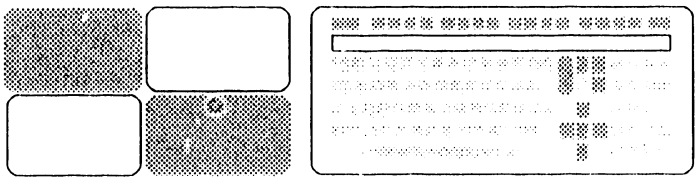
WANG

CUSTOMER SERVICE DOCUMENTATION



Twisted Pair NETMUX

Model: TP-NETMUX

Product Maintenance Manual 741-1836

PREFACE

This document is the Product Maintenance Manual (PMM) for the Wang Twisted Pair (TP)-NETMUX. The manual is organized in accordance with Customer Service Documentation's approved PMM outline. The scope of this manual reflects the type of maintenance philosophy selected for this product.

The purpose of this manual is to provide the Wang-trained Customer Engineer (CE) with sufficient instructions to operate, troubleshoot, and repair the TP-NETMUX. The manual will be updated on a regular schedule or as necessary. Such updates will be published either as Publication Update Bulletins (PUBs) or as full revisions.

First Edition (August, 1988)

Use of the material in this document is authorized only for the purpose stated in the Preface, above.

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SECTION 1

INTRODUCTION

1.1 Scope and Purpose

This manual contains installation, operation, troubleshooting and repair information for the Wang Twisted Pair (TP) NETMUX. Also, included is a functional description and an illustrated breakdown of replaceable parts.

The purpose of this manual is to provide Customer Engineering personnel with the information necessary to install, troubleshoot and repair the TP-NETMUX in the field.

● END

1.2 Organization and Layout

This manual is divided into 12 sections numbered 1 through 12. Each section covers a separate maintenance subject and is arranged to minimize references to other sections. Also, all or most of the information pertaining to a specific task is located on a single or double frame. Each frame, in turn, contains illustrations, numbered steps and/or text describing the individual steps required to accomplish task. The steps within a frame are numbered in sequence in a clockwise direction around the various illustrations. Each section is preceded by the section number and a section table of contents. The sections and the corresponding frames are arranged in numerical sequence from left-to-right and from top-to-bottom on the individual fiche cards.

All frames except the last of a multiframe procedure have a ➡NEXT designation in the lower right area which indicates that additional information follows on the next frame. The last frame of each procedure is identified as such by the ● END designation. Referencing to frames in another procedure or section is done parenthetically by means of an arrow followed by the section number(➡X.X.X).

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IDENTIFICATION

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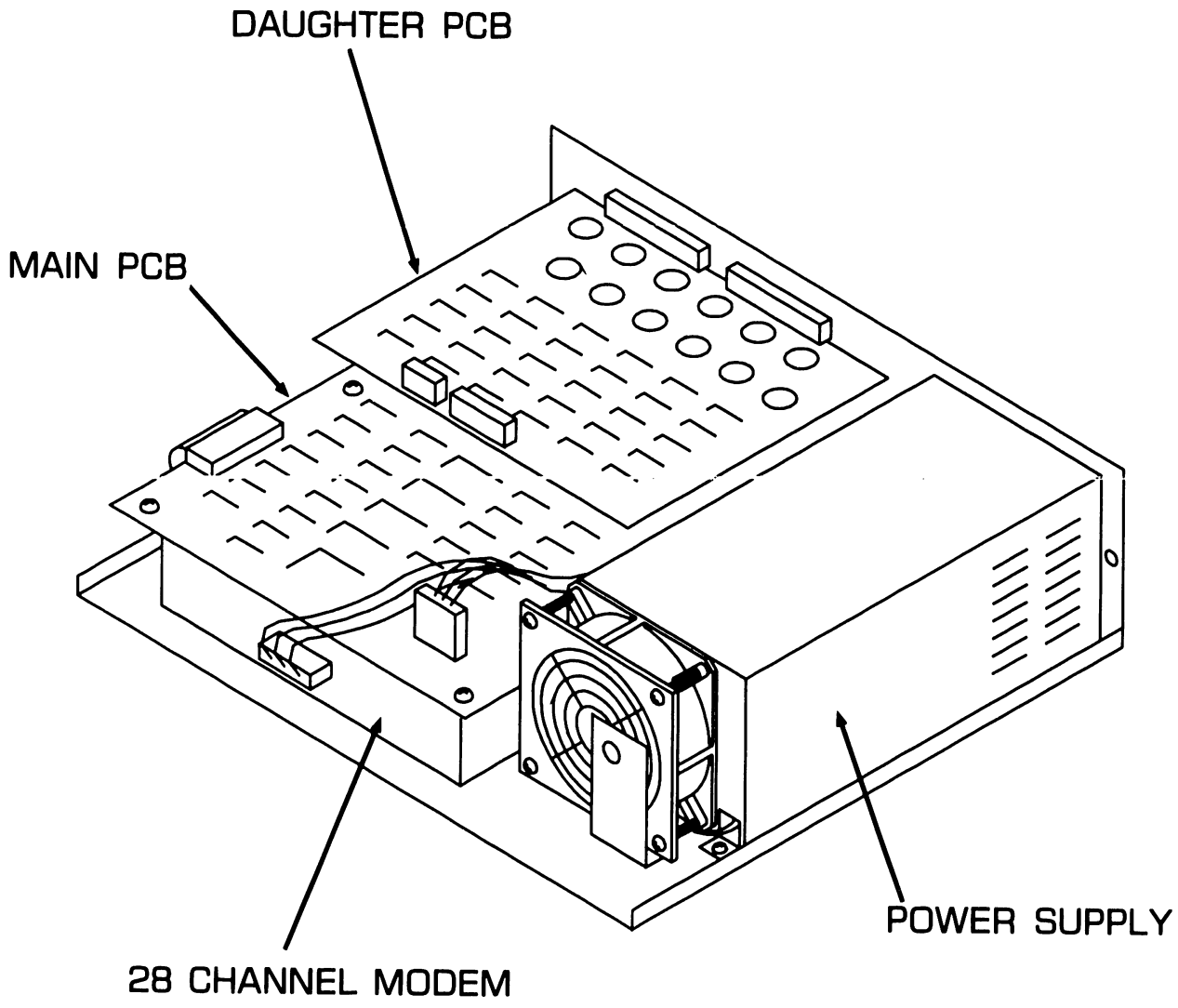
SECTION 2

IDENTIFICATION

2.1 Major Parts



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CONTROLS AND INDICATORS

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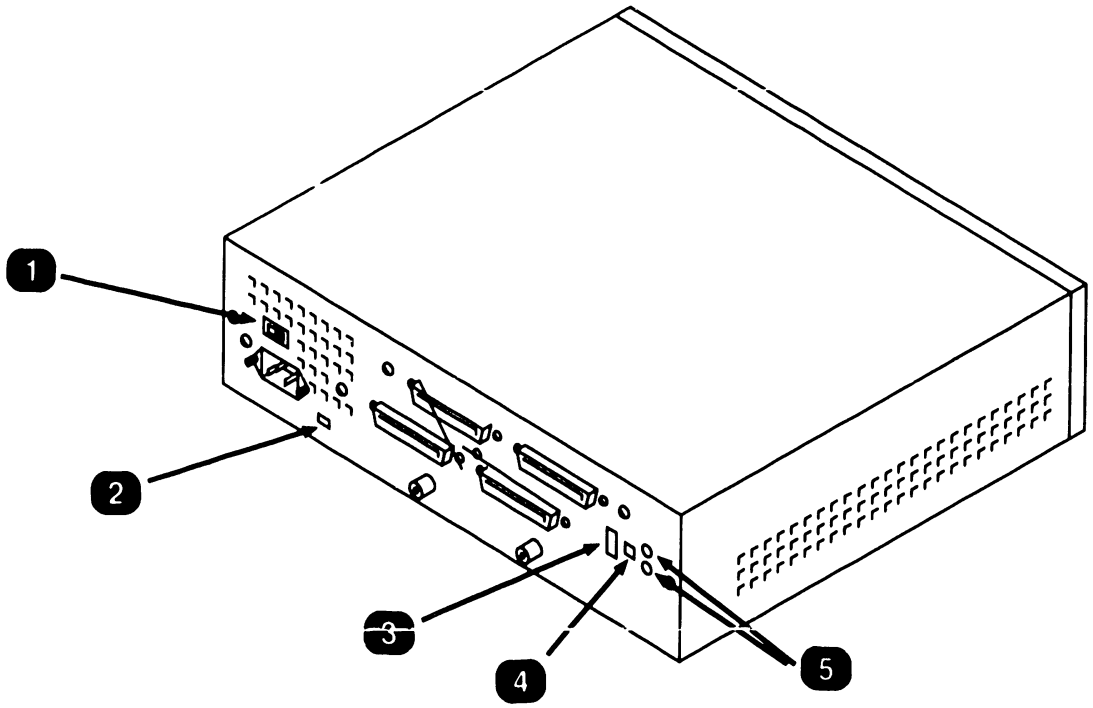
SECTION 3

CONTROLS AND INDICATORS

3 CONTROLS AND INDICATORS

3.1 Rear Panel Controls and Indicators

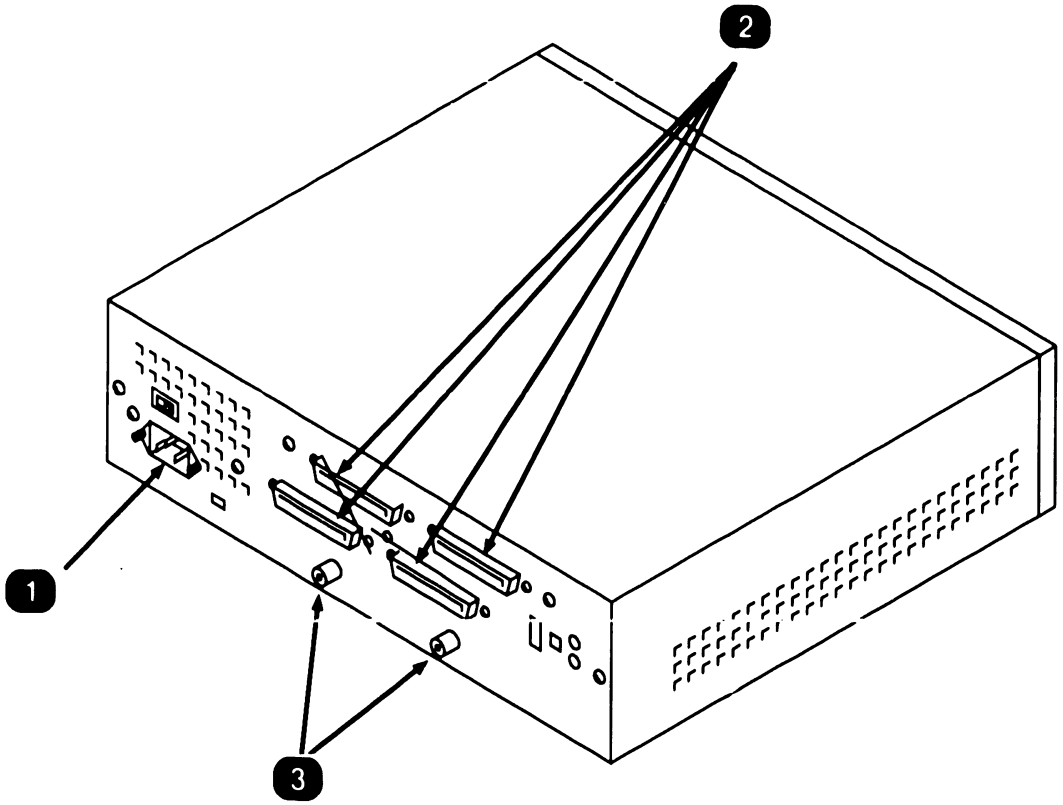


Item	*Name*	*Type and Function*
1	Power switch	Rocker type; turns ac power on (1) or off (0).
2	Line voltage switch	Slide type; electrically configures unit for 115 or 230 Vac operation.
3	8-part diagnostic LED	LED; status display of ±5 Vdc voltages and modem control signals.
4	7-segment LED	LED; status display of error codes generated by internal power-up diagnostics. Also, displays TP-NETMUX's manufacturing ID number.
5	Channel select switches	Screwdriver actuated rotary; permits manual selection of Peripheral Attachment channels and internal diagnostic tests.

● END

3 CONTROLS AND INDICATORS

3.2 Rear Panel Connectors

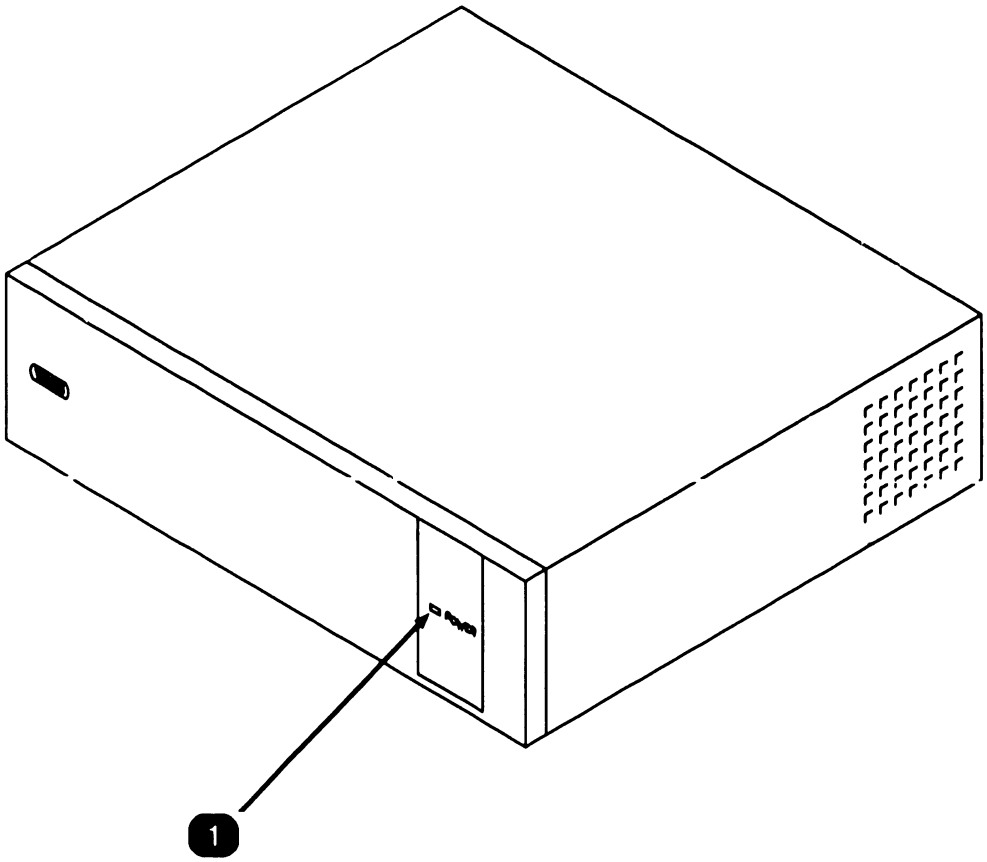


Item	*Name*	*Type and Function*
1	Power connector	Receptacle for ac power cable.
2	Peripheral device connectors	50-pin; connect TP-NETMUX to peripheral devices via multipair cables or 8-section modular connectors.
3	Cable system connectors	F type; TX/RX terminals of TP-NETMUX which connect to WangNet dual-coaxial broadband interface cable.

● END

3 CONTROLS AND INDICATORS

3.3 Front Panel Indicator



Item	*Name*	*Type and Function*
1	Power indicator	LED; illuminates when ac power is on.

● END

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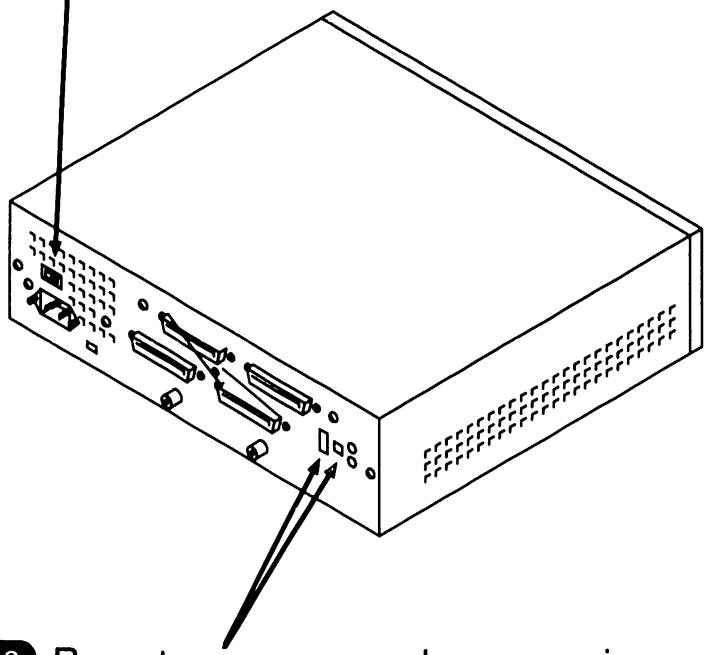
SECTION 4

OPERATION

4.1 Power-Up Procedure

1. Turn TP-NETMUX ac power switch on (1).

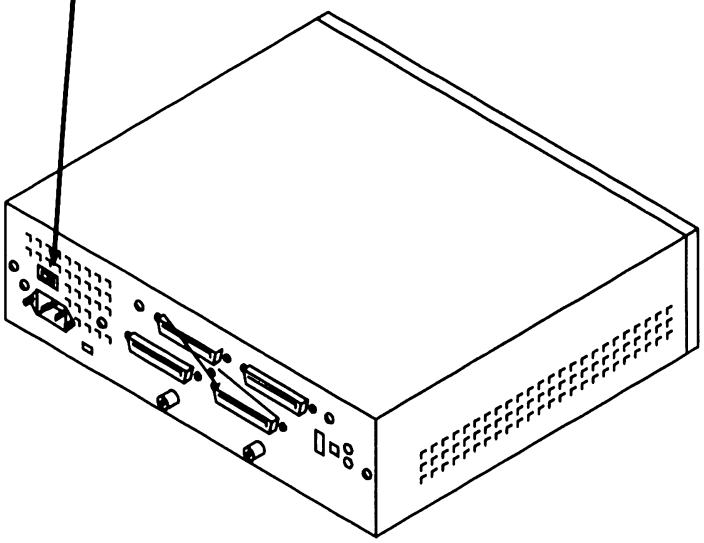


2. Report any error codes appearing on 7-segment LED and indications on 8-part status LED to appropriate administrator.

● END

4.2 Power-Down Procedure

1. Turn TP-NETMUX ac power switch off (O).



● END

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SECTION 5

PREVENTIVE MAINTENANCE

This section contains no information since no preventive maintenance is required in the TP-NETMUX.

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SECTION 6

TROUBLESHOOTING

6.1 Diagnostics and Error Codes (Sheet 1 of 2)

To prepare a TP-NETMUX for off-line diagnostics, set the rear panel rotary switches for 9 over 8 and turn on power. The LED should display a blinking 1. If the Z80 CPU is not running properly, the display is likely to show an 8 or some random pattern of segments. Diagnostic error codes and their indications are described as follows:

NOTE

PCB assemblies are field replaceable only.

0 A non-blinking "0" indicates failure of the EPROM test. The calculated checksum has failed to match the checksum recorded on EPROM. However, since failure of the EPROM itself would preclude running the diagnostic program, the more likely cause of a "0" is improper setup of the checksum or MFID.

1 A non-blinking "1" indicates failure of the RAM test. Two likely causes of this failure are improper seating of the RAM ICs in their sockets (bent pins, etc.) and defective RAM selection logic.

2 Indicates failure of the Register test. These registers control port selection and direction of data flow, and they show up as locations in memory (they are memory mapped). One register is imbedded in the custom IC. The most likely cause for a Register test failure is a problem with the custom IC. Note that when using an In-Circuit Emulator, stopping the system and restarting from 0000 will result in a display of "2". This occurs because the diagnostic routine cannot find a value of 82 (HEX) in the custom IC's register. This value can be reset into the custom IC's register by performing a system reset (power cycle or grounding L51, pin 2).

3 Indicates failure of the FIFO test. The diagnostic calls for the system to transmit data on the first port and to receive it back uncorrupted. To isolate the cause of this problem, trace data activity all the way to the modular connector and back to the custom IC.

4 Indicates failure of the CRC generation logic inside the custom IC. The most likely cure is replacement of the custom IC.

5 Indicates failure of the Slave Port test. This test is a repeat of the FIFO test and is not part of the normal power-on test sequence; it is run only under diagnostic 98 and 92. The test checks all ports in sequence, and then starts over from the first port, cycling until a port fails. Thus, the last port with activity is the last working port. To isolate the cause of the problem, trace data activity at the modular connectors with an oscilloscope.

➡NEXT

6.1 Diagnostics and Error Codes (Sheet 2 of 2)

6 Indicates a failure of the Interrupt logic on the 9030 board. The interrupt logic depends largely on the Z80 and the custom IC.

7 Indicates failure of the 256 Byte Transfer logic within the custom IC. This test is not included with normal power-on diatnostics; it is run only under diagnostics 98 and 94. Change the custom IC.

8 After passing 1, an 8 indicates failure of the Bus Request test. The system is unable to do DMA operations. These operations depend largely on the Z80, the custom IC, and the RAM selection logic.

9 Indicates failure of the Auto-Turnaround logic within the custom IC. This test is not included with normal power-on diagnostics; it is run only under diagnostics 98 and 96. Change the custom IC.

● END

6.2 Test Program Description

The power-up diagnostic program resides in the power-up EPROM located on the CPU board. This diagnostic is used as a basis for troubleshooting. The user interface for testing purposes is the Channel Select Switch and the diagnostic LED display. The tests in the program are described below.

Test No.	*Description*	*Hardware Tested*
.0	EPROM checksum test	Z80, 2732A
.1	SRAM test	6264 RAMs
.2	Command and status register test	74ALS273, 74ALS244, 74ALS240, WL3038
.3	Fifo test	74ALS151, loopback path, WL3038, drivers and receivers for first port
.4	CRC test*	WL3038
.5	Slave channel driver receiver test*	75113, 75107
.6	Interrupt on received data test	Z80, WL3038
.7	256 byte test*	WL3038
.8	Bus request test	74ALS374, 74ALS74, WL3038
.9	Auto turnaround test	26LS32, WL3038
.A	Loopback thru modem test pass indicator	WL3038, Modem, 26LS32, 26LS31
.F	Loopback thru modem test fail indicator	

* The CRC test, the slave channel driver receiver test, and the 256 byte test will not execute on power-up. If either of these circuits are to be tested, the Channel Select switch must be set to the appropriate number before power is applied.

● END

6.3 Test Program Operation

6.3.1 Normal Power-Up Operation

The channel select switches are set to the channel number that the modem is tuned to. The program will sequentially execute tests numbered 0 thru 9 described on the previous page. If any test should fail, the diagnostic LED will display the test number steadily and the test will continuously execute. If all tests pass, the program will pass control to the operating system.

● END

6.3.2 Special Diagnostic Uses (Sheet 1 of 4)

Switch Settings 90 - 96

These switch settings allow the operator to select a test that will continuously execute. The number set on the switch determines which test the program will loop on. All tests previous to the test selected will execute and the diagnostic LED will indicate which test is executing. The operator first sets the switch and then turns on power to the unit. The test selected by each switch setting is shown below.

Switch Setting	*Test Selected*
90	Fifo test
91	CRC test
92	Driver receiver test
93	Interrupt on received data
94	256 byte test
95	Bus request test
96	Auto turnaround test
98	Repeat all tests except Modem

NOTE

The most effective way to use these tests is by selecting switch setting 98. When the switch is set on 98, a failure in any of the tests will be indicated by the failing test number showing steadily on the LED. A pass shows as a blinking "1".

➡NEXT

6.3.2 Special Diagnostic Uses (Sheet 2 of 4)

Switch Settings 97 - 98 - 99

These settings allow the operator to perform the following options:

- Perform the modem test on a selected channel (switch setting 97/99.
- Loop through all tests except the modem test (switch setting 98).

NOTE

A 40 dB loopback connector must be assembled for use in running the modem tests which follow. This connector consists of two 20 dB attenuators (336-2002) connected in series on the silver connector end of a one foot cable (220-0314).

➡NEXT

6.3.2 Special Diagnostic Uses (Sheet 3 of 4)

To perform the modem test at a selected channel:

1. Check that TP-NETMUX power is off.
2. Connect 40 dB Loopback Connector to modem.
3. Select switch setting 97.
4. Apply power to TP-NETMUX.
5. Note that LED indicates .C.
6. Change switch to desired channel number (switch must be set within 18 seconds). Note that LED starts blinking a .C to indicate that channel has been recorded.
7. Select switch setting 99.

NOTE

If the TP-NETMUX was unable to read back the characters it transmitted on the 40 dB loopback, an "F" will appear on the LED indicating a test failure. The "F" will linger for about three seconds and then the test will resume. If the modem is marginal, the "F" may come and go at random. Watch for at least 20 seconds to check for this condition. When an "F" appears, disconnect loopback cable to help determine what the failed state might be. The 8 position LED displays several modem status lines, but the 8 port adapter may have to be removed before these lines appear.

➡NEXT

6.3.2 Special Diagnostic Uses (Sheet 4 of 4)

To loop through all tests excluding the modem test:

1. Turn off power to TP-NETMUX.
2. Set switches to 98.
3. Apply power to TP-NETMUX.

NOTE

If all tests pass, the program will continuously loop. If a test fails, the program will loop on the failing test. Because the longest test is the SRAM test (1), that number will dominate the display. Only a steady "1" indicates SRAM failure. The flickering "1" is actually all of the tests being cycled rapidly and is the "all-pass" condition.

● END

SECTION 7

PARTS REPLACEMENT

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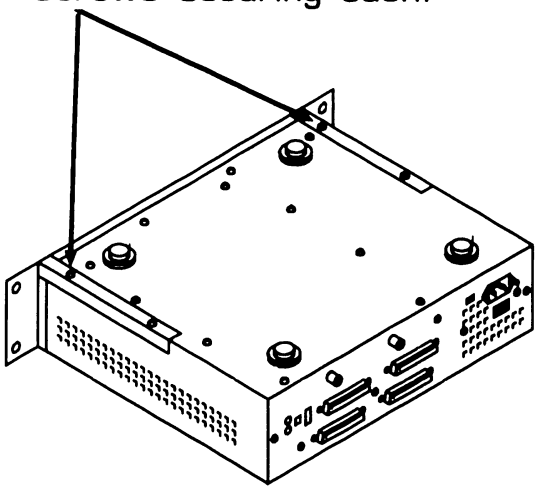
SECTION 7

PARTS REPLACEMENT

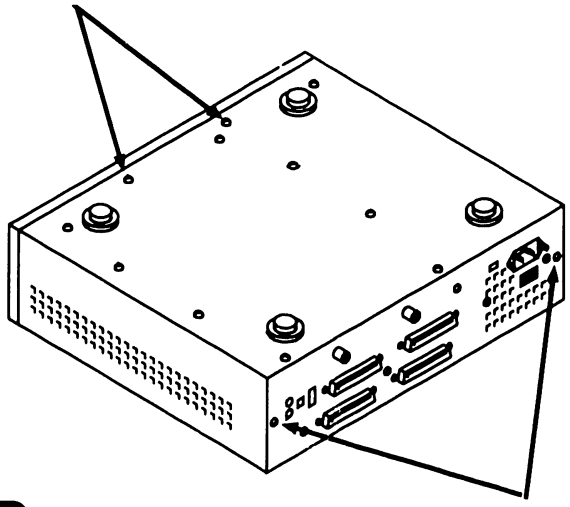
7.1 Cover

To remove:

1. Disconnect ac power to TP-NETMUX.
2. If cabinet has rack-mount ears mounted, remove two screws securing each.



3. Remove two screws at bottom front.



4. Remove two screws on rear panel.
5. Slide cover forward about one inch and lift off.

To replace:

Reverse above procedure.

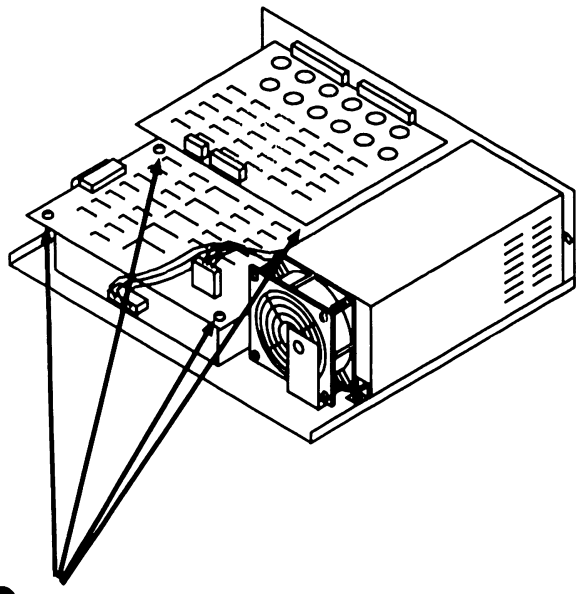
● END

7.2 PC Board Assembly

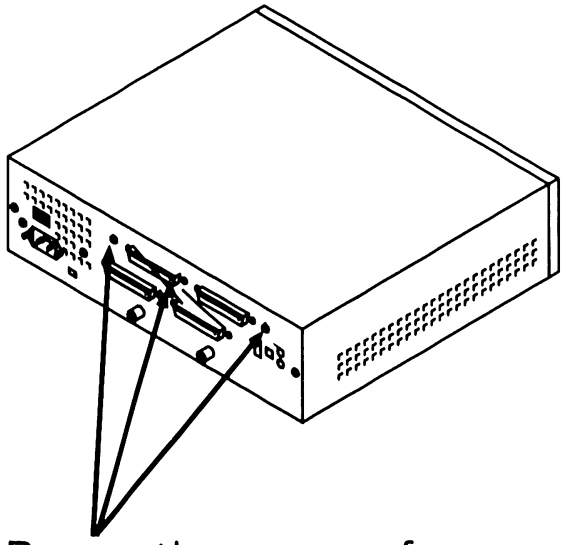
To remove:

1. Remove cover (➡7.1).

2. Remove all cables connecting to board assembly.



3. Remove four screws securing motherboard.



4. Remove three screws from rear panel.

5. Lift mother/daughter board assembly away from chassis.

To replace:

Reverse above procedure.

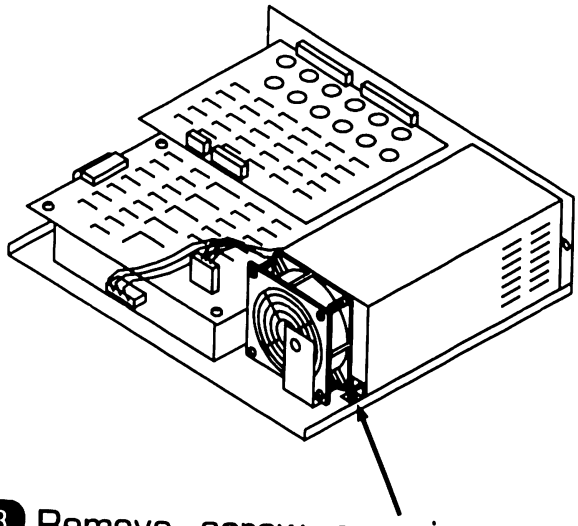
● END

7.3 Power Supply

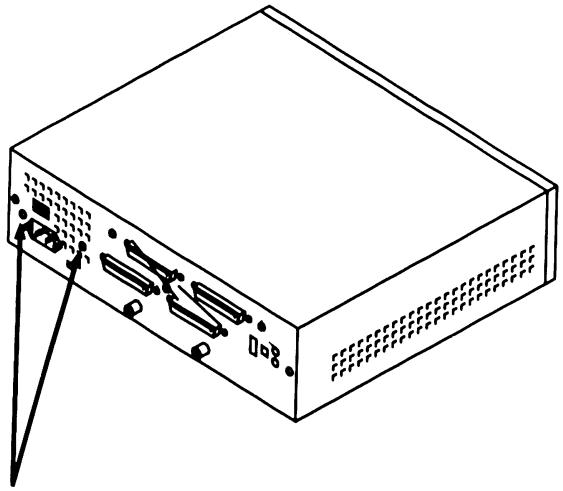
To remove:

1. Remove cover (➡7.1).

2. Remove all cables connecting to board assembly.



3. Remove screw securing power supply to chassis bottom.



4. Remove two screws securing power supply to rear panel.

5. Lift power supply away from chassis.

To replace:

Reverse above procedure.

● END

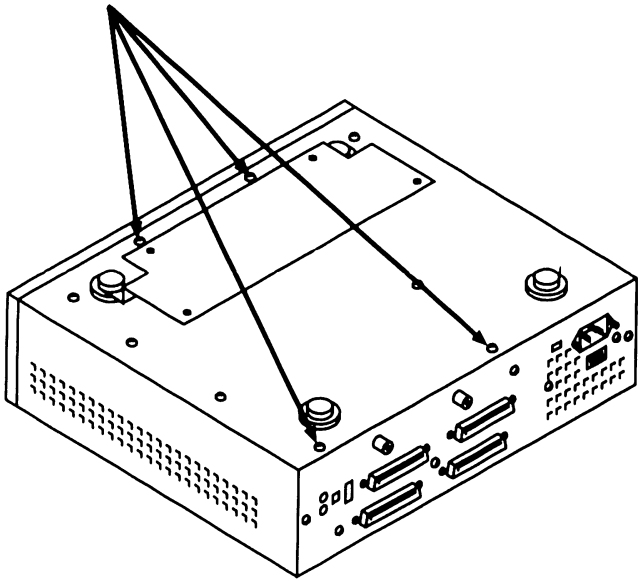
7.4 Modem

To remove:

1. Remove cover (➡7.1).

2. Remove PC board assembly (➡7.2).

3. Remove four screws from bottom of chassis.



4. Remove modem.

To replace:

Reverse above procedure.

● END

SECTION 8 ADJUSTMENTS

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SECTION 8

ADJUSTMENTS

This section contains no information since no adjustments are required in the TP-NETMUX.

SECTION
9
INSTALLATION

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SECTION 9

INSTALLATION

9.1 Installation Site Check

When selecting a suitable location for the TP-NETMUX, consideration must be given to proximity of the TP-NETMUX to a broadband LAN and the peripheral serial devices to be connected to it. Distances for both coax cable and twisted-pair wiring must stay within specified limits. Additional consideration must be given to configuration status of the user outlet, port numbers of devices to be attached, etc. All these factors must be worked out in consultation with the WangNet system administrator.

● END

9.2 Accessory Interface Components (Sheet 1 of 2)

A TP-NETMUX installation uses two types of cabling; rf coaxial and twisted pair.

RF Coaxial Cabling

Connection between the TP-NETMUX and the RF broadband cable system uses a standard 10 ft/3.0 m (P/N 220-0294) or optional 25 ft/7.6 m (P/N 120-2307) cable.

Serial Device Twisted Pair Cabling

Connections between the TP-NETMUX and serial peripheral devices use twisted pair cable, modular adapters, modular cords, and TP adapters.

CAUTION

Because of wiring differences between Wang equipment and standard telephone company equivalents, use of equipment other than Wang serial peripheral devices and cabling components with the TP-NETMUX may cause damage to the cabling or to the equipment itself.

The twisted pair cable (25 pair) is custom built to accommodate particular site requirements for cable type and size. This cable is terminated with 50 pin connectors - male on one and female on the other. The male end plugs into one of the four 50 pin receptacles on the TP-NETMUX rear panel. The female end accepts a modular adapter (described below). These cables may be chained in series to make an extension of up to 400 ft/121.2 m for attaching remote peripheral devices. Up to 100 additional feet of 2 or 3 pair cable (excluding drop cord) may be used to connect from the modular adapter to the TP adapter. Specifications for these cables are given in Section 11.

➡NEXT

9.2 Accessory Interface Components (Sheet 2 of 2)

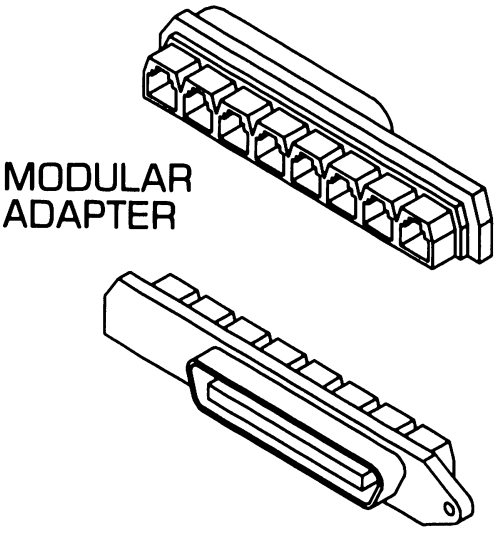
The Wang modular adapter (P/N 654-2221) has a 50 pin male connector on one end and a female connector on the other end containing eight (RJ-11 type) individual modular receptacles. Wiring inside the adapter connects the eight serial port signals carried in the 25 pair cable to the eight modular receptacles. This device may be plugged into the female connector on the end of a 25 pair cable or into one of the peripheral device receptacles on the TP-NETMUX. The eight modular receptacles accept eight modular cords (described below).

The TP modular cord is a light flexible cable with modular connectors on each end. This cable links a Wang modular adapter to a Wang TP adapter (described below). A 6 x 6 pin modular cord is available in two lengths: standard 12.5 ft (3.8 m) (P/N 420-1176) or optional 25 ft (7.6 m) (P/N 420-1163). A 6 x 8 pin cord (P/N 420-1177) is also available.

WARNING

Standard telephone modular cords cannot be used in a TP-NETMUX hookup because they are cross-wired whereas the Wang modular cord is straight wired (pin 1 to pin 1, etc.).

The TP adapter (P/N 200-1200 or 200-1522) provides the interface between the BNC/TNC coax interface from a serial peripheral device and a Wang modular cord. One end of the adapter has a short cable with BNC/TNC connectors for connection to a serial device and the other end has a RJ-11 jack for connection to a modular cord.



● END

9.3 Unpacking Procedure

1. Open shipping carton and check contents against shipping list. Carton should contain the following:

   - TP-NETMUX unit
   - AC power cable
   - WangNet TP-NETMUX Serial Device Multiplexer Reference Guide
   - Rack mounting brackets
   - 10 ft WangNet rf interconnecting cable

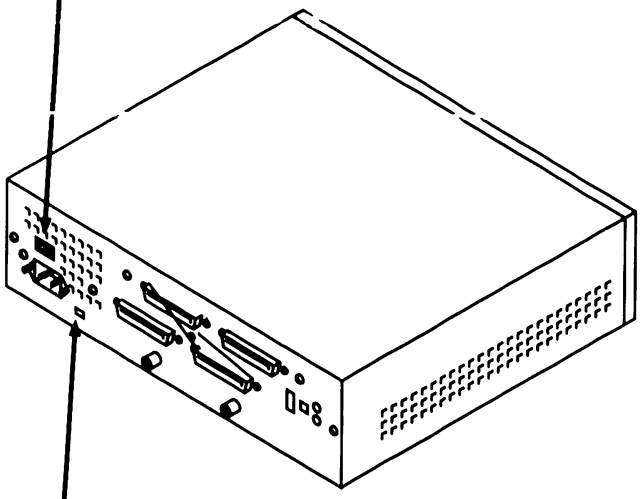
2. Check all items for external damage.

● END

9.4 TP-NETMUX Power Connection

1. Place TP-NETMUX within cabling distance of its assigned cable outlet.

2. Check that ac power switch is OFF (O).



3. Check that line voltage switch is set for correct supply voltage.

4. Connect TP-NETMUX ac power cable to selected ac outlet.

● END

9.5 TP-NETMUX To User Outlet Connection

1. Connect TX and RX terminals on TP-NETMUX to selected user outlet with a standard 10 ft (optional 25 ft) Wang broadband cable. Gold (TX) and silver (RX) connectors must be matched at each end of cable.

CAUTION

TX connectors are left-threaded and RX connectors are right-threaded. Any attempt to mismatch connectors may damage threads.

● END

9.6 TP-NETMUX To Peripheral Device Connections (Sheet 1 of 4)

NOTE

The responsible system administrator should be informed of the device type and its assigned port number before connecting each serial device to the TP-NETMUX. Each 50 pin receptacle on the TP-NETMUX rear panel accommodates eight separate serial devices. The cable system between the TP-NETMUX and each serial device must include a multipair cable and/or modular adapter, a modular cord and a TP adapter (balun).

CAUTION

Use only cables meeting Wang specifications. Use of non-Wang cabling and equipment can cause failure or result in damaging operation to Wang baseband or TP or to the unauthorized equipment because of pin-to-pin wiring differences (Wang TP modular cords use uncrossed connections).

➡NEXT

9.6 TP-NETMUX To Peripheral Device Connections (Sheet 2 of 4)

1. Connect multipair cable (if used) or Wang modular adapter to TP-NETMUX 50 pin connector selected for ports 108. (If multipair cable is used connect modular adapter to its remote end).

NOTE

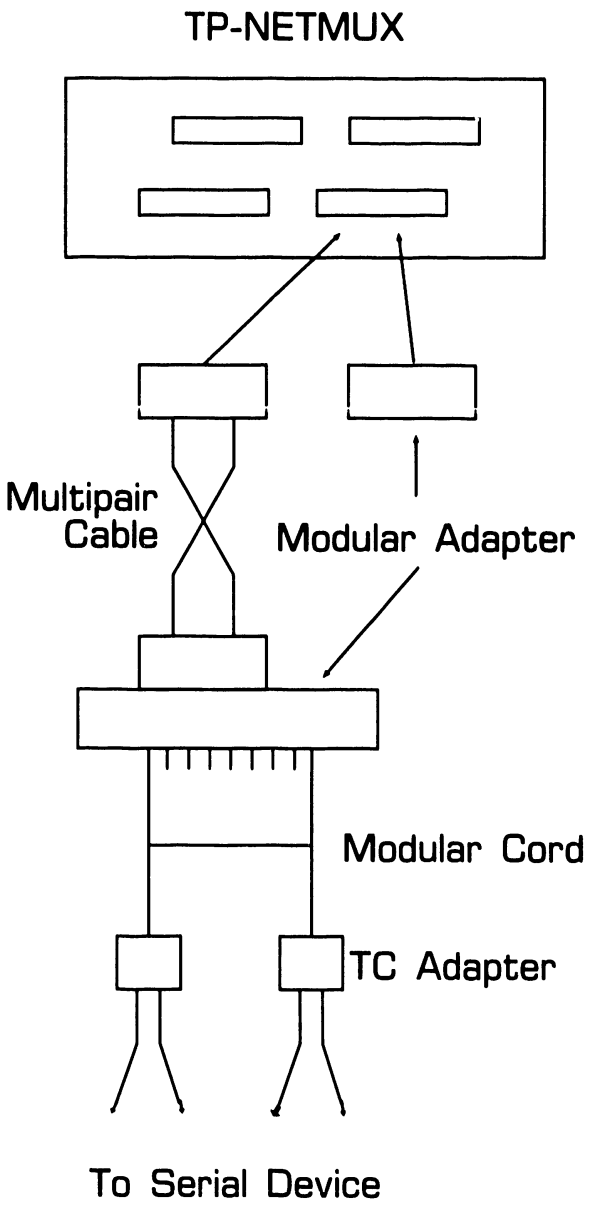
The modular adapter should be tagged and marked with the same port numbers shown on the associated TP-NETMUX connector.

2. Plug modular connector on one end of a modular cord into one of eight receptacles on modular adapter, noting assigned port number.
3. Plug other end of modular cord into a Wang TP adapter.
4. Connect BNC/TNC serial connectors on TP adapter to serial peripheral device assigned to that port number.

CAUTION

Do not connect Models CIU-A, -B, or -C or Wang Telecommunications Processor Models VS-TC or OIS-TC to a TP-NETMUX. Each of these external Wang cable interface units must be connected directly to an I/O port provided exclusively for local attachment provided only by a VS master data link IOP or Electrical Acitve Port Assembly (EAPA) module.

5. Connect remaining peripheral devices per above procedure.



➡NEXT

9.6 TP-NETMUX To Peripheral Device Connections (Sheet 3 of 4)

NOTE

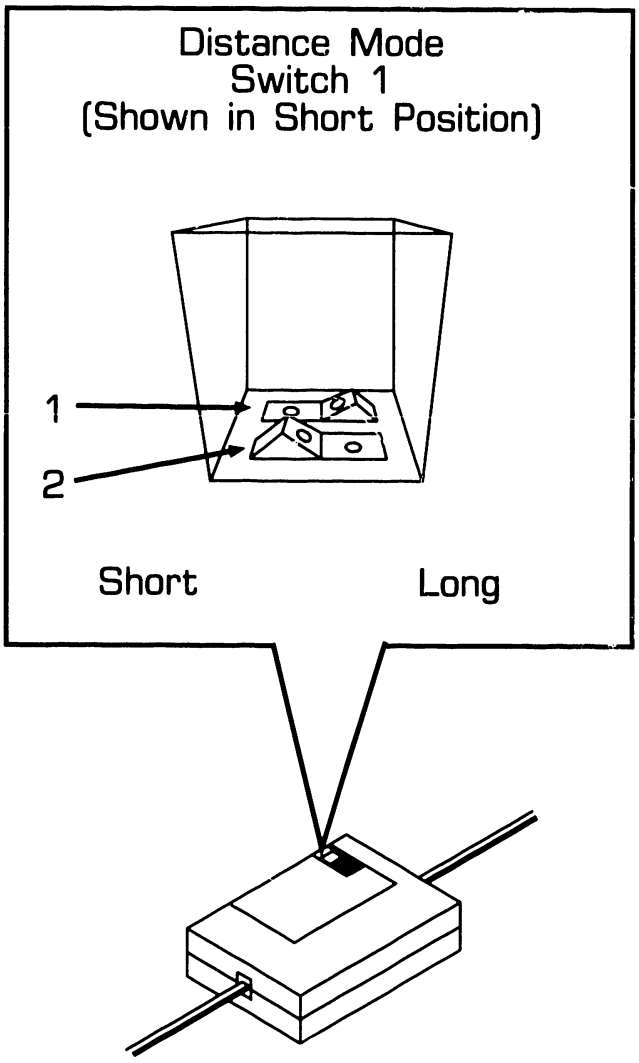
The TP adapter may contain a Distance Mode switch. If the TP adapter has no Mode switch, skip steps 6 and 7. The proper setting of this switch is determined by the total length of twisted pair wiring from TP-NETMUX to TP adapter. There are two Distance Mode switches on the adapter. Switch 1 is the active switch. Switch 2 is not functional and may be left in either position.

6. Verify the total length of twisted pair wiring between TP-NETMUX and TP adapter.

7. Set Distance Mode switch 1 on TP adapter using a small screwdriver or similar device (not a pencil) as follows:

   If total twisted pair length is less than 300 feet, set switch 1 to "Short".

   If total twisted pair length is more than 300 feet, set switch 1 to "Long".



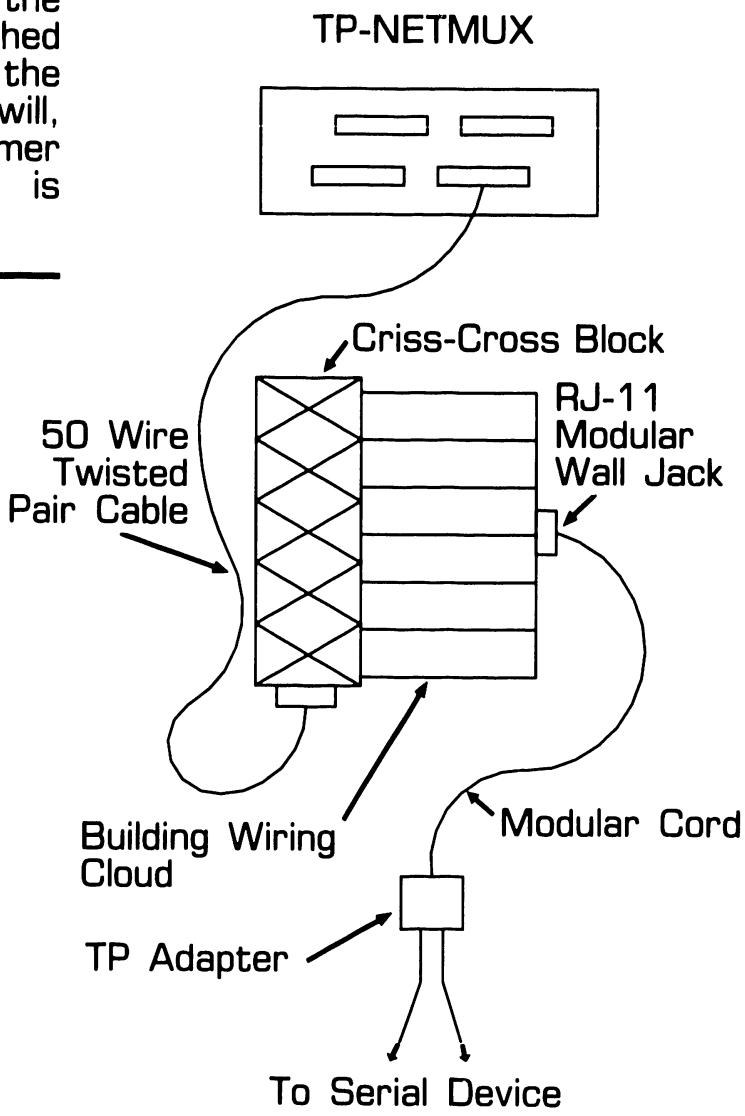
TP Adapter

➡NEXT

9.6 TP-NETMUX To Peripheral Device Connections (Sheet 4 of 4)

NOTE

Customers may utilize their existing building wiring cloud for connecting the TP-NETMUX to peripheral devices. The 50 pin twisted pair cables may be supplied by the customer or other vendors but the TP wiring must meet the published Wang specifications. All the precautions given in this section will, of course, apply to a customer hookup. One type of wiring is illustrated.



● END

9.7 Determining Manufacturing Identification Number (Sheet 1 of 2)

The manufacturing identification (MFID) number is a 16 digit hexadecimal number installed in the TP-NETMUX by Wang manufacturing to identify the device. The CPU uses the MFID to poll and communicate with devices attached to the WangNet cable system. The MFID for the TP-NETMUX can be observed on the 7-segment LED located on the rear panel. It is displayed only when the channel select switches are set to 80.

The LED displays one hexadecimal digit at a time, beginning with the highest order (leftmost) digit in the MFID and then alternately displaying high and low order digits until all digits have been shown. The LED displays an H to indicate that the following digit is a high order digit and an L to indicate a low order digit. The Hs and Ls are not part of the MFID.

Since the LED has only 7 segments, not all upper case HEX characters can be displayed. A lower case b is used to avoid confusing a HEX B with the digit 8 (care must be taken not to confuse a lower case b with the number 6), and a lower case d is used to avoid confusing a HEX D with digit 0. For example, the MFID 0123456789AB-CDEF would be displayed as follows:

H0L1H2L3H4L5H6L7H8L9HALbHCLdHELF.

The actual HEX characters are 01 23 45 67 89 AB CD EF.

9.7 Determining Manufacturing Identification Number (Sheet 2 of 2)

Proceed as follows to determine the MFID number for the TP-NETMUX being installed.

1. Set TP-NETMUX switch to 0 (off).
2. Using a small flat-blade screwdriver, set channel select switches to 80 as follows:
   - Set tens digit by turning upper rotary switch to 8.
   - Set units digit by turning lower switch to 0.
3. Set power switch to 1 (on).
4. Record each MFID digit in its order of apearance on 7-segment LED (ignore Hs and Ls).

NOTE

The entire sequence of digits will take about one minute. On completion of the MFID cycle, the LED goes off.

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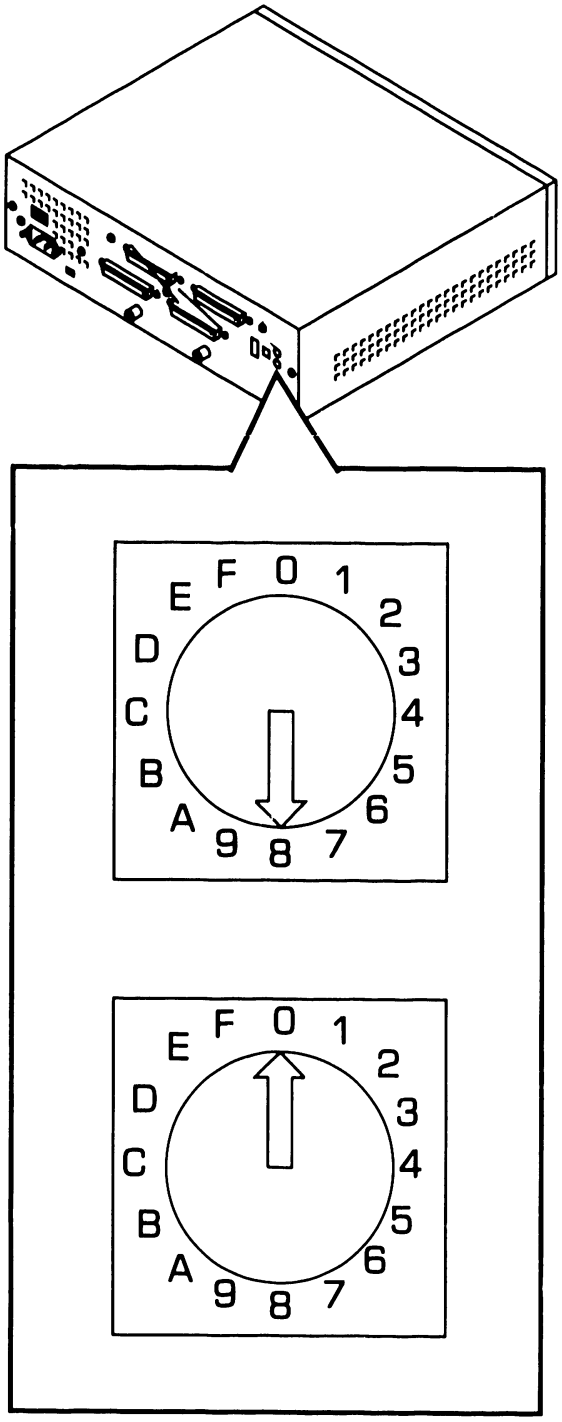
5. Reset channel select switches to assigned rf channel.



● END

9.8 Determining Port Numbers

A VS system administrator identifies a serial peripheral device by its port number and NETMUX MFID. Each of the four 50 pin connectors on the rear panel of the TP-NETMUX is labeled with port numbers referred to as "muxport" numbers. If a multipair cable is to be attached to one of these connectors, it should be labeled with the same muxport numbers as the connector, preferably at the end attached to a modular adapter.

The eight receptacles on a modular adapter should be labeled with the same muxport numbers as the 50 pin connector on the TP-NETMUX to which it is connected (either directly or via a multipair cable).

The VS CPU assigns a device address (DA) to each MFID/ muxport number. The DA of a device appears on the screen of its attached terminal upon power-up. DAs that correspond to a particular set of muxport numbers on a modular adapter are available only from a system administrator or operator.

Wang Modular Adapter Port Numbering

Modular Adapter Receptacle Number	TP-NETMUX Peripheral Device Connectors			
	Ports 1 - 8	Ports 9 - 16	Ports 17 - 24	Ports 25 - 32
1	1	9	17	25
2	2	10	18	26
3	3	11	19	27
4	4	12	20	28
5	5	13	21	29
6	6	14	22	30
7	7	15	23	31
8	8	16	24	32

● END

9.9 Determining Channel Setting

The Broadband LAN administrator assigns exclusive use of a peripheral attachment channel to a specific CPU or master. Both the CPU or master and its TP-NETMUX unit must be set to the same channel.

NOTE

Channel selection becomes effective only after the ac power switch on the TP-NETMUX is turned off and then on.

To select or change an rf channel:

1. Turn ac power switch off (0).
2. Set upper channel select switch to tens digit of channel number.
3. Set lower channel select switch to units digit of channel number.
4. Turn ac power switch on (1).

● END

9.10 Configuring Operating System Software

Refer to the appropriate software release for OS 7.20 with TP-NETMUX.

● END

9.11 Initialization

1. Turn off ac power to TP-NETMUX and all attached serial peripheral devices.
2. Turn on ac power on TP-NETMUX.

On power-up the TP-NETMUX executes a power-up diagnostic. After a successful self test, the unit is initialized by the CPU or master. The +5V and -5V indicators on the Status LED stay on while the other LED status indicators flash. If none of the attached peripheral devices are powered-up, the 7-segment LED displays a steady "0". If a test should fail, the 7-segment LED will display the test number and the test will continuously execute.

3. In the event of a test failure, refer to section 6 for troubleshooting information.
4. After successful initilization power-up all attached serial devices and follow standard operating procedures. The 7-segment LED should display a flickering "1".

The TP-NETMUX will next poll its baseband ports to determine which ports have an active slave connected. The resulting table of active ports will then be stored in RAM. After the table has been generated, the unit will go into its normal receive mode and await input from the master. The possible LED displays and their meanings are shown below:

Display	*Meaning*
⊓ (solid after .1)	No slaves powered-on or connected.
.1 (solid after diagnostics)	Slave connected and powered-on but TP-NETMUX on wrong valid (00-31) channel or on valid channel and slave connected and powered-on but master or RF cables are not active.
⊓ (.1 solid with other segments flashing fast)	Normal operation.

● END

SECTION 10

FUNCTIONAL DESCRIPTION

SECTION 10 CONTENTS

SECTION 10

FUNCTIONAL DESCRIPTION

FUNCTIONAL DESCRIPTION

10.1 General Features

The TP-NETMUX is a redesign of the old 8-port NETMUX. A functional description of the old NETMUX is contained in the NETMUX Product Maintenance Manual (741-1217). The new TP-NETMUX supports 32 twisted pair cable ports whereas the old NETMUX supported only 8 coaxial cable ports. The TP-NETMUX has a completely different package designed to reduce manufacturing costs. It has improved self diagnostic capabilities, an expanded internal memory and supports modems with more than 19 channels.

The TP-NETMUX enclosure may be either rack or wall mounted. The rack mounts are included with unit when shipped. The wall mount can be ordered as an option. This package configuration is the same as that used for several other WangNet products. The unit is forced-air cooled with a 12 vdc fan to improve its operation in telephone closets where temperatures may be high.

Because of the extra space required for the connectors, switches and other components needed to accommodate 32 channels, two PC boards, a main board and a daughter board, are used in the TP-NETMUX. The main board has the CPU, memory, custom IC, modem interface, and drivers, receivers and connectors for 16 ports. The daughter board contains the drivers, select logic and connectors for 16 more ports.

The main and daughter boards are interconnected with two "stacking connectors"; one for signals and one for power. The daughter board is supported above the main board by the stacking connectors, stand-offs and the rear panel bracket.

● END

FUNCTIONAL DESCRIPTION

10.2 New Functions (Sheet 1 of 2)

The TP-NETMUX supports up to 32 slave devices. Ports are numbered from 1 to 32. Software selects the ports in banks of 8 via a new bank select register located at 40001H in the memory space. This register may be written to and read from just like a memory location.

The TP-NETMUX will support only twisted pair wiring to the slave devices. Therefore, the slave devices must be equipped with Wang TP adapters. These adapters convert from the TNC/BNC coaxial cable connectors normally used in serial device connections to RJ11 type (similar to standard telephone modular plugs but with 6 wires instead of 4).

The TP-NETMUX is equipped with four 50 pin type D connectors, the type usually used to terminate telephone 25 pair cables. Each 50 pin connector supports 8 slave ports. The signals from the 50 pin connectors are carried to the vicinity of the slave devices by 25 pair twisted pair cables which have 50 pin male connectors on one end and 50 pin female connectors on the other.

A 50 pin to 8 RJ11 modular adapter is then plugged into the slave end (female connector end) of each twisted pair cable. The other end of the modular adapter has 8 RJ11 jacks which accept up to 8 Wang 6 wire modular cords. The 8 modular cords connect to 8 balun coil TP adapters. The output ends of the TP adapters are short serial cables having TNC/BNC connectors for connection to the serial devices.

Channel selection on the TP-NETMUX is done with two HEX coded rotary switches which allow up to 28 channels to be selected.

The TP-NETMUX has the same 7 segment diagnostic LED used on the old NETMUX but, in addition, it has a package of 8 discrete LEDs which monitor the following signals coming from the Global Modem:

Request to Send	RTS
Clear to Send	CTS
Transmit Data	TD
Received Data	RD
Transmit Timeout	TXTO
Carrier Detect	CD

➡NEXT

10.2 New Functions (Sheet 2 of 2)

Two of the LEDs monitor the +5V and -5V dc power, thus serving as the Power-On indication.

The old NETMUX had 4K of RAM located at 1000H to 1FFFH. The TP-NETMUX has an additional 8K of RAM located at 8000H to 9FFFH. This 8K block can be accessed again at A000H, C000H, and E000H. It need not be tested and should not be used except at 8000H through 9FFFH. Only the RAM at 1000H to 1FFFH can be used for DMA operations.

● END

10.3 Block Diagram Description (Sheet 1 of 2)

The details of operation of the TP-NETMUX are quite similar to the old 19 channel NETMUX. However, the new TP-NETMUX circuitry is packaged quite differently. The TP-NETMUX block diagram shows that the circuitry is divided into four major assemblies; a power supply, a main board, a daughter board, and a 28 channel global modem.

The following components are mounted on the main board:

- Z80 CPU
- Memory
- Custom IC
- Status and controls
- Drivers/Receivers/Baluns for 16 ports
- Two 50 pin connectors

The daughter board contains the following:

- Drivers/Receivers/Baluns for 16 ports
- Two 50 pin connectors

The Custom IC or NETMUX chip is a semi-custom integrated circuit which contains most of the digital logic required for the TP-NETMUXs functions. It was developed in an effort to reduce manufacturing cost of the TP-NETMUX.

The chip contains receive logic which samples the input serial data and extracts the 8 bit data and the corresponding CRC bytes or parity bits. The data is then loaded into a 32 x 10 bit receive FIFO. The output of the receive FIFO is connected to the internal data bus as well as to the 32 x 10 bit transmit FIFO.

The transmit logic is responsible for unloading the transmit FIFO and inserting start and stop bits before and after the serialized data byte. Depending on the destination of the data packet, odd parity will be included in each transmitted byte or two CRC-16 data bytes will be added at the end of the data packet.

The NETMUX chip has two inputs for serial data, one for the RF master as the source and the other for baseband sourced data. On power-up, both inputs are disabled. Under normal operating conditions, the baseband input is only enabled when a response is expected from the slave device as a result of a data transmission to that device. This is accomplished by setting the Auto Turn Around bit in the command register which enables the input after a 7 us time delay.

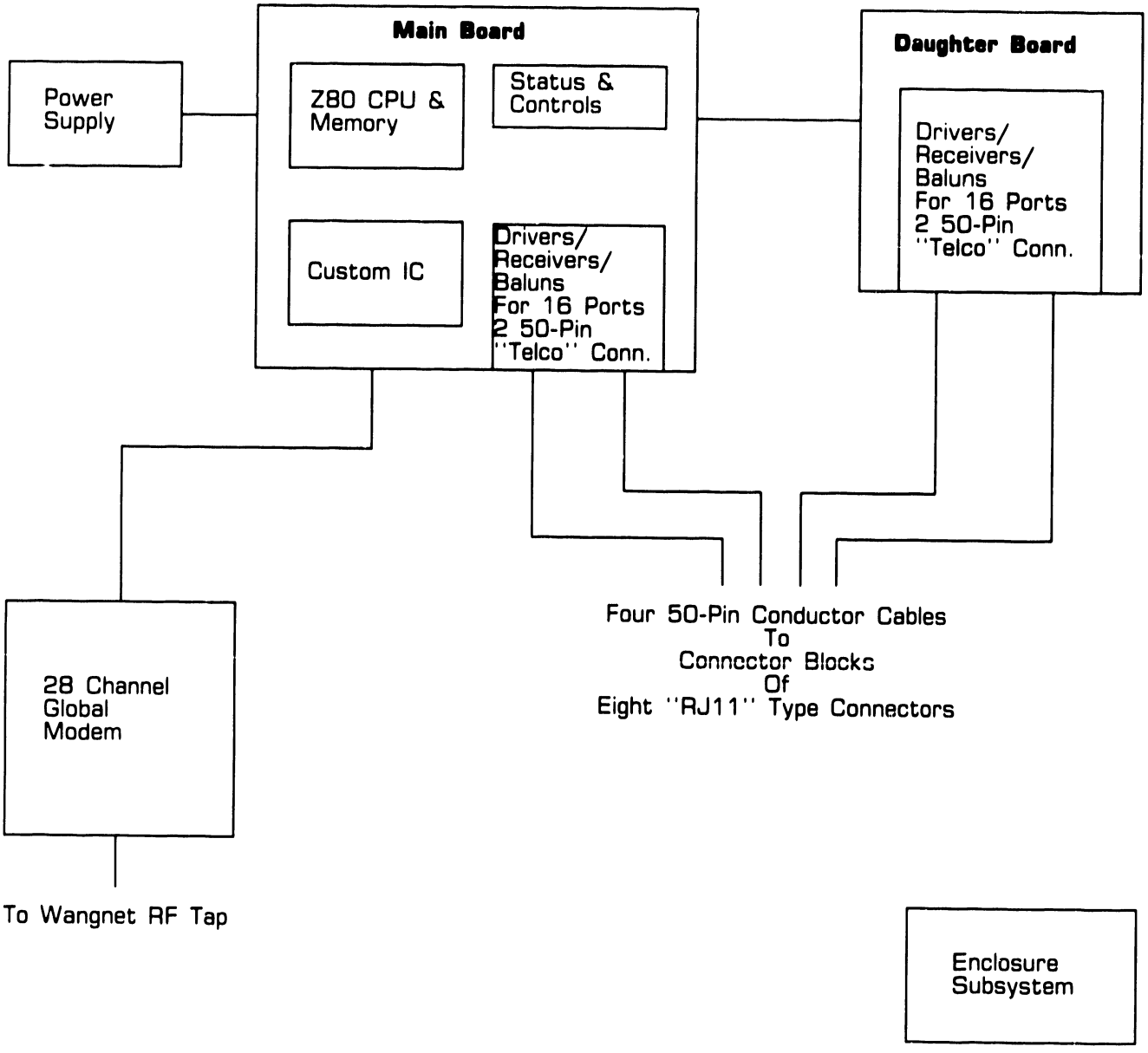
➡NEXT

10.3 Block Diagram Description (Sheet 2 of 2)

The Carrier Detect signal from the modem, which can be enabled and disabled by the software, enables the rf serial data input when it is asserted. Since WangNet has separate transmit and receive rf cables, the data transmitted by any device will appear on the receive cable after passing through the head end. As a result, the rf serial input is disabled whenever the chip asserts the Request to Send signal of the modem. This prevents receiving data just transmitted.

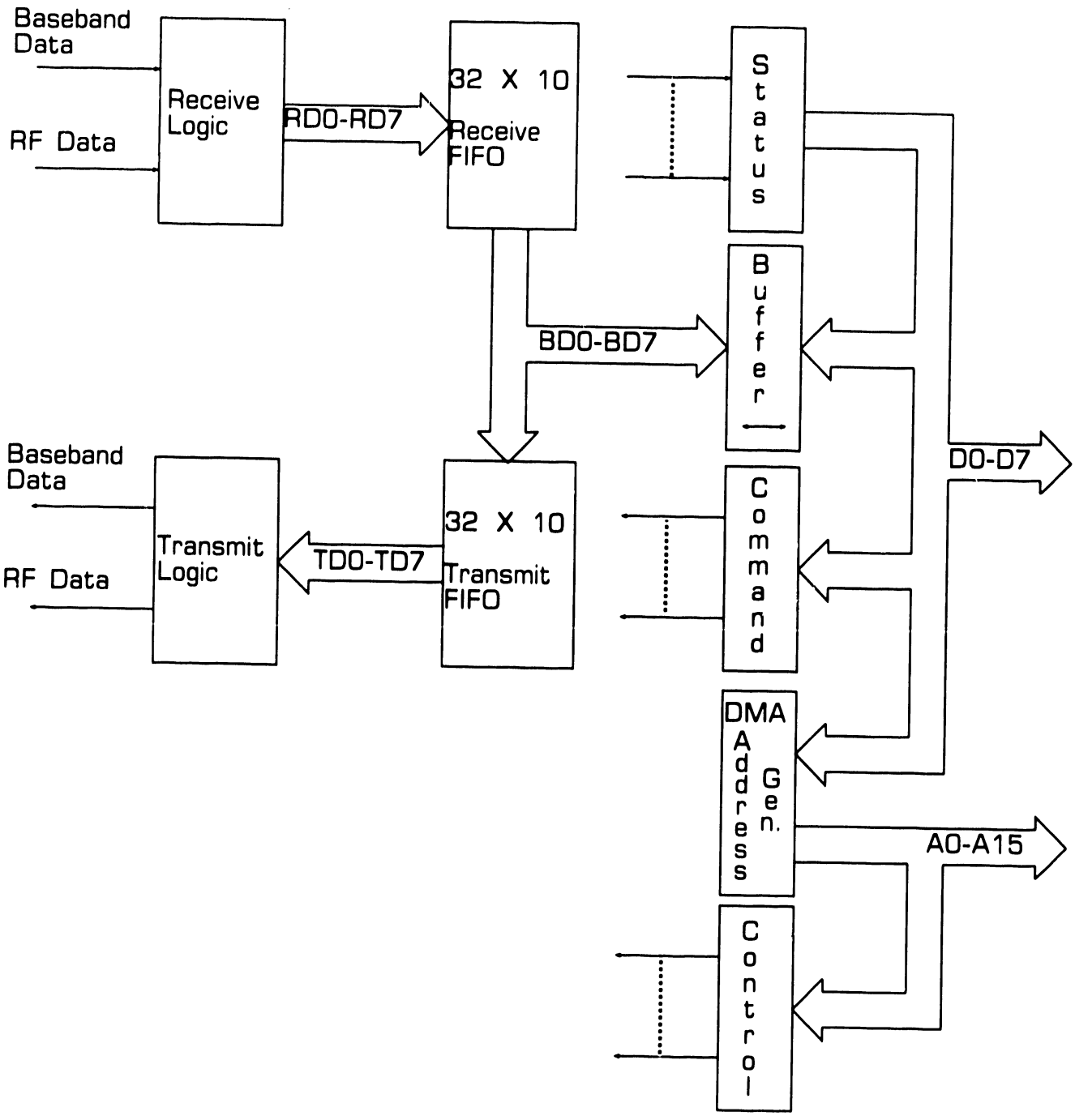
● END

10.4 FUNCTIONAL DESCRIPTION
Overall Block Diagram



● END

10.5 FUNCTIONAL DESCRIPTION
NETMUX Chip Block Diagram



● END

SECTION
11
SPECIFICATIONS

SECTION 11 CONTENTS

SECTION 11

SPECIFICATIONS

SPECIFICATIONS

11.1 Hardware (Sheet 1 of 3)

Model
TP-NETMUX

Physical Dimensions
Height: 3.85 in. (9.78 cm)
Depth: 13.35 in. (33.9 cm)
Width: 15.75 in. (40.0 cm)
Weight: 14.0 lb. (6.35 kg)

Operating Environment
Temperature:
60 to 95°F (15.5 to 35°C)

Relative Humidity:
20% to 80% noncondensing

Power Requirements
115 Vac or 230 Vac ± 10%
50 Hz to 60 Hz
0.7 amp. at 115 Vac or
0.35 amp. at 230 Vac

Power Dissipation
81 watts

Heat Output
275 Btu/hr

Data Transfer Rate
4.27 Mbps

Data Format
Asynchronous, Binary, Serial

Mode
Half Duplex, Polling, Asynchronous

Channel Spacing
7.98 MHz

Frequency Stability
±0.01%

Modulation Technique
Two-level PSK

Channel Coverage
Valid Peripheral Attachment Service Channel Numbers: 00-05, 06, 08-15, 19-31

➡NEXT

11.1 Hardware (Sheet 2 of 3)

Channel Center Frequencies

Center Channel Setting	Frequency (MHz)	Center Channel Setting	Frequency (MHz)
00	101.5	15	221.4
01	109.5	19	253.2
02	117.5	20	261.2
03	125.5	21	269.1
04	133.5	22	245.2
05	141.5	23	285.1
06*	149.5	24	293.1
08*	165.4	25	301.1
09*	173.4	26	309.0
10	181.4	27	317.0
11	189.4	28	325.0
12	197.4	29	333.0
13	205.4	30	341.0
14	213.4	31	349.0

* Peripheral Attachment Service channels 06, 08, and 09 cannot be used in a WangNet cable system that includes diplexers. Instead, the three channels are used to establish a guard band for proper diplexer operation.

➡NEXT

11.1 Hardware (Sheet 3 of 3)

RF Interface Impedance
75 ohms unbalanced

TP Interface Impedance
91 ohms

RF Transmit Level
+45 dBmv, adjustable +3, -5 dB

RF Transmit Level Flatness
±3 dB

RF Transmit Disable Level
-70 dBc, minimum (dBc = dB relative to transmit carrier)

RF Transmit Spurious Level

Bandwidth (MHz)	*Additive (dBc)*	*Non-additive (dBc)*
10 - 82	-72	-55
82 - 350	-50	-45
350 - 400	-55	-45

RF Carrier Turn-On Time
3 usec, maximum

RF Receiver Input Level
+5 dBmv, nominal

RF Image Rejection
50 dB, minimum

RF Carrier Detect Level
-10 dBmv, adjustable ±6 dB

RF Carrier Detect Time
3 microseconds

Error Rate
1×10^{-8} within ±5 dB of nominal Rx input level

● END

11.2 Twisted Pair Wiring Guidelines

(Sheet 1 of 2)

Specifications

Fire Resistance: National Electric Code Article 800

Number of twisted pairs: 2, 3, 4, 16, & 25

Wire gauge: #22 or #24 AWG

Conductor Type: bare or tinned solid copper

DC loop resistance (nom.):
22 AWG: 32.3 ohms/1000 ft
24 AWG: 51.3 ohms/1000 ft

Mutual capacitance (nom.):
22 AWG: 15.0 to 19.0 pF/ft
24 AWG: 17.5 to 20.4 pF/ft

Characteristic impedance, R nom. @ 1 MHz:
84-113 ohms

Return loss vs R, 0.1 to 10 MHz:
16dB

Attenuation - +15%, -10%

22 AWG	*1 MHz*	*2MHz*
2, 3, 4 pair	4.9	7.1 dB/1000 ft
16 and 25 pair	5.7	8.2 dB/1000 ft

24 AWG	*1 MHz*	*2MHz*
2, 3, 4 pair	6.8	9.8 dB/1000 ft
16 and 25 pair	8.0	11.6 dB/1000 ft

➡NEXT

11.2 Twisted Pair Wiring Guidelines (Sheet 2 of 2)

Distance Considerations

The maximum lengths of twisted-pair wire over which Wang protocol signals can remain effective are as follows:

	22 AWG	*24 AWG*
Multi-user cable 16 or 25 pair	600 ft	400 ft
Single-user cable 2, 3, or 4 pair	800 ft	600 ft

These distances do not include the standard 12.5 ft or optional 25 ft drop cord between the wall jack and the peripheral serial device. Also, an additional 100 feet of single-user cable may be added to multi-user cables of maximum length (for example: 100 ft of 2-pair cable may be added to two pairs of wires in a 400 ft 25 pair cable.

Wang TP Adapters

Wang TP adapters enable Wang VS systems to communicate with serial peripheral devices over standard unshielded data grade twisted pair wire. The TP adapter is approved for all Wang coaxial devices except the VS-TC and VS-TC1 telecommunications controllers.

All serial devices attached to the TP-NETMUX must be equipped with a Wang TP adapter.

● END

SECTION 12
ILLUSTRATED
PARTS

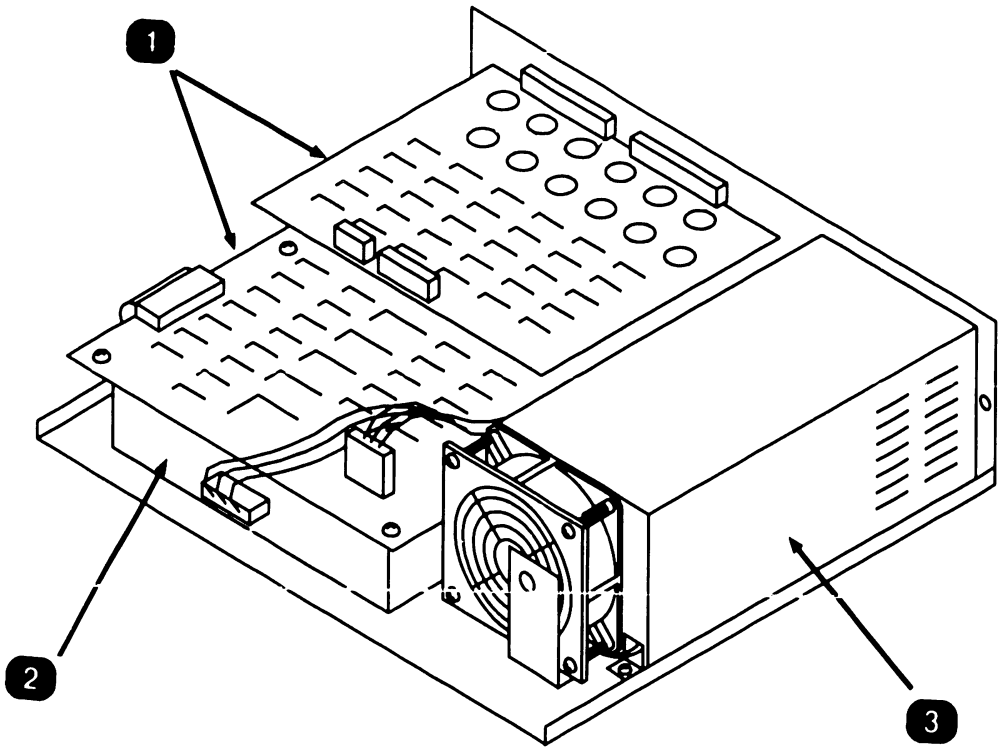
SECTION 12 CONTENTS

SECTION 12

ILLUSTRATED PARTS

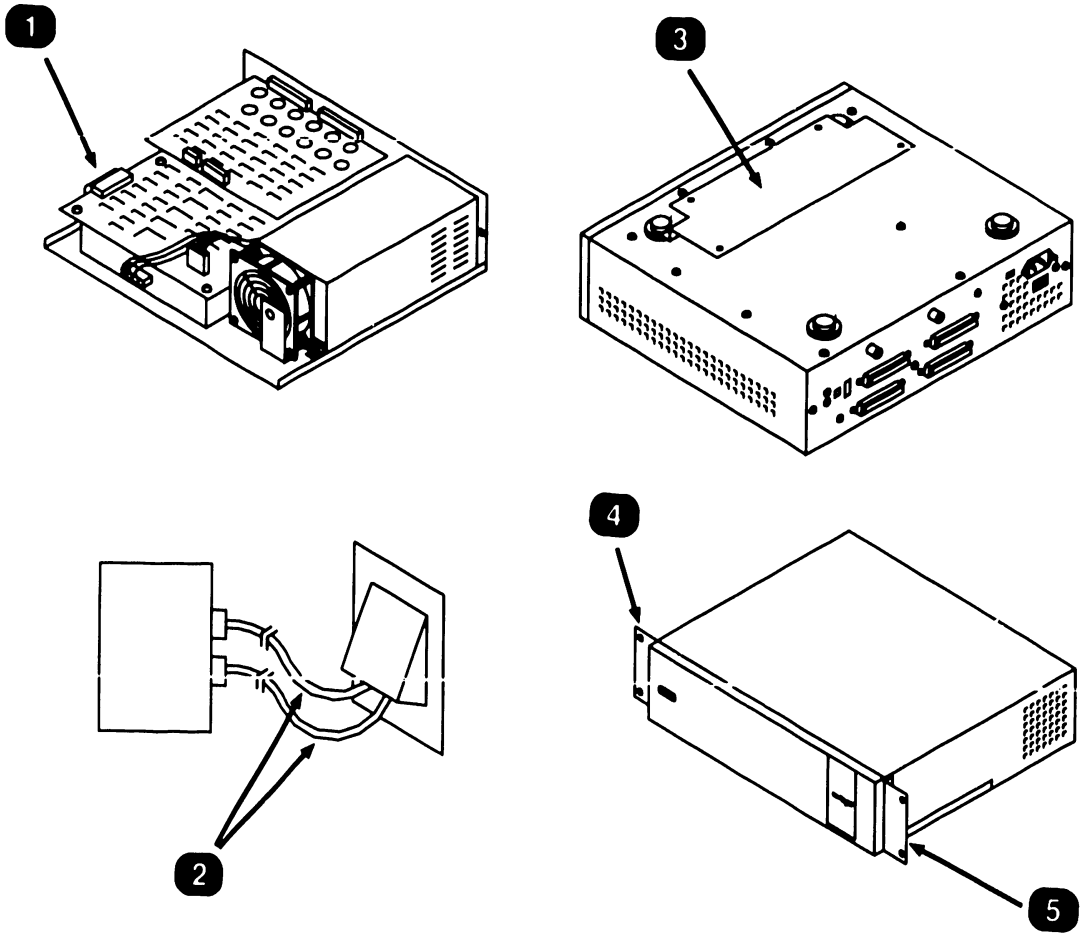
12 ILLUSTRATED PARTS

12.1 Major Components



Item	*Part Number*	*Description*
1	212-7105	Mother/Daughter Board
2	279-0723	28 Channel Modem
3	270-1065	SPS78 Power Supply

● END



Item	*Part Number*	*Description*
1	220-3234	34 Position Socket-to-Socket 4'' Cable
2	220-0294	10 ft Equipment Cable
3	451-5458	Wall Mounting Adapter Bracket
4	451-5456	Rack Mounting Adapter Bracket (Left)
5	451-5455	Rack Mounting Adapter Bracket (Right)

● END

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