHIFT** key with a key having no separate shifted character, such as **G**, the displayed character will be preceded by an up arrow, **↑G**. (*Note: You cannot check **SHIFT Q** with this test. Holding down the **SHIFT** key and pressing **Q** will return the computer to the master title screen.*) Continue entering characters until you are satisfied that the keyboard is working properly. When you press the **ENTER** key, **ENT** is listed as a character, and **PRESS ENTER FOR MAIN INDEX** is displayed at the bottom of the screen. Press the **ENTER** key again to return to the Diagnostic Selection List.

RAM TESTS

The third option on the Diagnostic Selection List checks the computer's memories for proper operation. The three tests included are: the Checker Board Test, the Test with Address, and the Input Test Pattern.



Each of these three options gives you the same error information. However, options 1 and 3 check memory more thoroughly than option 2, and thus take longer to perform.

After you've selected one of the RAM options, press either **1** for a single test or **2** for a loop test. Complete results are achieved by running these tests for at least one entire loop.

If you select the single test option, the computer takes a few minutes to run a memory-checking program. Then the display reports any errors which were found or indicates that no errors were detected. To stop this test before it's finished, press the **ENTER** key. The display will return to the Diagnostic Selection List. The **SPACE BAR** has no effect during a single test and thus will not return any error information.

With a loop test, you can press the **SPACE BAR** at any time and this report appears.

```
ERRORS                                00:00:00
      RUN NO. 0000   LOC 0000
LOC  EXP  ACT  LOC  EXP  ACT
COUNT 0000
```

TEXAS INSTRUMENTS HOME COMPUTER

The length of time the program has run is displayed in the upper right-hand corner. The information in the columns for location, expected result, and actual result tells the repair technician where the computer is malfunctioning. If these columns contain no data, your computer is working properly for that particular test. To return to the Diagnostic Selection List, press the **ENTER** key.

Now let's see what each RAM test looks like. (If your display doesn't agree with the description given here, an error exists and repairs are necessary.) The time given for each test represents how long that test lasts in a single uninterrupted loop.

Checker Board Test (about 4 minutes)

With this test, the screen fills with rectangles of two alternating colors. The colors may not be the same each time you run this program. However, this checkerboard always changes to green and white. After about a minute, the display turns white, then green, and then back to white again. At this point, the test starts over in a loop test or gives an error report in a single test.

Test with Address (about 2 minutes)

This test checks the RAM very quickly. Initially the screen fills with columns of various characters. These may be different each time you run the program. Then the display changes to eight columns in two groups of four columns each. Each column is made up of various colored squares. Some activity takes place within each square at the beginning of the test, and then the eight columns stabilize. After about a minute, the area between the columns displays a green and white pattern. Notice that while the routine is running, the border color is green. At the end of the program, the border is white if no errors were found and purple if any errors were located.



Input Test Pattern (about 3 minutes)

This test is like the Checker Board Test except that you input your own pattern in hexadecimal code. To do this, enter four characters from the keyboard using any combination of the numbers from 1 through 9 and the letters from A through F. For example, with the pattern 23AF, every other column is a solid bar with the number sign (#) in the other columns. The number sign is then replaced by other bars. The screen then fills with bars which periodically change colors. Your main error indication is again the screen's border. It is green while the computer is checking and white if no error is found. A purple border indicates that an error was found.

VIDEO DISPLAY TESTS

If you think the display screen is not working properly, select option 4 from the Diagnostic Selection List. Then choose the Pattern Mode Test, the Multicolor Mode Test, or the Text Mode Test.

To stop the action so that you can check the display with either the Pattern Mode Test or the Multicolor Mode Test, press the **SPACE BAR**. Pressing the **SPACE BAR** again resumes the activity. The **SPACE BAR** has no visible effect on the Text Mode Test.

In all three VDP tests, the program continues checking until you press the **ENTER** key to return to the VDP Selection List. Press the **ENTER** key a second time to return to the Diagnostic Selection List.

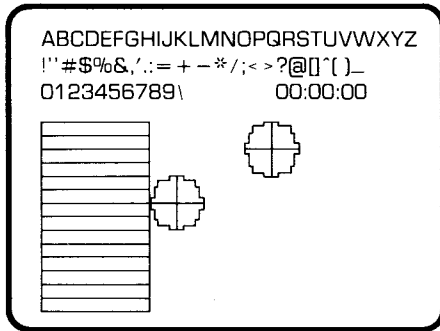
The following information tells you what you see on the display screen if the computer is working properly. If the display does not agree with the description given here, repair is necessary.

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Pattern Mode Test

This test checks both the colors and the characters displayed on the screen. The following shows a typical display.



All 16 colors are displayed on the left side of the screen. Since the screen is white, you will actually see bars in 14 colors because the first bar is white and the last one is transparent. When the background color changes, the transparent bar changes color too. One of the two spinning wheels moves from left to right, and the other moves from top to bottom. Occasionally these two wheels touch each other. When this happens, the background changes to purple and the word COINCIDENCE appears at the bottom of the display, indicating that the computer has properly detected two characters in the same location.

Multicolor Mode Test

You can use this test as a second method for checking colors. When you select this option, the display blanks and then fills line by line with squares in 16 colors. Each line is shifted one space to the left of the preceding one. Thus, each color forms a diagonal line. Once the display is completely filled, each line shifts two spaces to the left, one line at a time.



Text Mode Test

Choose this option to check character display. Each row in this mode will contain up to 32 characters. The correct display is shown here:

```
!'"#$%&{'}*+,-./0123456789;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
!'"#$%&{'}*+,-./0123456789;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
!'"#$%&{'}*+,-./0123456789;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
!'"#$%&{'}*+,-./0123456789;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
!'"#$%&{'}*+,-./0123456789;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
!'"#$%&{'}*+,-./0123456789;<=>?
@ABCDEFGHIJKLMNPOQRSTUVWXYZ[\]^_
```

SOUND TEST

To check the tone-generating capabilities of the computer, select option 5 from the Diagnostic Selection List. This display appears:

```
*****
SOUND TEST
***** 00:00:00

TONE          ATTENUATION
■ TONE 1      ■ 0 DB
  TONE 2      ■ 2 DB
  TONE 3      ■ 4 DB
NOISE         ■ 8 DB
  PERIODIC    ■ 16 DB
  RANDOM      ■ OFF

*PRESS ENTER FOR INDEX*
```

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Seven tones are checked at six volume (attenuation) levels, one level at a time. You won't hear any tones when the *OFF* level is being checked. This process is repeated three times, once for each tone generator. The seven tone frequencies tested are, in hertz: 20,000, 10,000, 5,000, 1,000, 500, 150, and 110. The highest of these approach the upper limits of human hearing so you may not actually hear all seven tones.

After checking the tone generators, the program checks the periodic and random noise generator. Three "tones" are checked at the six volume levels.

Next the program checks a three-note chord. The chord is played on all three tone generators and is formed one note at a time. First a "C" is played. Then "E" is added and "C" and "E" are played. Finally, "G" is added to the chord forming the "C-E-G" combination.

Black squares on the display show which tone or noise the computer is checking. Press the **SPACE BAR** to hold the note being played. To resume the test, press the **SPACE BAR** again. The test continues to run until you press the **ENTER** key to return to the Diagnostic Selection List.

No error report accompanies this test since errors can be detected by ear. Examples of errors are:

- Multiple tones are played instead of single ones.
- The same tone is repeated.
- One or more tones are skipped by the generator.
- The tones are played in an unusual sequence.



CALCULATION TEST

The Calculation Test, option 6 on the Diagnostic Selection List, checks for errors in mathematical operations. Addition, subtraction, multiplication, division, logarithmic functions, trigonometric functions, and miscellaneous functions are checked in this test.

A green marker appears to the left of each operation if no error is found in checking. The message **NO ERROR HAS BEEN DETECTED** is displayed at the bottom of the screen.

If an error occurs during a test, the marker does not appear beside the operation name. The error message, **ERROR FOUND – SEE MANUAL**, is shown at the bottom of the display. (See "In Case of Difficulty" on page 20.)

To return to the Diagnostic Selection List, press the **ENTER** key. Pressing the **SPACE BAR** does not affect the Calculation Test.

CASSETTE TEST

The Cassette Test determines whether the cassette recorder or the computer is working improperly. Press **7** from the Diagnostic Selection List to access this test.

First attach a cassette recorder to the console according to the directions given in the *User's Reference Guide*. For accurate results, use either a new cassette tape or a tape which has been entirely erased. Remember to use CS1 for checking both writing and reading (CS2 is used only for writing).

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After you select CS1 from the Cassette Selection List, the display gives you these instructions:

```
*****
          CASSETTE TEST
*****
RREWIND CASSETTE TAPE      CS1
  THEN PRESS ENTER
RPRESS CASSETTE RECORD    CS1
  THEN PRESS ENTER
RRECORDING
RPRESS CASSETTE STOP      CS1
  THEN PRESS ENTER
RCHECK TAPE (Y OR N)?     Y
RREWIND CASSETTE TAPE    CS1
  THEN PRESS ENTER
RPRESS CASSETTE PLAY      CS1
  THEN PRESS ENTER
RCHECKING
```

A delay occurs while the computer records (writes) preprogrammed information on the tape. (You don't have to enter any data.) After you rewind the tape, another delay occurs as the computer checks the information stored on the tape. If no error is found, the display shows DATA OK and then the program returns to the Cassette Selection List.

If the data was not recorded properly, you'll receive one of two error messages:

<i>MESSAGE</i>	<i>PROBLEM</i>
ERROR – NO DATA FOUND	<ul style="list-style-type: none">■ The data was not recorded.■ The data did not play back correctly.■ The recorder's volume level was set too low for proper data transmission.
ERROR IN DATA DETECTED	<ul style="list-style-type: none">■ Some part of the data did not record properly.■ The recorder's volume level was set too high for proper data transmission



With either message, you'll also receive three directions from which you choose one:

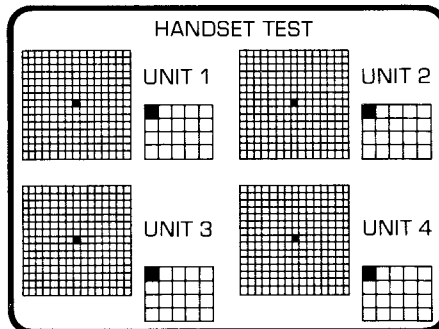
- **PRESS R TO RECORD CS1** (records the data again)
- **PRESS C TO CHECK** (computer checks the data again)
- **PRESS E TO EXIT** (stops the test)

If you receive an error message, try to correct the problem by cleaning the recording heads on your cassette and inserting a new tape. If possible, attach a different audio cassette recorder and try the test again. See the *User's Reference Guide* for other possible correction methods.

To return to the Diagnostic Selection List, press the **ENTER** key. Pressing the **SPACE BAR** doesn't affect the Cassette Test.

HANDSET TEST

If the Wired Remote Controllers don't seem to be responding properly, use the Handset Test. To access this test, select option 8 from the Diagnostic Selection List. Eight grids, four large and four small, are then displayed.



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The large 15 x 15 grids represent the possible screen positions controlled by the lever on the Wired Remote Controllers. A black square indicates the position of the lever. If the accessory unit is working properly, the grid response corresponds to the input from the Wired Remote Controllers.

The small 4 x 5 grids for Units 1 and 2 test the FIRE buttons on the Wired Remote Controllers. When the FIRE button is pressed, the blue square moves from the upper left-hand corner of the grid to the block directly under it. Pressing the FIRE button again returns the square to its original position.

These grids also represent the screen positions possible using the keyboard. The positions in the grids for Units 1 and 2 correspond to these keyboard characters.

Unit 1

1	2	3	4	5
Q	W	E	R	T
SPACE	A	S	D	F
SHIFT	Z	X	C	V

Unit 2

6	7	8	9	0
Y	U	I	O	P
G	H	J	K	L
B	N	M	•	ENTER

When you press any key on the console keyboard, the blue square should move to the corresponding position as shown above. Notice that when you press the **ENTER** key one time, the blue square moves to the lower right-hand corner of the Unit 2 grid. If the **ENTER** key is pressed a second time, the display returns to the Diagnostic Selection List. However, if a different key is pressed after the first **ENTER**, one of the blue squares in grid 1 or 2 moves. Pressing the **SPACE BAR** doesn't affect the Handset Test.



MAINTENANCE TEST

Option 9 on the Diagnostic Selection List is the Maintenance Test. As stated on the Maintenance Selection List, this test is to be used **ONLY** by repair technicians.

A Signature Analyzer is necessary for these tests. Information regarding this section is included in a separate Technician's Service Manual.

Press the **ENTER** key to return to the Diagnostic Selection List.

CARING FOR THE MODULE

Command modules are durable solid-state devices, but they should be handled with the same care you would give any other electronic equipment. Keep the module clean and dry, and don't touch the recessed contacts.

<p>CAUTION:</p>

<p>The contents of a module can be damaged by static electricity discharges.</p>
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Static electricity build-ups are more likely to occur when the natural humidity of the air is low (during winter or in areas with dry climates). To avoid possible damage of the module, just touch any metal object (a doorknob, a desk lamp, etc.) before handling the module and plugging it into the console.

If static electricity is a problem in your area, you may want to purchase a special carpet treatment that reduces static build-up. These commercial preparations are usually available from local hardware and office supply stores.

TEXAS INSTRUMENTS HOME COMPUTER

IN CASE OF DIFFICULTY

If you have any difficulty in using the Diagnostic Command Module, or if the module gives you an error message during any of the tests, here are some correction procedures to try before returning the module, computer, or accessory for service:

Problem

Possible Solution

Module activities do not appear to be working properly.

- Press **SHIFT Q** and remove the module from the console. Align it with the module opening and reinsert it carefully. Then repeat the selection procedure.

No sound in Sound Test.

- Be sure that the volume control is turned to the proper level.
- Check the connection of the cables.

Cassette recorder will not operate when connected to the console, but works properly when not connected.

- Make sure the cassette is connected to the 9-pin connector on the *back* of the console (*not* on the *left* side).
- Be sure that the cable is properly installed; the red wire should be plugged into the Microphone Jack.
- Check the Audio Cassette Recorder Information sheet enclosed with the computer.



Problem

Possible Solution

Cassette Test gives an error message.

- See pages 14-18 in the *User's Reference Guide* for a complete list of check items.

Handset Test gives an error message.

- Make sure that the Wired Remote Controllers are connected to the 9-pin connector on the *left* side of the console (*not* on the *back*).

Automatic Tests indicate an error.

- Run the corresponding test to check that area more thoroughly.

If these procedures do not correct the problem, please contact the dealer from whom you purchased the unit and/or module for service directions. Making a detailed list of the errors detected by the module will be helpful to a service technician. Additional information concerning use and service can be found in your *User's Reference Guide*.

If the Home Computer is in warranty, it will be repaired or replaced under the terms of the Limited Warranty. Out-of-warranty units in need of service will be repaired or replaced with reconditioned units (at TI's option), and service rates in effect at the time of return will be charged. Because our Service Facility serves the entire United States, it is not feasible to hold units while providing service estimates.

With the Diagnostic Command Module, service technicians, sales clerks, and computer owners can verify proper operation of the Texas Instruments Home Computer. This step-by-step guide allows you to quickly compare the computer's operation against the displays and descriptions given for each test.

Diagnostic module checks include these computer operations:

- **Keyboard function**
- **Random Access Memory**
- **Video Display**
- **Sound-Tones and Noise**
- **Calculations**

This module also provides tests for checking the operation of audio cassette recorders and the Wired Remote Controllers. Repair technicians will also find a special maintenance test. However, no repair techniques or procedures are provided.

Adds 6K bytes of active memory with stored program to the TI Home Computer

Command Module program and data base contents
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