

TANDY®

**Technician Series
Diagnostics Software**

MUTEST

4-User Serial Adapter

Diagnostic

01-0220 Computer Technical Services

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MUTEST

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GENERAL DESCRIPTION

MUTEST is used to test the Tandy 4-User Serial Adapter (also known as the multi-user board).

FEATURES

- * Easy to operate menu system
- * On-screen configuration with up to three boards at the same time
- * Displays tests run and tracks both individual and cumulative errors
- * Allows loopback and port-to-port testing
- * Terminal mode for checking terminal connections

EQUIPMENT REQUIRED

Tandy 3000, 3000-12, 4000, 4000/20/25/33LX, 4016DX
Monitor
Display Adapter
Keyboard
Tandy 4-User Serial Adapter (one or more)
Male-to-male 25 pin serial cable
25 pin loopback connector
Null Modem Adapter

LOADING MUTEST

There are two methods for loading the multi-user board diagnostics. The first is to select the multi-user board test function that appears on the main menu of our diagnostic software suite for your machine. Because MUTEST is a MS-DOS executable program, you can run it directly from MS-DOS. To run it from MS-DOS, at the MS-DOS prompt type:

MUTEST<ENTER>

You will then see the main display screen of the diagnostic.

OPERATING MUTEST**ORGANIZATION:**

MUTEST is organized around the main menu. Since a board must be configured to be tested, the configuration menus appear first followed by the main menu.

MOVING AROUND MUTEST:

Use the arrow keys to move around the menus, or press the highlighted character on the menu screen for the item desired. To execute a menu option or make a menu selection, press the <ENTER> key. To back out of a menu at any time, you may press the <ESC> key. The exception to this is the main menu, which requires you to press the <Q> key.

DISPLAY DESCRIPTIONS

MUTEST Tandy 4-Port Multi-User Board Diagnostic
xxxxxxx, 199x V2.00
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BOARD SELECTION
Select Number of Boards Installed:

- 1 Board Installed
- 2 Boards Installed
- 3 Boards Installed

<ENTER> To Select, <ESC> To Abort _

BOARD CONFIGURATION SCREEN:

The figure above is the first screen that appears when running MUTEST. This screen is the start of the board configuration menus. With this screen you tell the diagnostic how many boards you have installed.

BOARD #x
SELECT INTERRUPT

Select Interrupt For This Board:

- <1> IRQ 10 (S2-5 ON) Recommended
- <2> IRQ 11 (S2-6 ON) Not Selected
- <3> IRQ 12 (S2-7 ON) Not Selected

<ENTER> To Select, <ESC> To Abort

INTERRUPT SELECTION:

Once you have selected how many boards are installed, the next screen is the interrupt selection screen, shown above. The board number you are configuring is shown at the top of the screen. The interrupts available are shown next with their associated DIP switch settings. Finally, the right side displays the recommended setting for each board and which interrupts have been selected.

SELECT I/O BASE ADDRESS

Select I/O Address For This Board:

<1> 100h (S1-4 ON) Recommended
<2> 104h (S1-3 ON) Not Selected
<3> 108h (S1-2 ON) Not Selected

<ENTER> To Select, <ESC> To Abort

I/O BASE SELECTION:

The next screen displayed is the I/O Base Address screen. This screen allows you to choose the base I/O address for each board. It also displays the DIP switch setting, the recommended setting for each board, and which ports have been selected.

**SELECT DCE/DTE JUMPER SETTINGS
FOR PORT x**

<1> Jumpered DCE
<2> Jumpered DTE

<ENTER> To Select, <ESC> To Abort _

DCE/DTE JUMPER SETTING SELECTION:

There are four DCE/DTE selections screens, one for each port, and these tell the program how you have the board jumpered to ensure correct null modem adapter usage.

BOARD CONFIGURATION						
Confirm Board Interrupts and I/O Addresses						
Board #	Int #	I/O Base Address	DCE/DTE 1 2 3 4			
Accept Configuration Reconfigure Boards						
<ENTER> To Select, <ESC> To Abort						

BOARD CONFIGURATION CONFIRMATION:

The final screen while configuring the boards is shown above. This screen displays each board's number that has been configured, followed by the interrupt selected for that board, the I/O Base (Port) Address, and the chosen DCE/DTE selection for each port on the board. The DCE/DTE selection is abbreviated with 'C' standing for DCE and 'T' for DTE.

CONFIGURATION ERROR	
Could not find an un-allocated segment at C000h, D000h or E000h.	
Please configure the system so one of these segments is un-allocated.	
Press Any Key to Return to DOS _	

CONFIGURATION ERROR:

This screen may appear if you are out of address space in the lower one megabyte area of memory. If this screen does appear, remove or reconfigure one of the installed options to free up a contiguous 64K segment starting at one of the three listed addresses.

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TEST SELECTION		BOARD CONFIGURATION		
		Board 1	Board 2	Board 3
<1> RAM Test	Active:	Yes	No	Unconfigured
<2> ROM Checksum	Interrupt:	10	11	
<3> Self-Loopback Test	I/O Base:	100h	104h	
<4> Port 1 To Port 3 Test	DCE/DTE:	C C C C	T T T T	
<5> Port 2 To Port 4 Test	Segment:	C000h	D000h	
Update Test Parameters				
Change Active Board				
Reconfigure Boards				
Display Error Log				
Terminal Mode				
Quit To DOS				

PARAMETERS		TEST STATUS	
Mode: CONTINUOUS	Baud Rate: 9600	Pass Count:	
Comm Parm: 8,None,1		Error Count:	

Board	ST-Status	ROM Ver	ST-Sum	RAM	Checksum	1 2 3 4	1 To 3	2 To 4
1	n/a							
2	n/a							
3								

MAIN MUTESt SCREEN:

The figure above is the main screen of MUTESt. After the board or boards have been configured, this screen appears. From this screen all the tests are selected, and the board configurations, test parameters, test pass and error counts, and test status are shown.

The board configuration shown is the configuration that was selected with the addition of the Segment. The Active row indicates which boards have been configured and which one is the current active board. The Interrupt, I/O Base, and DCE/DTE rows are the current settings for these options. The Segment is the area that the program has found available to address the multi-user board.

The Parameters are the test options that are currently in effect. The Mode determines the loop control of the program. In CONTINUOUS mode, the test loops until <ESC> is pressed and in SINGLE mode, the test is performed once and stops. The Baud Rate and the Comm Parm (Communication Parameters) are the current settings for these options.

The Pass and Error counts are the counts of the current test, if one is in progress, or the last test executed if the main menu is displayed. These are not cumulative and are cleared before each test is performed.

At the bottom of the screen is the Test Status area. This area contains the results of both the board's self-test and the program's tests. The first three columns are the self-test status and the last five columns are the program test status.

The first self-test status column is the result from the board's reset self-test. The next column is the reported version of the board's ROM. The third column is the self-test's reported checksum of the ROM.

The first program test status column is the result of the RAM Test. The next column is the checksum found by the Checksum Test. The third column contains the result of each port's Loopback Test. The next column is the result of the Port 1 to Port 3 Test, and the final column is the Port 2 to Port 4 Test result.

NOTES:

1. The segment used for the multi-user board, as displayed on the main screen, must be a 64K area that contains no other memory. As this diagnostic runs in the real mode of the processor, and because of communications limitations, the 64K area must be in the lower 1MB of memory address space. Because of common devices occupying most of this low address space, the program is left with three segments to choose from: C000h, D000h, and E000h. These segments may also be occupied by devices, such as VGA, disk controllers, and the BIOS ROM, so the diagnostic may require the removal of one of these devices to operate.

2. See the Appendix for a complete description of the Test Status messages.

Fixed & Rotating Modified Address

RAM TEST SELECTION:

When the RAM Test is selected from the main menu, the test type window appears as above. You may then select which type of RAM test you want to perform.

```

| ENABLING ACTIVE |
| BOARD           |
|
| Attempting to enable
| active board.
|
| STATUS: WAITING
|
| Press <ESC> To Interrupt _
|

```

ENABLE ACTIVE BOARD:

This screen appears when the program is attempting to enable the board's memory. If the board is successfully enabled, the status will change to **ENABLED**. If the board cannot be enabled for some reason, for example the board's self-test fails, the status will then change to **FAILED**, and you may return to the main menu.

NOTE: This screen appears whenever any of the tests are selected.

```

      RAM TEST
Testing the Active Multi-
User Board's 64k RAM.

Percent of Pass Complete:
.....

Current Test Pattern:

Last Error:

Press <ESC> To Interrupt _

```

RAM TEST:

This is the RAM test screen that appears during either RAM test operation.

During the Fixed and Rotating option, the current test pattern is the pattern written to each RAM location. A RAM error is displayed with the address at which the error occurred followed by the data bit of the error.

When testing RAM with the Modified Address operation, the test pattern is the value that is logically exclusive or'd (XOR) with each address value. A RAM error is displayed with the address where the error occurred followed by the address line number of the error.

If any errors occur during the current run of the current test, the last one will be shown on the Last Error row.

```

      ROM CHECKSUM
Computing the Active Multi-
User Board's 4k ROM Checksum

STATUS: WORKING

Checksum:

Press Any Key to Repeat or
Press <ESC> To Quit _

```

ROM CHECKSUM TEST:

The screen above is displayed when the ROM Test selection is chosen.

When the checksum has been calculated, the status changes to either **DONE** or **FAILED** depending if the calculated checksum matches the one returned by the board's self-test. The checksum calculated is displayed in either case.

Port 1
Port 2
Port 3
Port 4

SELF-LOOPBACK TEST PORT SELECTION:

This is the first screen that is displayed when selecting the Self-Loopback Test. The port selection determines which port to test.

INSTALL LOOPBACK
 Install Loopback Connector on Port x of Active Board Press Any Key to Continue _

LOOPBACK INSTALLATION:

This screen prompts you to install the loopback connector on the selected port.

NOTE: Please see the Appendix for the pin-outs of this connector.

```
SELF-LOOPBACK TEST
Testing: LOADING
Xmit Data:
Recv Data:
Last Error: n/a

Port x RS-232 Status
RTS -> CTS
DTR -> DSR-DCD

Press <ESC> To Interrupt _
```

SELF-LOOPBACK TEST:

The screen above is the test screen displayed during the Self-Loopback test.

The Testing row displays the program status and test in progress. When done **LOADING**, the screen changes to the first part of the test which is **Handshake**. After that, the row displays **Xmit/Recv**, which is the transmit and receive portion.

The Xmit Data and Recv Data rows show the test data that is sent by the program and the data received.

If any errors occur during the current run of the current test, the last one will be shown on the Last Error row.

The RS-232 Status columns show the current condition of the RS-232 pins. When the line is active (positive voltage, binary zero), the selection is highlighted. When the line is inactive (negative voltage, binary one), the selection is darkened. The direction of the arrows is determined by the DCE/DTE jumper selection option.

NOTE: The receive data display area will indicate certain transmission/reception errors. Please see the Appendix for an explanation of these errors.

**INSTALL ADAPTER
Port x To x Test**

Connect the two ports
with a Null-Modem adapter.

Press Any Key to Continue _

INSTALL ADAPTER:

This is one of the first screens displayed after selecting either the Port 1 to Port 3 or the Port 2 to Port 4 test.

This screen will be displayed when the two ports to be tested have the same DCE/DTE jumper configurations.

INSTALL CABLE

Connect the ports
directly with an RS-232
cable.

Press Any Key to Continue _

INSTALL CABLE:

This is the other of the two screens that will be displayed when selecting the Port to Port tests.

This screen will be displayed when the two ports to be tested have different DCE/DTE jumper configurations.

```
PORT x TO x TEST
Testing: LOADING
Xmit Data:
Recv Data:
Last Error:  n/a
      Port x      Port x
      RTS -> CTS
      DTR -> DSR-DCD
      CTS <- RTS
      DSR-DCD <- DTR

Press <ESC> To Interrupt _
```

PORT TO PORT TESTS:

The screen shown above is the screen for both of the Port to Port tests.

The Testing row displays the program status and test in progress. When done **LOADING**, the screen changes to the first part of the test which is **Handshake**, for the RS-232 handshaking lines test. After that, the row displays **Xmit/Recv**, which is the transmit and receive portion.

The Xmit Data and Recv Data rows show the test data that is sent by the program and the data received.

If any errors occur during the current run of the current test, the last one will be shown on the Last Error row.

The RS-232 Status columns show the current condition of the RS-232 pins. When the line is active (positive voltage, binary zero), the selection is highlighted. When the line is inactive (negative voltage, binary one), the selection is darkened. The direction of the arrows is determined by the DCE/DTE jumper selection option.

```
Test Mode
Baud Rate
Comm Parm
```

UPDATE PARAMETERS:

This window allows you to select which test parameter you wish to update. The Test Mode selects between **CONTINUOUS** and **SINGLE** loop modes. The Baud Rate and Comm Parm options select the communication parameters of the test.

CONTINUOUS
SINGLE

TEST MODE SELECTION:

This is the Test Mode selection window.

<1>	9600
<2>	4800
<3>	2400
<4>	1800
<5>	1200
<6>	600
<7>	300
<8>	200
<9>	150
<a>	134.5
	110
<c>	75
<d>	50
<e>	ALL

BAUD RATE SELECTION:

This window allows you to choose between the available baud rates, or have the tests run through all baud rates.

Word Length
Parity Mode
Stop Bits

COMMUNICATION PARAMETERS SELECTION:

The window above selects between the various communication parameters.

8
7
6
5

WORD LENGTH SELECTION:

This window allows the selection of the supported data bits per word length.

NOTE: If selecting either five or six data bits per word, the test messages will look garbled because the ASCII values of the data are changed by the reduced word length.

None
Even
Odd

PARITY SELECTION:

The above window selects between the three parity modes.

1
2

STOP BIT SELECTION:

This window allows selection of the number of stop bits per data word.

<1> Board 1
<2> Board 2
<3> Board 3

CHANGE ACTIVE BOARD:

This main menu option allows you to choose between the configured boards.

NOTE: This screen may be different depending on how many boards have been configured.

RECONFIGURE BOARDS:

This option selects the Board Configuration screens. See above (page 7) for a complete description of the Board Configuration screens.

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ERROR LOG			ERROR LOG		
Board	Test	Error	Board	Test	Error

CUMULATIVE ERRORS						
Board 1			Board 2		Board 3	
Errors	Passes		Errors	Passes	Errors	Passes
RAM Test	0	0	0	0	0	0
Self-Loopback: 1	0	0	0	0	0	0
Self-Loopback: 2	0	0	0	0	0	0
Self-Loopback: 3	0	0	0	0	0	0
Self-Loopback: 4	0	0	0	0	0	0
Port 1 to 3 Test	0	0	0	0	0	0
Port 2 to 4 Test	0	0	0	0	0	0

Press Any Key To Return _

DISPLAY ERROR LOG:

The Display Error Log option will show up to the last twenty errors and show the cumulative error and pass totals of each test.

NOTE: The error and pass counts will be cleared (zeroed) if the boards are reconfigured.

Port 1
Port 2
Port 3
Port 4

TERMINAL MODE:

The window above is displayed when the Terminal Mode option is chosen. This allows you to select which port to use on the active board.

QUIT TO DOS:

This option returns you to MS-DOS control.

TEST DESCRIPTIONS**RAM TEST:**

This tests the 64K of RAM on the active multi-user board. There are two modes of this test. The first mode, the Fixed and Rotating bit, checks the RAM for data line or data bit errors. This mode will detect any data line or bit failures and will report the address of the failure and the bit that failed. The second mode, the Modified Address mode, is for checking any address line problems. Any errors detected will report the address of the failure along with the address line number that failed.

For example, if there was a data line failure detected on line number four at address 4AA5h, the error would read: 4AA5,04.

ROM CHECKSUM TEST:

This test will calculate the active board's on-board ROM's checksum. It will then compare the calculated checksum with the checksum returned by the ROM's self-test. Then it will display the appropriate status message and the calculated checksum.

SELF-LOOPBACK TEST:

This will test an individual port on the active board by using a loopback connector. This tests the RS-232 handshaking capability and the transmit and receive functions of the port.

NOTES:

1. The test will prompt you to install a loopback connector. Please see the Appendix for the pin-outs of this connector.
2. The receive data display area will indicate certain transmission/reception errors. Please see the Appendix for an explanation of these errors.

PORT 1 TO PORT 3 TEST:

This test will check these two ports on the active board. The two ports will need to be connected, and, depending on the configuration of the DCE/DTE jumpers, may require a null modem adapter. If the two ports are jumpered differently, i.e. one is DTE the other is DCE, you simply need a straight through cable to connect the ports.

This test tests the RS-232 handshaking capability and the transmit and receive functions of the ports.

PORT 2 TO PORT 4 TEST:

This test will check these two ports on the active board. The two ports will need to be connected, and, depending on the configuration of the DCE/DTE jumpers, may require a null modem adapter. If the two ports are jumpered differently, i.e. one is DTE the other is DCE, you simply need a straight through cable to connect the ports.

This test also tests the RS-232 handshaking capability and the transmit and receive functions of the ports.

APPENDIX**ERROR MESSAGES:****Windows Error: Memory**

This error message is displayed when the multi-user board test cannot allocate enough memory from DOS to display the windows. This indicates that the program is too big for the amount of memory in the system.

It can also occur when there is an error de-allocating memory. This indicates that something has corrupted either the DOS software or the MUTEST diagnostic.

First verify that there are no memory resident programs installed as they might be taking too much memory to allow the program to run. Once you have verified that there should be enough memory, get a new copy of the diagnostic. If this fails to rectify the problem, try booting with a different copy of DOS.

TEST STATUS MESSAGES:

The following is a list of the main screen test status messages and a description of them.

ST-Status (Self-Test Status) Messages:

- n/a : This self-test result is not available yet. There have been no tests performed yet.
- Pass : The self-test has passed.
- Fail-BRF: The program did not get the Board Ready Flag within a reasonable length of time. The first thing to check is that the configured I/O Base address matches the DIP switches on the active board. If they do, then ensure that the I/O Base address does not conflict with any other devices in the system.

After these have been checked, note the Segment address displayed and check to be sure there are no other devices in that 64k segment.

If none of the above checks determine the cause of the problem, then the active board cannot complete its self-test. This may indicate a ROM, RAM, Z80 or other serious low-level problem.

- Fail-Z80: This indicates that the self-test has failed the Z80 test. For this and the following self-test results, the specified area can be assumed to be faulty.

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- Fail-Gen:** This indicates that the self-test has failed the Baud Rate Generator test. The board uses two Counter/Timer Circuits (CTCs) for baud rate generation. They are located at U6 and U18, and either one or both may be the cause of the failure.
- Fail-CTC:** The self-test has failed the Counter/Timer Circuit (CTC) test. There are two other CTCs that are used to time interrupts. One or the other of these may have caused this failure. They are located at U3 and U4.
- Fail-SIO:** The Serial I/O (Z80 SIO) self-test portion has failed. This indicates one or more of the Z80 SIOs has failed.
- Fail-RAM:** The RAM self-test failed.
- Fail-Hlt:** There was no Halt instruction at the end of the self-test results. At the end of the Z80's self-test, the result codes are placed in RAM, and the remaining RAM is filled with Z80 Halt instructions (76h). If the diagnostic does not find this instruction following the result codes, the Z80 self-test has not completed successfully. This may indicate a ROM or RAM problem with the multi-user board, but also could be an addressing conflict with other devices installed in the test system.

Self-Loopback Test Status (Labeled 1 2 3 4):

- (blank) : This means the test has not been performed on this port.
- P: This indicates the test for this port has passed.
- T: This denotes that there was a transmit/receive timeout. This may mean a number of things, from the loopback connector incorrectly wired or installed, to a break in either port's TD or RD lines, to a problem with the associated Z80 SIO chip or RS-232 line drivers.
- H: This signifies that the RS-232 RTS/CTS handshake test has failed on this port. This could point to various problems, from incorrect installation or wiring of the loopback connector, a break in either port's RTS/CTS lines, to a problem with the associated Z80 SIO chip or line drivers.
- h: This signifies that the RS-232 DTR/CD/DSR handshake test has failed on this port. This could point to various problems, from incorrect installation or wiring of the loopback connector, a break in either port's DTR/CD/DSR lines, to a problem with the associated Z80 SIO chip or line drivers.

- p: This indicates that a parity error has occurred in the transmit/receive portion of the test. This may indicate a faulty TD/RD connection or problem with the Z80 SIO. Please see 'T' above for more information.
- F: This denotes that a framing error has occurred in the transmit/receive portion of the test. This may indicate a faulty TD/RD connection or problem with the Z80 SIO. Please see 'T' above for more information.
- O: This signifies that an overrun error has occurred at the displayed baud rate in the transmit/receive part of the test. This means that the multi-user board's receive buffer was filled before the diagnostic could empty it. This may be caused by something slowing the system down, such as a memory resident program, or that the system is in the slow mode. It may also be caused by a RAM addressing conflict preventing the Z80 memory to be addressed properly. Ensure there is not a conflict by checking for any devices that have memory (RAM or ROM) addressed at the displayed segment the multi-user board is using.

If the above suggestions do not reveal the problem, then there is probably some faulty Z80 RAM preventing the receive buffers, which are in RAM, from working properly.

- D: This indicates that a data mismatch error has occurred. This means that the data received does not match the data transmitted and the Z80 SIO did not detect a transmission error. This may point to a defective Z80 SIO, but again could indicate a RAM problem. See 'O' above for more suggestions.

Port to Port Test Status

- n/a : This means the test has not been performed on these ports.
- Pass : This indicates the test for these ports have passed.
- TO: baud: This denotes that there was a transmit/receive timeout at this baud rate. This may mean a number of things, from the connection between the two ports incorrectly wired, to a break in either port's TD or RD lines, to a problem with the associated Z80 SIO chip or RS-232 line drivers.
- RTS/CTS: This signifies that the RS-232 RTS/CTS handshake test has failed on this port. This could point to various problems, from incorrect installation or wiring of the port connections, a break in either port's RTS/CTS lines, to a problem with the associated Z80 SIO chip or line drivers.

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- TR-DSRCD:** This signifies that the RS-232 DTR/CD/DSR handshake test has failed on these ports. This could point to various problems, from incorrect installation or wiring of the port connections, a break in either port's DTR/CD/DSR lines, to a problem with the associated Z80 SIO chip or line drivers.
- PE: baud:** This indicates that a parity error has occurred at this baud rate in the transmit/receive portion of the test. This may indicate a faulty TD/RD connection or problem with the Z80 SIO. Please see 'TO' above for more information.
- FE: baud:** This denotes that a framing error has occurred at the displayed baud rate in the transmit/receive portion of the test. This may indicate a faulty TD/RD connection or problem with the Z80 SIO. Please see 'TO' above for more information.
- OE: baud:** This signifies that an overrun error has occurred at the displayed baud rate in the transmit/receive part of the test. This means that the multi-user board's receive buffer was filled before the diagnostic could empty it. This may be caused by something slowing the system down, such as a memory resident program, or that the system is in the slow mode. It may also be caused by a RAM addressing conflict preventing the Z80 memory from being addressed properly. Ensure there is not a conflict by checking for any devices that have memory (RAM or ROM) addressed at the displayed segment the multi-user board is using.
- If the above suggestions do not reveal the problem, then there is probably some faulty Z80 RAM preventing the receive buffers from working properly.
- DE: baud:** This indicates that a data mismatch error at the indicated baud rate has occurred. This means that the data received does not match the data transmitted and the Z80 SIO did not detect a transmission error. This would point to a defective Z80 SIO.

TRANSMISSION/RECEPTION ERRORS:

The transmit/receive display area may indicate certain transmit/receive errors. An error is indicated on the screen by being in reverse video. The following is a list of the possible transmit/receive error codes:

- D:** This indicates that a data miscompare has occurred. Other than being a faulty 280 SIO chip, this may be caused by a faulty loopback or RS-232 cable, an electrically noisy environment, or bad RAM. This message only appears during loopback testing, when the transmitted data is known.
- X:** This indicates a transmission or reception parameter error. This may be an overrun error, a parity error, or a framing error. Please see 'D' above for possible causes.

LOOPBACK CONNECTOR PIN-OUTS:

The loopback connector should be made with a DB25 male connector. The following pins should be jumpered together:

2 to 3
4 to 5
6 to 8 to 20

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JUMPER SETTINGS

The Baud Rate Clocks are set with the following jumpers:

A1-A2 Channel 1 uses on board clock
B1-B2 Channel 2 uses on board clock
L1-L2 Channel 3 uses on board clock
M1-M2 Channel 4 uses on board clock

Each of the four channels can be configured for either Data Communications Equipment (DCE) mode or Data Terminal Emulation (DTE) mode. When connecting to Tandy computers or terminals the DCE mode should be selected. When connecting to Tandy modems the DTE mode should be selected. For non-Tandy equipment consult the individual equipment's owner manual for proper mode selection. The jumpering for each mode is as follows:

Data Communications Equipment (DCE)

<u>Channel 1</u>	<u>Channel 2</u>	<u>Channel 3</u>	<u>Channel 4</u>
D2-D3	G2-G3	P2-P3	W2-W3
D5-D6	G5-G6	P5-P6	W5-W6
E1-E3	H1-H3	T1-T3	X1-X3
E2-E4	H2-H4	T2-T4	X2-X4
F1-F2	K1-K2	V1-V2	Z1-Z2
F3-F4	K3-K4	V3-V4	Z3-Z4
F5-F6	K5-K6	V5-V6	Z5-Z6
F7-F8	K7-K8	V7-V8	Z7-Z8

Data Terminal Emulation (DTE)

<u>Channel 1</u>	<u>Channel 2</u>	<u>Channel 3</u>	<u>Channel 4</u>
D1-D2	G1-G2	P1-P2	W1-W2
D4-D5	G4-G5	P4-P5	W4-W5
E3-E4	H3-H4	T3-T4	X3-X4
E5-E6	H5-H6	T5-T6	X5-X6
F1-F5	K1-K5	V1-V5	Z1-Z5
F3-F7	K3-K7	V3-V7	Z3-Z7
F4-F8	K4-K8	V4-V8	Z4-Z8

SERVICE POLICY

Radio Shack's nationwide network of service facilities provides quick, convenient, and reliable repair services for all of its computer products, in most instances. Warranty service will be performed in accordance with Radio Shack's Limited Warranty. Non-warranty service will be provided at reasonable parts and labor costs.

CUSTOM MANUFACTURED FOR RADIO SHACK A Division of Tandy Corporation

**U.S.A.: FORT WORTH, TEXAS 76102
CANADA: BARRIE, ONTARIO L4M 4W5**

TANDY CORPORATION

AUSTRALIA

91 Kurrajong Avenue
Mount Drutt, N.S.W. 2770

BELGIUM

Rue des Peds d'Alouette. 39
5140 Naninne (Namur)

FRANCE

Centre Commercial des 3 Fontaines
B.P. 147
95022 Cergy Pontoise Cedex

U. K.

Bilston Road Wednesbury
West Midlands WS10 7JN